The Western Solent – a SARCC Case Study.
2019 fieldwork and research

Towards the understanding of coastal change

Sea levels are rising, the seabed is eroding and the shoreline is under threat. Over the millennia, rising water levels have remoulded the coastline and forced people to retreat inland. In more recent times the coastal population is preferring to hold the line, inadvertently putting properties and our archaeological heritage under threat. But what are the potential impacts in the decades to come and can the frontlines against ongoing change be sustained?

To answer these questions there is a need to understand the long-term patterns of coastal change that have resulted from a fluctuating climatic and sea level rise. These processes laid the foundations for the current equilibrium that, in turn, acts as a platform for future changes. Fortuitously, past trends can be calibrated by interrogating data and datable material in the intertidal, and subtidal, palaeo-environmental, archaeological and historical archive. When the underlying patterns of long-term geomorphological change are understood, the results can help to anticipate future trends and inform strategies for coastal sustainability as waters continue to rise at 3-4mm per year.

Providing a narrative and seeking solutions

The western Solent is an archetypal example of coastal geomorphological change where sea level has risen, causing floods and separating landmasses. Nonetheless, it was not all catastrophic as the inundation covered and preserved large swathes of the Solent valley below sediment; including prehistoric settlements and ancient forests. In more recent times, however, the protective silts of the north-west Solent are being removed and exposing land surfaces that have remained stable for thousands of years. This indicates areas subject to new threats while also revealing a valuable resource that holds the story of past events. These newly exposed land surfaces retain exquisitely preserved material dating back many thousands of years. The nature and quality of the discoveries are being made are of international importance and of immense cultural significance. They are opening new windows into the understanding of our ancestors and provide a powerful narrative that charts the prehistoric colonisation of Great Britain as the climate was changing.

Archaeological and palaeo-environmental analysis of the new exposures will both enhance our understanding of current coastal change and provide unique access to a past that has yet to be explored.

Action for a SARCC Case Study

The archaeological material of the Solent is part of a sequence of sites that date back over 8,000 years. A large amount of this data lies underwater and remains largely unseen. This has made awareness of the resource challenging, but the material in the intertidal zone provides tangible and visible evidence of recent coastal change. The SARCC project is enabling a study to be conducted across the Solent that will give us a holistic overview of long-term coastal change. This seamless approach is using data from the submerged landscapes of Bouldnor Cliff, the north-west Solent, including the recent archaeological discoveries at Calshot Spit, Thorns Bay, and Pitts Deep while locating more material in areas under increasing threat. It will look at palaeo-environmental and archaeological markers to date and monitor sites, while also using the archaeological evidence to paint a picture of life that once inhabited the drowned lands of the Solent.

Sites in the case study:

1 Bouldnor Cliff

The submerged Mesolithic landscape at Bouldnor Cliff lies on the edge of the drowned palaeo-valley and is now 11m underwater, 1 km east of Yarmouth on the Isle of Wight. It stretches for a further kilometre west to east and contains five known loci containing archaeological evidence. Two of the sites are particularly productive and have been dated to c.6,200 to 6,000 cal BC. One has been the source of almost 1,000 worked flints, flakes and tools while the other, with close to 100 pieces of worked wood, has practically doubled the amount of Mesolithic worked wood in the UK. The site has also been the source of the oldest piece of prepared string in the country, probably the oldest boat building site in the world and sedimentary ancient DNA which has revealed a habitat of oak forest and herbaceous plants, including Einkorn, providing evidence that wheat arrived in Great Britain over two millennia earlier than previously recorded. This material, coupled with tangentially split timbers and finely crafted tools suggests an advanced Neolithic influence. It also contains an arrangement of trimmed and split timbers that could be a platform, walkway or collapsed structure. More of the structure is lost each year as it continues to erode (figure 1).

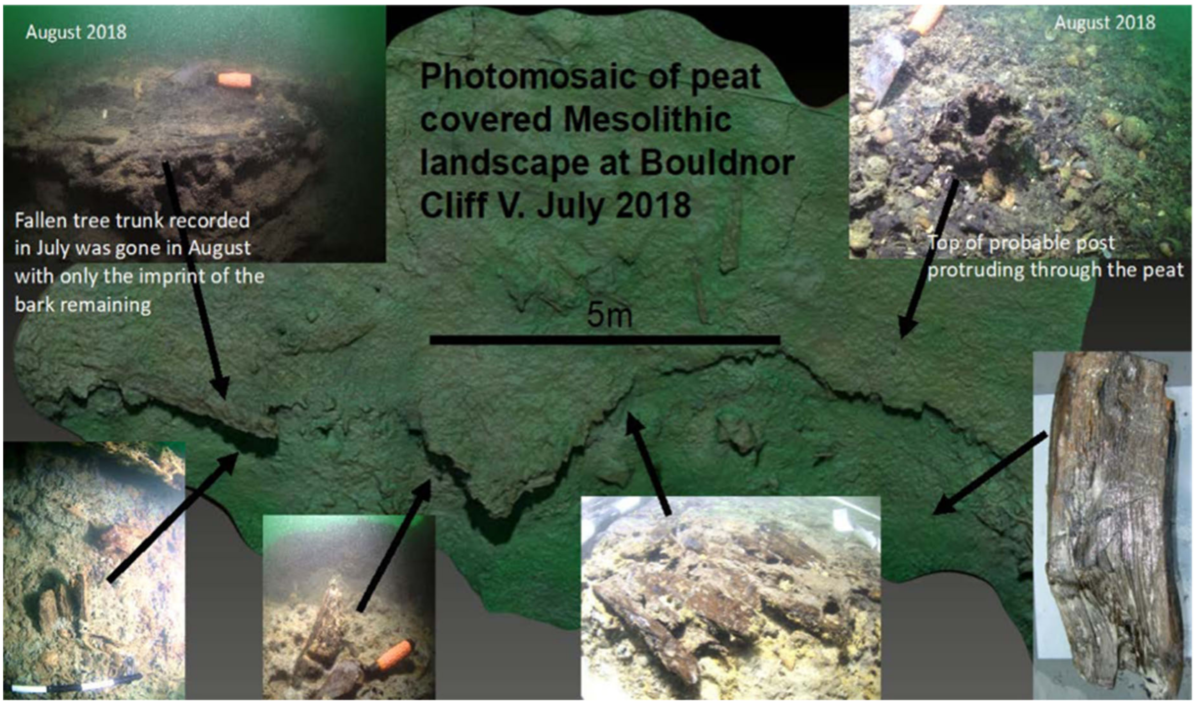


Figure 1: Plan view of 3D photomosaic model of Bouldnor Cliff V (BC-V). Images were collected in July 2018. Some of the Mesolithic artefacts recovered from the area are inserted as stills along the bottom of the image. In August 2018, a further inspection identified a probable post protruding through the peat (top right) and noted the loss of a large tree trunk. Erosion is

Significance

Bouldnor Cliff is the only archaeological site in a submerged Mesolithic landscape currently known in the UK. The waterlogged anaerobic conditions have created an excellent environment for preservation for non-lithic material. Consequently, the site has the highest potential for the best-preserved discoveries of organic Mesolithic artefacts and palaeo-environmental evidence in the UK, as has already been noted with the unique DNA, boat building and string finds mentioned above.

Internationally, the findings suggest a sophisticated Mesolithic site with social networks linked the Neolithic across the North Sea to the low countries of the 2Seas area and possibly to southern Europe or the north European plain. These were the last people to link the continental landmass with Great Britain before the formation of the North Sea. Interpretation of the results would help us understand the potential and character of international links and the cause of coastal change. This is particularly pertinent as the evidence is eroding. Monitoring over a ten-year period has recorded lateral erosion of up to 4m in the most vulnerable parts of the archaeological sites.

Recent discoveries and opportunities

2019 began with the photogrammetry to help monitor changes to the site, Bouldnor Cliff V (BC-V). This included a location that was subject to active degradation further to the east of the hypothesised boat building area. During the initial inspection, a new structure was discovered eroding from within the drowned forest. This consisted of trimmed timbers lying parallel to the cliff, sitting above round-wood pieces that lay perpendicular to the upper layer and extending into the cliff behind. See figures 2, 3, 4 and 5 below.

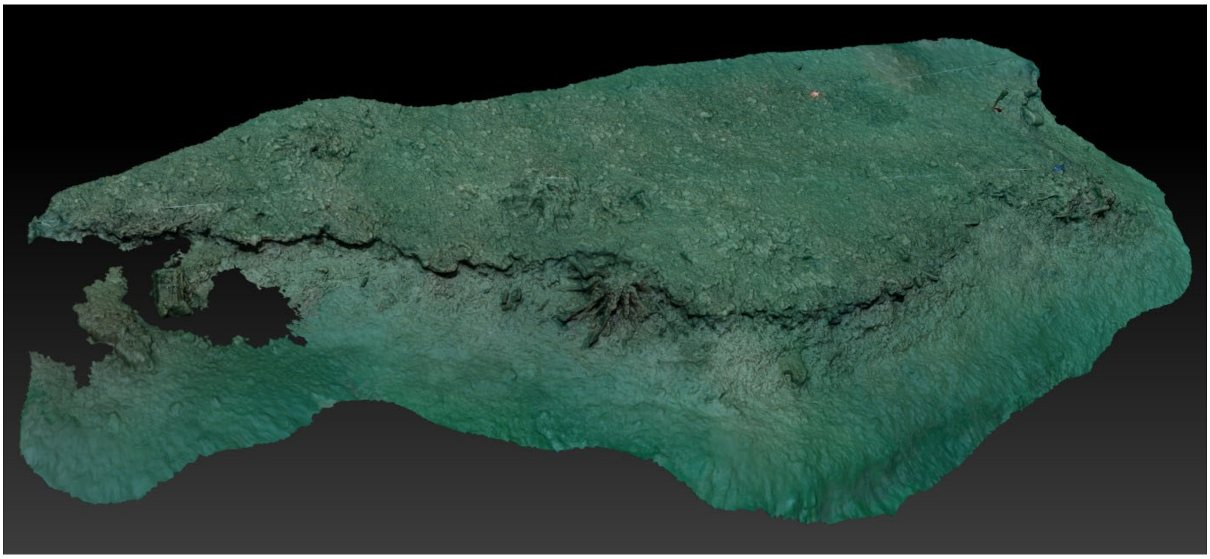
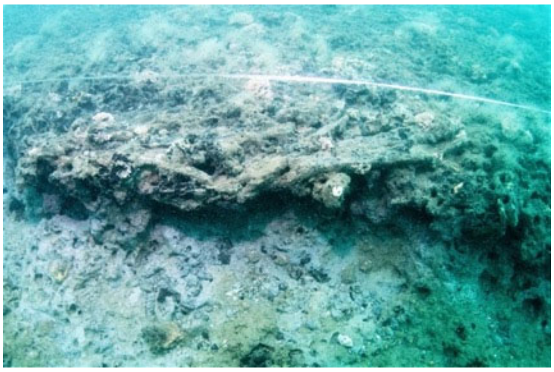
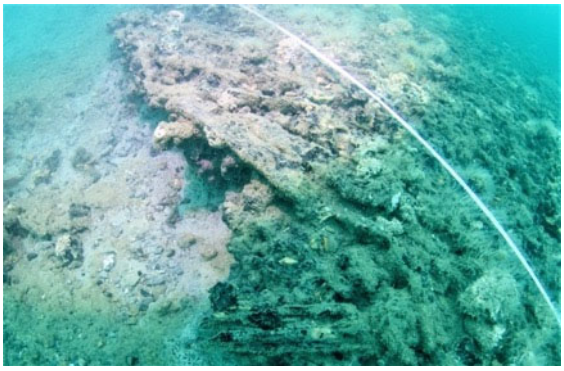


Figure 2: Plan view of 3D photomosaic model of Bouldnor Cliff V (BC-V). Images were collected in the summer of 2019. The area is 11m underwater and is the eroding edge of an 8,000 year old land surface. The roots from a tree stump can be seen eroding out of the cliff in the middle of the image while a wooden platform is now exposed on the left (see figures 3 and 4 below). The excavation of the boat building site is at the far right.





Figures 3 and 4: Images of the 8,000 year old structure eroding from the underwater landscape. The flat surfaces along the edge of the cliff are split timbers. They are resting on Roundwood that is positioned at right angles. These pieces are protruding through the edge of the cliff.

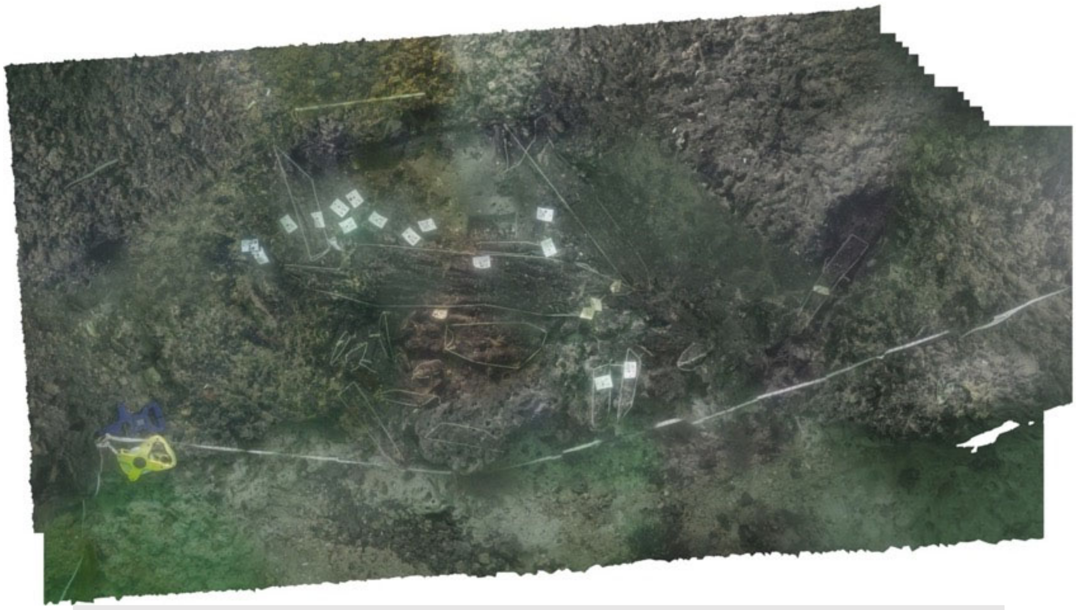


Figure 5: 3D photomosaic of the structure in the process of excavation.

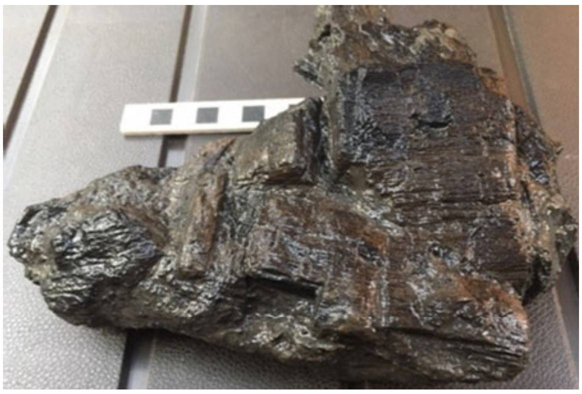
The structure was a challenge to decipher within the dark matted peat and in the limited visibility underwater, accordingly, it was recovered in layers following numbering, marking and recording. The pieces were reassembled on the surface and part of the lower layer can be seen in figure 6.

Figure 6: 3D lower layer of the timber structure from Bouldnor Cliff reconstructed following recovery.

Additional reconstruction revealed there were up to three layers of cut timbers resting on top of each other. It appears to be a platform, possibly next to a stream, although further work is necessary to refine the interpretation. But even so, it has proved to be the most intact, wooden Late Mesolithic structure ever found in the UK (figures 7 and 8).

Figure 7 (above) and 8 (right): plan and oblique views of the reconstructed Bouldnor Cliff ‘platform’.

Beyond the southern side of the structure, the seabed was excavated to reveal a clump of wood chippings. The purpose of this chopped timber is difficult to interpret but the distinct cut marks are undeniable. Analysis of these few pieces alone would provide greater insights into Late Mesolithic woodworking technology in a way that has not been possible before (Figures 9 & 10).



Figures 9 and 10: remains of the cut timbers, below and immediately to the south of the structure. Image 9 on the left shows the artefact in situ, while image 10 on the right shows it after recovery.

Following recovery of the platform timbers it was reconstructed in the laboratory, photographed and digitised (figure 11). The pieces have now been individually cleaned, numbered and placed in fresh water to desalinate. They await recording and conservation. A site interpretation is presented in figure 12.

Figure 11: 3D digital model of the 8,000 year old Mesolithic platform from Bouldnor cliff. It is just under 6 foot wide. See: https://sketchfab.com/3d-models/bouldnor-cliff-bcv-platform-recovered-july-2019-754396cdae05464b80d51652ac08b126

Figure 12: interpretation of the landscape at Bouldnor Cliff before sea level rise forced people to move.

The Cadland Causeway

The Cadland 'Causeway' is an enigmatic structure that sits across an ancient palaeo-channel on the edge of the Cadland Estate. It was discovered in 2015 and a sample from a stake was recovered and dated to 42 cal BC – 60 cal AD while a sample of wattle-work within the structure was dated to 86–242 cal AD. What had become clear over the years it has been exposed is that the feature was becoming more exposed as the silt was winnowing away and timbers had been lost (Figures 13, 14, 15 and 16). This led to an investigation of the structure in 2019 as part of the broader SARCC project.

Figure 13

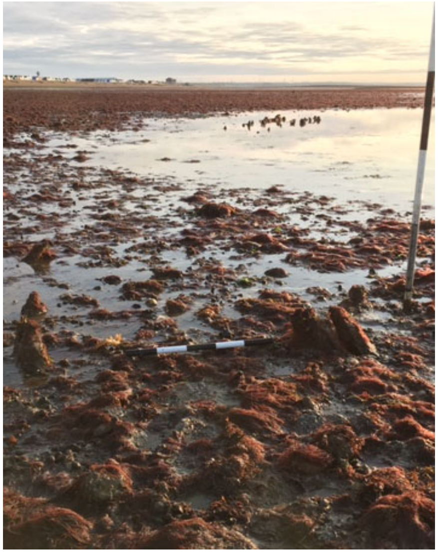


Figure 14

Figure 15

Figure 16

Figures 14 and 15 show the upright and horizontal timber elements of the structure in 2015. Figures 13 and 16 show the structure in April 2018. In Figure 1 looks east from Bronze Age timbers in the foreground to the central feature in the water filled embayment. Figure 4 shows the horizontal timbers that are now more exposed as the silts have winnowed away.

The location at extreme low water, with the limited window of time to work before the tide came in, warranted a diving operation at high tide to carry out the recording, excavation and sampling. During two days of fieldwork, an area of the site that was the furthest offshore was surveyed, photographed and an evaluation trench was excavated. This resulted in the discovery and excavation of three posts that were comparable to some of the early Bronze Age and Roman posts found further inshore the year before. These earlier samples had been submitted for radiocarbon dating and gave 'highest probability dates' of 23–140 cal AD, 41 cal BC to 80 cal AD, 122–1047 cal BC and 1447–1373 cal BC (Figure 17).

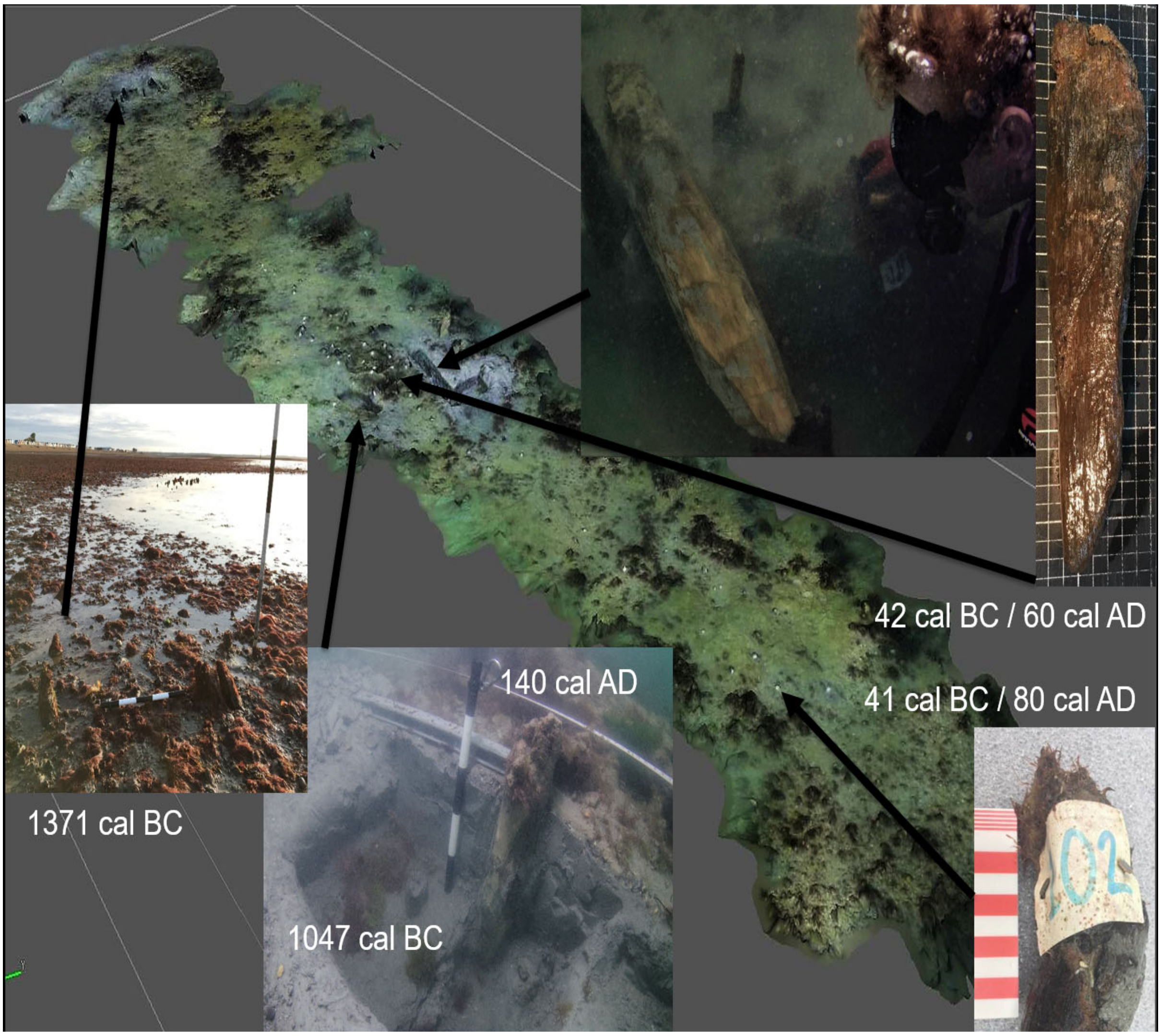


Figure 17: 3D photogrammetric model of the Cadland Causeway. The plan is orientated roughly north-east to south-west with the western end being in the top left corner of the image. The older Bronze Age stakes are at the western extent of the site while the smaller Bronze Age stakes run towards the east and are found in the centre of the site, towards the middle of this image.

Significance and opportunities

The dates show the structure was constructed over different periods indicating that the site has seen phases of activity that extended for a millennium and a half. This was a time when the sea level fluctuated, but levels were not too different from today. The eastern end of the structure was relatively lightly built so it must have been within a landscape that provided protection from the direct impact of the sea. Accordingly, the current coastline must have extended further into the Solent. The last phase of building introduced much more substantial timbers, possibly due to increased level of exposure as the surrounding land receded and sea level changed. However, the persistent use over such a long period demonstrates that it was of enduring local significance.

The surveys in 2019 identified many more timbers than originally recorded. This has raised further questions about the function of the feature. The heavy Bronze Age timbers in the west could be the footings for a platform or more substantial structure while the smaller Bronze Age timbers that run in a line to the east could represent an associated causeway or walkway. This is a structure that can provide index points for sea level change and coastal change in an area that is now exposed to erosion.

Thorns Bay

As the intertidal zone along the Western Solent is becoming increasing exposed to marine attack, new areas are being stripped of protective sediments. Thorns Bay, on the Beaulieu Estate is a recently discovered example where the removal of the foreshore cover has revealed a Neolithic landscape C14 dated to around 5,200 years old. The site is only uncovered on low spring tides. The remains lie within the confines of a palaeo-channel that was fed by a fluvial system from the New Forest in the north. The current river is now truncated by a hard sea wall (Figure 18).

Figure 18: and exposed palaeochannel with embedded 8,000 years old trees at Thorns Bay is backed by a recent coastal defence. This deposit had remained undisturbed until recently and coincides with the erection of hard defences around the north west Solent.

The palaeo-channel that cuts through the Solent foreshore is defined by soft infill sediments and bordered by outcrops of ancient landscape deposits including trees and timbers (Figure 19). The trees are encapsulated in peat on the east side of the relict channel, while relatively regularly sized and spaced timbers lie on the west side. The sample that was collected to date the site came from a peat deposit associated with trees and root systems on the east side of the channel.

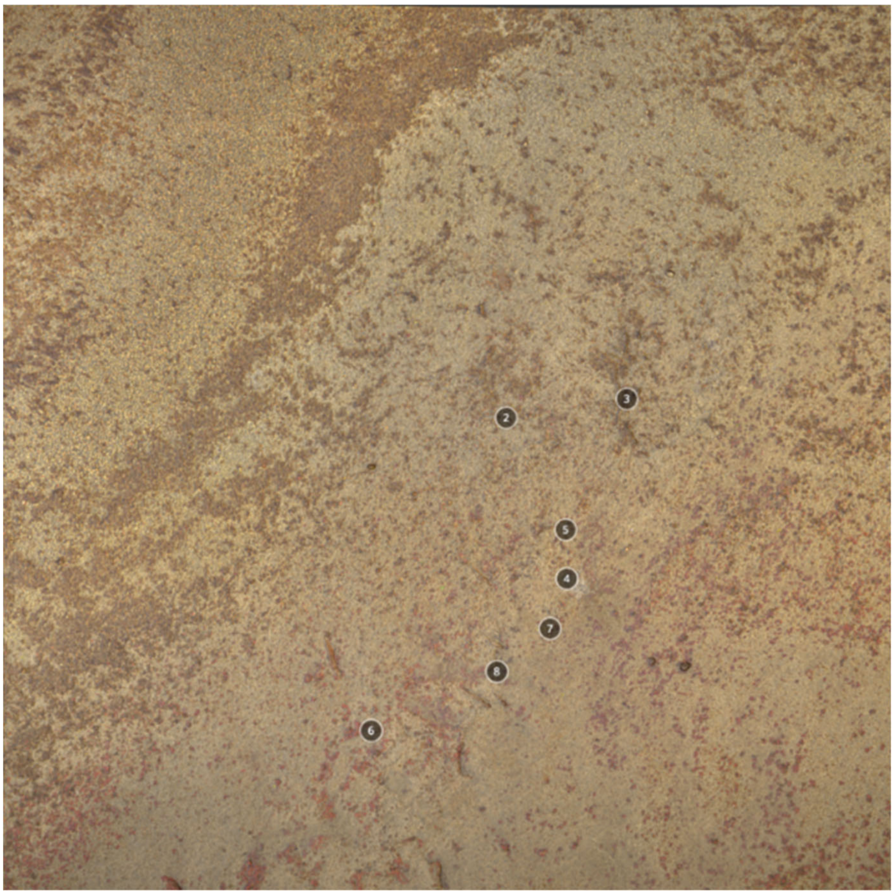
Figure 19: Looking south-west along the peat exposures at Thorns Bay. Large tree trunks are eroding from the peat, in which they have been embedded for up to 5,000 years. The wood and peat continues below water.

In 2019, samples of worked wood were dated from the palaeo-deposit. These were posts were different shapes and sizes and one was dated to around 5,200 years old with a 95.4% probability to 3346 - 3090 Cal BC (SUERC-86552), (figures 20 and 21). The remains lie within the confines of a palaeo-channel that was fed by a fluvial system from the New Forest in the north. The site is only uncovered by the sea during low spring tides.

Figures 20 and 21: 34cm long digital 3D model of Neolithic post (TB E20). It was recovered from the landscape, recorded and dated to 3346 – 3090 Cal BC. The post clearly showing areas of the covering deposit that most probably formed a protective barrier, and the distinctive cut and tear scar indicated by the arrow. The digital model has been posted on the Maritime Archaeology Trust Sketchfab page: https://sketchfab.com/maritimearchaeologytrust/models.

This timber is one of seven that have been identfied eroding from the seabed and rescued because they were under threat from loss. We have discovered a cluster of worked timbers towards the middle of the beach (see location 3 in figure 4 below) while smaller timbers have been recorded further down the beach towards low water mark (see locations 4 to 8 in figure 22 below). The evidence so far shows the two sets of posts were positioned in a different substrates when they were first pushed into the ground. The peat covered palaeolandsurface has now been eroded and lost to the east, while a gravel bank covers the centre of the palaeochannel to the west (figure 22).

Study of the site will tell us about the changing coastline. The fact the prehistoric landscape is now exposed, most probably for the first time in 5,000 years demonstrates the erosive processes along the coast and its study will help inform our understanding of coastal change.



Figures 22: Aerial photomosaic of eastern area under investigation. Number 3 is the centre of a cluster of worked Neolithic timbers. This is around the remains of an ancient tree stump and root system. The numbers running down the page represent additional posts. These timbers are exposed at the edge of the peat deposit that is eroding in the east and protected by gravel in the west/north west. The image is 50m across

Significance and opportunities

The deposits at Thorns bay are part of the landscape that was inundated by the sea over 5,000 years ago. It would have been protected until relatively recently as the condition of the exposed timbers is still fair and degradation is limited. The deposit provides an index point for sea level rise and an indicator of recent erosion. This will provide valuable information, particularly when integrated with the other dates from around the Solent.

Archaeologically, the banks of the palaeo-channel at Thorns Bay would have been attractive for early human activities. The preservation potential of the remains is very good, so if archaeological material is found, it would be rich in organic artefacts and ecofacts. This is a great site to tell a human story from the past that relates to climate change. The story would have been common across the 2Seas area.

The ancient and important site at Thorns Bay will inevitably be lost. This will be a great detriment to our understanding of the region, as the deposits contain material that can demonstrate the impact of a changing climate and the ongoing threats to the shoreline that are beginning to effect large parts of the Solent and the UK. Further sampling for dating and palaeo-environmental analysis will characterise the ancient environment and help identify the presence of earlier human activity.

Northwest Solent and Hurst Spit
In the shallow waters of the north-west Solent a submerged landscape runs for over 10km from Hurst Spit to the east of Pitts Deep. This is represented by submerged forests within two peat horizons between 4 and 6m of water that are around 4,000 and 7,000 years old. The trees are dominated by oak, alder and silver birch. Searches by divers a decade ago identified birch on the upper peat platform as they could see the silver bark still covering the fallen tree trunks. This was remarkable being that it came from a level dating to c.6,300 years old, but more importantly, it indicated that it had only recently been exposed for the first time, as such delicate material will only last a number of weeks before being degraded and washed away.

Past inspections off Tanners Hard found that a lower, older peat sits on a hard clay substrate. This is covered by a metre and half of fine alluvial clay that was topped by the upper peat. The hard clay substrate is the base of the ancient valley floor. Over the last few decades hundreds of worked flint tools have been trawled up by fishermen from this level and the MAT diving team have also recovered several pieces of debitage between Tanners Hard and Pitts Deep (Figure 23). The soft clay above the basal peat is alluvial estuarine sediment. This, along with the second layer of peat that caps the clay, is relatively unconsolidated and eroding at a much quicker rate.

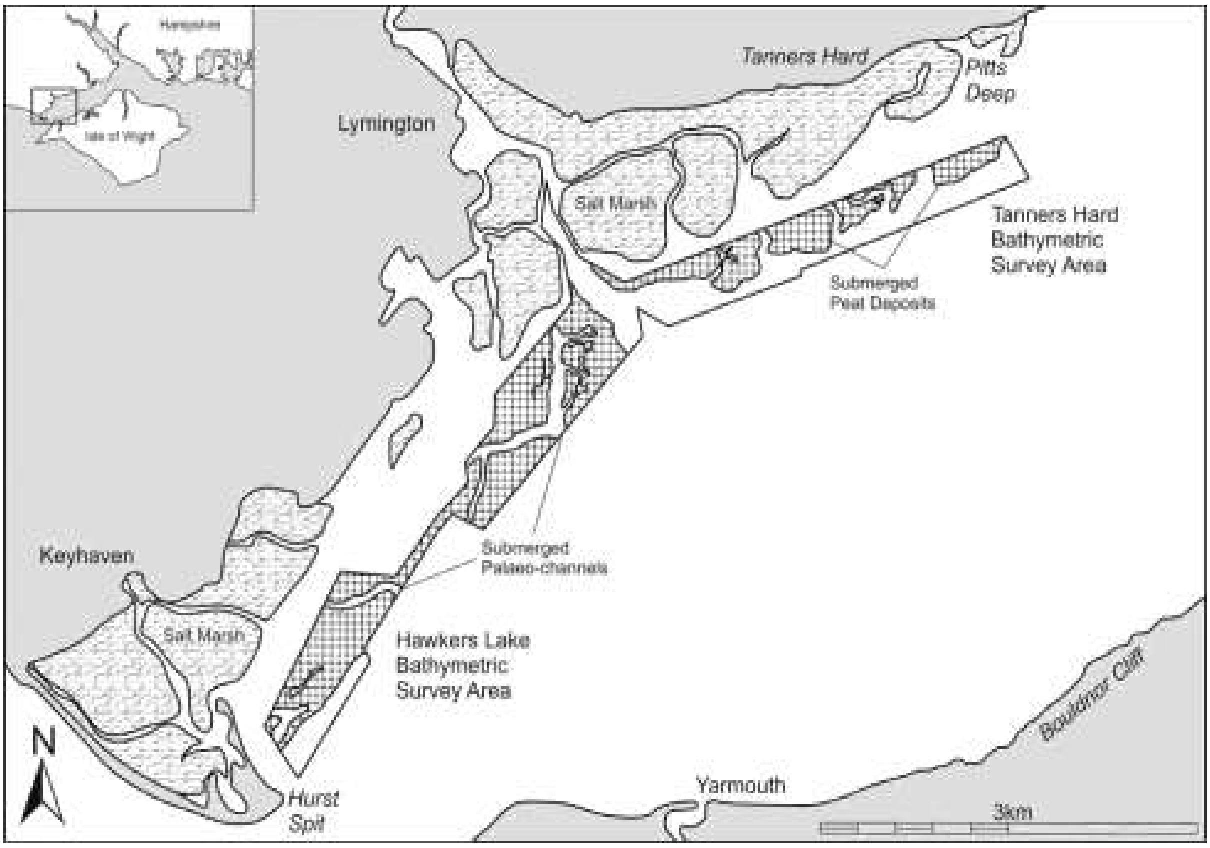


Figure 23: Map regression using old charts in the North-West Solent. The hatched lines are surveyed peat deposits. They are now exposed but they were below mud flats when they were surveyed in 1781 by Murdoch MacKenzie.

At Hawkers Lake, adjacent to Hurst Spit, a sample of the drowned forest lying just 2.5m below OD was dated to c.4,000 years ago. This was from a deposit that had developed in an estuarine environment before the Solent was fully marine. On the west side of the spit, another area of submerged peat has been identified and sampled. It gives a similar date. This area of submerged peat has recently become exposed because storms over the last three or four decades have forced the spit eastwards. As the spit has migrated, the ancient land surface is being revealed. As the spit migrates it is also moving over the brow of an ancient hill that has now become buried. As it does so, the Spit is becoming more susceptible to overtopping (Figure 24).

Figure 24: The battered 'Hurst Spit' following an overtopping event. These events are becoming more frequent as the spit migrates east and can get less support from the substrate it is now moving over.

Significance and opportunities

The peat deposit that extends from Hurst Spit to Thorns Bay, holds laminated sediments and a datable archive of material that can provide us with a model for the rate and scale of sea level rise, along with an indication of the date the Solent formed and when it reached an equilibrium. More significantly, when this evidence is combined with historical data it can be analysed to see when the equilibrium was disturbed and erosion increased. The exposed sediments can show us where more recent changes are having the greatest impact. The site is analogous to similar areas on the French, Belgian and Dutch coasts

Coastline regression analysis over the last 240 years, beginning with the Murdoch MacKenzie chart of 1781, has shown that mudflats once extended out as far as Jack in the Basket at the mouth of the Lymington River Channel (approx. 2km south east of the Lymington Yacht Haven). The mudflats were exposed until ¾ high tide and stretched from the reverse end of Hurst Spit in the southwest to Sowley in the northeast. Further east, a band of mudflats 300-400m wide, fronted the foreshore all the way to Calshot. The discoveries of delicate 6,000 year old environmental material underwater, below the footprint of the mudflats, demonstrates that the removal of silt is new and that this is the first time the underlying land surface has been exposed for many millennia. This means the natural defences below the water are diminishing and they will not be returning. There is a need to assess all the evidence if we wish to fully understand the process. While we do nothing, threats to the coastline will accelerate as the areas of shallow water get deeper, and there is an increased impact from the Solent as it grows in width and depth.

Data to inform our studies could be collected by targeted sampling and inspection of the areas where erosion is greatest. These sites can be recorded for monitoring purposes in combination with selective dating to enhance our understanding of long term patterns of change. Inspection of the selected loci can be conducted for evidence of underwater cultural heritage. The resultant material will provide valuable insights into the changes that can inform coastal managers of the long-term and ongoing processes. In addition, new archaeological discoveries will help engage with the public and raise the awareness.

Conclusion

As the submerged landscapes and coastlines erode, the land is reduced and volume of water increases. Deeper water and more of it results in greater impacts along the shoreline. Accordingly, each site outlined above is now accessible because the coastline and the prehistoric landscapes underwater are eroding away. Individually, they can provide new data about past environments and the people within them.

The value of the archaeological and historical resource has been demonstrated over the last two decades. Collectively, their study can provide a narrative that recounts the changes in sea-level and climate that effected the lives of people who lived along the shoreline for thousands of years. The recent exposures tell us where areas of threat are developing along the shoreline. This is information that can contribute to our understanding of the long-term patterns of change, and provide valuable data. This is an ideal case study to present to coastal managers across similar EU areas who have a responsibility to protect the shoreline.