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The Protection of the
Underwater Cultural Heritage

SCIENTIFIC COLLOQUIUM ON FACTORS IMPACTING UNDERWATER CULTURAL HERITAGE

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The Significance of Underwater Cultural Heritage

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Abstract
During the past decade, there has been an increase of interest in the underwater world, dating back to earlier examples of underwater finds as well as landscapes that have been submerged by the rise in sea level at the end of the last glacial period. In fact, for 90% of human existence on this planet, sea levels have been lower than the present by about 40 m in response to the growth and decay of the continental ice sheets. The high sea level that we presently enjoy was established about 6,000 years ago. The submergence of large areas of the continental shelf due to rise in sea-level has long been recognised as a major factor in changing the palaeogeography of the world's coastlines. However, it is only within the past decade that there has been a clear recognition of how important it is as the missing data on the submerged shelf. An increase of prehistoric underwater archaeological sites, ranging in age from over 6,000 years to 300,000 years ago, has been recovered at a depth ranging from less than 10m to more than 40m. They often have unusual and spectacular conditions of preservation of organic materials such as wood and fibres. There is clear evidence that substantial traces of submerged prehistoric landscapes and archaeology are preserved on the continental shelf that was important for human settlement during long periods of the Pleistocene.

Underwater cultural heritage is typically associated with the study of shipwrecks and what they can tell us about the history of ship building, maritime trade and migration over the past five millennia. During the past decade an interest in the underwater world has been extended much further back in time, and not simply to earlier examples of underwater finds but to whole landscapes that have been drowned by sea level rise at the end of the last glacial period. In fact, for 90 percent of human existence on this planet, sea levels have been lower than the present, typically by about 40 m, and for shorter periods by as much as 130 m, in response to the growth and decay of the continental ice sheets. The period of high sea level that we presently enjoy was established only about 6,000 years ago. Sea level was then low throughout the last Ice Age, until we reach back to the previous period of high sea level about 125,000 years ago. And this alternation of high sea levels lasting for about 5–10,000 years, alternating with periods of low sea level ranging between -40m and -130m below present for periods of about 100,000 years, has been the norm for most of the past 1 million years.

The submergence of large areas of the continental shelf by sea-level rise has long been recognised as a major factor in changing the palaeogeography of coastlines in Europe. However, archaeologists have been reluctant to explore the submerged landscapes of the continental shelf or to pursue the implications of sea level change. The main deterrents to such an exploration are the long-standing belief that little of interest is likely to have survived the process of marine inundation, and that the costs of underwater exploration are in any case prohibitive, with little likelihood that much useful information would be recovered. It is only during the past decade that the climate of opinion has begun to change, and three factors can be identified as contributing to a growing momentum of interest in this submerged world.

The first and most compelling fact is that despite the preconceptions of land-based archaeologists, archaeological sites and extensive features of the pre-inundation landscape do survive inundation and continue to be preserved underwater, and there has been a steady growth in the numbers of prehistoric settlements that have been discovered over the past 30 years. Some have been found by chance exposure and discovery, others by targeted survey, and increasing numbers as a result of commercial activity on the seabed combined with archaeological monitoring. In Europe alone, it is estimated that there are as many as 3,000 such underwater sites, ranging in age from over 300,000 years to 6,000 years ago, and at depths ranging from less than 10m to more than 40m, often with unusual and spectacular conditions of preservation of organic materials such as wood and fibres, thanks to burial in anaerobic sediments. There is clear evidence that substantial traces of submerged prehistoric landscapes and archaeology are preserved on the continental shelf and can be recovered, and as more underwater exploration and excavation are carried out, so the cumulative impact of the finds becomes more compelling.

Perhaps the best known sites are the underwater Mesolithic sites of Denmark, where the relatively calm and shallow waters, the relatively easy accessibility of the seabed, and the longstanding knowledge from dredging and fishing activities that the seabed is littered with prehistoric stone artefacts, have all encouraged exploration and the development of expertise in underwater survey and excavation. Sites such as Tybrind Vig, and Mollegebaet II demonstrate the unusual quality of preservation and the range of finds that can be preserved in these underwater conditions. These

include an extensive material culture based on wood, such as fish weirs originally built out from the shoreline over a distance of several hundred metres, dugout canoes, richly carved and decorated timber artefacts such as canoe paddles, and human burial grounds. Similar sites of Neolithic and Mesolithic age have been systematically examined more recently in the offshore regions of the German Baltic, producing a similar range of finds and including collapsed remains of timber-built dwellings.

It can of course be objected that the conditions in which these sites occur are atypical and that more exposed and wave-swept coastlines are inherently unlikely to preserve material. However, it is clear that underwater preservation occurs in many other locations, in the English Channel off the north coast of France, on the southern coastline of England offshore from the northern shore of the Isle of Wight, and in the North Sea. Remains of a Neanderthal skull recently dredged up from the trawler fishing grounds of the North Sea, along with literally tons of Ice-Age faunal remains of mammoth and walrus give some indication of the richness of material present on the seabed. Handaxes recently recovered during the course of commercial seabed operations in the North Sea off the coast of East Anglia, together with sediments preserving details of the palaeoenvironment, and dating to a period of 300,000 years or more, demonstrate that even in apparently unpromising conditions of preservation, material can survive intact and be recovered, even though it must have undergone repeated terrestrial exposure and marine inundation during several cycles of sea level rise and fall. Further afield there are the submerged Neolithic and Bronze Age villages in the Bulgarian sector of the Black Sea, the remarkable Pre-Pottery Neolithic village of Atlit Yam of the coastline of Israel, with a stone-lined well, and evidence of fishing, seafaring and farming. Similar finds of submerged PalaeoIndian settlements are being discovered in the Americas, in areas like the Gulf of Mexico off the Florida coastline.

The conditions under which archaeological material survives inundation and can later be discovered is, of course, complex, depending on the interplay between coastal topography and marine currents during the inundation phase of sea-level rise, and the further interplay between the accumulation of marine sediments that bury and protect material, and the erosive activities of submarine currents, or indeed human operations on the seabed, which re-expose the material to view and to systematic recovery. As more sites are explored, so predictive models about the locations which might have been attractive to prehistoric people, as fishing locations, or conditions of shelter for tying up boats, and about the geological conditions in which material is likely to be preserved and discovered, become more refined, so facilitating the discovery of new material.

A second fact that has contributed to the growth of this field is the improvements in technology for underwater exploration that have occurred in recent decades, driven in large part by the development of commercial operations such as oil and gas exploration and geoscientific and biological exploration of the oceans. Ships equipped with remote sensing equipment for rapid bathymetric survey and sub-bottom and side-scan profiling, remotely operated vehicles and cameras, submersibles, a variety of coring equipment, and more sophisticated techniques for deep diving including mixed gas technologies, have all expanded the horizons of what is possible.

Thirdly, it has become increasingly obvious just how much of the prehistoric record we are missing by ignoring these extensive and now submerged landscapes. These are the areas that offered the most attractive terrain for human settlement during long periods of the Pleistocene. Coastlines are not uniformly attractive, but they frequently offer greater diversity and richness of resources than their adjacent hinterland, and support greater concentrations of population and larger settlements. Better supplies of surface water, greater density and variety of plant and animal life on land, and marine resources of shellfish and inshore fish or stranded sea mammals, all easily accessible at the shore margin even without seagoing boats, are likely to have made coastlines powerful attractors of population at all periods of human prehistory, and at all technological levels, from the very earliest period and with the simplest level of technology.

These are the areas that are likely to provide the key evidence for some of the most important transformations in human social evolution, including the early dispersal of ancient humans from Africa, the extinction of our close cousins such as the Neanderthals, the earliest development of seafaring and fishing, the early dispersal of agricultural economies, and the roots of many ancient civilizations. These are developments that took place when sea level was lower than present, and the key evidence is likely to lie on the now-submerged landscape and in coastal locations that are now underwater.

Given that sea levels have been lower than present for 90 percent of human history on this planet, it seems likely that we are missing a very significant part of the evidence for early human development and social evolution, and perhaps the most significant part, with the surviving evidence on dry land forming a truncated fragment of the whole. It is not only whole areas of evidence that we are missing by ignoring this submerged landscape, or the deeper history and early development of a human interest in maritime activities. As the evidence accumulates, so the possibility begins to emerge of focussing on the impact that sea-level change would have had on past human societies and how they coped with such changes. This is an issue that has recently come more sharply into focus as modern society begins to appreciate the reality of future sea-level change and the disruptive or destructive effects that this is likely to have on our own real estate and livelihoods. Yet, much greater changes of sea level occurred in the past. With the melting of the ice sheets of the last glaciation, sea levels rose through a vertical height of more than 100 m between about 16,000 and 6,000 years ago. Of course, that dramatic rise was not experienced within a single lifetime, but it is likely that the effects were noticeable on the time scale of the individual life, and certainly within the span of collective memory. Moreover, the effects were sustained over many centuries, resulting in the drowning of huge areas of previously productive land. How did our ancestors deal with such changes? And how, for that matter, did they respond when new territories opened up with a corresponding drop in sea level during earlier cycles of sea level change? These are fascinating questions, the answers to which no longer lie solely within the realm of speculation, and which, in addition, may give us some insight into the changes that our modern civilisation is going to have to face in the coming centuries.

Investigation along these lines will not be easy. Underwater exploration is expensive and uncertain in terms of the likelihood of archaeological discoveries. However, new collaborations are underway between archaeologists, geoscientists and government agencies responsible for the underwater heritage, sometimes with the active cooperation and assistance of commercial companies, who frequently have little to lose by cooperation and a great deal to gain in terms of interest amongst a wider public.

Moreover, collaborative research between archaeologists and marine geoscientists on the continental shelf is likely to provide new and more precisely dated evidence of submerged palaeoshorelines, of importance in refining models of climatic and sea level change, on which predictions about future such changes will depend. This is a young field of scientific exploration – the last frontier of archaeological discovery. It is, moreover, a new field that is exciting interest amongst scientists, scholars and policy makers across many disciplines, which lies at the very heart of our shared existence and identity, and which is likely to develop a new narrative of our history on Earth that is capable of capturing the wider public imagination.

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The Future of Underwater Archaeology

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Abstract

As mankind becomes more aware of its role in preserving its own heritage and in caring about the natural environmental evolution our world, conventions pertaining to underwater cultural heritage should be a major item on the agenda of the international community. Future development depends on worldwide recognition of the priceless valuables deposited under water along with decades of evidence of human existence, as well as the willingness of politicians to act enthusiastically to preserve our common cultural treasures. A good sign is indicated by the 41 states that have already ratified the 2001 Convention on the Protection of the Underwater Cultural Heritage as of 2012. Archaeology is a sensitive subject when heritage is presented to the public. Apart from legal provisions, which still need to be improved, practical means for research in this field are not at the disposal of all nations. This is why technical knowledge achieved during the last decades has to be shared for an appropriate valorization of underwater archaeological sites. Cooperation from all possible levels is the main goal for future research of our common past history. An important task in identifying possibilities and in developing a framework for international cooperation is conferred to the working groups and the advisory bodies initiated by the Convention. The future of underwater archeology is also dependent upon the practical implementation, resolutions and recommendations by UNESCO and all interested parties in preserving underwater cultural heritage. An important aspect in this respect is the ecological evolution of water reserves worldwide.

There are three subjects, which we consider important when trying to develop a strategy regarding the future of underwater archaeology. They are at the same time linked to the present situation of cultural heritage all around the world: research, restoration-conservation and legal provisions.

First of all, research in this field has known a spectacular development due to more or less sophisticated equipment for the location of sunken ships or artifacts, but also of flooded building structures created by human activity. The evolution of such technical means is one factor, which can lead us into future better understanding of our civilization by enlarging our knowledge about our history. Because every single newly discovered element in such until recent difficult to access environment can contribute to enrich, at least with one page, the history of our planet. As a whole, this generous environment is a deposit of a large quantity of cultural heritage, more and more accessible for research and valorization. Even if in future, such heritage will still encounter accidental or intention destruction by people, enterprises or even states, not responsible or educated enough to understand the importance of underwater cultural treasures, the results of archaeological research under water are also in a delicate position, which must be fostered with utmost care. It is the task of future specialists to decide which of the discovered objects they have to leave on the spot and which to restore and present to the public, in permanent or temporary exhibitions. In our opinion, one of the most important issues regarding this particular kind of heritage should be in future to outline an efficient methodology to advice specialists what measures they have to take, when they encounter one or another situation. It would be a useful manual for underwater archaeologists, which would contain not only excavation regulations and recommendations, but also restoration and conservation ones. An accompanying catalogue and a list of good practices would have to complete the foreseen manual, with examples for as many situations and materials as possible. The problem how to handle and manage large dimensions discoveries is one of the most stringent for the future of our investigations. I would like to bring to your attention only two significant cases: “Gustav Vasa” and “Titanic”, both of utmost value as cultural heritage. If the first one is safely sheltered in a museum, with all contained artifacts (after massive investment in its conservation), the second one unfortunately still lies exposed to looting (even if in great depth, on the bottom of the ocean), due to advanced technical means at the disposal of individuals, more or less aware of their destructive activities. What will become of the second if the implied parties will not reach agreements as soon as possible, to protect the site from further destruction? This symbol, a famous sample of early twentieth century life and navigation, will suffer further, until it will only be a rotten piece of metal with no significance whatsoever. No surveillance and deeper probing, with remote operating vehicles and complex technology, endangers not only the mentioned objective, but also a large number of others, already known to treasure hunters. The word treasure means not only precious metals, but also all kinds of heritage objects, which have market value. Examples in this respect could continue and it is the duty of law enforcement authorities to protect the national and international heritage. As is the case with artifacts illegally excavated on land (see constant looting in southern Italy, in ancient Basilicata), the ones

coming from underwater sites are valuable merchandise for those investing in such illegal activities. A better surveillance, not only of such individuals or organizations, but also of the markets negotiating objects with cultural significance, arbitrarily extracted from their archaeological context under water, should be a constant concern for nations really cherishing their and sometimes universal cultural heritage.

The future should bring about a more complex surveillance system to monitor all existing evidence of human history and adverse human activity under water. This system already exists (see military satellites activities) and it takes only determination from specialists, implied public and private bodies, but also financial resources, to convince responsible authorities to use these possibilities for protection of our common heritage.

Even more difficult for archaeologists is now research in rivers, lakes and lagoons, due to sometimes very poor visibility and other unfavorable circumstances. That brings us back to future development of special equipments for such environments, sometimes even more difficult to investigate, because of more or less strong currents. Only advanced solutions will permit such research in future, so existing technologies must develop to the point of putting at the disposal of archaeologists some secure and efficient technical means, developed for instance from present applications, such as protective domes or precincts capable of isolating a certain surface from being flooded. A good example in this respect is the huge archaeological salvage excavation site in the area of the Byzantine harbor in Istanbul. Of course, there are also situations when the archaeological layer lies deeply buried under thick sand or mud deposits and it is again applied technology, which could help us determine the configuration of respective archaeological structures. Though already used in other fields, investigations must be adapted to special conditions, very different from site to site.

Such methods would be in future the already known magneto metric measurement scanning of the waterbed, with different energy parameters, the use of deep probing sensors of different types, but also taking continuous vertical samples (carrotage), where long term geological deposits can give some answers, regarding the evolution of human communities, along the sea-, river- or lakeshores. Not long ago our colleagues at the GEOECOMAR geological institute in Constanta, Romania, have applied these methods at a Byzantine naval base from the 10^{th} century, situated partly on an island and another part in the riverbed of the Danube. The good results we obtained encourage a future application at other similar locations.

A second important item on the agenda of future archaeological evolution is restoration and conservation of objects discovered under water, from the tiniest to the largest ones. It is a complex matter, to which only an inter-disciplinary approach is the answer. Research regarding chemical and biological on-site and laboratory analysis methods must be an important aspect in future restoration and conservation of underwater cultural heritage. We have to develop new, efficient and rapidly acting materials, so that we can adequately treat different types of objects, as soon as we recover them from the liquid and often salty environment, in which they have stayed for a long time. The large array of textures and compositions encountered at such documents during excavation, their fragile state and their long-term storage and preservation are most important for archaeologists and restorers as well, if they intend to keep them for future generations.

Training specialty personnel for underwater excavation and restoration is one of the subjects on which the last meeting of State Parties to the Convention has already largely debated. It is a priority for competent future investigations. It is also a great, substantial step forward that UNESCO and Croatian authorities recently enhanced quality and material basis for such specialists, by inaugurating the regional center for underwater research and restoration in Zadar. As already done during last summer, in future a certain number of interested young archaeologists and restorers will have the opportunity to attend the courses there and get some knowledge to apply at the underwater investigations in their countries. As far as I know, there is another such center in Thailand. As this activity will be more and more attractive to younger generations of archaeologists, the need for developing their professional skills will probably determine responsible authorities to finance opening more such institutions.

As financial resources for proper excavation, restoration and conservation of large objectives, such as large sunken vessels, are scarce and there are limited possibilities to finalize work, last recommendations are to clean and preserve them in situ. All the same, there are solutions for salvaging endangered objectives by public-private partnerships.

A limitation of human intervention in this sensible environment is the best solution too for protected species living in different areas. Archaeologists and biologists can often establish close connections between cultural and natural underwater heritage. In our opinion the example of valorizing some underwater discoveries by archaeologists-guided visits to underwater sites and their video monitoring, applied in Sicily by Soprintendenza del Mare is a most adequate example for underwater cultural heritage management. Future can already be reality: anyone interested can experience it himself while visiting a history museum and looking at a Roman shipwreck on a large screen, in the same position as it has sunk many centuries ago. Like those we have established on land, we must identify and outline in future more underwater areas in need of legal protection, exclusive zones where economic, commercial and traffic activities, even sports diving would be prohibited.

A series of actions and measures could make underwater archaeological objectives more accessible to the public in future: establishing a network of internet sites, all showing such objectives, making of educative movies to explain the importance of UCH and prevent looting, more public conferences about this subject.

Regarding the third important aspect concerning future evolution of underwater archaeology, one must admit that legal provisions as measures for heritage protection are not at all a priority for certain states, rather interested in individual, selfish goals than in preserving universal history in this particular environment. This is why efforts must be done in future to convince public opinion to act responsibly, to overcome local national interests, to become aware of the risks implied by lack of responsibility, to lobby for adopting the Convention by explaining its noble goals and to determine politicians to adopt specific legal measures. It must be clear for everyone that UCH is not only property of one or more nations, but also a treasure of all humankind. In future, it must reach all interested people by means of scientific and public valorization. Unauthorized interventions must stop immediately and all efforts are necessary to prevent destruction of UCH. Cooperation on official, institutional, individual levels between states will be necessary to reach these objectives. From scientific point of view, for each country a database is extremely important for future research and valorization strategies.

An open mind is required from all stakeholders, from archaeologists trying to bring the light and culture of humanity to everyone from beyond the waves, to political personalities capable of understanding this message.

Each one of the above-mentioned aspects could give us an almost complete image about the future of underwater archaeology.

Humanity must become more and more aware of its part in preserving its own heritage.

The Extent and the Prevention of Pillaging on Submerged Archaeological Sites: The French Experience

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Abstract : *La mer, chacun aujourd'hui en convient, est le plus grand musée du monde. Malheureusement, c'est aussi le seul musée qui ne dispose pas de système de sécurité renforcé ni d'un gardiennage adapté à son immensité. Le résultat est que sur tous les océans, sous toutes les mers du globe, une lutte féroce oppose les partisans d'une protection renforcée de cet héritage englouti à ceux qui persistent à ne voir dans ce dernier qu'une proie commerciale susceptible d'appartenir au premier qui s'en saisira. Pays de naissance de l'archéologie sous-marine avec la fouille dans les années 1950 des épaves du grand Congloué, la France fut aussi le premier pays au monde à se doter en 1966 d'un service officiel chargé d'assurer la protection, l'étude et la valorisation du patrimoine immergé de ses eaux territoriales, lesquelles couvrent près de 11 millions de km² de l'Atlantique au Pacifique et de l'océan Indien à la Méditerranée. Disposant d'un arsenal juridique très ancien et très structuré, dotés de moyens logistique relativement importants, inscrits au cœur d'un réseau de relations institutionnelles très dense les archéologues sous-marins français n'ont pu empêcher pourtant que de très nombreux sites archéologiques sous-marins des eaux françaises soient pillés. Il a donc fallu réagir, mettre en place des réseaux d'information et développer des enquêtes dont les résultats aujourd'hui sont très loin d'être négligeables. Des coups très durs ont ainsi été portés ces dernières années aux trafiquants, non seulement en France mais aussi dans d'autres pays avec lesquels la France entretient des relations suivies et qu'elle épaule dans ce combat dont l'issue est la protection du patrimoine de l'humanité. Cette communication sera l'occasion d'évoquer les modes opératoires mis en place, et d'en montrer quelques résultats. Elle vise à démontrer que le pillage et la destruction de notre patrimoine immergé n'est pas inéluctable. Le chemin est encore long certes mais le désespoir n'est plus de rigueur. Le bon droit finira par l'emporter !*

Sous toutes les mers du globe, une guerre secrète fait rage. Elle oppose les partisans de la protection du patrimoine sous-marin à des individus ou à des entreprises qui ne manifestent aucun intérêt pour cet héritage et n'éprouvent aucun remord à le détruire ; ou pire n'y voient qu'une proie facile et un nouveau moyen pour s'enrichir rapidement. Comme dans toute guerre, si l'on veut en sortir vainqueur, il importe de mobiliser des énergies et des moyens logistiques, disposer de réseaux d'information et trouver des alliés. C'est je pense ce triple objectif qui nous réunit pour deux jours à Bruxelles.

Pour l'heure, si l'on observe les forces en présence, il faut bien admettre que la position des défenseurs du patrimoine est relativement préoccupante. Notre capacité à protéger notre mémoire collective engloutie est en effet cruellement insuffisante alors que la menace est omniprésente et très diversifiée. Elle est même d'autant plus inquiétante qu'elle est souvent la simple conséquence du développement des activités humaines, lesquelles impactent de plus en plus largement les fonds marins.

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Le patrimoine culturel subaquatique vit de fait en sursis sous une quadruple menace :

1) - Le développement de la plongée autonome à grande profondeur qui depuis quelques années a donné à un nombre de plus en plus important de plongeurs sportifs accès à des épaves situées dans la zone des 70 à 150 mètres et les a donc fragilisées.

2) – Les interventions de plus en plus dévastatrices de chalutiers que la raréfaction du poisson a conduit depuis 20 ans à tirer leur chalut sur des fonds marins de plus en plus importants. Ainsi, la profondeur moyenne des épaves dévastées par les chalutiers pélagiques est-elle passée de 150 m à 200 mètres de fond dans les années 1970-1980 à des profondeurs comprises entre 500 et 1300 mètres dans les années 2000.

3) – La recrudescence des activités offshore et en particulier la multiplication des exploitations de granulats marins et la généralisation des dragages à l'approche des grands ports de commerce afin de les adapter à l'évolution du transport maritime international.

– Dans le cas des extractions de granulats marins qui se sont multipliées depuis 20 ans, notamment en Manche, on a pu constater que les entreprises concessionnaires ne déclaraient jamais la découverte d'aucune épave… Or, si l'on superpose les zones où ces entreprises travaillent régulièrement et les cartes de localisation d'épaves que les archéologues français ont dressé durant 15 ans pour cette même zone de la Manche, tout donne à penser que ces entreprises ont très certainement dissimulé toutes ces années, par négligence ou sciemment, la découverte d'épaves.

– De même, des enquêtes conduites auprès des entreprises qui ont la charge de draguer l'accès

– des grands ports commerciaux ont révélé qu'à de nombreuses reprises ces travaux avaient conduit à la découverte et à la destruction illégale mais immédiate d'épaves historiques importantes. Cette réticence des entreprises à déclarer la découverte de patrimoine immergé est d'autant plus préoccupante que les grands ports d'aujourd'hui sont bien souvent ceux vers lesquels convergeaient déjà dans l'antiquité, au Moyen-Age et à l'époque moderne tous les trafics maritimes. Il est donc raisonnable de penser que les atterrages de ces grands ports sont potentiellement aussi des zones extrêmement riches en patrimoine englouti.

4) - La dernière menace enfin qui guette le patrimoine immergé, celle qui retient le plus l'attention du public car elle est souvent la plus spectaculaire et qu'elle suscite plus que d'autres l'intérêt des média, est celle qu'incarnent les chasseurs d'épaves professionnels. Le danger que constituent ces groupes privés est un peu différent des précédents car leur activité est moins systématique et concerne des zones géographiques nettement mieux circonscrites. En revanche, la menace est clairement plus précise et elle est souvent définitivement destructrice pour les épaves qu'elle a prises pour cible. Si l'on veut poursuivre notre métaphore militaire, je dirais que ces entreprises privées sont donc des spécialistes de la frappe chirurgicale quand les chalutiers pélagiques et les concessionnaires de granulats marins sont plutôt des armes de destruction massive.

Confronté à cette prolifération des menaces et à une situation qui ne cesse pas depuis plusieurs décennies d'empirer, il est logique que l'Unesco se soit efforcé d'attirer l'attention des gouvernements sur la nécessité de prendre des mesures fortes pour assurer la sauvegarde du patrimoine culturel subaquatique. Si les instances internationales ont donc joué leur rôle, il demeure que la protection du patrimoine sous-marin reste encore et toujours du ressort de chaque pays.

D'où des situations extrêmement diversifiées d'un pays à l'autre car dans de nombreux pays la protection du patrimoine immergé va surtout poser un problème de moyens financiers, techniques et humains**.** Dans la majorité des 41 pays d'ores et déjà signataires de la Convention de l'Unesco sur la protection du patrimoine culturel subaquatique il n'existe de fait aucun service archéologique spécialisé pour inventorier, étudier et mettre en valeur le patrimoine englouti. Faute de spécialiste pour les stimuler, les épauler voire les conseiller, les services de police de ces pays sont eux-mêmes insuffisamment armés pour lutter contre le cancer rampant du pillage qui menace les épaves… Il faut donc hâter les transferts de compétence, multiplier les formations, assurer une meilleure circulation des informations, en un mot, il faut créer entre tous les défenseurs du patrimoine cette solidarité sans laquelle on ne peut pas espérer gagner une guerre.

Ayant rappelé ce constat, je vais, si vous me le permettez, vous présenter maintenant rapidement un état des lieux de la situation en France.

En préambule, je souhaiterais rappeler que la France a adopté une notion du patrimoine sous-marin moins restrictive que celle qui a été retenue dans la convention de 2001. Cette dernière a en effet privilégié le seuil de 100 ans d'âge pour définir chronologiquement le patrimoine alors que la législation française considère que l'archéologie commence dès hier et non pas seulement il y a plus de 100 ans. J'engloberai donc pour ma part dans ce vaste ensemble du patrimoine menacé le patrimoine contemporain. D'autant que ce fut à mes yeux une erreur flagrante d'écarter notre héritage récent des préoccupations de la Convention puisqu'il est précisément l'un des plus directement menacés aujourd'hui par les plongeurs sportifs et les chalutiers. Il suffit pour s'en convaincre de voir combien de plongeurs visitent chaque week end les épaves de la seconde guerre mondiale et tentent d'y prélever des vestiges pour leur collection personnelle ou pour les négocier auprès des antiquaires…

La seconde singularité de la situation de la France que je veux mettre en exergue tient à la localisation géographique et au positionnement historique particulière de notre pays au cœur du continent européen. Située à l'interface des deux mondes maritimes de la Méditerranée et de l'Atlantique, qui ont tous les deux une forte personnalité, la France dispose d'un patrimoine sous-marin extrêmement riches et extrêmement divers, depuis les grottes ornées du paléolithique jusqu'aux vestiges les plus récents, en passant par les chargements d'amphores grecques ou romaines ou les cargaisons de faïences anglaises du 19^{e} siècle.

Ce constat et l'opportunité des découvertes ont conduit les archéologues français à se préoccuper très tôt de la protection du patrimoine sous-marin. Dès 1907, en Tunisie, alors territoire français, l'archéologue Alfred Merlin a ainsi entrepris avec des scaphandriers grecs l'étude de l'épave de Mahdia. Immédiatement portés à la connaissance du monde scientifique, les résultats de ses travaux ont très vite permis de sensibiliser les autorités françaises à la richesse du patrimoine sous-marin et à la nécessité de le protéger. Signe de cette évolution des esprits, un conservateur de musée, Salomon Reinach, a publié dès 1928 une phrase restée célèbre tant elle apparaît d'une lucidité prophétique: « *la mer est le plus grand musée du monde* » ! On sait aujourd'hui à quel point Salomon Reinach avait raison, mais force est d'observer que ce musée géant est encore aujourd'hui le seul musée du monde qui ne dispose d'aucun gardien permanent, ni d'aucun système d'alarme… C'est précisément cette vacuité des systèmes de sécurité qui rend ses collections si accessibles et si fragiles…

En matière de protection des biens culturels maritimes, la France n'est pas, et de loin, le pays le plus démuni.

Alors qu'un peu partout sur la planète, le vide juridique favorise le pillage, le trafic illicite et les fouilles clandestines, la France a en effet la chance d'être dotée d'une législation à la fois très ancienne, puisqu'elle se fonde sur le droit romain, et périodiquement rajeunie, puisqu'elle est portée par un grand nombre de lois régulièrement remises au jour depuis le 16^{e} siècle. Signe du caractère très vivace de cette législation, la dernière évolution des textes français a d'ailleurs moins de 10 ans. Elle date de 2004.

Dotée d'une législation très protectrice pour les épaves et pour le patrimoine immergé, la France fut aussi le premier pays au monde - et il reste aujourd'hui encore l'un des très rares - à s'être donné les moyens de protéger et de valoriser cet héritage englouti. Notre pays dispose en effet depuis plus de quarante-cinq ans d'un service et d'un personnel spécialisés aptes à gérer scientifiquement et administrativement les biens culturels maritimes. Il s'agit du département des recherches archéologiques sous-marines, le DRASSM pour lequel je travaille depuis plus de 30 ans et que je dirige depuis 2006.
La création en 1966 de ce département spécialisé ne manquait pas d'ambition puisqu'on a d'emblée décidé de lui confier la gestion de l'ensemble du patrimoine immergé de l'intégralité des eaux territoriales françaises. Or la France dispose de la deuxième plus vaste Zone Economique Exclusive (ZEE) du monde puisqu'elle couvre plus de 11 millions de km² de l'Atlantique au Pacifique et l'on estime que le nombre des sites archéologiques sous-marins dissimulés au cœur de ces espaces maritimes est sans doute proche de 150 000 à 200 000.
Pour aider les archéologues du DRASSM, il a été décidé dès 1966 de construire un navire spécialement équipé pour la recherche archéologique sous-marine : *L'Archéonaute*. C'est en particulier avec l'aide de ce navire, mais pas seulement, que les archéologues français ont d'ores et déjà expertisé ou étudié plus de 1500 épaves en un peu plus de 45 ans. *L'Archéonaute* étant aujourd'hui tout à fait obsolète au regard de l'évolution de la discipline, il a été décidé en 2006 de

lancer un programme d'étude pour construire un nouveau navire de recherche archéologique sous-marine. Après 3 années d'étude, le ministère français de la Culture a finalement ordonné en octobre 2009 la construction d'un nouveau navire. En hommage au ministre qui a créé le Drassm en 1966, il a été décidé de nommer *André Malraux* le nouveau navire du Drassm.
Après 36 mois d'étude et 18 mois de construction dans les chantiers navals de La Ciotat, près de Marseille, j'ai donc le plaisir de vous montrer en avant première les photos de notre nouveau navire de recherche. Il sera baptisé à La Ciotat le 19 janvier prochain.
Dotée d'un organisme d'Etat fort de 45 années d'expérience, disposant d'un personnel bien formé, bénéficiant d'un navire de recherche spécialisé et animée par près de 500 chercheurs professionnels ou bénévoles participant à plus d'une centaine de chantiers archéologiques sous-marins par an, la recherche archéologique sous-marine française pourrait légitimement considérer que sa situation est presque idéale. Et de fait, elle l'est à coup sûr en regard de presque tous les autres pays dans le monde ! Pour autant, le patrimoine sous-marin des eaux françaises reste menacé et c'est la raison qui nous a conduit voici 5 ans à prendre des initiatives pour lutter plus efficacement et de manière plus déterminée contre le pillage de ce patrimoine.

La première mesure que nous avons prise a été d'établir des contacts plus étroits avec les services de police, en particulier celui de la Douane judiciaire qui est une branche de la Douane française. Nous avons privilégié ce service parce que nous avions déjà travaillé avec lui et que ses enquêteurs avaient manifesté à plusieurs reprises leur intérêt pour la lutte contre le trafic du patrimoine immergé. Puis les archéologues du DRASSM ont participé régulièrement à des formations spécialisées au profit des enquêteurs de la Douane et ces derniers nous ont fait bénéficier en retour de leur expérience en matière d'enquête et de lutte contre les trafics internationaux. Cette démarche est un peu inhabituelle car si les archéologues disposent bien souvent d'une connaissance approfondie du pillage, ils répugnent souvent, par suite peut-être d'une certaine culture de l'indulgence, à saisir les services de police des informations qu'ils possèdent. Or, notre expérience a prouvé que l'association entre les services de police et les archéologues permet de faire progresser plus vite les enquêtes et de porter des coups plus rudes aux trafics. Désormais, il n'est ainsi pas de semaine où le Drassm n'ait pas de réunion ou d'échange téléphonique avec les enquêteurs des Douanes et nous avons mené ces 5 dernières années de nombreuses enquêtes et de missions en commun.

Nous avons ensuite décidé de rechercher méthodiquement des informations, de n'en négliger aucune et de porter systématiquement plainte contre les plongeurs indélicats ou les sociétés en infraction. Cette mesure nous a permis de rencontrer plus régulièrement les procureurs et les juges, de mieux les connaître et de mieux les sensibiliser à la protection du patrimoine sous-marin. En retour, nous avons nous-mêmes mieux compris comment un dossier devait être présenté à la justice pour retenir son attention alors même que les tribunaux sont déjà encombrés d'énormément d'affaires de droit commun auprès desquelles le pillage d'une épave pourrait parfois apparaître comme un dossier de peu d'importance.

Après 5 ans, le premier bilan de cette nouvelle stratégie offensive est loin d'être négligeable. De vrais succès ont même été enregistrés. Ainsi, près de 3000 objets archéologiques significatifs ont été saisis ou récupérés chez des clandestins au cours des seules années 2007-2008.
Fort de ces premiers résultats, nous nous sommes également préoccupés de mieux protéger les épaves contemporaines dont le pillage avait trop longtemps bénéficié de la clémence des services de police et de la justice mais également, il faut le reconnaître, des archéologues eux-mêmes. Nous avons donc réorienté notre stratégie et nous avons entrepris, dans les années 2006 à 2008, d'informer au cours de nombreuses réunions les plongeurs que les épaves contemporaines aussi devaient désormais être protégées puis nous avons diligenté après 2009 des enquêtes qui ont permis de ralentir ces trafics. A cette occasion, nous avons également entrepris de surveiller plus attentivement les sites de vente en ligne sur Internet et nous avons été amenés à plusieurs reprises à demander l'intervention des douanes pour faire saisir des objets vendus sur Ebay

Cette reprise en main générale a débordé de loin le seul cadre de nos frontières puisque nos actions ont permis dans le même temps de faire obstacle à des pillages menés dans d'autres territoires maritimes que le nôtre, notamment à Madagascar où nous avons pu interrompre le pillage d'une très rare épave portugaise du début du 16^{e} siècle et bloquer l'exportation de biens culturels maritimes d'une très grande valeur archéologique. Notre intervention dans cette affaire ne s'est d'ailleurs pas bornée à récupérer les objets volés mais nous avons également offert notre aide au Gouvernement

Malgache pour assurer notamment la conservation préventive des canons en bronze illégalement prélevés sur le site et que nous avons fait saisir en Océan Indien par la Douane française

Je voudrais achever ce tour d'horizon des actions entreprises pour lutter contre le pillage en évoquant rapidement une dernière affaire qui constitue un incontestable succès pour les archéologues et les services de police mais dont certains épisodes illustrent bien la difficulté pour nous de mener ce combat.
Il s'agit de l'affaire du trésor monétaire de Lava trouvé en mer voici 25 ans sur les côtes de la Corse. Ce trésor du 3^{e} siècle apr J.-C. est considéré par tous les numismates de la planète comme l'un des trésors monétaires les plus importants au monde. Après sa découverte qui n'a pas été déclarée, il a fait l'objet dans les années 1985 et 1986 d'un gigantesque pillage qui n'a cessé qu'après l'intervention en 1986 du DRASSM et de la Police. Une centaine de 100 pièces en or, dont certaines rarissimes puisqu'elles ne sont connues que par ce trésor corse, ont été récupérées à l'époque par les enquêteurs. Plus de 1000 autres pièces en or, dont certaines ont une valeur estimée à l'unité à plus de 300 000 euros, ont en revanche disparu. De même un plat en or, unique pour le 3^{e} siècle apr. J.-C a été subtilisé au cours du pillage. Or, en 2006, 20 ans après le pillage, le DRASSM a pu disposer d'informations qui ont permis de rouvrir l'enquête, de remonter des réseaux clandestins et finalement de récupérer en octobre 2010 le plat dérobé en 1985. Grâce aux informations recueillies au cours de l'enquête, un juge français a pu obtenir l'ouverture d'une enquête internationale qui a permis de saisir dans plusieurs pays, notamment en Belgique, Espagne, Portugal, Allemagne et Autriche…, de nombreuses monnaies en or détenues illégalement. Interpol a même publié une affiche spécifique pour alerter les polices internationales sur l'importance de ce trésor. Or, les justices allemandes et autrichiennes viennent d'ordonner que les monnaies saisies sur leurs territoires soient restituées à leur propriétaires sous le prétexte que ces derniers les avaient légalement achetées même si elles étaient illégalement détenues par ceux qui les leur avaient vendues. Si les justices allemande et autrichienne persistent dans cette attitude, vous comprenez aisément combien il nous sera difficile de lutter contre les pilleurs d'épaves. Là encore, il faudrait sans doute que les archéologues fassent pression sur leur gouvernement respectif pour que le droit soit respecté et qu'on ne puisse pas, sous de quelconques prétextes, contourner les textes et légaliser la détention d'objets qui relève du pillage d'un patrimoine dont l'Unesco a rappelé qu'il était celui de l'humanité.

Pour conclure
La lutte pour la protection du patrimoine immergé est une lutte de tous les jours et j'espère avoir montré, à travers l'exemple français, que les pays qui disposent de personnels et d'organismes spécialisés en matière d'archéologie sous-marine sont nécessairement mieux armés pour l'emporter. Les réunions qui se multiplient de part le monde, souvent sous l'égide de l'Unesco, et qui associent de plus en plus de pays autour du thème de la protection du patrimoine englouti, sont un témoignage fort de l'attention que l'on porte partout à la protection et à la mise en valeur du patrimoine sous-marin. Elles montrent qu'une évolution, sinon une révolution est en marche. Elle est nécessaire. Essentiellement côtiers et de faible fond il y a 30 ans, les pillages ont gagné aujourd'hui la haute mer et les abysses. De même, aux dragages et déroctages de faible emprise programmés dans les entrées de port voici 3 décennies, ont succédé des permis d'extraction de granulats marins sur de très vastes zones maritimes. Il faut donc agir mieux, se concerter mieux, se former mieux. La France, nation pionnière dans le domaine de l'archéologie sous-marine et qui dispose déjà d'une longue expérience de la protection et de la valorisation du patrimoine immergé entend contribuer à cette lutte que la Convention de 2001 de l'Unesco sur la protection du patrimoine culturel subaquatique entend promouvoir. Tout indique que le combat sera long et probablement acharné. Mais j'ai une conviction et je veux vous la faire partager. Si nous savons rester unis ; si chaque jour nous luttons ensemble pied à pied pour que le patrimoine culturel sous-marin soit préservé, alors une chose est absolument sûr : ce combat nous le gagnerons !

The Centenary of Titanic and the Treaty Giving Legal Protection

Ole Varmer and Mariano J. Aznar[2]

Abstract: *As of April 15, 2012, the centennial anniversary of the sinking of RMS Titanic, this iconic wreck is protected by the United Nations Educational Science and Cultural Organization (UNESCO) Convention on the Protection of Underwater Cultural Heritage (UCH) (November 2, 2001) (hereinafter 2001 UNESCO Convention) which applies to all historic shipwrecks that remain underwater for 100 years or more. This paper discusses the application of the more important provisions of this Treaty and the implications for parties, such as Spain, and non-parties, such as the United States. It also discusses the International Agreement on Titanic that was negotiated by the United States, the United Kingdom, France and Canada. Additionally, the paper will discuss the laws in the United States to protect Titanic from looting and unwanted or unauthorized salvage, including orders protecting Titanic under the maritime law of salvage issued by Chief Judge Rebecca Smith sitting in admiralty jurisdiction in the United States Federal Court in the Eastern District of Virginia. The court orders prohibit the salvors from disturbing the two large hull portions that are the final resting place of many of those passengers who did not survive the tragedy. Court orders also protect the artifacts salvaged from the field around the two large hull portions by requiring proper conservation and curation of the collection of artifacts as a whole for the public benefit and prohibiting the sale of individual artifacts to private collectors.*

Introduction and Background

Titanic sank a century ago on April 15, 1912. Its sinking and the tragic loss of approximately 1,500 lives captivated the hearts and minds of people around the world and significantly influenced the development of related law of nations, including the U.S. Radio Act of 1912 and the International Convention for the Safety of Life at Sea (SOLAS) in 1914, among other laws regulating ship design, lifesaving equipment, distress signals, and international ice patrols. The establishment of the International Maritime Organization (IMO), an international body overseeing the safety of international shipping, is also directly attributable to the lawmaking frenzy that occurred in the aftermath of the Titanic incident. Since its sinking, the legend of Titanic continues to shape culture through songs, books, plays, and movies, which illustrate the stories of numerous heroes and heroines aboard the ill-fated ship who risked their own lives to save the lives of others.

A. Discovery of *Titanic* by Joint French-U.S. Expedition

The shipwrecked Titanic was discovered on September 1, 1985 by a joint French-U.S. expedition lead by Jean Luc Michel of the French Research Institute for Exploration of the Sea (IFREMER) and Dr. Robert Ballard of the Woods Hole Oceanographic Institution (WHOI). The expedition found the wreck approximately 350 nautical miles (nm) out on the slope of Canada's continental shelf, at approximately two and a half miles below the ocean surface (depth of 12,500 ft or 3,800 m). In July 1986, Dr. Ballard returned and placed a plaque at the Titanic wreck site recording its discovery the previous year and calling for the wreck to be left undisturbed in memory of those who perished aboard the wreck. In 1987, Titanic Ventures Inc. and IFREMER returned to the wreck and began to salvage artifacts from the field around the two large hull portions (hereinafter artifact field). As such, the discovery of Titanic became a catalyst for two different legal initiatives reflecting the broad public interest in Titanic: 1) the enactment of legislation in the United States in 1986; and 2) the 1987 salvage of Titanic, initially controlled under the laws of France and subsequently under the laws of the United States. The enactment of the RMS Titanic Maritime Memorial Act of 1986 in the United States also influenced the orders of the court in the United States.

B. 1986 U.S. Legislation and International Agreement and Guidelines for Activities Directed at Titanic

In an effort to address threats from future activities and ensure future preservation of the site as a maritime memorial, Dr. Ballard urged legislators to enact legislation on Titanic. In 1986, President Ronald Reagan signed into law the RMS Titanic Maritime Memorial Act. The Act recognizes the wreck site as an international maritime memorial that should be preserved for present and future generations. In particular, it encourages the U.S. Department of State (DOS), in consultation with the National Oceanic and Atmospheric Administration (NOAA), to initiate negotiations with the United

[2] The views and opinions expressed in this paper are those of the authors in their respective individual capacities and do not necessarily reflect the views, opinions or positions of their respective employers or the governments of the United States or Spain.

Kingdom, France, Canada and other foreign governments to develop an international agreement providing for additional protection of Titanic. Additionally, the Act encourages NOAA, in consultation with DOS and other governments, to develop international guidelines (NOAA Guidelines) for the exploration, research, and, if determined appropriate, salvage of Titanic. It was not until the 1990s that other countries expressed an interest developing an agreement perhaps because of salvage activities and/ the exhibition of salvaged artifacts.

C. 1993 Salvage Award by France to Titanic Ventures (RMST) of 1987 Salvage Artifacts

In 1987, France's IFREMER returned to the wreck site with the U.S. company Titanic Ventures Limited Partnership (hereinafter Titanic Ventures), now known as RMS Titanic Inc. or RMST. The expedition recovered approximately 1,800 artifacts. IFREMER's charter agreement with the salvors included conditions that the salvor would keep all of the salvaged artifacts together as an intact collection for the public benefit and would not sell individual artifacts. They did not immediately file a claim under salvage law or return to the site for additional salvage as might be required in order to exercise "due diligence" under the maritime law of salvage. In 1992, the Marex Company filed for rights to salvage Titanic in the United States. This is likely to have been a factor in RMST requesting a salvage award in France.

In a letter from Titanic Ventures to the Office of Maritime Affairs for France (Ministry of Equipment, Transportation, and Tourism) on September 22, 1993, Titanic Ventures stated that the search for the 1987 recovered artifacts' heirs was complete and requested title of the unclaimed 1987 artifacts. Titanic Ventures committed to the "respectful use of the artifacts recovered," stating "that the artifacts will only be used [for] a cultural purpose and will not, therefore, be part of any operations which would lead to their dispersion, but to the exception of exhibition purposes, and none of the artifacts will be sold." These conditions, as set forth in the charter agreement and reaffirmed by Titanic Ventures in its request for ownership, are in the public interest of all nations.

France subsequently awarded the unclaimed 1987 salvaged artifacts to Titanic Ventures (RMS Titanic, Inc.) pursuant to the same conditions. In a response letter dated October 12, 1993, a chief administrator in the French Office of Maritime Affairs stated that unclaimed recovered objects "shall be delivered to the company Titanic Ventures." The Administrator incorporated Titanic Ventures' assurances from the company's September 1993 letter in stating,

> "Concerning the delivery of ownership, I have duly noted your intention, entered in the letter of 9/22/93, by which you agreed to make use of such objects in conformity with the respect due to the memory of their initial owners and to not carry out any commercial transactions concerning such objects nor any sale of any one of them nor any transaction entailing their dispersion, if not for the purpose of an exhibition."

On October 20, 1993, the Administrator declared in formal minutes (a "procès-verbal") that he delivered the 1987 recovered artifacts from the *Titanic* wreck to Titanic Ventures and attached an exhibit of "the letter of intent of Titanic Ventures Limited Partnership dated September 22, 1993." The salvaged objects were conserved and curated by Electricite de France ("EDF"), the French government-owned utility. In addition to the recovery of historic objects, the Company's 1987 expedition also produced approximately 140 hours of videotape footage and an estimated 7,000 still photographs from the wreck site which are also part of this *Titanic* collection that was awarded by the French government in 1993 after the 1992 filing in U.S. and Admiralty court.

D. 1992 Filing of Salvage Rights by in U.S. I Court Eastern District of Virginia

In 1992, Marex Titanic, Inc. (Marex) sought rights to salvage Titanic in the U.S. District Court for the Eastern District of Virginia, Norfolk Division.[3] On August 12, 1992, the Court asserted jurisdiction over the Titanic and issued a warrant to "arrest" the shipwreck. However, it was subsequently determined that Marex never performed any salvage operations at the Titanic site, much less brought salvaged artifacts within the territorial jurisdiction of the Court for a proper *in rem* salvage claim. When Titanic

[3] While there were no particular connections to Virginia or the United States mentioned in the filing of the case, this was the same court that asserted admiralty jurisdiction in year over salvage of the Columbus America shipwreck more than 100 nautical miles off the coast of Virginia on the continental shelf of the United States pursuant to a filing by the salvors in that case.

Ventures (RMST) learned of the salvage claim, the company filed a complaint to challenge Marex's claims and assert its own claim to exclusive rights to salvage based on its 1987 salvage expeditions and plans for future salvage.

E. 1994 RMST Award of Exclusive Salvage

On August 26, 1993, RMST, the successor in interest to Titanic Ventures, brought a wine decanter which it had salvaged from the wreck site within the territorial jurisdiction of the Court to assert *in rem* jurisdiction and pleaded with the Court that it should be recognized as the exclusive salvor-in-possession of Titanic. U.S. District Judge J. Calvitt Clarke, Jr. asserted *in rem* jurisdiction over the artifact as well as jurisdiction over the salvage of the Titanic wreck site. The Court recognized the U.S. Marshal as custodian of the Titanic and appointed RMST as substitute custodian of the salvaged artifacts and the Titanic wreck site. In a court order dated June 7, 1994, the Court granted RMST exclusive salvage rights to Titanic.[4] RMST and IFREMER returned to Titanic for salvage expeditions in 1993 and 1994. RMST's efforts to bring a collection of Titanic up for display in museums with public access such as the British National Maritime Museum, was appreciated by some. On the other hand, the fact that the collection was the subject of a commercial expedition by a private company trying to profit from its salvage raised questions of ethics in the professional archaeological community. The 1994 salvage award and public display of artifacts was also a catalyst for discussions on the need for laws to protect Titanic and other underwater cultural heritage (UCH).

F. 1995 Exhibition of Artifacts in United Kingdom and the Greenwich Conference

The British National Maritime Museum convened an international conference in Greenwich, England, in February of 1995 to discuss Titanic and, more importantly, other UCH that was vulnerable to looting and unscientific salvage. Participants agreed that there was a need to protect UCH from looting and unwanted salvage and reviewed the International Law Association's draft Convention to protect UCH. However, there were questions as to which international organization, such as UNESCO or the International Maritime Organization (IMO), would be the best forum for further discussions, including UNESCO. A second international conference took place at the IMO in January of 1996 and resulted in an official international statement, known as the Greenwich Declaration, concerning the management of UCH. It became clear at these meetings that the IMO was not interested in expanding its scope from international shipping activities and that UNESCO was the most appropriate international forum for negotiating an agreement on historic shipwrecks and other underwater cultural heritage. Thus, these two conferences appear to have been a catalyst for the subsequent meeting of experts convened by UNESCO that resulted in the UNESCO Convention on UCH, agreed to on November 2, 2001. These meetings sponsored by the British National Maritime Museum also facilitated the development of an international agreement on *Titanic*.

G. International Agreement on *Titanic*

At these two UCH conferences, the United States, United Kingdom, France, and Canada held informal sidebar meetings to discuss the purpose, scope, outline, and contents of a potential international agreement on Titanic. Following up on a sidebar discussion at the 1996 London conference, national delegations from Canada, France, the United Kingdom, and the United States convened for official negotiations between 1997 and 2000. The objective of these negotiations was to combine their individual efforts and governmental capacity for the joint purpose of preserving the Titanic wreck site and salvaged artifacts. Negotiations concluded on January 5, 2000. Shortly thereafter RMST filed a suit against U.S. negotiators, Bob Blumberg and Ole Varmer, and ultimately the government agencies they work for, the U.S. Departments of State and Commerce respectively, to prevent the implementation of an international agreement on *Titanic*. RMST argued that the international agreement and NOAA Guidelines were unconstitutional and an infringement of their rights to salvage *Titanic*. The suit was dismissed on the grounds that the agreement and guidelines were not final and not in force. Thus, the action was not ripe for judicial review. The NOAA Guidelines on the

[4] In response to subsequent pleadings that RMST owned *Titanic* under the law of finds, the Court held that while RMST continued to have the rights under the law of salvage, RMST does not own *Titanic* under the law of finds. Like the French Administrative Tribunal, the Court ordered that the artifacts salvaged from *Titanic* be kept intact as a collection for the public benefit and prohibited the sale of individual artifacts. The Court also prohibited any piercing or penetration of the wreck's hull or salvage of artifacts from within the hull. Salvage is limited to the field of artifacts around the large hull portions.

Exploration, Research and Salvage were published in final form on April 12, 2001 without further litigation. Finally, on November 6, 2003, the International Agreement Concerning the Shipwrecked Vessel RMS Titanic (hereafter "International Agreement") was signed by the United Kingdom and open for signature by the other parties. The United States signed the Agreement on June 18, 2004; however, at the signing, the United States indicated that before it could be bound in international law, congressional enactment of legislation authorizing the control over activities directed at Titanic and enforcement of the agreement over those persons over which the U.S. has jurisdiction under international law was needed. As called for in the RMS Titanic Maritime Memorial Act of 1986, the U.S. Department of State submitted to Congress draft legislation to implement the agreement a number of times. While the U.S. Congress has not yet enacted such legislation, it is hoped that the centenary will be a catalyst for the enactment of such legislation or other actions clarifying the existence of legal authority for the United States to carry out the obligations under the Agreement.
In sum, the purpose of the International Agreement and draft implementing legislation was to protect Titanic from looting and unwanted salvage and ensure adherence to the scientific rules for research, recovery or salvage to help preserve Titanic for present and future generations. To fulfill this purpose, the International Agreement and draft legislation would prohibit potentially harmful activities directed at Titanic and establish a permit system to manage the research, exploration, recovery, and salvage of Titanic. The Annex Rules would require the application of the current professional standards of scientific and archaeological resource management so that Titanic is properly preserved and conserved for present and future generations. The scientific standards in the Annex Rules are similar to the NOAA *Titanic* Guidelines and the 1996 Charter on the Protection and Management of Underwater Cultural Heritage on which they are both based. However, the Annex Rules would be mandatory and clearly enforceable in court. Thus, while court orders under the maritime law of salvage afford some protection to *Titanic*, particularly through control of the activities of the salvor in possession over which the Court has *in personam* jurisdiction, additional legislation or authority is needed to enforce the agreement against looters and unauthorized salvage.

One of the questions that congressional staffers and others have raised is how U.S. legislation or even an international agreement between the United States and the United Kingdom will actually protect Titanic from looters or unwanted, unscientific salvage by those who are not from the United States or the United Kingdom. Part of the response is that the United States and United Kingdom can use international law concepts such as flag State jurisdiction and jurisdiction over nationals and other persons in their respective nations to control activities of foreign persons directed at the wreck site. The United States and United Kingdom could also apply their domestic trafficking laws to artifacts looted from *Titanic* by foreign persons and vessels, provided the trafficking is within the territorial jurisdiction of the United States or United Kingdom.

Of course, the more nations that become parties to the International Agreement, the better its protection will be. Perhaps the most important potential signatory is Canada as *Titanic* lies on Canada's extended continental shelf and most expeditions have used Canadian ports. As a result, activity at the wreck site would be subject to Canada's port State jurisdiction. While the United Kingdom waits for the United States, Canada, France, and perhaps other nations to become parties to the International Agreement, all of the parties to the 2001 UNESCO Convention will be obligated to protect *Titanic* consistent that Treaty as of April 15, 2012, when Titanic falls under the Convention's temporal requirement. In the meantime, there are existing international and U.S. laws protecting Titanic.

II. EXISTING PROTECTION FOR TITANIC UNDER INTERNATIONAL AND U.S. LAW

A. International Law of the Sea: Duty to Protect Titanic and Other UCH

The Law of the Sea Convention (LOSC) has been referred to as the constitution or framework treaty for activities, including the preservation of UCH, conducted at sea in all of the various maritime zones. While the United States is not a party to the LOSC, the United States has been a leader in its development and implementation and recognizes that much of the Convention reflects customary international law.

The United States has a good track record of cooperating with other nations, such as the United Kingdom, France, Canada, Spain, Germany, and Japan, to protect UCH. In some cases, the cooperation has involved U.S. courts sitting in admiralty jurisdiction; for example, the "Black Swan" case in which Spain successfully argued that its sunken vessels Mercedes is subject to sovereign

immunity and may not be salvaged without its consent. While the U.S. pleading to the court did not express any position on the facts of the case, it did consult with Spain in the filing of its amicus brief, which, in sum, stated that if the court determined that the "Black Swan" was a sunken Spanish craft, then it would be subject to sovereign immunity and could not be salvaged without the consent of the vessel's flag state, Spain. As such, the U.S. government and particularly NOAA's Maritime Heritage Program cooperates with Spain on a Memorandum of Understanding regarding the protection and management of UCH. This cooperation is consistent with the LOSC.

Article 303(1) of the LOSC recognizes the duty of all states "to protect objects of an archaeological and historical nature found at sea" and to cooperate for that purpose. As the United States, the United Kingdom, France, and Canada cooperated in the development of the International Agreement, which recognizes Titanic as a maritime memorial of historical significance, there is little or no dispute that other states have a duty to protect Titanic and cooperate for that purpose.

This duty to protect under the LOSC may be carried out in many ways, such as under the International Agreement on Titanic or the 2001 UNESCO Convention. This cooperation may be carried out under the private international law of salvage, which allows regulation of private companies, such as the commercial salvors in the case of the Mercedes (Odyssey Marine Exploration's Black Swan project) as opposed to public international law, which regulates the activities of nations. As indicated above, much of the existing protection of Titanic to date has been accomplished under the maritime law of salvage in France and recent U.S. court orders. The French Tribunal in its award of the artifacts recovered from the 1987 expedition required that the collection of artifacts be kept together as an intact collection for the public benefit, and the U.S. federal court issued similar orders requiring that the collection of artifacts salvaged be kept together as an intact collection for the benefit of the public and prohibiting penetration or harm of the hull portions. The U.S. court also recognized that the International Agreement and the NOAA Guidelines are in the public interest in Titanic. Other U.S. domestic laws, including the National Historic Preservation Act and the trafficking laws including the National Stolen Property Act and/or the Archaeological Resources Protection Act section 6(c), may be available to help enforce the International Agreement.

Under LOSC Article 303(1), the U.S. has a duty to protect objects of a historical or cultural nature like Titanic and to cooperate with other nations for that purpose. Although the U.S. may not be a party to the LOSC, it takes a leading role around the work in its implementation of many of its provisions as they reflect customary international law. For a number of reasons, the U.S. is also not a party to the 2001 UNESCO Convention. Regardless, under customary international law the U.S. has a duty to cooperate with other nations including those with the additional duty to protect and cooperate for that purpose under the 2001 UNESCO.

III. THE 2001 UNESCO CONVENTION AND ITS LEGAL PROTECTION OF TITANIC

A. 2001 UNESCO Convention Protects All Wrecks Underwater for at least 100 Years

The 2001 UNESCO Convention provides "blanket protection" to all UCH as defined under Article 1 (Definitions). Under the Convention, UCH is defined as "all traces of human existence having a cultural, historical or archaeological character which have been partially or totally under water, periodically or continuously, for at least 100 years . . . ." Included in this definition of UCH are "human remains," "vessels . . . or any part thereof, their cargo or other contents," and "their archaeological and natural context."

B. *Titanic* Subject to 2001 UNESCO Convention as of April 15, 2012

On the night of April 14, 1912, *Titanic* collided with an iceberg and sank in the early morning of April 15, 1912. Thus, as of April 15, 2012, the wreck site falls under the 2001 UNESCO Convention definition of UCH and is subject to the Convention's protection. Parties to the Convention will be obligated to protect the wreck site. The Titanic shipwreck has been continuously underwater since the date of its sinking and consists of the vessel, human remains, and the personal cargo and contents of those who were aboard Titanic at the time of the tragic accident. The shipwreck is of cultural and

historical significance, and serves as the gravesite for over 1500 men, women, and children. Therefore, Titanic is UCH and brought within the scope of the UNESCO Convention as of April 15, 2012.

C. Summary of 2001 UNESCO Provisions Protecting UCH like Titanic

1. Article2 (5): In situ preservation

Article 2(5) of the UNESCO Convention provides that "[t]he preservation in situ of underwater cultural heritage shall be considered as the first option before allowing or engaging in any activities directed at this heritage." As a precautionary management approach to protecting UCH, in situ preservation provides flexibility for UNESCO Convention State Parties to implement the duties that already exist under customary international law. These duties, as stated in LOSC Article 303(1), include the "duty to protect objects of an archaeological and historical nature found at sea" and "to cooperate for this purpose."

Similarly, the Annex Rules to the International Agreement call for in situ preservation as the preferred policy. Under the International Agreement, any activity directed toward Titanic may be authorized only if "justified by educational, scientific or cultural interests, including the need to protect the integrity of RMS Titanic and/or its artifacts from a significant threat . . . ." UNESCO Convention State Parties must implement in situ preservation unless "activities directed at underwater cultural heritage . . . [are] authorized for the purpose of making a significant contribution to protection or knowledge or enhancement of underwater cultural heritage." The rules annexed to both the UNESCO Convention and the International Agreement required that certain scientific methodology be used for any activity directed at UCH/Titanic. As indicated above, artifacts around the two large hull portions of Titanic have been subject to salvage consistent with the charter agreement with IFREMER and NOAA Guidelines, while the hull portions continue to be preserved in situ. Without project authorization or proper justification, interested parties and the general public would be limited to non-destructive activities such as viewing, surveying, photographing, and visiting Titanic. Some critics of the UNESCO Convention and the International Agreement criticize the in situ preservation policy as actually resulting in damage to UCH that would be better protected if recovered or salvaged. However, this reflects a misunderstanding of these agreements and the in situ preservation policy. The Annex Rules of both agreements contemplate that UCH is going to be subject to intrusive research and recovery when the UCH is threatened by human activity or nature, or when it is time for the Titanic "time capsule" to be recovered. In situ preservation is consistently implemented by the UNESCO Convention and the International Agreement. However, one major issue may be whether the Parties to the 2001 UNESCO Convention will respect the treatment of Titanic under the U.S. court implementation of the law of salvage and NOAA Guidelines. The U.S. court and NOAA guidelines in turn recognize and respect the orders of the court consistent with the RMS Titanic Maritime Memorial Act of 1986, the LOSC and many provisions of the Agreement, and the 2001 UNESCO Convention Annex Rules.

2. Article 4: Prohibition Against Application of Law of Salvage and Law of Finds

Article 4 provides an express prohibition against the application of the law of salvage and the law of finds. Parties to the Convention would generally be prohibited from the unauthorized salvage of *Titanic*. In regard to the whether and how the authorizations of salvage of *Titanic* by the United States and France would be recognized and treated by parties to the 2001 UNESCO Convention, it should be noted that Article 4 includes an exception which allows nations to authorized activities through the law of salvage provided the salvage is conducted in strict accordance with the Convention and Annex Rules. More specifically, the law of salvage may only be applied if (1) the salvage is controlled or authorized, (2) the UCH will receive maximum protection, and (3) such authorization is "in full conformity with this Convention." As there is a preference for in situ preservation and a general ban against the law of salvage and finds, none of the Parties to the Convention are likely to authorize an expedition to recover artifacts under the law of salvage or finds. The question remains as to how they will view the salvage activities previously authorized by the governments of the United States and France. However, as no other nations have indicated that they object to these salvage awards and the salvage company is required to comply with orders that appear consistent with the Convention, the parties may continue to be silent on the matter, if not respect the orders under the circumstances. RMST is required by the orders or authorizations of the United States and France to keep the collection together for the public benefit.

3. Other Articles that Apply to Protect Titanic

The blanket protection of UCH of the Convention may also involve a number of other articles under the 2001 UNESCO Convention, including:

- Article 5: Activities incidentally affecting UCH;
- Article 14: Control of entry into the territory, dealing and possession;
- Article 15: Non-use of areas under the jurisdiction of States Parties;
- Article 16: Measures relating to nationals and vessels;
- Article 17: Sanctions;
- Article 18: Seizure and disposition of UCH;
- Article 19: Cooperation and information-sharing; and
- Article 3: Relationship to the LOSC

Also involved are the Annex Rules to the 2001 UNESCO Convention which are very similar to the Annex Rules in the *Titanic* Agreement and NOAA Guidelines.

Conclusion

On April 15, 2012, the wreck site of Titanic will have been underwater for 100 years and thus will become subject to the provisions of the 2001 UNESCO Convention on the Protection of Underwater Cultural Heritage (UCH), which provides blanket coverage to all shipwrecks and other UCH that have been underwater for at least 100 years. There are already some duties under customary international law as reflected in LOSC that apply to Titanic. Some existing U.S. laws and policies also protect Titanic, including orders of the U.S. federal court sitting in admiralty. Many of these laws and policies are consistent with the 2001 UNESCO Convention. As the wreck site of Titanic hits the temporal milestone, legal protection will increase, thus bolstering protection of the wreck site for the benefit of present and future generations. Even with this increased protection, there are many gaps and weaknesses in the current protection that would benefit from the enactment of legislation to protect Titanic and perhaps other UCH from looting and unwanted, unscientific salvage.

Quantification of Trawl Damage to Pre-modern Shipwreck Sites: Case Studies from the Aegean and Black Seas

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Abstract: *The past four years of exploration by the E/V Nautilus off the Aegean and Black Sea coasts of Turkey have located 40 pre-modern shipwrecks, ranging from Archaic Greek to early 19th century. More importantly, these wrecks also range in their state of preservation, due in a large part to the amount each site has been damaged by bottom trawling activities. Analysis was conducted of the damage reflected by each wreck site, the extent and intensity of trawl scars visible in side-scan sonar mapping, and the proximity of each site to the coast and other areas of fishing restrictions. In the Black Sea, these results are correlated with evidence of anoxic events caused by internal wave activity at the oxic/anoxic interface, reflected by the preservation of wooden shipwrecks. These data show areas of the Turkish coast where sites are more severely threatened or where they may have already been eradicated. Damage reflected by the dispersal of wooden timbers or by broken ceramic cargos indicates areas that may be aided by additional establishment and enforcement of marine protected areas.*

Introduction

Damage by mobile fishing gear to shipwreck sites is an unfortunate result of humanity's continued exploitation of the sea. Recent exploration in the Aegean and Black Seas by the Institute for Exploration (IFE) with Ocean Exploration Trust's vessel, *E/V Nautilus*, has begun to document and quantify the damage by bottom trawls to ancient shipwreck sites. Forty shipwrecks ranging from Archaic Greek to the early 19th century have been located and documented since 2008 along the Turkish coast, comprising a catalogue of deep water sites that now allow us to discuss spatial patterns of trawl damage on the seabed and how these wreck sites fit into the submarine landscape as modern features of the seafloor. Ancient wrecks range in preservation state from consolidated, ship-shape piles of intact amphoras that have been protected in harbors, to disarticulated scatters of smashed ceramic cargos with very few whole artifacts remaining, in areas of flat seabed far from shore. The location and amount of damage exhibited by each of these forty wreck sites illustrates the extent and intensity of bottom trawling along the Turkish coastline. We plan to use these data to argue for the establishment of additional marine protected areas (MPA) and increased enforcement of trawl restrictions in key areas. The documentation of this type of damage is essential to understanding the dismantling of these sites by bottom trawling by quantifying the effects of trawls on both the seabed and on ancient wreck sites. Severe damage to many of these wrecks highlights the need for better protection of affected areas as well as more comprehensive surveys of these areas before the wrecks are damaged to the point that they can no longer be found.

Trawl damage to shipwrecks has been a topic of recent interest and debate, as commercial salvers have begun citing such damage as a justification for removing cultural material from the seafloor (e.g., Kingsley, 2009, 2010; Sinclair, 2010). Technology to access the deep sea is now available to the private sector, removing the protection a site's depth used to provide. This only makes the role of an archaeologist more important in protecting sites, including upholding the principles of the UNESCO Convention. While *in situ* preservation of underwater sites is the primary objective, when this is not possible, they must, in every case, be excavated scientifically, conserved, catalogued, and curated, not sold off. The "scientific" approach to wreck sites must also be carefully monitored, as some commercial salvers have begun publishing their work online, creating an "illusion of research" (Greene et al., 2011:314) that has not been peer reviewed or vetted by the archaeological or scientific communities. The threat of trawling to shipwreck sites does not change the way they should be handled, documented, or reported. Contrary to being an excuse for salvage, our work in the Aegean Sea shows that the establishment of additional marine protected areas around wreck sites and increased enforcement can do much to keep these sites protected *in situ* (Brennan et al., in revision).

Aegean Sea

We have begun quantifying trawl damage both to the seabed, through side-scan sonar mapping, and to amphora wrecks, through counts of broken artifacts visible in photomosaics. Side-scan sonar mapping has focused on depths ranging from 80 to 600 m, as well as in and around areas where trawling is prohibited, such as within 2.5 km from shore, and along a 100 m swath around submarine cables (KKGM, 2006). Post-cruise analysis of the sonar data created trawl intensity maps that show the number of scars per area, illustrating the extent and intensity of recent damage to the seabed, for example off the coast of Yalikavak, Turkey (Figure 1; Brennan et al., in revision). This figure shows the intensity of trawl scarring plotted over the shaded 2.5 km coastal boundary, and illustrates that this restricted area is clearly observed by trawlers. South of Datcha, we observed that heavy trawling is conducted parallel to submarine cables to avoid catching it, despite the prohibition. These areas, further from shore, are less easily enforced than the zones close to shore, and are therefore more likely to be illegally trawled. A number of trawled wreck sites were located in close proximity to these cables in 2009 (Brennan, 2010).

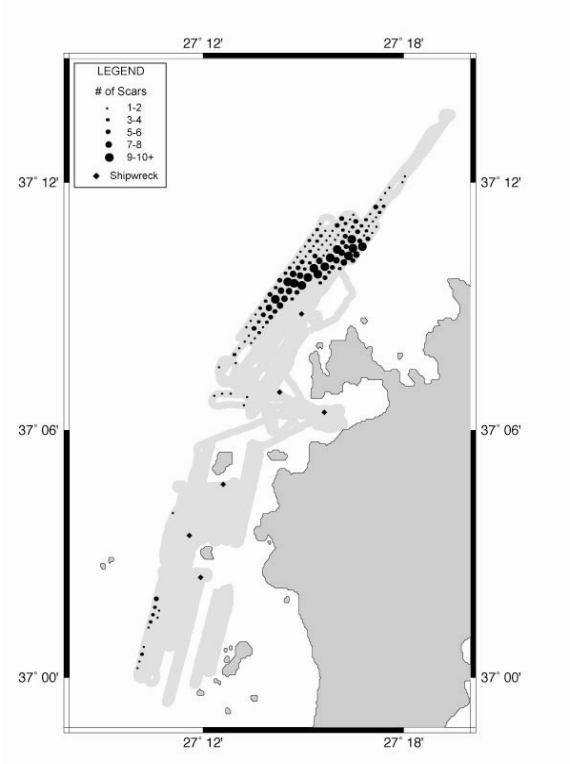

Figure 1. Map of the Bodrum peninsula and Yalikavak, Turkey, showing side-scan sonar coverage (light gray), shipwreck locations (gray circles), trawl intensity (black dots), and the 2.5 km coastal boundary (dark gray). Figure by the author.

Our work off the Bodrum and Datcha peninsulas of southwestern Turkey between 2008 and 2011 has located 31 ancient shipwrecks, of which 17 are made up of piles of amphora cargo. Photomosaic and microbathymetry surveys were conducted with the ROV Hercules for each wreck site to obtain detailed maps, dimensions, and imagery of the sites (Figure 2; Roman et al., 2010). With these high resolution mosaics, an assessment of the damage to each amphora wreck is possible, through counts of the whole and broken artifacts that comprise the site. While these are estimates based on the images and do not reflect total artifact counts, they are useful for comparing each site in regard to its location on the seafloor, the trawl intensity in that area, and the amount of damage to the site. Other ancient

wrecks in areas that have not been trawled were also evaluated for damage to determine what percentage of the artifacts should be expected to break during the sinking event. Wrecks from Skerki Bank, the coast of Israel, and the Black Sea that have not been trawled showed <5% broken artifacts. Greater damage can be attributed to trawling, especially in the Aegean, which rarely gets deeper than trawlers can operate (Brennan et al., in revision).

Figure 2. Photomosaic of Knidos C shipwreck site in the southeast Aegean Sea. Figure by Chris Roman.

The amphora wrecks along the southwestern Turkish coast show a large range in the amount of damages from trawls. For example, Yalikavak II, discovered in 1990 by INA and re-located in 2008 by IFE, lies at 50 m depth in the sheltered Yalikavak harbor and has <1% broken amphoras (Figure 3a). On the other end of the spectrum is Marmaris B, discovered in 2010 nearly 10 km from the coast in an area of flat bathymetry, which has >62% broken artifacts (Figure 3b; Brennan et al., in revision). When plotting the percentage of damage to each wreck against its distance from shore, these two wrecks form the end points of a line that the other wrecks southeast of Knidos fall along (Figure 4). This strong correlation represents the trawlers avoiding operating within the coastal restricted area 2.5 km from shore, increasing the damage to wrecks further from this zone, such as Marmaris B. Four wrecks (gray triangles) were not included in this model because they lie in significantly different environments than the group southeast of Knidos. Those located northwest of Knidos (Knidos A, Knidos B, and Knidos F) are in areas of steep bathymetry or rocky slumps and ridges where trawling is more difficult. Yalikavak I lie in shallow water (80 m) and therefore exposed to the effects of storms, which can break artifacts independent of trawl activity. This observation also correlates with the intensity of trawl scars mapped along the seabed, with a greater intensity visible further from shore and in areas of flatter bathymetry. However, along the swath of the submarine cable south of the Datcha peninsula, heavy scarring was observed, indicating that this restricted zone, further from shore, is not observed, likely due to a lack of enforcement.

Figure 3a. High definition video captures of Yalikavak II. ©IFE/OET

Figure 3b. High definition video captures of Marmaris B shipwreck sites. ©IFE/OET

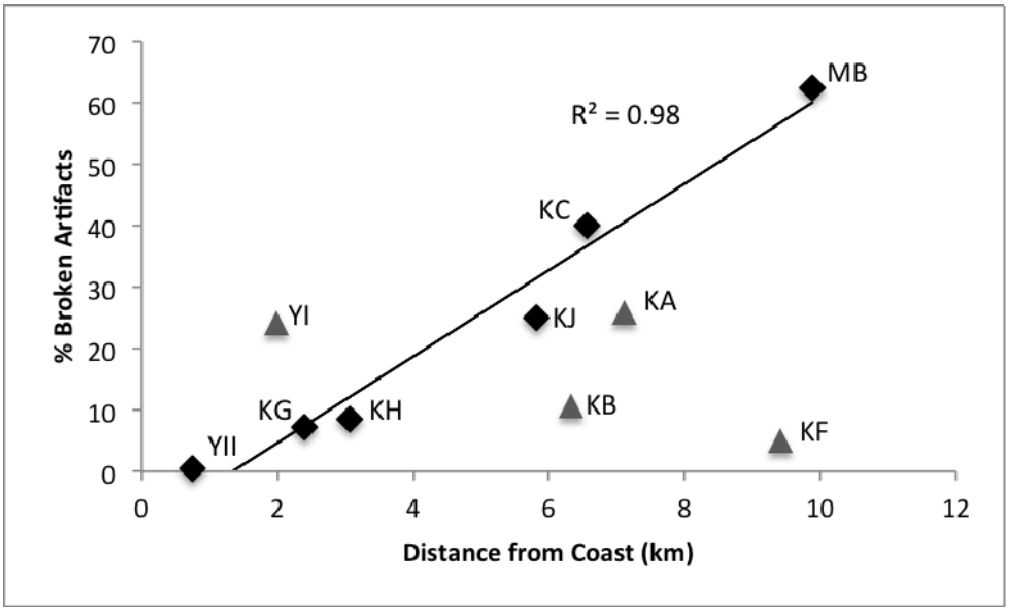

Figure 4. Plot of trawl damage by distance from shore. The black diamonds represent the amphora wrecks used in the model. Gray triangles represent wreck excluded from the model due to their location in different environments. Figure by the author.

BLACK SEA

The 2011 expedition to the Black Sea with the *E/V Nautilus* focused on mapping the coastal landscape off Turkey between 100-300 m depth to document changes across the oxic/anoxic boundary. This survey was a continuation of work conducted by IFE in 1999 and 2000 during which four shipwrecks were discovered. The 2011 expedition located an additional nine wrecks all between 100 and 115 m deep. These wreck sites are well-preserved, all with wood still visible, and some with parts of the ships' structures still standing. The preservation state of the wooden elements of the shipwrecks is due to the low-oxygen contents of the waters here. While the onset of the suboxic and anoxic zones of the Black Sea are deeper than these wrecks, density currents along the oxic/anoxic interface wash anoxic waters higher up onto the shelf, making it hard for wood-boring organisms to live there, and thereby preserving the structures of the ships (Duman et al., 2006; Trembanis et al., 2011).

However, the preservation of the wreck sites is also heavily dependent on trawling along the northern Turkish coast. Heavy trawl scarring was observed with side-scan sonar during the surveys down to about 100 m, although small numbers of scars were seen as deep as 200 m. In a few cases, it appeared that trawl activity may have even caused some of the slope failures from the shelf down into the basin. Some of the wrecks show evidence of trawl damage, while others do not. We revisited the Sinop A, B, and C wrecks, discovered in 2000 (Ward and Ballard, 2004), and these wrecks, between 95 and 105 m, also appear to have been trawled. Figure 5 shows a photomosaic of Sinop A from 2011, where trawl scars that have swept through the site are visible. While the damage to the amphora wrecks in the Black Sea can be quantified and related to the extent and intensity of seabed scarring, the wooden wrecks pose a new problem. Some retain the ship shape, while others have had the timbers ripped apart by trawls, but a quantification of the extent of the damage to the wrecks is difficult. Additionally, further data needs to be collected in the region around Sinop to determine why some wrecks escaped damage and others did not.

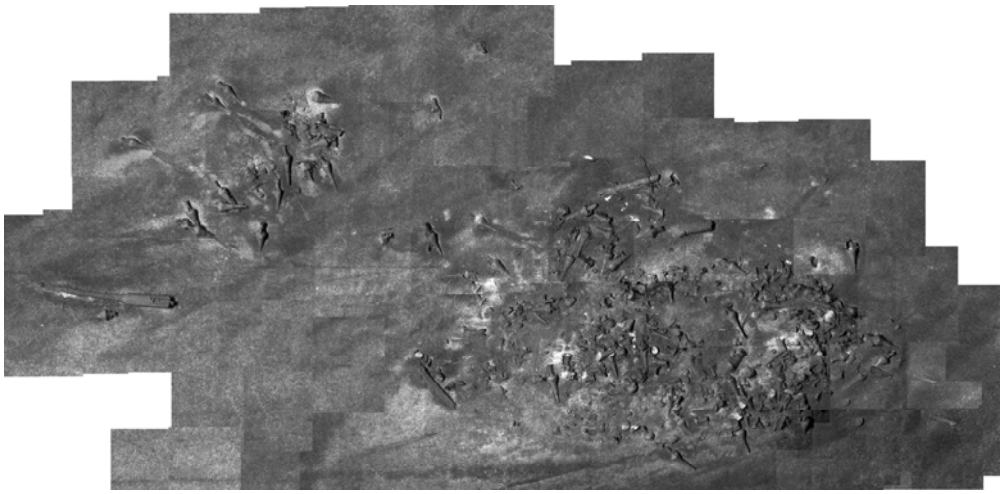

Figure 5. Preliminary photomosaic of Sinop A shipwreck site in the Black Sea. Figure by Chris Roman.

Marine Protected Areas

The 40 pre-modern shipwrecks we have located in Turkish waters comprise a large enough database that we can now begin to look at spatial relationships such as geographic location, depth, and proximity both to shore and to other wrecks in the region. Areas with a high concentration of wrecks, such as northwest of Sinop and southeast of Knidos, are prime locations for the consideration of potential marine protected areas. Especially the wrecks off Knidos show clear correlation to increased trawl damage with distance from the coastline. This general adherence to the coastal trawling restriction suggests that the combination of an MPA in this area and increased enforcement of this can provide the protection needed to preserve these sites *in situ*. Additional research into the preservation states of the Black Sea wrecks located in 2011 will also allow us to determine the most threatened areas along the northern Turkish coast, and suggest the establishment of a similar MPA. The enforcement of such protected areas can also help increase fish populations and allow benthic habitats to recover, in addition to preserving archaeological sites. The high number of pre-modern shipwrecks located in the deep waters off Turkey show that the salvage of threatened sites is not only an ethical issue, but also a logistical one. If the establishment and enforcement of regulations can protect these sites on the seafloor, then this should be the first action taken.

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The Consideration of Archaeological Sites in Oil and Gas Drilling Operations

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***Abstract**: In the United States, Gulf of Mexico, oil and gas industry operators are required by the Bureau of Ocean Energy Management to provide archaeological assessments of potential resources in their project area as a condition of the permit application process. Permit approval may depend on the investigation, mitigation, or avoidance of a submerged archaeological resource. All reasonable types of submerged cultural resources must be addressed in the assessment, and in shallow waters includes both historic shipwrecks and late Pleistocene/early Holocene occupation areas. All areas available for lease by oil and gas operators require an archaeological assessment, including the ever-increasing depths of deepwater exploration. The area of impact, as defined in the permit approval process, includes any ground disturbing activity. During construction activities this may include a drilling site for well installation, pipeline trench, or anchor spread. Ancillary impacts may include drilling splay, or temporary ground installations such as mud mats or acoustic positioning beacons. This presentation will introduce common methods used in assessing the potential presence of submerged archaeological resources, as well as oil and gas industry activities that have the potential to impact or damage submerged cultural resources.*

Introduction

The northwestern Gulf of Mexico has experienced over 500 years established nautical history, and the continental shelf, which was exposed as dry land during the last glacial maximum, was available for habitation by indigenous populations until nearly 6,000 years ago. Over the last 70 years, the northwestern Gulf has also been home to one of the most heavily developed oil and gas fields in the world. The United States federal government requires that oil and gas operators complete an archaeological survey and assessment of their project area prior to permit approval for ground disturbing activities on the outer continental shelf (for more on this topic see the preceding paper by Brian Jordan, BOEM, USA). The purpose of these surveys is to identify any and all potential archaeological resources that may be present in the survey area in order to avoid damaging or destroying these resources. The effective protection of archaeological resources depends upon an understanding of both the impact of the proposed activity and the area of potential effect.

The Gulf of Mexico region was home to the world's first offshore well and continues to be one of the densest and most productive continually-used oil and gas fields in the world. The MMS/BOEM has been at the forefront in terms of regulating submerged archaeological resources in this region making this area an excellent case study. Although the focus here is on the Gulf of Mexico region, the technological and archaeological issues are relevant world-wide.

Oil and Gas Industry in the Gulf of Mexico

Oil and gas operators first began drilling in the world's oceans in the 1890s, but the actual drilling platforms were connected to land, built on piers extending from the shore. In 1937, the world's first freestanding drilling structure was built in the Gulf of Mexico (GOM), located one and a half miles from shore in approximately 14 feet (4.3 meters) of water (National Commission 2011). In 1947, the first successful well was drilled out of sight of land. It was located approximately 10.5 miles (17 kilometers) offshore of Louisiana, in 20 feet (6 meters) of water in the Gulf of Mexico (National Commission 2011). Since then, over 5,500 platforms, and over 30,000 miles (48,280 kilometers) of pipelines have been installed in federal waters of the Gulf of Mexico alone (Cranswick 2000). Today, offshore development can be operationally distinguished by water depth, which ranges from shallow water (less than 656 feet/200 meters BSL), to deepwater (656 to 4,999 feet/200 to ~1,500 meters BSL), and ultra-deepwater (greater than 5,000 feet/1,500 meters BSL). Activity in the Gulf of Mexico prior to 2010 was high, with an average of 30 drilling rigs active every year from 2006 to 2008, each of which typically drilled multiple wells each year. In 1986 the first verified deepwater oil field was discovered (Nixon et al. 2009:10), and marked the beginning of an industry-wide shift away from shallow water reserves to more profitable deepwater fields. Although the vast majority of infrastructure in the Gulf of Mexico is located in shallow water, as of 2008, approximately 26% of all new Gulf of Mexico oil and gas industry leases were in shallow water, while 74% were in deep- and ultra-deepwater (Nixon et al. 2009:24).

In the United States, offshore oil and gas industry activities are regulated by the Bureau of Ocean Energy Management (BOEM). The need to protect submerged archaeological resources in the Gulf of Mexico from oil and gas development was first recognized by the Bureau of Land Management and later the Minerals Management Service (now BOEM). Archaeological lease stipulations were first issued to oil and gas operators in 1973 to protect submerged cultural resources from industry related damage. The following year geophysical survey guidelines and report specifications were issued. From the beginning, guidelines addressed both historic shipwrecks and submerged prehistoric sites on the continental shelf, requiring archaeological assessments in order for an operator to obtain approval to drill a well, or install a pipeline.

The current survey requirements in shallow water in the GOM require acquisition of sidescan sonar, magnetometer, subbottom profiler, and bathymetry data utilizing either a maximum of 50 or 300 meter line spacing. Deep water surveys require only sonar at 300 meter intervals using an acoustically tracked deep-tow array or Autonomous Underwater Vehicle (AUV). The limitations of the 50 and 300 meter survey line spacing intervals, particularly in regards to shallow water magnetic, are known and have been discussed by a number of MMS/BOEM funded studies (Garrison et al. 1989; Pearson et al. 2003; Enright et al. 2006). Alternative investigation techniques such as archaeologically directed diver or remotely operated vehicle (ROV) investigations may also be considered, but are generally atypical at this point in time. When potentially significant sonar targets, magnetic anomalies, or subbottom feature are identified, an avoidance zone is assigned to the resource and the operator is required to ensure that no ground disturbing activities take place within this exclusion zone. Failure to comply with this avoidance can result in operator-financed mitigation, and even civil penalties. Mitigation can include any number of measures, such as detailed diver or ROV site documentation and assessment of historical significance.

Offshore Drilling

Oil and gas wells are drilled offshore using depth-specific techniques and equipment that have variable levels of impact on the seabed below. Worldwide, seafloor mounted jackup rigs are the most common type of drilling rig utilized offshore, representing 42% of the world's offshore rig fleet (statistics derived from rigzone.com, as of November 2011). In the Gulf of Mexico, semi-submersible rigs are the next most common type of rig used, and account for the majority of deepwater and ultra-deepwater drilling. Although the permitted area of impact associated with drilling activities on the continental shelf is typically fairly restricted, the overall disturbance associated with drilling can extend beyond the footprint of the rig.

Ensco 8502 DP Semi-Submersible Dill Rig (Courtesy Ensco)

In shallow water, drilling operations are typically conducted using seafloor mounted drill rigs, called jack-up rigs. These rigs are generally towed on site by support vessels. Upon arriving at the drilling location, the legs of the rig are lowered to the seafloor through the platform. Jack-ups typically have

three (3) legs that support the rig, but the mat-supported rig also has a large A-shaped base that distributes the weight across the legs. In shallow water, both submerged prehistoric sites and historic shipwrecks may be impacted by drilling activities.

Due to the geomorphology of the Gulf of Mexico and the location of the maximum low sea-level stand, submerged prehistoric resources are not present beyond the shallow water areas of the continental shelf, therefore only historic shipwrecks are present in deepwater and ultra-deepwater lease areas. Wells in these water depths are typically drilled using either dynamically positioned semi-submersible drilling rigs, or moored semi-submersible drilling rigs. The difference between the two is that the moored drilling rigs are secured to the seafloor by anchors with mooring lines. A typical anchor spread utilizes eight anchors, except during hurricane season (June – November) when twelve anchors are required in the GOM. The typical anchor radius is 2.5 times the water depth, therefore in 5,000 feet (1,524 meters) of water, the anchors can extend 12,500 feet beyond the well site (3,811 meters). Dynamically positioned rigs, also known as DP rigs, use advanced thrusters to maintain their position in the water during drilling operations. Bottom impacts for DP rigs are therefore limited to the actual drilling site, transponder beacons set around the site for positioning, and associated drilling splay. The use of moored or anchored rigs causes greater bottom impacts due to the placement of anchors and associated structures, as well as the sweep of anchor chains or mooring lines.

In addition to the bottom disturbance caused by the rig, the act of drilling creates an impact beyond the well shaft; drill cuttings, drilling mud or fluid, and produced water may splay outwards from the well site during drilling operations (Boesch et al. 1987:22). Drill cuttings are fragments of earth produced during drilling and removed from the well hole via drilling fluid or "mud". Three (3) different types of drilling muds or fluids exist: water-based, petroleum-based, and synthetic-based. Drilling mud is defined as a "freshwater or seawater slurry of clay (or natural organic polymer), barium sulfate, lignosulfonate, lignite, and sodium hydroxide, plus several minor additives" (Boesch et al. 1987:23). Drill cuttings consist of crushed rock and sediment produced by the grinding action of the drill bit as it penetrates through the well shaft towards the target depth (Boesch et al. 1987:23). Drilling fluid or mud must be continually circulated through the well shaft in order to lubricate the drill bit, prevent the drill bit from overheating, and remove drilling solids from the well shaft (Neff et al. 1987:150). Operators will often try to recirculate drilling fluids on the rig deck in order to separate out the drill cuttings so that they can reuse the drilling fluid (Neff et al. 1987:150). The separated drill cuttings are disposed of over the side of the rig, and left to settle on the bottom, creating a secondary disposal pile in addition to the drilling splay at the well site (Neff et al. 1987:150).

Only water-based drilling fluid may be discharged in US coastal and offshore waters. According to Boesch et al. (1987:23), drilling of an exploratory (non-producing) well can generate "5,000 to 30,000 barrels of drilling fluid (containing 200 – 2,000 metric tons of solids)" and "from 1,000 to 2,000 metric tons of drill cuttings." Development wells, added to the site of a successful exploratory well, are often shallower, and have a smaller diameter than the exploratory well, thus producing less drilling fluid and cuttings. In water depths greater than 120 feet (37 meters), drill cuttings have been observed to extend outward from the well site to a radius of 82 feet (25 meters) in diameter (Neff et al. 2000:15). According to Neff et al. (2000:15), drill solids disposal piles located near platforms can be up to 26 meters high, however most are less than 10 meters in height.

It is possible that drilling splay or cuttings piles could accumulate at or over a previously unobserved archaeological resource in deepwater. Observations have shown that in shallower waters, however, drill cuttings typically do not collect on the seabed but instead dissipate due to the high energy effects of currents and waves (Zingula 1977:548; Neff et al. 2000:15). While numerous studies have been conducted analyzing the impact of cuttings on biologic communities (NRC 1983; Boesch and Rabalais 1987; Neff et al. 2000; and UKOOA 2005), no known studies have been conducted that examine their impact on shipwreck sites. Based on research conducted in the wake of the Exxon Valdez oil spill, contamination of radiocarbon samples was examined at ten (10) different oil-impacted sites. No adverse impacts to radiocarbon dating were identified (Reger et al. 1992). Without further study though, it is unknown to what degree, if any, petroleum-based drilling fluid or additives in water-based or synthetic-based fluids could contaminate a site and adversely impact sample testing or data recovery. Certainly burial under drilling splay would obscure an archaeological site and make documentation more difficult or time-consuming.

Although drilling is the primary goal of oil and gas operators, a well site is part of a much larger system and cannot be considered in isolation. This is an important point to recognize when drilling a well location in proximity to a potential archaeological resource. Although the avoidance zone assigned to the resource may be adequate to ensure that drilling activities do not impact the site, the site may be subjected to greater development if the exploratory well is successful. The proximity of the resource to the construction area can complicate construction plans, or result in inadvertent damage to the site. This issue can be alleviated by ensuring that future activities are taken into account when a well site is initially permitted.

Platform Installation

Installation of a permitted structure such as a platform or caisson often takes place at the site of a successfully drilled well location. During drilling and subsequent platform operation phases, activities at a well site may include drilling additional wells with a different rig footprint, the use of seafloor mounted lift boats for maintenance or repair work, and anchoring associated with dive boats or other support vessels. Materials are frequently discarded from the rig or platform or from other service support vessels, usually through accidental loss. In addition to ancillary activities associated with resource extraction, platforms and well caissons often become popular sites for fishermen and recreational divers who can also produce impacts to archaeological sites. Despite the wide range of potential impacts associated with drilling a well, the area of impact is generally relatively localized, focused on the immediate vicinity of the well site.

Pipeline Installation

If a well is successful, then product will need to be transported off-site for refinement and distribution. The installation and use of subsea pipelines is the most common method for moving oil and gas from wells to production facilities. Pipelines in the GOM are required to be buried to a depth of at least 0.9 meter (3 feet) below the seafloor in water depths under 61 meters (200 feet). Within shipping fairways, pipelines are required to be buried 3 meters (10 feet) below the seafloor and within anchorage areas, 4.9 meters (16 feet) to avoid incidental damage from anchoring (30 CFR 250.1003(a)(1)). The two (2) most common methods for pipeline installation are through the use of anchored lay-barges or dynamically positioned reel-ships. Although dynamically positioned pipeline installation can occur in water depths as shallow as 33 meters (100 feet), it is generally not used in less than 61 meters (200 feet) of water (Cranswick 2001). This installation method does not require anchoring, limiting the seabed disturbance to the actual footprint of the pipeline.

Anchored lay-barges are the most common pipeline installation method in shallow water. Operational procedures for anchored lay-barges restrict their use to areas less than 300 meters deep (1,000 feet) (Cranswick 2001), although the amount of anchor cable available on an individual vessel may restrict the operating depth to shallower water. Pipeline burial is accomplished during installation through the use of a jet-sled or plow. The lay-barge deploys the pipe from the surface via a device called a stinger and the jet-sled or plow digs a trench into the seabed in which the pipeline is laid. Jetting can cause substantial impacts to a shipwreck, but it should be noted that it is also in the installer's best interests to avoid impacting any wrecks, since the wreck could damage the highly specialized and expensive equipment or cause considerable construction delays.

In addition to the impacts caused by jetting and laying the pipeline, anchors and anchor chain used by the lay-barge during installation also can cause substantial bottom disturbing activities. A standard pipeline lay-barge extends anchors equal to a distance of five (5) times the water depth. An anchored barge typically requires between eight (8) and 12 anchors, each weighing between 30,000 to 50,000 tons (Cranswick 2001). The anchors are lifted onto anchor handling support tugs which are used to deploy the anchors along the route. Winches aboard the lay-barge are used to move the barge along the route by tightening up on the foreword anchors. Generally, after anchors are set, they would need to be repositioned every 610 meters (2,000 feet) along the pipeline route (Cranswick 2001). Ground disturbance is not limited to the actual anchor touch-down points. During barge movements slack is placed on the stern lines prior to pulling the vessel forward along the bow anchor lines, which may allow portions of the chain to rest or drag on the bottom. The large diameter wire rope used to handle these massive anchors can cause substantial damage to a shipwreck site.

Pipeline installation may be the most significant threat to shipwreck sites associated with oil and gas development. The anchors and anchor chains can cause severe damage to shipwrecks in shallow water depths, and deepwater pipelines have been laid through or in close proximity to shipwrecks (Jones 2004; Ford et al. 2008). These incidents have in turn resulted in changes to regulations to ensure that additional sites are not damaged in the same manner. If operators adhere to current regulations the risk to submerged resources caused by pipeline installation can be minimized; although it should be noted that current regulations in the GOM may be insufficient for identifying all shipwrecks, particularly buried wooden wrecks in shallow water.

Ancillary Activities

Ancillary activities such as those conducted by lift boats and anchored vessels offering support (such as dive ships) are not explicitly regulated by the BOEM. These vessels can produce fairly significant bottom disturbances but due to the frequency with which they operate and the number of vessels involved, it would be difficult to regulate these bottom disturbing activities on a case by case basis. Bottom disturbing activities associated with lease development or pipeline installation are regulated under the permitted activity, so it is the operator's responsibility to ensure that contractors do not impact targets or anomalies that have been stipulated for avoidance. Off-lease bottom disturbing activities are typically exempt from survey requirements. These activities are usually risk aversion activities that cannot be explicitly regulated, and include actions such as anchoring a vessel or setting a platform on the seafloor during severe weather conditions to mitigate risk to the vessel and crew.

Conclusion

Throughout most of the Gulf of Mexico, BOEM regulations governing oil and gas activities are the only protection for submerged archaeological sites. The BOEM, however does not have the authority to regulate other activities that may impact submerged sites, such as offshore fishing or recreational diving. Due to this lack of regulation, the surveys required by the BOEM are the primary method in which sites are discovered in this region and the only impetus for subsequent archaeological study of these resources.

It is not possible to predict every scenario or protect against all potential threats to a site. During installation, proper regulation and monitoring can ensure that submerged cultural heritage sites are avoided by vessels, anchors, and the actions of offshore personnel. Post-installation industry presents few threats to submerged archaeological resources. The most practical way to protect sites against impacts related to future infrastructure is to ensure that the location is selected in consideration of the current avoidance zone and potential placement of subsequent installations.

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The Significance and Contribution of Marine Aggregates

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Abstract
Marine aggregates off southern Britain commonly originated in fluvial environments during phases of lower than present sea level in the Quaternary Period. Aggregate extraction from such fluvial terrace and channel infill deposits has revealed evidence for low sea levels, including faunal remains, peat deposits and, most significantly, flint hand axes. In addition, more recent maritime and aviation remains are occasionally recovered in aggregate cargoes, including timbers, cannon balls and wartime aircraft parts. Artefacts found either in dredged cargoes or at the receiving wharf or other landing point are recorded through a reporting protocol agreed between BMAPA and English Heritage (EH). This involves the participation of dredger crews, wharf and processing plant staff, industry management, archaeological specialists and officials in English Heritage. The protocol, underpinned by a partnership between BMAPA and EH, a joint Guidance Note and a high standard of archaeological investigation and feedback on finds, has been and continues to be a great success.

The significance of marine aggregates as an archaeological repository

The origin and formation of marine aggregates off southern Britain

Marine aggregates are sands and gravels of a quality useful for civil engineering and coastal defence which lie on the seabed of the continental shelf surrounding the British Isles. Their temperate marine setting off southern Britain commonly contrasts with a cold climate terrestrial geological origin and in order to understand aggregate deposit formation events during the Quaternary Period (approximately the last 2 million years) must be studied. Offshore surveys by both the UK Government (eg James *et al* 2011) and by the marine aggregates industry (eg Bellamy, 1998 and 2011 in press) have revealed that sands and gravels are commonly found within infilled river valleys, now submerged on the seabed. During episodes of lower than present global sea level in prolonged cold stages of the Quaternary, rivers draining an arctic-type landscape extended onto the continental shelf and deposited sands and gravels over their floodplains, typically reaching thicknesses exceeding 5 m (Figure 1). Rivers draining the English Midlands occasionally carried glacial meltwater whilst those of southern England and the present English Channel were supplied entirely by snow and ground ice melt in periglacial environments akin to Arctic Canada. Repetition of cold stages with intervening and relatively brief interglacials over the past 2 million years led to complex fluvial cut, fill and terrace sequences which record a long history of sedimentation on the continental shelf off southern Britain (Figure 2). This clearly implies a significant prehistoric archaeological potential for such deposits, especially as the sediments are simply the downstream equivalents of deposits found in present river valleys on land, which themselves are commonly notable for their Palaeolithic archaeological content (eg Wymer 1999).

The following palaeovalleys contain marine aggregates:

- The ancestral River Yare off Great Yarmouth
- The ancestral Thames and its tributaries off the coast of Suffolk and Essex
- The “Channel River” and its tributaries in the eastern English Channel
- The ancestral Arun off West Sussex
- The Solent River and associated streams east and west of the Isle of Wight

Investigation of the prehistoric archaeological potential of marine aggregate deposits has increased in recent years (see for example Firth, 2011). Tizzard *et al* 2011 investigated sediments infilling the submerged Yare Valley off Norfolk and established a model of depositional events using seismic and sample data from dredging licence areas. Furthermore, age estimates using the OSL (Optically Stimulated Luminescence) technique on sediments from the same area show that gravel sedimentation occurred within the Middle Palaeolithic period, with dates of 207,000 – 283,000 years before present established from fluvial gravelly sands in 25 m water depth.
In addition, reconstructions of cut and fill events using high resolution shallow seismic and sample data from other palaeovalleys (eg Bellamy 1995; Emu Ltd and The University of Southampton, 2009) and emerging age estimates from some of these localities strongly suggest a similarly long

evolutionary history and hence a strong potential for in situ or at least locally derived Palaeolithic remains. This deduction is supported by the absence of glaciation and its erosive effects in the southern North Sea basin since the Anglian (Elsterian) stage over 450,000 years ago and the lack of any glaciation or fluvio-glacial activity in the English Channel region, fluvial sedimentation having occurred here exclusively in nival periglacial or early temperate environments before marine transgression.

These factors combine to present a fascinating sedimentological record and tantalising archaeological potential off southern Britain, unaffected by the disruptive effects of recurrent glaciations which have dominated Quaternary geology in the central and northern British Isles. This potential has recently been realised in dramatic fashion by the documented recovery of 121 flint artefacts, including 36 handaxes, from several dredged aggregate cargoes taken from a licence area south of the last, Weichselian, glacial limit (Figure 3). The site, Licence Area 240 off Great Yarmouth, is located over part of the former Yare Valley floodplain and the artefacts were found at a receiving wharf in the Netherlands following offloading by the dredger. These finds, many of which are in pristine condition, provide the first direct evidence of human presence *in situ* on the UK continental shelf at times of lower than present sea level and a thorough investigation is continuing. The OSL age estimates referred to above provide a sound basis for the interpretation of these finds, the dated sediment samples being taken from the same localities as the handaxes.

Allied to these exceptional and unusual finds, the more common recovery of terrestrial faunal remains in dredged cargoes and the presence of temperate climate peat deposits beneath the seabed also demonstrate terrestrial conditions and hence potential human presence. Well preserved bones, teeth and antlers are also of considerable intrinsic interest (Figure 4) and permit a vivid reconstruction of the long periods when the entire southern North Sea and English Channel were subaerially exposed, linking the British landmass to continental Europe.

During the last marine transgression, the plains linking Britain and Europe were rapidly submerged, relatively small rises in sea level inundating large areas of land. In high energy coastal and shallow marine environments, surficial reworking of fluvial sediments took place as the shelf adjusted to the onset of fully marine conditions with associated tidal currents and storm waves. There is therefore the additional potential for finds in a primary context within submerged gravelly coastal deposits, analogous for example to those in southern England at Slindon in West Sussex (Roberts 1998). In addition, scattered faunal and Palaeolithic remains in secondary contexts are likely, after reworking during marine transgression.

Marine aggregates as a source of maritime and aviation remains

The complete submergence of the continental shelf by approximately 7,000 years ago clearly precluded human occupation but began the maritime archaeological period. The most common finds associated with this period are shipwrecks and isolated wreckage. Charted wrecks are carefully avoided by the marine aggregates industry, not only to preserve their integrity but also to ensure safety at sea and to avoid damage to dredging vessels. However, uncharted or small isolated remains exist which cannot be easily detected by pre-dredge seabed surveys and it is these that can be recovered unintentionally in dredged aggregate cargoes. The most common finds are cannon balls of various sizes and a wide variety of cargo, although timbers and even domestic items such as hallmarked silver cutlery and candle holders have been recovered.

Aircraft parts are occasionally recovered in dredging licence areas from uncharted crash sites, these most commonly relating to WWII. These have included aluminium airframe fragments, engine parts, guns and ammunition. A human thigh bone dating from the Battle of Britain was recovered in 2007 in association with the remains of a German Junkers 88 from a dredging area east of Southwold, Suffolk. An American Flying Fortress which ditched off Great Yarmouth was unintentionally dredged in 2006 and a pistol, flying helmet and machine gun were recovered at the wharf (Figure 4). The aircraft had sunk almost intact and in the 65 years since its loss had become buried in mobile sand. It is likely that other uncharted and partly buried remains exist in dredging licence areas some of which will no doubt be unintentionally recovered in the dredged cargoes of the future.

Courtesy of UMA and CEMEX

The contribution of the marine aggregate industry to the development of marine archaeology

Making and recording finds

The preceding discussion has reviewed the great archaeological potential of marine aggregates, highlighting the wide variety of finds recovered in recent years as part of dredging and shore-side processing activity. The recovery and recording of this material is only possible with the co-operation of the industry, most importantly the crew on the dredgers and staff at the receiving wharves who routinely handle the sediments in their natural state before they enter the processing plants and are then delivered as aggregates into the construction industry.

To consolidate this co-operation, the industry, in partnership with English Heritage, published a Guidance Note in 2003 entitled *"Marine Aggregate Dredging and the Historic Environment: assessing, evaluating, mitigating and monitoring the archaeological effects of marine aggregate dredging."* This was followed in 2005 with a Protocol for the reporting of finds of archaeological interest on dredgers and at the wharf, again published by the industry in partnership with English Heritage (Figure 5).

The 2003 Guidance Note

The Guidance Note aims to provide practical guidelines on dealing with archaeological issues for marine aggregate developers, consultants, curators, contractors and industry regulators and built on the already published Code of Practice for Sea Bed Developers produced by the UK's Joint Nautical Archaeology Committee. The Note was prepared by Wessex Archaeology in consultation with the British Marine Aggregate Producers Association (BMAPA) and English Heritage. Topics covered included:

- the character and importance of the historic environment
- the regulatory framework
- possible effects of aggregate extraction on the marine historic environment
- the nature of and need for archaeological advice by companies applying for dredging licences

- how aggregate extraction proposals should be properly assessed
- sources of archaeological data
- techniques for the evaluation of seabed sites
- mitigation and monitoring measures should permission to extract aggregates be given to an operator

Since 2003, the Guidance Note has become a standard reference for all environmental impact assessments for dredging licence applications with the approaches highlighted now widely accepted as best practice. The Guidance and subsequent Protocol have provided a model for archaeological management in other industry sectors, notably the offshore wind industry and, most recently, with some locally based fishing interests.

The 2005 Protocol for reporting finds of archaeological interest

The success of the Guidance Note led English Heritage and BMAPA to discuss how best to encourage the reporting of archaeological finds made on dredgers and at wharves receiving their cargoes. Rather than have different protocols in separate licence conditions for each of the operating companies, BMAPA and EH decided to devise a single protocol applicable to all dredging areas, vessels and wharves irrespective of which company operated them. The Protocol was designed to promote awareness in the industry of the high archaeological potential of marine aggregates. In addition the Protocol set out an approach to the reporting, handling and stabilising of any finds made on ships and at the wharf which all companies in the UK industry have adopted. With the agreement of the companies, the single Protocol was intended to ensure consistency of approach and to encourage the participation of all involved in the running of the industry. Most importantly, the aim of the Protocol is to reduce any adverse effects of marine aggregate dredging on the historic environment by enabling those working at sea and at wharves to report their finds conveniently and effectively without undue disruption to their tasks. Guidelines for indentifying finds are given in the Protocol be they composed of rubber, plastic, metals, bone, wood, stone, pottery, brick or peat and clay.

The Protocol works by establishing a line of communication for those involved. Finds either in cargoes or on stockpiles are reported to a Site Champion on the ship or wharf who then reports to a Nominated Contact acting for or representing the operator concerned, normally a member of the company's management team. The Nominated Contact then passes the details of the find to a specialist archaeological consultancy acting on behalf of English Heritage, currently Wessex Archaeology. Details of the dredging location, date, find made, photographs and name of the person making the find are passed by the company to English Heritage and their consultant. At the same time advice is provided to the industry on how best to stabilise finds in the period immediately after their discovery. Finds are collected by EH for further examination if they are particularly interesting or unusual.

Once the find is recorded, advice on the identification of the find and its seabed location is provided as well as how to conserve the find into the future. EH liaises with other archaeological authorities, the Receiver of Wreck (over possible find ownership) and the Crown Estate (as mineral owner) where necessary. Advice may also be given on measures to mitigate the effects of dredging on finds, where needed.

To encourage reporting of finds, which might otherwise go unnoticed or be destroyed in the processing plant, a poster was issued to ships and wharves displaying the diversity of possible finds and the means of reporting them (Figure 5). Staff from EH and their consultants regularly visit wharves to discuss archaeological issues with industry staff and presentations are given to raise awareness and to provide information on how to recognise finds and keep them safe. A DVD with similar information is provided to dredger crews because ship visits have proved more difficult to arrange due to operational constraints. In addition, a popular twice yearly newsletter is issued to the industry with updates on the Protocol Implementation Service and articles on selected aspects of marine archaeology. Thirdly, an annual report on the Protocol is published by BMAPA, The Crown Estate and EH. This contains detailed accounts of all of the finds made in a given year, their collective distribution and specific identification. A page is devoted to each find, including details on its characteristics and identification, with the finder and his/her ship or wharf named. The report is sent to all ships and wharves and is well received, having provided a strong sense of pride and ownership by all involved in implementing the Protocol.

To consolidate this success, shortly after the Protocol was introduced BMAPA and EH decided to award a small prize to the best find made by both a ship's crew and a receiving wharf for the year. A prize is also awarded for the most professional attitude to archaeology shown by a ship or wharf, irrespective of the type of finds made.

Concluding remarks

The acknowledgement that aggregate dredging can disturb or remove unknown archaeological evidence is tempered by the high priority the industry affords the subject as part of its routine operations. Whilst the archaeological sites themselves can be disturbed, their significance can be fully realised with the recovery of archaeological finds in aggregate cargoes, material which in many cases would otherwise never have been seen or appreciated, lying beneath the sea within seabed sediment. The protocol, now in its 6th year, has helped engender a keen interest in marine archaeology with those in the industry and is proving to be a success for all involved - operators, curators and regulators alike. The Guidance Note and Protocol are proving effective in minimising the impact the industry has on marine archaeology. As a result of the adoption of these measures, over 800 finds have been reported since 2005, many of which are highly significant and have prompted considerable interest and ongoing research, ranging from unravelling the record of prehistoric occupation on the continental shelf to tracing the origin of wartime wreckage.

A further benefit arising from the initiative is the potential for outreach, education and enhancing museum collections. Finds are frequently donated and lent by BMAPA member companies and EH for these purposes and help to illustrate the diverse submerged cultural heritage of the British Seas.

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The Appearance of New Bacteria (Titanic Bacterium) and Metal Corrosion

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Abstract

The sinking of the Titanic in 1912 resulted in global consequences. Some of the important consequences resulted in marine research and the development of submersible technology. After the discovery of the wreck in 1985, scientific research reached a new high due to interest in the well known tragedy. The rusticle samples were obtained from the 1991 expedition to the wreck. In the years following the attempt to isolate different bacteria which reside in and form the rusticles was undertaken. Due to different mini environmental niches which exist in the rusticles, one species was isolated and identified as Halomonas titanicae. This species is characterized as holo-philic and gram negative. They also have polar and lateral points of origin of flagella indicating that they are peritrichous and motile. It adheres to iron surfaces forming knob-like mounds. The rusticles are highly porous and support a complex variety of microorganisms.This species can affect marine industry by corroding structures like oil rigs, oil and gas pipelines etc. It can also be used to dispose of old merchant and naval ships and oil rigs in the ocean after they have been cleaned of toxins and oil based products.

Introduction

On April 12, 1912 after a two year effort, involving more than 1,700 workers from Harland and Wolff ship builders, the Royal Mail Steamship (R.M.S.) Titanic was completed and ready to set sail. At that time it was the largest moveable object, measuring 28.7 m wide, 269.1 m long, by 53.3 m high from the keel to the top of the four funnels. At 12:00 h the R.M.S Titanic left port in Southampton, England. The first stop was France and then on to Ireland, with the final destination across the Atlantic Ocean to New York City, USA (Ballad, 1995). On the third day of the transatlantic voyage, at 23:35 h, the Titanic struck an iceberg. At 02:00h on April 15, 1912 the proclaimed “unsinkable” R.M.S Titanic sank.

The wreck of the Titanic was discovered in September 1985, 73 years after her sinking by ocean scientists from America and France. The lead figures were Dr. R. D. Ballard, USA and Dr. Jean-Louis Michelle, France. The ship was scattered over the North Atlantic Ocean floor, 3.7 km deep.

In 1986 Dr. Ballard returned to the Titanic wreck site using a manned submersible, the Alvin, which enabled him and his team to view the sunken ship. The organic material had disappeared from the wreck, but the damage to the inorganic material varied, based on its elemental composition (Freemantle, 1994). Some objects such as dishes, copper and glass, however, were preserved. The scientists observed that the ferrous-iron structures, such as cast iron, wrought iron, and steel were corroded and covered; draped with rust-like precipitates. Ballard (1995) named them “rusticles” because they hung like icicles but looked like rust.

In June 1991, a group of Russian, Canadian, and American ocean scientists returned to the Titanic wreck site to produce the IMAX documentary movie “Titanica”. On this dive, they collected samples of water, sediment cores and rusticles. The water surrounding the wreck was 2.16 °C, the oxygen concentration was 7.35 % and the salt concentration was 3.5 % w/v (Wells & Mann, 1997). The Titanic wreck was, however, not covered everywhere by sediments. Some sediment was partially removed by wave currents from the Western Boundary Undercurrent (Hayson, 1993, Wells, & Mann, 1997).

A Short Discussion on Metallurgy

The Titanic was constructed primarily of steel. Rusticles grow on this metal. It is therefore important to understand the make-up of the various types of steel used in the Titanic because the type of steel affects both the types of rusticles and their chemical and crystallographic composition.

It is generally assumed that our ancestors found meteorites and, thinking they were ordinary stones, placed them around their wooden fires. After these fires cooled, however, the meteorites turned to iron sponge. This happened due to a reduction of iron oxide in the meteorite. The carbon from the wood had reduced the melting point of the iron within the meteorite. The resulting sponges were collected, hammered into different shapes and used as tools. By 1,500 BC, what was by then known as iron ore, was well established in the art of tool making (Borestain, 1984).

For about 3,000 years no change occurred in the use of iron ore. People reduced iron oxide into sponge and pounded it into different products to produce wrought iron. The Titanic had many pieces made by this technique i.e. stair wells, ornamental railings, gates, etc.

In the middle ages, the use of blast furnaces was established. The hot air was forced into the iron ore rocks; thereby further reducing iron oxide, resulting in a change in the chemical reaction. This technique produced "pig" iron, which has the characteristics of being hard and brittle. It was therefore difficult to shape by hammering alone. Pig iron is primarily used for creating cast iron. The difference between wrought iron and pig iron is in the composition of carbon. Wrought iron has 0.005% or less carbon, while pig iron has 3% or more carbon (Borestain, 1984).

In the science of metallurgy, metal is defined as a pure element made up of only one type of atom and one crystal structure. It may, however, have some impure atoms within its structure.

An alloy is a combination of two or more chemical elements, one of which must be a metal. An alloy containing iron as the primary component, and small amounts of carbon as the major alloying element, is referred to as steel (Borenstain, 1984).

Alloy steels are, in metallurgical terms, steels that contain manganese silicon, chromium, molybdenum, nickel or copper in quantities greater than those listed for carbon steel. The alloying process enhances the mechanical properties of the steel, its fabricating characteristics and other features.

This paper will focus on two types of steel found in the Titanic, carbon steel and cast iron. Carbon steel was used to build the hull of the ship. It contains less than 1.65% manganese, 0.60% silicone, and 0.60 % copper with no minimum for other alloying elements.

Cast iron, used in the Titanic's coal furnaces, is a generic name for a group of cast ferrous alloys in which the carbon content exceeds the solubility of carbon in austenite face-centered cubic crystal structure, a high temperature form of iron. The carbon is greater than 2% in cast irons, most being between 3.0 and 4.5 wt % C (Borenstain, 1994).

Biomineralization

If we simplify the biomineralization process, there are two categories: biologically induced mineralization and biologically controlled mineralization (Frankel & Bazylinski, 2003). The induced mineralization process generally starts the extra-cellular growth of crystals, due to the metabolic activity of bacteria and the chemical reactions of its byproducts. The bacteria secrete metabolic products that react with ions or compounds in the environment around the Titanic, causing continuous decomposition of mineral particles, in this case, iron, manganese, nickel, etc.

Bacterially induced mineralization is almost equivalent to inorganic mineralization Fig 1. Under some environmental conditions, the minerals have crystal chemical characteristics, produced by inorganic chemical reactions. The bacteria surfaces either in the form of cell walls or sheaths, or as dormant

spores, can act as inactive sites for absorption of ions and mineral nucleation and growth (Beveridge, 1989, Bauerlein, 2003).

There are two general types of cell wall surfaces: gram positive and gram negative. This is based on the staining techniques in light microscopy. The gram negative cell wall is different from gram positive in that it has a thinner peptidoglycan layer and does not contain secondary polymers Fig 1. It is sandwiched between two lipid/protein bilayers. This space is called periplasma Fig 2, 3 (Beveridge, 1981, Frankel & Bazylinski, 2003).

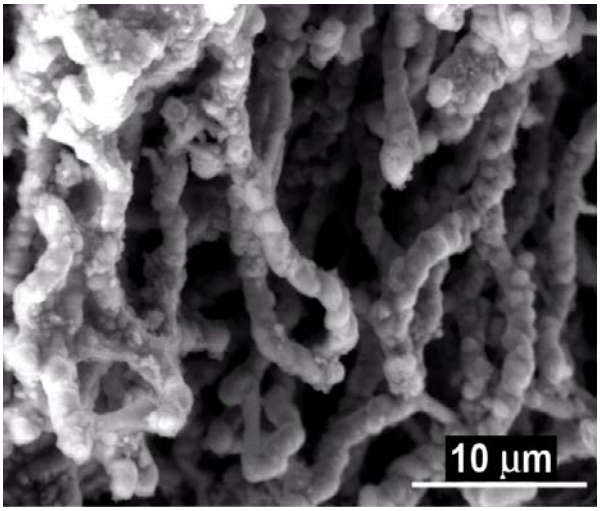

Figure 1. An ESM micrograph of bacteria in the initial stages attaching to the RMS Titanic's metallic structures and forming chain-like configurations. In this stage the bacteria is already biomineralized.

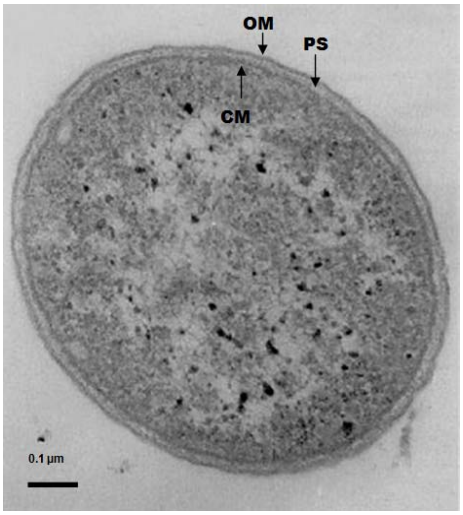

Figure 2. This TEM micrograph shows a thin section of a *Halomonas titanicae* cell with three distinct layers of the cell envelope: dense outer membrane [OM], middle light zone periplasmic space [PS] and inner dense cell membrane [CM].

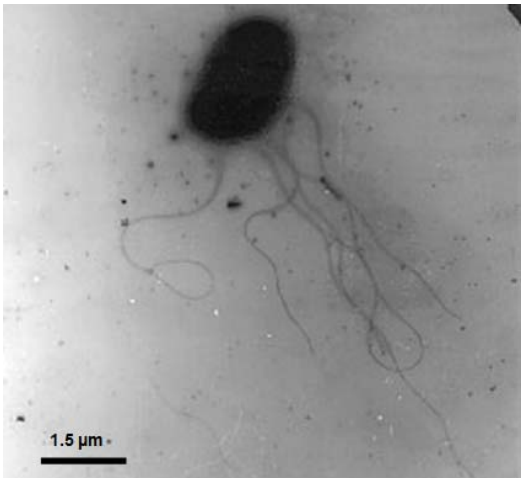

Figure 3. Negatively stained cells show varying numbers of unsheathed flagella, between 2 - 6. Length of flagella range from 9-12 µm and diameter from 15 - 18 nm.

Figure 4. A foot shaped sample of rusticle taken from the RMS Titanic in 1991. The chemical reactions of iron oxide produce the autumnal colours of red, orange, yellow and brown. The large blackish opening on the upper right side of the sample is a channel that circulates water through the rusticle structure.

Iron and manganese minerals, often found in rusticles, are sometimes produced by bacteria. This is caused by the precipitation of oxides of both metals, at acidic and neutral pH conditions. The changes of pH in rusticles may occur due to the circulation of the water inside this formation, whereby some of their internal spaces may have less water, or, in some cases are cut off from water circulation altogether. Figure 4. The rusticles contain sulfate-reducing bacteria as a part of the rusticle formation and are responsible for forming small niches in consortia, with almost or completely anerobic conditions. Mineral formation results from the neutralization of chemically reactive sites on the cell, and the combination of additional metal ions, with the initially absorbed metals (Southam, 2000). The outer surface of the cell, the cell wall, is most active where mineralization takes place. Figure 1. Non living cells can, however, also form minerals (Urrutia et. al, 1992).

Bacterially Induced Corrosion

The corrosion process by bacteria can be characterized as microbiological, metallurgical, electrochemical and aquatic chemistry. Microbiological corrosion depends on the diversity of microorganisms in the specific environment. Metallurgical corrosion depends upon the type, structure, and the process of how this metal was created. Electrochemical corrosion depends upon the mechanisms by which the corrosion process has occurred. In this case, the metal enters into a solution in the form of ions and rust forms by subsequent reactions (Borenstain, 1994). Aquatic chemistry is influenced by local substrate such as sediments, bed rock, water currents and waves.

As discussed above, samples from the Titanic site included water, sediment, rusticles, and metal. Sediments at the site also included a dense mud (Blasco personal communication, 1996).

Rusticles are made of a brittle 100-200 μm thick oxyhydroxide shell with a smooth, dark, red lepidocrocite (y-Fe0 (OH)) outer surface Fig 5. There is a rough, orange, geothite (α-Fe0 (OH)) inner surface Fig 6. Lepidocrocite is a stable, orthorhombic ferric hydroxide mineral which occurs as scaly aggregates or as occasional elongate crystals (Steffyn-Egli and Buckley, 1998). It is formed under oxidizing conditions by weathering, or by hydroternal alternation of iron bearing minerals, along with its polymorph, which is the same chemical composition but different structure of goethite and hematite. It also forms as a direct inorganic or biogenic precipitate from water. Geothite is also a stable orthorhombic ferric hydroxide mineral but it occurs as acicular (needle-like) reinform kidney-shaped, or botryoidal cauliflower shaped aggregate. Like its polymorph, lepidocroite, it is formed under oxidizing conditions by weathering or hydrothermal alternation of other iron bearing minerals and also forms as a direct inorganic or biogenic precipitate from water (Wells & Mann, 1997).

Bacteria are the most important group of microorganisms involved in iron mineralization. They are considered important in the transformation of iron at geological mineral formation sites, and mineral formation during corrosion of steel and other iron based structures as mentioned previously. Iron bacteria are also special in their ability to survive at a wide pH and temperature range.

Figure 5. Lepidocrocite is an iron oxyhydroxide mineral occurring on the outside of the rusticle structure.

Figure 6. Goethe is an iron bearing oxide mineral occurring inside the rusticle structure.

Metal Samples Collection

Metallic samples were brought up from the Titanic wreck during the 1991 dive. These samples fall in three broad categories of ferrous materials: cast irons, wrought irons and steels. The research on these metals was conducted by Metals Technology Laboratories of CANMET in Canada (1992). The first specimens, a bracket and a screw, were taken from the sediment ~ 200m east of the stern. They are a gray cast iron consisting of graphite flakes in a pearlitic matrix and show strong corrosion, called graphitization metallic matrix, whereby it is dissolved leaving behind only graphite flakes. This is typical of cast iron. The second specimen was a foot casting coming from the same location as the first. This is pearlite gray cast iron showing extensive corrosion as in the first sample. The third specimen was found on the deck near the starboard gunwale. It was made of gray cast iron, and showed graphitization from corrosion. The fourth specimen was a rivet with red paint on the head, suggesting that it came from the hull plate. This confirms that hull plates were put together with wrought iron rivets. The fifth and sixth specimen, a small hinge and a large hinge, were recovered from the forward section of the bow, starboard side, beside the officers' quarters on the top deck. Both were made of wrought iron, and show galvanic corrosion. This occurs when two different metals come in contact, as in this case bolts on screws. The seventh hull plate is low carbon steel (<0.2% C). Its high sulfur content indicates it was formed using the basic open-hearth process. The eighth specimen is sheet metal from the low section of the wreck, near the centre line of the ship which is the top deck. This steel sample is fully-billed and has sulfur content within today's limits (Brigham and Lafreniere, 1992).

Description of the Rusticles

Rusticles are very complex structures. The main purpose of the rusticle is to supply nutrition by the circulation of water through the rusticle. A rusticle is a consortium of bacteria, fungus and marine snow. The consistency of rusticles is like a combination of sponge, fumical and hard material made of iron flakes of varying sizes. The rusticles have several different shapes, plate-like branching, oozing, clustered and folded (Pellegrino & Culimure, 1997).

The description of the small foot is provided. The width is 6 cm and the length is 5 cm. Fig 4. The colouration of the foot is like autumn leaves in Canada, varying from dark red to orange, different

shades of brown and yellow and also black. The colour is in some instances tied to a crystallized or a morphic iron compound. eg, goethite, lepidocrocite.

The crystal shapes vary; some can be seen as cubic needle like or orthorhombic shapes. Besides the bio-organic occupants, sand and small pieces of glass, clay, and coal are buried within the rusticle. It, therefore also contains water channels.

Rusticles grow from exposure to outside water currents. The debris carried in the currents contributes to the variety of objects found in and on them. Sea shells, glass and sand found embedded on the outside of the rusticle provide a historical data of strong water current periods specific for that part of rusticles growth.

Rusticle Formation from a Bacterial Perspective

1) The microbial adhesion mast occurs as the first step of rusticle formation
2) Consortia are formed by two or more microorganisms with similar ecological niches, but different physiologies that complement each other (Marshall, 1984). These microorganisms stay together permanently with normal cell-to-cell contact. Since the members of the consortia stay together for a long time (as observed since 1985 on the Titanic) during their life cycle, beneficial interactions between them is assumed.
3) Forms similar to Caulobacter rosettes had been observed in the rusticles. As the rosette cells had stalks of equal length, the indication is that this could be the second species to appear on the Titanic wreck.

For a permanent consortium to become newly established, certain conditions have to be met:

1) The species must be in the same environmental location.
2) Both species should have a need for each other as in a stress situation or symbiosis. Extreme conditions often favour the production of a polymer on the cell surface.
3) The species will have to find each other. A motile central cell may be chemotactically attracted by excretion of “peripheral” cells.
4) The peripheral organisms may accidentally touch a surface polymer of a central cell and remain there permanently. Adhesiveness of at least one species must play an important role in the initial formation of consortia.
5) Chemical/biochemical interactions have to begin (Marshall, 1984).

Synchronous division may depend on syntrophic interactions on cooperative metabolisms of one substrate and on a constant environment. There must be some kind of symbioses of the rusticle consortium. There most likely is a bacterial species which excretes or produces only polymers formations, which attracts nutrients from the environment (Marshall, 1984). This is going to be studied further.

Characteristics of the New Bacterium *Halomonas titanicae*

The cells are rods, 0.5-0.8μm in diameter and 1.5-6.0 μm in length. They occur individually or in pairs, a gram negative, heterotrophic, aerobic, peritrichausly, flagellated and non-endspore forming. Most importantly they are mobile Fig 2.

The colonies are circular, smooth, convex, and white cream colour, when grown on agar. The liquid medium cells grow on the surface of the medium. Moderately halophilic optimal growth is at 2-8% (w/v) NaCl. The temperature range for growth is 4-42 °C, but optimal growth is at 30-37°C, and pH at a 5.5-7.5 range.

Phylogenetic analyses, based on 165 rRNA gene sequence comparison, indicated that bacterium clustered within the species of Halomonas. The nearest strain was *Halomonas neptunia* (98.6%) and the *Halomonas variablis* (98.4%). On the basis of phenotypic chemotaxonomic and phylogenetic data, this bacterium was considered as a novel species and named *Halomonas titanicae* sp. (Sanchez-Porro, et. al, 2010, Kaur & Mann, 2004).

Recommendation

Rusticles are unique. They contain different species of bacteria, fungi, marine snow, sand clay, small pieces of glass, and shells in some instances pieces of coal. The coal pieces are from the coal used to power RMS Titanic. The Titanic is not unique in having rusticles. Other wrecks made of iron and steel, including oil rigs and gas pipe lines in the deep ocean also have rusticle formations.
Within a year or two of being installed, rusticles begin to form on the moorings of oil rigs. The corrosion caused by the formation of rusticles, bacteria and normal processes incurs costs in the millions of dollars to the marine industry.

The identification of the *Halomonas titanicae* bacteria helps shed light on rusticle formation. This knowledge can be used to assist the marine industry. These bacteria can also be used to dispose of old merchant and naval ships and oil rigs in the ocean after they have been cleaned of toxins and oil based products.
The story of the RMS Titanic is well known internationally. It has captured our imaginations throughout history. We have explored the wreck, taken artifacts and scientific samples. It is through these samples that we continue to learn so much about the deterioration of the Titanic wreck and how this knowledge can be used to help maintain other metal structures in the marine environment.

Unfortunately, due to rusticle consumption, the Titanic wreck cannot be preserved forever as an underwater heritage site. While it exists, however, we can visit it and continue to learn more about our marine environment through further scientific study. The story of this ship will live on long after it has become a rust spot on the ocean floor.

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Environmental Impact Assessment and Archaeological Heritage

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Abstract: *Today Environmental Impact Assessment is one of the most important tools for decision makers when it comes to assessment of the possible positive or negative impact that a proposed may have on the environment. The regulations for which type of projects needs an EIA vary from nation to nation, but usually the environment consists of natural, social and economic aspects. In many cases, the assessment of the impact on the cultural heritage seems to be questioned or even regarded unnecessary. During the planning process for the Nord Stream – natural gas pipeline through the Finnish EEZ, the underwater cultural heritage turned out to be one of the key issues when among other finds circa 50 previously unknown shipwrecks were found.*

The Nord Stream AG was founded in 2005 to plan, construct and operate a twin pipeline system through the Baltic Sea from Vyborg, Russia to Lubmin near Greifswald, Germany. The two 1,224-kilometre offshore pipelines are the most direct connection between the vast gas reserves in Russia and energy markets in the European Union. The pipeline passes through the exclusive economic zone (EEZ) of five countries; Russia, Finland, Sweden, Denmark and Germany and the territorial waters of Denmark and Germany. The section running through the Finnish EEZ is 375km long from east to west.

The preparation of an Environmental Impact Assessment (EIA) report is an important part of public authority approval in Finland. The EIA is done to identify and assess the environmental impacts and consequences that can be expected in connection with construction projects. In the EIA report it is assessed how any negative impact on the environment can be avoided or limited as far as possible. If there is a major impact on the environment, alternatives are investigated and the impacts are compared. One part of the EIA concerns the cultural heritage, or in this case underwater cultural heritage, affected by the planned project.

Several possible threats to cultural heritage during the Nord Stream pipeline construction period were identified as the following:

The pipeline itself would be a threat if it were laid on top of or very close to existing UCH, thus harming or restricting access to UCH during the lifetime of the pipeline. The normal installation corridor is +/- 7.5 m. With the use of ROV touchdown monitoring and/or acoustic beacons the accuracy of pipeline installation can be increased to +/- 1 m.

Anchoring of vessels taking part in the construction work is one of the greatest threats to cultural heritage. During construction, the pipe-lying barge will be positioned by 12 anchors, each weighing 25 tonnes. Depending on the water depth, the anchoring zone will be at maximum 2 km wide. The barge will be supported by anchor-positioning vessels that help move the anchors during the construction phase. In addition, other support vessels may use anchors as well. Anchors from even rather small vessels can severely damage cultural heritage. Special anchoring plans was required for sites were anchoring will take place.

According to Nord Stream AG, the only type of *seabed rectification* that was going to take place in the Finnish EEZ was rock-dumping. Rock-dumping was carried out to support the pipeline in areas were freespans otherwise would be too great. The material was placed on the seabed through a fall pipe, which controlled where the material was placed, thereby limiting the affected area.

Erosion will occur adjacent to the pipeline (<10 m) in areas where the pipeline is placed directly on the sea bottom. Over time, the pipeline will erode into the sediment, and changes in sedimentation patterns will decrease. Erosion will occur in limited areas and is not considered a problem in this case.

Clearance of ammunition was carried out prior to construction works. During World War I and World War II, the Gulf of Finland was heavily mined. After both wars, parts of the minefields were cleared through sinking. At present, standard practice for mine-clearing is to explode them on site, which can damage nearby cultural heritage. Also other types of ammunition ended up on the seafloor during the wars due to different circumstances. The effect of the ammunition clearance on the wrecks has been

investigated by Nord Stream AG. Most of the wrecks are situated so far away that the ammunition clearing will only have minor or none effect on them.
Other possible threats to cultural heritage, such as *corrosion*, have been discussed with the different partners in the project. Corrosion is not considered a problem in relation to UCH.

In Finland, antiquities are protected under the *Antiquities Act* (295/63). The Antiquities Act protects Old shipwrecks by their age. Wrecks of ships and other vessels that can be considered to have sunk more than 100 years ago, or parts thereof, are all considered ancient sites. All finds in this category must be reported to the Finnish National Board of Antiquities (FNBA) without delay. If it is obvious that the owner has abandoned part or all of a wreck, the find is understood to belong to the state. The artefacts in or outside a wreck of this kind belong to the state as well.

According to the Antiquities Act, those who plan public waterworks must verify whether the execution of such works will also impact upon ancient monuments. Because the FNBA's Register for Underwater Finds is not comprehensive, developers are usually required to survey the sea bottom beforehand. If a site may be harmed or destroyed during a construction project, the Antiquities Act obliges the developer to pay for the necessary investigations.

From 2005 to 2009 several large-scale geophysical investigations using different methods were made as part of the planning process for the natural gas pipeline. The 140m wide pipeline corridor and the 1.6km wide anchoring zone were investigated separately. In all, 74.000 ha of seafloor were surveyed. Following interpretation of the survey material, target reports were made and targets were selected for inspection by a remotely operated vehicle (ROV). During the different surveys close to 20.000 targets were inspected by a ROV. The bottom survey material and the inspected targets were evaluated from a culture heritage point of view and an impact assessment for each target considered to be cultural heritage was carried out.

An archaeologist spent three and a half months going trough objects in the survey material. The work concentrated on checking the quality and coverage of the survey material, comparing the found wrecks and their positions to known wrecks in databases and going extensively trough survey-material and to pick out objects of interest and compare them to the target reports. Another three months was spent on evaluating the wrecks inspected by ROV and writing a report on the evaluation of the cultural heritage. As a result of the investigations circa 40 wrecks and some other targets were evaluated from a cultural heritage point of view.

Two different safety-zone protocols were set up in relation to cultural heritage. Archaeological sites closer than 250 m from the pipeline or the anchoring positions needed to be assessed. If the pipeline or an anchor was planned to be laid within 50 m of an archaeological site, sustainable protection is not possible. In such a case, a plan for safeguarding the archaeological information at the site must be established prior to the construction.

Due to the amount of ammunition and wrecks fond during the surveys, a decision was made by Nord Stream AG to use a non-anchoring pipeline lying barge in for more than 200km in the Finnish EEZ. For the remaining part, special anchoring plans was established for cultural heritage sites and presented prior to the construction and the sites was also be inspected by ROV after the installation of the pipeline.

Nord Stream AG decided to attend to an avoidance strategy in relation to cultural heritage sites. To avoid impact on cultural heritage, the pipeline will be routed around shipwreck sites.

The Impact on and Opportunities Arising from Tourism to Submerged Sites

James P. Delgado[i]

Abstract
Access to the underwater cultural heritage by tourists poses both a potential threat and also an opportunity for archaeologists to present heritage and archaeological work for better appreciation and understanding. The concept of in-situ preservation raises the need to consider UCH as a "museum IN the sea" as much as a submerged "museum OF the sea" compels us to examine strategies for appropriate tourist access to the UCH. This presentation examines the approach to shipwrecks undertaken by the U.S. National Oceanic and Atmospheric Administration and the National Park Service, and concludes with comments on appropriate tourist access to sites such as the Titanic.

Tourism of historical and archaeological sites predates the development of scientific archaeology; indeed, one could argue that tourist interest in such sites, especially among the literate, cultured and wealthy classes of Europe in the 18th and 19th centuries, helped to inspire the development of archaeology as antiquarian interest gave way to a systematic, scientific approach. As archaeology matured, the practice of complete excavations and the shipment of artifacts (including entire structures and architectural decoration and sculpture) to institutions large and small, especially those abroad associated with sponsoring institutions, shifted to retention of material in the country where the excavation took place, as well as a greater emphasis on preservation *in situ*. The more recent trend to greater societal mobility and increased tourism, especially cultural and eco-tourism, has also encouraged a greater emphasis on *in situ* preservation and display at archaeological sites.

The twentieth century advent of easier access to submerged sites, and the development of underwater archaeology conversely led to the rise of underwater tourism, at its "easiest" and simplest through the modern media of virtual tours, or in the real world through glass-bottomed boat tours. The next point of access, though more complex in execution, is through scuba or other diver-directed tourism, and the ultimate is found in submersible tourism, which at its most extreme involves diving to *Titanic* depths of 3,800 meters. Tourist dives to *Titanic*, which began in 1998 and continued in 2000, have carried approximately three dozen visitors to the wreck, and advertised plans for tourist dives in July 2012 suggest as many as 70 individuals have paid approximately 46,665 € for the experience.[ii]

The Titanic wreck sank in 1912.

Criticism of tourist visits to *Titanic* in 2012, the 100th anniversary of the sinking, have included opposition to cruise ships visiting the site on the surface during the April commemoration of the wreck event as well as the dive sea dives. On the other side are thousands of passengers who have booked the cruises as well as the divers. At the same time, there are concerns voiced by some of what constitutes "safe" tourist access to submerged sites like *Titanic*, and if such visits can be conducted without damaging the fragile nature of the wreck. Properly conducted tourism does not impact sites, and the dives conducted to date have been accomplished by the world's leading professionals, in

particular the crews of the Shirsov Institute of Oceanology utilizing the *Mir* submersibles deployed by the research vessel *Akademik Mstislav Keldysh*.[iii] Without entering the debate on what is or is not appropriate to visit (tourism sites on land include settings of battle, imprisonment, atrocity and genocide as well as museums, architectural and engineering achievements, gardens and holy places) the issue is conducting tourism in a manner that is non-disturbing and sustainable for both the resource and the industry

In this last point, tourism is not an incompatible "use" of heritage resources regardless of whether it is a land or sea-sited resource, or if it is an iconic shipwreck at 3800 meters or a group of ships resting in shallower water. Shipwreck sites in a number of nations are the subject of active shipwreck tourism. Tourism for some is provided by private industry, others by government at various levels (local, regional, national) and yet others through government/private sector licensing or other forms of partnership and/or regulation. These include well-known and successful examples such as Canada's Full Fathom Five National Marine Park in Lake Huron, Ontario, and in Louisbourg Harbour, Nova Scotia, or the numerous wrecks that rest off the coast of Bermuda.

In the United States, a wide range of Marine Protected Areas (MPAs) administered by all levels of government also include shipwrecks which are actively utilized as sustainable tourism resources. These include dive preserves in Lake Champlain, Vermont, which includes a world-renowned shoreside museum with an active research and educational program, the Lake Champlain Maritime Museum, dive trails in Florida, in Lake George, New York, in Maryland, California, Wisconsin, Ohio, North and South Carolina, and Michigan, where one existing state underwater preserve, at Thunder Bay, is jointly managed with the federal government as Thunder Bay National Marine Sanctuary and Underwater Preserve in cooperation with the National Oceanic & Atmospheric Administration. The federal system, embodied particularly in the national parks and national marine sanctuaries and monuments, is administered by the National Park Service and NOAA's Office of National Marine Sanctuaries.[iv]

A large number of national parks and monuments, as well as the NOAA sanctuaries contain submerged cultural heritage and thousands of shipwrecks. While primarily established to protect nationally significant cultural and natural resources, these federal areas are managed for public benefit, which includes "recreational and aesthetic" uses such as tourism, as well as management with an emphasis on education, outreach and support for local communities. This is particularly evident at Thunder Bay National Marine Sanctuary on Michigan's north shore of Lake Huron. The lake is a border between the U.S. and Canada, an active highway for maritime trade for centuries, and a repository for hundreds of wrecks, especially during the "shipwreck century" of 1830-1930.

Established in 2000 through the designation of 1,160 k², Thunder Bay NMS contains some 200 known shipwrecks, some fifty of which have been located. As the management plan for the sanctuary notes,

> Lake Huron's cold, fresh water ensures that Thunder Bay's shipwrecks are among the best preserved in the world. Many sites remain virtually unchanged for over 150 years.
> With masts still standing, deck hardware in place, and the crews' personal possessions
> often surviving, sites located in deeper waters are true time capsules. Other shipwrecks
> lay well-preserved but broken up in shallower waters. Readily accessible by kayakers, snorkelers and divers of all abilities, these sites often provide sanctuary users with their first shipwreck experience.[v]

That experience comes through on-land museum interpretation at a visitor center, on-line interactive tours, educational programs, glass-bottom boat and snorkel tours of shallower sites, and dive buoys and interpretive guides for scuba diving visitors. The visitation to Thunder Bay after the sanctuary's establishment has aided and added to the local economy, creating jobs, bringing in tourist dollars, and generating significant community and regional support for the sanctuary. It has done so in tandem with a mandate and action to protect the resource while making it accessible.

The Thunder Bay NMS management plan specifically addresses its role and strategies in regard to tourism under the goal to "Increase and encourage access and responsible use of sanctuary resources by fostering greater awareness among recreational users," the plan identifies these actions:

Provide practical information for users such as shipwreck locations and information, access points, regulations, and contact information.

A. Develop outreach materials and Web-based information for recreational users of sanctuary resources.

B. Explore the use of cell phones and podcasting as a means of allowing recreational users to access interpretive materials at shipwreck sites.

C. Provide information about shipwrecks, sanctuary regulations, and enforcement contact information at marinas, boat ramps, and other access points.

Maintain existing and install additional mooring buoys at shipwreck sites to protect shipwrecks from anchor damage and to facilitate shipwreck access.

A. Develop a five-year plan for increasing the total number of moored shipwrecks in the sanctuary, including permitting procedures, staffing requirements, and operational and scheduling considerations.

B. Develop an operational plan for annual redeployment and maintenance of existing buoys.

C. Work with local dive charters to monitor moorings throughout the dive season.

D. Investigate the permit requirements for using smaller, easier to maintain marker buoys where appropriate.

Reduce the impact of divers and snorkelers on Thunder Bay's maritime landscape by forming a partnership with commercial operators to educate their customers about maritime heritage resources, sanctuary, as well as diving and snorkeling etiquette using a program similar to Florida Keys National Marine Sanctuary's Blue Star Program.

Work with other agencies, local governments, and non-governmental organizations to improve recreational access along Lake Huron.

These actions are similar to those employed by the National Park Service and other MPAs, albeit at a better-funded and more intensive level not always available to other jurisdictions. While there is risk, and at times damage to the resource, something characterized by Arthur Cohn and Joanne Dennis as "wear and tear," there is ongoing interest in access to such sites, and the question of balancing protection through limited or closed access versus open access remains open ended. As Cohn and Dennis note, is a successful preserve one "that is visited frequently by divers and brings in revenue to the local community through tourism," or measured by a metric in which public access and site preservation are balanced, and if so, "does the measurement of success have to do with how many wrecks a system can host, or the amount of attention a wreck receives through educational outreach?"

Like Cohn and Dennis, I see potential to achieve success through new technologies for non-diving access that have opened the door for new forms of interpretation and a different type of tourism. This would not replace, but add to and enhance existing tourism on and under the water. Three-dimensional video, interactive online tours that simulate a dive, webcasts, "live from the dive" presentations by archaeologists and educators presenting interactive live programs from underwater, robotic-conducted live "over the shoulder" broadcasts of deep wrecks and for the process of discovery and research, as well as the concept of underwater museums with aquarium-like walk-through tunnels in shallow environments all offer great potential, in several cases a potential already being demonstrated. Ultimately, personally and professionally, I believe in interpretation, outreach and tourism. Without public engagement, interest and awareness, archaeological study of such sites face the question of for whom are we doing this, for whom are we protecting such places, and to what end? We protect and study the past to learn and to share what we learned, and we must continue to embrace public access for the resource's sustainability and its ability to yield understanding as well as excitement for generations to come.

[i] The views expressed in this paper are those of the author and are not necessarily the view of the National Oceanic and Atmospheric Administration.

[ii] The tourist dives were the subject of litigation by the salvor-in-possession, RMS Titanic, Inc., which claimed tourist dives and photography and filming of the wreck by other parties would have a negative impact on their ability to profit from the wreck. Although they initially won their case, the judge's ruling was overturned on appeal, opening the shipwreck site up to visitation. See David G. Concannon, "The Battle for the *R.M.S. Titanic*," *The Philadelphia Lawyer*, Summer 1999, Vol. 62, No. 2.

[iii] I audited the 2000 tourist dives, made one dive to the wreck site to observe, and reported on them to the International Congress of Maritime Museums and to the Archaeological Institute of America. I found them efficiently, safely and respectfully operated by both the tour operator and the crews and team from the Shirsov Institute. See James P. Delgado, "Diving on the *Titanic*," *Archaeology*, January/February 2001, Vol. 54, No. 1.

[iv] An excellent and detailed review on this topic is the recently published article by Arthur B. Cohn and Joanne M. Dennis, "Maritime Archaeology, The Dive Community, and Heritage Tourism," in Alexis Catsambis, Ben Ford and Donny L. Hamilton, editors, *The Oxford Handbook of Maritime Archaeology*. Oxford University Press, 2011.

[v] *Thunder Bay National Marine Sanctuary Final Management Plan*, NOAA, 2009.

Making a Statement for Heritage Preservation: Ratifying the 2001 Convention

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Abstract
UNESCO Conventions for the protection of the cultural heritage on land have gradually been ratified by Member States; it is important to emphasize that the protection of the underwater cultural heritage is equally important. It is not enough for Member States to say "We will respect the Annex to the Convention, and that is enough." Of course such undertakings must be rigorously checked; but this is not enough. Too much concentration on the Annex could, it may be argued, prove a distraction from the obligation on Member States to proceed to full ratification, and full participation in the working of the Convention. Only when the major maritime states have thrown their full weight behind the undertaking will it be able to function in the way which we all desire. The quiet opposition by some can be used as a cover by others.

UNESCO Conventions for the protection of the cultural heritage on land have gradually been ratified by Member States; it is important to emphasize that the protection of the underwater cultural heritage (hereafter UCH) is equally important.
We are meeting on the tenth anniversary of the important vote on the adoption of the UNESCO Convention on the Protection of the UCH, and we have been reviewing progress over the last decade. I should like to start by recalling the origins of this Convention, which go back almost 35 years!

Origins of the Convention
The campaign for a Convention to protect the UCH in international waters began already in 1977 as a European initiative, in the Parliamentary Assembly of the Council of Europe in Strasbourg. A report on the need to fill this gap in the protection of our cultural heritage was prepared by John Roper (a member of the British Parliament and of the Parliamentary Assembly, with cultural and nautical interests), and presented to the Assembly's Committee on Culture and Education. It was adopted by the Assembly in plenary session on 4 October 1978, after a hearing of experts in committee in March. It contained a series of recommendations for action at international level (by the Committee of Ministers of the Council of Europe) and by the individual member states; and it was supported by detailed proposals on the necessary legal and archaeological procedures; long appendices were written on the archaeological aspects (by Blackman, an archaeological adviser to the Committee, who had been involved in the effort to achieve legislation for UK territorial waters) and on the legal aspects by the legal advisers to the Committee, two young lawyers of the Australian Foreign Service, Lyndel Prott and Pat O'Keefe, who had just negotiated a bilateral agreement with the Netherlands Government, on disposal of finds from Dutch East India Company wrecks found on the coast of Australia, mainly Western Australia. One of our main successes in 1977 was to persuade Prott and O'Keefe to devote their expertise and energies to this study. They were to become key players for the next 25 years, and I think it important to pay tribute to them again today!

The report was adopted unanimously by the Parliamentary Assembly, and passed to the Committee of Ministers for implementation, particularly of the proposal to draw up a European Convention on the UCH; but the ad-hoc committee set up for this purpose failed to produce a unanimously agreed text, mainly because of bilateral disputes in the Aegean.

Action through the Council of Europe then seemed to lapse; but those involved in the initiative did not give up, and continued to press for a Convention (now to be *international* rather than simply European in scope) through various channels, notably the International Law Association, where O'Keefe had played a key role, to arrive eventually in the forum of the competent UN body – UNESCO, where Lyndel Prott had become Head of the International Standards section of the Secretariat, and was to play a central role in achieving the Convention.

Over the years a series of notorious cases (e.g. the Skerki Bank affair in 1997) had shown how much damage could be done to the UCH in international waters, on the deep seabed (now accessible to remotely operated submersibles - ROVs) where much of the missing information about ancient to late medieval ships and their cargoes is likely to be found. This built up the political will to move towards an international protection measure, and a Draft Convention was negotiated at a series of grueling working meetings; however, a number of delegations ensured the watering down of the text - for which their representatives did not vote when after long debates. The Draft Convention was adopted by the

UNESCO General Assembly in 2001: 15 states abstained and 4 voted against. I note that Spain and Portugal soon ratified the Convention, and they have a world-wide UCH equivalent to that of the UK.

A number of states (notably the 'Western Maritime States') have said that they will not sign or ratify the Convention, though some have said that they support its general principles and objectives, particularly those set out in the Annex, based on the Charter that had been prepared in parallel and had recently been adopted by the International Council on Monuments and Sites (ICOMOS); and would adopt the Rules set out in the Annex, which represent internationally accepted standards of archaeological practice. It is fair now to ask of these countries, such as the UK, what they have done to respect and implement those Rules.

The British problem

A conference on the Convention was organized in London in October 2005 by the Joint Nautical Archaeology Policy Committee (JNAPC), a British body which brings together informal representatives of the specialist non-governmental organizations (NGOs) and the relevant government departments, and as such performs a very useful role; the Nautical Archaeology Society published the Proceedings on behalf of the JNAPC.

The seminar looked at the situation in other countries, but specially concentrated on the U.K., as did the Declaration adopted at the end of the seminar: 'The Burlington House Declaration'. This Declaration basically welcomed the Convention; it noted that Her Majesty's Government had already assumed obligations under the UN Convention on the Law of the Sea (UNCLOS) 1982 (which it *had* ratified) 'to protect archaeological and historical material found in all sea areas and to co-operate for that purpose'; and welcomed the Government's support for the general principles and objectives of the UNESCO Convention 2001, 'particularly those set out in the Annex, and noting that the Rules in the Annex represent internationally accepted standards of archaeological good practice.'

The Declaration therefore called on the British Government to 're-evaluate its position regarding the 2001 Convention with a view to considering how its specific reservations to that Convention may be overcome' (very diplomatic language); in the interim, to pursue the Convention's principles and objectives in its own activities at national level; and to co-operate with UNESCO, the States Parties to the Convention and the International Seabed Authority, in their implementation of the Convention when it comes into force. The Government *more or less* rejected the declaration, confirming that its position was unchanged; and it is sad to note that it was necessary to hold a second Burlington House Conference in November 2010, because there is no sign of movement by the British Government.

The Convention comes into force

In October 2005 the Convention was simply a draft text and a distant prospect. But gradually the number of states ratifying the Convention reached the figure 20, when the Convention came into force (on 2 January 2009). The basic operating committee (Meeting of States Parties) was then set up by those states which had ratified, and they will make important decisions for the future. They have held a series of meetings in Paris, and set up a Scientific and Technical Advisory Body, consisting of 11 members (nationals of these states) nominated by the States Parties, whose number has now reached 40. The STAB met in Cartagena in June 2010. The International Centre for Underwater Archaeology in Zadar, Croatia, has been granted the auspices of UNESCO, in recognition that Croatia was one of the first states to ratify the convention.

Another important milestone is that Italy has ratified the Convention (January 2010); and now we await the ratification by France, already announced by Culture Minister Mitterrand; this breaks the hitherto solid negative front of the North European maritime states (France is both North European and Mediterranean).

States still outside the Convention

How will this progress affect the states which have refused to ratify the Convention?

We hope that they will feel more and more uncomfortable 'on the outside'. They should not be allowed to interfere in a process from which they have opted out, and yet they should be encouraged to support the operation of the Convention and particularly of its Meetings of States Parties and Scientific and Technical Advisory Body. After all, as signatories of the UN Convention on the Law of the Sea

(weak on cultural heritage, but see article 303) they have a general obligation to protect this specific UCH.

We must also continue the debate, and try to persuade the 'non-ratifiers' of the advantages of ratification and full participation in decision-making and implementation of the Convention. We must contest the arguments used against ratification by different governments, and suggest that their fears are exaggerated: for example, over the question of 'sovereign immunity' for warships; the cost of implementing the Convention; and fears of 'creeping coastal state jurisdiction'.These seem to be the principal concerns of the British Government – other 'non-signatories' may have different reservations.

More controversial for the British Government in the current situation are commercial operations by foreign salvage companies, working with all the latest deep-water technology and recovering valuable material from, e.g., the wreck of a 17th-century British warship located outside UK territorial waters, and landing it outside UK jurisdiction. The '*Black Swan'* (code name) may after all have been a Spanish, not a British ship, but *Odyssey Marine Exploration, Inc.* (a leading underwater treasure-hunting company) has filed a claim for salvage rights in respect of wrecks in the English Channel. The low profile of the British government over the *Black Swan* dispute has been compared with the vigorous action of the Spanish government in the US courts. The main reason for the change in the French position on the Convention has been the increasing activities of treasure-hunters.

Other states like Spain and Portugal, with a long colonial tradition, and warships wrecked all over the globe, have understood that accession to the Convention could be said actually to reinforce the Doctrine of 'Sovereign Immunity' in relation to such remains, as it puts an obligation upon coastal states to report the discovery of such remains, to consult, and to co-operate on their protection from unauthorized interference. For example, British-related wrecks found in international waters can only be protected by the Convention, but a State must be a Party to the Convention to register an interest in UCH.

These arguments were presented again at the second Burlington House Seminar in November 2010, about which Bob Yorke and others have talked in this seminar. We hope that our continuing dialogue with government officials will encourage a review of the British government's objections [the JNAPC has already initiated such a review], and more appreciation of the advantages of ratification; also, more commitment to what it has already accepted: that the Convention's Annex is recognized government policy. This has not been evident in all the British government's decisions on 'Marine Historic Assets'. Also, the strength of the British government's commitment to the doctrine of 'Sovereign Immunity' has been put in doubt by the revelation that in 1954 it sold to a German salvage company. The salvage rights on three British warships sunk 22 nautical miles off the Dutch coast early in the First World War.[v] These are war graves – a matter of considerable sensitivity, which will come to the fore as First World War maritime graves come within the scope of the Convention in the next few years.

It would be unfair to highlight only the failures of the British government to respect the Rules of the Annex. One could cite a recent case in Greece: the Greek Ministry of Culture has just approved the construction of a massive breakwater, creating a harbour for cruise ships at Aegina, which would seriously threaten one of the best surviving remains of an ancient dockyard; and this despite the opposition of the responsible Ephorates (Superintendencies) of Antiquities. This is of course a site within national jurisdiction, but it would be absurd to argue that a State should not respect the Rules of the Annex within its own national jurisdiction. The same is the case in Lebanon (a State which has accepted the Convention), where the Ministry of Culture appears likely to allow the displacement of a (probably) Phoenician dockyard in Beirut, the first such remains in Lebanon, rather than impede a high-rise building development.

It is, however, not enough for States to say "We will respect the Annex to the Convention, and that is enough." Of course such undertakings must be rigorously checked; but this is not enough. Too much concentration on the Annex could, it may be argued, prove a distraction from the obligation on Member States to proceed to full ratification, and full participation in the working of the Convention. Only when the major maritime states have thrown their full weight behind the undertaking will it be able to function in the way which we all desire. The quiet opposition by some can be used as a cover by others. The Russian position seems to be: "We will ratify when the US have."

Issues to pursue
The issue of maritime graves is not just a question of war graves: the centenary of the sinking of the *Titanic* comes in April 2012, and will attract much publicity. The *Titanic* agreement follows the wording of the Convention.

Bilateral and multilateral agreements will have an important part to play, and the Convention (Art. 6) encourages States Parties to conclude such agreements. A number of existing bilateral agreements involve vessels of one state found in the territorial waters of another state, but recently some multilateral agreements involve wrecks beyond the jurisdiction of any state (e.g., on the *Estonia* and the *Titanic*). So far many of the agreements have come *after* the location of a wreck and damage to it. Some now advocate regional agreements for closed or semi-closed seas (an idea that goes back to Strasbourg, 1977), to provide protection before damage. A regional agreement in the Baltic under the aegis of the Convention could be a useful development of the existing Baltic Co-operation framework.[v] A regional agreement for the Black Sea also deserves consideration.

Another idea is to promote agreements relating to a particular battle-site: the site of the Battle of Jutland has received much attention. The UNESCO 2001 Convention is affecting the development of law and policy around the world, even with countries that have not ratified the Convention, in national legislation as well as in the agreements just mentioned. As Michel L'Hour has said, "We have in a sense implemented the Convention without ratifying it." He has also justifiably asked the question: "What have the States who have ratified the Convention done to implement it at a practical level?" Michel has also rightly emphasized the importance of archaeologists following more closely the meetings of states Parties, and not just the STAB. The former meetings must not be left to the lawyers alone. The role of the National Commissions for UNESCO should not be ignored. If they are not allowed to be simply mouthpieces of national governments, they can exert a positive influence.

Conclusion
These considerations must not weaken our principal aim, 35 years after the debates in Strasbourg: to persuade the 'non-signatory' states to ratify the 2001 Convention. Apart from Italy, Spain, and soon France, the 'non-signatories' are the states which have the technology to undertake deep-water recovery work, and their failure to ratify will leave a huge hole in the Convention's protective network, which relies to a large extent on flag states controlling the activities of their vessels. With a mixture of 'quiet diplomacy' and occasional public pressure, and with the new situation which has emerged with the coming into force of the Convention, I hope that it will be possible to persuade the 'non-signatories' to change their mind.

The Nordic Experience – Access Through Maritime Dive Trails and Virtual Simulation

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Abstract: *This presentation introduces two projects using different methods to make underwater cultural heritage sites more accessible in the Nordic and in the Baltic Sea Region. First of the cases describes an international project called Nordic Blue Parks. The second project is called Vrouw Maria Underwater Project. Nordic Blue Parks Project was an innovating one year pilot project creating a new concept combining – for the first time – natural and cultural heritage and recreation at underwater trail and park sites. It aimed to formulate criteria and guidelines for sustainable trails and to set up new trails and to improve old ones. During the project three new underwater parks were opened and two old ones were improved. Vrouw Maria Underwater Project aims to make this Dutch shipwreck - sunk in 1771 off coast of Finland - more accessible through a blog site, a virtual simulation and an exhibition. The interactive, real-time, virtual reality simulation gives for a visitor a feeling of being there at the actual site and a possibility to experience the wreck, the underwater landscape and the sounds cape. This is especially important for a site located in an area where sport diving is prohibited. The exhibition introduces also ideas and feelings of those few divers who have visited the site bringing alive the idea that a heritage is combination of the site and the people who uses it.*

The Nordic Blue Parks Project

The Nordic Blue Parks Project was an innovating one year pilot project in 2009 creating a new concept combining – for the first time – natural and cultural heritage and recreation at underwater trail and park sites. It aimed to formulate criteria and guidelines for sustainable trails, to set up new trails and to improve old ones in Denmark, Norway, Sweden and Finland.

Underwater cultural heritage in the Baltic Sea is exceptionally well preserved due to the excellent preservation conditions, but a problem has been that these underwater secrets have been accessible only to a small group of sport and scientific divers. A similar situation holds true also for the underwater nature. To protect this underwater heritage better it is essential to make the sites more accessible because the visitors of the sites are the best protectors of this heritage when educated with proper attitudes and awareness. We must bear in mind that heritage is a combination of a site and the people who are using that site. Our cultural heritage should be used, but not consumed – not exploited as a product, but linked to the good practices and sustainable development of the whole society.

To protect the underwater cultural heritage better we need to know what there is in the Baltic Sea. It is not possible to protect something if we don't know what there is. The modern divers visiting the sites are important players of the underwater world and their behavior can destroy or save our underwater heritage. The more they know, the more they care. The idea of my place, local identity and our common sea was important in the Nordic Blue Parks Project.

The Nordic Blue Parks Project started with GIS analysis to find overlapping areas of high natural and cultural values. In all four countries ten possible potential park sites were selected. Next step was to prepare threat/pressure analyses to find areas of particular sensitivity or resilience. From these results it was decided in principle where the new parks could be placed. One problem was the fact that only a few places are surveyed for sufficient amount of information concerning underwater culture and nature.

During the Nordic Blue Parks Project three new underwater parks were opened and two old ones were improved. The two existing underwater trails in Finland were used as examples. These sites were the Stora Hästö underwater nature trail in Korppoo (Archipelago Sea) opened in 2005 and the Kronprins Gustav Adolf underwater shipwreck park in Helsinki opened in 2000. The three new parks were opened in Finland, Denmark and Sweden. In all parks also non – divers can enjoy the site. This can be done for example through a museum exhibition, internet site, publications and films.

The first new park in Finland was the Perämeri Underwater Nature Trail which was opened in 2009 in the Bay of Bothnia in the northwestern corner of the Selkä-Sarvi archipelago. This underwater trail shows the typical sub-aquatic world of the Bay. The trail has been primarily planned for SCUBA divers

with an interest in the underwater nature, culture and the marine biological work carried out in the Bay of Bothnia.

In Denmark the Højklint site underwater trail was opened in November 2009. The trail tells about the submerged Stone Age landscapes in the waters around Southern Fyn (Funen). The site offers with seven information stations a safe and easy dive in good visibility at the maximum depth of three meters.

In Sweden so called Dalarö Model was developed. The model is based on the idea of controlled access to protected shipwreck sites. Divers will get a permission to dive on the wrecks when accompanied by a licensed underwater guide. The guide has relevant competence and training to educate the divers on the cultural heritage of the area and the shipwrecks. This will increase professionalism as well as business opportunities among dive charter companies operating in the area. The model is well received by the Swedish diving community.

In Dalarö model also non-divers can enjoy the underwater cultural heritage in real-time experience onboard charter boats equipped with ROV's. In addition digitally enhanced movies and animated reconstructions of ships can be made for display on widescreen television and on movie screens. The Dalarö model is a method to simultaneously preserve, use and enrich the underwater cultural heritage for both divers and the general non diving public.

In July 2010 the Axmar underwater park was opened at Axmar 17th century industrial heritage iron works. In the park it is possible to enjoy both nature and culture. The many shipwrecks of the park are located mainly in the shallow waters and they can be visited by divers, boat tourists, canoeist and some of the sites can be seen even from the shores. In addition Axmar is a nature preserve and marine protection area which adds the importance of the underwater park.

In Norway plans were made to open an underwater park at the shipwreck site of frigate Lossen sank in 1717. Although the trail will focus on the wreck, it will also include information plates on the animal and plant life at the site and there will be in addition some general knowledge about the national park where the wreck is located. The Lossen site has been extensively excavated and most of the artefacts have already been removed.

The Kronprins Gustav Adolf underwater park was the first maritime historical underwater park in Finland and in the Baltic Sea region when opened in 2000. The park is situated at the wreck site of the Swedish ship of the line Kronprins Gustav Adolf which sank off Helsinki in 1788. The wreck was found in 1995 and underwater investigations were carried out 1997–1999. Diving among the cannons at the depth of 19–21 meters gives a good picture of the size of an 18th century military vessel. There are 13 information signs at the site. No special permission is needed for diving at the park. During the Nordic Blue Parks Project a new bio- sign was planned and placed at the wreck site to explain the invertebrates of the area. In addition the park internet site was developed placing new texts and photos. Also a video footage was produced to give a possibility to make a virtual dive at the site along the underwater cultural path. Now the Kronprins Gustav Adolf Park has been open for over ten summers and our experience has been very good.

The Stora Hästö underwater nature trail in Finland was opened in 2005 offering two routes with information plates, a shallower one for snorkelers and a longer, deeper trail for divers. Along the trails visitors can experience the rocky shores, seaweed communities and sandy seabed with sea grass meadows. In addition divers can observe small fish, mussels, and many small invertebrates, such as snails and isopods. There is also a traditional terrestrial nature path on Stora Hästö Island. In July 2010 a new underwater on line - camera was installed at the Stora Hästö Park. With an image refresh rate of every 10 seconds, the almost live footage shows a clump of bladder wrack in the near distance, as well as some bedrock. The unit is powered by solar panels set on land.

The Nordic Blue Parks Project was organized through the Nordic Council, and the Nordic Council of Ministers and it was led by the Natural Heritage Services of Metsähallitus (Finland).

The Vrouw Maria Underwater Project 2009 – 2012

Vrouw Maria - a Dutch snow ship - had left the port of Amsterdam destined for St. Petersburg in September 1771 when it suffered a shipwreck off the coast of South-Western Finland. Vrouw Maria carried a cargo of typical merchant goods like sugar, cloth, dye stuff and food, but in the cargo there were also some paintings and other luxuries bought by Russian aristocrats and Catherine the Great. The paintings bought for Catherine were lost in the accident.
The story of Vrouw Maria has been known from archival sources since the early 1970s and it was also searched for several times. Finally the wreck was found at a depth of 40 meters in 1999 by Pro Vrouw Maria Association and Rauno Koivusaari.

Vrouw Maria is a well preserved example of an 18th century Snow rigged Dutch merchant ship which sailed between Europe and Russia. Since the discovery of the wreck it has been discussed and debated lively in Finland, Russia and the Netherlands, the countries essentially related to the story.

Vrouw Maria has a great international cultural historical significance. It is a good example of the common European maritime heritage or should we even use term global maritime heritage because of those colonial goods in the cargo like sugar, tobacco and coffee which might have derived from India, China, Africa, North and South-America. Instead of talking only about common European cultural heritage, should we even talk about “cultural heritage of humanity” using a term borrowed from the UNESCO 2001 Convention?

The National Board of Antiquities of Finland has conducted research at the site since 2000. Extensive documentation has been carried out and the environmental conditions have been studied quite thoroughly. In addition some objects have been raised. Between the years 2001 – 2004 Vrouw Maria represented Finland in an international European Union funded project called MoSS (Monitoring, Safeguarding and Visualizing North-European Shipwreck Sites). The Project was set up with the aim of monitoring, safeguarding and visualizing shipwrecks in situ.

In 2007 National Board of Antiquities published so called Vrouw Maria Report were five different options of the future of Vrouw Maria were looked at according to the strengths, weaknesses, possibilities and threats of the alternatives. The options included also the raising of the wreck. Finally it was recommended to keep the wreck in situ and to undertake the Vrouw Maria Underwater Project.

The reasons for the in situ solutions were for example, that there were no immediate environmental risks for the safety of the wreck in the original location and in Finland there was a legal battle going on concerning the ownership of the wreck. In addition in the early 2000 the staff of the Vasa Musem had found iron and sulphur compounds problems with Vasa ship and it was recommended that shipwrecks should not be raised before the problem is understood in more details. It was also clear that the in situ option was more realistic than raising the wreck because the technological demands, risks, and resource requirements were moderate. Vrouw Maria Underwater Project offered also solutions to everyday maritime archaeological questions like in situ protection, maintenance, documentation, and methods of visualisation and underwater exhibition.

Vrouw Maria Underwater Project shall be operated in 2009 – 2012. It aims to make the wreck more accessible through a blog site, a virtual simulation and a museum exhibition. The Project aims to show the best ideas and practices of the in situ – preservation idea recommended by UNESCO and ICOMOS. In addition we undertake every summer archaeological fieldwork at the site, make research in the archives, write articles and in April 2012 we shall open an exhibition called ”The Story of Vrouw Maria and St. Michael” at the Maritime Museum of Finland in Kotka. In the end of 2012 also an international shipwreck seminar shall be arranged in Kotka. The Project is funded by the Ministry of Culture and Education.

Vrouw Maria is located in the Archipelago National Park in a Natura 2000 Area. This means that all activities at the wreck site must be granted by the Finnish nature agencies. In addition the wreck lies within the so-called “strict preserve” part of the Park where even entering the area is restricted without a permission. Also diving with apparatus is prohibited. Being so, it is not possible to open an

underwater park at the site. These different layers of prohibitions means, that the general public just can't go and visit the site above or below the water surface. In this circumstance it is especially important to make Vrouw Maria accessible in another ways.

The Vrouw Maria interactive, real-time, 3D virtual reality simulation gives for a visitor a feeling of "being there" at the actual site and a possibility to navigate and experience the wreck, the underwater landscape and the sound scape. The landscape is based on the multibeamsonar data collected from the field and the wreck is a 3D – scanning of a traditional model of the Vrouw Maria. The sounds have been collected from different sources. The underwater sounds have multiple roles in the simulation - to tell the story, to create a submerging atmosphere of immersion and to give audible feedback for user's actions. Non-interactive parts of the simulation (animated scenes) explains the historical events and passing of the time between the years 1771 – 2011 in the form of visual and audible events. In addition there are info points for more detailed information. The simulation is used by hand gestures. The simulation is made in a co-operation with Aalto University. Presenting the underwater scene of Vrouw Maria as an experience shall add an appealing aspect to the story of the wreck.
The Museum exhibition introduces also in the form of recorded interviews the ideas and feelings of those few divers who have visited the site bringing alive the idea that a heritage is combination of the site and the people who uses it. In addition the not- easy to visit site of Vrouw Maria shall be made accessible showing a video clip of the above water landscape. We aim also to produce a touchable 3D- print of the underwater landscape for blind persons.

The future of Vrouw Maria is still an open case, shall it be managed and safeguarded in situ for ever or shall it be eventually raised and put on a display in a museum? We must also ask should Vrouw Maria really be raised and how could it be raised according to the best modern international maritime archaeological standards and where to have the funding? There are also many other questions to be answered what it comes for the future of Vrouw Maria. It has been estimated that the raising and conservation of the wreck and building up a new museum could cost about 100 milj. Euros.
Documenting and displaying the underwater landscape and sound scape of Vrouw Maria becomes all the more important if the wreck is raised, since the raising operation itself will change the milieu drastically.

Conclusions

It has been said that the Baltic Sea is a treasure trove of underwater cultural heritage. To protect this heritage better – in a modern way – it is vital to give the non diving people and the divers possibilities to visit the sites in many ways, to give them an experience of being there.
The Nordic Blue Park Project's underwater cultural heritage and nature parks and trails are good examples of the practical use of the in situ preservation principle recommended by the ICOMOS 1996 Charter and by the UNESCO 2001 Convention and the idea of underwater parks. Experience gathered around the world have shown that underwater parks - when managed successfully - are an excellent way to enhance as well the in situ preservation as to improve the accessibility of sites for the general public whatever they dive or not.

Always it is not possible to open an underwater park, but there are also some other solutions available to give a stunning experience of a site. For example, virtual simulation technology can give an opportunity to visit an underwater site and to have a feeling "of being there" without actually diving at the place. It is understandable that a simulation can never replace a real experience, but it can help us to explore, to see and to hear the otherwise unseen underwater landscape and unheard sounds cape.

The Role of Archaeologists in Understanding and Preventing the Impacts of Marine Industries on the Prehistoric Environment

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Abstract

A wide range of impacts are caused by marine industries on the seabed and in some instances these impacts may affect archaeological remains associated with the seabed or buried in sediments beneath the seabed. Where we understand something of the nature of the submerged landscapes (such as the southern North Sea), these impacts can be mitigated through a range of approaches. In other areas deemed to be 'unknown' or of low archaeological potential it is very difficult to develop an approach to seabed prehistory because of a set of preconceptions about the nature of the seabed among both archaeologists and developers.

In order to help educate and inform maritime industries about the nature of the archaeological problems associated with submerged prehistory it is therefore important that as an industry we are clear about what our aims and objectives are when considering developing projects in the marine sector. Too often we only have vague notions of what we mean when we discuss the prehistoric record and there is little consideration for example that approaches to late Palaeolithic/Holocene prehistories require different strategies to those dealing with the Lower and Middle Palaeolithic.

Introduction

The survival of evidence relating to the human use of formerly dry areas presently submerged beneath the marine waters surrounding our coasts is now well attested (Bailey 2008). Archaeological remains from the Solent in Southern England (Momber 2011), the English Channel (Cliquet *et al*. 2011) and the North Sea (Verhart 2008; Van de Noort, 2011) (Figure 1) clearly demonstrate that before sea levels attained modern elevations our ancestors accessed and used areas of the continental shelf that have, at times, been dry. Geophysical evidence for such paleolandscapes has been well publicized through the work in the southern North Sea by Gaffney and others (Gaffney *et al* 2007; 2009; Tizzard *et al* 2011) that has demonstrated the variety of topography and the scale of inundated valleys and hills of the area now known as Doggerland. A common feature of the landscapes that have been investigated is the extensive spreads of sediment containing a record of the inundated environment either through a series of superimposed depositional events such as those found in the southern North Sea Basin (Gaffney *et al*. 2007) (Figure 2A, Figure 3), as terraces and estuarine infills in former valley systems (Bellamy 1995) (Figure 2B) or as sequences built up at the foot of slopes (Cliquet *et al*. 2011) (Figure 2C).

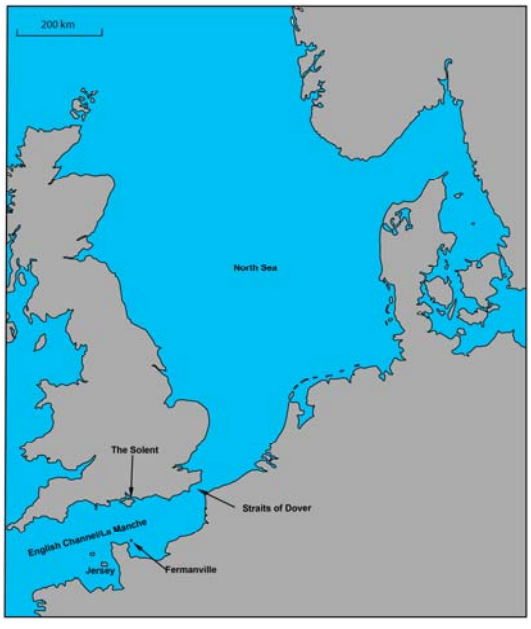

Figure 1. Site location for sites and areas within the English Channel and North Sea.

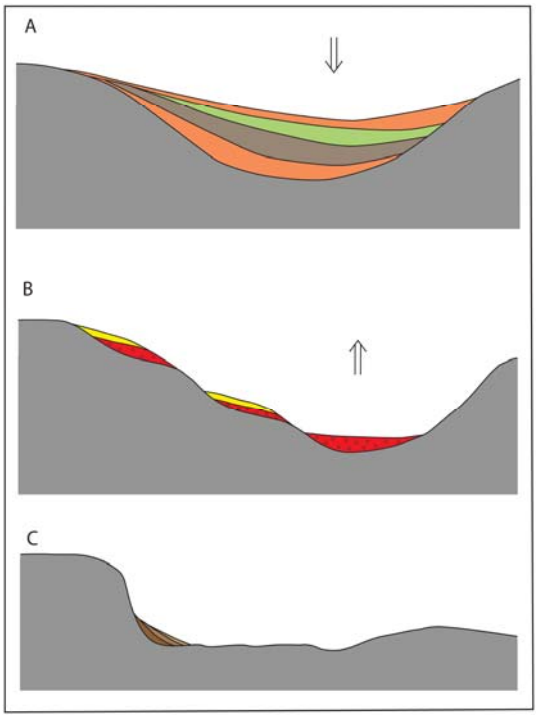

Figure 2. Schematic illustrations indicating geological situations of key terrain types in study area.

A: Basin structure such as present in the southern North Sea characterizing a subsiding situation.

B: Terraces within a valley system undergoing long term uplift such as in the English Channel.

C: Cliffs with associated scree slopes such as at La Mondrée.

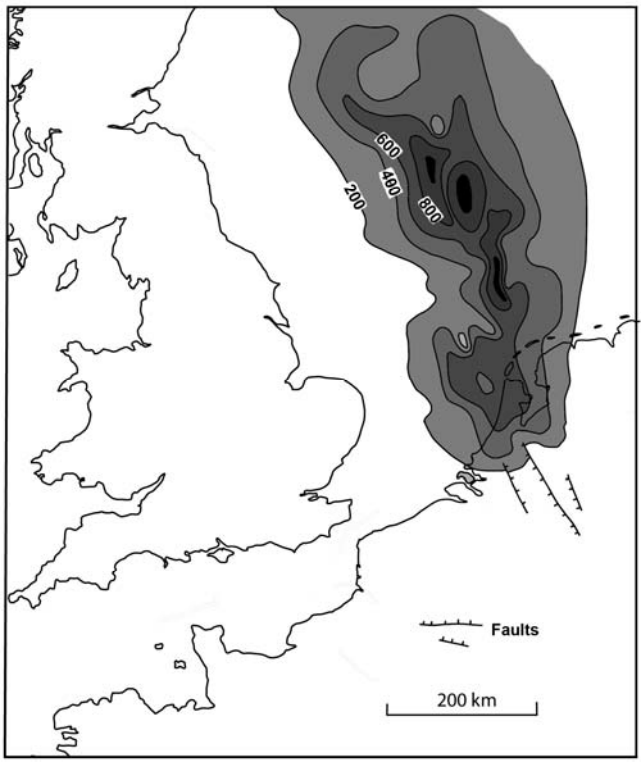

Figure 3. Map showing sediment thickness with the southern North Sea basin (area of subsidence based on Caston (1977)).

The archaeological potential of these landscapes is however hard to ascertain. Despite the abundance of information pertaining to these previous landscapes, except in the shallowest waters close to the modern coast (Momber *et al*. 2011; Tizzard *et al*. 2011), relatively little archaeological material has been systematically recovered from such contexts. This is in part a function of the vast scale of the landscapes which would have been open to settlement and activity by local populations, but is also a function of the environments of deposition of the artefacts. Consequently there are considerable difficulties in discovering human artefacts that directly confirm a human presence in these landscapes

By contrast with the aggradational environments there have been few attempts to investigate those parts of the shelf area that are dominated by bedrock where deposits that may contain the archaeology are few and erosion may be the dominant mechanism in operation (erosional environments) (Bates *et al*., submitted). In such situations (e.g. around the Channel Island of Jersey or in Orkney) there appears to be a presumption towards minimal archaeological preservation and consequent low potential. Additionally these areas contain little in the way of mineral aggregates and have seen only minimal investigation. Such areas may characterise extensive tracts of the English Channel as well as the interfluves between major drainage basins. However, rather than being barren tracts of relatively sterile landscape with low archaeological potential, such areas may contain pockets of sediment with their own unique archaeological signal. Understanding the nature of this submerged record in these situations requires a different approach in order to obtain an archaeological narrative.

This paper considers some of the problems of investigation both in depositional and erosional environments with particular reference to the Paleolithic record and concludes with a few thoughts on future avenues of investigation. It places particular emphasis on issues that we as an industry need to clarify in order to be able to communicate clearly (with a unified voice) with industry developing areas of the marine sector.

Paleolithic archaeology: problems, contexts and strategies

Our consideration of the Paleolithic resource in the marine area needs to acknowledge a number of factors that include:

1. The nature and values of that resource.
2. Problems of investigating the resource and establishing significance.
3. Defining contexts and the use of terrestrial models in the marine zone.

The Paleolithic archaeological resource that we find in terrestrial situations today occurs in a range of depositional environments, but by far the greatest occur in association with fluvial and lacusterine sediments of the major river valleys of southern England (Figure 4A) (Wymer 1999). Within these sediment bodies artefacts commonly occur as derived material within coarse grained (cold climate) sediments (Figure 4B) or more rarely as *in situ* material within finer grained sands and silts (sometimes associated with interglacial regimes (Figure 4C)). Commonly *in situ* discoveries are considered to be of greater significance than reworked artefacts because of the behavioral implications that can be drawn from a knapping scatter or butchery episode such as those at the site in Boxgrove, West Sussex (Roberts and Parfitt 1999). This stance is clearly taken in many of the recently published guidelines for investigating the Paleolithic resource in the UK (English Heritage, 1991, 1998, 1999, 2008). However, this perspective requires clarification and careful consideration of the importance of the questions that an individual may like to ask in relation to the information attached to an individual discovery (Bates and Wenban-Smith, 2011). For example, a knapping scatter made one afternoon at Boxgrove may provide significant information on an individual activity, however, it cannot provide information on long-term population trends or trajectories in tool types and technologies over the course of the Lower Paleolithic. Questions relating to these latter issues can only be answered by reference to large collections of aretefacts such as those from derived contexts in river gravels. In such instances, where patterns being examined change at the scale of glacial/interglacial timescales, the time averaged sediment packages associated with river gravels and terraces are ideal base units for study. These considerations have important implications for the prioritization and collection of material from the seabed and will influence both the foci of investigation and methods of collection of samples.

Turning now to our ability to investigate the Paleolithic resource we find ourselves presently in an area of some controversy. Until very recently many of the investigations of our terrestrial Paleolithic resource over the last 30 years have come from the reinvestigation of sites previously discovered in quarrying or other forms of ground works (e.g. Swanscombe (Conway *et al*. 1996), Barnham (Ashton

et al. 1998), High Lodge (Ashton *et al.* 1992)). Other sites have been discovered accidentally during quarrying (Boxgrove (Roberts and Parfitt 1999); Lyndford (Boismier, in press)) or in the course of major construction projects (Southfleet Road elephant site; Wenban-Smith *et al*. 2006). By contrast purposive exploration for new sites has been, at best, only marginally successful. This is in part a function of an absence of universally applicable sets of procedures for site investigations (when compared with guidelines for later periods) including even notions of what constitutes an appropriate project design for investigating the Paleolithic record in most instances. Where investigation has been undertaken the scale and levels of investigation vary widely from county to county and usually reflect the familiarity (or not) of the development control officers with Paleolithic archaeology. This lack of purpose impacts on what developers perceive as acceptable levels of investigation and makes determination of the significance of the discovery of, for example, a single artifact within a sequence of sediments, difficult to determine. As a consequence we are typically facing a varied response to the Paleolithic in different areas and no universally accepted level of investigation to follow.

There is also the problem of the scale of the area of investigation. For example, the Paleolithic resource within the Thames Valley (Wymer 1968, 1999) has been built through nearly 150 years of research mainly through the quarrying industry. Collectors and more recently archaeological teams have focused on the recovery and/or excavation of artefacts from sites while geologists and biologists have contextualized, correlated and created environments of deposition for these finds. Despite this intensity of research significant problems remain regarding the nature of the basic record, how artefacts behave in these active systems and how we should interpret the results from these studies. In the marine sector we have virtually no historical data and only a basic understanding of the geology, correlation of deposits and associated environments of deposition.

Finally a major problem we face within the marine sector is the applicability of the terrestrially derived logic for determining significance within a body of sediment. The relationship between major mapped sediment bodies within the fluvial systems in southern England and their associated artefacts is an important factor in many instances in determining potential. For example in southern England the fluvial archive within the river Thames appears to suggest the younger terraces of the river contain fewer Paleolithic artefacts than those associated with the higher terraces (Ashton and Lewis 2002). This information has been used to model changes in population densities within the UK over these time frames and the implications of this logic has been used by curatorial staff when determining strategies in advance of construction. However, projecting terrestrial sequences and terraces into the offshore zone and onto the shelf area at times of lowered sea levels is fraught with difficulties and at present has not been demonstrated anywhere around the UK (Figure 5). Furthermore it is likely that fluvial processes and sedimentary architectures in those areas are likely to be different to those operating in what is now the lower reaches of our river valleys. Consequently it is difficult to determine at present how relevant data derived from study of terrestrial situations is to submerged contexts.

The implications for investigating the Paleolithic resource within the marine zone are therefore considerable and include:

1. The scale of the systems being investigtated and minimal levels of information available for study.
2. An absence of suitable baseline data sets from terrestrial situations to compare against marine derived information.
3. The strong possibility that processes operating in landscapes intermittently exposed at times of lowered sea levels may be very different to those operating higher in the fluvial systems at the same time.
4. The impact of repetitive transgressions and regressions across these areas.

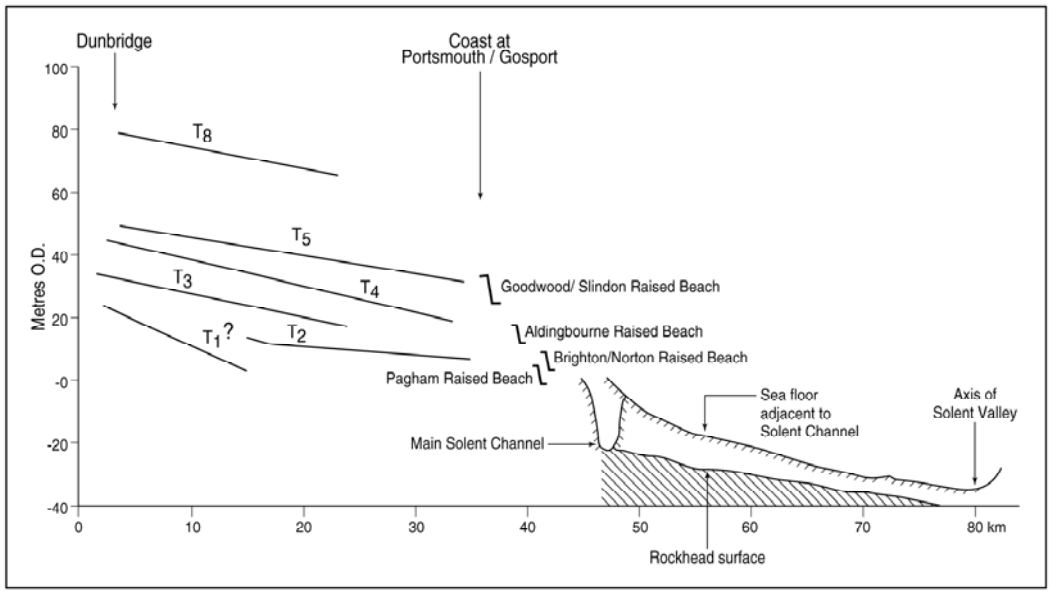

Figure 5. Schematic profiles of terraces of the Solent system east of the Test and the seabed within the Solent illustrating the difficulty of terrace projection across the transition zone.

The nature of submerged landscapes and the associated archaeology

The concept of a submerged landscape is one that can be traced back to at least Clement Reid's work in the late 19th century in which he considered the significance of the fossil forests around our coastline (Reid 1913). Today we tend to think of submerged landscapes as relicts of former "dry land" systems in which we have evidence for rivers, estuaries, coasts etc. These tend to be within areas of net deposition in which evidence for these former systems are coincident with the seabed or where the deposits lie close to the seafloor. The southern North Sea (Figure 3) is a case in point in which continued subsidence over the Pleistocene has resulted in the vertical aggradation of sequences within the tectonic basin. In such systems archaeological remains associated with the final Paleolithic and Mesolithic periods are likely to be buried close to the seabed or actually lying on the seabed surface. Consequently the contemporary landscape for these periods is that immediately beneath the seabed in most cases.

By contrast evidence for the much of the Paleolithic record is likely to be deeply buried within the sedimentary stack at the site and where (as a result of erosion) only fragments of former landscapes are likely to survive. As a result there will be considerable difficulties in reconstructing these landscapes as well as recovering direct evidence for human activity except in those locations where local factors bring older sediments to the surface or where older beds reach the surface as sequences thin towards the margins of the basin.

Away from major zones of deposition in emergent zones or zones of net uplift erosion will become an increasingly important process in operation. This will result in considerable tracts of bedrock lying close to the sea bed or actually forming rock skerries on the seabed. In this case, there is usually the presumption that evidence for submerged landscapes are absent or at best fragmentary, and that this will also apply to the archaeological signature. Hence the archaeological potential for these areas is low. While this is undoubtedly true in many locations localized pockets of sediment (perhaps containing important archaeological remains) may exist and therefore the potential for preserving archaeology is more complex that those in areas of well preserved buried landscapes.

It is now clear from the discussion above that future investigations of the seabed should clarify at the outset the differences between investigating the Lower and Middle Paleolithic archaeological resource from the latest Paleolithic/Holocene archaeological resource. Different approaches, methods, questions and scales of investigation will be required to investigate each area. This is recognized in

terrestrial situations where (usually) guide lines for Paleolithic investigations (English Heritage 1998, 2008) differ from those for Mesolithic investigations. Recognition of these factors in the marine sector will immediately instill clarity where ambiguity presently exists.

A way forward: an example from the English Channel and Channel Islands

The Paleolithic site at La Cotte de Saint Brelade (Figure 6) on Jersey (Callow and Cornford 1986) preserves a long record of human occupation perhaps spanning nearly 250,000 years. Although today the site overlooks the Norman/Breton Gulf, for much of the time during its long occupation a very different view would have greeted occupants of the cave as lowered sea levels revealed extensive lowland vistas to the west. The landscapes are dominated by a variety of underlying rock types including granite, limestones and conglomerates and erosion dominates throughout much of the area. Today it is clear to us, as Paleolithic archaeologists, that any attempt to understand human activity at the site must model these landscapes associated with it. However, attempts to do so will be hampered by fragmentary evidence, incomplete sequences, poor dating control and an absence of material to examine the faunal and floral aspects of the landscapes. Coupled to these problems is the likelihood that landscapes do not have modern analogues today. However, there are approaches to the site and its landscape that can be taken when we consider the context of La Cotte at three discrete scales:

1. Macro-scale landscapes at the scale of the context of the English Channel/Manche (Figure 7) and the marine isotopic record at 100k year cycles, where even a relatively coarse temporal framework can be achieved using the available dating methods. Such frameworks are useful for considering human distribution/dispersal within macro regions and across the full occupation history of the site. Data sets suitable for this include regional bathymetries, bedrock and superficial sediment maps and a refined Marine Isotope curve.

2. Meso-scale landscapes at the scale of the Breton/Norman Gulf (including the Channel Islands) (Figure 8) where geographies at smaller scales and shorter time intervals may potentially be reconstructed. For example seabed data including bathymetric maps, regional geologies and seabed samples can provide information at a scale typically of less than 100km and with temporal resolutions probably down to 10,000 years or less. For example, within the study area core and grab sample data from the seabed indicates a scatter of fossiliferous units indicating the presence of former strand lines (Danukalova and Lefort 2009) at number of locations suggesting that in the future it might be possible to map still stand phases within the Weichselian. This scale probably approximates to the regional foraging territory of the human groups that might have occupied La Cotte and such a map would have considerable potential significance when compared against changing behaviour indicated from stone tool assemblages within the site.

3. Micro-scale (site) landscape at the scale of travelling distance from La Cotte (1-2 hours, 4-10km radius) (Figure 9) where detailed survey and sampling may provide records of events at the finest scale including evidence such as buried landsurfaces, local stratigraphies etc. may be present (Figure 10).

Indeed mapping of the seabed close to La Cotte (Figure 10) has already altered our perception of the site within its local territory. We can now view La Cotte as commanding a presence across a lowland landscape within which La Cotte sits at the end of a blind valley leaving the plains and entering the uplands of modern Jersey.

Figure 6. La Cotte de Saint Brelade, Jersey. A view into the sea cave looking along the western ravine towards the cone of Weichselian deposits from which Neanderthal remains were recovered.

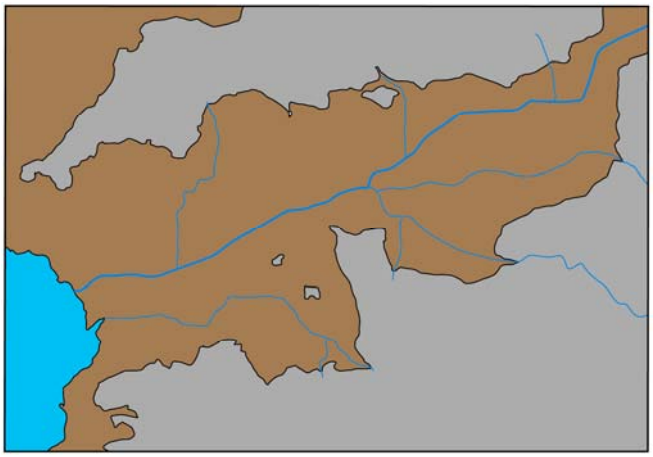

Figure 7. Drainage network on floor of the English Channel at times of lowered sea levels during the Weichselian.

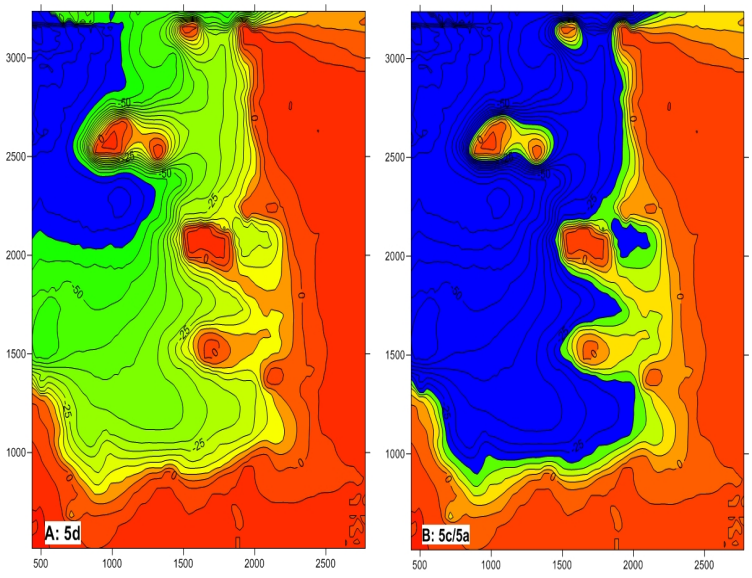

Figure 8. Topography of the seabed around the Channel Islands showing the position of the coasts during A: MIS 5d and B: MIS 5c/5a.

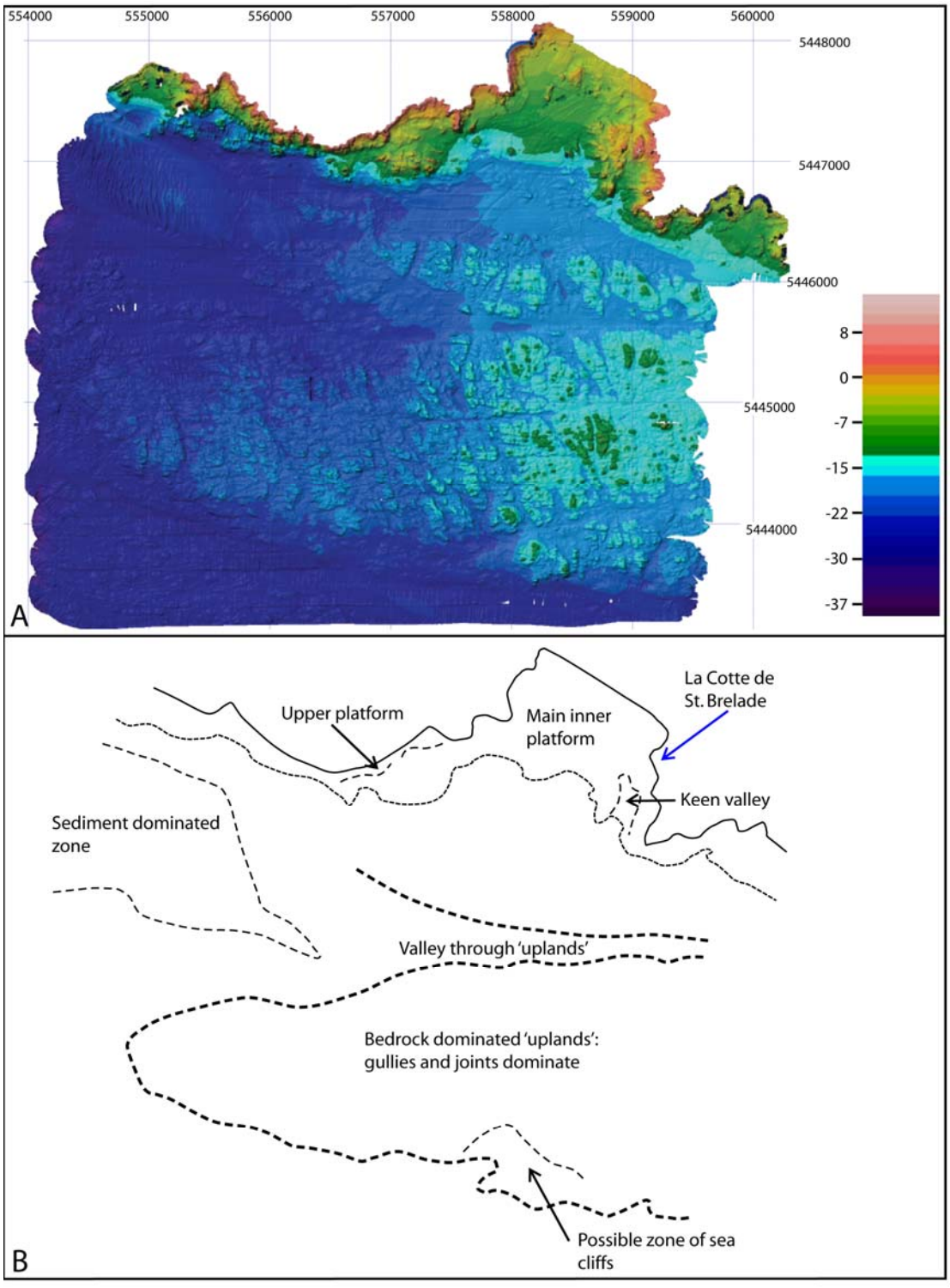

Figure 9. A: Bathymetry for the seabed south of La Cotte de Saint Brelade, Jersey.

B: Geomorphological interpretation of the seabed topography south of La Cotte de Saint Brelade, Jersey.

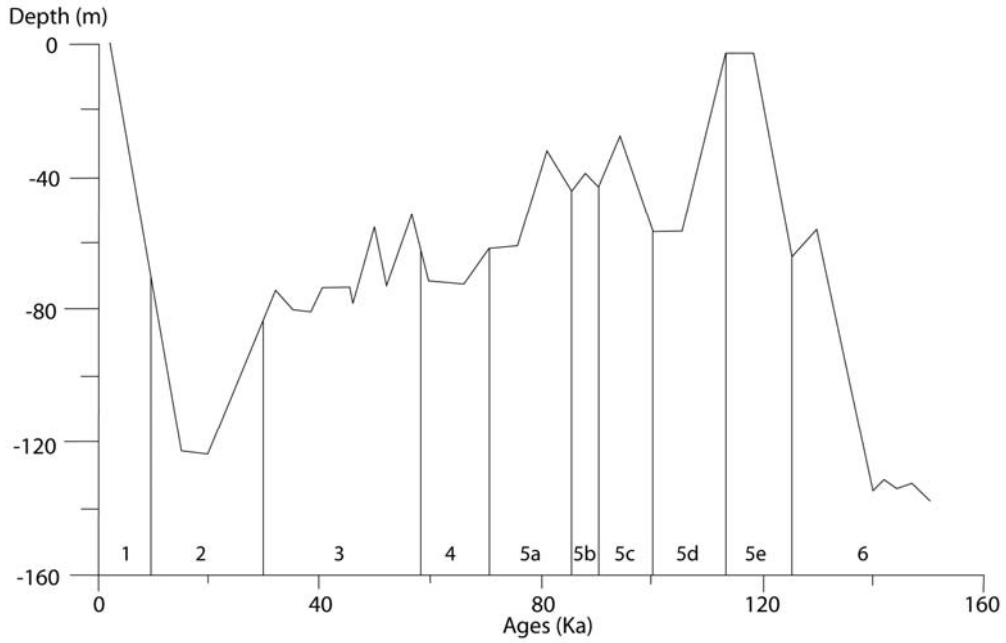

Figure 10. Sea level curve for the last 160,000 years based on Shackleton (2000).

Conclusions

Previously much of the investigation into submerged landscapes of the British coastline has focused on methodological approaches to identifying the presence, on or beneath the seabed, of sediments relating to former landscapes and, where possible, locating and excavating archaeological remains associated with elements of this landscape. This might be viewed as a pioneer phase in working in the marine environment and perhaps we as group can now move forward towards a phase of colonizing these areas with targeted questions and by beginning to address the nature and potential of the resource in both predominantly depositional and erosional landscapes by formulating nested hierarchies of questions at a variety of scales appropriate to individual sectors of the landscape.

Understanding our submerged heritage is not always about the identification of large, complex and well preserved landscapes but can also include small scale surveys of packages of sediments preserving important archaeological remains in areas of our seas that at first seem hostile to preserving such records. Until now it has been reasonable to focus attention on those large, well preserved landscapes in order to highlight the importance of the submerged archive however now we have to move forward as a discipline and embrace those areas in which we have to look more closely for the archaeological archive.

In developing methodologies for landscapes in which erosion dominates we need to be far more focused on what information we are trying to extract from the seabed and how that information relates to a range of archaeological questions that we should be asking of our surveys. It is only by carefully constructing our research designs in such a fashion that we can meaningfully investigate such areas and, perhaps more importantly, convince industry that the resources we request from them are being wisely spent.

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The Development of Measures to Mitigate Impact on the Underwater Cultural Heritage: Impact Mitigation in the Management Submerged Archaeological Sites

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Abstract

Submerged archaeological sites are highly vulnerable to e.g. looting, trawling, gravel extraction, various building activities and erosion. But on the other side, it is possible to oppose and mitigate these impacts by setting up proper management standards. In many cases, it is even possible to turn threats into possibilities. An overview of strategies, for example in the planning phase of building projects, and the potential of pro-active site management and site-monitoring will be presented, which aim not only to minimize the destruction of the submerged sites, but also to protect and understand them. In doing so, impact mitigation in the management of submerged archaeological sites in many cases goes well along cooperating e.g. with large development projects. Therefore, it allows economic progress while also providing better knowledge and understanding of the values of the underwater cultural heritage.

Impact mitigation strategies:

-Similar to Terrestrial Archaeology
-Part of the Environmental Impact assessment, similar aims and strategies
-Culture - nature
-Pro-active site management
-Site-monitoring
-International Cooperation

Threats	Impact Mitigation Strategies	Benefits/Opportunities
Fishing Industry **Dredging**	- Collaboration & information - Declaration of protection zones, Supervision - Adaptation of equipment	New finds and positioning of obstacles (wrecks etc.)
Off-Shore Industries **Construction works** **Aggregates extraction**	- Joint EIA pre-disturbance survey - Positioning avoiding UCH - Management plans - Reporting & monitoring system	- New data & finds for understanding human activities in the paleo-landscape - Pipelines/cables: long transects
Tourism	- Raising awareness - Guided Tours - Dive rules/parks - Cooperation with involved agencies	- Public support - Networking
Erosion	- Constant monitoring - Physical protection, where possible	Understanding “raise and fall” of submerged cultural landscapes
Looting	- Supervision - Law enforcement - Getting involved ?	Dispute/Awareness ?

Innovative, Non-destructive Techniques and Methodologies for the Survey and the Exploration of Submerged Cultural Remains on the Shallow and Deep Seafloor

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Abstract
Remote sensing techniques have found wide application in underwater archaeological surveys, particularly in deep waters and self areas. With their use large areas of the seafloor can be surveyed in detail at almost any depth and in very short time. Spectacular discoveries of ancient shipwrecks in deep waters have been possible with the use of advanced marine geophysical techniques and sophisticated underwater vehicles (HOVs, ROVs, AUVs) operating from big oceanographic vessels. Opposite to deep water research, very few archaeological survey in the shallow coastal zone have incorporated remote sensing techniques for the mapping or detection of archaeological remains. A main reason is that marine survey techniques are predominantly designed for use in deep waters and their application in shallow water surveys is logistically complicated: requirements for sufficient power supply and relatively large space on the survey vessel for the installation of the various devises make their use inconsistent to the concept of low-budget, shallow-water, archaeological or prehistoric landscape surveys from small vessels. The development of user-friendly, purpose-designed techniques for the high resolution survey, early detection and mapping of archaeological sites and prehistoric landscapes in shallow waters is a major challenge for the broad marine geo-archaeological and marine technology community.

Deep vs. shallow water survey techniques

Marine technology and marine geological – geophysical techniques and methodologies for the survey of the seafloor and its substrate have already been available for over 4 decades. Recent developments have increased their efficiency and the resolution of the geophysical recordings. Remote sensing techniques like deep towed side scan sonar, multi beam systems, sub bottom profilers and magnetometers have found wide application in underwater archaeological surveys, particularly in deep waters and self areas. With their use large areas of the seafloor can be (and have been) surveyed with high resolution at almost any depth and in relatively very short time.

Spectacular discoveries of archaeological remains, particularly shipwrecks dated to various historic periods from the first millennium BC till more recent times (post-Medieval, post-Byzantine and even recent post 2nd World War wrecks) in deep waters have been possible with the use of advanced marine geophysical, remote sensing techniques and sophisticated underwater vehicles, manned submersibles (HOV), remotely operated (ROVs) and autonomous underwater vehicles (AUVs) operating from open-sea oceanographic vessels (Hobbs at al. 1994; Søreide and Jasinski, 1998; Barto Arnold III et al. 1999; Ballard et al., 2000; 2001; Quinn et al., 2000; 2002; Blondel and Pouliquen, 2004; Papatheodorou et al., 2005, Sakellariou, 2007; Sakellariou et al 2007, Foley et al, 2009).

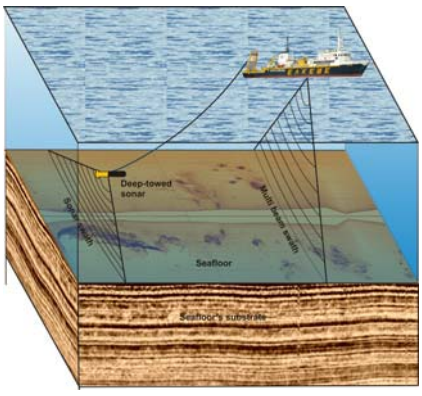

Fig. 1 (left): Simplified, synthetic illustration of the use of remote sensing techniques (deep towed sonar, sub bottom profiler, multi beam) from marine research vessels for deep-water archaeological surveys. A side scan sonar image has been used for the seafloor and a section of a seismic sub bottom profile for the substrate. The vessel shown is R/V AEGAEO of the Hellenic Centre for Marine Research.

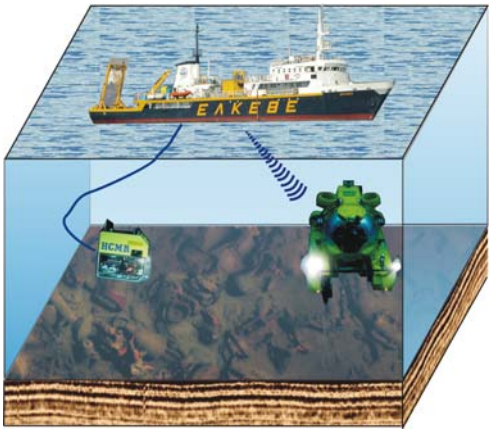

Fig. 2 (right): Synthetic illustration of the operation of remotely operated vehicle (ROV Super Achilles) and submersible (Thetis) on an ancient shipwreck. A section from the photomosaic of a 4th century BC wreck off Chios Island, Greece (Foley et al, 2009) has been used for the illustration of the seafloor.

The imperative to investigate shipwrecks at full ocean depths derives from the new views of ancient cultures they present. Beyond scuba diving depth and wave-induced disruptions, deep waters hold vast numbers of shipwrecks containing well-preserved artifacts (Ballard et al., 2001; Ballard et al., 2000; Ballard et al., 2002; McCann & Freed, 1994). Significant advancements has been made in the last twenty years in the design, engineering and capabilities of underwater vehicles and sensors and have enabled very detailed imaging of the deep seafloor, detection and characterization of anthropogenic objects, visual investigation and sampling. Deep towed or autonomous underwater vehicles, equipped with high resolution side scan sonars, combined or not with chirp profilers and multi beam systems enable detailed exploration and imaging of the seafloor. Powerful underwater vehicles (submersibles, ROVs, AUVs) equipped with high definition cameras, sampling tools and various sensors are capable in producing high definition photomosaics of the wrecks and collecting artifacts.

Opposite to the deep water archaeological research, very few archaeological surveys in the shallow environment of the coastal zone or shallow lakes have incorporated remote sensing techniques for the detection, exploration or mapping of archaeological remains. Conventional archaeological survey, mapping and detailed drawing of remains on the seafloor are carried out by diving archaeologists with limited or no access to state of the art seafloor mapping facilities and equipment, commonly available in oceanographic and marine geological institutions. The lack in communication between the underwater archaeology community and the marine geosciences and engineering communities may be one of the reasons for the limited use of remote sensing techniques in shallow underwater archaeological research.

The second reason is that the majority of the available marine survey techniques are designed for use in the stable environment of deep waters while their operational capabilities in the very dynamic shallow waters are very limited. Therefore, most of the times these techniques have been used in very shallow waters they failed to collect data of similar quality to the data collected in deep waters. In addition to the operational limitations, the use of the remote sensing techniques in shallow waters has been proved logistically too complicated: the requirements for sufficient power supply for the operation and for relatively large space on the survey vessel for the installation of the various devises make their use inconsistent to the concept of low-budget, shallow-water, archaeological or prehistoric landscape surveys from small vessels. These difficulties have been encountered by many scholars, marine geoscientists and archaeologists, who attempted to explore very shallow sea- or lake-floors by using remote sensing techniques.

Shallow water submerged cultural heritage

What is the significance of the shallow coastal zone for the submerged cultural heritage? Why it is important to survey the shallow seafloor for submerged cultural remains?

Most archaeologists worldwide have ignored, till recently, submerged environments in the belief that it is logistically and technically too difficult to deal with them and that any submerged cultural remains would have not survived the inundation. In contradiction to these arguments, several thousand submerged prehistoric and historic archaeological sites have been found on the European continental shelf and in water depth shallower than 10-12m and many times shallower than 5m from the Baltic to the eastern Mediterranean and the Black Sea during the last 25 years (Bailey, 2004; Bailey & Flemming, 2008; Fischer, 2004;).

The ecstatically driven global sea level rise after the last Ice Age has led to the drowning of numerous prehistoric and historic sites and their preservation in the shallow coastal zone. Regional and local processes like the isostatic rebound (uplift) effect in Northern Europe and the active, vertical tectonic movements (subsidence / uplift) in the Central and Eastern Mediterranean modified the global picture by moving large or small land masses vertically (Flemming, 1998; Harff et al, 2007). Over 2000 Mesolithic and Neolithic settlements 6000-8000 years old have been found on the Baltic seabed, off Denmark, Sweden, Germany and Poland. Neolithic villages, 9000 years old, are located at 10m depth off the coast of Israel while Neolithic and Bronze Age villages have been found in the Black Sea off the Bulgarian coasts. Many younger sites in the date range 5000-10,000 years old have been identified off the Mediterranean coasts. Numerous Classical, Hellenistic, Roman and younger archaeological sites, predominantly harbor installations and constructions are scattered all along the European shoreline at depths shallower than 5m with the greater density in the Eastern Mediterranean and Black Sea.

Most of the known submerged shallow sites in all sea areas have been discovered by chance. Some of them are exposed on the shallow sea floor, others are seasonally covered by coastal sediments or have been recently exposed due to progressing coastal erosion while many others, not yet discovered, may rest for centuries and millennia below the seafloor, permanently buried by recent and Holocene coastal deposits. In addition to the drowned archaeological remains, submerged physical prehistoric landscapes and paleo-sea level indicators are preserved on or beneath the shallow seafloor.

Science-driven technological advances for shallow water surveys

The underwater archaeological community, the marine geoscientific and the marine engineering communities are facing a major challenge: to work together with the aim to develop science driven, innovative, non-destructive technologies designed to work in shallow and very shallow waters and able to support high resolution survey, early detection and mapping of archaeological sites and prehistoric landscapes.

In the last years, some attempts have been made to incorporate shallow water parametric multi beam systems, sub bottom profilers, side scan sonar, electric resistivity methods operating from small boats or even mounted on small autonomous surface or underwater vehicles. First results are promising but there is still a long way to go till these methods and techniques become operational and standardized.
The necessary first step is to improve mutual understanding between geoscientists, engineers and archaeologists about appropriate methods of investigation and a wider recognition of the need for interdisciplinary research on shallow submerged cultural remains.
The aim will be to establish an innovative methodology for the survey, early detection and mapping of submerged archaeological sites and prehistoric landscapes exposed on or buried beneath the shallow

seafloor of the coastal zone or lakebed by developing user friendly, light, portable, “plug-and-play” combined devices designed to operate from small boats and collect ultra high resolution data.
The major goal is to improve knowledge on the investigation methods and the interpretation of underwater geological, paleo-environmental and archaeological evidence for the location and preservation conditions of submerged prehistoric and historic human occupation sites and activities, create best practices for the new, interdisciplinary field of marine geo-archaeological research and provide guidance for earth scientists, archaeologists, heritage professionals, government agencies, commercial organizations, policy makers and a wider public.

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Setting National Research Agendas as a Guide to Mitigation

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Abstract: *Research frameworks may be seen as vital research tools for guiding, facilitating and integrating research by individuals and groups that can collectively contribute to a deeper understanding of marine and coastal archaeology. The fundamental relationship of archaeological activity to its research base is strongly endorsed by English Heritage; the development of frameworks is advised to give researchers a yardstick against which to formulate ideas, collate their data, and measure results.*
The Maritime, Marine and Coastal Historic Environment Research Framework of England, coordinated by the University of Southampton, has developed a Resource Assessment and Research Agenda through thematic working groups. This paper will show how gaps in knowledge identified through the Research Agenda are driving Research Strategies that will be delivered through English Heritage's National Heritage Protection Plan (NHPP). Implemented from April 2011, the NHPP is a statement that sets out priorities to deliver heritage protection over the next four years by making the best use of resources so that England's vulnerable historic environment is safeguarded in the most cost-effective way at a time of massive social, environmental, economic and technological change.

Introduction

Research frameworks can be seen as vital research tools for guiding, facilitating and integrating research by individuals and groups that can collectively contribute to a deeper understanding of marine and coastal archaeology. The fundamental relationship of archaeological activity to its research base is strongly endorsed by English Heritage; the development of frameworks is advised to give researchers a yardstick against which to formulate ideas, collate their data, and measure results.
This paper will attempt to show how gaps in knowledge identified through two Research Agendas are driving Research Strategies that will be delivered by English Heritage's National Heritage Protection Plan (NHPP). Implemented from April 2011, the NHPP is a statement that sets out prioritized mitigation to deliver heritage protection over the next four years by making the best use of resources so that England's vulnerable historic environment is safeguarded in the most cost-effective way at a time of massive social, environmental, economic and technological change.

English Heritage's Role and Responsibilities

English Heritage is the UK Government's statutory advisor on the historic environment of England and provides expert advice about all matters relating to the historic environment and its conservation as set out in the National Heritage Act 1983. Funding is received direct from Government the form of Grant in Aid (GIA), with top-up income generated from membership, properties and from fundraising.
English Heritage works in partnership with central government departments, local authorities, voluntary bodies and the private sector, to conserve and enhance the historic environment, broaden public access to the heritage and increase people's understanding of the past.
Functions relating to underwater archaeology derive from the National Heritage Act 2002 which extended English Heritage's general powers under s33 of the National Heritage Act 1983 to cover ancient monuments in, on, or under the seabed within the seaward limits of the UK territorial seas adjacent to England. These powers include providing grant assistance in respect of any protected wreck and the provision of advice to any person in relation to any ancient monuments within England's inshore region.[v] English Heritage is also empowered to provide advice, assistance or other services or information related to monuments and buildings situated beyond the UK inshore region. In fulfilling these responsibilities, English Heritage advocates a seamless approach to conservation management which is not determined by where the sea is now – or where it will be.

Research Frameworks

In to secure a sustainable future for the marine historic environment and identify its significant components, Research Frameworks are seen as vital research tools for guiding, facilitating and integrating research by individuals and groups that can collectively contribute to a deeper understanding of marine and coastal archaeology.
It is widely accepted that Research Frameworks should have three parts; a *Resource Assessment* (a statement of the current state of knowledge and a description of the archaeological resource), a *Research Agenda* (a list of the gaps in that knowledge, of work that could be done, and the potential for the resource to answer questions), and a *Research Strategy* (a statement setting out priorities and method).

As research is an iterative process, investigations to answer one question will inevitably raise further questions, and these in turn will feed back into the framework making a continuously updated and dynamic document. National frameworks should therefore; i) provide an infrastructure and means of validating the decision making inherent within the planning process, ii) assist in the formulation of priorities for the distribution of resources (on a national scale) and iii) couple curation and research.

(Inter)National Research Agendas

Until recently, national Research Frameworks for the study of maritime landscapes and shipwrecks remained poorly developed, despite the application of regional frameworks in England (see Essex County Council 2010 & Wessex Archaeology 2004). However, in recent years, two Research Frameworks have been prepared to specifically guide national agendas for research in the marine and coastal zones: the collaborative *North Sea Prehistory Research and Management Framework* (Peeters *et al*, 2009) and the *Maritime and Marine Historic Environment Research Framework of England* (Ransley *et al*, forthcoming).

The purpose of the *North Sea Prehistory Research and Management Framework* (NSPRMF) is to facilitate the large-scale systematic and interdisciplinary study and preservation (where possible) of a unique sedimentary and archaeological record of that is currently submerged beneath the waters of the southern North Sea. Informed by ongoing collaboration with industry, combined with data derived from the requirements of the EU Strategic Environmental Assessment and Environmental Impact Assessment Directives, the NSPRMF is intended as a 'living document'.

To date, the NSPRMF international Research Agenda has identified three priorities for action; i) increasing the understanding of the paleogeography of the North Sea, ii) developing an improved chronology and iii) increasing the number of data points and improved prospection techniques for site detection and characterisation. Current agendas for resource management comprise; i) continued and improved collaboration with industry and private collectors, ii) data sharing and spatial definition of research potential and threats and iii) mitigation, conservation and designation.[v]

The similarly collaborative *Maritime, Marine and Coastal Historic Environment Research Framework*, coordinated by the University of Southampton, has drafted a national Research Agenda for England through ten thematic working groups which range from Palaeolithic to Modern interests, inclusive of an assessment of cross-theme archaeological archives and collections. When published, the research framework will provide a coherent overview of previous research into the maritime, marine and coastal historic environment of England, which will enable long-term strategic planning, inform policy and provide a statement of agreed research priorities within which researchers can shape and seek funding for projects. The final draft of the resource assessment and research agenda volume is now being prepared for publication and is eagerly awaited.

Implementation of the Research Agenda's derived from the NSPRMF and the *Maritime, Marine and Coastal Historic Environment Research Framework* in England is to be delivered strategically according to priorities driven by threat, character assessment and the need to manage change.

England's National Research Strategy

As a response to current social, environmental, economic and technological change, English Heritage is seeking to deliver a national Research Strategy for the qualification, protection and management of marine heritage assets through the National Heritage Protection Plan (NHPP). Implemented from April 2011, the NHPP is a cross-sector statement that sets out priorities to deliver heritage protection over the next four years by making the best use of resources so that England's vulnerable historic environment is safeguarded in the most cost-effective way.

The NHPP will be the national framework for bringing together work by English Heritage and other partners within the sector to protect the historic environment, whether on land or underwater. It will allow for the re-alignment of, and apply the full range of expertise and resources towards, protection activities carried out directly by English Heritage or through supporting others in their protection of what is valued and significant.

The Plan is focused on understanding and articulating the significance of the historic environment, as the key to its informed and effective protection and management. At the heart of delivery of the NHPP does the Action Plan, which is divided into eight Themes, which are further sub-divided into a series of Activities comprising over 400 projects. The Activities address specific areas of work (such as places of worship, historic ports, strategic designation) that have been identified as priorities for the Plan which reflect the need to respond to threats as well as to ensure that significant assets are identified.

While publication of the *Maritime, Marine and Coastal Historic Environment Research Framework* is progressed, work has already begun to initially audit the current state of knowledge of submerged Pleistocene and early Holocene deposits, with further provision being made to protect and mitigate their loss. In addition, a strategic assessment of some 300 recorded early boats and ships (defined as encompassing vessels dated from the earliest times to about 1840, when the use of steam tugs and paddle steamers working in estuaries and docks had become relatively common) is due to commence in 2012 and it is expected that this will be followed by protection of the most significant sites.

Prioritising Priorities!

The NHPP will allow for the identification and understanding of areas where the state of knowledge is insufficient (such as paleolandscapes and the remains of early boats and ships) to enable the development of risk mapping, technical advice, guidance and advocacy to support protection work. The Plan will identify integrated and holistic of activities, which will enable joined-up and co-ordinated work across the sector in a way that has not been done before.

However, we are all conscious of the magnitude of what needs to be done to protect a historic environment that is under threat from many directions, not least in the face of the budgetary strains in England resulting from Government spending plans and the reform of public services across the period 2011-2015.

As such, not all research identified in national agendas can be undertaken simultaneously. Priorities will therefore have to be firmly identified to ensure that resources are sharply focused to meet the most urgent needs first. The best way to do this is to identify the threats that face assets, landscapes, areas or sites, to understand better the way those threats pose a risk the historic environment, and to prioritise mitigation activities accordingly, ensuring that the most threatened, or biggest risks are dealt with first. The NHPP will ensure that the significance of assets is not irretrievably lost while at the same time providing early warning to address or mitigate threats where possible, before loss becomes imminent.

One mechanism to facilitate prioritization is English Heritage's Heritage at Risk programme. This national programme provides evidence on the condition of the historic environment, highlighting those designated historic sites that are at risk of neglect, decay or even demolition. Initially focused on buildings at risk, the assessment method has since been adapted to serve other types of heritage asset, from archaeological sites and conservation areas to registered parks and gardens, registered battlefields, and protected shipwrecks.[v] Its end result is a dynamic picture of the health of the country's designated heritage that identifies the most vulnerable sites and highlights where strategic intervention is most urgently needed. Newly released figures for 2011 shows that the strategy works for the proportion of England's Protected Wreck Sites at risk fell by 12.5% to 15% of all sites as a result of a targeted programme of works throughout the year.

Conclusion

The story of England's marine historic environment is one largely shared by other north-west European countries. A common ancestry and seafaring tradition of communities bordering the North Sea basin and Irish Sea has given rise to the development of international Research Agendas in recent years.

Research Agendas identify gaps in knowledge; they indicate work that can be undertaken to fill those gaps and they highlight the potential of the historic environment to answer questions about the past. However, Research Agendas can only ever be a guide research; the prioritisation of the research itself must be implemented strategically. For England, a national Research Strategy is being delivered through the National Heritage Protection Plan which recognises the need to respond to threats as well as identifying the most significant elements of the past.

In addition, the Plan accommodates a wide range of protection measures that are compatible with the sustainable exploitation and conservation of the marine environment. Coupled with the Heritage at Risk initiative, opportunities for positive or pro-active measures are a factor in prioritisation, to ensure that actions can be taken which will forestall or negate threats while ensuring the promotion of the enjoyment, valuing of, or caring for the historic environment are not overlooked.

High-quality research contributes to knowledge and informs and directs policy decisions, advice, guidance and other forms of action and assistance. Research is therefore the key to understanding the historic environment: its scope, value and condition, and the threats and opportunities that confront it. Research also underpins the sustainable management of the historic environment. A national Research Strategy delivered through the National Heritage Protection Plan encompasses these prime objectives and enables improved decision making as well as the management of marine heritage assets to enhance protection while recognising that community action is a key part of helping society protect the best of our heritage.

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Web links

The Greater Thames Estuary Historic Environment Research Framework
http://www.thamesweb.com/tep-docs/cat_view/89-greater-thames-archaeological-steering-committee.html

Maritime and Marine Historic Environment Research Framework
http://www.southampton.ac.uk/archaeology/research/projects/maritime_research_framework.html
National Heritage Protection Plan
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North Sea Prehistory Research and Management Framework
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