Submerged Cultural Landscapes

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Introduction

Indigenous populations around the world have made extensive use of the coastal zone for tens of thousands of years. Rising sea-level since the Last Gacial Maximum (LGM) have seen vast areas of what were once terrestrial cultural landscapes transformed into submerged (or underwater) cultural landscapes. Innundated terrestrial archaeological sites, however, can result from a number of other natural processes, as well as rising sea-levels, including earthquakes (such as Port Royal in Jamaica) and volcanoes (such as the island of Santorini in the Mediterraneum). Human activity can also result in archaeological sites becoming submerged under fresh water such as the innundation of sites by reservoir (or dam) construction. Large scale dam construction in the USA during the twentieth century, for example, resulted in the inundation of many indigenous archaeological sites prompting the US National Parks Service to conduct the Reservoir Inundation Studies Project during the 1970s (Delgado 1997: 291-292; May et al 1978). This paper will consider a selection of the submerged cultural landscape studies conducted to date and outline the potential for this type of research to be conducted in Australia, and specifically in South Australia.

It is possible to sub-divide submerged cultural landscapes into three major groups on the basis of both material remains and the cause of inundation:

[a] 'Prehistoric' (pre-8000 BP)- including environmental remains (such as fossilised forests, peat beds, etc.), associated to the early, long-term, human occupation of landscapes usually become submerged through very long-term ('deep-time') processes of environmental change, including: [a] eustatic sea-level rise; [b] regional or local tectonic activity; [c] isostatic (land) uplift; [d] sediment deposition and infilling; [e] long- and short-term climatic change.A distinctive characteristic of such sites is a large percentage of non-cultural data, including 'geological' data such as strata, and climatological and environmental data such as floral and faunal remains recovered using techniques such as coring.

[b] 'Ancient' (8000-1000 BP) – including major cultural remains associated to the global rise of ancient city-states capable of large-scale sedentary activity, usually rendered submerged through medium-term processes of change including: [a] regional or local tectonic activity; [b] sediment deposition and infilling; [c] long- and short-term climatic change.A distinctive characteristic of such sites is a diverse array of cultural material associated with early attempts by humans to 'manage' and manipulate the coastal zone on a large-scale.

[c] 'Historic' (1000 BP – Present) – including cultural often compatible with 'historic' (i.e. documentary, iconographic, oral) evidence, usually rendered submerged through short-term processes of change. These include [a] regional or local tectonic activity; [b] sediment deposition and infilling; [c] long- and short-term climatic change, particularly dramatic short-term incidents like tsunami, tidal-waves, etc.; [d] culturally-driven change, such as war or economic developments like the construction of dams or artificial lakes.

A distinctive characteristic of some of these sites is the variation between those sites deliberately (culturally) submerged and stripped of most material culture prior to inundation, and those sites accidentally (naturally) submerged – usually as a result of dramatic short-term incidents – and not stripped of most material culture.

Until WW2, the analysis of submerged cultural landscapes remained extremely small-scale and informal. Although a number of sites were identified, there was no formalised research methodology, and research was conducted by individuals or small teams. Access to sites also proved problematic. After WW2, studies of submerged cultural landscapes became increasingly international in scope, and with the development of SCUBA diving equipment, access became vastly easier. However, the development of SCUBA and the rise of 'maritime archaeology' as a sub-discipline of archaeology, although broadly beneficial to submerged cultural landscape studies, meant that such sites fell out of the public eye to be replaced with superficially more appealing shipwreck sites. To some extent, this problem persists to this day, with 'maritime' 'marine' or 'underwater' archaeology all being grouped in the public mind as being devoted entirely to shipwreck sites, rather than a diverse array of cultural materials that includes submerged cultural landscapes. Although there is growing awareness of the unique value and survival of submerged cultural landscapes much remains to be done to 'level the playing field' and give this area of research the full respect it deserves.

One of the "big issues" in indigenous archaeology Europe, the Americas and Australia involves settlement (Dixon 1999; Dillehay 2000; Koppel 2003). Questions of where and how people first arrived, how they spread across the land and how they changed it from a "natural" landscape into a "cultural" landscape. For example, for many years it was thought that people travelled into Western North America across a land bridge in the Bering Strait and then migrating south through an ice-free passage between two vast areas of glacier. Coastal migration theory has suggested, and recent archaeological research has clearly demonstrated, that people probably travelled along the coastlines, frequently by water, and that some of the archaeological evidence of this has been submerged by rising sea-levels. Despite the difficulties of locating Indigenous sites underwater, artefact assemblages dating from 400 to at least 7000 years B.P. including stone tools and even a nearly complete antler harpoon point, have been found on innundated terrestrial sites in North America. These sites include Montague Harbour in British Columbia, Canada and at Corral Beach in Los Angeles County, California (Delgado 1997:282-283; Muche 1978). Furthermore more than thirty years of underwater research in Florida has clearly demonstrated the potential for well preserved archaeological evidence to survive for more than 10,000 years at sites like Warm Mineral Springs and Little Salt Springs (Murphy 1978; Delgado 1997: 243-244 & 480-481)

Submerged cultural landscape studies in Europe

The 1970s witnessed a range of submerged prehistoric archaeological sites being identified around the coasts of Denmark, Germany, the Netherlands and Britain. These coincided with similar discoveries in the Eastern Mediterranean and North America (Blackman 1973, 1982a, 1982b; Blavatsky 1972; Flemming 1962, 1972, 1980; Frost 1966, 1969, 1970, 1971, 1972, 1973; Marx 1967, 1972, 1973), and were part of the great expansion of the discipline of "maritime archaeology" in this era. Since that time, the broader archaeological potential of offshore sites in

the North, Baltic and North Atlantic seas has also begun to be explored. Since the 1980s and particularly the mid-1990s, there has been sustained but sporadic interest in such sites by a variety of public- and privately-funded organisations. Much of this interest has been driven by the changing management and legislative climate of counties in this region, itself fed by the growing economic exploitation of the seabed and coastal zone, including fishing, marine aggregate and hydrocarbon (oil and gas) extraction.

Denmark and Britain have been at the forefront of enquiry into such sites, as recently demonstrated in Nicholas Flemming's edited volume *Submarine Prehistoric Archaeology of the North Sea* (Flemming 2004). This book brought together much previous research on the subject, and was the result of a conference held in Britain in 2003, entitled *North Sea Submarine Prehistory and Relations with Industry*. Another British archaeologist, Bryony Coles, is responsible for the concept of 'Doggerland', a term she first employed in 1998 to describe the now-drowned habitable and huntable lands in the coastal plain now under the North Sea (Chapman & Lillie 2004; Coles 1998, 1999, 2000).

It is notable that fieldwork in Britain has been characterised by land-based exploration of intertidal sites at low-water, whereas in Denmark, the majority of fieldwork has been underwater, taking advantage of the benefits of scuba equipment in sheltered, shallow-water (c. 5m) to float over and sample sites rather than attempt potentially more destructive land-based analyses. The impact, if any, of this methodological distinction on the analysis of such sites is as yet unclear.

Denmark

The archaeological potential of the North Sea basin was first recognised in the mid 1970s, when submerged sites around the coast of Denmark – most famously at the Ertebølle sites of Tybrind Vig and Fyn – began to be discovered and investigtated (see Andersen 1980, 1982, 1984, 1985, 1987; Fischer 2004; Gregory 2001; Grøn & Skaarup 2004). Due mainly to eustatic rises in sea level since the last glacial maximum, large parts of the North Sea seabed had previously been lush, low-lying land until inundated between approximately 20,000-8000 BCE. Sections of the North Sea seabed have since been shown to include traces of permanent, semi-permanent and transitory (hunter-gatherer) settlement and use. These traces include relatively ephemeral evidence such as unaltered ancient 'landscapes' with hearth remains and flint-scatters, as well as more formalised sentiment debris comprising post-holes from dwellings, working surfaces, and even fishtraps. There is also much contributory evidence for the environment of these areas in prehistory, with rich floral and faunal remains, including large-scale fossilised forests, often buried within dense layers of peat rich in organic debris and suitable for palynological and climatological coring. Such remains are themselves often buried under dense layers of later sediment, sometimes metres thick (the sediment load of major rivers feeding into the North Sea is considerable), resulting in further anaerobic layers suitable for radiocarbon dating.

Britain

The archaeological potential of the submerged cultural heritage of NW Europe is exemplified by the range of sites now known around the coast of Britain, where the expanding heritage management structure, together with interest from both universities and developer-led

consultancy fieldwork, has led to an unprecedented number of sites being investigated. This process has been encouraged by developments such as government-sponsored surveys of the English, Welsh and Scottish coasts of Britain (Davidson 2002; Dawson 2004; Fulford, Champion & Long 1997), which contributed to new legislation, including the National Heritage Act (2002), and the Aggregates Levy (2002). The former expanded regional government heritage organisations (English Heritage, Historic Scotland and Cadw) control over cultural heritage out to the 12 nautical mile limit (formerly mean low water); the latter addressed the socio-cultural costs associated with quarrying operations - including aggregate dredged from the seabed within territorial waters (12 nautical mile limit) - by a one stage, non-deductible specific tax charged at £1.60/tonne, part of which goes towards archaeological assessments. There has also been the influence of related government-sponsored thematic surveys, notably English Heritage's 'Wetlands Strategy' (2002), which derived from its 'Monuments at Risk in England's Wetlands' Project
(see *http://www.english-heritage.org.uk/filestore/archaeology/pdf/wetlands_strategy.pdf*).

The Severn Estuary

The Severn Estuary, one of the major estuarine environments of Britain, is located between SW England and Wales and is notable for its extremely large tidal range (12.2m mean spring tide) and extensive intertidal mud-flats. Numerous well-preserved and waterlogged prehistoric sites are known from the shores of the Levels, the importance of which lies in the exceptional preservation of wooden artefacts and structures, and the detailed evidence of past environments, given by palynological, faunal and floral remains. Research into the Severn Estuary has been undertaken by a range of academic and consultancy organisations, and has an unusually high public profile thanks to the efforts of the Severn Estuary Levels Research Committee (*http://www.selrc.dial.pipex.com/index.shtml*). SELRC produces a peer-reviewed annual report *entitled Archaeology in the Severn Estuary*, which enjoys international renown.

Archaeological sites located within the Severn Levels range from the Palaeolithic to the present day, but are particularly rich in the Mesolithic, Neolithic and Bronze Ages, where intertidal and submerged remains point to the extensive use of the coastal wetlands during these periods. Sites are spread across both the English and Welsh coasts of the levels (creating a division of historic management authority), and include not only mud-flats but also coastal sand dunes, as at Brean Down, Somerset, where five Bronze Age (4,100- 2,600 BCE) settlement horizons have recently been discovered, providing the earliest evidence from Western Europe for the extraction of sea-salt. Associated to such coastal surveys have been allied research into the wetland environment of the nearby Somerset Levels (see Bell et al. 2002; Bell et al. 2003; Bell et al. 2004; Haslett et al. 1998; Haslett et al. 2001; Scaife & Long 1995; Timpany 2004).

The Solent

Since the early 1990s, submerged archaeological research in this region of southern England has been coordinated by the Hampshire & Wight Trust for Maritime Archaeology (*http://www.hwtma.org.uk/*) a unique, quasi-autonomous governmental organisation established - and partially funded by - by the county councils of Hampshire & Wight. HWTMA have been

assisted by local universities (particularly the Universities of Southampton and Portsmouth), professional consultancies and avocationals.

The HWTMA has highlighted the submerged archaeological significance of two particular areas of the Solent, [a] Bouldner Cliff off the Isle of Wight, where Mesolithic remains, including worked flints, have been discovered within an eroding peat cliff approximately 10m underwater, and [b] Langstone harbour, to the east of Portsmouth, where continuous human settlement has been demonstrated to go back as least as far as the Bronze Age, including in areas now submerged. The latter was recently published as *Our Changing Coast: a Survey of the Intertidal Archaeology of Langstone Harbour* (Allen & Gardiner 2000), to considerable acclaim as an excellent example of interdisciplinary 'seamless' research and management. Together, the Bouldner Cliff and Langstone Harbour projects have successfully demonstrated that in prehistory, the entire submerged Solent region formed a rich river valley used extensively by ancient peoples (see Allen & Gardiner 2000; Loader, Westmore & Tomalin 1997; Momber 2000a, 2000b, 2001, 2002, 2004; Tomalin 2000).

The Humber

The Humber wetlands of NE England have been subject to a series of inter-related if sporadic investigations since the 1930s. The intertidal archaeological potential of the Humber, which has a mean tidal range of between 4-6m, was first highlighted in the discovery of prehistoric vessel fragments on the foreshore of North Ferriby in 1931 by a local resident, Ted Wright. Investigations by Wright throughout the 1930s, and again in the 1940-50s, eventually revealed the remains of three vessels, dated using carbon-14 to the early Bronze Age, and providing the earliest archaeological evidence of planked watercraft in the world. (*http://www.ferribyboats.co.uk/*) (see Wright 1990, 1994).

During the 1990s, the Humber Wetlands Survey was undertaken, funded by English Heritage. The survey evaluated the nature and extent of the archaeological and palaeoecological record of the wetlands, including intertidal areas, and was preceded by a desk-top assessment of the landscape development and known archaeological resource of the Humber wetlands, which addressed the threats to the archaeological and palaeoenvironmental resource. This assessment was published in 1993 as *Wetland Heritage: an Archaeological Assessment of the Humber Wetlands* (Van de Noort et al. 1993) (see also Van de Noort 2004). Allied research by the Wetland Archaeology & Environments Research Centre of the University of Hull (*http://www.hull.ac.uk/wetlands/*), and the Centre for Wetland Research of the University of Exeter (*http://www.ex.ac.uk/sogaer/wetlandresearch/*) have also highlighted the range of intertidal and submerged remains in the Humber region, particularly into the existence of 'Doggerland' (see above) at the latter.

Submerged cultural landscape studies in Australia

In Australia it has long been recognised that many of the first places settled by human beings in this region are now located underwater (Fleming 1982; Allen & O'Connell 2003). This has been acknowledged by researchers since the 1980s (e.g., Flemming, 1982; Dortch, Henderson & May 1990, Dortch 1997).

In the 1980s, for example, a team led by Nic Flemming attempted to search for terrestrial archaeological sites undewater in the Arafura Sea (Flemming 1982).

Subsequently Charles Dortch of the WA Museum has investigated prehistoric sites in freshwater sites such as at Lake Jasper and he has considered the potential of Indigenous sites in the sea (Dortch et al 1990; Dortch 1997). The most important work directed to understanding the potential submerged archaeological of lakes was the survey of Lake Jasper in Western Australia conducted in 1989 by Charles Dortch in association with the Western Australian Maritime Museum. Lake Jasper is located in south-western Western Australia. The survey began in 1988 when the lake was a an uncommonly low level and scattered stone artefacts and stumps of trees and grass-trees (*Xanthorrhoea preissii)* were located in their growth position leading to the conclusion that they had been part of a pre-inundation environment (Dortch et al 1990:43). The following year Dortch directed a Western Australian Maritime Museum team of archaeologists in a diving survey that collected a total of about 100 stone artefacts from four (4) sites. This was in addition to about 60 artefacts collected from three exposed sites the previous year when the lake level was lower. (Dortch et al 1990:44).

The survey identified a common element that is a feature of archaeological work underwater – limited visibility. This is a limitation that can be expected in most lake environments, with the exception of limestone sink-holes. Limited visibility precludes a visual survey the whole of the lake bed, particularly when a large proportion is covered in a thick layer of organic sediment. At Lake Jasper this was reported to range from a few millimetres to half a metre. In some lakes it can be considerably more. To accommodate these issues, the survey was structured around four located sites and three transects. Transects enabled the lake bed between the sites to be sampled quickly and efficiently and quickly identified and eliminated those areas where sediment precluded visual survey of the lake bed. The x-axis tape provided the central reference point for transects and divers then worked within a $5m^2$ units (Dortch et al 1990:45). Tree stumps in the lake were presumably from trees that died following inundation. Radio-carbon dating provided estimates of c.3400-4000 b.p. (Dortch et al 1990:49). No artefacts from the lake were able to be radio-carbon dated but the dating of the trees was an important reference point for any artefacts found at depths greater than the tree stumps.

The significance of the Lake Jasper survey was to confirm the potential for undertaking archaeological investigation of Aboriginal sites. It also began the development of methods and discipline for their analysis including linking the investigation with known terrestrial and tidal sites in the region including fish traps at Wilson Inlet and Broke Inlet (Dix & Meagher 1976; Dortch et al 1990:50). In addition it raised the prospect for further work on inundated Aboriginal landscapes such as 'Warren Beach' in south-west western Australia. At Warren Beach tree stumps dating to about 8340 yr B.P., 'apparently in growth position', were reported to lie submerged hundreds of metres out to sea (Merrilees 1979:120). This is a significant claim as it appears to suggest at least one area where hydrodynamics of coastal inundation have not entirely destroyed or randomised the previously terrestrial landscape. It would suggest that traces of human habitation may therefore have also survived within this context. However, there has been no further work to date to confirm or refute the potential of this area.

The need to develop techniques and predictive models in order to provide appropriate management of this unique component of Australia's underwater cultural heritage has also been identified (Nutley 2000:1).

Stone fish traps are perhaps the site types most likely to survive the process of inundation. Examples of these in intertidal zones or areas of periodic inundation exist throughout Australia. A significant regional study of marine and estuarine stone fish traps at Eyre Peninsula and the West Coast of South Australia was by Sarah Martin for the Department of Environment and Planning in South Australia in 1986 and 1987 (Martin 1988). The study provides a broad coverage of published and unpublished literature about all forms of Aboriginal fish traps up to 1988 and is an important reference work.

Potential areas for the existence of Indigenous maritime heritage include lakes (natural and artificial), rivers and coastal environments – each of these has their own general geological, hydrological and climatic characteristics as well as the characteristics of subdivisions and micro-environments within those subdivisions. It is the examination of these characteristics that will help to predict the likely condition or survival of inundated cultural sites and remains. There are a number of studies that throw significant light on the potential survival of inundated Indigenous sites in the Australian coastal environment. These include the works by Beaton (1985), Rowland (1989, 1992, 1996) and Bird (1992, 1995), Littleton et al. (1994).

O'Halloran (2000) investigated two inundated post colonial settlement period villages at Lake Hume on the New South Wales and Victorian border to identify threats impacting on inundated archaeological sites. This study did not include specific Indigenous sites or any underwater archaeological fieldwork, and only observed those inundated sites that are periodically exposed. However, it provides valuable information on the impacts of inundation upon cultural sites (O'Halloran 2000:9-10). O'Halloran examined several issues including the effect of wave action and water level fluctuations particularly those involving periodic inundation and exposure (O'Halloran 2000:125). The study clearly demonstrates that the periodic inundation and exposure is associated with heightened rates of erosion and dispersal of artefacts (O'Halloran 2000:125). This has important ramifications for the potential survival of inundated Indigenous sites and sets an platform on which to extend the parameters of that study to include those sites that are permanently inundated.

Taken together, these studies support the view that, typically, lakes are bodies of relatively still, fresh water that attract a diversity of fauna and flora – together these three resources are of considerable importance to human economies. Physical evidence of this relationship between people and lakes can reflect both the material culture and social practices of a society. In lakes, inundated material culture is much less subject to disturbance from the scouring, grinding and dispersal associated with waves and surge. As in the ocean, organic materials, e.g., wooden implements become buried in silt and have potential for preservation over a very long period. The worked or worn surfaces of stone implements are also likely to survive with less post-depositional abrasion - although wind induced abrasion may occur pre-inundation as well as through any periodic exposure during droughts or at other times when lake levels are low.

South Australia has a number of ideal locations for locating and investigating submerged cultural landscapes in particular the palaeo-landscape of the Backstairs Passage area between Kangaroo Island and the mainland where drowned river valleys offer excellent archaeological potential. In addition there are reports of post-colonial period settlement sites at sites like the Mylor reservoir that have been innundated by reservoir construction and appear above water during times of drought.

Discussion

A series of questions exist for the future of submerged cultural landscape studies. As the fossil fuel crisis worsens in the next 20-50 years, new areas of the world's seabed are likely to be explored for their oil- and gas-bearing potential. The SE Asian region and particularly the Australian continental shelf is a prime area for such development, given the known existence of oil-bearing deep-level strata in this region. The exploration of such sites would have a profound impact on both the rate of discovery and management environment of submerged cultural landscapes. Simultaneous to this, the continuing expansion of the global population not only creates an ever larger demand for fossil fuels, but also for land and for resources such as fish and marine aggregates, and associated developments like the dredging of deep-water channels for ships, land-reclamation, etc. These are also likely to increase the rate of discovery of submerged cultural landscapes, often in areas of the world least able to manage and protect their submerged cultural remains. Developments on land, such as deforestation, also contribute to this problem, leading to siltation and pollution, which can bury, obscure or destroy such fragile remains. Meanwhile, in locations such as Australia, Indigenous Communities have yet to be properly consulted on their feelings about the discovery – accidental or otherwise – of such sites, and how such sites should be 'managed' as, arguably, the traditional 'owners' of such sites. Elsewhere in the world, particularly in NW Europe, the continuing impact of eustatic and isostatic change should not be discounted, with sites now on land becoming submerged and vice-versa. Such long-term change is exasperated by the impact of global warming, which appears to be having an appreciable impact on the climate of NW Europe, particularly the frequency and ferocity of winter storms, leading both to inundation and enhanced coastal erosion. The presence of large-scale flood-defence systems such as the Thames Barrier in London is an example of how seriously this impact is being taken. The unstable global geopolitical climate also means that such structures are at serious threat of terrorist attack; if successful, an attack on the Thames Barrier when raised would have an incalculable human toll, leaving aside the question of damage to material remains, both ancient and modern.

The really exciting changes at the start of the twenty-first century are the developments in marine geophysics and manned submersibles as well as unmanned Remote Operated Vehicle (ROV) and Autonmous Underwater Vehicle (AUV) technology. As this technology becomes cheaper, easier to operate and is able to conduct different operations underwater then the possibilities of locating and excavating Indigenous archaeological sites underwater have increased dramatically. At present the Australian National University is developing AUV systems which are expected to provide cheap and reliable seabed survey information and Flinders University is considering being a part of a consortium of research institutions involved in the purchase and operation of a new $2 million submersible. This new technology is expected to provide access to sites that have

been inaccessible in the past and to expand our understandings of submerged cultural landscapes in Australia.

Conclusion

The North Sea Basin is an instructive example of the characteristics and management environment of submerged cultural landscapes. Representing a discreet, definable geographic region, the area contains a distinct and well-understood archaeological sequence with cross-cultural contacts since prehistory. The area is subject to exploitation by a diverse range of interests, including the marine aggregates and hydrocarbon industries, the fishing community, as well as the heritage, tourism and leisure industries. Because of the relatively small area and shallow waters, governments with shores adjoining the North Sea must act together to manage the area, and collaboration also takes place between research and management organisations. The North Sea has also witnessed virtually unprecedented levels of cooperation between industry and academia, particularly in Britain. For these and other reasons, the North Sea basin represents an opportunity for management strategies for submerged cultural landscapes to be explored in a relatively benign management, legislative and environmental climate. Such strategies employed in the North Sea, once adapted for local conditions, could prove suitable for use elsewhere in the world, including the route of the land-bridges and open-water crossings that represent the likely migration route of early humans into 'Greater Australia' (*Sahul*) from SE Asia and Indonesia (*Sunda*) in approximately 45,000 BCE.

In *Submarine Prehistoric Archaeology of the North Sea,* Flemming (2004: 118-20) reaches a variety of conclusions about submerged cultural landscapes:

Understanding the prehistoric archaeology of the… Continental Shelf is an essential part of understanding prehistory… [particularly] after the last glacial maximum and the movement of peoples' (Flemming 2004: 118).
'[These areas] constitute a large area of potential terrain which could support vegetation, fauna and coastal resources exploitable by Palaeolithic and Mesolithic peoples. This area should not be regarded as a land bridge, but as a territory with its own special environmental conditions, sequence of climatic changes, culture and evolution of technologies'.
'Submarine prehistoric sites survive in the protected low-energy environments… artefacts without stratigraphic context have been retrieved from offshore… in principle prehistoric occupation sites in locations which had low wave and current energy at the time of inundation should survive intact at many places'
'Submarine sites can survive with sufficient stratigraphic integrity to provide evidence of dwelling patterns, village structure, flint-knapping sites, lithic technology, waterfront structures, fish weirs, hearths, food remains, canoes, paddles and burials with human bones. This array of materials provides a sound basis for cultural and social interpretation'.
'Prehistoric sites close to shore in water depths of 5-115m can be studied and excavated using scuba-diving techniques or surface-supplied air diving. The potentially more interesting sites offshore are likely to be in the neighbourhood of the slopes, valleys and ancient shorelines. Detection and study of sites in these environments will require use of swath bathymetric acoustics, sub-bottom profiling, and support for seabed interventions using ROVs and surface-support diving to depths of the order of 30-50m. This is technically feasible, but will need the

progressive development of a case for the research before expenditure on this scale would be justified'.
The role of offshore industry… is potentially beneficial, since industrial equipment can reveal the presence of submarine prehistoric sites, or environments conducive to human occupation. The risk of damage to sites has to be balanced against the advantage of discovering sites in areas where it would be impossible to justify spending academic funds on a speculative basis. This judgement depends upon a monitoring and licensing regime for marine industrial processes… which require the operator to prepare an environmental assessment including the risk to the prehistoric landscape'.
Success depends on goodwill and collaboration between industrial operators, the environmental officials in commercial companies, regulatory authorities, professional academics, and amateur enthusiasts' (Flemming 2004: 119).

Flemming also makes a number of pertinent recommendations that apply equally well to Australasia and elsewhere:

The discharge of international treaty obligations should be done in such as way that professional groups can work together across lateral boundaries and median lines'.
Mutual recognition [of diving] standards would increase the efficiency of joint research programs.
An active policy is needed to investigate and determine the correct balance of research, modelling, exploration, discovery, mapping, excavation and protection of [prehistoric archaeological] sites, both legal and physical'.
A more secure funding environment should be established… combining academic and institutional programs, statutory conservation policies, and funding from private organisations and trusts as well as through collaboration with industry'.
There is a great deal to be gained by collaborating with the marine industries so as to exploit the powerful technologies used. These technologies can be used to prospect the archaeological potential of regions of the sea floor, and to recover artefacts, geological and palaeontological samples. Industries should be encouraged to participate in joint projects through good communications, publications and personal contacts' (Flemming 2004:120).

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