21

Underwater Investigations at the Early Sites of Aspros and Nissi Beach on Cyprus

Albert J. Ammerman, Duncan Howitt-Marshall, Jonathan Benjamin and Tim Turnbull

This chapter presents the results of underwater reconnaissance work carried out in front of two early sites on Cyprus. In addition, it is the story of how a land-based project decided to get its feet wet. As late as 2003, there was only one good candidate for a site (Aetokremnos) dating to the pre-Neolithic on the island. In 2004, reconnaissance work on land made it possible to identify several new early sites (including Aspros and Nissi Beach) located on coastal formations of aeolianite. Previously, the archaeologist on Cyprus had essentially ignored the aeolianite that now holds one of the keys to the study of the origins of seafaring in the Eastern Mediterranean. Given the low position of sea levels prior to 10,000 years ago, there is a good chance that what one finds on land today is just the tip of the iceberg. At Aspros in the summer of 2007, the aim was to trace one of the early sites out into the water. For the first time on Cyprus, dive site C at the foot of a submerged cliff on the north bank of the Aspros River yielded a set of chipped stone pieces in the water. Much, of course, remains to be done at Aspros and Nissi Beach. The work undertaken so far represents just the first step toward learning more about early sites in submerged contexts on Cyprus.

Keywords: underwater archaeology, Cyprus, Younger Dryas, Aspros, Nissi Beach

Introduction

The aim of this chapter is to report on the underwater work recently done in front of two early sites on Cyprus: Aspros and Nissi Beach (Fig. 21.1). They both occur on coastal formations of aeolianite, the name for an old sand dune that has become lithified over the course of geological time. The two sites were identified by means of reconnaissance work on land in 2004 (Ammerman *et al.* 2006). The spatial distribution of the lithic scatters at each site (on land today) covers an area the size of a football field, and the chipped stone tools found on the surface in both cases date to the end of the Last Glaciation (*c*. 10,000 to 12,000 years ago). Previously, there was a lack of known prehistoric sites on the island dating back to this period of time. In section 2, more will be said about the reasons for initiating the fieldwork, the development of the project over the years, and the decision that we eventually made to get our feet wet.

By way of introduction, it is worth adding that since Cyprus is one of the very few large, offshore islands in the Eastern Mediterranean, the sites of Aspros and Nissi Beach now play a leading role in the study of the origins of seafaring in this part of the world (Ammerman 2010). In the case of Aspros the underwater reconnaissance work was conducted in 2007, and it led to the recovery of several pieces of chipped stone (Ammerman *et al.* 2008: 4–9). For the first time on Cyprus, a set of early lithics was recovered from a submerged context. This chapter has three main sections. After this brief introduction, the first section

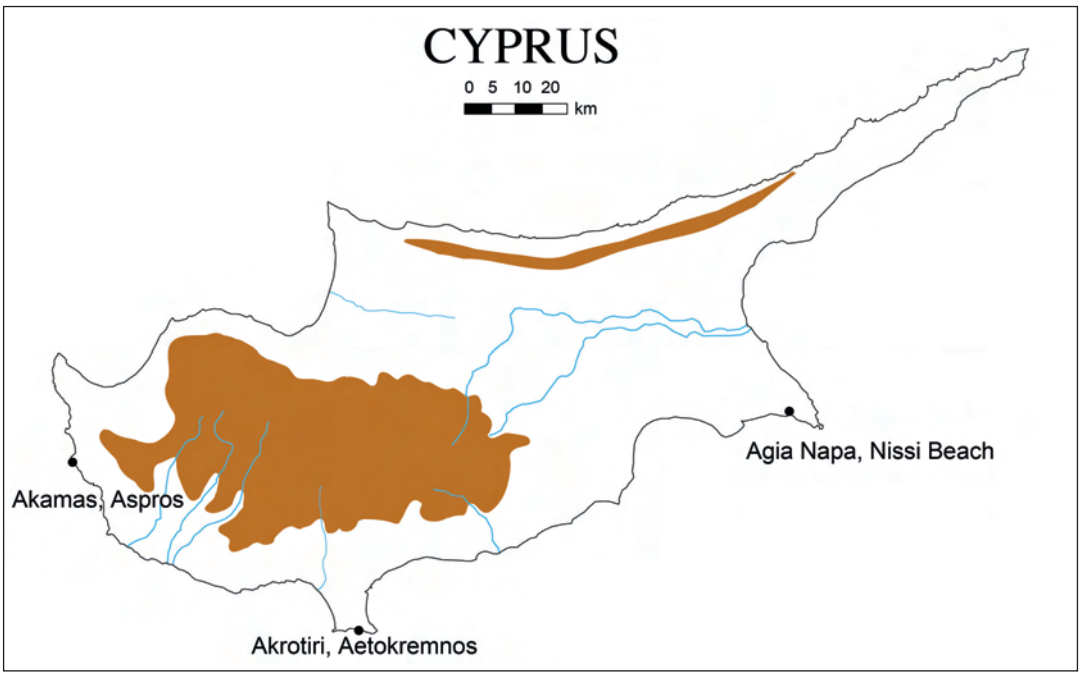

Figure 21.1: The location of the early sites in Cyprus. Underwater surveys have been carried out off the sites of Aspros and Nissi Beach

will describe the underwater reconnaissance work that was done in front of Aspros. The purpose of the second section – in light of the positive results at Aspros – is to step back and trace the steps in the evolution of our work over a span of six years (2004–2009). The purpose of the third section is to comment on where we stand today and what needs to be done next on Cyprus. In effect, this chapter is the story of a land-based project that, in time, came to realize – not without trepidation – that it had to take the plunge.

The underwater reconnaissance work at Aspros

As part of the environmental studies that Jay Noller carried out on land at Aspros in 2006, he drew a map (Fig. 21.2) showing where the shoreline would have stood at two times in the past: 6000 and 12,000 years ago (Ammerman *et al.* 2007: fig. 3). It is well known that sea level was lower at the end of the Last Glaciation (e.g. Lambeck and Chappell 2001; Peltier 2002; Lambeck *et al.* 2004). Given the bathymetry in front of Aspros, there would have been an area of dry land that was just over 1 km wide at the latter time. The implication for the archaeologist is that what one finds on land is probably just the tip of the iceberg. Thus, the logical thing to do would be to explore the submerged area just off the coast. Of course, this is something that is much easier said than done. To our knowledge, no one on Cyprus has ever tried to trace an early site out into the water before.

To start with, trying to find small pieces of chipped stone on the seabed at a depth of 10–12 m may pose a challenge even for a person with training in underwater archaeology. In practical terms, one can cover only a small area with the kind of close attention that is called for, and the success or failure of the work may well depend upon selecting the right place to look. The costs and the logistical aspects of doing underwater archaeology are not insignificant. And one could add to this list the possibility that the marine transgression at the end of the Last Glaciation

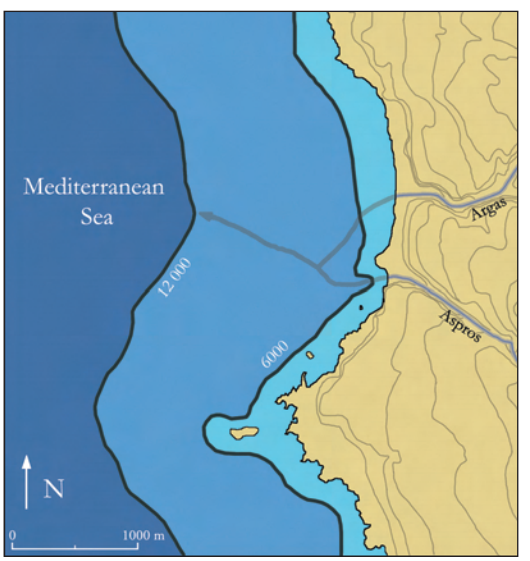

Figure 21.2: The environmental context of the Aspros site. Palaeoshoreline ages in cal yr BP

may have been less than friendly when it comes to the survival of an early site. On the other hand, such an investigation was something that we had to do, if we wished to obtain a more balanced and comprehensive picture of what was happening at Aspros. Fortunately, we can report that the underwater work in front of the site yielded positive results.

The fieldwork had two main aims: (1) the recovery of pieces of chipped stone from the seabed at a certain depth and distance from the coast (to show that this could be done), and (2) the acquisition of a better knowledge of what the submerged area in front of Aspros looks like in terms of its relief, its geology, and its potential for future reconnaissance work of this kind.

At this point, it is worth adding that some preliminary work had already been done in June of 2006 in order to find out whether or not underwater archaeology was really feasible at Aspros. Toward this end, Jonathan Benjamin, then a graduate student at the University of Edinburgh, came out to Cyprus and joined us at Aspros for a week. He explored the shallow area close to the shoreline by means of snorkeling; he also made two SCUBA dives from a boat off the coast to a depth of 15 m (Benjamin 2006). Although this trial work did not lead directly to the recovery of lithic material in the water, it was a valuable step in providing local knowledge on the submerged area in front of the site. In June of 2006, we also had the chance to put differential GPS equipment on a boat with a depth finder and to use it to make transects just to the west of the site (Ammerman *et al*. 2007: 8–13). One of the transects ran along the course of the Aspros River itself, and one was made on the river's south side. The three others covered the area to the north of the river. Thus, there was the chance to generate a good overall picture of the submerged relief just off the coast.

Unfortunately, Benjamin had other commitments that summer. Turnbull now took the lead in coordinating the work in the water and its documentation. The lead underwater archaeologist was Duncan Howitt-Marshall, a graduate student at the University of Cambridge. A total of thirteen dives were made at Aspros in the period between June 26 and July 4 (Ammerman *et al.* 2008: 4–9).

The basic approach was to concentrate on the north side of the Aspros River: the area to the west of the site on land. All of the dives except a deeper one (down to *c*. 28 m) were made at depths in the range of 6–15 m and at a distance of 50–200 m from the shoreline today. Dive sites of limited size were selected, and initial survey of the bottom was carried out with the aim of finding good potential places for closer inspection and the collection of pieces of chipped stone. Two or three divers working together as a lithic-recovery team were then assigned to such a place with the task of collecting the lithics on the bottom, while an over-watch dive master kept an eye on the progress of the work and documented the dive site. The divers soon learned from experience that the best way to search for small pieces of chipped stone on the seabed was by using a gentle hand fanning motion over the substrate to reveal underlying rock fragments and lithic pieces hidden beneath particles of coarse and fine sediments.

On the north bank of the Aspros River out to a depth of 15 m, one finds a westerly-directed extension of the geological formations of aeolianite and marine sandstone observed on land (Ammerman *et al*. 2007: 7). At a distance of *c*. 150 m from the present shoreline, there is a well-defined vertical 'step' or drop in the bedrock of the kind seen in outcrops of aeolianite just to the east of Aspros. The wave-cut terrace produced by the marine transgression is deeply eroded and scoured because of the soft character of the aeolianite in some places. Since it is less well lithified with depth, this kind of rock has a tendency to become undercut if it is exposed in a vertical face. Hence, the seabed immediately in front of Aspros takes the form of elevated spurs where the rock is more resistant to wave action and depressions and crevices where the bedrock is less resistant in character. Because of the 'case hardening' of the aeolianite at the valley edge (Ammerman *et al*. 2007: 7), the cliff on the north bank of the Aspros River, as seen for instance at dive site C, is more resistant to the marine transgression. In fact, this is why we chose it as one of our dive sites and, not surprisingly, it produced the best results of the 2007 season.

The first three dive sites that we selected all produced at least one lithic artefact. In each case, only part of the bottom was examined intensively in the limited time that was available (Ammerman *et al*. 2008: 7). The work at dive site A produced two intact ground stone tools. It is worth adding that pieces of ground stone have not been recovered from the land surface at Aspros, so the underwater reconnaissance work is adding something new here.

Dive site B occurs at a distance of approximately 135 m from the present shoreline, in a place where a long spur of the aeolianite terminates and there is a pronounced drop in the relief just to the west. In this case, the coverage reached a maximum depth of 13 m. At the start of the survey, the team made two dives at this site, and the work led to the recovery of two pieces of chipped stone.

Dive site C is clearly the one that produced the most interesting results. It occurs right on the north bank of the Aspros River. Here one finds a steep cliff some 4 m tall – much like the cliff that is seen on land at the south edge of the Aspros site (Ammerman *et al.* 2006: fig. 4). We examined the surface of the aeolianite at the top of the cliff and also the area at its foot (Fig. 21.3), where the land surface once stood in a position slightly above the riverbed of the Aspros. In all, the team made six dives in this place, working at depths of 9–12 m. At several different points along the foot of the cliff, the divers were able to recover chipped stone pieces that have survived in a fairly good state of preservation (Figs 21.4 and 21.5). On the bottom, one finds a coarse sediment that is rippled into ridges oriented at right angles to the easterly-directed wave action. Small gravels, pebbles, and even the occasional piece of sub-angular rock are sequestered in the intervening furrows. At the top of the cliff, the rocky surface is dominated by a low algal growth; one encounters here and there either small depressions filled with sediment or else pockets of rock occasionally overlain with mats of dead seagrass. On the whole, visibility is more limited in the upper part of dive site C. For this reason, less effort was put into the coverage there. In all, a total of 38 pieces of chipped stone were recovered at dive site C.

The size of the lithic sample at dive site C is, of course, small, and there may be some biases when it comes to the sizes and the shapes of the lithics that the divers were able to see in the water. The important thing at this stage of the research is that the fieldwork did lead to the recovery of lithics in a submerged context and that the material is made with the same reduction technology found on land at Aspros. Pieces classified as cultural in the underwater sample by Carole McCartney, our lithic specialist, were clearly produced by conchoidal fracture, though all of them have been altered to some extent by the mechanical action of waves and abrasion from sand. Because of this, the artefacts are highly fragmentary, and formal tools are more easily recognized than informal utilized implements,

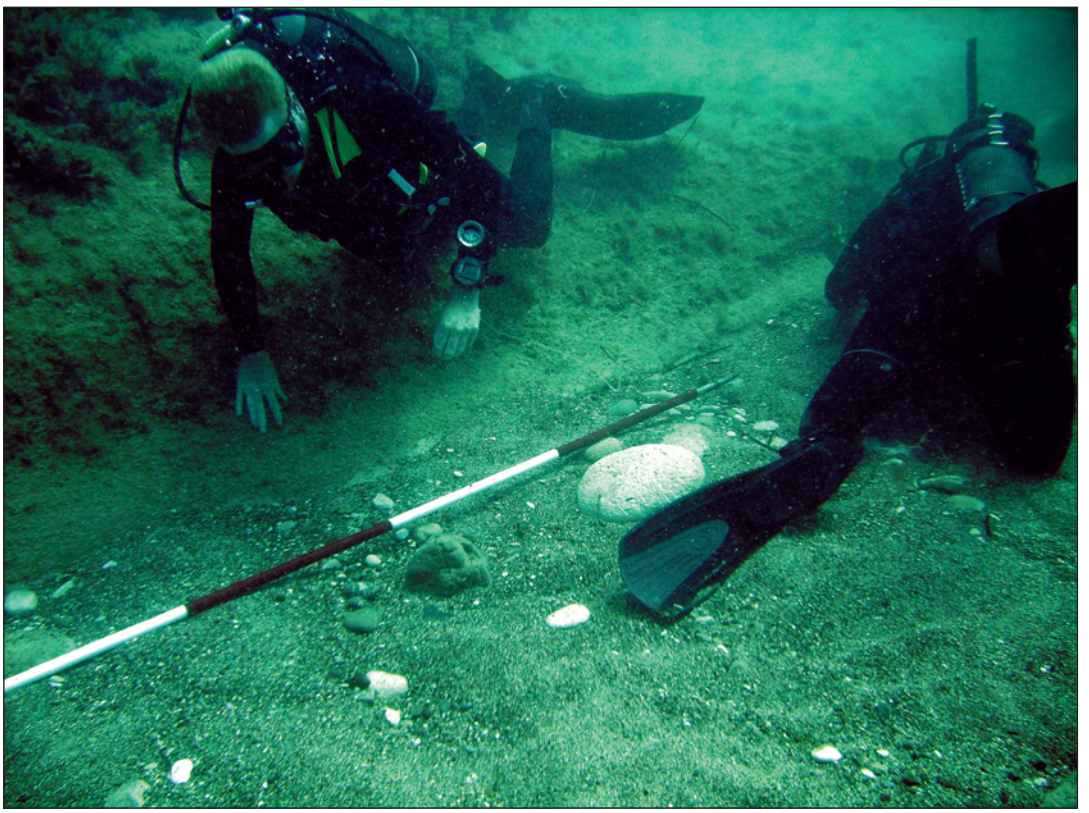

Figure 21.3: Work in progress at dive site C in front of Aspros (Photo: A. J. Ammerman 2007)

Figure 21.4: Example of lithics from dive site C off Aspros (Photo: A. J. Ammerman)

which are poorly attested. Cores are absent from the underwater sample, which is dominated by debris and equal numbers of unworked blanks (mainly chips) and tools. The pieces classified as tools include: one backed piece, one notch, two perforators, four pieces with miscellaneous retouch, and two utilized flakes (Ammerman *et al*. 2008: 19).

What is now called for at dive site C is the more active extraction of the chipped stone pieces from the sediment by using appropriate mechanical means, so that a larger sample of lithics as well as more diagnostic tools can be recovered (as suggested by Anders Fischer at the EAA meeting held in September 2009). The real challenge now is to assemble the right team with the right equipment on Cyprus and to obtain sufficient funding for the next cycle of more intensive underwater work at Aspros. In retrospect, it is perhaps not all that surprising that we were able to recover early lithics on the seabed where we did, since dive site C is close to a place on the landscape where two rivers, the Aspros and the Avgas, once came together (see Fig. 21.2).

Evolution of the research

The purpose of this section is to place the underwater work at the two sites in its wider context. Doing underwater archaeology was the last thing that the first author had on his mind in the autumn of 2003 when he went out to Cyprus as a Fulbright Senior Scholar with the task of finding the missing pre-Neolithic sites on the island.

Indeed, it was far from clear in 2003 whether or not the fieldwork (on land) would be all that productive. Previously, others had carried out surveys in search of pre-Neolithic sites on Cyprus. But they had come away empty-handed. It was entirely possible that this would be our fate as well. Many of the friends and colleagues of the first author thought that he was not making a wise decision in going out to Cyprus. At the time, the only good candidate for a pre-Neolithic site on the island was Aetokremnos on the Akrotiri Peninsula (Simmons 1999). However, this site (a collapsed rockshelter found by a British schoolboy and not by an archaeologist) was the subject of much debate in the literature (e.g. Binford 2000; Ammerman and Noller 2005). And, in 2003, the conventional wisdom still had it that coastal foragers were reluctant seafarers and that pre-Neolithic sites were hard to find on the Mediterranean islands (e.g. Cherry 1990). The new early sites that would soon come to light on Cyprus (Ammerman *et al*. 2006, 2007) and Crete (Strasser *et al*. 2010) together with the ones recently documented on several islands of the Aegean would now show that these were old and misguided ideas (Ammerman 2010).

As it turns out, what had been missing all

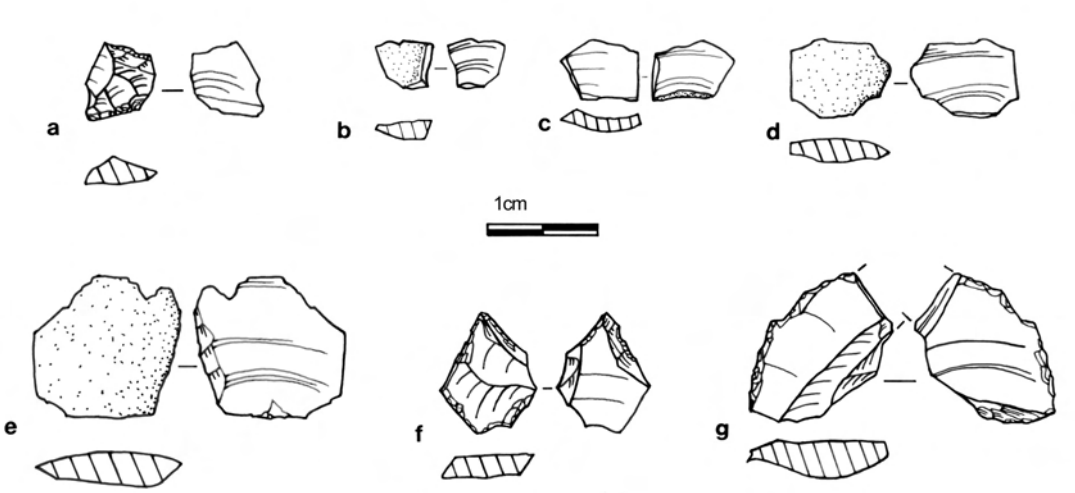

Figure 21.5: Characteristic lithic specimens from Aspros site C (2007 Survey): backed piece (a), chips (b–c), core-opening flakes (d–e), perforator (f), retouched flake (g) (Drawings: Tom Davis)

along on Cyprus were not the early sites but the right approach to finding them. If one looked on the formations of aeolianite around the coast, which archaeologists had essentially ignored before, the sites were sitting there on the land surface – patiently waiting to be discovered. In retrospect, the problem of the missing pre-Neolithic sites on Cyprus was due, in many ways, to the success of the multi-period survey itself. Embedded in the sampling strategy of such surveys, as they were commonly done in the 1970s and 1980s, was an agricultural agenda, which discouraged the archaeologist from covering the aeolianite.

What sparked the first author's interest in going out to Cyprus was the new evidence from the excavations at Shillourokambos and Mylouthkia: namely, the new knowledge that the Neolithic package on the mainland had already crossed the sea by 8000 cal BC (e.g. Guilaine and Le Brun 2003; Peltenburg and Wasse 2004). For such an early and rapid transition to the Neolithic to have taken place, it was reasonable to think that there must have been a prelude to it: that is, coastal foragers from the mainland were making seasonal trips to the island before that time. By taking a new approach to reconnaissance work on the island (Ammerman *et al.* 2006), we soon had the chance to find Nissi Beach, Aspros, Alimman, and several other new early sites on the island.

The new sites, as mentioned before, are all located on coastal formations of aeolianite. In planning the reconnaissance work, we specifically set out to cover such places on the landscape since the aeolianite offers favourable conditions for the visibility of small pieces of chipped stone on the ground. At first glance, this part of the landscape appears to be a rather inhospitable one. However, if one takes a closer look, the aeolianite offers a good place for making a short-term campsite. There is little or no vegetation to clear, and the land surface is invariably a dry one. In addition, the local configuration of the bedrock can provide in some cases what amounts to built-in, Stone Age 'furniture' (see Ammerman *et al.* 2008: fig. 7).

The study of the lithic material recovered at the two new early sites was done by Carole McCartney who had previously examined the chipped stone assemblage at Aetokremnos. What one is dealing with in each of the three cases is a reduction technology that is quite different from the blade-oriented one normally found at sites of Pre-Pottery Neolithic (PPN) B age on Cyprus. Instead, the lithic tradition at all three sites is a more expedient one; it involves the production of small flakes from local pebbles and cobbles. In addition, the types of stone tools recovered at Aspros, Nissi Beach, and Aetokremnos are, for the most part, much the same (Ammerman *et al.* 2006: 11–17; Ammerman *et al.* 2008: 17–26).

From the excavations at Aetokremnos, there are eight ^{14}C dates on samples of charcoal whose calibrated ages (Fig. 21.6) date to the time between *c*. 11,000 and 9500 cal BC (Ammerman *et al.* 2007: fig. 9). Thus, it was now possible to put forward the working hypothesis that the advent of seafaring (on a recurrent basis and not just an accidental voyage or a rare case of rafting) in the Eastern Mediterranean goes back to the Younger Dryas (Ammerman *et al.* 2006: 18). Working independently on a review article in the same year, Broodbank (2006: 208–11) came up with the same idea: that is, the connection between the Younger Dryas and the birth of seafaring in the Mediterranean world. Previously, the evidence for pre-Neolithic sites on offshore islands in the Eastern Mediterranean was so thin that no one was in a position to advance this hypothesis.

The next steps in the work at the two sites were taken in June of 2006 when Benjamin came out to Cyprus to conduct his underwater feasibility study. At that time, only 18 months had elapsed since the discovery of Aspros in December of 2004. In other words, we were already starting to think about getting our feet wet. However, it was Benjamin (2006) who took the real initiative and asked if he could come out and work with us. And everyone has benefited from his eagerness to do so. Noller's map (Fig. 21.2) now became the centrepiece in an on-going mental tug-of-war between optimism and scepticism over whether we should take the plunge or not. In the end, the decision was made to go for it. And we began to cobble together a team of divers for the underwater survey at Aspros in the summer of 2007. Again, there were friends and colleagues who thought that we were not making a wise decision. In their view, the risks of spending a good deal of time, money and effort and then coming up with nothing in the end were simply too great. However, we were now ready to take the chance. And we had the good fortune to focus our attention on the 'case-hardened' cliff at dive site C.

But the story is not over. In January and February of 2007, we took the next step and

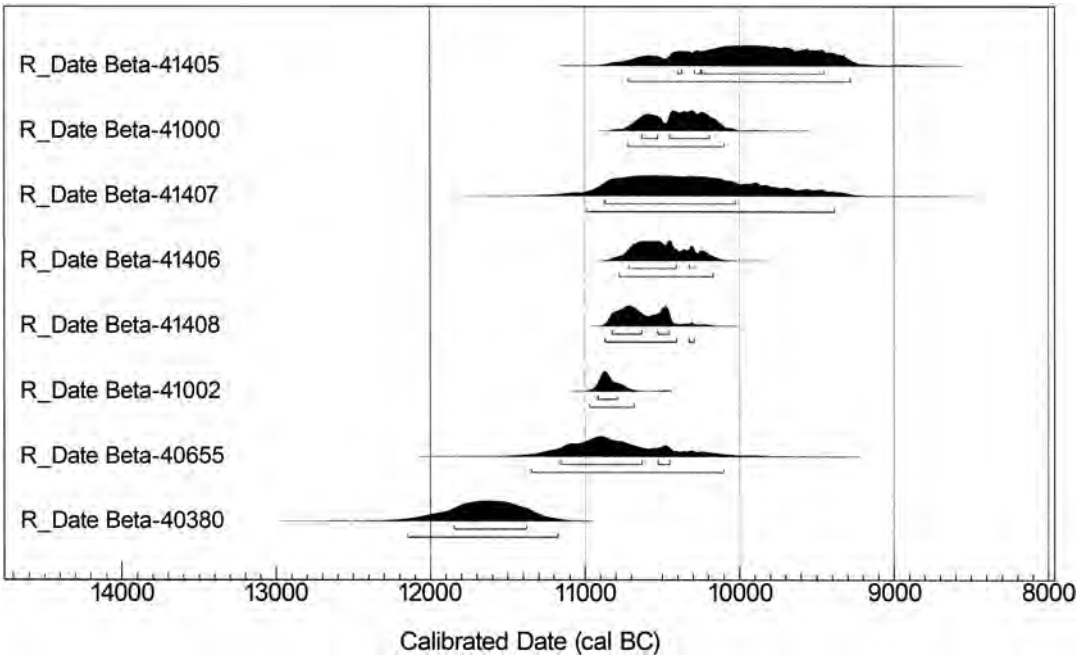

Figure 21.6: Two-sigma calibrated age ranges of eight radiocarbon dates run on samples of charcoal from stratum 2A at Aetokremnos. Calibrations performed with OxCal 4.0.1 (Bronk Ramsey 2001), using the IntCal04 calibration curve (Reimer et al. *2004)*

began to make trial excavations at Aspros and Nissi Beach. In low places on the aeolianite, there are patches of old soil that one can excavate. It was now possible to recover pieces of chipped stone in the context of a well-developed reddish-brown palaeosol at both sites. In the case of Aspros, the four small trial trenches excavated in 2007 all yielded a number of pieces of chipped stone. And the lithics – in terms of their raw materials, reduction technology, and tool types – were essentially the same as those found on the site's surface. However, in quantitative terms, the material recovered from a given trench was always quite modest (in the range of 7–25 pieces of chipped stone per square metre).

There was now the realization that such small numbers were probably to be expected since the places where we were digging were not located on or near the shoreline at the time but at a fair distance behind it. Thus, the results coming in from the excavations at Aspros now began to make their own separate case that the main places where the coastal foragers had once made their campsites were closer to the shoreline at the time. The two new areas that we excavated at Aspros in February of 2008 yielded much the same results. For example, the excavation in Area V, where the local outcrop of aeolianite made it a good place to sit, produced 16 pieces of chipped stone in a small, enclosed space, and half of them were tools. In short, this was a place on the landscape – once situated well back from the shoreline and visited only occasionally – where one or a few curated pieces of chipped stone were discarded from time to time. The real locus of human activity prior to 10,000 years ago must have been elsewhere. By this time in the project's evolution, we had already taken the plunge at Aspros and found the chipped stone pieces on the seabed at dive site C.

Finally, there was a new development at Nissi Beach that made us want to get our feet wet there for a different reason. It arose from the new observations on site formation processes that were made by Ioannis Panayides of the Cyprus Geological Service in 2008. He drew attention to the large number of beach rock fragments found on the site's surface and also in the top 4 cm of the soil (but not below this depth in the ground). Such pieces are now seen as the consequence of one or more tsunamis (Ammerman *et al.* 2008: 12–15, 29). In other words, there is an inverted stratigraphic sequence at Nissi Beach. The oldest lithics are found on top where they occur in a redeposited context. This material rests in turn on a well-developed palaeosol, which has yielded *in situ* features and chipped stone tools (made in a related but somewhat different lithic tradition) that date to the 8th and 7th millennia cal BC on the basis of AMS dates run at Oxford. The radiocarbon dates are coeval with those produced by a site of Pre-Pottery Neolithic age on Cyprus such as Shillourokambos.

The new evidence at Nissi Beach came as a

complete surprise to us. No one had expected to encounter the persistence of coastal foraging down to such a late date (e.g. Ammerman 2011). This now means that there was once the coexistence of first farmers and late coastal foragers on the island. Nissi Beach is accordingly adding a whole new chapter to 'Neolithic' studies on Cyprus. The excavation of a larger area at the site in February of 2009 confirmed the inverted stratigraphy at Nissi Beach. This gave us a further reason to learn more about the nature of things on the seabed in front of the site.

It is worth adding briefly here that an underwater feasibility study was initiated at Nissi Beach in June of 2009. The work was exploratory in nature, and it was done over the course of four days. One of its main aims was to learn more about the submerged relief and geology in front of the site. This is not the time or place to go into a detailed account of what was observed in the water. A finding of special interest was the identification of a low ridge of aeolianite at a depth of 36 m that runs parallel to the coast and steps down on its seaward side. In short, the ridge – much like the one occurring at the site of Nissi Beach itself – offers a flat area some 100 m wide, which would have made a good place for a campsite near the coast at the time of the Younger Dryas. It was concluded that the submerged landscape off Nissi Beach appears to have potential for underwater prehistory.

Conclusion

In closing, it is worth adding a few words about where the underwater study of coastal foragers on Cyprus stands at the present time as well as what needs to be done next. The main point to make here is that the first steps have only been taken in the last few years, and these steps have to be seen as modest and exploratory ones.

Prior to 2006, no proper study of this kind was undertaken on the island. In fact, even as late as 2003, there was only one good candidate for a pre-Neolithic site on Cyprus. The situation has now changed. Of course, a great deal remains to be done at Aspros and Nissi Beach and elsewhere around the island. In the case of dive site C at Aspros, it would make good sense to bring in equipment that will make it possible to process a large volume of sediment and obtain a larger sample of stone tools. At the same time, there is the need to conduct more detailed studies on the nature of the sediments themselves.

So we are, on one hand, just at the beginning of this kind of work on Cyprus. On the other hand, if one looks back and takes the long view, the work at Aspros represents a turning point (Ammerman *et al.* 2008: 27). Although it was well known that sea levels around the world were lower in the time before 6000 years ago and this was a concept that had entered the archaeological literature on Cyprus some years ago (Gomez and Pease 1992), there was for many years no attempt by the prehistorian to rise to the challenge and search for early sites in the water. The idea that what one finds on land is the tip of the iceberg was just that: simply a working hypothesis (something that could be either right or wrong). Now this uncertainty has been removed. What is found on land at Aspros is indeed just part of the picture. The world of early coastal foragers on Cyprus has to be seen as larger and richer than the prehistorian had previously envisioned.

In retrospect, this is something that should come as no surprise. If we consider what has come to light in the Baltic Sea and the North Sea over the last thirty years (cf. multiple authors in this volume), this is what we should have expected all along. The real surprise then is the time lag between the developments in Northwest Europe and those in the Eastern Mediterranean. The notable exception here is the excellent work that has been done at the submerged Neolithic settlement of Atlit-Yam off the Carmel coast of Israel (e.g. Galili *et al.* 2004; Galili and Rosen, this volume). What is implied here is that those who work on submerged early sites in the Eastern Mediterranean still have much to learn from their colleagues in Denmark, Germany, and Great Britain.

The challenge then is the transfer of technology and experience from one region of Europe to another one. It will take time, international collaboration, and proper funding to accomplish this. So far, all of our work in the water on Cyprus has been done on a shoestring. In other words, the investigations in front of Aspros and Nissi Beach are pioneering efforts that drew upon the goodwill of those on our dive teams. In moving to the next stage of the investigation, what is called for is a joint international project that will enable us to work on a larger scale and with the latest equipment. In addition, given the age of the earliest coastal foragers on the island (older than 10,000 cal BC) and the low position of sea levels at the end of the Last Glaciation, we shall probably have to think in terms of diving

to greater depths in the water. Otherwise, much of the submerged picture will remain missing. In turn, this will call for a more technical approach to diving.

At the *Submerged Prehistory* session of the European Association of Archaeologists (EAA) meeting 2009, it came as something of an eye-opener to learn that comparatively little work on early sites in European waters has been done at depths of more than about 15 m so far. In the recent exploratory work in front of Nissi Beach, we observed submerged areas at depths of more than 30 m where the aeolianite may well offer a good place for early campsites. Thus, Cyprus, notwithstanding its late start, may one day have a significant contribution to make to the field of submerged prehistory in Europe – perhaps comparable to the role that the island now plays in the study of the origins of seafaring in the Mediterranean world.

References

Ammerman, A. J. 2010. The first Argonauts: towards the study of the earliest seafaring in the Mediterranean. In Anderson, A., Barrett, J. H. and Boyle, K. V. (eds) *The Global Origins and Development of Seafaring*. Cambridge, McDonald Institute for Archaeological Research: 81–92.

Ammerman, A. J. 2011. The paradox of early voyaging in the Mediterranean and the slowness of the Neolithic transition between Cyprus and Italy. In Vavouranakis, G. (ed.) *Seascapes in Aegean Prehistory*. Athens, Danish Institute at Athens: 11–29.

Ammerman, A. J. and Noller, J. S. 2005. New light on Aetokremnos. *World Archaeology* 37: 533–543.

Ammerman, A. J., Flourentzos, P., McCartney, C., Noller, J. and Sorabji, D. 2006. Two new early sites on Cyprus. *Report of the Department of Antiquities, Cyprus*: 1–22.

Ammerman, A. J., Flourentzos, P., Gabrielli, R., McCartney, C., Noller, J., Peloso, D. and Sorabji, D. 2007. More on the new early sites on Cyprus. *Report of the Department of Antiquities, Cyprus*: 1–26.

Ammerman, A. J., Flourentzos, P., Gabrielli, R., Higham, T., McCartney, C. and Turnbull, T. 2008. Third report on early sites on Cyprus. *Report of the Department of Antiquities, Cyprus*: 1–32.

Benjamin, J. 2006. Underwater archaeological feasibility report for the Aspros site, western Cyprus. Unpublished technical report, University of Edinburgh.

Binford, L. 2000. Review of *Faunal Extinction in an Island Society: Pygmy Hippopatumus Hunters of Cyprus*, by A. H. Simmons. *American Antiquity* 64: 711.

Bronk Ramsey, C. 2001. Development of the radiocarbon calibration program OxCal. *Radiocarbon* 43: 355–363.

Broodbank, C. 2006. The origins and early development of Mediterranean maritime activity. *Journal of Mediterranean Archaeology* 19: 199–230.

Cherry, J. F. 1990. The first colonization of the Mediterranean islands: a review of recent research. *Journal of Mediterranean Archaeology* 3: 145–221.

Galili, E., Lernau, O. and Zohar, I. 2004. Fishing and maritime adaptations at Atlit-Yam, a submerged Neolithic fishing village off the Carmel coast, Israel. *Atiqot* 48: 1–34.

Gomez, B. and Pease, P. P. 1992. Early Holocene Cypriot coastal palaeo-geography. *Report of the Department of Antiquities, Cyprus*: 1–8.

Guilaine, J. and Le Brun, A. (eds) 2003. *Le Néolithique de Chypre: Actes du Colloque Internationale Organisé par le Département des Antiquités de Chypre et l'École Française d'Athènes, Nicosie, 17–19 Mai, 2001*. Bulletin de Correspondance Hellénique, supplement 43. Athens, École Française d'Athènes.

Lambeck, K. and Chappell, J. 2001. Sea level change through the last glacial cycle. *Science* 292: 679–686.

Lambeck, K., Antonioli, F., Purcell, A. and Silenzi, S. 2004. Sea-level change along the Italian coast for the past 10,000 yr. *Quaternary Science Reviews* 23: 1567–1598.

Peltenburg, E. and Wasse, A. (eds) 2004. *Neolithic Revolution. New Perspectives on Southwest Asia in Light of Recent Discoveries on Cyprus*. Oxford: Oxbow.

Peltier, W. R. 2002. On eustatic sea level history: Last Glacial Maximum to Holocene. *Quaternary Science Reviews* 21: 377–396.

Reimer, P. J., Baillie, M. G. L., Bard, E., Bayliss, A., Beck, J. W., Bertrand, C. J. H., Blackwell, P. G., Buck, C. E, Burr, G. S., Cutler, K. B., Damon, P. E., Edwards, R. L., Fairbanks, R. G., Friedrich, M., Guilderson, T. P., Hogg, A. G., Hughen, K. A., Kromer, B., McCormac, G., Manning, S., Bronk Ramsey, C., Reimer, R. W., Remmele, S., Southon, J. R., Stuiver, M., Talamo, S., Taylor, F. W., Van der Plicht, J. and Weyhenmeyer, C. E. 2004. IntCal04 terrestrial radiocarbon age calibration, 0–26 cal kyr BP. *Radiocarbon* 46: 1029–1058.

Simmons, A. H. 1999. *Faunal Extinction in an Island Society: Pygmy Hippopotamus Hunters of Cyprus*. New York: Kluwer.

Strasser, T. F., Panagopoulou, E., Runnels, C. N., Murray, P. M., Thompson, N., Karkanas, P., McCoy, F. W. and Wegmann, K. W. 2010. Stone Age seafaring in the Mediterranean: evidence from the Plakias region for Lower Palaeolithic and Mesolithic habitation of Crete. *Hesperia* 79: 145–190.