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# Submerged Prehistory

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# Contents

# The Pavlopetri Underwater Archaeology Project: investigating an ancient submerged town

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*Pavlopetri, off the coast of Laconia, Greece, is a submerged prehistoric town, which consists of intact building foundations, courtyards, streets, graves, and rock-cut tombs. New underwater research in 2009 consisted of detailed underwater survey of the structural remains (using a robotic total station and sector-scan sonar technology) alongside sampling of the artefactual material across the site. In addition to the digital recording of the 30,000 $m^2$ of previously known buildings, over 9000 $m^2$ of new buildings were discovered in 2009 including a large rectangular hall and a street lined with buildings. The ceramics recovered confirm the Mycenaean occupation of the site but also reveal occupation as early as 3500 BC making Pavlopetri, at over 5000 years old, the oldest known submerged town in world.*

**Keywords**: submerged settlement, underwater survey, sector-scan sonar, Bronze Age Greece, Mycenaean, processes of submergence

## Introduction

In 2009 the University of Nottingham, through a British School at Athens permit, began a five-year collaborative project with the Ephorate of Underwater Antiquities of the Hellenic Ministry of Culture and Tourism and the Hellenic Centre for Marine Research (H.C.M.R.) to outline the history and development of the submerged prehistoric town at Pavlopetri, which lies just off the Pounta shore, opposite the island of Elaphonisos, in southern Laconia (Fig. 17.1). Through detailed digital underwater archaeological survey (2009–2010) and targeted underwater excavations (2011–2013), the Pavlopetri Underwater Archaeology Project aims to establish when the site was occupied, what it was used for and, through a systematic study of the geomorphology of the area, how the prehistoric town and the Strait of Elaphonisos became submerged. More broadly, the project aims to shed light on the importance of Pavlopetri


*Figure 17.1: Location of the submerged ancient town of Pavlopetri*

in terms of maritime control over the Laconian gulf and southern Peloponnese and the role of the settlement in maritime trade and the regulation of trade networks in the Aegean and beyond.

## Project background

Submerged archaeological remains were first identified off the coast of southeastern Laconia in the west end of the Bay of Vatika in 1904 by the geologist Fokion Negris (1904: 362–3) but the importance of his discovery was not widely recognized at the time. The remains were re-discovered in 1967 by Nicholas Flemming who identified and confirmed the existence of a prehistoric town at the location (Flemming 1968a, 1968b).

In 1968 a team from the University of Cambridge surveyed the submerged remains over six weeks using a fixed grid system and hand tapes (Harding *et al*. 1969; Harding 1970). They produced a plan of a prehistoric town covering an area of *c*. 300 × 100 m, lying in 1–4 m of water. At least 15 separate building complexes (consisting of a series of rooms), courtyards, streets, two chamber tombs, and 37 cist graves were identified. The underwater site was seen to continue southward on Pavlopetri Island on top of which the remains of walls and archaeological material were still visible. On the Pounta shore they recorded an extensive cemetery of at least 60 rock-cut graves that have been provisionally dated on the basis of their architectural plans to the Early Helladic (EH) period (3000–2000 BC). The 1968 project recovered a small amount of surface finds from the seabed (mainly pottery, but also obsidian and chert blades and a bronze figurine), which suggested a date range from the Early to the Late Bronze Age (*c*. 2800–1180 BC) (Harding *et al*. 1969: 132–7). On the basis of the higher frequency of Late Helladic ceramics, however, the submerged buildings at Pavlopetri were considered to date mainly from the Mycenaean period (1650–1180 BC) (Harding *et al*. 1969: 139). Evidence for the later occupation or use of the site has been provided by the occurrence of a fair quantity of later pottery, namely a fragmentary Hellenistic cooking-pot, black-glazed sherds and fragments of ribbed ware of Roman date, and sherds with wavy grooved decoration of the late 6th or 7th century AD (Harding *et al*. 1969: 137–8). After the 1968 survey no further research was carried out and the site was placed under the care and protection of the Greek State.

In 2007 a postdoctoral researcher in the Department of Archaeology at the University of Nottingham, Chrysanthi Gallou, began a reassessment of the 1968 finds from Pavlopetri as part of her wider research on prehistoric Laconia. She began discussions with Jon Henderson about the possibility of returning to the site to carry out further archaeological work. The Pavlopetri Underwater Archaeology Project began to take shape when, together with Nicholas Flemming, the two visited the site in 2008, exactly 40 years after the original Cambridge survey, and discovered its remains were still well preserved on the sea floor. Following this trip, a five-year plan of survey and excavation was conceived in collaboration with the Ephoreia of Underwater Antiquities of the Hellenic Ministry of Culture and Tourism.

## 2009 survey season

Over two-and-a-half weeks from May to June 2009, a joint Greek and British team of archaeological divers and archaeologists under the general direction of Elias Spondylis and Jon Henderson began the essential first stage of the project: to accurately record, using modern digital techniques, the surviving architectural remains on the site as well as recover and study a range of archaeological surface finds from across the site. Thus, fieldwork consisted of detailed digital underwater survey of the structural remains (using shore-based total stations and revolutionary sector-scan sonar technology) alongside sampling of the artefactual material across the site.

### *Survey techniques*

In 2009 the project employed two cutting-edge methods of underwater survey. First, points were taken using a shore-based robotic total station equipped with data-logging software and a pen-based computer. The total station was used to target divers taking points in the water using a detail pole equipped with a prism. These points were displayed on the computer screen as they were taken, which is particularly advantageous for underwater survey; it means that grids and tapes do not have to be set up underwater and divers can position themselves at any point on the site at any given time (Henderson and Burgess 1996). The key difficulty with this technique is ensuring that

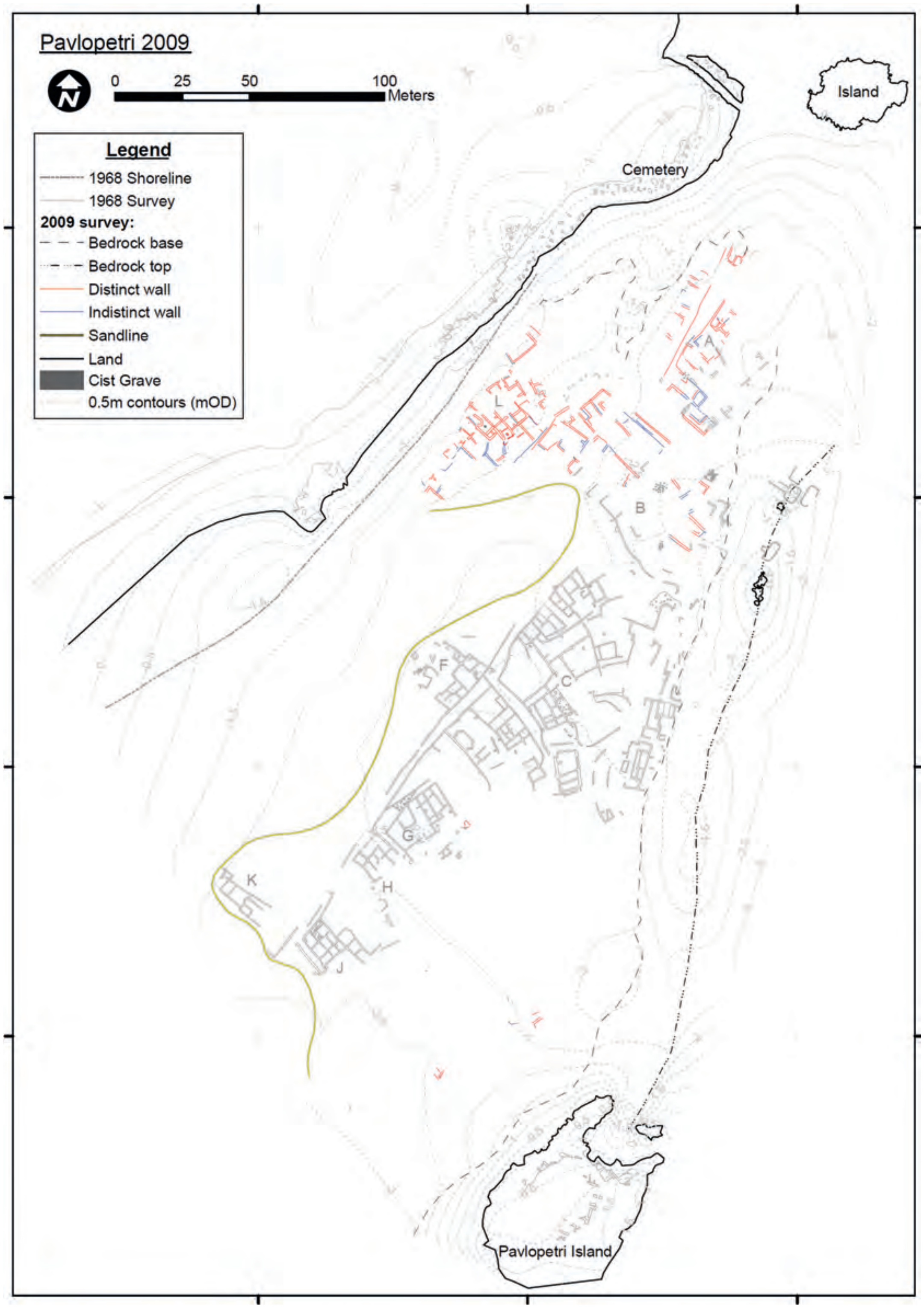


*Figure 17.2: 2009 total station contour survey of Pavlopetri*

the detail pole in the water remains vertical over the point to be taken underwater. A lightweight aluminium detail pole was designed for the project, which could be extended from 1–5 m in height. The pole has bubble levels attached throughout its length, which can be read by divers in the water. The pole is used in the water by four divers, two working underwater and two snorkelling on the surface. The first diver is present at the bottom of the pole to place it on the point to be taken, while the second diver decides on the next point to be taken. Using a series of signals the divers underwater and the surveyor on shore can communicate with one another quite effectively through the snorkellers on the surface. As well as facilitating communications, the snorkellers are responsible for ensuring the staff is vertical – looking at the bubble levels, one holds the staff and ensures it is in line with the total station on the shore while the other snorkeller, positioned to the side of the staff, ensures there is no tilting away from or toward the shore. Using the bubble levels the maximum error (where only half the bubble was inside the centre circle of the bubble level) was found to be less than 5 cm at a full pole extension of 5 m. The most common staff height was 3.5 m ensuring errors of less than 3.5 cm for the majority of the points taken. The accuracy of the instrument was tested twice a day on known reference points on the site. The shallow nature of the site and its proximity to the shore allowed the survey to be carried out to similar levels of accuracy and speed as achieved on terrestrial sites (Fig. 17.2).

In addition to the total station work, trial survey was carried out using a Kongsberg–Mesotech MS 1000 sector-scan sonar under the direction of Nautilus Marine Group International – a company that uses this new technology in the commercial sector to carry out underwater inspections and surveys of bridges, dams, ports, and harbours. The sector-scan sonar is a device that generates high quality metrically accurate images of the underwater environment, and as such has great potential for underwater archaeological survey.

Side-scan sonar has been traditionally used in maritime archaeology to locate archaeological sites and map areas of seabed. Specifications and models of side-scan sonar vary but all must either be hull-mounted or towed by a vessel. For side-scan to operate the survey vessel must be in constant motion through the water which makes it difficult to use in confined areas such as Pavlopetri and, equally, side-scan units usually cannot be deployed in shallow water (<4 m). Since the sector-scan sonar operates from a fixed position on the seabed it is better suited to planning individual sites in detail as the location of areas being scanned can be more tightly controlled. It is relatively simple to redeploy the sector-scan sonar over known points, to revisit and rescan important areas, and as a result build up a more detailed record of a site over time. The sector-scan sonar can be deployed in depths of up to 3000 m but, crucially for the work at Pavlopetri, it can also be used in extremely shallow water – as long as the sonar head is immersed it will function. It can thus operate in depths of water as shallow as 0.5 m and obtain accurate data.

*Figure 17.3: The Kongsberg MS 1000 sector-scanner as it is deployed underwater. The device is secured within a protective tripod, which is lowered onto the seabed*

The system consists of a sonar operating computer housed on a boat, which directly connects through a high tensile weight cable to a sonar head unit hung from a movable stainless steel tripod in the water (Fig. 17.3). The in-water sonar unit can be accurately positioned on the seabed using GPS position fixing to within ±50 mm. The sonar head transmits a very narrow acoustic beam, which is swept vertically so that the returning echoes indicate the distance and angle of depression to the many reflectors. Since the position of the transmitter is fixed, it can obtain higher levels of resolution of acoustic data than conventional side-scan or echo sounder units. The sonar head incorporates a stepped motor that allows full 360° scan coverage of the area surrounding the unit, with successive high-resolution pulses. A high-frequency (675 KHz) acoustic ping is transmitted from the sonar head and the system waits to receive the echoed returns. Once the return is received the motor steps the transducer in parts of a degree to a new azimuth angle, and the process is repeated. This is done until a full 360° circular sweep is carried out. The scan radius is set by the operator and may range in distance from 5 m to 1000 m. It normally takes between two and five minutes to complete an individual scan once the head is deployed on the seabed. As the distance from the scanning head increases, the quality of the image decreases.

Typical scan radii used for the submerged structures at Pavlopetri ranged from 100 m scans of building complexes (covering a total seafloor area of 31,000 $m^2$) down to very high resolution 5 m scans of areas of importance such as cist graves (Fig. 17.4). Image resolution is improved by moving the sonar head closer to the feature being imaged. In terms of recording individual buildings, scan radii between 15 m and 30 m were found to be most effective producing measured scans in which the individual stones used in the construction of the walls were visible. In much the same way as a terrestrial laser-scanner cannot see through solid objects, the sector-scan will produce an acoustic 'shadow' behind upstanding features that it images. To overcome the problems of acoustic 'shadow', the in-water sonar unit is redeployed at additional locations around

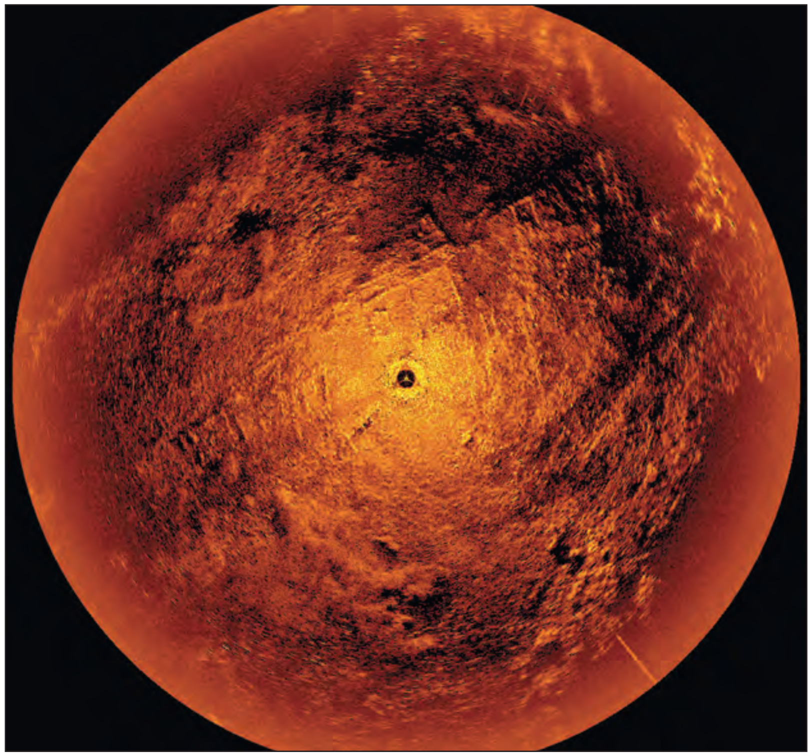

*Figure 17.4: 100 m radius sector-scan of Pavlopetri. Scanner is located 10 m to the south of Building IX in Area C*

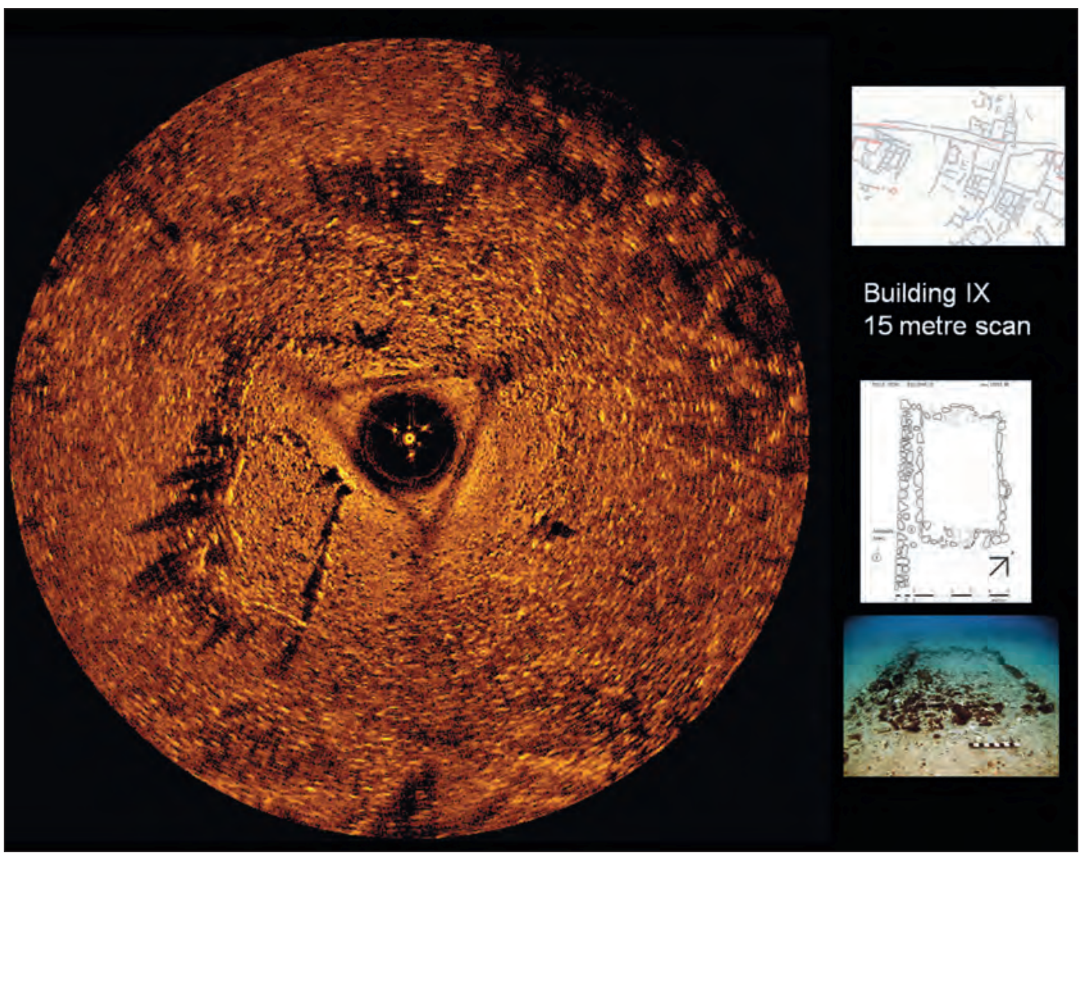


*Figure 17.5: 15 m radius scan of Building IX, Area C*

structures to map the areas in 'shadow'. A mosaic can then be created of all the scans taken of a given area to eliminate shadows and produce a highly detailed and accurate composite master image. In order to fully image individual buildings at Pavlopetri at least one scan from within a building was needed, backed up by at least four separate scan locations around the perimeter of the building to eliminate areas of acoustic 'shadow' (Fig. 17.5).

The ability to visualize submerged archaeological features and produce measured scans of them in a matter of minutes has obvious advantages to the practice of underwater archaeology. The MS 1000 sector-scan sonar provides instantaneous high-resolution seafloor scans that consist of three-dimensional point cloud data comparable to that produced by terrestrial laser scanners. Carrying out circular scans from known points fixed by GPS the whole site plan at Pavlopetri was mapped in a matter of days. All of the upstanding structural elements of the site – buildings, streets, courtyards, walls, and graves – were recorded in three dimensions alongside the topography of the seabed. The data produced by the sector-scan sonar can be manipulated in 3D environments to produce isometric images of the building complexes at Pavlopetri. Over the coming year the sector-scanning data will be combined with the total station data to produce accurate three-dimensional models of the site.

***Discoveries***

The visible architectural remains at Pavlopetri begin some 20 m from the shore at Pounta Beach and run over 300 m south out to Pavlopetri Island. They are bounded to the east by a bedrock ridge, running north to south, and to the west by extensive sand deposits and deeper water (no remains have been identified in water depths exceeding 3 m). Beyond Pavlopetri Island and the eastern rocky ridge the sea is deeper and no artificial constructions can be traced. Nothing to indicate the existence of artificial harbour constructions or jetties could be identified in 2009.

The town appears as a series of large spreads of stones indicating building complexes, amongst which a network of stone walls can be traced. The walls themselves are made of uncut aeolianite, sandstone and limestone blocks, and were built without mortar. They can survive up to three stones in height but the vast majority survive only one course high or are completely flush with the seabed. The submerged remains (buildings, streets, cist graves, and rock-cut tombs) recorded in 1968 can be clearly identified (Fig. 17.6) and survive more or less in the same condition as they were originally reported (though most of

*Figure 17.6: Diver over room in Building II, Area C*


*Figure 17.7: New areas uncovered in 2009*

the cist graves seem to have been interfered with). The existence of the eastern rocky ridge has protected the remains from the full force of wave action over the years – where there are gaps in the ridge walls have either been completely eroded away, as seems to have happened near Pavlopetri Island, or they have been eroded almost flush with the seabed.

The accuracy of the survey plan produced in 1968 was checked and verified using the total station and sector-scan sonar. In addition to the recording of the 30,000 $m^2$ of buildings first identified in 1968, over 9000 $m^2$ of new structures were discovered coming out of the sand to the north of the original remains in 2009 (Fig. 17.7). It is likely that these remains had been covered by sand deposits in previous years, as they had not been seen by divers or swimmers visiting the site in 1967, 1968, or 2008. The suggestion that the buildings were recently exposed was borne out by the cleaner appearance of the stonework in the new areas compared to the older areas which feature well-established marine algal species and encrusting marine organisms (especially brown and black sponges and sea urchins). Changes in sand cover could be related to changes in the position and shape of the shoreline over time causing variability in wave action (cf. Galili and Rosen, this volume). Equally the map of the bathymetry and topography of the town and the eastern bedrock ridge that protects the site shows there are low gaps in the ridge where wave action would pass through and be diffracted and refracted round Pavlopetri Island itself, and the other high points. This would result in a focusing of wave energy at discontinuous points over the town and the adjacent beach, with a pattern of high and low energy determined by the recent wave direction. While this shifting pattern is not yet understood, the discoveries made in 2009 suggest that revisiting the site in future years and at different seasons may reveal further parts of the Bronze Age town, which are at present under thick beds of sand.

The newly discovered remains consist of an area of at least 25 conjoined square and rectilinear rooms (built of rough square limestone blocks as elsewhere on the site) starting some 10 m from the existing shoreline. A 40 m long street was also identified lined with rectilinear buildings with stone foundations. One square building, measuring *c*. 3 × 3 m, contains the remains of a central pillar-like structure comparable on first glance with pillar crypt rooms associated with palaces and villas on Minoan Crete (cf. McEnroe 1982). If this room were indeed a pillar crypt it would be the first example from the Greek mainland. Two new cist graves were discovered alongside what appears to be a Bronze Age *pithos* burial located in a corner of one of the newly discovered rooms.

One of the most important discoveries of the 2009 season was the identification and recording of a large trapezoidal building, measuring *c*. 34 m in length and 12–17 m in width. The structure contains at least three separate rooms and is comparable in layout to Early Bronze Age (EBA) buildings (cf. Shaw 1987; Darcque and Treuil 1990). Its large dimensions and its prominent position within the settlement certainly imply that it was a building of some importance.

The new discoveries, combined with the data from the 1968 survey, suggest a town of greater importance than previously estimated. The visible remains now cover almost 4 ha and consist of intact stone building foundations, monumental structures, courtyards, streets, cist graves, and rock-cut tombs. Given that there are probably still many more buildings hidden under the sand, and that scattered fragments of walling are found out toward Pavlopetri Island suggesting that the town originally extended as a fully built-up area as far as the island, the original size of the settlement is likely to have been at least 8 ha. Given the lack of rubble from the site as a whole it is likely that the surviving walls represent the ground floor of the buildings with stone foundations built to around a metre in height and the upper sections constructed of mud brick and/or timber frames covered in plaster. Thus only the very base of the wall was stone, probably to prevent the foundations from being eroded away by rain and water running down the streets.

A non-random sample of diagnostic surface sherds was collected from across the full extent of site, including the newly discovered areas, in order to provide some insight into the length of occupation at the site. The ongoing study of the pottery sampled in 2009 (a total of 442 ceramic artefacts alongside an iron nail and an obsidian chip) provides the following statistical data: 3% Final Neolithic, 40% Early Bronze Age, 15% Middle Bronze Age, 25% Late Bronze Age, 3% Classical/Hellenistic, and 0.5% Roman/Byzantine. The remaining 13.5% of the pottery is provisionally characterized as 'Bronze Age'. The discovery of a group of sherds dates the original occupation of the site in the Final Neolithic period. The Final Neolithic pottery shows affinities with examples from contemporary settlements and cave sites in Laconia, whereas the occupation of the site during this period corresponds well with the evidence from other sites in the vicinity of Pavlopetri (Waterhouse and Hope Simpson 1961: 145–6; Gallou 2008: 294) as well as cave sites in the Vatika region (Efstathiou-Manolakou 2009: 14–15).

An extensive range of EH *pithoi* and storage jars can be identified decorated with an impressive repertoire of rope- and finger-impressed patterns. In addition to the storage vessels (some with mat-impressed bases), the sampled pottery features the standard EBA shapes such as cups, sauceboats, conical saucers, askoi, portable hearths, and dishes. Significant for our understanding of the relations between Pavlopetri and the Aegean is the pottery that shows close links with the Cyclades, western Crete, and northeast Aegean (Henderson *et al.*, in press).

In contrast to the limited picture we have from the 1968 survey for the occupation of the site during the Middle Bronze Age, a fair amount of MH pottery was lifted in 2009 and includes locally produced wares and what appear to be a few imports, possibly from the nearby Minoan colony on Kythera. Of particular interest are the sherds from storage vessels that feature rope- and finger-impressed decoration with Middle and Late Minoan parallels (Christakis 2005).

The Late Bronze Age pottery is dated from the transitional MH/LH period until the collapse of the Mycenaean palaces. The collected sherds belong to drinking vessels, mainly kylikes and cups including a fragmentary Vapheio cup, storage vessels (amphorae and alabastra), and vessels for serving liquids (squat jugs, skyphoi, and kraters). A large number of sherds feature strong Late Minoan IB influence. The discovery of a clay strainer that can be provisionally dated to LM IB times is of particular interest. Part of a strainer of the same date, albeit of a different form, was discovered in 1968.

The site was most probably abandoned in post-palatial times and was re-occupied – to a much lesser extent – during the Classical and Hellenistic periods as suggested by a number of shattered skyphoi that can be securely dated to the 4th century BC, and body sherds and double-barrel handles dating to the 3rd century BC. The Late Antique pottery recovered both in 1968 and in 2009 could be associated with the limited re-occupation of the site and the involvement of the local community in the trade of the local *poros* stone, iron from the nearby ores at Ayios Elissaios, and the exploitation of beds of *Murex* (marine gastropod *Murex trunculus* or the banded dye-murex) for the production of purple dye.

## The submergence of Pavlopetri

It is clear that the Bronze Age buildings foundations and pottery at Pavlopetri have been submerged by *c.* 4–5 m during the last 5000 years. The lowest building foundations found so far are at almost 3 m depth, and these were presumably well clear of storm wave run-up in extreme winter storms, which would likely recur within a generation. Mean annual wave significant height (Hs) at Pavlopetri is 0.55 m (Watson 2008), and the 100-year return value of Hs is 1.0–1.5 m. Since the maximum wave height (Hmax) is of the order of twice Hs, waves of the order of 1.5–2.0 m could strike the shore at Pavlopetri at intervals of a few decades. The following discussion of the geomorphology of the site, and the geomorphological and tectonic changes that have occurred will be based on the two possible estimates of 4 m or 5 m vertical displacement until a more accurate assessment can be derived from the on-site data.

There are several questions about the development of the town in the Bronze Age, and its subsequent submergence, which depend upon an understanding of the geomorphology of the seabed and coast from the western entrance to the Channel between Elaphonisos and the mainland, round the seaward side of Pavlopetri Island, and several kilometres along the shore of the Bay of Vatika. These are:

1. The position of the shore at the time of first occupation of the town site.
2. The position of any shelter for ships, embayment, lagoon or harbour, which may have attracted settlement, and may have supported seafaring and trade.
3. The shape of the isthmus connecting Elaphonisos to the mainland at the time of settlement.
4. The rate of submergence and the evolution of the isthmus, leading to its final rupture and the creation of an unobstructed channel.
5. The possible construction of a causeway, or reinforcement of the isthmus, in the last stages of submergence or the erosion of unconsolidated alluvium.
6. Calculation of the most probable rate of submergence, and the effect of this on the

development of and final abandonment of the site.
7. The significance of modern movement of the sand banks overlying the submerged ruins.

The eustatic rise of sea level after the Last Glacial Maximum terminated at *c.* 6800–5700 cal BP (Flemming 1978; Lambeck and Chappell 2001; Lambeck 2004; Lambeck *et al.* 2004) and regional sea level in the Mediterranean has fluctuated by less than 0.5–1.0 m since that date (Flemming and Webb 1986; Morhange *et al.* 2006; Marriner and Morhange 2007). Thus the submergence of Pavlopetri is due largely to tectonic factors associated with the plate convergence and subduction in the Cretan Arc and the related local and regional faulting. It is not possible at present to attribute the subsidence to a particular fault or seismic event, but the frequent occurrence of seismicity in the area is well documented (Angelier *et al.* 1982; Pirazzoli *et al.* 1982; Stiros 2009). The archaeological site of Plitra, 26 km to the north of Pavlopetri, is also submerged by several metres (Flemming 1973; Hadjidaki *et al.* 1980) while Antikythera 80 km to the south is uplifted (Flemming 1973; Pirazzoli *et al.* 1982). While the process of submergence, and its nature in terms of continuous or successive steps of subsidence is not yet established, the average rate is of the order of 0.8–1.0 m per thousand years.

In 2009 submerged strips of beach-rock were identified and drawn by divers in Vatika Bay within 200 m of the eastern edge of the site at a depth of 3.5–4.0 m, and aerial photographs show two or more parallel dark strips on the seabed in the same location. These strips of beach-rock provide the potential to measure the position and depth of the shoreline at precise dates. The shoreline at 4–5 m depth will be established by an accurate survey of the bathymetry in this depth range, taking account of the thickness of modern marine sediments.

The shape and position of the aeolianite ridges, which form the bedrock of the cemetery on land, and the protective ridge to the seaward side of the Bronze Age town suggest an embayment that may have enclosed a harbour. This impression is misleading, since, if the sea were 4–5 m lower than at present, the depression would have been completely dry land, and the town itself clearly occupied most of this space. It is, however, unlikely that there was no local shelter for sea-going vessels. The location of the Bronze Age town is at the point of minimum wave action in Vatika Bay (Watson 2008), and other sites are known where ships were dragged up onto the beach for protection (e.g. Bronze Age sites Ashkelon and Tel Qatif in Israel [Flemming *et al.* 1977]), but there is still a need to identify conclusively whether there was an enclosed sheltered basin or not. Single-beam echo-sounding and multibeam surveys of the seabed west of the town, between Pavlopetri and into the Channel, will reveal whether there was an inlet, lagoon, or basin there that would have provided secure protection for vessels without beaching.

Classical references establish that Elaphonisos was connected to the mainland by an isthmus (Strabo. iii.5.1; Ptol. iii.16.9; Pausanias iii.22.10). The present water depth in the Channel is of the order of 2–4 m, though this has still not been measured accurately throughout the area. It is apparent that submergence of 4–5 m is consistent with the existence of an isthmus at the time of first occupation, and the isthmus may have been higher than the solid bedrock as a result of tombolo wave action constructing sandy beaches on each side.

When the site had been submerged by 2–3 m, probably by *c.* 2000 cal BP, the isthmus would have been almost underwater. There are three occurrences of incised cart-tracks cut into the rock on the north shore of the Elaphonisos Channel indicating that regular transport, at various unspecified dates, was conducted to supply materials to and from Elaphonisos. The westernmost set of tracks (Fig. 17.8) is the

*Figure 17.8: The westernmost set of cart tracks running into the sea at Viglafia with Elaphonisos Island in the background (Scale 1 m)*

largest and most heavily incised, and suggests a last-ditch attempt to maintain dryland contact with Elaphonisos at the western and shallower end of the Channel.

Diving surveys and acoustic mapping are still needed to confirm the exact sill depth at the western end of the Channel, and to establish any possible remains of an artificial causeway. The supposed existence of a masonry causeway or fordable isthmus in use as late as the AD 1670s, attributed to the diaries of John Covel (Covel 1670–9) is incorrect. The printed texts later than 1679 (Bent 1893; Wace and Hasluck 1907–8; Waterhouse and Hope Simpson 1961; Harding *et al.* 1969) are based on a misreading of the manuscript diary by Bent in 1893, and the mistake has been repeated since then by many reputable authors, who trusted the 1893 publication (or those citing Bent). The probable absence of a shallow ford in 1670 results in, and is consistent with, a model for the stages of submergence that consists of successive downward co-seismic faulting.

Although the rate of submergence in any given millennium, or the size of downward steps of subsidence, are not yet established independently, the evidence so far indicates that the Bronze Age town area was probably inundated and awash by the time of the Roman Empire, and thus completely abandoned. This is consistent with no later construction on the site, whereas other settlements in Laconia often have continuous occupation with construction of large buildings in the Roman and Byzantine periods (e.g. Asopos, modern Plitra [Flemming 1973: 10–11]).

## Future work

In 2010 the Greek–British team will continue the detailed digital survey of the site alongside oceanographic research, being carried out by Dimitris Sakellariou of the Hellenic Centre for Marine Research (HCMR), to reconstruct the ancient shoreline and the geomorphology of the seabed between Elaphonisos and Viglafia. The oceanographic research will employ three acoustic technologies: high-resolution swath bathymetry, side-scan sonar, and sub-bottom profiling. The ultimate aim of the 2010 season is to identify how and when the site became submerged. Determining when Elaphonisos became an island and the intervening strait was formed is crucial to understanding Pavlopetri's function and how ancient mariners may once have exploited this sheltered natural anchorage.

Informed by the results of the 2010 season, an underwater excavation strategy will be formulated to run over three annual seasons (2011–2013). The excavations will aim to shed light on the nature of the settlement throughout the Bronze Age, its association with contemporary settlements in Laconia and, most crucially, its role in the maintenance of maritime trade networks in the Aegean and beyond. Already, it seems that Pavlopetri was a thriving Bronze Age port, with the ceramic evidence indicating significant Cycladic and Minoan influences as well as activity spanning the critical Minoan–Mycenaean transition, which provided an important stopping off point for Bronze Age ships plying local and long distance trade routes around the southeastern Peloponnese.

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