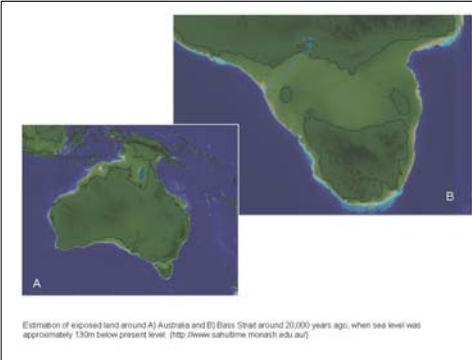


CONCEPT

For many years it has been recognised that major climatic changes have a dramatic effect on global and local sea-levels, which in turn expose and submerge vast areas of land. More recently, work in the Atlantic, English Channel and North Sea has demonstrated the survival of archaeological objects and ancient land surfaces. The prevailing view in Australia, however, has been that the local environmental, climatic and oceanic conditions would prevent the survival of any similar submerged prehistoric land surfaces or associated archaeological material.

GOAL

This project aims to test methodologies used to investigate the survival of submerged landscapes in the English Channel and North Sea, using previously published data and demonstrate the survival of ancient land surfaces in Port Phillip Bay, Victoria, which have the potential to preserve ancient Aboriginal relics.



CONTEXT

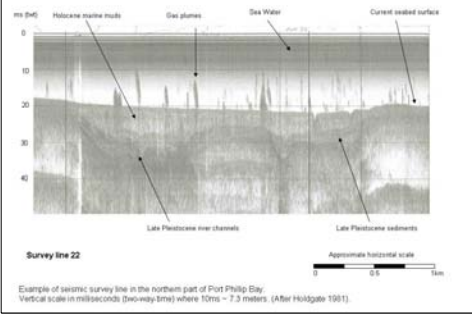
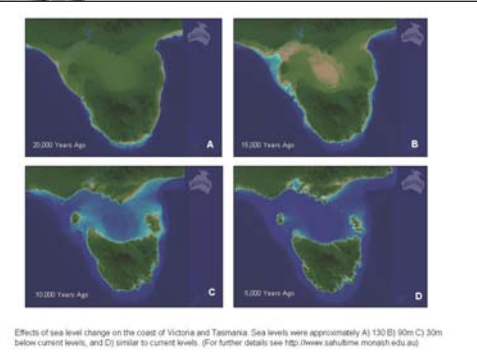
At the height of the of the last Ice Age, around 20,000 years ago, sea levels were approximately 130m below present, and Australia was a vastly different continent, connected by dry land to Papua New Guinea in the north, and to Tasmania in the south.

Using modern seabed bathymetry, the extent of exposed land can be estimated for various periods of past lower sea level (see right and left).

During the Ice Age, the area now known as Port Phillip Bay would have been dry land, connected to Tasmania. Rivers that now drain into Port Phillip Bay would have flowed through the region, southwards towards the ocean.

It is estimated that Tasmania and the Bass Strait islands became separated from mainland Australia around 14,000 BP, when the sea level was approximately 50m below present levels (Lambeck & Chappell 2001). It is estimated that Port Phillip Bay was flooded by post-glacial rising sea levels between 8000 and 6000 years ago (Bird 1993, Bowler 1966, Holdgate et al 2001).

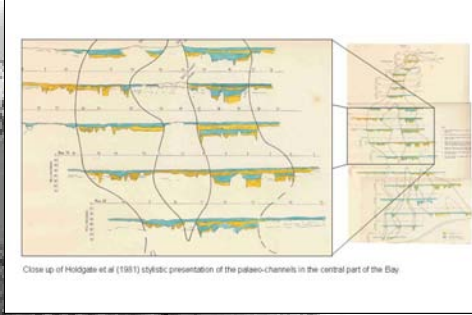
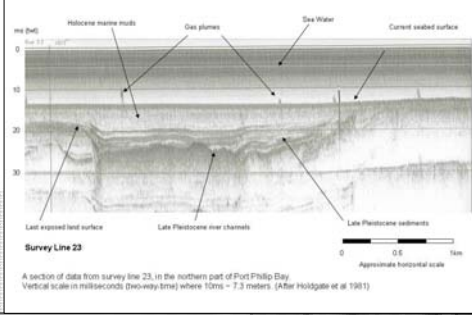
Aboriginal dreamtime stories from the Woiwurrung and Wurundjeri communities living around Port Phillip Bay include two descriptions of the flooding of the area. Both stories describe the Port Phillip Bay area as good hunting grounds, prior to flooding, and serve to highlight the ancient connection between Aboriginal groups and the submerged land.



MAPPING BURIED LAND SURFACES

Seismic surveys have identified buried channels within Port Phillip Bay, thought to represent the route of the palaeo-Yarra and palaeo-Werribee Rivers.

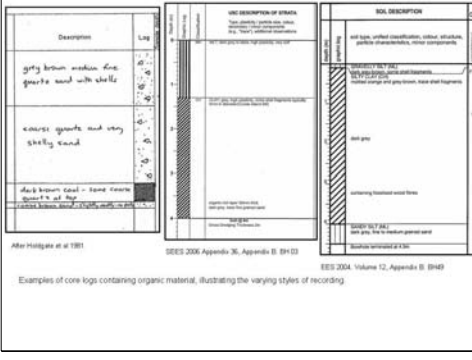
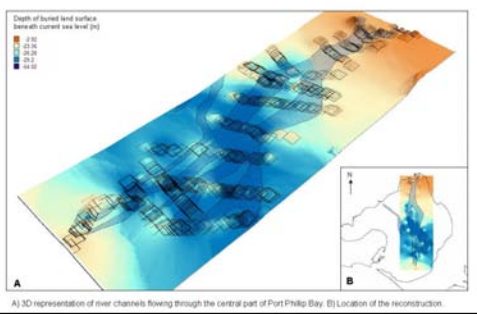
C14 dates from palaeo-Yarra infill sediments date c.8000 BP, confirming that these channels were formed during the last Ice Age.



RECONSTRUCTING LANDSCAPES

By digitising the seismic data (paper rolls from the 1970s) reconstructions of the ancient buried landscapes were made using xyz data and computer modelling.

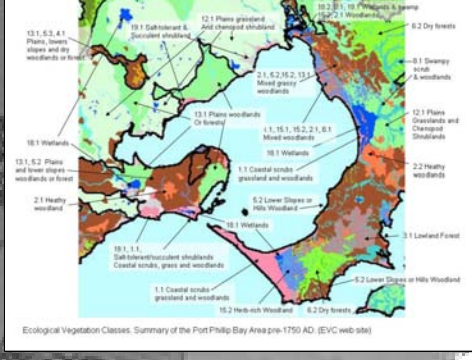
This 3D model can be transformed into a Digital Elevation Model (DEM) which can be used as a basis for digital landscape reconstruction.



IDENTIFYING ANCIENT LAND SURFACES

Core logs from a number of sources, with varying detail (see left), were assessed for evidence of surviving organic remains beneath modern Holocene sediments. A total of 16 cores were found to contain clear descriptions of organic remains. The distribution of the cores containing organic remains is shown to the right.

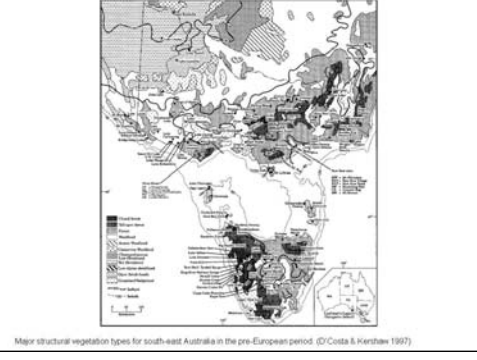
The extent of the surviving organic layers is illustrated by gas plumes visible in the seismic data (above), which Holdgate (2001) identifies as methane gas seepage resulting from "organic breakdown of peaty deposits". Gas plumes are seen in all 15 survey lines used for the 3D topography reconstruction.



RECONSTRUCTING PAST ENVIRONMENTS

Published data on the past environment of central Victoria has focused on the pre-European (c.1800) period (Presland 2005, EVC 2008), but very little has been published on earlier periods. The two most relevant publications are summarised left and right.

It is suggested that vegetation cover c.20,000 years ago, was a thin and broken band of temperate woodland, possibly focused in river valleys, with grass and scrub dominating on open plains (Adams & Faure 1997). As the climate warmed, vegetation cover became similar to the pre-European environment by c.10,000 years ago.

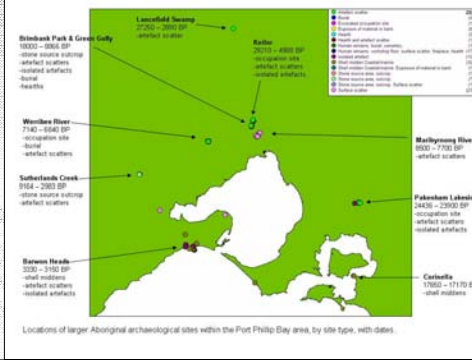


ABORIGINAL ACTIVITY AND ARCHAEOLOGICAL POTENTIAL

In addition to the dreamtime stories, data was collated from Aboriginal Affairs Victoria and published sources, about dated archaeological sites in the area around Port Phillip Bay (right). Assessment of these sites enabled parallels to be drawn about the activities of Aboriginal groups who might have used the area prior to inundation, and the archaeological site types which may have been formed as a result.

The archaeological data demonstrates a range of activities including the collection of raw material and food, occupation and burial sites. Artefact scatters and isolated objects are likely to represent tool manufacture and use for activities such as hunting and processing animals.

While it is possible that scatters of stone artefacts may survive within the peat layers, ethnographic studies show that a range of objects made from organic materials, wooden containers and basketry, were also part of Aboriginal toolkits. Due to more favourable conditions, it is possible that these objects could survive within the peat deposits underneath Port Phillip Bay.



RESULTS

This research, based on published data alone, suggests that the Port Phillip Bay area would have been a reasonably flat landscape with a number of wide valleys traversing north to south, containing the flow of the palaeo-Yarra and palaeo-Werribee rivers.

Research suggests that around 20,000 years ago, the area is likely to have been wooded within the valleys, and dominated by grass or shrubs in the more exposed areas. By 10,000 years ago, the area is likely to have been dominated by woodland and forest, with the volcanic plain grasslands of the north-west extending south across Corio Bay. A range of animals, including kangaroo and emu, would have lived in these environments.

Archaeological evidence demonstrates that Aboriginal groups were living in the area between 20-10,000 years ago. The dreamtime stories support this and go further to indicate that, prior to inundation, the Port Phillip Bay was also part of their territory. Fresh water and food would have been plentiful in the area.

This research has also demonstrated that the sediments of the 20,000 year old land surface do survive beneath Holocene marine sediments and the sea, and that they are extensive across Port Phillip Bay.

CONCLUSIONS

This project aimed to test methodologies previously used to investigate submerged landscapes in the English Channel and North Sea in an Australian environment. It has demonstrated, by using previously published data, that the ancient landscapes can be identified beneath modern marine sediments, and that the remnants of these former land surfaces can survive. It has also demonstrated the potential for archaeological remains to exist within these deposits, and the value of combining geological, geophysical, archaeological and palaeo-environmental studies for the investigation of ancient submerged landscapes.

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