JOURNAL OF WETLAND ARCHAEOLOGY **4**, 2004, 139–153

That Sinking Feeling: Wetland Investigations of the Origins of Venice

R. A. Housley, A. J. Ammerman and C. E. McClennen

ABSTRACT

It is well known that Venice has always had an intimate association with the sea. Despite the historical interest the origins of the city have, until relatively recently, remained cloaked in obscurity. Until the mid-1980s Venice remained one of the few major historical cities in Europe where urban archaeology had yet to uncover significant information. Over the last two decades the situation has changed as shown by fifteen sites with early levels. Despite the difficulties of working in a tidal lagoon at considerable depths, archaeology has begun to chart the earliest inhabitation. This paper outlines some of the findings and the methodological approach adopted.

Keywords: EARLY MEDIEVAL, VENICE, LAGOON, WETLAND INVESTIGATIONS, SAN LORENZO DI CASTELLO, SAN FRANCESCO DEL DESERTO, TORCELLO

Introduction

For many years Venice has been renowned for its long historical tradition and its artistic heritage. The origins of the city and the early centuries are, however, much less known. In chronicles written in the later Middle Ages the Venetians elaborated several legends about how their city began. The historian today is, for the most part, quite sceptical about the tradition that Venice was 'born free and Christian' (Brown 1991). From the 11–12th century AD written and pictorial sources on Venice start to become more numerous (Agazzi 1991; Crouzet-Pavan 1992; Schulz 1991). As a city built on water and with a strong maritime history, one might think that Venice should have a long record of archaeological wetland investigation, but this is not the case. In fact archaeological

Authors' Addresses: **Rupert Housley**, Department of Archaeology, University of Glasgow, Gregory Building, Lilybank Gardens, Glasgow G12 8QQ, UK; email: r.housley@archaeology.arts.gla.ac.uk
Albert J. Ammerman, Department of the Classics, Colgate University, 13 Oak Drive, Hamilton, New York 13346–1398, USA.
Charles E. McClennen, Department of Geology, Colgate University, 13 Oak Drive, Hamilton, New York 13346–1398, USA

excavation of the earlier levels of the city began only comparatively recently. Prior to 1985 there had been only one modern excavation that reached levels associated with the early habitation of the city – in the vicinity of the Church of Santa Maria Assunta on the island of Torcello (Leciejewicz *et al.* 1977; Tombolani 1988). However, subsequent palaeoenvironmental studies that we have undertaken have shown the island of Torcello to be much smaller in late Roman times than previously thought. Thus there is now the realisation that the excavations by the Polish mission and Tombolani had taken place off the original island in areas that were only subsequently reclaimed from the Lagoon. Such problems, in conjunction with the difficulty of undertaking excavations in a dense urban fabric with few open spaces and at depths well below mean modern sea level, meant that little was known of the original habitation of the area.

However, in the last two decades this has begun to change, as archaeological and palaeoenvironmental studies have taken place both ahead of, and in parallel with, building restoration work. Since the mid 1980s archaeological fieldwork has led to the discovery of fifteen sites with cultural horizons dating to the period before the 9th century AD (Figure 1). This recent work, in combination with current studies of the wider lagoon environment, has now begun to provide a better insight into the origins of the city. Methodologically, it is the combination of a rich and complex urban archaeology, located within a tidal saltwater setting that is undergoing regional subsidence, which makes for some of the special aspects found in this study. The aim of this paper is to show how the fieldwork is being undertaken in Venice through consideration of some of the more significant new discoveries.

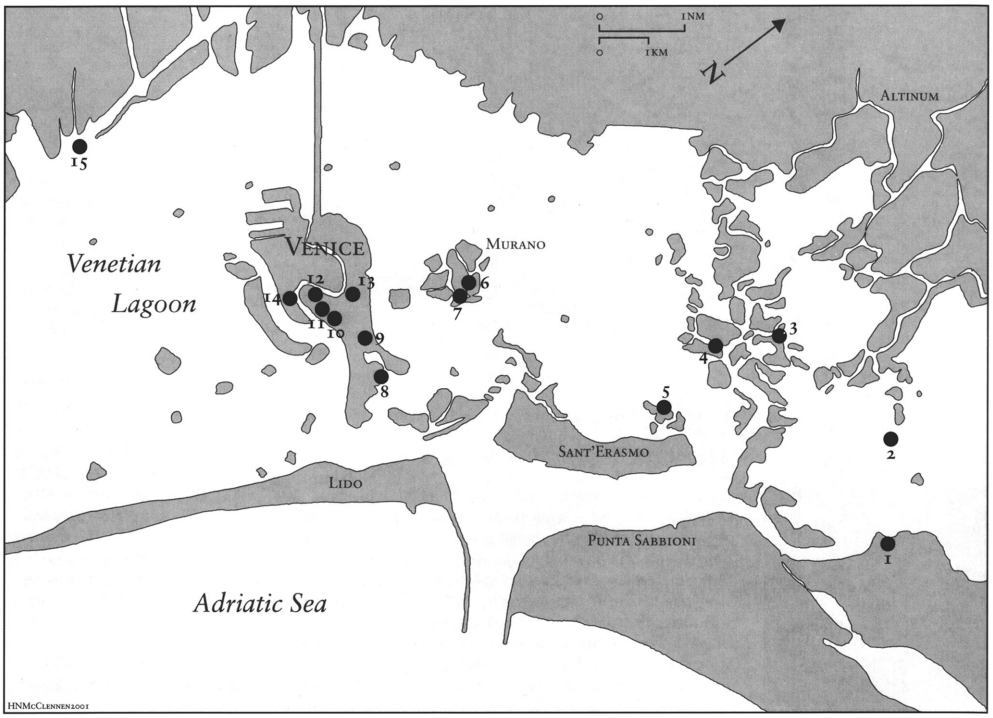
Aspects specific to the early archaeology of Venice

Ancient written sources and the earliest Venetian chronicles

Venice is virtually unique in northern Italy in being a major urban centre with no Roman roots. Through the 3rd century AD, whenever an ancient source mentions *Venetia*, the term is used with reference to a broad geographical region, and not a town. The earliest source with any real detail relating to the Venice Lagoon is the well-known letter that Cassiodorus wrote to the Lagoon dwellers in AD 537–8[1]. There is no mention of Venice being an urban centre prior to the writings of Paul the Deacon (*History of the Lombards* II.14) in the late 8th century. The Venetian chronicles, which start with the account written by John the Deacon in the first half of the 11th century,[2] attempt to go back to much earlier times but there are always nagging questions about their reliability. It is not until the 12th century that the historical evidence becomes more comprehensive, and the paucity of detailed information for the late Roman and early medieval periods means that the onus of uncovering early Venice rests with the discipline of archaeology.

Tides and the Lagoon Environment

The Venetian Lagoon, at 550 km^2, is a large, shallow body of water at the head of the Adriatic separated from the sea by a narrow strip of sand, the barrier beach known as the



EARLY ARCHAEOLOGICAL SITES IN THE VENETIAN LAGOON

ARCHAEOLOGICAL SITES WHERE EXCAVATIONS HAVE BROUGHT TO LIGHT REMAINS DATING BEFORE THE 9TH CENTURY A.D.

	SITE NAME	EARLIEST MATERIAL
1	LIO PICCOLO	2ND CENTURY A.D.
2	SAN LORENZAO DI AMMIANA	1-2ND CENTURY A.D.
3	TORCELLO CATHEDRAL	2-3RD CENTURY A.D.
4	MAZZORBO SANT'ANGELO	6TH CENTURY A.D.
5	SAN FRANCESCO DEL DESERTO	3-4TH CENTURY A.D.
6	MURANO SAN DONATO	7-8TH CENTURY A.D.
7	MURANO MUSEO VETRARIO	5-6TH CENTURY A.D.
8	SAN PIETRO DI CASTELLO	5-6TH CENTURY A.D.
9	SAN LORENZO DI CASTELLO	6-7TH CENTURY A.D.
10	PIAZZA SAN MARCO	7-8TH CENTURY A.D.
11	CINEMA SAN MARCO	7TH CENTURY A.D.
12	LA FENICE	6TH CENTURY A.D.
13	MALIBRAN TEATRO	5-6TH CENTURY A.D.
14	LICEO MARCO POLO	7-8TH CENTURY A.D.
15	FUSINA	5-6TH CENTURY A.D.

SITE ON THE MAINLAND BEHIND THE LAGOON

ALTINUM	6TH CENTURY B.C.

Fig. 1. Map of the northern Venice Lagoon showing the location of the 15 sites where excavations have uncovered archaeological remains that date from before the 9th century AD. (Based on Ammerman and McClennen 2001, 14.)

Lido. At the height of the Last Glacial Maximum the Veneto region was a considerable distance from the Adriatic shoreline, which lay some 275 km to the southeast beyond the present day town of Ancona. Prior to the arrival of the sea the area comprised an extensive river floodplain – part of a much-enlarged Po River valley. With climate warming and melting of the continental glaciers, the sea level around the world began to rise rapidly. The transgression of the marine waters rose vertically over 120 metres, reaching the point where Venice is now to be found by the mid Holocene, i.e. around 6000 years ago. Thus was formed the Venice Lagoon. Since then the Lagoon has been in continual circulation with the sea through twice-daily tidal fluxes. This has created a highly dynamic sedimentary environment with a continually changing mosaic of mudflats, marsh islands and meandering channels. These three distinct sedimentary types dominate the upper five metres or so of the stratigraphic record. Only in the upper levels are *in-situ* archaeological structures and artefacts to be encountered. Some parts of the Lagoon experience high-energy wave action and tidal currents, causing erosion were it not countered by human intervention in the form of artificial public and private works. In other localities the wave energy is weaker, leading to an accumulation of fine-grained inorganic estuarine silts. Before the 9th century AD, the Lagoon would have offered rich fishing, fowling and salt production opportunities, but except for reeds, and trees growing along the banks of the tidal inlets, rivers and creeks, there would have been few resources suitable for building a city.

Tides in Venice had, and continue to have, a profound influence on habitation patterns. At the time of full and new moons, the difference in water level between high and low tide on any given day would have been approximately 80–100 cm. In their building practices the Venetians took account of this difference and also included an allowance for the monthly and annual high-water levels. Thus pavements and living floors in both early and later Venice were generally built at least 100 cm above the mean sea level current at the time of construction. In other words, in order to avoid flooding Venetian building practice was keyed to high water levels – locally termed *acqua alta* – rather than to mean monthly and annual levels.

The extent to which it was feasible to move around the Lagoon in the past is a complex question. As today, in the past it was possible to travel to most parts of the Lagoon by small boat except at times of extreme low tide when large expanses of mudflat would have been exposed. However, the water depth would have been too shallow to permit the use of larger boats and sea-going ships except in the deeper channels. Study of the prevalence and position of these deeper channels is complicated due to the processes associated with lagoon tidal channel meandering (Figures 2 & 3). The deeper channels are associated with higher tidal current speeds and thus tend to be sandier in composition and are associated with dipping (sloping) channel point bar deposits. With continuous twice-daily tidal flow reversals, the channels migrate over time, eroding and re-working older sediments and creating scour and fill deposits. Due to the rapidity of accumulation, plant material is often preserved in these point-bar deposits. While the shallower channels simply re-work the upper lagoon salt marsh and mudflat sediments, the deeper channels cut down into the pre-lagoonal floodplain strata that existed prior to the arrival of the rising Adriatic Sea to the Veneto region.

This geomorphological framework has implications for the archaeology. Due to such

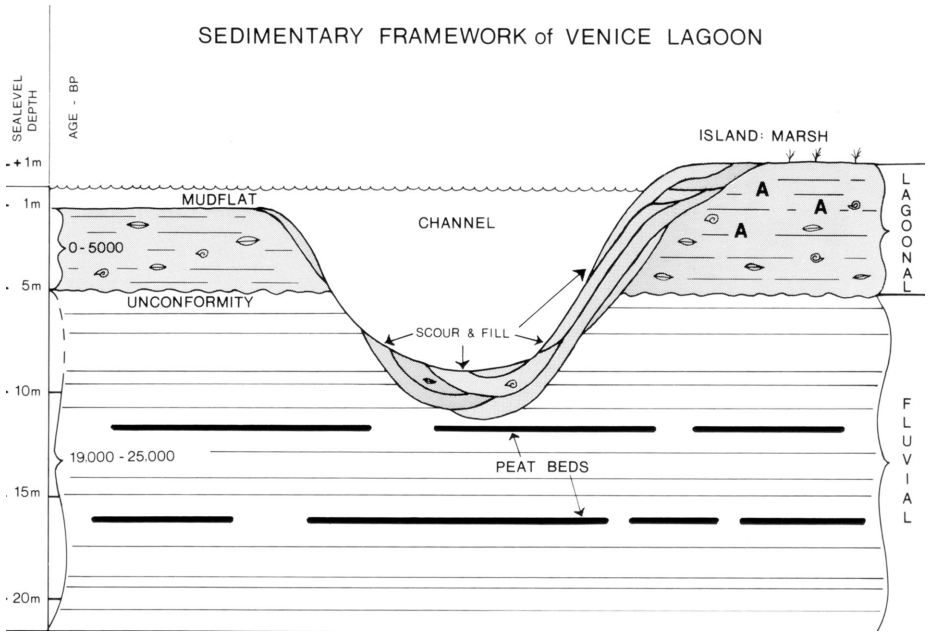


Fig. 2. A stratigraphic cross-section of the Venetian Lagoon showing the main sedimentary units and their approximate age. (McClennen, Ammerman and Schock 1997, 758.)

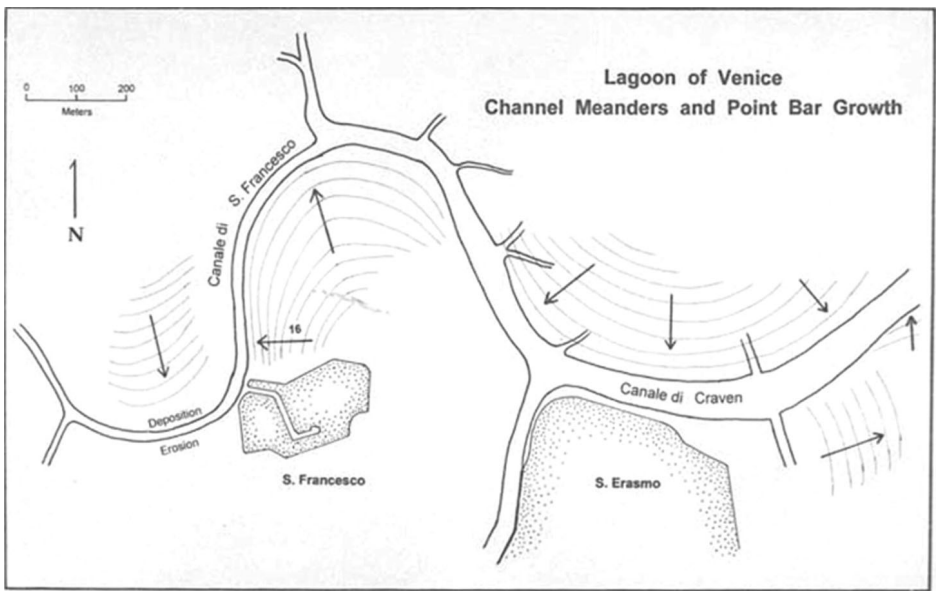


Fig. 3. Map of the area around San Francesco del Deserto showing the direction of movement of the channel meanders within this part of the Lagoon. (CMcC)

sedimentary processes, it is unlikely that we will ever find an old ship or boat in the bottom of a modern channel. For this reason underwater archaeology of this nature is not likely to be productive[3]. Instead the place where early archaeological remains have the best prospect of surviving, in a good state of preservation, is at a site with a long and continuous history of occupation. In such situations the measures taken to prevent erosion, and the progressive build-up of the ground level over the centuries, will have enhanced preservation of the remains. The problem is in reaching such levels. One often has to excavate down through architectural structures of considerable interest, which limits the scope for archaeology.

Relative Sea Level and Subsidence in the Venice region

Many different factors can influence a change in the relative sea level of a particular locality (Revelle 1990). They include: (1) changes in atmospheric pressure, winds or ocean currents, (2) changes in the mass of ocean water brought about by wastage or accumulation of global ice, (3) changes in the volume of ocean water due to temperature fluctuations (excluding those attributed to water mass), and (4) earth movements such as subsidence or uplift. As regards the last factor, in the case of Venice we are dealing with subsidence rather than uplift, and the subsidence is influenced by a range of local factors. These include tectonic movement linked to the thrusting of the Alps over the Po Plain; the compaction of the sediments under loading; oxidation of the peat layers that interleave with the riverine alluvium in the pre-Lagoon sequence; and groundwater extraction for human and industrial use (Ammerman *et al*. 1999, 305). This last point is more of relevance to present day Venice than to the past for it seems that groundwater extraction between 1930 and 1970 was responsible for significantly increasing the rate of subsidence in those years (ibid 306–7). When measuring changes in local relative sea level it is important to have a common reference point. The tide gauge at Punta della Salute is the best point of reference for measuring relative sea level because it has been in continuous use for over one hundred years and is still the standard used today. For this reason all the recorded elevations associated with our investigations are expressed relative to this 1897 reference point. However, it must be recognised that regional subsidence continues to affect the Punta della Salute reference point (Ammerman *et al*. 1999, 308).

Subsidence, taken in conjunction with the global eustatic rise in sea level over the last few millennia and other factors like dewatering and loading, means that much of the early archaeology of Venice is now well below present-day sea level. In practice in-situ archaeological material may occur up to 2 m below the 1897 sea level reference point (Ammerman *et al*. 1999, Figure 2; Ammerman in press, Figure 1). This means, in effect, a depth of some 3 m below street level today. The logistic difficulty of undertaking excavations in such situations helps to explain why the archaeology of early Venice got off to a slow start.

Human impact and the transformation of the Lagoon

As will be seen below, there is good archaeological evidence for habitation of the islands

within the northern Lagoon beginning in the first few centuries AD. Dry land suitable for building purposes, as opposed to marsh islands prone to regular flooding, was at a premium and so right from the start there was a strong incentive to alter conditions to favour human needs. By raising the height of the land, through the importation of extra sediment to a site, it was possible to reduce the probability of flooding in periods of *acqua alta*; sand from some of the barrier island dunes seems to have been favoured at certain times, or building rubble when it was available. Additionally, the enclosure and infilling of areas of salt marsh which abutted the small natural islands on which early settlement occurred allowed the inhabited area to expand. By building successive phases of wooden waterside structures, to minimise erosion and increase the usable margins of islands, it was possible to protect and maximise the land that already existed. Based on the archaeological evidence now available (presented below) these methods were employed in the Lagoon at least from Roman times.

As time passed, the scale of habitation increased and the nature of settlement changed. Initially, habitation in Venice was more akin to a broadly dispersed series of settlements than to an urban centre. Only later, in the 8–9th centuries AD, would it have taken on the character of a city (Ammerman 2003). Maps of the 11–13th centuries, and detailed parish records, suggest that even close to Piazza San Marco gardens, orchards and open places existed. Certainly by the end of the 13th century Venice was a flourishing city with a population of more than 100,000 inhabitants – the only other European centres of comparable size at that time were Milan, Florence, Naples, Palermo and Paris. The city grew using the age-old method of founding buildings on newly reclaimed land, on wooden piles and boards. Later, brick and mortar became the favoured building medium due to its comparative lightness.

On the extensive mainland behind the Lagoon, the region known today as the Veneto, there was a system of rivers that drained into the Lagoon. By the 14th century human use of this area for agriculture, and use of the rivers Brenta, Sile and Zero for transport, meant a deterioration of the Lagoon, which began to silt up because of heavy sedimentary loads. Shoals interfered with navigation, which threatened the trade-centred economic basis of the city. If allowed to continue, the sedimentation would have opened Venice up to direct military attack. Such a change would have been a disaster for the Venetians, and so a start was made on schemes to divert the rivers away from the Lagoon so that their sediment load would be discharged directly into the Adriatic. Thus the primary source of alluvium responsible for causing shoaling in the port of Venice would be eliminated, and the lagoonal salinity increased as less freshwater entered the Lagoon. Over the next few centuries this was gradually achieved such that a map from 1709 shows how levees and dikes had totally diverted all the main rivers around the Lagoon (Ammerman and McClennen 2001, 27). This illustrates how, in so many ways, historical Venice is the consequence of human environmental interventions that, from small beginnings, ultimately transformed the city and Lagoon to the situation visible today.

Approaches to Studying the Lagoon and its Archaeology

In the course of studying the early origins of Venice, three novel approaches proved to be especially beneficial. The first was the initiation of a programme of hand coring on land

and also from small boats that could access all parts of the Lagoon. On first thought, the latter might not seem particularly novel since previous knowledge of the Lagoon was based upon an extensive series of cores used to investigate the stratigraphy and depositional environments (Gatto 1980). However, it is now apparent that two limitations affected this earlier work. Firstly, the cores were taken from work barges that could only sample canals, channel edge sites and inlets where the water depth was sufficiently deep to permit access of deep draught boats. Failure to sample the shallow mid-saltmarsh island and mid-mudflats meant that the low energy environments were missed. The second was the realisation that the sampled high-energy localities contained mostly re-worked material and that the associated conventional ^{14}C dates on marine shells had to be biased. The large-sized marine shells selected for dating had to be sufficiently robust to stand up to abrasion and were very likely re-worked. Furthermore, the difficulty of correcting for different carbon sources in the shells – both the marine reservoir effect (Stuiver *et al*. 1986, Stuiver and Braziunas 1993) and the dissolved carbonate in the river water from the Dolomite region of the Italian Alps – meant the resulting ages were potentially seriously misleading.

The second technique that proved to be crucial in improving our understanding of the Lagoon and its archaeology was the development of the accelerator mass spectrometric (AMS) ^{14}C dating method and its application to small samples such as peat lenses and wood and reed fragments that could be recovered from deep excavation soundings and auger cores. Whenever possible we have tried to date at least ten samples from a range of stratigraphic contexts on a given site, in order to establish a firm framework of absolute chronology. Choice of materials that get their carbon from the atmosphere avoided the problem of complex carbon sources associated with the marine shells and allowed single entities to be dated from a wider range of localities. Furthermore, this approach to dating overcame the difficulty prevalent in the upper levels of Venice of having to decide whether or not culturally diagnostic artefacts were *in-situ* and thus indicative of the age of the context in which they were found. Certainly the Venetian practice of using any available material, including old building rubble, as landfill to build-up the land surface meant that full confidence could not be placed in finds of such material as chronological indicators.

The third methodology that greatly helped develop a much-improved understanding of the sedimentary dynamics of the Lagoon was the use of high-resolution seismic-reflection sub-bottom sonar profiling (McClennen *et al.* 1997). This involves the use of sonar echoes to resolve contrasting sedimentary layers in the Lagoon. The sound waves that the equipment generates can penetrate through the 5–6 m of lagoon sediment down into the fluvial and peat horizons that were laid down in the Late Pleistocene period: ^{14}C dates on the peat fall in the 19,000–25,000 uncal years BP range (Figure 2; Ammerman *et al.* 1995). As the survey vessel proceeds over the bottom, reflected echoes from the sonar display various sedimentary features like horizontal beds, dipping layers and channel banks, as well as scour and fill deposits. By continually recording the position of the vessel using a global positioning system (GPS), it was possible to plot a record of the sub-bottom features. Part of the success of this work again stems from the use of a small boat, which allowed us to range widely over large areas of the Lagoon. In conjunction with hand coring, this methodology has allowed a fundamental revision of the sedimentary framework of the Lagoon.

The Archaeology of Early Venice

To illustrate the impact that the new forms of investigation have had on our understanding of the early origins of Venice, we shall now examine the findings of three excavations undertaken in the 1990s. Firstly, the excavations beneath San Lorenzo di Castello, a 9th century church extensively remodelled in the 16th century and lying within the confines of the present city; secondly the site of San Francesco del Deserto, a Franciscan monastery on an island in the northern part of the Lagoon; and thirdly Torcello, the site of the former cathedral established in AD 639 when the Bishop of Altinum relocated his seat from the mainland to this island in the north of the Lagoon.

San Lorenzo di Castello

Standing midway between San Marco and the Arsenal is the church of San Lorenzo di Castello that was completely rebuilt at the end of the 16th century to the design of Simon Sorella. For some time the present structure had suffered stability problems, to the extent that in 1987 urgent restoration work had to be carried out. This provided the opportunity to make a series of archaeological soundings to learn about the earlier structures that occupied the site. A well preserved floor mosaic dating to the 12th century was uncovered, which overlaid an apse supported by sandstone foundation blocks that, in turn, rested on vertical wooden posts the tops of which were at an elevation of –0.8 m relative to mean modern sea level (De Min 1990). An AMS date on the outer ring of one of the piles subsequently showed that they probably dated to the 9th or first half of the 10th century (Ammerman *et al.* 1992), which ties in well with the earliest literary record for the area that informs us that the first church at San Lorenzo was built by the Badoer family at the beginning of 9th century AD (De Min 2000). But this was not the earliest human activity on the site. At lower elevation (around –1.9 m with respect to mean modern sea level) were more cultural remains in the form of inorganic building debris (brick, tile, mortar, slag and pottery of an undiagnostic form) and organic matter (wood fragments and a matted reed structure). Hand auguring demonstrated that this cultural horizon occupied an area of at least 160 m^2. A series of AMS dates (Ammerman *et al.* 1992) showed that these lowermost remains dated to between AD 550–700, thus placing the activity coeval with the Lombard occupation of mainland Italy – essentially between the time when Cassiodorus addressed his famous letter[4] to the Lagoon dwellers in AD 537–8 and the relocation of the ducal seat from Malamocco on the Lido to San Marco in AD 811 (Ammerman and McClennen 2001, 8 & 13). The fact that the first human use of the site appears to have involved more than just simple wooden structures suggests a construction of some consequence. Whatever its nature, the structure pre-dates the earliest historically attested literary record for the area thereby demonstrating the value of archaeological investigation for elucidating the early origins of Venice.

San Francesco del Deserto

Near Burano, in the northern Lagoon, is the small island of San Francisco del Deserto, which has been, since the 13th century, the home of a Franciscan monastery. In 1993

archaeological fieldwork began on the north side of the church. The first excavation uncovered the remains of a boat, which was made using ribs of oak (*Quercus cf. robur* L.), a hull of lime (*Tilia* sp.) and held together by 'pegs' of dogwood or cornelian cherry (*Cornus sanguinea* L. or *Cornus mas* L.) (Ammerman *et al*. 1995, 501–3). AMS dates on two of the 'pegs' indicate that the boat was constructed sometime between AD 425 and AD 550. The boat came from an elevation of –1.67 m relative to mean modern sea level. At a lower level in the same excavation, –1.80 m, a series of vertical and horizontal wooden poles were found, which are thought to represent an enclosure or simple wharf of similar age to the boat.

In 1998, further excavation in an adjoining area uncovered a succession of wooden palisades, dating from the late 4th (phase II) to the early 6th centuries AD (phase X), that are interpreted by the investigator to represent repeated attempts to reinforce and stabilise the island bank closest to the sea (Figure 4; Ammerman and McClennen 2001, 19). These structures provide a good example of how artificial measures were required to combat the erosional force of the tides and waves. The three most common species of trees used by the builders to construct these wooden palisades were alder (*Alnus* Miller), oak (*Quercus*) and elm (*Ulmus* L.), the alder being mostly used for the smaller diameter upright posts and the larger oak and elm for horizontal planking. Less numerous forms included timber from fir (*Abies* Miller), apple type (Maloideae), willow (*Salix* L.), dogwood (*Cornus*), and sea buckthorn (*Hippophae rhamnoides* L.). The numerous fragments of associated broken amphorae, some of which had originated from Gaza in the eastern Mediterranean, show how cultural material came to be re-used in Venice for secondary purposes, as landfill or as part of a breakwater defence. While there are other archaeological finds that place occupation on the island to as early as the 1st century AD, these 4–6th century palisades are the earliest wetland structures so far discovered at San Francisco del Deserto.

Torcello

The island of Torcello is where the best evidence for the early architecture in the Venetian Lagoon has been found. The earliest structure, which is over 7 m in length, is documented both beneath the fourth nave of the church and just on the north side of the basilica. It consists of a walkway made of tiles, built in the 2nd century AD and resting directly on the natural land surface of the marsh island – known locally as a *barene* (Ammerman and McClennen 2001, 17). Below the portico of the church of Santa Maria Assunta are the remains of two walls dating to the 5th century AD. By the 6th century there is good evidence, from excavations on the north side of the basilica, for several small timber-framed houses on stone and tile footings and with interior hearths, built along a pebble-paved road (Figure 5; Ammerman and McClennen 2001, 17). As in the case of San Francesco del Deserto, off-site environmental investigations have shown that the original extent of the island was very much smaller. In addition to repeatedly reclaiming land at the edges, over the centuries since late Roman times the inhabitants have locally raised the land surface by over 2.5 m.

The first archaeological and literary evidence for the existence of an ecclesiastical building on Torcello comes in the form of a stone inscription recording the arrival of the

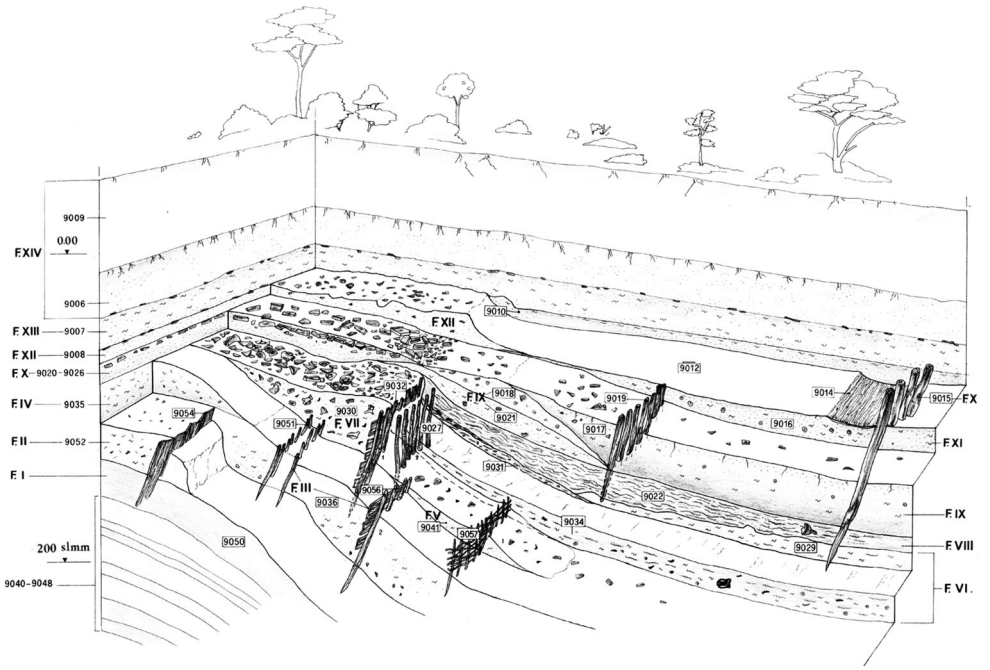


Fig. 4. This reconstruction diagram shows a series of wooden structures built to defend and enlarge the north side of the island of San Francisco del Deserto in the period from the late 4th century AD to the early 6th century. There are 14 chronological phases to this sequence with the earliest waterside structure, stratigraphic unit 9054 on the left, belonging to phase II, consisting of a row of vertical planks. The latest structure, unit 9015 on the right, from phase X, represents a palisade made from wooden piles. The fact that the north side of the island was the one closest to the sea could well explain why there were so many repeated attempts to consolidate the waterside over the course of less than two centuries. (Ammerman and McClennen 2001, 19.)

bishop of Altinum and the establishment of his seat in the cathedral in AD 639. Excavations on the west side of the basilica of Santa Maria Assunta have uncovered remains of the first baptistery in association with window glass and coins that show it was built at the end of the 7th century. Human burials have also been found and these have produced ^{14}C dates indicating interment going back to the 7th and 8th centuries (Ammerman and McClennen 2001, 23). By the 10th century, Torcello was of sufficient importance for the Byzantine Emperor Constantine Porphirogenitus to describe it in his writings[5] as a large emporium or trading station.

We have evidence in the form of macrobotanical remains – seeds, grain, nuts and fruits – for the diet of the early inhabitants of Torcello (for a more comprehensive account see Housley and Miller forthcoming). The abundance of millet (*Panicum miliaceum* L.) and cereal bran (from *Triticum/Secale*: wheat/rye and *Hordeum*: barley), preserved in

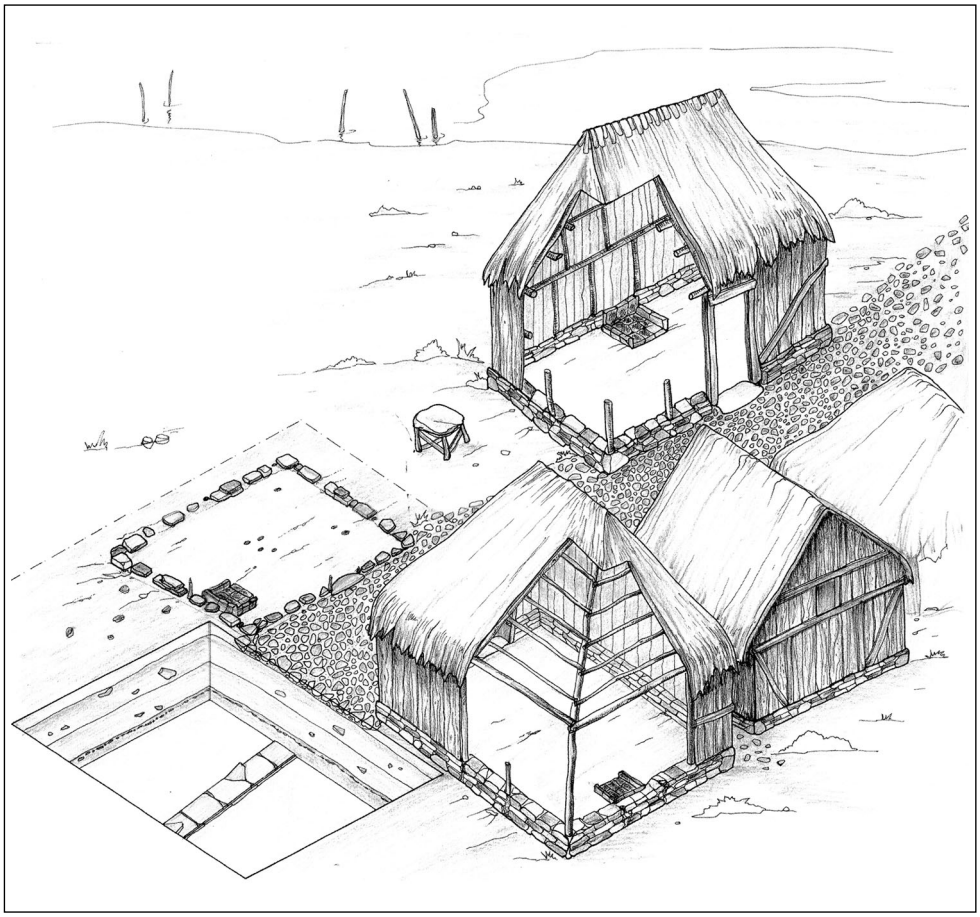


*Fig. 5. This reconstruction diagram shows the 6th century AD structures found during excavations on the northern side of the basilica of Torcello. Several small timber framed houses, on stone and tile footings and with interior hearths, are shown along a pebble-paved road. Seen at a lower level on the left side is the 2nd century AD tile walkway that rested directly on the natural land surface of the salt marsh (*barene*). (Ammerman and McClennen 2001, 17.)*

midden deposits off the edge of the then smaller island, is highly suggestive of sewage linked with the remains of past meals or discarded associated waste. In addition to bran there are also seeds of barley and common (i.e. broomcorn) millet. Other food, or potential food, plants from Torcello include fragments of hazel nuts (*Corylus* L.), walnut (*Juglans* L.), stone pine (*Pinus pinea* L.), and possible sweet chestnut (*Castanea sativa* L.), the stones from sloe (*Prunus spinosa* L.), and fruits from the cultivated grape (*Vitis vinifera* L.) and fig (*Ficus carica* L.). A number of these plants can tolerate wet ground but on the whole it is

likely that they were imported to the island of Torcello, albeit not necessarily from very far away. A range of plants associated with crop weeds or as habitants of waste ground were also present in the same samples. The presence of one seed of Vervain (*Verbena officinalis* L.) could point to a possible medicinal plant for it has a long and well-documented history as a treatment for such complaints as depression, epilepsy, and to treat wounds and skin irritations (Stuart 1989; Podlech 1996). However, since it is native to the Mediterranean and grows along roadsides and in waste places, there is no proof that the early inhabitants of Torcello used Vervain in such a way.

Conclusions

The purpose of this paper has been to introduce some of the more distinctive features of the archaeological investigations that are now under way on the origins of Venice. Thus a start has been made to move beyond the legends that the Venetians held for many centuries and to base our knowledge of early life in the Lagoon on these new lines of investigation. It is clear from initial studies that even in the first phases of settlement human manipulation of the environment was happening in small ways, and that the cumulative effects of these interventions were to influence the subsequent development of the city and the Lagoon. Whilst much of the historical evidence comes from a time when Venice had acquired an urban character with its cultural, religious, political and economic life centred firmly on San Marco, the Rialto and the Grand Canal (Ortalli 1981), the early archaeology paints a different picture of less nucleated settlement in which power lay with a number of centres that changed with time, and where the pattern of communication within and beyond the Lagoon was significantly different to that prevailing in later times (Ammerman 2003). Due to the environmental setting, it is inevitable that a significant wetland archaeological component is involved, although as this account has shown, some of the archaeology represents dry land structures that only subsequently became submerged through a combination of relative sea level rise and the regional subsidence. Work has been undertaken, and is still ongoing, in a number of fields of study that have not been discussed in this paper to any degree. For example, the pollen and foraminifera from sediments in the Lagoon, the dendrochronology of the timbers, the chemical composition of the early Venetian glass (of particular interest as Venice became one of the major glass manufacturing centres of Europe), and the stable isotope composition of the human burials, are all fields that in their own way have contributed to our better understanding of the early inhabitants of this region. It is likely that further excavation work conducted ahead of building restoration by the Venice Superintendency in the next few years will provide further information on the first Lagoon dwellers.

Acknowledgements

We wish to thank Maurizia De Min and the Superintendency of Archaeology for their encouragement and collaboration over the years. A fair proportion of the information used in this paper derives from a conference, exhibition and catalogue organised at Colgate University in October 2001 (Ammerman and McClennen 2001). In addition to all the individuals and organisations whose help enabled that event to take place, the authors would like to acknowledge the financial assistance provided by the Arts and Humanities Research Board (AHRB) that enabled this paper to be presented at the WARP wet-site archaeology meeting in Olympia in 2003.

Notes

1. 'You live in houses like those of sea birds … by weaving together flexible reeds you manage to increase the solidity of the ground in the lagoon and you are not afraid to pit such a fragile defence against the surging tides of the sea.' *Letter to the Maritime Tribunes*
2. This is where the connection is made between the Lombard invasion of Italy in AD 568 and the movement of refugees from mainland cities to islands in the region (Carile and Fedalto 1978)
3. So far only a few vessels have been recovered by systematic underwater archaeology in the Venetian Lagoon. Note that in the case of the Venetian galley recently recovered at San Marco in Boccalama the vessel (stripped of its fittings) was intentionally sunk in the 14th century in order to defend the island from erosion.
4. Cassiodorus, *Various Letters* XII.24; XX.22.
5. Constantine Porphirogenitus, *On the Administration of the Empire* 27.71 FF; 28.

References

Agazzi, M., 1991, *Platea Sancti Marci*. Venezia: Comune di Venezia.

Ammerman, A.J. 2003 Venice before the Grand Canal. *Memoirs of the American Academy in Rome* 48: 141–158.

Ammerman, A. J. in press Flooding and environmental challenges for the Venice Lagoon. In Fletcher, C. and Spencer, P. (eds) *The Third Dimension in Venice.* Cambridge: University Press.

Ammerman, A. J., De Min, M., and Housley, R. A., 1992, New evidence on the origins of Venice, *Antiquity* 66: 913–916.

Ammerman, A. J., De Min, M., Housley, R. A., and McClennen, C. E., 1995, More on the origins of Venice, *Antiquity* 69: 501–510.

Ammerman, A. J., and McClennen, C. E. (eds.), 2001, *Venice before San Marco. Recent Studies in the Origins of the City*. Hamilton, New York: Colgate University.

Ammerman, A. J., McClennen, C. E., De Min, M., and Housley, R. A., 1999, Sea-level change and the archaeology of early Venice, *Antiquity* 73: 303–312.

Brown, P. F. J., 1991, Self-definition of the Venetian Republic, in *City-States in Classical Antiquity and Medieval Italy* (Eds. Molho, A., Raaflaub, K. and Emlen, J.): 511–548, Ann Arbor (MI): University of Michigan Press.

Carile, A., and Fedalto, G., 1978, *Le origini di Venezia*. Bologna: Pàtron.

Crouzet-Pavan, E., 1992, '*Sopra le acque salse.' Espaces, pouvoir et société à Venise à la fin du Moyen Âge*. Rome: Ecole Française de Rome.

De Min, M., 1990, Venezia. Rinvenimenti medioevali nella chiesa di S. Lorenzo. Notizie preliminari, *Venezia Arti* 4: 159–166.

De Min, M., 2000, Venezia. Chiesa di San Lorenzo di Castello: un esempio di scavo corrlato al restauro architettonico, in *Ritrovare restaurando. Rinvenimenti e scoperte a Venezia e in Laguna*: 41–52. Venice.

Gatto, P., 1980, Il sottosuolo del Litorale Veneziano. *Consiglio Nazionale della Ricerche, Instituto per lo studio della Dinamica delle Grandi Masse*. Venice: Technical Report 108: 1–19.

Housley, R.A. and Miller, J.J. in press The use of wood and other macroscopic plant remains from the Venice Lagoon. In Ammerman, A.J. and McClennan, C.E. (eds) *The Origins of Venice.* Baltimore: John Hopkins University Press.

Leciejewicz, L., Tabaczynska, E., and Tabaczynski, S., 1977, *Torcello. Scavi 1961–62.* Rome: Fondazione Giorgio Cini.

McClennen, C. E., Ammerman, A. J., and Schock, S. G., 1997, Framework stratigraphy for the lagoon of Venice, Italy: revealed in new seismic-reflection profiles and cores, *Journal of Coastal Research* 13 (3): 745–759.

Ortalli, G., 1981, Il problema storico delle origini di Venezia. In *Le origini di Venezia. Symposium italo-polacco*: 85–89. Venice: Marsilio.

Podlech, D., 1996, *Herbs and healing plants of Britain and Europe.* London: HarperCollins.

Revelle, R. R., 1990, Overview and recommendations. In *Sea-level change* (Ed. Revelle, R. R.). Washington (DC): National Academy Press. Studies in Geophysics: 3–34.

Schulz, J., 1991, Urbanism in Medieval Venice, in *City States in Classical Antiquity and Medieval Italy* (Eds. Molho, A., Raaflaub, K., and Emlen, J.): 419–466. Ann Arbor (MI): University of Michigan Press.

Stuart, M., 1989, Reference section, in *The encyclopaedia of herbs and herbalism* (Ed. Stuart, M.): 141–283. Novara: MacDonald & Co Ltd.

Stuiver M., and Braziunas, T. F., 1993, Modeling atmospheric ^{14}C influences and ^{14}C ages of marine samples to 10,000 BC, *Radiocarbon* 35 (1): 137–190.

Stuiver, M., Pearson, G. W., and Braziunas, T. F., 1986, Radiocarbon age calibration of marine samples back to 9000 cal yr BP, *Radiocarbon* 28 (2B): 980–1021.

Tombolani, M., 1988, Saggio stratigrafico a Torcello, in *La Venetia dall'antichità all'alto medioevo*: 205–214. Rome: Enciclopedia Italiana.