# CONSTRUCTING IDENTITY: THE ROMAN-ERA NORTHWESTERN ADRIATIC LACED TRADITION OF BOATBUILDING

A Dissertation

by

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## ABSTRACT

This dissertation investigates the development of a local tradition of laced boatbuilding along the coasts and inland waterways of the northwestern Adriatic Sea during the Roman period (with definitive evidence between the second century B.C.E. and the sixth century C.E.). The primary focus of this research is to explore in particular how the preservation of this tradition reflects the existence of a local cultural identity for the community of builders in this region in the path of an expanding Roman presence as evidenced by changing material culture in the contemporaneous Mediterranean world. An environmental deterministic model has been proposed to explain the perseverance of the northwestern Adriatic laced tradition of boat-building; however, this model leaves several sociocultural and economic factors unexplored. This project is the first comprehensive study to contextualize northwestern Adriatic laced boats against the broader social, cultural, and economic background of the Mediterranean world and the local region, and to examine why a particular local boatbuilding tradition endured in a relatively small geographic region over an extended time period. It is the ultimate goal of this study to translate the technical aspects of the boat-building culture represented by northwestern Adriatic laced vessels into a broader discussion of the lifeways and identities of these ancient builders.

The decision-making strategies of the ancient builders are examined in regards to the materials used and techniques employed in the construction of these vessels, how these features changed across time, space, and/or function, and what factors might have affected the stability or dynamism of these material and structural aspects of the boat-building tradition Through this approach, I identify the stable features of the construction method that define the tradition as well as dynamic features that likely represent distinct builders or groups of builders within the broader community of practice. Understanding the decision-making strategies of the ancient builders of northwestern

Adriatic laced vessels adds to our understanding of this local tradition of boatbuilding and provides an example of the nuanced experiences of various groups with the processes of Roman colonialism and subsequent cultural change.

## DEDICATION

To my parents, who first taught me to follow my dreams, and to my sister Shannon, who first pointed me toward this dream.

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notice to help me record 2000-year-old pieces of wood; I would not have made it through this program without your steadfast friendship. I consider myself most fortunate to have shared successes, as well as disappointments, with you throughout this process.

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## NOMENCLATURE

Standard abbreviations (as listed here) are used to cite primary textual sources throughout this dissertation. Any author or text not listed here is spelled out in the footnote citation.

| | |
|---|---|
| Ath. | Athenaeus |
| *AUC* | *Ab Urbe Condita* (Livy) |
| Cassiod. *Var.* | Cassiodorus, *Variae* |
| *CIL* | *Corpus Inscriptionum Latinarum* |
| Cic. *Pis.* | Cicero, *In Pisonem* |
| Serv. *Comm. In Verg. Georg.* | Servius, Commentary on the Aeneid of Vergil Georgius |
| Gel. *NA* | Aulus Gellius, *Noctes Atticae* |
| *Geog.* | *Geographica* (Strabo) |
| Hom. *Il.* | Homer, *Illiad* |
| *Orig.* | *Origines* (Cato) |
| | *Origines* (Isidore of Seville) |
| Plaut. *Mil.* | Plautus, *Miles gloriosus* |
| Plin. *HN* | Pliny (the Elder), *Naturalis historia* |
| Polyb. | Polybius |
| *Rust.* | *De re rustica* (Columella) |
| Theophr. *Hist. pl.* | Theophrastus, *Historia plantarum* |
| Verg. *Aen.* | Virgil, *Aeneid* |
| Vitr. *De Arch*. | Vitruvius, *De architectura* |
| Xen. | Xenophon |

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# CHAPTER I

# INTRODUCTION

Ancient boats and ships played a vital role in past societies, providing an important means of transportation for goods, peoples, and ideas; showcasing the technological sophistication of a culture; and representing the livelihood of sailors, merchants, and boatbuilders. In the river systems and along the coast of the northwestern Adriatic Sea, a distinct tradition of boatbuilding by means of lacing wooden planks together persisted from the Roman late Republic through the Imperial period, with definitive evidence between the second century B.C.E. and the sixth century C.E.[1] During this same time period, the Mediterranean was dominated by boats and ships constructed by means of mortise-and-tenon joinery.[2] The laced tradition of boatbuilding is not only present in the northwestern Adriatic, but overshadows the archaeological record in this region, presenting a unique nautical landscape.

Laced boatbuilding traditions have been discovered and documented around the world and from many different time periods, even to the present day, but there are three traditions of fully laced vessels from the Mediterranean.[3] The most geographically widespread tradition of laced hull construction in the Mediterranean, with examples from the coastal waters and ports of Spain, France, Italy, and Turkey, dates to the sixth and fifth century B.C.E.; personal effects from these shipwrecks indicate a Greek origin for these laced ships.[4] The transition from Greek-laced ship construction to mortise-and-tenon ship construction in the ancient Mediterranean is well

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[1] Beltrame 2000, 2002a.
[2] Bruni 2000; Pomey 1988; Steffy 1985, 1994; Van Doorninck 1976; Wachsmann 1990.
[3] See Prins 1987.
[4] Bound 1985, 1991; Panvini 2001; Polzer 2009; Pomey 1981, 1995, 2003.

documented.[5] However, while the majority of boatbuilders transitioned to mortise-and-tenon construction, two pockets of laced construction remained in the ancient Mediterranean world. These other two laced traditions of the Mediterranean are found in the upper Adriatic Sea, with substantial differences in materials and techniques between the northwestern and eastern halves of this small sea to warrant separation into two distinct traditions.[6] Most of the hull remains from these two laced traditions date to the Roman period, but the recently discovered Bronze Age laced boat at Zambratija supports the hypothesis that these traditions pre-date Roman influence in the region. Contemporary texts[7] document the laced tradition of the eastern Adriatic coast as a product of the Liburni, a people group who inhabited the islands and coastal region between the Istrian peninsula and the river Titus (Krka) along the Dalmatian coast and who had a reputation for superb seamanship as well as piracy.[8]

Unfortunately, the use of laced construction along the northwestern Adriatic coast is not associated with any particular group of peoples within the textual record. Modern scholarship attributes the preservation of the northwestern Adriatic laced tradition to the presence of lagoons and shallow inner waterways that pervade the landscape.[9] However this environmentally deterministic model leaves several factors unexplored that may have contributed to the persistence of this method of boatbuilding in this region. Drawing on the conceptual framework of the *chaîne opératoire*, this study will undertake an intensive analysis of the physical remains of Roman-era laced boats of the northwestern Adriatic tradition in order to understand the technological choices of this ancient community of boatbuilders and to relate these strategies and processes to the larger

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[5] Kahanov and Pomey 2004.
[6] Boetto and Rousse 2011.
[7] Festus *De significatu verborum* 460-461; Varro *Antiquitates rerum humanarum* 25 in Gel. *NA* 17.3.4.
[8] Appian *Illyrian Wars* 3; Livy *AUC* 10.2; Brusić and Domjan 1985; Wilkes 1969, 1992
[9] Beltrame 2000, 2002a; Beltrame and Gaddi 2013.

discussion of constructing and maintaining local cultural identities in the negotiated periphery of colonial contexts.

This dissertation analyzes both newly excavated and previously recorded boats of the northwestern Adriatic laced tradition, fully characterizing the northwestern Adriatic laced tradition of boatbuilding, to better understand the decision-making strategies of the ancient boatbuilder, and to engage in a discussion of local cultural identity formation within a non-elite community.

**DEFINING THE NORTHWESTERN ADRIATIC LACED TRADITION**

The basic feature of the Adriatic laced boat tradition is that the planks of the hull were held together only by means of cordage, which passed through diagonally-oriented holes, located 1-2 cm from the internal edge of the plank to a trapezoidal hole along the edge of the external side of the plank (see Fig. 5.3). A bundle of plant material (often referred to as caulking, though the term 'seam wadding' is more accurate, and will be used in this dissertation) was positioned along the internal seams between the strakes, and the cordage passed over it during the lacing process, thus providing sufficient leverage (and surface area) to pull the cordage taut.[10] Once the cordage was pulled tight and tied off, the holes were plugged with wooden pegs. Even though the wooden components would swell once the boat was placed in water, sealing the seams, this type of hull was still prone to leakage and modern ethnographic reports indicate that the lacing must be replaced every six months to one year.[11]

Currently, there are 19 known examples of the northwestern Adriatic laced tradition of ship construction. Of these known examples, only two represent mostly complete hulls that have

[10] Polzer 2009.
[11] Prins 1987.

undergone extensive examination (another mostly complete hull is currently under excavation).[12] At least six finds come from secondary contexts, where the planking was incorporated into the construction of docks and hydraulic systems in the lagoons and canals surrounding modern-day Venice and the Po river system.[13] The remaining finds of partial hulls and isolated hull components were discovered along the coast or river banks of northeast Italy; four of these finds were found outside of a known archaeological context.

Marco Bonino was the first to describe this distinctive form of boatbuilding of the northwestern Adriatic when he published his report on the finds from Cervia and Pomposa-Borgo Caprile.[14] In the 1980s, Bonino investigated the largest laced vessel yet found – the Comacchio wreck – and authored the most complete hull description to date for a northwestern Adriatic laced vessel.[15] Since then, Carlo Beltrame has published an extensive account of all finds related to this system of boatbuilding.[16] His publications focus mainly on a description of each find and how the "Roman" (Italian) tradition compares to both the earlier Greek laced tradition and the concurrent eastern Adriatic laced tradition located in modern-day Slovenia and Croatia. Beltrame's explanation for the preservation of the laced tradition is entirely environmental in character, and he argues that these vessels were adapted to the shallow inner waterways of the region.[17] While the upper Adriatic is notable for its concentration of lagoons, artificially constructed canal systems, and rivers – an environment to which the flexibility of a laced hull's bottom is certainly well-suited – an environmentally deterministic argument leaves many factors (such as socio-cultural, economic, and/or individual choice) unexplored. After all, there are other rivers, lagoons, deltas,

[12] Berti 1990; Castro and Capulli 2011, 2016.
[13] Beltrame 2002a; Capulli and Pellegrini 2010; Tiboni 2009.
[14] Bonino 1968, 1978.
[15] Bonino 1985, 1990.
[16] Beltrame 2000, 2002a.
[17] Beltrame 2000.

and shallow waterways around the Mediterranean; why are laced boats not found in those locations? The local geography was certainly a factor in preserving this system of boatbuilding, but I argue that it is not the whole picture.

In a recent publication, Giulia Boetto and Corinne Rousse have taken the next step for the eastern Adriatic tradition, in their in-depth review of the Llubljana (Lipe) barge (dated to the beginning of the first century C.E.).[18] Here they argue persuasively for a re-contextualization of this boat into the southeastern European subgroup of boatbuilding; as such, they have been able to demonstrate how this barge and the construction technique it represents were influential within the broader bottom-based tradition. In so doing, Boetto and Rousse tackle the intellectual differences in designing a hull, and demonstrate the similarities of shipbuilding philosophy between the builders of southeastern Europe and those who designed and built the Llubljana barge. They reached into the mind of the ancient builder to arrive at a broader understanding of the Llubljana barge and the eastern Adriatic laced tradition.

Likewise, the northwestern Adriatic laced tradition must be fully contextualized within the socio-economic framework where it was used and the physical remains fully characterized so as to reach again into the mind of the ancient builder to understand their decision-making strategies. Furthermore, the vessels themselves should be considered as potentially insightful diagnostic artifacts in the narrative of cultural contact between the Romans and native populations.

[18] Boetto and Rousse 2011.

## RESEARCH OBJECTIVES

The ultimate objective of this dissertation is to investigate the formation and maintenance of a local cultural identity by the community of northwestern Adriatic laced boatbuilders. To pursue this goal, I have identified four specific objectives:

> **1) To contextualize the northwestern Adriatic tradition of laced construction within the broader socio-economic framework of the region and the increasing interconnectedness of the Mediterranean world.** What local factors might have contributed to both the stability and dynamism of the tradition? Can Roman, or other external, influences be detected within the resources or features of the tradition? How did the ancient builder of northwestern Adriatic laced vessels operate within the changing socio-economic context?
>
> **2) To reconstruct the technological stages of northwestern Adriatic laced vessels through a *chaîne opératoire* framework in order to understand the decision-making strategies of the ancient builders.** Where, when, and with what were northwestern Adriatic laced vessels manufactured and maintained? How long were these vessels used and how were the hull components reused after the vessel's demise? Which materials were available locally and which were necessary to import? What materials and features of the tradition change across time, space, and/or function? How do these materials and features reflect the decisions of the ancient builder of these vessels?
>
> **3) To explore how local cultural identity(ies) were formed and maintained during the various technological stages and decisions of northwestern Adriatic laced vessel *chaînes opératoire*s.** Through what means do peoples (past and present) construct local cultural identities for themselves, and especially how does technological craftsmanship in general contribute to or reflect the formation and maintenance of local cultural identities? How do the decisions of the builders of northwestern Adriatic laced vessels reflect a local cultural identity for the builders and communities of the region in antiquity?
>
> **4) To consider the results of this study within the broader discussion of the process(es) of cultural change within a colonial context.** How do the experiences, conditions, and decisions of the builders of northwestern Adriatic laced vessels compare to the experiences, conditions, and decisions of other local craftsmen in other regions of the Roman world? What does the preservation of a local tradition of boatbuilding indicate about the general process(es) of cultural change in colonial contexts? What insights into the process(es) of cultural change does this research uncover?

These research questions guide the structure of the dissertation and provide the focus for individual chapters. Chapter 2 outlines the theoretical perspectives that underpin this research and ground the exploration of the stated research objectives – including modeling cultural change, defining and accessing identity in the archaeological record, and outlining the *chaîne opératoire* as a conceptual framework. In this chapter, I examine existing models of cultural change within the Roman world, exploring in particular the efficacy of the concept of Romanization. This is complemented with current approaches to cultural change in colonial contexts within the anthropological literature. Furthermore, I discuss the various ways archaeologists have attempted to access identity in the archaeological record and the importance of materiality to understanding aspects of identity. In addition, drawing from the literature on communities of practice and an anthropology of learning, I examine the concept of the *chaîne opératoire*, which provides a framework for analyzing the material remains of the boats themselves. I also discuss the specific methods used to extract details from the physical remains of these boats – species identification of the wood and fiber materials, pollen analysis of the fibers, radiocarbon dating, and residue analysis. This chapter lays the groundwork for an approach that incorporates anthropological thought into the interpretation of ancient shipbuilding, an approach that adequately examines the material remains of the northwestern Adriatic boatbuilding tradition within the sociocultural context of the region.

Chapters 3 and 4 are guided by Research Objective 1, contextualizing the northwestern Adriatic tradition of laced construction within the broader socio-economic framework of the region and the increasing interconnectedness of the Mediterranean world. Drawing on textual, epigraphic, iconographic, and archaeological source material, in Chapter 3 I track the historical context of the region where the boats of this tradition were built and used, while in Chapter 4 I present a detailed discussion of the nautical landscape – the waterways, boats and boatbuilders of the region specifically. Chapter 3 provides a representative sketch of the northwestern region, broadly outlining the urban, economic, ritual, social, and political landscapes of both the pre-Roman and Roman periods. I also explore in this chapter the entangled cultural landscape and changing regional identities that resulted from the progressively entwined interactions between the Roman state and the indigenous population of this region. In Chapter 4, I search for evidence of the northwestern Adriatic laced boatbuilding community in the relevant texts, inscriptions, images, and artifacts; the results of this investigation highlight the importance of the hull remains themselves to understand the nature of this community of boatbuilders.

Chapter 5 is guided by Research Objective 2, reconstructing the technological stages of northwestern Adriatic laced vessels through a *chaîne opératoire* framework in order to understand the decision-making strategies of the ancient builders. Within this chapter, the *chaîne opératoire*, that is, the technical stages or operational sequences of this tradition of boatbuilding is delineated in order to highlight trends within the tradition and pinpoint the significant stages or sequences in the construction that are most relevant to understanding the community of builders. Each of the five technological stages – resource procurement, manufacture, use, maintenance, and discard – potentially contain traces of the decision-making strategies of the ancient builders. The first two stages, resource procurement and manufacture, are emphasized here as they can be tied most directly to the community of builders. The technical features identified within these two initial stages (e.g. material selection of hull planking, diameter of lacing channels, and spacing of the frames) are compared and contrasted across the various hull remains of this tradition, as well as to vessels of the Mediterranean mortise-and-tenon joinery method of ship construction.

Chapter 6 is guided by Research Objective 3, exploring how local cultural identity(ies) were formed and maintained during the various technological stages and decisions of northwestern Adriatic laced vessel *chaînes opératoire*s. In this chapter, drawing on the anthropological literature on technology and identity, I explore in more detail the sociocultural patterning of technical variation. In addition, through a review of ethnographic sources on modern laced boats, I investigate common technological and behavioral patterns observed across the laced tradition of boatbuilding. Combined, these two datasets (ethnoarchaeological research on technology and identity and ethnographic studies of laced boats) inform the situation of northwestern Adriatic laced boatbuilding communities, and provide a link between the physical (boat remains) and the abstract (identity).

Finally, Chapter 7, the conclusion, is guided by Research Objective 4. In this chapter, I consider the results of this study within the broader discussion of the process(es) of cultural change within a colonial context. The findings from each chapter are summarized and integrated into a more complete picture of this tradition of boatbuilding. Then, the contributions of this research to understanding cultural change in the context Roman colonialism are outlined and evaluated. In conclusion, I highlight the significance of this research, advocating for the efficacy of incorporating anthropological perspectives to the study of ancient ship construction.

# CHAPTER II

# BUILDING AN APPROACH

Developing an approach that adequately examines the material remains of the northwestern Adriatic boatbuilding tradition within the sociocultural context of the region and that is firmly grounded in the relevant anthropological theoretical perspectives requires a balance between the concrete and the abstract, between the physical remains of the boats and a means to relate them to sociocultural phenomena. The interwoven nature of the perspectives and concepts that inform this research demands a focused attention to detail and an attempt to guide the narrative in a logical and referential manner. Through a meticulous presentation of the relevant anthropological theories, and how they correlate to current research of Mediterranean cultures, I intend to build a robust and dynamic approach.

This study seeks to wed the overlapping yet separate disciplinary branches of nautical archaeology, classical archaeology, and anthropology in a way that generates insightful contributions to each discipline. This research is part of a larger discourse in the academic community on the process(es) of cultural change within colonial contexts, the creation, maintenance, and negotiation of identities in past communities, and the relationship between these processes of identity formation and technical behaviors (seen as the embodied activities of individuals and groups while making and using objects). Within this chapter, I examine existing models of cultural change within the Roman world, including Romanization as a historiographical concept, as well as current approaches to cultural change in colonial contexts within the anthropological literature. In addition, I define identity and discuss the various ways archaeologists have attempted to access identity in the archaeological record. I review the literature on communities of practice and anthropology of learning and relate it to the concept of the *chaîne* *opératoire*, which provides a framework for analyzing the material remains of the boats themselves. Furthermore, I delineate the intellectual underpinnings that informed the construction of a general approach and present the methods used to assemble a comprehensive data set of features for this boatbuilding tradition. Finally, I briefly discuss the significance of the approach advocated here and how it contributes to current scholarship. The ultimate goal of this research is to highlight the efficacy of incorporating anthropological thought into a hull study, and this chapter lays the groundwork for such an approach.

## PROCESSES OF CULTURAL CHANGE IN COLONIAL CONTEXTS

### Romanization as a Historiographical Concept

Romanization, the traditional model used to understand the pattern(s) of cultural change in indigenous peoples who came in contact with expanding Roman imperialism, was born out of colonial and imperialistic attitudes of 19th- and early 20th-century historical scholarship. In its original formulation, this model interprets the presence of "Roman" material culture as evidence of the civilizing processes of the empire on native populations.[19] The traditional model of Romanization can be traced to the historian Theodor Mommsen, who established the basic approach to studying cultural change from the perspective of the imperial center and based on the primacy of the text.[20] Francis Haverfield followed Mommsen's model, incorporating archaeological data.[21] These early perspectives established Romanization as a deliberate policy implemented by the Romans in their interactions with conquered peoples.

[19] Bradley 2007; Hingley 1996, 2005; Mattingly 2004, 2011; Roth 2007a, 2007b.
[20] Mommsen 1854-6, 1885.
[21] Haverfield 1912, 1915, 1923.

This early model of Romanization was criticized for its nationalistic biases and conflation of modern imperialist practices with an intentional ancient strategy; as Philip Freeman points out, "Mommsen saw Rome's unification of Italy as the model for German unification."[22] Furthermore, this model emphasized progress and implicitly assumed the superiority of Roman culture. Other scholars, such as Ronald Syme, have also questioned the existence of a deliberate Roman policy of imposing cultural practices and material goods on local populations.[23]

Despite these critiques, some scholars have continued to use the traditional model of Romanization instituted by Mommsen and Haverfield with little if any variation. Mario Torelli employed this model in his work on the formation of "Roman" Italy, clearly stating that the "profound economic and social transformations" were "imposed on subjugated peoples" and that certain religious cults were used as a deliberate tool to incorporate provincials into Roman lifestyles.[24] In a modest shift toward incorporating local perspectives outside the imperial center of Rome, Ramsay MacMullen argued that native populations throughout the empire adopted Roman-ness (*Romanitas*) because they admired their conquerors and thus adopted their cultural practices.[25]

Critiques of the traditional model, however, largely led to the development of postcolonial interpretations of Romanization, re-conceptualizing the colonial encounter through the lens of the indigenous experience. Postcolonial studies, such as those by Martin Millett and Greg Woolf, offered a fresh perspective by acknowledging the agency of native populations.[26] Millett's study on the Romanization of Britain was the first among these approaches. He argued that Romanization was indigenously motivated and that local elites voluntarily adopted Roman

[22] Freeman 1997, 30.
[23] Syme 1988.
[24] Torelli 1999, 89, 96. See also Torelli 1995.
[25] MacMullen 1984.
[26] Millett 1990; Woolf 1997, 1998.

practices and material culture as a means of establishing and maintaining their status within local society. Another interpretation is represented in Woolf's study of Gaul where he proposed that to become Roman was more about learning how to join in on the debate about what was Roman culture than it was about the adoption of any particular set of behaviors. Nicola Terrenato's concept of "cultural bricolage," the process of adapting pre-existing cultural elements to new functions and meanings in a new context, further elaborated on the arguments of both Millet and Woolf.[27]

While many scholars have welcomed the fresh perspective that allows for local agency and a more nuanced approach to the complex processes of cultural change, these models have also been found wanting. The models put forward by Millet, Woolf, and Terrenato have been criticized for their simplification of various complex interactions between peoples at all levels of society. Simon James notes:

> The recent incorporation of provincial elites as active agents in the creation of the Roman world… does not remove the boundary between the active and powerful and the supposedly passively-receptive dominated; it simply moves it, from the interface between the Roman empire and 'native' societies, to the divide between the culturally convergent provincial elites and the mass of the provincial population.[28]

Many scholars have recently called for a more nuanced approach to a) the processes by which Roman and native peoples exchanged cultural practices, goods, and technologies, and b) the examination of how this exchange fostered changing community identities.[29]

In fact, some have called for the complete abandonment of the term "Romanization" altogether, arguing that the static model has become a hindrance to interpretation. The two models that have since been proposed are informed by (a) postmodern theories and (b) discrepant experience. Richard Hingley proposes a model of Roman imperialism that is based on modern

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[27] Terrenato 1998.
[28] James 2001, 202.
[29] Alcock 2000, 2001; Dietler 2010; Hingley 2005; James 2001; Mattingly 2004, 2011; Roth 2007b.

globalization theory, while David Mattingly offers a model of discrepant identity, based on Edward Said's postcolonial analysis of imperial discourse as discrepant experience.[30] Even though Mattingly's framework has been more widely embraced within certain sectors of academia and has already inspired an edited volume, both of these models have flaws.[31] Eric Adler accuses Hingley's model of being more politically convenient, and not necessarily more accurate.[32] The model of discrepant identity often offers only hypothetical interpretations of the experience of empire that cannot be fully confirmed through textual, archaeological, and iconographic sources. Despite this limitation, the dynamic nature of the discrepant identity model has value in that it attempts to understand the multitude of ways that individuals at all levels of society negotiated cultural change in their public and private lives.

## Anthropological Approaches to Colonial Encounters

Modeling patterns of cultural change within colonial contexts has long been at the center of anthropological theory, from the early days of Edward B. Tylor and Lewis H. Morgan's Social Evolutionism to Franz Boas' Diffusionism, Alfred Kroeber's Acculturation, and Milton Gordon's Assimilation to, most salient for this discussion, Michael Dietler's Archaeologies of Colonialism.[33] Early anthropological approaches to colonialism drew largely on Kroeber's theory of Acculturation; however this approach parallels the earliest models of Romanization in its underlying assumption of unidirectional cultural progression from simple to complex and, as such, was subjected to the same criticisms.[34] During the 1970s, anthropologists began adopting a world-systems approach, based on the economic model of the previous decade that divided the world

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30 Hingley 2005; Mattingly 2004, 2011; Said 1993.
31 Roth et al. 2007.
32 Adler 2006.
33 Boas 1938; Dietler 2010; Gordon 1964; Kroeber 1948; Morgan 1877; Tylor 1871.
34 Dietler 2010, 47.

into core and periphery.[35] Although this model forced anthropologists to confront the underlying assumption of the "pristine" nature of their subjects, it has been criticized for its tendency to reduce explanations of various cultural phenomena to structural determinism, with the "economic macrostructures of power and the mechanistic articulation of modes of production" driving all sociocultural interactions.[36] To a limited degree, Romanists incorporated world systems theory into their discussions of Roman trade, but the approach was largely dismissed as a model for Roman imperialism due to a lack of central or systematic administration of provincial economies.[37] While still accounting for the influence of global economic and political systems, anthropologists have since moved toward situating local experiences of cross-cultural encounters within global structures and processes in a more culturally sensitive and flexible manner.[38]

Recent anthropological literature on cultural change within colonial contexts is largely informed by postcolonial theory.[39] Tracing its intellectual ancestry primarily to Frantz Fanon and Michel Foucault, postcolonial approaches emphasize cultural factors over the political or economic dimensions of world-systems models, and focus on locally relevant phenomena over global processes.[40] Key texts in the postcolonial literature include Said's *Orientalism*, in which he critiques western scholarship for allowing its own imperialistic roots to color its portrayal of "the

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[35] Dietler 2010, 48-50; Gosden 2004, 11-18.
[36] Dieter 2010, 49. See also Gosden's (2004, 11-18) critique of World Systems theory within archaeology.
[37] See Carandini (1986) for an example of world systems theory applied to the ancient Roman economy. See Millett (1990), Webster (1996), and Woolf (1990) for a critique of world systems in Roman studies.
[38] Dietler 2010, 49-50.
[39] E.g. Dietler 2010; Gosden 2001, 2004; Lyons and Papadopoulos 2002b; Stein 2005. As others have stated, calling postcolonial approaches a cohesive theory is a misnomer used for ease of discussion. The term encapsulates a range of analyses and conceptual schema all centered around the various cultural patterns that arise within colonial contexts. See especially Gosden (2001) and Dietler (2010, 27-54) for further discussion.
[40] Gosden 2001, 2004; Dietler 2010.

East”, and Homi Bhabha’s *Location of Culture*, in which he argues for the creation of hybrid or creole cultures in the cases of prolonged colonial encounters.[41]

While both Romanists and anthropological archaeologists have drawn from postcolonial theory, their emphases, critiques, and, to a large degree, their interpretations have differed.[42] Both highlight the role of local agency within colonial interactions and the central component of transforming identities in cross-cultural interactions, but anthropologists have placed more emphasis on the transformative nature of the interaction on ALL persons involved, whether colonizer, colonized, or some other category not covered by those narrow and often unhelpful terms. In general, the trend within anthropology in regard to colonialism has been to untangle itself from its own colonial roots and to problematize the approaches and concepts, fundamental to the discipline, which arose from these roots. As Peter Pels states, “[Anthropology] descends from and is still struggling with techniques of observation and control that emerged from the colonial dialectic of Western governmentality.”[43] As such, an anthropology of colonialism is inherently reflexive, assessing itself as well as colonial structures and interactions.[44] In particular, several scholars have wrestled with the recursive nature of colonialism and how modern consciousness has been, in many ways, colonized by the ancient Classical past, with the more recent European and American imperial agendas being born out of selective readings of classical texts and subsequent interpretations of ancient colonial motivations and strategies.[45] As Dietler cautions:

> [W]ithout a critical awareness of the complex referential loops involved in this process, archaeologists attempting to study ancient Greek and Roman colonialism (or, indeed, ancient colonialism in general) risk unconsciously imposing the attitudes and assumptions of ancient colonists, filtered and reconstituted through a modern interpolating prism of colonial ideology and

[41] Said 1978; Bhaba 1994.
[42] Here I address general trends in the literature of both sub-disciplines. There are certainly exceptions to these points, and scholars that straddle the disciplines.
[43] Pels 1997, 164.
[44] Pels 1997.
[45] E.g. Dietler 2005, 2010; Gosden 1999, 2004; Rowlands 1998; van Dommelen 1997.

experience and absorbed as part of the Western intellectual *habitus*, back onto the ancient situation.[46]

This has also resulted in renewed efforts to assess critically the dominant discourse embedded in the literary sources, both of ancient (i.e., Greece and Rome) and of modern "colonial" powers. Furthermore, scholars are compelled to combat the persistent assumption that the dramatic transformations seen within the material remains of the Mediterranean region, particularly during the period of Roman dominance (c. second century B.C.E. to fourth century C.E.), were *inevitable*.

Another consequence of the discipline coming to terms, so to say, with its own "sordid past" is the incessant need to refine, re-define, and forge anew the essential terminology of the field. The term "colonialism" has widely been abandoned in favor of "colonization" out of a desire to disassociate with Western imperialism. Anthropologists seem to desire terms that represent and iterate strong distinctions between present scholarship and past acceptance and enablement of power imbalances. This disciplinary baggage is unpacked and repacked, sometimes in an orderly fashion, other times not, at the onset of every fresh attempt to delve again into the very real phenomenon of colonialism, as I am doing now.

While I think further haggle over definitions is unfruitful at this juncture, clearly defining terms is a necessary step. For the purposes of this study, I follow the definitions of terms as presented in Dietler's 2010 publication, *Archaeologies of Colonialism*.[47] Of particular importance is his conceptualization of colonialism as a "highly contingent process of entanglement in which

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[46] Dietler 2005, 34.

[47] I follow the definitions provided by Dietler (2010,18), reproduced here: *imperialism* as "an ideology or discourse that motivates and legitimizes practices of expansionary domination by one society over another"; *colonization* as "the expansionary act of imposing political sovereignty over foreign territory and people"; *colony* as "settlement in a foreign territory" which entails both the Greek term *apoikia* and the Latin *colonia*; and *colonialism* as "the projects and practices of control marshaled in interactions between societies linked in asymmetrical relations of power and the processes of social and cultural transformation resulting from those practices."

asymmetries of power emerge from the unintended consequences of the actions of individuals and small social groups operating on the basis of socially situated interests and local cultural dispositions."[48] The imagery of "process of entanglement" is both evocative and insightful, allowing for a diversity of interactions and consequences that reflects what is seen on, or in, the ground. Furthermore, the active participation of individuals and groups at a local level reflects the anthropological interest in specific people groups and the postcolonial affinity for the intentionally myopic.

Despite the advantages of a postcolonial perspective, the approach has not been uncritically consumed by anthropological archaeologists (as it was not by classical archaeologists). While some scholars applaud the emphasis on local experience and subtle transformations, others decry the lack of a coherent broad theory of historical processes of change.[49] Dietler particularly cautions against a reductionist view of colonial encounters as a solely cultural event, recognizing the complexity of economic and political factors at play in these interactions.[50] Peter van Dommelen and others embrace the terms hybridization and creolization as powerful heuristic tools that contribute to a deeper understanding of colonial encounters, while others debate the efficacy of these terms, particularly for interpreting initial interactions between foreign and native populations.[51]

One criticism of postcolonial approaches that anthropological archaeologists seem to agree upon is the lack of attention to the material dimension of colonial encounters by postcolonial scholars. It is perhaps not surprising that archaeologists in particular would critique an approach that disregards their entire line of evidence. As Arjun Appadurai aptly states, material or physical

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[48] Dietler 2010, 346.
[49] Gosden 2004, 18-20.
[50] Dietler 2010, 52-3.
[51] van Dommelen 1997. See Dietler (2010, 51-3) and Palmie (2006) for critiques of hybridization and creolization respectively.

things “constitute the first principles and the last resort of archaeologists.”[52] However, beyond the limitations of the archaeological record, Chris Gosden argues for the underlying materiality of all colonial encounters.[53] In his perspective, colonialism is defined by the consumption and movement of material culture across geographic spaces and culturally-determined symbolic meanings; indeed, in his model, material culture is, in many ways, the source of the colonial center’s power.

Gosden perhaps more than anyone has tried to wed the advantages of the global perspective of world-systems theory and the precision of postcolonial theory in his tripartite model of colonialism. While he presents a cohesive analysis of colonialism at large, his resulting model oversimplifies historical details and obliterates the nuances of any particular colonial encounter – criticisms that he fully acknowledges as inherent in this type of scholarship (i.e., model making). His goal in creating a typology of colonialism was not to reduce the experiences of it into a rigid categorical system, but to offer a heuristic tool for comparison between varying forms and expressions of power. In contrast, Dietler calls for studies that “move beyond sweeping models of contact between cultures or broad ethnic categories to consider locally relevant social categories ... and socially situated interests.”[54] This study seeks to answer Dietler’s call by studying a community of boatbuilders within a focused geographical region and fairly established chronological parameters who have their own set of situated interests, and by analyzing the entangled processes through which local Adriatic boatbuilders negotiated their cultural identity in a colonial context.

[52] Appadurai 1986, 5.
[53] Gosden 2004, 3-6, 153-9.
[54] Dietler 2010, 76.

## IDENTITY AND TECHNOLOGY

An anthropological exploration of colonial encounters following a postcolonial approach incorporates relevant theoretical perspectives from anthropology as appropriate to analyze the material or context in question. For Dietler, and to a lesser extent for Gosden, this entailed the inclusion of anthropological theories of consumption. For my purposes, this entails the incorporation of anthropological theories of technology, and technology's role in the construction and reproduction of group identity.

### Defining Identity

There are several factors that influence identity, among them ethnicity, gender, religion, language, age, profession, social status, and access to political power and economic resources. As such, identity has been shown to be a dynamic process, not a singular entity, which is under constant revision and subject to a number of forces – political, economic, and social.[55] It is determined as much by individual and communal responses to interactions with others and the context of those interactions as it is by the processes of self-reflection and self-determination.[56] A person's identity is informed by the sum of their sensory experiences in life, by what they do, how they do it, and the other persons with whom they engage in these activities. Jean Lave and Etienne Wenger envision identity(ies) as "long term, living relations between persons and their place and participation in communities of practice."[57] In this sense, identity is both an inherently personal and social or group phenomenon.

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[55] Graves-Brown et al. 1996; Meskell and Purcell 2004.
[56] Meskell 2005, 14; Ivison 2002, 10.
[57] Lave and Wenger 1991, 53.

The term "cultural identity" has been widely used in the archaeological literature, and is almost always synonymous with "ethnic identity."[58] It is not the goal of my research to identify this boatbuilding tradition with any discrete ethnic marker, such as Venetic, for a number of reasons.[59] However, this research relies on a definition of "cultural identity" that emphasizes a shared sense of community based on dynamic sets of perceptions, understandings, and values that structure individual and communal responses to problems and opportunities. This concept is intended to be more closely aligned with the term "group identity" as the object of study here is a community of boatbuilders and not the society writ large.

**Accessing Ancient Identity**

The ethnic modifiers used to denote and classify indigenous populations of the ancient Mediterranean are largely derived from Greek and Roman textual sources. The inadequacy of using ancient texts uncritically to examine ethnic or cultural identities of indigenous populations has been demonstrated previously.[60] While textual sources are certainly appropriate and effective for orienting the researcher to Roman (or Greek) attitudes, institutions, and historic events, they present a clouded portrait of the people groups about which the ancient authors wrote and, where possible, should be interpreted in tandem with the archaeological record.

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[58] Degoy 2008; Graves-Brown et al. 1996; Gruen 2011; Lomas 2006, 2011; Shennan 1989.

[59] Primarily, ethnic markers of Italic tribes are mostly known through the textual record and are thus an etic label that may or may not have held emic value. Secondarily, while some scholars have identified the users of watercraft based on the personal items found on board, I hesitate to equate the ethnicity of the users with that of the builders. In my opinion, this approach to identifying the ethnic origin of vessels via the shipboard use items requires further problematization within nautical research. However, this is not to say that I make no mention or use of the known ethnic markers for indigenous populations in the region, as avoiding their use altogether would likely be more confusing than a careful and precise incorporation of them into this discussion.

[60] Dietler 2010, 43-4. See also Alston 1996; Martens 1989; Webster 1996.

Recently, epigraphy and iconography have become key sources through which classical archaeologists explore ancient cultural identity in the Mediterranean world. Through the epigraphic record preserved in Roman Africa, Mattingly was able to distinguish the "Janus-headed" nature of identity in Tripolitania, influenced by Roman, Punic, and African sources.[61] He then further differentiated expressions of these overlapping identities within the military, urban, and rural communities. Louise Revell detailed both a religious inscription from a temple complex in Roman Spain and the experience of Maurianus, the dedicator, within the temple complex to demonstrate how individuals could and did "routinely recreate their own social identities through routinized encounters."[62] Linda Hall studied multiple identities in the epigraphic record of the Levant in late antiquity and found that, while religious identity was changing from "Latin inscriptions [dedicated] to pagan deities" to "Greek inscriptions with Jewish and Christian symbols," statements of occupations remained constant.[63] As such, Hall argued that an individual's professional identity surpassed other types of identity, including religious and ethnic. Kathryn Lomas, in a study of both iconographic and epigraphic evidence from a survey of grave stelae of Naples, recognized a tension between Greek and Roman styles of dress and names (i.e. a Greek name but Roman dress) and uncovered no linear transition from Greek (names, epitaphs, dress, and customs) to Roman.[64] Instead, she concluded that there was an ongoing interplay between different cultural elements and thus different representations of identity. Lomas also conducted a study of a set of grave stelae in the northwestern Adriatic region, specifically from ancient Patavium (modern Padua), and argued that they contain evidence of composite personal identities among the ancient Venetic elite.[65] Her study of these stelae is discussed further in the next chapter.

[61] Mattingly 2004.
[62] Revell 2000, 5.
[63] Hall 2004, 243.
[64] Lomas 2003.
[65] Lomas 2011.

Funerary or monumental iconography and epigraphy does offer a unique window into ancient representations of identity, but it is important to note that this window is just that, a window that reveals part of the landscape, but not all of it. After all, how people present themselves for eternity does not always parallel how they identified themselves in daily life. Furthermore, most of the population is left out of the picture that these scholars describe, inasmuch as the epigraphic, iconographic, and written records are notoriously biased toward elite populations. How would a non-wealthy native individual or family group express and communicate his/her/their identity? The discrepant identity of all levels of society – particularly the non-elite population – is largely, if not entirely, lost. Instead, the only traces of these ancient persons lie in the material record, the objects this population manufactured, used, traded, and discarded. That is not to say that epigraphy, iconography, and contemporary texts are without value; indeed, my research draws on all three of these sources to tease out the attitudes and perspectives of local inhabitants. However, what is needed is an artifact set that represents the non-wealthy portion of the ancient population to complement and problematize the evidence from textual, iconographic, and epigraphic sources. In this regard, a collection of artifacts, uniquely constructed and used within a localized region, such as northwestern Adriatic laced vessels, may shed light on the expression of identity within a non-elite community.

As such, this research draws on anthropological approaches of materiality, holding that "objects ... are not simply residues of social interaction but are active agents in shaping identities and communities."[66] This study incorporates discussions of the role of material culture in identity formation[67] and the dialectic of people and things[68] to explore the ways through which ancient

[66] Lyons and Papadopoulos 2002a, 8.
[67] Hoskins 1998; van Dommelen and Knapp 2010.
[68] Gosden and Marshall 1999; Meskell 2005.

communities created, maintained, and transformed their identities,[69] particularly within a colonial context. Appaduari and Igor Kopytoff have put forward the concept of a biography of things, the idea that objects can carry and transfer meaning, and that a study of the life histories of things is a fruitful endeavor toward an understanding of social and cultural behavior.[70] Notably, Kopytoff, foreshadowing concepts such as Terrenato's cultural bricolage, suggested that "in situations of culture contact, [biographies of things] can show … that what is significant about the adoption of alien objects – as of alien ideas – is not the fact that they are adopted, but the way they are culturally redefined and put to use."[71] While Kopytoff and Appaduari focused on how people give meaning to objects, Janet Hoskins looked instead at how objects inform the biographies and life meanings of people, arguing that "local constructions of selves… are tied to the construction and use of specific types of objects."[72]

This idea that any object may have been the receptacle and perpetuator of ancient identities has caused archaeologists, including scholars of the classical world, to include a broader spectrum of material culture into their discussions of patterns of cultural change and changing local identities. As a side note to his study of tracing Romanization through local uses of and changes in pottery, Roman Roth argued that innovation of form in black-gloss ceramics from central Italian sites reinforced local identity, though this has been questioned by other scholars.[73] Jan Paul Crielaard and Gert-Jan Burgers investigated the single settlement of L'Amastuola in southeastern Italy – parsing out cultural identity in the patterns of domestic architecture, ritual or cultic objects, and funerary goods – hypothesizing that a 'third culture' arose in the interaction between foreign

[69] Graves-Brown et al. 1996; Shennan 1989.
[70] Appaduari 1986; Kopytoff 1986.
[71] Kopytoff 1986, 67.
[72] Hoskins 1998, 21.
[73] Roth 2007b, 176. See Colantoni (2008) for a critique of Roth.

(Greek) and indigenous populations at the site.[74] Soren Handberg and Jan Klindberg Jacobsen evaluated the efficacy of a postcolonial theoretical framework in a comparitive study of indigenous handmade pottery found at Greek *apoikiai* in both southern Italy and the northwestern Black Sea region, noting the absence of postcolonial theoretical frameworks in research conducted on the latter. According to Handberg and Jacobsen, scholars working in southern Italy have interpreted indigenous pottery at Greek *apoikiai* within a cohabitation model, whereas those working in the Black Sea region describe indigenous pottery as a trade good when discovered at *apoikiai,* maintaining their viewpoint of the ancient residential experience as one primarily segregated along ethnic lines.[75] These studies operationalize terms such as “hybridity” and “middle ground” from postcolonial literature to conceptualize the experience of (e)merging ancient populations.

The materiality of identity formation and negotiation is developed in more detail in Chapter 6. For now, I present a case study from classical scholarship that closely resonates with the approach to accessing ancient identity advocated in this research. Matthew Fitzjohn, a classical archaeologist who incorporates anthropological theory into his research, looked at changing forms of early Iron Age houses at Lentini in Sicily.[76] He argued that “the house [is] both the *product* and *creator* of people’s sense of place”[77] and, citing Yi-Fu Tuan and Nadia Lovell, that identity is learned through sensory experiences of everyday activities, including the communal construction of a domestic structure.[78] He demonstrated that the new forms of domestic structure at Lentini (i.e., rock-cut houses) were neither inherently indigenous nor foreign (Greek), but a completely new form of space – a hybrid third space. By fashioning a new space for the multicultural population, Fitzjohn concluded that the rock-cut houses not only embodied a new structure, but as such

[74] Handberg and Jacobsen 2011.
[75] Handberg and Jacobsen 2011.
[76] Fitzjohn 2011.
[77] Fitzjohn 2011, 156.
[78] Fitzjohn 2011, 158-61; Lovell 1988; Tuan 1977.

entailed new construction methods requiring different bodily activities, a new pattern of occupation within the space necessitating different daily tasks, and thus a new social construction of identities. Fitzjohn emphasized the need to move beyond dualities of "Greek" and "indigenous", or as relevant to my own study, "Roman" and "indigenous", to recognize the complex processes of identity construction, maintenance, and negotiation that is reflected in the archaeological record. His approach, particularly his consideration of the learned activities and sensory experiences of building a house as integral to the construction of identity, mirrors in many ways the approach which is followed in this study to explore the connection(s) between identity and building processes.

**Communities of Practice**

This research builds on existing anthropological perspectives on the relationship between culture and technology,[79] and particularly that of technology and social or cultural identity,[80] and relies heavily on the literature of communities of practice and an anthropology of learning.[81] Marcia-Anne Dobres maintains that an anthropology of technology should consider both the sociocultural contexts of the manufacturing process, including interpersonal or group interactions, and the sense experience or "corporeality of what humans experience when materially modifying and using the object world."[82] She identifies two arenas where the manufacture of objects take on cultural meaning(s): "1) where cultural sensibilities, communal values, and one's lifetime of sensory experiences engaging with the material world combine to inform technicians and work

[79] E.g. Dobres and Hoffman 1994; Hegmon 1998; Ingold 2001; Lemonnier 1993; Mahias 1993; Roux et al. 1995; van der Leeuw 1993.
[80] Arnold 1991, 2000; Degoy 2008; Gosselain 2000; Hegmon 2000; Kolb 2001; Roux 2003; Stark 2003; Wallaert 2008.
[81] Herbich and Dietler 2008; Lave 1993; Lave and Wenger 1991.
[82] Dobres 2001, 54.

groups how to get a job done within (or in spite of) social prescriptions and proscriptions, and 2) where such strategies and decisions further social reproduction."[83] Dobres argues that the technical stages of material production can be linked to the context and experiences of the producers through an approach embedded in practice theory.

Practice theory is derived in large part from the work of Pierre Bourdieu, and a practice-oriented framework within anthropology draws extensively upon the concept of *habitus*. Bourdieu defined the *habitus* as "systems of durable, transposable dispositions" or "principles which generate and organize practices."[84] An individual's *habitus* develops through a number of stages, beginning with the sociocultural norms and behaviors learned from his/her family in childhood. This represents the primary *habitus*, which Bourdieu contends remains the strongest influence throughout a person's lifetime. Sociocultural structures and formalized education also form secondary and tertiary aspects of the *habitus*. However, the *habitus* extends beyond the lifespan of any single individual, as Bourdieu states, "The habitus – embodied history, internalized as second nature and so forgotten as history – is the active presence of the whole past of which it is the product."[85] Bourdieu's concept of *habitus* links structure and agency, both of which affect and are affected by the *habitus*. The *habitus* is informed by the structure, learned by individuals, who shape it through their own life experiences, and then reproduce it in a slightly or, rarely, a drastically edited form.

Learning, as a key element to the production and reproduction of the *habitus*, warrants further development. Lave and Wenger maintain that "learning is an integral and inseparable aspect of social practice," and argue for an approach to situated learning that highlights the value

[83] Dobres 2001, 54.
[84] Bourdieu 1990, 53.
[85] Bourdieu 1990, 56.

of participation in sociocultural activities over the reified concept of learning as the acquisition of knowledge, which confines it to the mental realm.[86] By incorporating "participation" into their understanding of learning processes, they contend that the "dichotomies between cerebral and embodied activity, between abstraction and experience" are "dissolved."[87] The practitioners of a craft are part of communities of practice which reproduce themselves as they also maintain and reproduce their shared dispositions, or *habitus*. Techniques or technical behaviors, as Dietler and Ingrid Herbich argue persuasively, are the result of particular learning processes, of the "socially acquired dispositions" that comprise the *habitus*.[88] It is through participation in a community of practice that an individual learns the techniques necessary to practice his/her craft. For many practitioners, including boatbuilders, it is largely through participation in this community of practice that the object itself can be produced.

While seemingly obvious, Dietler and Herbich identify an important distinction between things and techniques, where things are "physical entities that occupy space" and techniques are "those human actions that result in the production or utilization of things."[89] This distinction is particularly important for archaeologists, whose primary evidence is material culture (things). Dietler and Herbich maintain that while archaeologists excavate *things*, the technical traces often preserved on or within the objects (or archaeological contexts) of investigation permit the study of *techniques*. Since technical behaviors are a product of the *habitus*, a study of techniques used to manufacture an object can be informative about the communities which practiced them.

In many ways, the practice-oriented approach is a reaction to ecological or functional deterministic models, which assume that the pressures of environmental conditions or physical

[86] Lave and Wenger 1991, 31.
[87] Lave and Wenger 1991, 52.
[88] Dietler and Herbich 1994.
[89] Dietler and Herbich 1998, 235.

demands exert so great a force on technology that “technical behaviors are better explained as adaptive strategies rather than as social (or cultural) choices.”[90] In other words, ecological or mechanical fitness is more determinative of the manufacturing process than social or cultural contexts. Olivier Gosselain, on the other hand, through an ethnographic study of southern Cameroonian potters, found that observed technical behaviors of these potters were not adapted as a reaction to environmental or functional pressures.[91] Instead, he identified economic, symbolic, and social constraints on the ceramic technologies of these potter communities, demonstrating that there are cultural dimensions to technical behaviors which are socially acquired and reproduced.[92]

## ***Chaîne Opératoire* as a Conceptual Framework**

By viewing technology (boatbuilding) as a "system of behaviors and techniques," the final product (laced vessels) as the result of "multiple technical choices made during the manufacturing process," and the builders as participants in a community of practice, then utilitarian artifacts, such as boats, become roadmaps to the decision-making strategies and situated learning processes of ancient builders.[93] In light of Gosselain’s argument that social or cultural choices “could reside in every stage of the manufacturing process and thus in every technical feature of a manufactured object,”[94] the strategies of the builders must be viewed as a potentially heterogeneous and complex mixture of entangled decisions at each phase of the building process. Individual decisions and any overarching strategy (if it can be proven to have existed) are influenced by the social conditions within which the builders learn and practice the skills of their craft.

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[90] Gosselain 1998, 79. For examples of the ecological or functional approach to technology, see O’Brien et al. (1994) and Schiffer et al. (1994).
[91] Gosselain 1998, 99.
[92] Gosselain 1998.
[93] Stark 1998, 6.
[94] Gosselain 1998, 82.

In order to delve into the choices and strategies of the ancient builders, this research follows the conceptual framework of the *chaîne opératoire*, the sequence of actions and mental processes through which an artifact is manufactured, from the acquisition of the raw materials to final discard of the artifact.[95] This analytic methodology and conceptual framework has been exploited by several scholars in order to examine a variety of ancient technologies, including stone tools, pottery, metallurgy, and organic tool assemblages.[96] The *chaîne opératoire* approach also analyzes the technical strategies and knowledge held in common by the group of practitioners. However, more than an avenue to access this shared knowledge, scholars use the *chaîne opératoire* as "an empirical entry point for researching how meaning-making, agency, and personhood unfolded during artifact production."[97] This follows on Pierre Lemonnier, who stated that "the mental processes that underlie and direct our actions on the material world are embedded in a broader, symbolic system."[98] Furthermore, as Gosselain argues, "[T]he contexts in which technical behaviors are constructed and reproduced correspond to the same networks of social interaction upon which identities are themselves constructed and reproduced."[99]

Gosselain demonstrated, in his study of African potter *chaînes opératoire*s, that "one may be able to differentiate among conspicuous, fluctuating, and superficial facets of identity on the one hand, and more subtle yet pervasive and rooted ones on the other."[100] Based on Gosselain's approach, it may be possible to determine various facets of identity by analyzing the stability or dynamism of each technological stage. Furthermore, my research seeks to move beyond teasing out the features that served a functional purpose from those that were stylistic in nature. Lynn

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[95] Sellet 1993.
[96] E.g. Perles 1992 (stone tools), Degoy 2008 (pottery), Hjarthner-Holdar 2010 (metallurgy), Dobres 2010 (organic tool assemblages).
[97] Dobres 2010, 52.
[98] Lemonnier 1993, 3.
[99] Gosselain 2000, 209.
[100] Gosselain 2000, 209.

Meskell in particular emphasizes this need for researchers to step outside the dichotomy of objects as either purely functional or purely symbolic.[101] Instead, my analysis views each technological feature as potentially multi-layered, both serving a function within the viability of the boat as a watercraft but also representing the choices of the builder relative to his identity as part of a community of builders of a particular style of (water)craft.

Many *chaîne opératoire* studies, Gosselain's included, use ethnoarchaeology as a method to understand artifact production and spatial distribution. The value of ethnography as an analog for the archaeological record has been well-argued[102] and implemented extensively.[103] Although ethnoarchaeological research on boatbuilding activities has only been conducted to a limited extent, the ethnoarchaeology of other technological crafts can supplement this material and provide additional insightful analogies to the shared human experience of creating, maintaining, and negotiating identities through embodied practice. These secondary discussions are instrumental in forging the link between the physical (boat remains) and the abstract (cultural identity), and are pursued in greater detail in Chapter 6.

Although a *chaîne opératoire* approach has been underutilized in studies of boatbuilding technologies, its application to a study of northwestern Adriatic laced vessels should permit an understanding of each technological stage – resource procurement, manufacture, use, maintenance, and discard – and can elucidate the decision-making strategies of the ancient builder and the collective cultural identity that these actions produced for the community of builders. Gosselain and Laure Degoy's research on the relationship between technical traditions and cultural identity in African and Indian potters' communities respectively is especially salient to this study

[101] Meskell 2005, 2.
[102] David and Kramer 2001.
[103] E.g. Dietler and Hayden 2001; Keller and Keller 1996.

and is used in constructing an approach to explore the technical behaviors of northwestern Adriatic laced boatbuilders.[104] Following Gosselain's research, the sociocultural dimension of technical behaviors "offers an opportunity to explore the deepest and more enduring facets of social identity."[105]

## CONSTRUCTING AN APPROACH

My own approach is derived primarily from that of Dietler and Gosselain, although all of the aforementioned literature has shaped my strategy to some degree. Following Dietler, I have combined a vertical (regional specificity) and horizontal (diachronic) orientation to the material.[106] As such, in this study, I focus on a single region – the northwestern Adriatic – and a specific social setting – boatbuilding – over a broad time span (at least 800 years) and rely on a theoretical perspective of the anthropology of technology (as outlined above) to explore the decision-making strategies of the ancient builders in light of the colonial contexts in which the boats were made.

More specifically in regard to the physical remains, following Gosselain, I have oriented the *chaîne opératoire* framework along three focal points – (1) the possibilities for each technical stage to be the location of sociocultural expression, (2) the processes that affect sociocultural dimensions of technical behaviors, and (3) the link between technical behaviors and group identity.[107] In order to evaluate the stages of the manufacturing process as locations of sociocultural expression, various options for each technical stage have been identified and other potential solutions available to the ancient boatbuilder have been considered. These may include alternative

[104] Gosselain 1998, 2000; Degoy 2000, 2008.
[105] Gosselain 1998, 82.
[106] Dietler 2010, 8-14, 26. My own focus is more weighted to the vertical orientation than is Dietler's as he covers a much wider time frame than is appropriate for my study.
[107] Gosselain 1998, 82-3.

technical systems of construction (i.e. mortise-and-tenon joinery and/or bottom-based construction), raw materials, and construction features (e.g. methods of attaching frames to the hull planking).[108] In order to understand the processes that affect the sociocultural dimension of technical behaviors, the stability of each stage of the manufacturing process has been traced through time and space and an attempt to identify potential factors that might have influenced decision-making has been made. And finally, in order to explore the link between technical style and group identity, the relevant ethnographic and ethnoarchaeological records have been consulted to fashion relevant and insightful comparisons to the process of meaning-making through communities of practice.

## **Methods**

Before this tradition of boatbuilding can be related to the larger discussion of group identity through a *chaîne opératoire* framework, the basic features of the technological system, including the materials used, and the season and location of the vessel's construction, must first be understood and described. Northwestern Adriatic laced vessels represent the perpetuation of a specific set of skills and knowledge held by local builders, reflecting the decisions of a non-elite portion of society. This research is particularly focused on the decision-making strategies of the builders in regards to the materials used and techniques employed in the construction of these vessels. In order to address the research questions outlined in the first chapter, a thorough examination of the excavated physical remains of several Adriatic laced vessels was undertaken. In addition to a comparative analysis of the construction features within and between vessels of

[108] The lacing system of the hull is the primary focus of this investigation as opposed to the construction of the entire vessel. This is to some degree a factor of the partial nature of the remains, as even the best preserved hull of this tradition is still not a complete vessel. As such, any discussion of superstructure would be almost entirely hypothetical. Since the lacing system clearly distinguishes these vessels from other technical systems of construction, it is appropriate that it is the focus of this analysis.

this tradition, five different laboratory analyses were conducted, including (1) wood identification of hull components, (2) fiber identification of seam wadding and cordage material, (3) residue analysis of hull planking, (4) pollen analysis of seam wadding and cordage material aided by scanning electron microscopy (SEM) as needed, and (5) radiocarbon dating. Each analytical method serves an express purpose in characterizing the technical stages of the northwestern Adriatic laced tradition of boatbuilding, and the overall methodology is intended to identify the materials used in the construction of northwestern Adriatic laced vessels (resource procurement stage), elucidate details about the location and season of their construction (manufacturing stage), and situate each artifact chronologically (contributing to a better understanding of use, maintenance, and discard stages).

*Wood Identification, Fiber Identification, and Residue Analysis*

The botanical materials used to construct these ancient hulls, including – wooden components (planking, frames, treenails, pegs, etc), fibrous material (seam wadding and cordage), and residues (such as resins and other waterproofing materials) – were identified based on samples collected from accessible laced vessels. These three analyses are critical to understanding the basic make-up of these boats, and are a fundamental element of a hull/timber study. Recently, Nili Liphschitz and Cemal Pulak have demonstrated the efficacy of sampling every individual component of a vessel; knowing the exact composition of some the 37 Yenikapı vessels, for example, has allowed for reconstructions of their life cycles and a better understanding of their designed purposes.[109] The results of these analyses are compared to regional paleoenvironmental reconstructions,[110] as well as the regional archaeological record of organic artifacts, to understand

[109] Liphschitz and Pulak 2010.
[110] Accorsi et al. 1999; Bosi et al. 2001, 2014; Kaltenrieder et al. 2010; Longo and Martini 2000; Mercuri and Sardori 2014; Mercuri et al. 2012, 2014.

the local availability of materials. In this way, the identification of the materials of construction allows for discussion of the resource procurement stage, and how decision-making in choosing materials may have shaped the local Adriatic tradition.

*Pollen Analysis*

The pollen trapped inside the fibrous seam wadding and cordage of the lacing system was analyzed in an attempt to reconstruct the life cycle of these vessels. Palynology in general is being incorporated with increasing frequency into the interpretation of excavated ancient ships, and has led to a better understanding of the cargoes carried and cautious conclusions about the timing of wrecking and even environmental reconstructions of the wreck/harbor site.[111] However, there has been only one instance where pollen analysis was carried out effectively on the materials of the ship itself to understand the processes of the ship's construction. Marie-Francoise Diot conducted a study on the moss caulking of the 17th-century Godefroy river boat in southwest France; based on pollen data she was able to suggest the forested sources of both the original harvesting of the moss and that used in subsequent repairs, thus reconstructing the probable life cycle of this boat.[112] The infrequency with which palynological analysis is pursued in relationship to ship construction is likely due to the fact that only a few boatbuilding materials, like resin and caulking, are viable pollen traps. In this sense, laced vessels are particularly suitable artifacts as the seam wadding and cordage materials used in their construction present a unique opportunity to apply pollen studies to the understanding of a ship's construction (or repair), as opposed to its demise. Pollen analysis of this boatbuilding tradition should permit a hypothetical reconstruction (season, location, stages,

[111] Allevato et al. 2010; Bryant 1995; Bryant and Murray 1982; Giacchi et al. 2003; Girard 1978; Gorham and Bryant 2001.
[112] Diot 1994.

and activities) of the manufacturing stage (and possibly the maintenance stage too) of each vessel and a comparison between vessels.

*Radiocarbon Dating*

Collected samples underwent AMS radiocarbon dating at the three separate radiocarbon laboratories.[113] Radiocarbon dating is not without its limitations, and some samples yielded only a century specific date due to plateaus in the calibration curve. Unfortunately, none of the studied timbers – consisting of hull planking and frames shaped from young limbs – has enough rings to permit dendrochronological analyses, which could pinpoint the felling of the tree to a more exact calendar date. Most vessels or hull components of the northwestern Adriatic laced tradition are dated via stratigraphy in secondary contexts or dated relatively based on their associated cargo. Yet cargo and stratigraphy only speak to the timing of the final deposition of the artifact, not the moment of its construction. Radiocarbon dates allow for a closer approximation of the date of the vessel's construction, albeit not an exact calendar date. In some cases, it was possible to compare radiocarbon dates with final deposition dates to more clearly understand the lifespan of the vessel, a method not without precedent in nautical archaeology.[114]

## SIGNIFICANCE OF THE APPROACH

The approach proposed here contributes to anthropological theory regarding cross-cultural contact and the process(es) of constructing identity within past communities. Understanding the process(es) of identity formation was recognized recently as one of archaeology's most important

[113] Arizona AMS Laboratory, International Chemical Analysis, Inc. (ICA), and Beta Analytic Laboratory. See Appendix E for radiocarbon analyses.
[114] E.g. the Kyrenia shipwreck, Swiny and Katzev 1973.

scientific challenges.[115] Furthermore, my research provides one of the first applied case studies of the *chaîne opératoire* as a conceptual framework to the technology of boatbuilding. Each time a dynamic and rigorous concept, such as the *chaîne opératoire*, is applied to a new type of data, the potential for original insights and new research trajectories is significant. This project offers a fresh perspective on the relationships between technology and identity formation and expands on discussions of local communities negotiating colonial encounters in a specific context.

This study is also one of the first attempts to underpin findings from the relatively new field of nautical archaeology with anthropological theory and interpret hull remains within a theoretical framework. As such, the research program outlined here has the potential to make a broad impact in the fields of anthropology, history, classics, and specifically within the subdiscipline of nautical archaeology. Much of the work to date within the field of nautical archaeology has been highly technical, seeking mainly to understand how a boat was engineered or performed as an entity in and of itself. As a relatively new field, this phase of research was absolutely necessary to build a data set that would permit theoretical modeling. Drawing on the pivotal work of J. Richard Steffy, Fred Hocker and Matthew Harpster have made broad strides in the effort to bridge the gap between the technical construction features of boatbuilding traditions and the humanistic aspects of the builders themselves, notably their shipbuilding philosophy.[116] Through a comparative study of the Bozburun and Serçe Limanı hulls, Harpster was able to model social patterns of the early medieval Mediterranean maritime community, effectively "chang[ing] a hull study from a technical exercise into a cultural study."[117] It is my goal through this study to translate the technical aspects of the boatbuilding culture represented by northwestern Adriatic

[115] Kintigh et al. 2014
[116] Steffy 1991, 1994; Hocker 2004; Harpster 2009, 2010.
[117] Harpster 2010, 54.

laced vessels into a broader discussion of the lifeways and identities of these ancient builders. This project could potentially be a bridge between the extensive research conducted on ancient ship construction and the sophistication of anthropological approaches for understanding cultural phenomena.[118]

[118] This study by no means is intended to prove the superiority of an anthropological perspective nor to denigrate the contributions of classical scholars and nautical archaeologists to date. Far from it, the research of classical and nautical archaeologists has generated the groundwork of evidence that is analyzed here. Instead, the goal is merely to highlight how an anthropological approach to the study of ancient boatbuilding can contribute to the discussion(s) already occurring within these disciplines and encourage further discussion(s) across disciplines.

# CHAPTER III

# SETTING THE STAGE: THE REGIONAL CONTEXT OF THE NORTHWESTERN ADRIATIC LACED TRADITION

When does the incorporation of foreign elements into a social and cultural structure move from a "natural" process of cultural change to an unnatural distortion of culture or even a dissolution of it? Cultures, after all, are not static, they are never a singular entity, they all change over time, whether gradual or drastic, and they all, by some means, become unrecognizable and distinct from earlier forms. Thus the issue that seems to be at stake in colonial-driven changes to cultures is that of choice. Colonial encounters often create power imbalances that precipitate change in the disadvantaged culture. While there is no overt evidence of exploitation of the northwestern Adriatic region on the part of the Romans or that the local population was anything other than an active agent (or perhaps an apathetic participant) in the colonial process, a power differential did exist between the Roman state and the local inhabitants of the region. Thus, the question becomes what was the role of local peoples in the process – how and to what extent did they redefine their own cultural traditions, their own local identity, in consideration of pressing external influences?

## THE ORIGIN MYTH

There is a story about the people who settled the northwestern coast of the Adriatic Sea, a story that is steeped in gravitas and epic heroes, a story that begins, as many do in the ancient Mediterranean, with the siege of Troy. When Troy fell to the Greeks and the population of the city scattered before the invading army, the escape of a handful of key individuals was recorded. The most famous of these fugitives was Aeneas, who sailed across the sea and settled in the Latin hills, whose progeny would eventually give rise to Rome. A lesser known escapee was Antenor, who, with his two sons and a band of displaced Trojans known as the Heneti, also sailed west into the Adriatic. Antenor led his small band of refugees along dangerous coastlines teeming with piratical Illyrians and past treacherous, surging river mouths to eventually arrive safely in the plains of the Po valley. There he established the city of Patavium (modern Padua), giving his Trojan charges a safe place to rest from their wanderings, to settle and thrive. Virgil, whose primary goal was to record the mythological founding of Rome by Aeneas, took a few lines to record Antenor's companion tale:

> Antenor, though th' Achaeans pressed him sore,
> found his way forth, and entered unassailed
> Illyria's haven, and the guarded land
> of the Liburni. Straight up stream he sailed
> where like a swollen sea Timavus pours
> a nine-fold flood from roaring mountain gorge,
> and whelms with voiceful wave the fields below.
> He built Patavium there, and fixed abodes
> for Troy's far-exiled sons; he gave a name
> to a new land and race; the Trojan arms
> were hung on temple walls; and, to this day,
> lying in perfect peace, the hero sleeps.[119]

This is a curious tale, one told by tragic poets, historians, and geographers alike, one that may be referenced as early as the fifth century B.C.E. and certainly was perpetuated throughout the period when the northwestern Adriatic laced boatbuilders were practicing their craft, but one that is only recorded in Greco-Roman literature. In the ancient texts, the population that occupied the northwestern coast(s) of the Adriatic were called the Veneti. The Veneti of the Adriatic Sea discussed here should not be confused with the perhaps more well-known Atlantic Veneti, whom

[119] Verg. *Aen.* 1. 242-249 translated by Williams (1910).

Julius Caesar defeated in a hard-fought sea battle during his military campaigns in northern Gaul.[120]

Concerning the Veneti of the Adriatic, several ancient authors corroborate Virgil's origin myth of Antenor's escape after the fall of Troy. Cato mentioned that the Veneti were of Trojan stock.[121] Polybius made a brief reference to the wondrous tales that tragic poets tell of the Veneti.[122] Strabo related two competing stories of the origins of the Veneti – first, that they are related to the Atlantic Veneti of Caesar's account, or second, that they are descended from Antenor.[123] Livy began his seminal work with the origin myth of Antenor and the founding of Padua, providing considerably more detail than is found in Strabo.[124] These authors tie the Veneti into the Trojan cycle and also into a shared mythological history with the Romans.

It is unknown (and perhaps unlikely) that the peoples of the northwestern Adriatic coast originally traced their ancestry to a Trojan survivor, however, during the period in which Livy, a Patavium native, records the tale it is possible that the local inhabitants had incorporated this origin myth into their own psyche. The presence of the Antenor myth in Virgil's account of Rome's foundation suggests a belief held by some Romans that the Veneti were similar to themselves, that they were a type of kin. Whether this was a mutual feeling held in common between these two cultural groups is more difficult to determine. Despite this, the Antenor myth persisted in time, with various references in textual sources throughout the colonial period (starting for this region

[120] Caesar *Bellum Gallicum* 3.8-15.
[121] Cato *Orig*. fr. 46.
[122] Polyb. 2.17. This is a possible reference to the *Antenoridae* of both Sophocles and Lucius Accius. See also Leigh (1998) for a discussion of how Accius' *Antenoridae* aids in filling out the fragmentary remains of Sophocles' version. Strabo (*Geog.* 4.4) does not put much stock in this tale, and instead supports the claim of their origin from the Atlantic Veneti. Livy (*AUC* 1.1), a Patavinus himself, only cites the Antenor founding myth. See also Thallon (1924) for a discussion of the possible historical plausibility of the Antenor founding myth. The importance of the myth within the psyche of the ancient Veneti is a worthwhile subject for future exploration.
[123] Strabo *Geog.* 5.1.4.
[124] Livy *AUC* 1.1.1-3.

in 181 B.C.E. as discussed below).[125] This tale provides a backdrop for the colonial encounter in the region and a lens through which to explore, and perhaps understand, the interplay between the Veneti and Rome.

The process by which the peninsula of Italy was united under Roman rule is itself a complex narrative. Each indigenous population of the peninsula interacted with Rome with varying degrees of hostility, assimilation, friendship, alliances, respect, and indifference. By the time Augustus divided Italy in 7 B.C.E. into 11 administrative regions, each region had undergone changes in its social, political, and cultural landscape. Despite the, in some cases, drastic changes, there is evidence for continuity of ethnic and cultural identity within both the literary, epigraphic, and archaeological records. This chapter tracks the social, political, economic, and cultural history of the northwestern Adriatic region, largely inhabited by the Veneti, within the 10th administrative region (*Regio X, Venetia et Histria*) in order to examine the context in which northwestern Adriatic laced boatbuilders lived and worked. In this chapter, I briefly describe the geographical and temporal boundaries of the region where the vessels have been found, compare the pre-colonial and colonial socioeconomic contexts, and finally discuss the entangled cultural landscape and changing regional identities that resulted from the progressively entwined interactions between the Roman state and the indigenous population of this region.

This is by no means intended to be an exhaustive overview of the social, political, and economic aspects of the region and the subsequent changes during the colonial period; such an undertaking is beyond the scope of this study. Instead, the goal is to sketch a representative portrait of the cultural context of the region and the impact of the colonial encounter. The specific maritime landscape of the region is developed separately in Chapter 4. There are several lines of evidence

[125] See Leigh (1998) for a full discussion of the textual traces of the Antenor myth across authors and over time.

that speak to the social, economic, political, and cultural conditions of this region as well as directly to the Venetic population that inhabited the coastline where the vessels were found. The historical, epigraphic, and archaeological records are all considered in order to construct the context in which northwestern Adriatic laced boatbuilders lived and worked.

## BOUNDARIES

Before engaging in a discussion of the social and economic context of the northwestern Adriatic laced tradition, it is important to clarify the boundaries, both physical and temporal, within which these vessels were built and used.

### Geographical Boundaries

The remains of the boats themselves are found primarily along the northwestern Adriatic coast between Aquileia and the Po River delta, with a noticeable concentration of finds in and around the Venetian lagoon (see Fig. 3.1). The remnants of northwestern Adriatic laced vessels have been unearthed as far east as Aquileia, as far south as Cervia, and as far inland as Padova and Oderzo (which are still less than 20 km or 12 miles from the coast). Perhaps unsurprisingly, all remains were found in close proximity to waterways – the sea coast, rivers, and/or ancient canal systems. The distribution of vessels also clearly overlies the recognized territory of the Veneti, and in most cases maps onto a known Venetic urban center (see Fig. 3.2). Altino (Altinum), Padua (Patavium), Oderzo (Opitergium), Concordia,[126] and Adria are all Venetic settlements that were later incorporated into the Roman administrative system as municipalities and they are all sites where laced remains have been found. The construction of the *Via Annia*, completed in 131 B.C.E.,

[126] While initially this settlement was thought to have been a Roman colony "ex novo", archaeology has shown that habitation at the site dates to the Bronze Age. See the discussion in Balestrazzi 2011.

united Adria, Padua, and Altino, through the colonial re-settlement of Iulia Concordia to the *colonia* founded at Aquileia. Laced boat remains of the northwestern Adriatic tradition have been found at each of these locations along the *Via Annia*, highlighting the importance of the connections between terrestrial and aquatic routes.

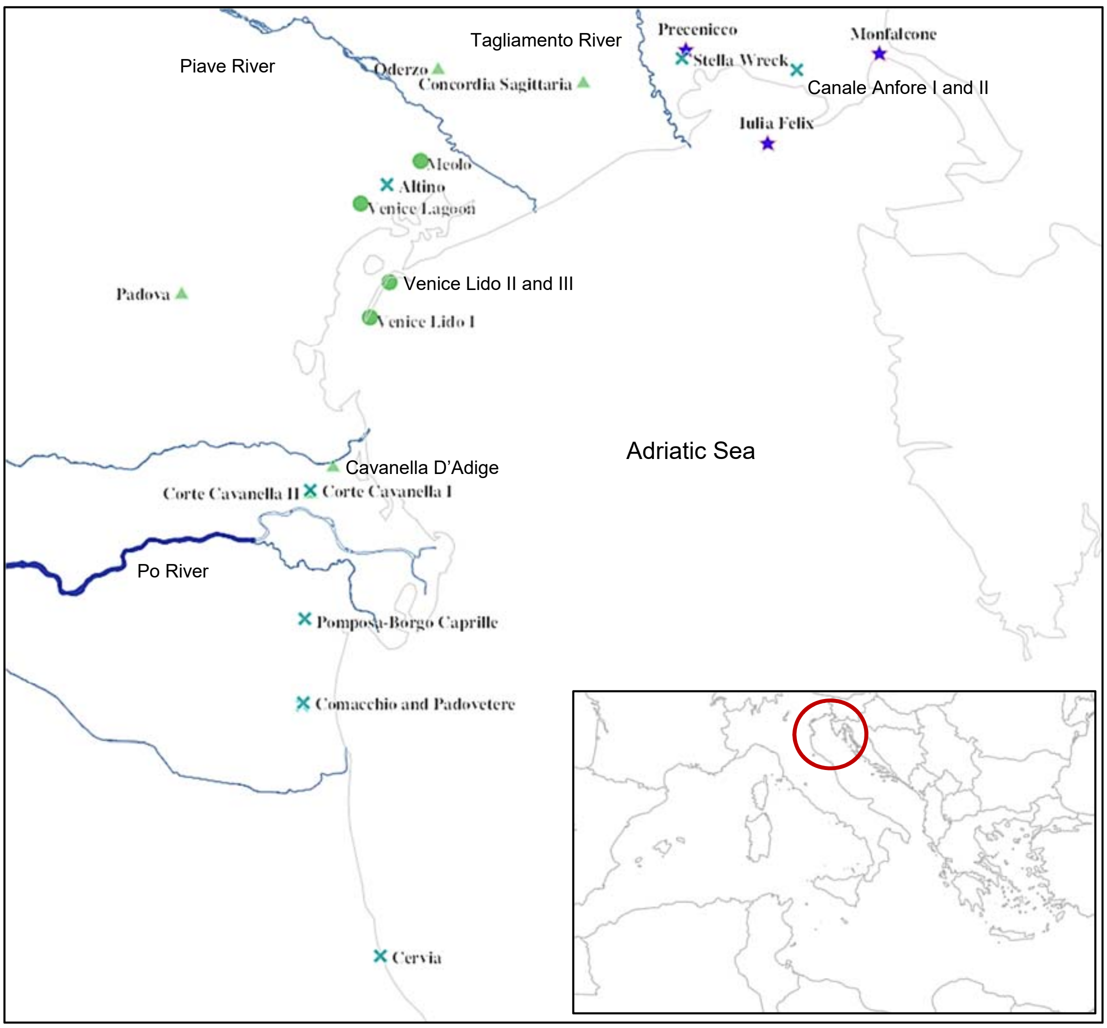


Figure 3.1: Map of hull remains in the northwestern Adriatic region. Northwestern Adriatic Laced Vessel Remains: Green X = Remains from primary context (shipwreck or abandoned vessel). Green Triangle = Remains from secondary context (reused in docks or canal structures). Green Circle = Remains without archaeological context. Mortise-and-tenon vessels = Blue Stars. (Created in Harvard World Map).

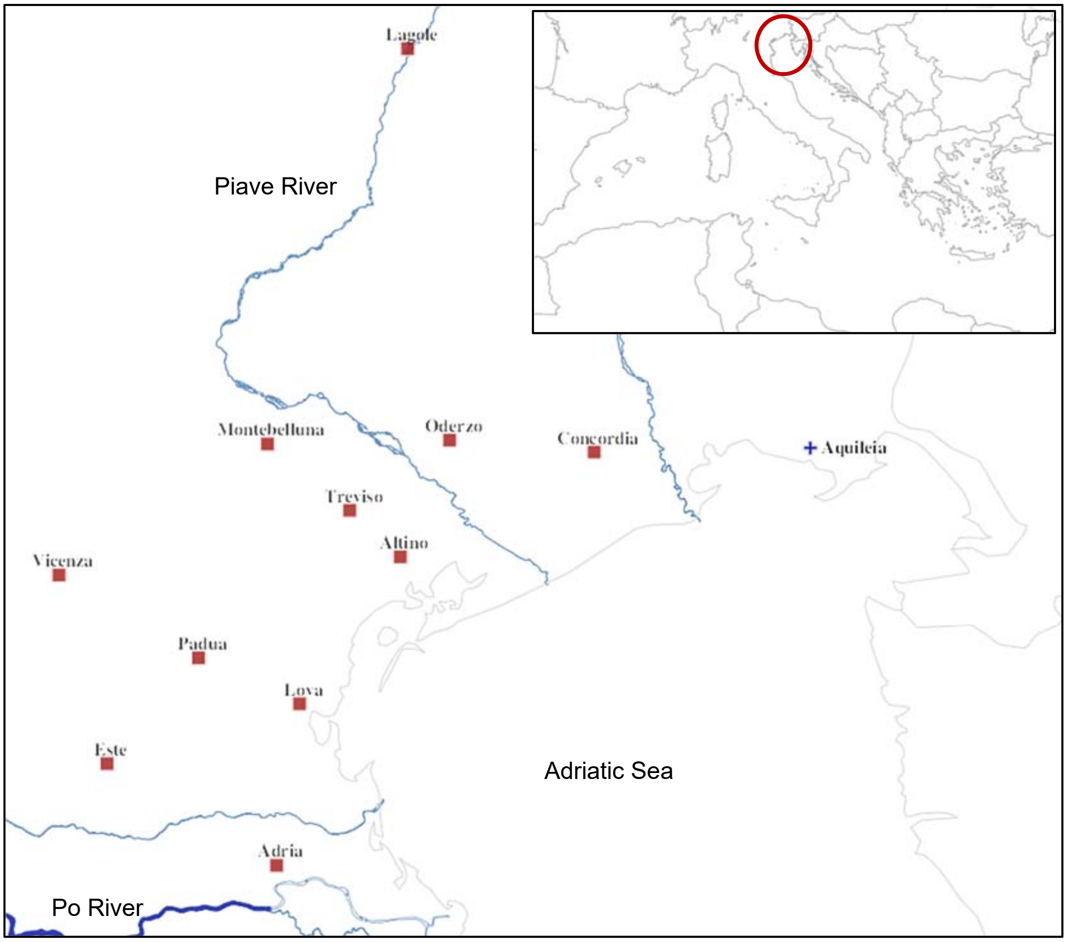


Figure 3.2: Map of archaeological sites in the northwestern Adriatic region. Red squares = Venetic urban centers and sanctuary sites. Blue Cross = Roman *colonia*. (Created in Harvard World Map.)

The remains of four laced boats were discovered south of the Po River outside the traditional domain of the Veneti, although only one (found near Cervia) is arguably outside the territory of the Po Delta. However, these vessels likely represent coastal traders, and as such had ranges which would have extended farther from their building site than most other vessels of this tradition (more details regarding the nature of individual vessels are discussed in Chapter 4). While I am not arguing that the boatbuilders of this tradition were definitively Venetic in ethnicity, the vessels were very likely built within the region primarily occupied and influenced by Venetic culture.

In antiquity, the Veneti occupied the area roughly equivalent to the modern regions of Veneto and Friuli-Venezia Giulia in northeastern Italy along the Adriatic Sea. This region is well connected, both internally within the confines of its territory and externally with neighboring regions, and is particularly suited to facilitate trade as it lies at the intersection of the Italian peninsula with central and northern Europe. Various bodies of water crosscut the region of the Veneti, creating a network of aquatic connections. Strabo described the marshy landscape, canals, and dikes that created fluvial links within the region.[127] This series of lakes, rivers, lagoons, and canals formed a continuous inland waterway system which permitted navigation from Ravenna all the way to Aquileia.[128] This inland navigation system ran parallel to the maritime route along the coast.

Furthermore, this region was a link between the lands and Celtic tribes north of the Alps and the rest of the Italian peninsula. A recent study has pushed the territorial boundary of the Veneti further north to the site of Monte Calvario Auronzo di Cadore, a center for production of lead and bronze votive objects.[129] Isotope analysis of lead ingots excavated from the site proved that they were not mined locally but instead were brought to Monte Calvario through trade networks that extended north and south through the Veneto region.[130] Finally, the Adriatic Sea connected the Veneti to the rest of the Mediterranean.

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[127] Strabo *Geog.* 5.1.4-6, 9-10.
[128] D'Agostino and Medas 2010.
[129] Zaghis et al. 2005.
[130] Zaghis et al. 2005, 348-49.

## Chronological Boundaries

The timeline of the laced boats spans anywhere from 800 to 1600 years. The earliest date attributed to these remains is the sixth or fifth century B.C.E. (590-470 B.C.E.) and the latest date is to the 11th century C.E. However, both the ends of this spectrum are contested. The wooden fragment radiocarbon dated to the sixth or fifth century B.C.E. may not be from a laced boat and the late date is based on associated pottery from an excavation in the 1960s; the wooden remains were not radiocarbon dated and the hull has since been reburied. Definitive chronological evidence of this tradition ranges from the second century B.C.E. to the sixth century C.E. Complicating even further the establishment of a clear chronology are the issues that four finds have no relative or absolute date and that repurposed hull planking has been dated based on its secondary deposition as opposed to its construction.[131] Despite these impediments, the tradition clearly covers several major political disruptions and systems of governance, as well as changing cultural practices.

The northwestern laced tradition was being practiced when the Roman colonies were founded in this area, including Aquileia in 181 B.C.E. and Iulia Concordia in 49 B.C.E., when Augustus incorporated the region into the 10th administrative unit of united Italy, when Atilla laid siege to and destroyed Aquileia in 452 C.E., when Justinian reconquered the city in the mid-sixth century, and when the Lombards invaded the region after 568 C.E. It is unclear whether laced vessels were still being built in 643 C.E. when the Lombards conquered Oderzo and took control of the region, but it is possible that, if they were in use, they might have provided an avenue of escape for the population that fled into the lagoon and established Venice.

[131] Please see Chapter 4 for complete details of the context and interpretation of the laced boat remains.

## PRE-COLONIAL CONTEXT

The pre-colonial context is known primarily through the archaeological record. The majority of archaeological material of the region has been excavated from ritual or funerary contexts – sanctuary and necropolis sites – as the ancient areas of settlement are, in most cases, currently covered by modern cities. In fact, the distribution of bronze votive offerings, which were used throughout the Adriatic basin, has been crucial in identifying the extent of the domain of the Veneti in pre-colonial times.[132] While the archaeological record of the region is biased toward ritual and funerary sites, a few houses and workshops have been identified, granting some insight into the domestic and industrial spheres of pre-colonial lifeways in the region. The key Venetic sites that have undergone archaeological investigation include: Oderzo, Lagole, Montebelluna, Treviso, Altino, Vicenza, Padua, Este, and Adria.[133] Of these, Este and Padua are two of the largest centers of Venetic civilization, though they are only 30 km (less than 19 miles) apart and shared a boundary line.[134] Archaeological evidence places the formation of Venetic civilization in the region at some point between 1000 and 800 B.C.E.[135]

Another important line of evidence for this region and the Veneti is the epigraphic record. There are about 350 inscriptions in the Venetic script and language dating from the sixth to first centuries B.C.E. (see Figs. 4.2 and 4.3 for examples of Venetic script). The Venetic language has been identified as an Indo-European language, and evidence supports that the Veneti were using a written script by the end of the seventh century B.C.E.[136] While scholars tend to agree that the Veneti adapted their written script from the Etruscan alphabet,[137] they debate how to best situate

[132] Lomas 2007a, 25-6; Bonetto et al. 2009.
[133] Lomas 2007a, 22-5.
[134] Lomas 2007a, 25.
[135] Bonetto et al. 2009.
[136] Bonetto et al. 2009.
[137] Bonetto et al. 2009; Gvozdanović 2012; Lejeune 1974; Prosdocimi 1988; Pandolfini and Prosdocimi 1990.

the language in relation to other Indo-European languages. Some claim that the Venetic language represents a linguistic anomaly within known western Indo-European language groups and cannot be attributed to any one classification.[138] Others argue that it should be classified as an Italic language.[139] Prosdocimi contends that the Venetic language is closely related to Histri, Carni, and Liburni from the Istrian peninsula and Dalmatian coast.[140] Most recenlty, Gvozdanović presented evidence for its attribution within the Celtic language group.[141] This debate over the classification of the Venetic language underscores the similarities that it shares with multiple linguistic groups and perhaps suggests the receptiveness of the ancient Veneti to external influence.

The appearance of writing in the region coincided with the emergence of urban centers along the coast. Venetic script was used mostly in funerary and ritual (votive) contexts, though possible ownership marks (using Venetic lettering) are also found on portable containers and objects.[142] In notable contrast to the Roman epigraphic record, the Venetic script is rarely found in demonstrably public or monumental settings.[143] Our knowledge concerning the breadth of use of the Venetic script may also suffer from the excavation bias outlined above.

As mentioned, several factors contribute to the difficulty in reconstructing the pre-colonial context of the region, including inconsistent excavation, the problems associated with urban archaeology in modern cities, the lack of surviving historical records written in the Venetic language, and the restriction of the epigraphic record to primarily funerary and ritual contexts. These factors create an incomplete picture of the lifeways of the people along the northwestern Adriatic coast, but enough of a record exists to make comparisons to the later colonial context.

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[138] Krahe 1950; Polomé 1966.
[139] Beeler 1949; Euler 1993; Lejeune 1974.
[140] Prosdocimi 1988; Pandolfini and Prosdocimi 1990.
[141] Gvozdanović 2012.
[142] Lomas 2007a, 34; Lomas 2007b, 150.
[143] Lomas 2007b, 150.

## Urban Landscape

There is distinct variability in the urban landscape between southern Veneto, the coastal region, and alpine Veneto, the northern mountainous area. While population centers in southern Veneto developed urban structures fairly early in their settlement history, the population of alpine Veneto remained dispersed in villages up to the founding of Roman colonies in the area.[144] Urban development in the southern Veneto region began as early as the seventh century B.C.E. and followed a similar pattern, particularly for the major settlements, which is perhaps best exemplified in the sites of Este and Padua.[145] By the sixth century B.C.E., both Este and Padua had an organized street layout, clear boundary markers, and divisions of space separating residential areas and burial grounds.[146] These early Venetic cities can be generally described as clusters of houses surrounded by cemeteries with sanctuary sites strategically placed to demarcate the boundaries of each city's territory.[147] In the third century B.C.E., each city developed into a fully established urban center with complex street plans and public buildings, and by the late second and early first centuries B.C.E., Hellenistic and Roman styles and forms of architecture had been incorporated into the urban landscape.[148] Again, due to the lack of excavation of settlement contexts, not much is known directly about private homes, domestic life, or the use of public space within the city center.[149] Unfortunately, no ancient writer described their experience in these urban centers prior to Roman influence on the urban landscape.

Kathryn Lomas notes that while the Venetic urban centers show a general consistency, shared language, and material culture, there are significant differences between sites and an

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[144] Lomas 2007b, 152-3; 2009, 15.
[145] Chieco Bianchi 1981, 49-53; Capuis and Chieco Bianchi 1992, 45-51; Capuis 1993, 114-21, 163-5.
[146] Capuis 1993, 140-59; Balista and Ruta Serafini 1992; Boaro 2001.
[147] Lomas 2007b, 154.
[148] Bosio 1981, 231-37; Baggio Bernardoni 1992, 305-20; Tosi 1992a, 400-18.
[149] Lomas 2007a, 23-33.

individuality to each site that suggests the increasing importance of the city-state as the primary focal point for Venetic identity as opposed to a regionally bounded ethnic identifier.[150] One of these significant differences between Padua and Este can be seen in the placement of sanctuary sites along the perimeter of the city. Lomas argues that sanctuary sites functioned to delimit the boundaries of a city, and, for the larger settlements such as Padua and Este, to mark the reach of each city's territories; in this way, sanctuary sites were located along the boundary lines dividing 1) the urban center from the surrounding landscape and 2) the wider territory under the control or influence of the urban center from that of surrounding city-states.[151] While the five sanctuary sites at Este form a clear ring around the settlement, the sanctuary sites at Padua are more numerous and concentrated to the east of the settlement, with only a few sanctuaries demarcating the northern and western limits and none at the southern border.[152] The differences in cultural practices between individual urban centers of the southern Veneto are further developed below.

**Economic Landscape**

Traces of the pre-colonial economy are embedded subtly in the textual and archaeological records, although most archaeological research has focused on the ritual landscape. Jacopo Bonetto listed the resources of the region as agricultural products, livestock, wool, timber, fish, salt, and building stone.[153] Lomas described the pre-colonial Veneti as primarily a subsistence agrarian society that likely produced wine, oil, fruit, and grains – the typical produce of this region.[154] These descriptions of the economy of the region are supported in textual sources. Polybius wrote that the peoples of this region, including the Veneti, lived on agriculture and war

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150 Lomas 2007a, 32.
151 Lomas 2007a, 30.
152 Lomas 2007b, 153-5.
153 Bonetto et al. 2009, 133.
154 Lomas 2007a, 35.

and held property in cattle and gold.[155] When describing the fertile lands of the Po, he stated that they are fruitful in the production of wheat, barley, wine, millet, and panic (another variety of millet).[156] The cultivation of grapes is corroborated in the archaeological remains of over 1500 grape seeds in a structure dated to the fifth or fourth century B.C.E. in the alpine Veneto region.[157] While Polybius is writing about the products of the region during the period of Roman colonial influence, paleoenvironmental reconstructions of the region during pre-colonial times verify the agricultural landscape he depicted.[158]

In addition to farming, the raising of livestock is supported in the ancient texts. Although he stated that the practice had ceased by his day, Strabo spoke of the former fame of the Veneti in horse-breeding, asserting that not only did the Veneti maintain and rear horses for Dionysus the tyrant, but that Venetic horses were esteemed highly by all Greeks.[159] Strabo's claim of the value of Venetic horses and the importance of horses to pre-colonial Venetic culture is reflected in the use of horse representations in stela iconography and in small bronze votive figurines or *bronzetti* (Fig. 3.3), and the presence of horses within burials.[160] Furthermore, a possible sacrificial horse was excavated from a ritual deposit at a sacred site at Altino.[161] Other domesticated animals are also mentioned in the literary record. Columella commented on the abundant milk that was produced by the cows of Altino.[162] Polybius remarked that nowhere in Italy are pigs slaughtered

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[155] Polyb. 2.15.
[156] Polyb. 2.15.
[157] Guidi et al. 2008, 19.
[158] Kaltenreider et al. 2010; See also Bosi et al. 2011 and Sardori et al. 2011 for additional paleoenvironmental data on the impact of human cultivation on the landscape of northern Italy during the Bronze Age and Iron Age.
[159] Strabo *Geog.* 5.1.4-6, 9-10.
[160] Lomas 2007a, 35.
[161] Tirelli 2003.
[162] Columella *Rust.* 6.24.4-5.

at a higher rate than in this region.[163] Zooarchaeological remains excavated from various sites throughout the region confirm the use of these domesticated animals in pre-colonial times.[164]

Figure 3.3: *Bronzetti* or bronze votive figurines from the sanctuary of Altnos at Altino (Bonetto 2009, 198, fig. 3.135).

Furthermore, the Veneti, positioned as a focal point between northern Europe and the Italian peninsula, were instrumental in the regulation of the amber trade in the Mediterranean. Matthew Leigh posits that Greeks were aware of the upper Adriatic primarily due to the amber trade, citing fragmentary Greek sources that identify the Po as the avenue for this trade.[165] Pliny the Elder, although mocking these same earlier Greek writers for their confusion over geography,

[163] Polyb. 2.15.
[164] Riedel 1994, 74-5.
[165] Leigh 1998, 90, citing Euripides (*Hipp*. 738-41) and Diodorus Siculus (5.23). These authors both tell the tale of Phaeton, who was struck by thunder on the Eridanus (perhaps the ancient Po River) and so the trees shed tears of amber and the local inhabitants wore black to show their mourning.

reinforced the importance of the Po to the amber trade and identified the Veneti as being the first to bring amber to the general notice of the Mediterranean world.[166]

Finally, ritual and funerary objects bear witness to the presence of various forms of craft specialization in the region. There was a thriving metal industry, particularly in bronze, as evidenced by votive plaques, *bronzetti*, and mirrors.[167] The decoration of bronzes gave rise to a local form of situla[168] art in the seventh century B.C.E.[169] An industry in stoneworking is attested by carved cippus boundary stones and grave stelae.[170] A ninth-century B.C.E. workshop for the production of mudbrick building materials was excavated at Oderzo, in addition to a substantial thoroughfare with artisan workshops along one side dating to before the end of the eighth century B.C.E.[171] The presence of loom weights as votive offerings at sanctuary sites suggests at least domestic, and perhaps industrial, weaving.[172] This evidence for a class of craft specialists suggests the existence of complex economic divisions in the region during pre-colonial times, whereby individuals could subsist without direct engagement in food production.

## Ritual Landscape

Of all areas of ancient Venetic life, ritual practices are the best documented and the most understood. The ritual landscape of the ancient Veneti includes excavated sanctuary sites and cemeteries, which permit interpretations of religious worship and burial practices. While there are overarching similarities in Venetic ritual practice and material culture, significant differences are

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[166] Plin. *HN* 37.11.
[167] Bosio 1981; Pascucci 1990; Pellegrini and Prosdocimi 1967; Prosdocimi 1988; Ruta Serafini 2002; Tosi 1992b.
[168] Latin term meaning bucket. Venetic situla are typically conical in shape with the decoration embossed from the inside.
[169] Capuis 2004; Locatelli 2003.
[170] Lomas 2011.
[171] Ruta Serafini 2003, 40.
[172] Pascucci 1990.

seen between large urban centers and individual sanctuary sites. Deities and rites were highly localized within the region and in some cases, the deity closely corresponded to civic identity, such as the worship of the so-called god Altnos at Altinum.[173]

A typical Venetic sanctuary was an open air site with no permanent stone buildings but an open enclosure demarcated by walls or fencing. Sanctuary sites often contained an environmental feature, such as a lake or rocky promontory, and votive offerings were deposited in pits.[174] Padua is the only Venetic urban center to have ritual deposits also associated with domestic spaces, as opposed to limited to sanctuary sites.[175] Two of the most well excavated sanctuary sites come from the territory surrounding the city of Este – Baratella, to the southeast, and Meggiaro, to the east. A number of votive offerings were excavated in the 19th century (1881-1886) from the sanctuary of Baratella, which was enclosed by trees or wooden fencing and included a natural spring, and dedicated to the goddess Reitia. The votive objects consisted of pottery, *bronzetti*, loom weights, and other bronze objects.[176] This site is remarkable for the frequent presence of votives inscribed with dedications and the name of the donor onto the votives; about 300 of the 14,000 votive finds carry inscriptions.[177] Additionally, the presence of bronze plaques decorated with ornately dressed women has led some to suggest that the ritual activities conducted at Baratella, and those associated with the goddess Reitia, were primarily for women.[178]

The sanctuary site at Meggiaro also followed the standard pattern that defines a Venetic sanctuary – no permanent stone buildings and an open enclosure. At Meggiaro, a wall enclosed an open space, where ritual objects from the eighth and seventh centuries B.C.E. were found in pits,

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[173] De Nardi 2007, 50-51; Lomas 2007a, 27-30. The nature of this deity is unclear as only three references are preserved on votive offerings.
[174] Fogolari and Prosdocimi 1988, 171-81; Pascucci 1990.
[175] Lomas 2007b, 155.
[176] Fogolari and Prosdocimi 1988, 173-4; Pascucci 1990.
[177] Pellegrini and Prosdocimi 1967, 94-188; Prosdocimi 1988, 262-82.
[178] Zaghetto 2002.

a square platform, where some propose ancient augurs might have observed the flights of birds, and large quantities of bone suggesting animal sacrifice played a key role in ritual activities there.[179] Elisa Perego suggests that the horns, teeth, and knucklebones found at Meggiaro and other Venetic sanctuary sites may also be evidence of the belief in and use of magic by the ancient Veneti.[180] Similar to what was seen at Baratella, embossed and incised bronze plaques were found. However, in contrast to Baratella, these decorated plaques were adorned with armed young men, which has led Luca Zaghetto to suggest that the ritual activities at Meggiaro were part of a warrior god cult or possibly related to rites of passage for young men.[181] In fact, all five of the sanctuary sites at Este have distinct patterns of votive offerings, highlighting the singularity of worship at individual sanctuaries.[182]

Following sanctuary sites and ritual offerings, the funeral practices of the Veneti are also well documented. Several cemeteries have been excavated at both Padua and Este. Again noting the individuality of Venetic sites, these excavations have revealed a different pattern of burial between the two sites. At Padua, the cemeteries were concentrated in the eastern part of the city, while those at Este were associated with distinct house groupings.[183]

There is a notable shift in burial practices during pre-colonial times – a shift noted throughout the Italian peninsula – from a mix of inhumation or cremation in *dolia* and stone-lined trench burials in the sixth to fourth centuries B.C.E., to predominantly cremation burials in individual pottery urns interred in smaller scale tombs by the end of the fourth century B.C.E.[184] Grave good assemblages also changed in parallel with the type of burial, from a large quantity of

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[179] Maggiani 2002; Ruta Serafini and Sainati 2002.
[180] Perego 2010.
[181] Zaghetto 2002.
[182] Lomas 2009, 15.
[183] Chieco Bianchi 1981, 49-53; Capuis and Chieco Bianchi 1992, 51-2.
[184] Lomas 2007a, 30-1.

luxurious goods in the earlier period – jewelry, bronze vessels, fine ware ceramics associated with drinking and feasting, and occasionally chariots and even the horses as well – to more modest assemblages of bronzes and ceramics.[185] Lomas interprets this shift in funerary practices as possibly representing a change "from a small and very dominant aristocracy with a clan-based social structure to a wider, but still restricted and wealthy, elite organized around the nuclear family."[186]

Another key element of Venetic burials is the placement of stone markers. These artifacts also differed from site to site. A plain cippus of local limestone marked groups of burials in the cemeteries at Este. Lomas suggests that these were likely used to commemorate family groups.[187] These markers were generally slightly tapered toward the apex and inscribed in the local language.[188] The presumed grave markers at Padua, on the other hand, were rectangular stelae also carved from local limestone.[189] Commonly referred to as the *stelae Patavinae*, this group of 18 commemorative markers[190] range in date from the late sixth to the first century B.C.E.[191] The *stelae Patavinae* display a mix of formulaic iconography – typically of mounted combat or a passenger-filled chariot – and local Venetic inscriptions.[192]

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[185] Lomas 2007a, 31.
[186] Lomas 2007a, 32.
[187] Lomas 2011, 9.
[188] Lomas 2011, 9.
[189] None of the stelae from Padua was excavated according to modern archaeological standards, and only a few have confirmed find locations in an area to the east of the city. Subsequent excavations have suggested that in this general area was a Venetic cemetery and other smaller foci of graves. Although, the exact nature of how these stelae were intended to be displayed and what they commemorated is still circumstantial, Lomas (2011, 10) argues, "[T]he balance of probabilities is that most or all of the stelae were intended to be set up at or near a tomb or group of tombs."
[190] Sixteen of the stelae were discovered at Padua; the other two were found near Altino but follow the same pattern as those at Padua.
[191] Lomas (2011, 10) urges caution when considering these dates as only a few come from datable archaeological contexts.
[192] Lomas 2011, 10-8.

Overall, the ritual landscape highlights the diversity of practices within a generalized set of cultural norms and the complexity of assemblages that can arise from a finite package of material culture. Consistently, however, the Veneti tended to distinguish themselves, in ritual contexts, according to their civic identities while also maintaining their kinship ties within urban centers. Furthermore, the use of votives, particularly inscribed with personal names of the giver, denotes the importance of individual worship at communal sanctuaries.

## Social and Political Landscape

The divergence of practice between urban centers noted in the ritual landscape is continued in the social sphere. Differences are seen in the form and use of writing between the alpine region, where inscriptions on votive offerings were largely dedicated by or for men, and the southern coastal region, where both men and women dedicated votives.[193] Females are particularly visible in the epigraphy and funerary deposits of Este, in comparison to other southern Veneto urban centers.[194] Certain letter forms in the Venetic alphabet as well as the direction of the script also show regionalization between the northern, southern, and eastern regions of Venetic settlement, as well as between Este and Padua, suggesting that the development and dissemination of literacy was not centrally controlled and may reflect local statements of identity.[195]

Unfortunately, little is known about the political organization of the pre-colonial Veneti. A possible scepter was found at Oderzo, but this need not imply monarchical rule and there are other likely interpretations of this enigmatic find.[196] Grave goods, however, show signs of wealth differentiation and social hierarchy by the sixth century B.C.E., suggesting that social boundaries

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[193] Lomas 2007b, 163-4.
[194] Lomas 2009, 21.
[195] Lomas 2007b.
[196] Fogolari and Prosdicimi 1988, 182-3.

existed between a ruling class "elite" and other non-elite members of the population. Broadly, Lomas interprets the rise of urban settlement coupled with richer burials and more complex layout of cemeteries and settlement as signs of the rise of politically dominant urban centers in the region and locally dominant elite within each center.[197] The image of the horse and chariot and the use of writing, particularly on durable materials of stone and bronze, have been interpreted as symbols used by this developing elite to demonstrate and reify their status.[198]

Strabo, Livy, and Polybius all identified the Veneti as a cohesive ethnic group, but whether the Veneti would have considered themselves as such is difficult to determine. Lomas argues that while archaeological evidence supports socio-political organization and identity focused on a city-state urban center, there is little evidence for an ethnic identity that the ancient Veneti would have recognized as connecting themselves across urban communities within the region.[199] An isolated inscription found at Isola Vicentina, near Vicenza, includes the adjective "venetkens".[200] Although this artifact has no archaeological context, and thus only limited information regarding its purpose or date, this find has been used to support the existence and use of an ethnic identifier among the Veneti.[201] In contrast, the differences noted in the form and use of writing between the two major regions of the Veneti (southern coastal plains and mountainous alpine), as well as between individual urban centers, supports Lomas' thesis that literacy was integral to the establishment of culturally divergent city-state identities in the region between the sixth and fourth centuries B.C.E.[202] Sarah De Nardi, relying heavily on the archaeology of the ritual landscape, described the

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[197] Lomas 2007b,
[198] Lomas 2007b, 2011.
[199] Lomas 2007a, 37.
[200] Marinetti 1999, 400-12.
[201] Marinetti 1999, 400-12; Lomas 2007a, 37. Lomas has suggested that this inscribed stone might have functioned as a boundary stone and may date between the fifth and third centuries B.C.E.
[202] Lomas 2007b.

region as "a constellation of largely independent local communities spread over a vast area that ... host[ed] a variety of local identities, dialects and traditions."[203]

Overall, the textual, epigraphic, and archaeological sources sketch a portrait of the lifeways of the pre-colonial Veneti. This evidence points to a socio-political organization centered around an urban core that relied on the land within its demarcated territory to supply the necessary foodstuffs, with an active community of craftspeople and localized religious worship. Through an interpretation of archaeological data, key aspects of the Venetic culture can be identified; these include the pivotal nature of the family or clan groupings as a social structure, the division of ritual votive offerings and cultic rites possibly by age and gender, a similar pattern of sanctuary sites used for localized religious practices and deities, a distinct social hierarchy as revealed through burial practices, and significant differences between major sites which suggest developing civic identities at the city-state level.

Although no definitive hull remains of the northwestern Adriatic tradition have been dated to the pre-colonial period, it is likely that this tradition was in practice prior to Roman colonization. As such, it is also likely that the local builders of these laced vessels identified with an urban center and practiced their trade within relative isolation from other boatbuilders in the area. Thus, it is reasonable to expect that the disparities between Venetic sites, observed in the archaeological record of the pre-colonial period, would be mirrored in the construction features of the laced tradition, reflecting multiple communities of practice in the region.

[203] De Nardi 2007, 54.

**Cultures in Contact**

The Veneti did not live in isolation. The interconnectivity of the landscape led to economic and cultural exchanges primarily with the Etruscans to the southwest, Greeks at Adria, Celts to the west and north, and eventually, with Rome.

Etruscan influence can be seen in the Venetic script and iconography.[204] The adaptation of the Etruscan alphabet to formulate Venetic script has already been noted. Etruscan iconographic elements have been identified in the *stelae Patavinae*, primarily the inclusion of horse drawn chariots.[205] While the horse was important to the Veneti, as noted in the discussion of the economic landscape, the borrowing of the horse/chariot scene from Etruscan art, where it was a symbol of kingship, suggests that it may have been used to denote an elite status.[206] In a separate study, Larissa Bonfante examines the extent to which Etruscan influence can be seen within the artistic and stylistic elements found at northern sites in a comparative study of the Arnoaldi mirror and the Treviso discs with Etruscan mirrors of the fifth and fourth centuries B.C.E. The Arnoaldi mirror was excavated from a female grave in a necropolis in the region of Bologna. Based on associated artifacts, the grave has been dated to the fifth century B.C.E.[207] The Treviso discs are also decorated bronzes that were excavated from a votive deposit near Este, though the artifacts are currently housed at the museum in Treviso. These discs are dated to the fourth or third century B.C.E., and share similarities in composition and style with the Arnoaldi mirror.[208] Bonfante argues that these artifacts reveal a superficial Etruscan influence within the expressive culture of the Veneti, who utilized the "artistic techniques and decorative motifs [of the Etruscans] to express

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[204] Lomas 2007a, 36.
[205] Lomas 2011, 18-20.
[206] Lomas 2011, 20; Maggiani 2003, 165-8.
[207] Bonfante 1978, 235.
[208] Bonfante 1978, 239.

their own native customs, language, and religion."[209] This same interpretation is postulated by Lomas for the borrowing of the horse/chariot motif.[210]

The *stelae Patavinae* have also been used to trace Greek influence in Venetic culture, although Lomas argues that "Hellenism is not the principal cultural reference point" within the iconography of this artifact set.[211] Beyond this, however, there is evidence of extensive commercial contact between Greek traders/settlers and the populations along the Adriatic coast of the Italian peninsula, especially during the fifth and fourth centuries B.C.E. Archaeological evidence shows a surge in Greek artifacts (especially luxury imports) along this coast in the sixth century B.C.E. that lasted until about the mid-fourth century B.C.E. and extended north to the Venetian lagoon.[212] The settlement at Adria was a center of trade during this time with Attic pottery and tin sourced to Cornwall present at this site.[213] Adria played a crucial role in the late Classical Period especially, not only as a point of contact between the Greeks and the peoples of northeastern Italy, but also within the expanding trade networks of the Adriatic coast.[214] Furthermore, there is an especially large concentration of Hellenistic material at Padua from the late fourth century B.C.E., including local sculpture that follows Hellenistic conventions.[215]

Celtic peoples (including the Cenomani, Boii, and Lingones) penetrated the region around 600 B.C.E. and had such a pervasive influence that, by the second century, Polybius claims that he could only distinguish the Veneti from the Celts by language.[216] Once again, traces of Celtic

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[209] Bonfante 1978, 240.
[210] Lomas 2011, 20.
[211] Lomas 2011, 18-9; See Zampieri (1999) for a discussion of the Hellenistic influences within this stelae group.
[212] Lomas 2006a, 176-77.
[213] Bonetto et al. 2009.
[214] Lomas 2006a, 178.
[215] Fogolari 1988, 99-105; Bandelli 2004.
[216] Polyb. 2.16-18. See also Capuis 1993, 218-36; Bonetto et al. 2009.

influence have been noted within the iconography of the *stelae Patavinae* from Padua.[217] In addition, inscribed names on votives from various sites show both Celtic and Venetic characteristics,[218] leading some to propose intermarriage between these two groups and supporting Polybius' assertion that over time the Veneti and Celts merged into one indistinguishable unit.[219] Lomas, however, cautions against ascribing a "large-scale 'Celticization'" to the region during this time period, stating that the shared Venetic language and material culture is resilient enough that the adoption of Celtic components into the local cultural practice "did not undermine Venetic identity."[220]

As demonstrated, the Veneti throughout their history interacted with various people groups and subsequently absorbed new practices, manners, and styles into their culture. This is a common practice seen in cultures worldwide. However, with the rise of Rome and the spread of "Roman culture", scholars tend to speak in terms of an all-encompassing "Romanization" of the region. The efficacy of this term has already been scrutinized in Chapter 2. Instead, the nature of the interaction of the Veneti with expanding Roman imperialism and the resulting changes in the material culture must not be considered as an inevitability, but instead as only one of many possible outcomes.

## COLONIAL CONTEXT

According to the historical sources, the Veneti had good relations with Rome, an alliance of mutual benefit, with the earliest documented contact in the third century B.C.E. These two

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[217] Fogolari 1988, 102-3.
[218] Verkvalos (Altino), Tivalos Bellenios (Padua), Frema Boialna (Este), deity called Belatukadriakos (Altino).
[219] Scarfi and Tombolani 1985, 60-3; Prosdocimi 1988, 288-92, 301-2; Lomas 2007a, 36.
[220] Lomas 2007a, 36-7.

cultures formed an *amicitia*[221] with each other against the Gauls in 238 B.C.E. The Veneti continued their alliance with Rome against Hannibal at the end of the third century B.C.E., fighting and falling alongside Romans and other Italians in the Punic Wars, including at the Battle of Cannae.[222] In 181 B.C.E., the Romans founded a colony in the region at Aquileia ostensibly in order to protect the Veneti from the incursions of Transalpine Gauls, and began construction of the *Via Aemilia* in the 170s B.C.E. to connect the region to the rest of the Italian peninsula. Lead missiles inscribed with the civic identifier "*Otergyium*"[223] attest to the presence of Venetic slingers fighting on behalf of the Romans at the siege of Asculum in the Social Wars (91-88 B.C.E.).[224] The Veneti were awarded Latin rights after the Social Wars and granted full Roman citizenship in 49 B.C.E. Following this, there was a large colonizing movement between 49 and 14 B.C.E., with the establishment of Roman *coloniae* both at established Venetic urban centers (such as Este, Altino, and Iulia Concordia) and on virgin soil (mostly concentrated in the Alpine region).[225]

Once again, these historical sources primarily represent an etic perspective of the colonial relationship between the Veneti and Rome. However, an interesting set of artifacts was discovered in the region which may provide insight into local attitudes. In the second half of the fourth century C.E., a number of mile markers were erected along the *Via Postumia* with the inscription: "Dominis nostris Flavio Valentiniano et Flavio Valenti divinis fratribus et semper Augustis devota Venetia conlocavit / Devoted Venetia placed [this marker] for our lords Flavius Valentinianus and Flavius Valentus, divine brothers and Augusti always."[226] The devotion of the Veneti is a theme found throughout Roman literary sources, a theme that is reflected in the Antenor origin myth, but

[221] Understood as an alliance with strong ties, albeit without a formal treaty or legal obligations between the parties.
[222] Strabo *Geog.* 5.1.4-6, 9-10.
[223] Oderzo
[224] Langslow 2012, 294.
[225] Lomas 2007a, 38.
[226] Basso 1990.

these mile markers are the first overt emic statement of devotion purportedly from the people of the region. Of course even these artifacts cannot be digested uncritically as the statement may not be representative of the feelings of the entire population (or even a majority) and ulterior motivations for such a display must be considered. However, a local expression of faithfulness to an arguably ancestral ally and confederate also cannot be overlooked; it is a rare instance of self-identification by the people of the region (or at least one person) as "Venetians" and their own acknowledgement of the colonial relationship.

For the purposes of this study and within the region under discussion, the Roman colonial period commenced in 181 B.C.E. with the founding of the first Roman colony at Aquileia. While Roman influence can be seen in the region during the third century B.C.E., it is the act of establishing a colony, of occupying (or perhaps cohabitating) a portion of land within the region that in effect started the process of colonization[227] of the Veneti. This process arguably is fully realized after the Social Wars when the region of the Veneti, as part of Cisalpine Gaul, was officially made a province of Rome. The transplanting of sizeable populations of settlers into the region is a sign of Rome's investment in the region.

## <u>**Urban Landscape**</u>

The formation of colonies had a tremendous impact on the urban landscape of the region, both in a direct sense – planting Roman architectural forms on an otherwise barren landscape – as well as in more subtle ways – such as influencing local ideas of possible urban organization and architectural features. The original settlement of Aquileia included over 3000 settlers, who each

[227] Again, *colonization* is here defined as "the expansionary act of imposing political sovereignty over foreign territory and people" (Dietler 2010, 18).

received an allotment of land based on their rank (infantry, centurion, and cavalry);[228] the city's population was soon supplemented by native Veneti inhabitants. While Livy explained the founding of Aquileia as a reaction to Gallic incursions in the region, the city was militarily a strategic site for expansion to the Istrian peninsula and the Dalmatian coast and also established access to the region's resources, including the amber trade.[229] Aquileia as a Roman *colonia* is perhaps most renowned as a center for Roman glass making. Evidence of this glassmaking industry, including crucibles, molds, and waste products, has been excavated at the site and a possible workshop was identified recently.[230] Furthermore, the excavation of the *Iulia Felix* shipwreck, which sank off the coast near Grado and dates to the first half of the third century C.E., revealed among the cargo a wooden barrel filled with about 140 kg (over 300 lbs) of recycled glass cullet in the form of broken glassware, likely bound for workshops in Aquileia.[231] Archaeological and epigraphic evidence from Aquileia have also identified other craftsmen at work in the city including metalworkers (*faber aciarius, clavarius, gladiarius, argentarii*), carpenters (*sectores*), and boatbuilders (*faber navalis*), the latter of which is discussed in further detail in Chapter 4.[232] During the imperial period, Aquileia was the capital of Regio X.

Incorporation of Roman cultural elements into the urban fabric can be traced along the northwestern Adriatic coast in the historical, epigraphic, and archaeological records. Cicero cites the willingness of the native Veneti to adopt Roman ways, incorporating typical Roman urban elements, such as a forum, theater, and amphitheater, into native Venetic city centers by the late Republican period.[233] Strabo describes the contemporary (first century C.E.) city of Patavium

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[228] Livy *AUC* 40.34.
[229] Maselli Scotti 2010, 43; Strabo *Geog.* 4.207 f., 5.214.
[230] Ventura 2010, 137.
[231] Silvestri 2008; Silvestri et al. 2008.
[232] Ventura 2010.
[233] Cic. *Pis.* fr. 10.

(Padua) as the finest of all cities in the region, that it manufactured many goods, especially clothing, for the market at Rome, and that it boasted 500 elites of equestrian status.[234]

The influence of the Roman urban ideal is also seen in the archaeological record. Throughout the last two centuries B.C.E, the urban structure of Padua underwent transformations, with the gradual implementation of a more regular street plan and the incorporation of Roman architectural styles and construction methods into the fabric of the Venetic city.[235] Luciano Bosio interprets this gradual process as one of local assimilation of the idea of a Roman city.[236] At Altino, the construction of the *Via Annia* transformed the layout of the Venetic urban center, and later structures – the theater, the odeion, and the forum – were all aligned to this new road.[237] At Concordia, the Venetic settlement was all but obliterated when a contingent of Latin settlers colonized the area to establish a new city – Iulia Concordia – according to the prescripts of a Roman *colonia*.[238]

**Economic Landscape**

The alterations to the physical environment seen in the urban landscape were also extended to the agricultural lands surrounding the city centers. While still relying on agriculture as an economic baseline, the centuriation of the land, which is clearly visible even today in aerial photographs of the region, drastically transformed the landscape and organization of farming practices. This shift was accompanied by a more general move from a primarily subsistence-based farming to high-yield farming that would produce a surplus in line with Roman values of

[234] Strabo *Geog.* 5.1.7.
[235] Bosio 1981, 231-37.
[236] Bosio 1981, 237.
[237] Rosada 2012.
[238] Balestrazzi 2011.

appropriate wealth.[239] This increase in agricultural production may be mirrored in animal husbandry, at least for some species – cows, pigs, and sheep included, a hypothesis which is supported both in the historical record and in faunal remains.[240] In fact, according to Michael Mackinnon, who has conducted extensive research on zooarchaeological remains of the pre-Roman and Roman Mediterranean contexts, not only is there increased output, but there are also noted improvements in domesticates.[241] For example, cattle breeds within the Po Valley show significant development, measured in increasing length, width, and depth of surviving bones.[242] Despite this increase in quantity and quality of animal husbandry, according to Strabo, by the first century C.E., the horse breeding, for which the Veneti were formerly renowned, had declined significantly and had effectively been abandoned as a practice.[243]

With the arrival of settler populations, new technologies and manufacturing practices were also introduced into the economic landscape of the region, such as the introduction of the glass industry at Aquileia. It is uncertain, however, whether the local population participated in glass production. Although glass manufactures are present in the region from the colonial period, no definitive production centers have been identified outside Aquileia. The abundance of glass artifacts from Adria has caused some scholars to postulate that a glass-making industry thrived there in antiquity.[244] In a study of glass dating between the first century B.C.E. and the fourth century C.E. from archaeological excavations around Adria, Filomeno Gallo and colleagues concluded that the consistency observed in the chemical composition of Roman glass, of which the Adria glass was a typical example, supports the claim that all Roman glass was likely produced

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[239] Maragno 1993, 48.
[240] Columella *Rust.* 6.24.4-6; Polyb. 2.15; Riedel 1994, 76-8.
[241] MacKinnon 2015, 270.
[242] MacKinnon 2015, 257.
[243] Strabo *Geog.* 5.1.4-6, 9-10.
[244] De Min 1987; Fogolari and Scarfì 1970; Zecchin 1956.

along the Syro-Palestinian coast.[245] Their argument does not take into account the archaeologically verified workshop at Aquileia, though it is possible that only recycled glass was being manufactured there. Nevertheless, Alberta Silvestri has argued, in her study of the *Iulia Felix* glass, that the upper Adriatic was a key point in the trade of glass from the Levant to northern Italy.[246]

Another manufacture introduced during the colonial period was a ceramic roof tiling system using *tegulae* and *imbrices*. Archaeological evidence suggests that *tegula* and *imbrex* type roof tiles were being produced in the region by the end of the second or beginning of the first century B.C.E.[247] A workshop for the manufacture of ceramics, including roof tiles as well as amphoras and lamps, was identified in a regional survey of centuriated land around Adria.[248] *Tegula* and *imbrex* roof tiles were the primary cargo of the Stella 1 shipwreck, a northwestern Adriatic laced barge that operated in the area around Aquileia.[249] These roof tiles, both those discovered during the Adria survey and those recovered from the Stella 1 shipwreck, were stamped with the name of the workshop and often symbols as well, which may represent individual workers.[250] The use of inscriptions on manufactured goods to identify the maker is a novel use of writing in the region. Incised letters are also found on loom weights from the Adria survey, another new medium for writing compared to the pre-colonial context.[251] There is evidence in the region for other new building technologies such as Roman forms of bricklaying and decorative techniques such as the use of mosaics.[252] The intensification of other industries is also proposed; for example, the number of loom weights found during a survey of the centuriated land area surrounding Adria

[245] Gallo et al. 2013; Bonomi 1996 also argued that there is not sufficient evidence to support the identification of a glass industry at Adria.
[246] Silvestri 2008.
[247] Maragno 1993, 56. Grigato and Maragno 1993, 192-3.
[248] Maragno 1993, 56-7.
[249] Vitri et al. 1999, 2003.
[250] Maragno 1993, 59.
[251] Maragno 1993, 66-7.
[252] Maragno 1993, 60-5.

suggests that a loom was in every home during the colonial period.[253] Furthermore, Pliny the Elder commented on the superiority of the white wool produced in the Po valley.[254]

## Ritual Landscape

Roman influence also extended into the religious activity of the region. The sanctuary of Reitia at Baratella, which has evidence of cult activity from the eighth century B.C.E., was re-dedicated to Roman deities by the second century C.E. – with dedicatory inscriptions to Minerva, Vesta, and the Dioscuri.[255] In addition, the standard Venetic open enclosure sanctuary at this site gave way to a Roman temple, that is a permanent stone structure, of Castor and Pollux.[256] Enrico Maragno has argued that Minerva is a substitute for the local goddess Reitia, and that while the name has changed, and perhaps some of the rites of worship, the Roman goddess was integrated into an established local belief system.[257] This syncretism of Roman and local deities was a common phenomenon throughout the Roman Empire.

Other sanctuaries also show signs of reorientation (rededication?). For example, Lagole is a remote lake near modern Pieve di Cadore that was a sacred site to the Veneti. Similar to other Venetic sanctuaries, it was a bounded open air sanctuary site with approximately 1000 votives – *bronzetti*, plaques, ladles, and other vessels – many of which were dedicated to Trumusiatus/a using the Venetic script and language. The earliest finds date to the fourth century B.C.E., but by the time of the Roman colonial period in the region, this site was transformed into a sanctuary of Apollo, the healer.[258] Although Apollo was a later addition to the Roman pantheon, the god was

[253] Maragno 1993, 66.
[254] Plin. *HN* 8.73.
[255] Baggio Bernardoni 1992, 321-24.
[256] Baggio Bernardoni 1992, 323-30.
[257] Maragno 1993, 70-1.
[258] Pensaventa Mattioli 2001; Marinetti 2001, 66-71.

given prominence by Augustus when he erected the first temple to Apollo on the Palatine Hill in Rome.[259] Again, this reorientation of deities may represent syncretization of beliefs and practices as votives to the deity Trumusiatus/a normally entailed ladles and bowls, paraphernalia associated with life-giving water and sustenance.[260] Giulia Fogolari emphasizes the gradual and fluid nature of this transition at Lagole.[261]

There is also a change in funerary practices. New cemeteries were created at both Este and Padua and Roman types of grave markers were incorporated into both new and established cemeteries. Overall, the quantity of grave goods in burials decreased. Once again, the *stelae Patavinae* show evidence of outside cultural influence, in this case, local elites began to present themselves in Roman togas on their grave stelae.[262] Epigraphic and linguistic changes are also detected in funerary inscriptions and inscribed votive offerings, beginning in the second century B.C.E.[263] There is a short transitional phase observed in the epigraphic record, including transliterated and bilingual inscriptions.[264] Inscriptions have been found that use the Latin alphabet to record dedications in the Venetic language and others that use the Latin language and alphabet but use Venetic formulas.[265] The Venetic alphabet and language disappears altogether from inscriptions in the first century B.C.E.[266]

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[259] Hekster and Rich 2006; Jones Roccos 1989.
[260] De Nardi 2007, 52; Fogolari 2001, 375.
[261] Fogolari 2001, 376.
[262] Lomas 2007a, 40.
[263] Lomas 2007a, 39.
[264] Pellegrini and Prosdocimi 1967, 113-15, 117-18.
[265] Pellegrini and Prosdocimi 1967, 221-34; Lomas 2006b.
[266] Lomas 2007a, 39. This does not entail the disappearance of the language altogether, as it may have been retained in its spoken form, but only the Latin alphabet and language were used in inscription from this point.

**Social and Political Landscape**

Politically, the northwestern Adriatic region came under the rule of Rome, starting as a senatorial province – *Gallia Cisalpina* – and later comprising one of Italy's administrative regions – *Regio X Venetia et Histria*. As such, this region and its inhabitants were integrated into the core of the Empire, as part of Augustus' *Tota Italia*. The epigraphic record testifies to the adoption of the Roman social structure of patron-client relationships at least among a portion of the population. One inscription in particular serves as an example of the extent to which the social and economic landscape was intertwined, highlighting the diversified holdings and positions of certain local inhabitants in the colonial period. Gaius was a self-proclaimed Italian resident of Aquileia who held multiple political positions and was a patron of several trades:

C Veratio C F Vel
Italo Aquileiensi
Inni Vir Quinq Pont
Equit Praef Clas
Praef Coh I Delmatar
Cur Viar Praef Aliment
Leg Prov Africae
Cur Illyr et Histriae
Patrono Coloniar
Concord et Altinat
Colleg Fabr Centonar
Dendrophor Navicular
Et Plebs Urbana
Ob Merita eius
Ex Aere Conlato
Decr Dec
Publice[267]

In addition to his roles as overseer of the roads (*cur viar*) and prefect of the grain dole (*praef aliment*), Gauis was also a patron of the *collegia*, or guilds, of builders (*fabr*), textile dealers

[267] *CIL* 5(1) 40.

(*centonar*), lumber trade (*dendrophor*), and shipowners (*navicular*).[268] While the patronage of textile dealers and the lumber trade is a combination recorded in other inscriptions in northern Italy,[269] Gaius was unique in his connection to shipowners in addition to these other guilds. This memorial to Gaius' achievements is evidence of the ubiquity of Roman social structure, not only in patron-client relationships, but also in the formation of professional societies of craftsmen and traders, a phenomenon not in evidence during the pre-colonial period. This is perhaps not surprising at Aquileia, a colony with both Latin settlers and indigenous residents, but evidence of *collegia* has been found at Altinum, Concordia, and Patavium as well as other sites in the region.[270]

By the first century B.C.E., Roman presence in the region of Veneto was pervasive and had affected many aspects of the Venetic way of life, including political structure, urban landscape, economy and industry, religious and ritual practices, burial rites, and the language of public use. Despite the substantial and significant shifts seen in a variety of lifeways in the region, some aspects of Venetic cultural tradition continued into the colonial period. For example, agriculture and animal husbandry, though perhaps altered and intensified, were still a major factor in the subsistence strategies or economy of the region. For many small-scale farmers, it is likely that daily activities continued much as they had prior to the increasing oversight and interest on the part of the Roman state. Furthermore, the possible syncretization of deities was, in some respects, a continuation of worship of local deities. It is also key to note that the practice of ritual deposition of votive offerings still continued at sanctuary sites throughout the colonial period; thus even if deities, structures, and objects changed the basic ritual practice of presenting a votive offering was maintained. Highlighting the Veneti's gradual and piecemeal adoption of Roman cultural elements

[268] See Liu (2009) for a discussion of the *collegia centonariorum* and their identification as textile dealers. Liu also discusses the social, political, and economic nature of being a patron of *collegia.*
[269] E.g. Bellunum (*CIL* 5(1) 98), Bergomum (*CIL* 5(1) 594), and Mediolani (*CIL* 5(1) 649).
[270] Liu 2009, 387.

(architectural styles, language and epigraphic practices, etc.) well before Rome's primary colonization efforts began in 49 B.C.E. (when full Roman citizenship was awarded), Lomas argues that the process of cultural change was voluntary in nature, a "cultural dialogue", and not the result of Roman imposition. She states, "Roman culture coexisted, and eventually merged with, local Venetic culture rather than displacing it entirely."[271]

## ENTANGLED CULTURES

Returning to the question posed at the opening of this chapter: when does the incorporation of foreign elements into a social and cultural structure move from a "natural" process of cultural change to an unnatural distortion of culture or even a dissolution of it? As stated previously, this largely appears to be a matter of choice, a slippery concept to identify within the archaeological record. There is no clear litmus test to delineate when imperialism shifts from an effect to a force, from optional to compulsory. However, its impact often does leave a material residue, and so, the question becomes: how did this process of cultural change affect the identity (or identities) of individuals experiencing and negotiating this phenomenon?

According to Lomas, the *stelae Patavinae* offer an ideal artifact set for the exploration of Venetic identity and how this concept changed over time.[272] Language use on these stelae demonstrates a complex process by which some chose to adopt Latin, though retain local inscription formulas, while others retained native Venetic, perhaps as a desire to highlight their local identity. Furthermore, the incorporation of Roman elements into the traditional iconography does not run directly parallel with the adoption of Latin as the language of inscription. Instead, Lomas contends that the combination of local and Roman ingredients "indicate[s] a sophisticated

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[271] Lomas 2007a, 38.
[272] Lomas 2006b, 2011.

use of cultural symbols in creating a composite personal identity."[273] This is a similar conclusion to that reached by Bonfante in her study of the Arnoaldi mirror and Treviso discs, which represents cultural borrowing during pre-colonial times.

Another interesting case study is the ritual site of Lova, a sanctuary built at the beginning of the Roman colonial period in the second century B.C.E in the southern zone of the Venetian lagoon.[274] From the time of its construction, the sanctuary at Lova may have appeared as a typical Roman religious center, with a permanent stone temple structure. However, De Nardi interprets the ritual deposition of a localized style of *bronzetti* along with local fauna as "a strong identity statement by local people, eager to establish their own cult place, to their own deity, in their own land."[275] The site fell out of use by the end of the first century B.C.E, thus this "revival" of traditional Venetic ritual identity may seem short-lived, but it is interesting to note that the sanctuary site as originally formed may have been only partially recognizable to a sixth century Venetic individual. The incorporation of permanent stone structures was no longer an impediment (if they ever were) to the expression of Venetic ritual identity.

Overall, analyses of Venetic artifacts and archaeological assemblages tend to suggest a strong receptivity on the part of the Veneti toward adapting foreign elements to express a distinctive local cultural identity. Lomas argues that there was a strong social pressure for Venetic elite males to present themselves in Roman regalia as a symbol of their citizenship status, an important political distinction within the local elite male community.[276] However, she notes, this impetus does not exist for women, who have retained more of their local identity markers (hairstyles and clothing) in iconographic representations. Lomas postulates that women had thus

[273] Lomas 2011, 21.
[274] Bonomi 2001; De Nardi 2007, 42.
[275] De Nardi 2007, 49.
[276] Lomas 2009, 23.

become the bearers of Venetic traditions during the Roman colonial period.[277] The same detachment from the political machinations of the local elite male community that characterized elite women, a discrepant identity, may be applicable to non-elites in general. In this sense, the absence of a politically-induced drive to identify as Roman may have led non-elite portions of the Venetic population, such as the builders of northwestern Adriatic laced boats, to retain more elements of their local cultural identity.

So what does this say about the context in which northwestern Adriatic laced boats were built and used? New Roman roads connected the region to the wider Mediterranean world, the immigration of Roman settlers into the region brought new technological practices (among other cultural expressions), and a myth bound the two populations together by means of a shared heritage. The boatbuilders of this tradition were operating in a context of increasing interconnectivity with the various peoples, customs and technologies of the wider Mediterranean basin. They were also practicing their craft in a context of continual and progressive entanglement whereby foreign cultural elements were drawn into the local cultural fabric. And they adjusted expressions of identity to best facilitate their interactions with the colonial landscape.

[277] Lomas 2009, 23.

# CHAPTER IV

# A NAUTICAL LANDSCAPE: A PANORAMIC VIEW OF THE WATERWAYS, BOATS, AND BOATBUILDERS OF THE NORTHWESTERN ADRIATIC

While understanding the social, political, economic, and cultural history of the region sets the stage for a discussion of the builders of northwestern Adriatic laced vessels within the broader context of colonial encounters and entangled cultures, dissecting the nautical landscape specifically frames the interests, motivations, and objectives that were most meaningful and influential to the community of boatbuilders. Here, the nautical landscape refers to the waterways of the region, the boats used to navigate these waterways, and the community who built these vessels. This chapter will examine the evidence of waterways, boats, and boatbuilders within this region, compiling evidence from multiple sources – textual, epigraphic, iconographic, and artifactual – in order to construct a panorama – a wide angle view – of the nautical landscape of the northwestern Adriatic.

Furthermore, even though the laced boats of the northwestern Adriatic arguably may be the best dataset to understand the community of builders who made them, the artifactual remains of the vessels are only one source of information about the community. In order to explore the lifeways and identities of these boatbuilders, the full nautical landscape, including all other pertinent sources of information from the region, must be investigated. Textual, epigraphic, and iconographic evidence of the regional nautical landscape not only creates a more complete picture, but also underlines the contributions of the hull remains to the general knowledge base regarding this community of boatbuilders.

This region represents a unique pocket of hull construction in the Mediterranean – it is the only area that maintained a large-scale production of laced hull construction into the Roman era and the majority of hull remains that have been discovered from the ancient northwestern Adriatic employed laced joinery. As such, laced boats dominate the archaeological record of this region. However, before diving into the artifactual evidence of the boats themselves (which will consume both the end of this chapter and all of Chapter 5), the textual, epigraphic, and iconographic records will be explored for insights into the local boatbuilding community and the significance of the nautical landscape to the local psyche.

## TEXTUAL EVIDENCE

Ancient authors provide an elaborate description of the paludal environment as well as recount details related to navigation within the region. Unfortunately, they say very little about the ships or boats of the northwestern Adriatic, and nothing at all related specifically to the boatbuilders themselves. Despite these limitations, the textual sources are particularly evocative of the underlying pervasiveness of waterways along the coastline and highlight the important role that watercraft played in facilitating regional movement.

### Regional Navigation in a Water-Rich Landscape

Marcus Vitruvius Pollio, writing in the first century B.C.E., cited Altino as an example of an appropriate way to build a city atop a marsh.[278] Strabo described the inundated environment of the region and the efforts of the local inhabitants to manipulate that environment toward improved human habitation:

[278] Vitr. *De Arch*. 1.4.11.

> The whole of this country is full of rivers and marshes, especially the district of the Heneti [Veneti], which likewise experiences the tides of the sea. This is almost the only part of our sea which is influenced in the same manner as the ocean, and, like it, has ebb and flood tides. In consequence most of the plain is covered with lagoons. The inhabitants have dug canals and dikes, after the manner of Lower Egypt, so that part of the country is drained and cultivated, and the rest is navigable. Some of their cities stand in the midst of water like islands, others are only partially surrounded. Such as lie above the marshes in the interior are situated on rivers navigable for a surprising distance, the Po in particular, which is both a large river, and also continually swelled by the rains and snows. As it expands into numerous outlets, its mouth is not easily perceptible and is difficult to enter. But experience surmounts even the greatest difficulties.[279]

This passage highlights not only the anthropogenic impact on the geographical landscape, but also the reliance upon indigenous ecological knowledge for successful navigation of the region. Pliny the Elder also referenced this network of canals, rivers, and lagoons of the region which connected the urban centers along the coastline from Ravenna to Altino.[280] Modern scholars suggest that this system of inland waterways could have extended all the way to Aquileia.[281] Moreover, Strabo mentioned additional canals that ran from inland sites to the sea: "Opitergium [Oderzo], Concordia, Atria [Adria], Vicetia [Vicenza], as well as some smaller cities, are less annoyed by the marshes: they communicate by small navigable canals with the sea."[282] Altogether, this network of waterways created a navigable fluvial web interconnecting the region. During the colonial period, both textual and archaeological evidence support the expansion of this system of canals.[283] The navigation of the canal system was detailed by Flavius Magnus Aurelius Cassiodorus who cited the use of pikes, poles, and towing from land as the means by which river

[279] Strabo *Geog.* 5.1.5 translated by Hamilton and Falconer (1903).
[280] Plin. *HN* 3.20.
[281] Capulli 2010, 91; D'Agostino and Medas 2010, 286; Rosada 1990, 170.
[282] Strabo *Geog.* 5.1.8 translated by Hamilton and Falconer (1903).
[283] Pliny (*HN* 3.20) chronicled the building of the Augustan Canal, Flavian Canal, and Philistina Canal in the region. Rosada 1990, 159.

boats and barges were transported through the canals of the Venetian lagoon in the sixth century C.E.[284]

**Accounts of Regional Boats**

A handful of references concerning the boats used within the region have survived in the historical record. Livy included minimal description of local Paduan boats in his account of the attack of Cleonymus in the late fourth century B.C.E.[285] Cleonymus, the commander of a Spartan fleet in 301 B.C.E., led his army into the northern Adriatic, sailed up the Meduacus (modern Brenta) River, and raided the villages in the territory of Patavium (Padua). In Livy's dramatic narrative, the Patavini successfully defended their territory, cutting the enemy to pieces, and Cleonymus barely escaped complete annihilation, retreating from the region with but one-fifth of his original fleet. The triumph of the Patavini was due largely to the superior fitness of indigenous watercraft for navigating the local waterways: "and armed men [Patavini] filling the river boats — suitably constructed with flat bottoms, to enable them to cross the shallow lagoons — and others manning the craft they had captured from the invaders, they descended upon the fleet [of Cleonymus] and surrounded the unwieldy ships [of the enemy]."[286] Three hundred years later, according to Livy, the Patavini still held commemorative naval contests to honor their victory over Cleonymus.[287]

Unfortunately, beyond the flat-bottomed nature of the vessels of the region, no other details concerning their construction features are given. *Sutiles naves*, or "sewn ships", are mentioned in the textual record; the term comes from Pliny, referencing the boats of Homer's

[284] Cassiod. *Var.* 12.24
[285] Livy *AUC* 10.2.1-15.
[286] Livy *AUC* 10.2.12 translated by Foster (1926).
[287] Livy *AUC* 10.2.15.

day.[288] The term, however, is not used by any ancient author to describe the boats of the northwestern Adriatic region or of the Venetic people.

In comparison to the general boats "*apte alveis planis fabricatas*"[289] of Livy's account, several ancient authors specifically described the *sutiles naves,* or more specifically the *serilia liburnica,* of the contemporary eastern Adriatic. These authors document the laced tradition of the eastern Adriatic coast as a product of the Liburni or Liburnians, a people group who inhabited the islands and coastal region between the Istrian peninsula and the river Titus (Krka) along the Dalmatian coast (modern Croatia) and who had a reputation for superb seamanship as well as piracy.[290] Marcus Terentius Varro in the first century B.C.E. explicitly mentioned the Liburnian method of laced boats: "but in fact [the Liburni] sewed their ships together with leather straps."[291] Furthermore, Marcus Verrius Flaccus, a Roman grammarian from the late first century B.C.E., provided the name of these vessels, stating that *serilia*, meaning "cordage", was the term for Liburnian boats.[292] Unfortunately, the works of Flaccus have been lost to antiquity. His account of the *serilia liburnica* is preserved by Sextus Pompeius Festus, a Latin grammarian who later copied and edited Flaccus' *De significatu verborum* ("On the Meaning of Words") in the second century C.E. Festus wrote:

> Serilia: According to Verrius [Flaccus] the name of Histrian and Liburnian ships, which were fastened with flax and esparto grass, designated after *conserendo* (to be joined) and *contexendo* (to be woven); because Pacuvius, in [his play] *Niptra*, said, "Neither do any carpenter's joints hold together the joinery of the hull, but in fact it is sewn together with flax and esparto grass ropes."[293]

[288] Plin. *HN* 24.40.
[289] That is, suitably constructed with flat bottoms.
[290] Appian *Illyrian Wars*, 3; Livy *AUC* 10.2; Brusić and Domjan 1985; Wilkes 1969, 1992.
[291] Varro *Antiquitates rerum humanarum* 25 in Gel. *NA* 17.3.4 translated by the author. Original Latin: Neque ea ipsa facultate usi Liburni; set hi plerasque naves loris suebant.
[292] Brusić and Domjan 1985, 82.
[293] Festus *De significatu verborum* 460 translated by the author. Original Latin: Serilia Verrius appellari putat navigia Histric[i]a ac Liburnica, quae lino ac sparto condensantur, a conserendo et contexendo dicta;

Thus, from the textual record, not only is the construction method revealed, but also the materials used (and those not used) to construct the laced boats of the eastern Adriatic (*serilia liburnica*). No such details are directly provided for the boats of the northwestern Adriatic. The archaeological remains of *serilia liburnica* are described in greater detail and compared to the remains of the northwestern Adriatic boats below.

Returning to the northwestern Adriatic region, ancient authors writing in later periods record the use of the regional *linter*, meaning a small light boat. According to Maurus Servius Honoratus, writing in the fourth and fifth centuries C.E., the *linter* was a multi-purpose craft employed in the region for all commerce, hunting and fowling, and to transport agricultural products.[294] Isidore of Seville mentioned the use of *lintres* on the River Po and the surrounding marshes in the sixth and seventh centuries C.E.[295] Isidore seems to use the terms *linter* and *carabus* synonymously, the latter defined as a "small wicker boat covered in rawhide."[296] Marco Bonino, an Italian naval historian, identifies *lintres* with monoxyles (dugouts), several of which have been recovered from the Po delta.[297]

Textual evidence portrays the northwestern Adriatic as a region interconnected by water, and whose geography was manipulated by the local residents to further facilitate movement through the region by these inner waterways. The historic record also documents the use of local boat types, designed for use within this specific paludal environment. However, while the ancient authors note the laced construction of other vessels within the broader region of the upper Adriatic,

quia dicat Pacuvius in Niptris: "Nec ulla sub<s>cus cohibet [et] conpagem alvei, sed suta lino et sparteis serilibus."
[294] Serv. *Comm. in Verg. Georg*. 1.262.
[295] Isidore *Orig.* 19.25.
[296] Oxford Latin Dictionary 1982.
[297] Bonino 1990a, 27-9.

this distinctive construction feature is not attributed to the vessels of the northwestern Adriatic, nor is the community of boatbuilders mentioned.

## EPIGRAPHIC EVIDENCE

As a documentary source, the epigraphic record is limited in scope. Inscriptions on stone, ceramic, or metal fulfilled a specific purpose within cultural practice of the region and any aspect of life outside this purview is therefore not preserved epigraphically. Despite the limitations, there is epigraphic evidence that pertains to the nautical landscape of the northwestern Adriatic. There are two data sets of inscriptions within the region; those written in the Venetic language and script, largely from the pre-colonial period and those in the Latin language and script, entirely from the colonial period.

### Venetic Inscriptions

Currently, there are some 350 inscriptions written in the Venetic language and script that have survived in the archaeological record. The majority of these inscriptions are from ritual or funerary contexts, inscribed on votive offerings, etched onto grave goods, or cut into stone slabs to honor the deceased. These inscriptions, known as talking inscriptions as they address the reader in the first person, follow predictable patterns, the two most common being: 1) "Personal name gave me to Deity" for votive offerings and 2) "I am the monument to (*ekupetaris ego*) personal name" for funerary monuments.[298] Unfortunately, due to the formulaic nature of Venetic

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[298] The meaning of the phrase "ekupetaris ego" is debated (Pellegrini and Prosdocimi 1967; Marinetti 2003). According to Lomas (2011, 17), the most widely accepted interpretation of this phrase is "I am the monument to…", but it could also indicate the economic activity of the individual (horse-breeding) or the social class of the individual (akin to Roman *equites*). Marinetti (2003) proposes that the concept changed over time from an indication of economic activity to a social class.

inscriptions, the known lexicon is extremely limited.[299] Only a very small number of nouns are preserved, and nautical terms (i.e. the words for boat, boatbuilder, etc.) are completely unknown. In fact, occupational titles in general are absent from the pre-colonial epigraphic record.[300]

There are some place names in the Venetic language that appear to be derived from hydronyms, the proper names for bodies of water, in this case, rivers. For example, the name of the city of Este (Ateste in Venetic) was derived from the Atesis River, with the enclitic ending -te meaning “in front of.”[301] It is also possible that Patavium is a derivative of the Padus River, though this attribution is more complex and less certain.[302] Aldo Luigi Prosdocimi develops this connection between hydronyms and Venetic sites in great detail.[303] Furthermore, one of the possible etymological roots of the local Venetic goddess Reita is “reito”, meaning river.[304] The onomastics of the Venetic language hint at the importance of water and waterways to the substance of Venetic life; however the inscriptions themselves do not speak directly to the nautical landscape during the pre-colonial period of the region. By contrast, inscriptions in the Latin language and script from the colonial period provide direct evidence of shipbuilders.

## Faber Navalis vs. Architectus Navalis

There are two terms in the Latin language that appear in the epigraphic record to denote a person engaged in boat- or ship-building; these are the *faber navalis* and *architectus navalis*, the former being more common than the latter. Plautus, a late third to early second century B.C.E.

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299 Prosdocimi 1988, 411-17.
300 Lejeune 1974, 330-41. The term “miles”, soldier (identical to the Latin term) is part of the ancient Venetic lexicon, which certainly speaks to the important role of soliders within Venetic society. However, words for craftspeople (bronze worker, stonecarver, potter, etc.), farmers, and horse-breeders – occupations that are verified by the archaeological record – are not present in the epigraphic record.
301 Marinetti and Prosdocimi 2005, 42; Prosdocimi 1988, 389, 396-97.
302 Marinetti and Prosdocimi 2005, 42; Prosdocimi 1988, 389, 395-96.
303 Prosdocimi 1988, 394-97.
304 Prosdocimi 1988, 388.

Roman playwright, referenced both an *architectus* and *fabri* in a short passage on ship construction.[305] In this passage, the role of the *architectus* seems to be to lay the keel "true to line" while the *fabri* are the workmen laboring under the supervision of the *architectus.* This excerpt has caused scholars to propose that the *architectus* was the equivalent of today's naval architect, an engineer who designs new hull shapes based on various calculations of loads and displacement and produces detailed construction plans from which the ship can be realized.[306] While there is some textual and archaeological evidence to support the use of simple sketches and basic principles of geometry by ancient architects, nautical archaeologist Patrice Pomey disputes the employment of detailed construction drawings and ship's lines as they are understood today.[307] Furthermore, there is, as yet, no evidence for the use of geometric applications (such as a mezzaluna) in ancient shipbuilding.

Pomey also argues for a different separation of work between these two occupational terms than what is suggested in the Plautus passage: that the *faber navalis* usually undertook private ship construction whereas the *architectus navalis* was employed by the State primarily for the building of naval ships and other purpose-built ships. Furthermore, he contends that the knowledge base of the *faber* was experiential, whereas the *architectus* relied on elementary calculations and drawings (based on previous successful ships and including basic lines, principal dimensions, and general proportions). Thus, as Pomey states, "The tools and processes of ship construction were different between these two types of construction."[308] Specifically, the required tools for the *architectus* are those that are capable of controlling shapes; in antiquity, there is evidence for the use of plumblines, rulers, compasses, and string lines.

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[305] Plaut. *Mil.* 915-18.
[306] Rouge 1966; Salviat 1978.
[307] Pomey 2009.
[308] Pomey 2009, 50.

So, the question becomes what can the epigraphic record reveal about these two professional paths? As stated, there are fewer epigraphic instances of the *architectus navalis.* Two funerary inscriptions of *architecti navales* are known in Italy. One, the grave stela of Quintus Caelius, was found at Minturnae on the Liris River in southern Italy.[309] Interestingly Caelius was the son-in-law of a Greek slave, which hints at the relatively low social status of the *architectus navalis*. The epitaph of another *architectus navalis,* a 25 year-old at the Porta Salaria in Rome speaks to the training period of an *architectus* (short enough to be completed by the age of 25).[310] Finally, there is a stela of a P. Celerius Amandus found at Ostia; although the funerary inscription does not specify that he was an *architectus navalis*, various tools including compasses, a ruler, and an adze, along with a quarter rudder indicate that he was a shipbuilder, and, since tools of control were displayed, perhaps he was an *architectus*.[311] He died at 18 years of age. The inscriptions at Rome and Ostia also suggest that the *architectus* was a distinct professional path from that of the *faber*, in contrast to the possibility that an individual labored for a time as a *faber* before being trained and graduated to an *architectus*. Instead, the age of known *architecti* likely implies that an individual was commonly trained as one or the other.

In all likelihood, the builders of northwestern Adriatic laced boats would have been considered *fabri navales*, constructing these vessels based on experiential knowledge. Within the Roman world, more is known and more evidence survives for the *faber navalis*. A temple of the *fabri navales* was excavated at Ostia, the port city of Rome and the center for commercial shipping within the empire.[312] This temple was likely built either in the reign of Marcus Aurelius or Commodus, but certainly during the second half of the second century C.E. and was in use until

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[309] *CIL* 10(1) 5371.
[310] *CIL* 6(4) 33833.
[311] *CIL* 14 321.
[312] De Ruyt 1995, 1999.

the fourth century C.E.[313] In addition, guild rolls for the *collegium fabri navales* have been found at both Ostia and Portus, the imperial Roman harbor, dating to the second and third centuries C.E.[314] There are more than 350 members on the Portus roll, emphasizing the size of the guild during the height of Roman power in the Mediterranean and the importance of Portus not only as a center of shipping but also likely of shipbuilding.

In addition to the epigraphic evidence of the *fabri navales* at Ostia and Portus, there are several funerary inscriptions from various locations throughout the Roman Empire that reference either the guild of *fabri navales* or a specific *faber navalis*. The stela of Gaius Paquius Optatus at Arles in southern France, a site connected to shipping on the Rhone River, reveals a certain degree of collaboration between the guilds of shipbuilders, the fire brigade, and bladdermen (who operated inflatable watercraft or floats?).[315] Marcus Naevius, a soldier from Pisa, bequeathed 4000 sesterces to the local guild of the *fabri navales* under specific conditions that they commemorate annually his death and adorn his tomb with roses.[316] Intriguingly, if they failed in these responsibilities, Naevius' inscription delineated that the money would thence be transferred to the local guild of carpenters. Deborah Carlson argues that, instead of indicating an antagonistic relationship, this particular inscription in all likelihood represents the existence of a collaborative exchange between these two parallel guilds.[317]

Finally, the funerary stela of Publius Longidienus, found in Ravenna and dated to the second century C.E., not only identifies him as a *faber navalis*, but also depicts him at work in a relief sculpture. In this relief, Longidienus is shown adzing a timber in front of a completed (or nearly completed) hull. The adjoining inscriptions are as follows:

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[313] De Ruyt 1995, 1999.
[314] *CIL* 14 256.
[315] *CIL* 12 700.
[316] *CIL* 11(1) 1436.
[317] Carlson 2002a.

P(ublius) Longidienus P(ubli) f(ilius) Cam(ilia)
faber navalis se vivo constit
uit et Longidienae P(ubli) l(ibertae) Stactini //
P(ublius) Longidienus P(ubli) l(ibertus) Rufio
P(ublius) Longidienus P(ubli) l(ibertus) P(h)iladespotus
inpensam patrono dederunt //
P(ublius) Longidienus
P(ubli) f(ilius) ad onus
properat[318]

Carlson interprets these inscriptions as indicating that Longidienus achieved financial success during his lifetime (particularly in comparison to his fellow shipbuilders) and was a well-respected patron.[319] Xavier Delmarre proposes that the name Longidienus may be derived from the Gallic "Longo-deno", meaning "swift boat", which suggests not only his likely ethnic origin, but also that he acquired this name based on his professional superiority for building fast ships.[320] However, if Pomey's delineation of professions is accurate, then it is unlikely that Longidienus was employed by the State to build naval vessels for the fleet at Ravenna. This may be corroborated by the the type of vessel shown behind Longidienus, which has more features in common with Roman depictions of a generic cargo ship than depictions of warships. The iconography of ships will be explored further below.

## A *Faber Navalis* at Aquileia

In 1936, a stela was discovered in the territory of Aquileia carrying the inscription of a *faber navalis* (Fig. 4.1).[321] The stela is dated to the first or second century C.E.; the inscription runs as follows:

P(ublius) Cattius
[P(ubli)] f(ilius) Salvius

[318] *CIL* 11(1) 139.
[319] Carlson 2002a.
[320] Delmarre 2013, 19-22.
[321] Capulli 2010, 107.

vivos fecit[322]
[e]t suis omn[ib(us)]
Ofeliae [- – -]
Tertiae uxor(i).
[Ca]ttia P(ubli) f(ilia) Fest(a)
[-] Catt[ius] P(ubli) f(ilius)
Gratus
C(aius) [Ca]ttius P(ubli) f(ilius)
[Te]rtius.
Lib(ertis) libertab(us)que
suis. L(ocus) m(onumenti) q(uo)q(uo versus) p(edum) XVI.
Faber navales.[323]

From this inscription we learn that Cattius, the “faber navales”, erected his stela while he was alive and dedicated it to all the members of his household, including his third wife, a possible step-daughter, his sons, and his freedmen and freedwomen. Similarly to Longidienus, this suggests that Cattius achieved a certain degree of financial success within his lifetime. His identification as a shipbuilder is squeezed in at the bottom of the inscription in smaller letters than the rest, between the upper portion of the quarter rudder and the bow of a small boat. The boat carved onto Cattius’ stela is a simple form, being marginally crescentic and double-ended, with two small protuberances at both the bow and the stern. While the ship on Longidienus’s stela may be a general cargo ship of Roman iconography, the form of Cattius’ boat may align more closely with local images of boats (see Figs. 4.3 and 4.5).

Interestingly, Cattius’ occupational title is not grammatically correct, pairing the plural form of the adjective (*navales*) with the singular form of the noun (*faber*), however this may represent a dialectic variation. If it is a mistake on the part of the stone carver, it might suggest that “faber navalis/es” was not a term regularly ordered in the region. This is not to say that

[322] This may represent a dialectic as another inscription from Aquileia also uses the form – vivos fecit – (*CIL* 5(1) 908), however “viva fecit” is far more common in the epigraphic record of the colony (*CIL* 5(1) 1066, 1183, 1261, 1332, 1458, and 1531).
[323] Aquileia, Museo Archeologico Nazionale, ivn. n. 50 630.

Aquileia did not boast a large community of shipbuilders, but that not many achieved enough financial means to set up a stela of this kind. However, biases of preservation and discovery cannot be discounted and make any generalization based on this singular find from Aquileia problematic. Cattius' inscription, nevertheless, serves as a marker for Roman cultural influence in the region, similar to Gaius' memorial discussed in Chapter 3. In particular, the inclusion of an occupational title within the epigraphic record of the colonial period stands in stark contrast to the use of inscriptions during the pre-colonial period, highlighting again the adoption of Roman styles of personal commemoration. The discovery of Cattius' stela in Aquileia, as with Gaius', also reinforces this city's role in disseminating Roman cultural traits in the region.

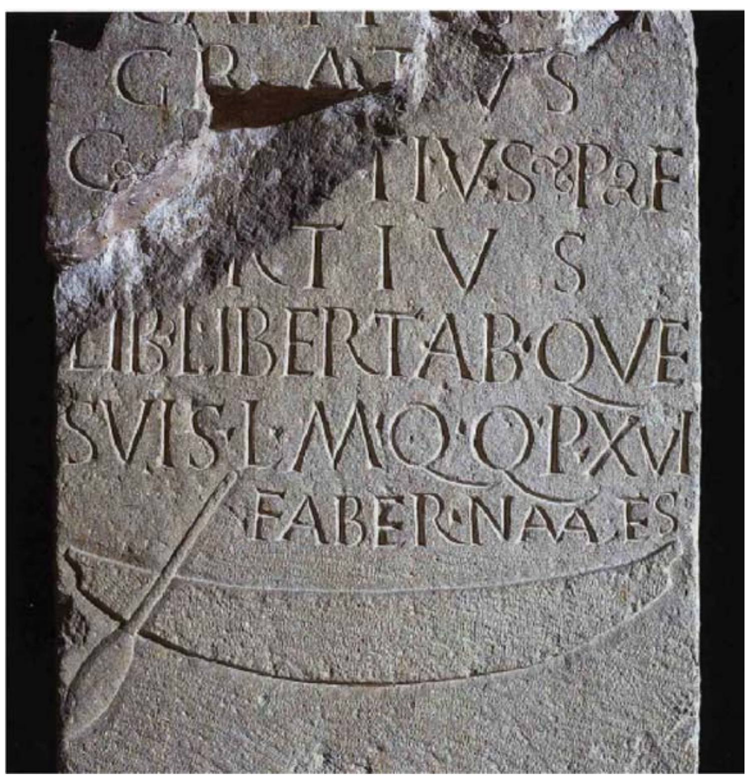


Figure 4.1: Funerary Stela of Cattius, Faber Navalis (Capulli 2010, 107).

Unsurprisingly, the inscriptions referencing shipbuilders all come from coastal port cities, many of which were also connected to major riverine shipping lanes. It must be emphasized that the epigraphic record, particularly that from the colonial period, is biased toward a more elite social class and those with enough financial means to afford the expense of the stone carver.[324] While evidence from inscriptions does indicate that some shipbuilders were able to achieve relatively affluent social standing and distinction, most of the community of shipbuilders is not represented in the epigraphic record. Furthermore, although Cattius of Aquileia was one of these financially successful shipbuilders, there is no evidence to either corroborate or refute his association with the community of northwestern Adriatic laced boatbuilders. There is also no indication that a *collegium* of boatbuilders was formalized in this region; while the community of builders existed in practice, it is unknown whether they adopted the Roman system of organizing themselves as an explicit club of professionals with fixed membership.

## ICONOGRAPHIC EVIDENCE

Iconography is a slippery data set. Trying to interpret objects, persons, or actions through brush strokes, chisel lines, and tesserae is an art form in and of itself. Shelley Wachsmann issued an important reminder to scholars that "an iconographic depiction is not the object itself. In ship iconography, we see not ships but *representations of ships* 'refracted' through the eyes, culture, schooling, mental attitudes, and skills of the creators."[325] These multiple layers of culturally-driven hues must be acknowledged when approaching iconographic sources and considered when developing any tentative conclusions based on iconographic analysis. Despite the difficulty in working with iconography, a careful study can lead to insights that other data sets cannot provide

[324] Cooley 2012, 53-4; Keppie 1991, 117.
[325] Wachsmann 1998, 5 (original emphasis).

or are not available to provide. For the northwestern Adriatic region, iconography related to the nautical landscape provides interesting details in both the pre-colonial and colonial periods.

## Pre-Colonial Iconography

Iconography from the pre-colonial period of the region is preserved primarily in ritual and funerary contexts, similar to the epigraphic record. Images and symbols are found within collections of votive offerings, particularly on bronze plaques and in the form of *bronzetti*, and of grave goods, including ceramic and metallic vessels as well as other ritualistic or symbolic objects. Much of the iconography from Este, for example, is on bronze plaques dedicated at sanctuary sites, whereas Padua boasts a large collection of carved stone stelae (*stelae Patavini)*. The bronze plaques from the Meggiaro sanctuary at Este generally show depictions of male warriors, sometimes mounted on horses, and other various accoutrements of war – shields, spears, helmets, etc.[326] A winged beast also makes a frequent appearance, commonly seen in the local *situla* art and adorning both votives and grave goods.[327] *Bronzetti* of human figures and horses are also a common votive and an occasional grave good, but female figures are more frequently seen at sanctuaries to Reita, such as at Baratella.[328] The majority of the *stelae Patavini* follow a limited repertoire of mounted warriors or horse-drawn chariots.[329] The horse is a ubiquitous figure in the iconography of Venetic settlements.

While the iconographic record of the pre-colonial period in the region is dominated by human figures, horses, and fantastical creatures, there are a few representations that reflect the paludal environment. These representations primarily include carvings and models of waterfowl.

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[326] Capuis and Chieco Bianchi 1992, 100-1; Zaghetto 2002; Salerno 2002.
[327] Capuis 1993, fig. 64; Capuis and Chieco Bianchi 1992, 76-7, fig. 64; Salerno 2002, 150, fig. 56, 154, fig. 58, 155, fig. 59.
[328] Capuis and Chieco Bianchi 1992, 64, fig. 43, 96-99, figs. 96-101; Lomas 2009, 15.
[329] Fogolari 1988, 99-105; Lomas 2011, 10-16.

An aquatic bird, likely a duck, crowns an enigmatic object from the Alfonsi 13 tomb at Este, dating to the end of the sixth century B.C.E. This object has been identified as either a "scepter" or a bell (*tintinnabulum*).[330] In addition, a zoomorphic ceramic vessel in the shape of a two-headed web-footed bird was discovered in the Lachini-Pela tomb at Este, which dates to the ninth century B.C.E. Although this object has been labeled as a generic vessel (*vaso*) and interpreted as a ritual object,[331] it was likely a toy as it is mounted on wheels and has a small loop at the front under the bird's breast which would have permitted it to be pulled by a string.

Moving outside the confines of Este, a bronze belt from Tomb 159 at Padua, dated to the end of the sixth century B.C.E., is adorned with several animal figures including what appear to be aquatic birds.[332] Finally, a duck is a central feature in one of the *stelae Patavini* (see Fig. 4.2), being an offering passed between a woman and a man (here the deceased) both of whom are clothed in the traditional Venetic dress of high status individuals.[333] This stela is considered the oldest of the *stelae Patavini* and is dated approximately to the end of the sixth century B.C.E.[334] In this scene, which has been interpreted as either an offering to the dead or a leave-taking/greeting ceremony, Giulia Fogolari contends that the duck is a representation of the soul of the deceased.[335] The use of a duck as a symbol of the soul of a Venetic individual is a powerful statement of the underlying dependence and connection with water. Perhaps, similar to a duck, the Veneti saw themselves as amphibious creatures, relying/living on both land and water in a seamless manner.

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[330] Malnati 2002, 39-40.
[331] Bianchin Citton 1992, 16-7; 2002, 101-2; Fogolari and Prosdocimi 1988, 26, 28.
[332] Michelini and Ruta Serafini 2005, 141, fig. 171.
[333] Fogolari 1988, 99-102; Lomas 2011, 10.
[334] Fogolari 1988, 102.
[335] Fogolari 1988, 100.

Figure 4.2: One of the *stelae Patavini* with a duck offering (Fogolari and Prosdocimi 1988, 99 fig. 127).

Despite the critical importance of water and waterways to the inhabitants of the region, depictions of the actual boats used to navigate these waterways are scarce during the pre-colonial period. At the Meggiaro sanctuary of Este, a bronze votive offering in the form of a longboat or galley (Fig. 4.3) was discovered in a ritual deposit alongside a miniature shield, an *aes rude* (pre-coinage monetary unit of bronze), a small enigmatic chest, a metal hoop (identified as an *armilla*, or armband), as well as plant and animal sacrificial remains. It has been suggested that this deposit represents a single ritual event.[336] The presence of clear nautical elements on the bronze crescentic votive makes it easily identifiable as a boat. These elements include a quarter rudder inscribed toward one end (indicating the stern) and two oars etched at the other end (toward the bow). The shape of the votive and the presence of oars suggest that this votive was intended to mimic a rowed

[336] Salerno and Medas 2003, 134.

galley (perhaps even a warship); however, it is less clear whether it was modeled after an archaic Greek warship, as Medas proposes.[337]

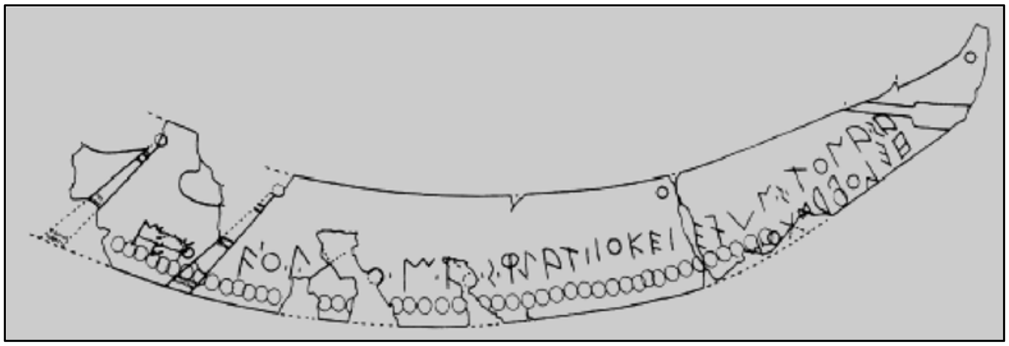

Figure 4.3: Bronze votive from the Meggiaro sanctuary at Este in the form of a boat (Salerno and Medas 2003, 134, fig. 2).

The dedication inscribed on this votive boat runs in two lines, following the curvature of the bottom of the hull and permits a date of the end of the sixth or beginning of the fifth century B.C.E.[338] Medas contends that the votive is lacking additional technical details of construction because the dedicators wanted to give supremacy to the text and additional elements would have interfered with that goal.[339] The inscription follows the general formula for Venetic votive offerings, in the vein of "talking inscriptions", and can be loosely translated: "Voltiomnos, Blodio, and [?]e-uns give me to Heno--to."[340] While the deity (or deities) to which the object was offered remains unknown, the inscription reveals that the boat votive was given on behalf of three individuals. The purpose of this boat offering, particularly when set in the context of typical votives at this sanctuary (utensils, ornamental objects, and bronze plaques decorated with male

[337] Salerno and Medas 2003, 138.
[338] Marinetti 2008, 160.
[339] Salerno and Medas 2003, 135.
[340] Marinetti 2008, 160-61.

soldiers), can be interpreted either as marking a symbolic rite of passage or denoting the economic activity of the dedicators (merchants or captains).[341] Other possible interpretations include that the three dedicators were rowers, marines, or boatbuilders. Considering the other votives found in the same ritual deposit, as well as the likelihood that the votive is modelled after a galley, Voltiomnos, Blodio, and [?]e-uns were likely some sort of naval warriors or marines.

**Colonial Iconography**

During the colonial period, the iconography of the region shows clear signs of Roman influence and the representations of the nautical landscape are considerably more extensive. While the pre-colonial iconography did not include images of people connected to the nautical landscape, there is at least one such physical likeness preserved from the colonial period. Unfortunately, Cattius, the *faber navalis* of Aquileia, did not order his portrait carved into stone alongside his inscription and simplistic boat outline. Neither is any other possible boatbuilder depicted in the known iconographic record of the region. Despite this void in the record, there is an image of a boatman, typically identified as a helmsman, from Aquileia. The funerary stela of the helmsman (Fig. 4.4), so named as he appears to be holding a tiny tiller connected to a quarter rudder in his oversized hand, is dated to the first century C.E.[342] Below his bust, alongside the aforementioned rudder, is a two-armed anchor with fixed stock.

Upon close examination of the relief, the tiller is misaligned with the man's grip, suggesting that the interpretation of this individual as a helmsman may not be accurate. Indeed, his pose is consistent with other togate figures in Roman iconography and the placement of the tiller in close proximity to his hand may be coincidental. Instead, the presence of both a rudder

[341] Marinetti 2008, 161-62. Salerno and Medas 2003, 138.
[342] Capulli 2010, 98.

and an anchor on the stela, symbols of the stern and bow of a ship respectively, may suggest this man is a shipowner. This interpretation is also more consistent with the wealth and social status typically required to set up such a funerary monument. It would be atypical for a simple helmsman to have achieved such status or wealth. Regardless, the boatman, whether helmsman or shipowner, is depicted with a short haircut, clean shaven, and togate. Unfortunately, the face is deteriorated so his features and expression cannot be seen.

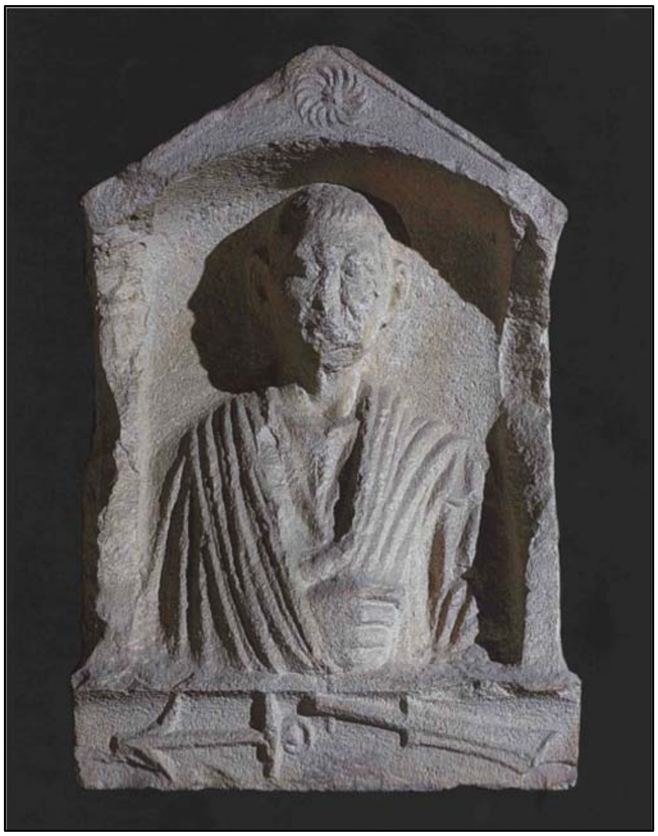

Figure 4.4: Funerary stela of a “helmsman” from Aquileia (Capulli 2010, 98).

While images of boatbuilders (laced or otherwise) are not preserved in the iconographic record, they may have represented their craft through another more personal medium. A study of the decoration of fibulas, the safety pins of the ancient world, suggests a possible parallel to laced boats. Of the fibulas excavated from votive pits at the sanctuary of Reitia at Este, several have decorations that appear as stitches,[343] and others depict a banded X pattern that is identical to the interior face of the planking of a laced boat.[344] The former, labeled by Meller as the Gorica Type, is dated to the second half of the first century B.C.E. and is local to the region of northeastern Italy south of the Alps and surrounding the Po River, with two examples also found in the Istrian peninsula.[345] The latter, which Meller calls the Carceri type, is arguably local to Este and dated to c. 50/45-35 B.C.E.[346] Although the association of these decorated fibulas to laced boats (and the boatbuilding community) is disputable, the use of stitching as an embellishing theme within the region where laced boats are found is at least suggestive, if not compelling.

While evidence of boat iconography at Venetic settlements is limited during the pre-colonial period, there are several depictions of ships during the colonial period. A small marble stela dated to the second century B.C.E. was recovered in the 18th century from an area on the western border of Este.[347] This area has since been tentatively identified as a possible sanctuary site devoted to the Dioscuri, the divine twins Castor and Pollux.[348] Based on the Greek inscription, this stela was offered in gratitude by an individual who survived a shipwreck on account of the miraculous intervention of the Dioscuri. The survivor, Argenidas the son of Aristogenidas, is dressed in a traditional Greek manner and stands beside a fairly generic Greco-Roman depiction of a ship, similar in style to a *navis oneraria* (cargo ship) – with a concave stem, pointed prow, and high sternpost – known in the Roman world as a *ponto*. This stela may have been dedicated

[343] Meller 2002, Plate 37 n. 430, 432, 434, 435, Plate 84 n. 459.
[344] Meller 2002, Plate 20 n. 240, 243, 244, Plate 19 n. 228-39, Plate 18 n. 225-27.
[345] Meller 2012, 219.
[346] Meller 2012, 163-5.
[347] Baggio Bernardoni 2002, 277-78; Tosi 1992a, 329 fig. 243.
[348] Baggio Bernardoni 1992, 324-330; 2002.

by a Greek wrecked along the coast on his way to Este (itself over 30 miles inland from the Adriatic Sea), or may represent Hellenistic influence upon the local inhabitants.[349]

A similar *navis oneraria* is seen on a metope found in Aquileia dated to the second century C.E and in a boat model from the Villa Lucheschi in the surrounding region of Treviso dated to the first century C.E.[350] Both of these depictions show a vessel with a concave stem, pointed prow, and an upturned stern comparable to the stela from Este. However, on the metope ship from Aquileia, the upturned stern piece is not connected to the sternpost, but part of a slightly extended stern deck. The boat model from the Villa Lucheschi has a squared element at the bow which has the appearance of an oculus, a ship's apotropaic eye, but is more likely a representation of a through-beam. Thick lines run longitudinally along the side of these vessel depictions, possibly representing wales, and a quarter rudder penetrates vertically through the thickened caprail on the Aquileia metope. Such depictions of *naves onerariae* have parallels throughout the empire, including the corporation advertisements at Ostia, a Roman sarcophagus now displayed at the Ny Carlsberg Glyptotek Museum in Copenhagen,[351] the Althiburus catalogue of ships mosaic from Tunisia, a relief on the gravestone of Demetrius of Lampsacus in northwestern Turkey, a mosaic from a tomb near Sousse in Tunisia, and the even likely the stela of Longidienus from Ravenna.[352]

It might be assumed that the presence of the imperial fleet at Ravenna would influence the naval representations in the whole region, with the settlements nearest to the fleet producing the most abundant and well-crafted images. Yet this does not appear to be the case as the clearest and most frequent depictions of naval vessels in the region come from Aquileia. These include two prows of warships, complete with rams, carved in stone – one of which was part of an honorary

[349] Baggio Bernardoni 2002, 278.
[350] Capulli 2010, 92-3; Tirelli 1998.
[351] Original findspot is unknown, though allegedly Ostia.
[352] All of these iconographic representations can be found in Casson 1995.

or sepulchral monument dated to the first century C.E. and the other part of an elaborate gravestone without a confirmed date.[353] While the former is lavishly decorated and flawed in its form (the ram is pointed), the latter is realistic with an oculus, proembolon, and blunted ram that corresponds to known archaeological examples.[354] The prow of a warship was also carved onto a metope that was part of a Doric frieze of a portico in Aquileia.[355] This is also an oddly fashioned representation, with an upturned, pointed ram, and a serpentine stem protruding above the deck. Finally, a stylized double-ended warship, with four warriors on board, was carved onto a gem found in excavations at Aquileia.[356] This depiction shows a crescentic vessel with high upturned ends, similar to galley representations seen on first century B.C.E. coinage of northern Italy.[357]

Not all the ship representations from this region have clear parallels to Roman depictions of ships as seen throughout the empire. For example, a boat model made of purple glass, found near Altino and dated to the first century C.E., portrays a long, slender craft (Fig. 4.5).[358] Tirelli identifies it as representing a river vessel for the transport of cargo, but the elegance of its form is remarkably analogous to the sixth or fifth century B.C.E. bronze longboat votive recovered from Este.[359]

Far from elegant, however, is a bas relief from Altino of a larger type of *navis oneraria* (Fig. 4.6). This depiction of a tubby cargo vessel decorates a monument, identified as a sepulchral altar and dated to the first century C.E., includes many enigmatic elements.[360] This vessel has a high and fully rounded hull, with no differentiation in curvature between the bow and stern. In

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353 Capulli 2010, 105.
354 E.g. the Athlit Ram, the Acqualadroni Ram, the Egadi rams, etc. See Buccellato and Tusa 2013; Casson and Steffy 1991; Tusa 2005; Tusa and Royal 2012.
355 Zaccaria 2010, 73
356 Capulli 2010, 104.
357 See Casson 1995, fig. 120-21.
358 Tirelli 1998.
359 Tirelli 1998.
360 Tirelli 1998; 2011, 133-4, fig. 2.

fact, it is difficult to distinguish which end is which on this relief. The ship has an extended superstructure, with six squared elements resting atop the caprail spaced equally on either side of a head (Gorgon?) amidships. A possible Gorgon head also decorates one end of the vessel which is slightly raised. Unfortunately, the opposite end of the vessel is not intact. This strange arrangement makes interpretation difficult. The squared elements may represent misplaced through-beams, extended frames (used as bollards), or may indicate the cargo of the vessel (timber?).

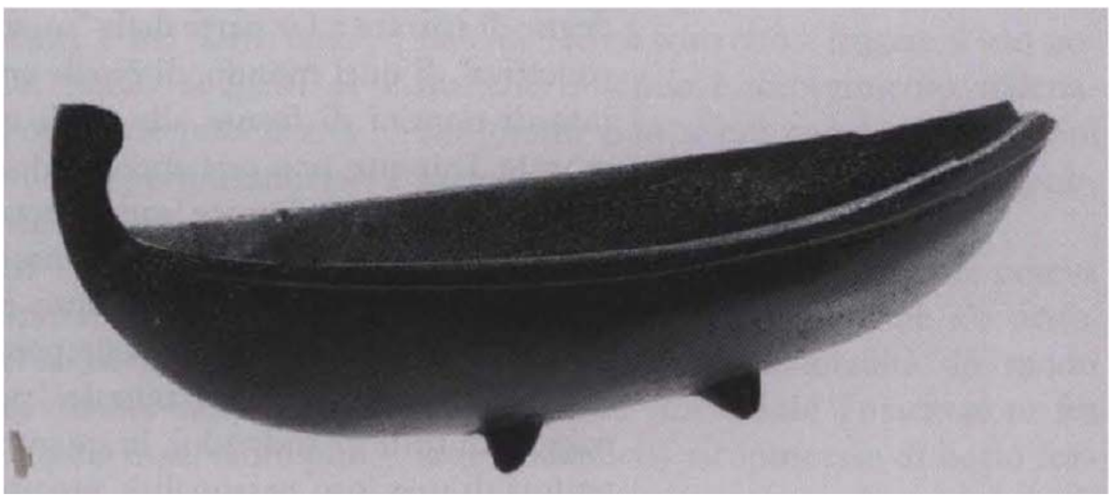

Figure 4.5: Glass boat model excavated from the territory surrounding Altino (Tirelli 1998).

Another puzzling representation is a carved stone ship topping a cylindrical altar (Fig. 4.7). This ritual object also comes from Altino and is dated to the first century C.E.[361] It too may represent a *navis oneraria*, but it is fragmentary and heavily degraded, with only the rounded bottom of the hull and a quarter rudder at the stern preserved. Although it is not fully preserved, a

[361] Cresci Marrone and Tirelli 2003, 17, 24 fig. 6; Tirelli 1998; 2011, 134.

perplexing detail is still clearly retained, that of the presence of four vertical lines running between two longitudinal thick lines (wales?) starting at midships and continuing forward. Tirelli describes this vessel, "La nave, a doppio timone e decorata ai lati della prua da due elementi a rilievo che vogliono forse alludere a due occhi opotropaici, è frammentaria nella parte superiore."[362] (The ship, with a double tiller and decorated on both sides of the prow with two elements in relief that perhaps allude to two apotropaic eyes, is fragmentary at the top.) These two elements that Tirelli identifies as possible oculi are not visible in the published photograph of the piece. Unfortunately, she does not interpret the clearly discernible vertical lines; these might represent oars or stanchions, suggesting the depiction is of a galley. These propositions are problematic as there are only four lines, which would seem too few to either propel a vessel of the given size (if oars) or to support the superstructure (if stanchions). However, the appearance of only two to four lines on long galleys has a precedent in Adriatic naval iconography in the sixth or fifth century B.C.E. bronze boat votive.[363] The latter two ship depictions from Altino are particularly crude representations in comparison to others seen at Aquileia and throughout the empire. The role of Aquileia as a center for the diffusion of Roman influence in the region, including the dissemination of ship iconography, can be developed more fully by looking at a fascinating maritime scene preserved in a mosaic floor in the Basilica at Aquileia.

[362] Tirelli 1998.
[363] This element is also seen on the Novilara stela from Pesaro (Tiboni 2009b, figs. 1-5).

Figure 4.6: Bas relief from Altino of a large cargo ship (Tirelli 2011, 133, fig. 2).

Figure 4.7: Cylindrical altar from Altino with relief of a ship (Tirelli 2011, 133, fig. 3).

## **The Maritime Mosaic in the Basilica at Aquileia**

One of the most striking iconographic displays of the maritime landscape in this region was inlaid on the floor of the Basilica at Aquileia. The Basilica at Aquileia was constructed during the fourth century C.E., and the mosaic floors are dated specifically to 314 C.E. based on the inscription of Bishop Theodore floating within the maritime scene.[364] The full mosaic floor of the fourth-century Basilica measures about 750 $m^2$, and is the earliest example of Christian art in the western Mediterranean.[365]

The maritime scene (Fig. 4.8), located in the south end of the mosaic floor, consists of a large sea filled with marine animals – sundry fish, octopi, rays, squids, and even a sea monster – upon which there are five boats. The scene can be broadly divided into two themes – (a) the story of Jonah in the upper portions of the space and (b) fishermen, some fishing from boats, others from small squares of land, beneath. The fishing scene that runs parallel to Jonah's saga, with winged *putti* and richly-dressed boatmen at work at the helm and with the nets, is populated by unrealistic characters for a representation of everyday fishing activities. Scholars have interpreted these two themes as allegories of Christ.[366]

This departure from realistic depictions of common people runs parallel to trends in mosaic art during the fourth century C.E. seen throughout the Roman Empire. Katherine Dunbabin notes the shift particularly in marine scenes from the realism of third century C.E. mosaics to the fantastical nature of fourth and fifth centuries C.E. mosaics.[367] The latter is more often

[364] Brumat Dellasorte 1990, 69-70.
[365] Brumat Dellasorte 1990, 69; Gough 1974, 71, 76; Lehman 2010, 162.
[366] Bisconti 2010, 220-1. Jonah was trapped in the belly of the fish, in this case a sea monster, for three days just as Christ laid in the tomb for three days; both were resurrected and completed the prophetic work for which they had been sent by God (Matt. 12:40-1; Brumat Dellasorte 1990, 71-2). In addition to this obvious biblical reference, the *putti* and well-dressed boatmen of the fishing scene have been identified as Jesus' apostles, themselves mostly real fishermen of the early empire, and those promised by Jesus to be made "fishers of men" (Matt. 4: 19; Brumat Dellasorte 1990, 73).
[367] Dunbabin 1978, 125, 130.

characterized by the imaginary, with *putti* and Erotes performing the fishing tasks instead of the realistically depicted fishermen and boatmen of the third century.[368] Zaraza Friedman echoes this analysis in regards to ship iconography, observing that ships lose their realism in the later Roman period and instead become an outline of representative types.[369]

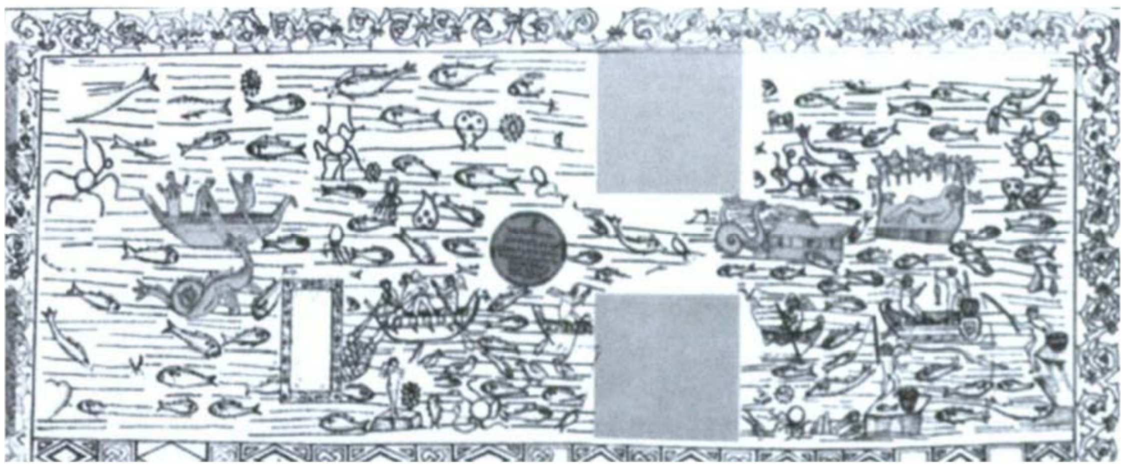

Figure 4.8: Maritime mosaic from the Basilica at Aquileia (Bisconti 2010, 229, fig. 9).

This is not to say that fourth century marine mosaics are devoid of authentic features. Scholars have been able to reconstruct fishing techniques based on marine mosaics, including those from the fourth century, and have argued that mosaicists would have needed to witness actual fishing along the coast in order to create such realistic scenes.[370] There are two fishing techniques demonstrated in the Aquileia mosaic – net fishing and rod or pole fishing. The accuracy of these techniques gives some credence to discussing the ships as purposively accurate representations of real vessels, and supports a hypothesis that these nautical scenes have a certain documentary quality to them.

[368] Dunbabin 1978, 130.
[369] Friedman 2011, 9.
[370] Bekker-Nielson 2010, 188-92; Ghalia 2006, 36.

Moreover, Taher Ghalia states, "The real and the imaginary are often combined in certain marine compositions…as if to emphasize the significance of the marine world, laden with mysteries and myths, in the minds of the works' patrons."[371] This sentiment would certainly be appropriate for a setting that witnessed the burgeoning eastern cult of Christianity in Italy. For the mosaicists at Aquileia, the "significance of the marine world" gave them the ability to meld the artistic trends of the period with the mysticism of Christianity in order to create a powerful scene for worshippers. These religious and artistic overtones to the maritime scene at Aquileia are just two of the culturally-driven hues that separate the modern scholar from understanding the ancient representation of watercraft in this scene, and must be kept in mind during the analysis of this mosaic.

The early Christian floor mosaic at Aquileia features four fishing vessels and one merchant vessel, the ship from which Jonah is hurled. Several similarities are immediately apparent between these five ships. All the vessels depicted in this scene show evidence of a stern bench for the helmsman. Furthermore, each helmsman only needed a single quarter rudder to operate his fishing vessel effectively. Finally, each hull's sides were decorated with a similar motif of alternating colored squares directly beneath and up to the railing. These elements of the Aquileia fishing vessels are also represented in other fishing scene mosaics. The villa of Piazza Armerina in Sicily is dated to the first quarter of the fourth century C.E. concurrent with the Basilica at Aquileia, and also possesses exquisite mosaic floors.[372] Three of the mosaic floors from this villa depict fishing scenes – the *frigidarium*, Room 29, and the atrium.[373] The fishing vessels in these mosaics reveal figures seated in the stern area,[374] though the helmsmen generally have two steering oars instead

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[371] Ghalia 2006, 31.
[372] Friedman 2011, 135-6.
[373] Friedman 2011, 136-47.
[374] The helmsman in Boat 1 of Room 29 is seated in the bow, which may indicate that these vessels could be steered from either end or, more likely, may represent a mistake on the part of the mosaicists.

of one. The sides of the hulls are also decorated, though not with the square motif seen in the Aquileia mosaic. Decorated hulls and stern benches are also seen in the fishing scenes from Hadrumetum and Sousse, both sites in North Africa dated to the third century C.E.[375] Thus, these elements may represent a preservation of genuine ship features from the period of heightened realism in ship iconography.[376]

Despite these similarities, there are also differences in the depictions of individual ships at Aquileia, mostly in regards to hull form. Two of the fishing boats are only partially preserved due to the subsequent placement of columns in the church. The merchant vessel and one of the fishing vessels have rounded hulls with slightly raking stems and curving sternposts ending in a bird head. The final fishing vessel has a inward curling sternpost and what appears to be a bulbous projection at the bow. Since the trend of fourth-century mosaics is toward the portrayal of representative types, it may be possible to identify the distinct types of fishing boats illustrated in this scene. A mosaic floor dating to the late third century C.E. from Althiburus, Tunisia presents a catalog of ship types, which other scholars have used to identify ship types depicted in mosaics at other sites and even to associate archaeological finds to a specific ship type.[377]

With only the stern portions of two of the fishing boats preserved, it is not possible to identify their types based on the ship catalog. Additionally, the form of the merchant vessel and comparable fishing boat, though fully depicted in the scene at Aquileia, do not have a parallel form to the types represented in the Althiburus mosaic. However, the nature of the fishing boat with a bulbous projection is elucidated upon comparison with this North African catalog. The strange

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[375] Blanchard-Lemee and Mermet 1996, Fig. 81; Ghalia 2006, Fig. 14.
[376] While the decoration of a small boat may seem unlikely and therefore this feature disregarded as only an artistic flourish, Colombini et al. (2003) report traces of red and white pigments from several of the Pisan ships, which were small harbor craft. While the use of encaustic painting on ships is preserved in ancient texts (Plin. *HN* 35.149; Ath. 5.203.), these references are limited to warships.
[377] Friedman 2011, 66, 155, 185-6; Grossman 2011, 25-6.

bulbous stem of this fishing boat appears remarkably similar to the depiction of the bow of the *horeia* type vessel. The *horeia* type is a unique vessel with a transom prow, that has also been identified in the mosaics from the atrium floor at Piazza Armerina (Boats 2 and 4) and in the archaeological record from the ship remains at Naples and Toulon.[378] Furthermore, the exterior of the transom displays a decorative motif in both the Althiburus and the Piazza Armerina mosaics, just like the fishing boat from Aquileia. Though the *horeia* type is often associated with harbor duties,[379] the depiction of them as fishing craft appearing in at least two distantly-spaced locations, here northeastern Italy and Sicily, demonstrates a fuller picture of the life-use of these multi-purpose vessels, as Carlson has argued.[380]

The merchant vessel and comparable fishing boat are disparate from the other three fishing vessels, not only due to their larger size, but also the distinct sternpost in the shape of a bird's head. This style of sternpost was quite common in ship iconography of this time period for merchantmen, though a goose or swan head was more common than the likely duck depicted on the ships at Aquileia.[381] The use of the duck, prevalent within Venetic iconography during the pre-colonial period, raises the question whether the mosaicist at Aquileia was intending to associate these boats with local Venetic culture.

It is likely, based on their size and hull form, that both of these vessels are intended to represent merchant ships. Merchantmen frequently appear in fishing scenes elsewhere in the mosaics of the Roman world.[382] While it is almost certain that fishing activities took place aboard

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[378] See Friedman (2011) for the *horeia* type in the Piazza Armerina mosaic and Boetto (2009) for the *horeia* type at Naples and Toulon.
[379] Parker 2012, 210.
[380] Carlson 2002b.
[381] Wachsmann 1998, 177-8, figs. 8.24, 8.25.
[382] Dunbabin 1978, 126.

merchant vessels,[383] Dunbabin argues that the insertion of merchant vessels into fishing scenes was intended as a symbol of the source of wealth of the proprietor who funded the mosaic.[384] The hull form of a merchantman for a fishing boat certainly may have been chosen to represent a wealthy ship-owning donor of the early development of the Basilica; however, the identical nature of this fishing boat to the vessel in the Jonah storyline proposes an alternative interpretation. As the two themes of this marine scene are intended to be connected through allegories of Christ, the reuse of the merchant vessel hull form to initiate each thematic development strengthens the connection not only between the themes but also of both to the life of Christ.

As this mosaic is intended to communicate allegorical stories of a religious nature, any conclusions about the representative quality of the depicted fishing vessels should be made carefully. Yet, based on comparisons with other non-religious fishing scenes of the period, the accuracy of the Aquileia mosaicist's use of ship hull forms seems to be balanced and consistent with genre trends. Overall, the consistency of the depictions of ships at Aquileia with other examples from various corners of the Roman-influenced Mediterranean is in stark contrast to some of the strange forms seen at other sites in the region during the colonial period (such as the reliefs from Altino). The former continued the tradition of the art which connected it to the broader Mediterranean; as such, even in the details of iconography, Aquileia is shown to be the center of Roman influence in the region and likely the center through which Roman forms of ships, both real and illustrated, were disseminated.

[383] Archaeological evidence of fishing equipment has been found during excavations of various merchant vessels including the Serçe Limanı ship (Bass 2004), Kyrenia ship (Katzev 2007), Ashkelon wreck (Galili et al. 2010), and Porticello wreck (Eiseman and Ridgeway 1987) among many others.
[384] Dunbabin 1978, 126.

There are no indications on or in any of these ship representations to suggest that these vessels were laced,[385] which is perhaps not surprising during the colonial period since they were copying Roman forms and referencing Roman types. Furthermore, northwestern Adriatic laced boats were constructed in such a way that ligatures would not be exposed on the external side of the hull, therefore a laced boat of the region should not be depicted with stitches on the outside. There is very little detail preserved of the interior of the boats in these representations to identify lacing. Of course, communicating the means of ship construction was not likely the goal of the ancient artist. Instead, by depicting ships within the artwork of the region, the artists (and patrons commissioning the art) were referencing the presence of actual ships within their experiences, whether that was a dramatic event (such as Argenidas surviving a shipwreck), the source of livelihood (such as Cattius' profession as a shipbuilder), or a general maritime scene familiar to all inhabitants of the region (such as the fishing scenes in the Basilica at Aquileia).

## ARTIFACTUAL EVIDENCE

There are many possible artifactual remains that could survive in the archaeological record which would provide insight into the professional activities and lifestyles of the boatbuilders of the northwestern Adriatic region – remains of a shipyard, shipbuilding toolkit, skeletal remains associated with items connecting the individual to shipbuilding activities, etc. Unfortunately, within this region at least, none of these elements has survived in the existing archaeological record. The only artifactual remains that survive from this region which speak to this community of builders, beyond those already discussed above, are the vessels they built. These remains of

[385] Indeed, there are no indications of the joinery method, either laced or mortise-and-tenon. It is generally not possible to detect joinery methods in iconography, although there are some examples such as the ninth to seventh century boat models from Nuragic culture of Sardinia (e.g. "Noah's Ark" from Tomba del Duce in Vetulonia; Bonino 1985, 87-8). The stitchings are shown on the exterior of the vessel in this example.

several laced boats that have been found throughout this region allow for a discussion of the range of sizes, forms, and uses. This range speaks to the variety of forms the community could produce, and lays the groundwork for an analysis of the *chaînes opératoires* (or technical stages) of the tradition, which will be explored in more detail in Chapter 5. However, before looking at the laced vessels of the region it is important to define the context of the broader methods of ship construction in the Mediterranean and the other types of plank-built boats found in the region during this time period.

**<u>Contemporary Ship Construction in the Mediterranean</u>**

In order to understand how this region is unique in regards to ship construction it is important to review the standards of ship construction in the Mediterranean and the rest of the Italian peninsula. During the period of Roman expansion and dominance in the Mediterranean (200 B.C.E. to 400 C.E.), mortise-and-tenon joinery of the hull planking was the prevailing method of ship construction. Outside of the upper Adriatic, all other Mediterranean hull remains from this period exclusively used this form of edge joinery.[386] A shift in the use of mortise-and-tenon joinery can be traced starting in at least the fourth century C.E. For example, the Madrague de Giens ship, an iconic hull of the late Republican period (first century B.C.E.) wrecked off the coast of southern France, was about 40 m long (135 ft) with an estimated carrying capacity of 400 tons.[387] The tenons were 20-22 cm long and the corresponding mortises were spaced every 15 cm (center-to-center).[388] By comparison, the Yassıada fourth-century hull, a smaller ship that was wrecked off the coast of Turkey, had tenons that were only 8.5 cm long and the corresponding mortises were unevenly

[386] Parker 1992; Steffy 1994.
[387] Pomey 1982.
[388] Pomey 1982, Steffy 1994, 65.

spaced, but spacing ranged from 15-32 cm.[389] By the seventh century, mortise-and-tenon joints were even smaller, more widely spaced, and no longer locked into place with pegs, and by the 11th century, edge joining the planks was abandoned altogether in some hulls.[390] This transition in ship construction from building an edge-joined shell to a frame-first hull is well documented within the literature of nautical archaeology.[391]

The framing system used in the Mediterranean also followed a fairly consistent pattern of alternating floor timbers and half-frames.[392] In this system, neither the floors nor half frames were connected to the keel or to any additional futtocks. This is in contrast to a made-frame, where floors and futtocks are assembled as a whole unit. The framing system of alternating floors and half-frames was first seen in the archaeological record in the late fourth or early third century B.C.E., but it remained in widespread usage into the 10th century C.E.[393] Along with the transition in edge-joinery, the framing system also underwent a shift to pre-made/designed frames fixed to the keel – the first step toward skeletal construction and naval architecture as it is known today.[394]

These two construction elements – the joinery system and the framing system – are key to understanding the design of a ship's hull, the tradition that the builder followed, and the relative limitations under which the builder worked (economic, social, environmental, etc.). In Italy, several ships that follow this pattern of mortise-and-tenon construction have been discovered along the peninsula[395] and from the area surrounding Rome itself.[396] The northwestern Adriatic laced

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[389] Steffy 1994, 79-80; van Doorninck 1976, 122-23.
[390] Pomey et al. 2012, 291-97; Steffy 1994, 83-5.
[391] Pomey et al. 2012; Steffy 1991, 1994, 83-5.
[392] Pomey et al. 2012, 241.
[393] Pomey et al. 2012, 275-77.
[394] Pomey et al. 2012, 298-301; Steffy 1994, 87-9.
[395] E.g. the mortise-and-tenon joined hulls from the Roman period found at Herculaneum, Pisa, Naples, and Ravenna. See Bruni 2000; Giampaola et al. 2005; Medas 2003; Steffy 1985, 1994, 67-71.
[396] E.g. the Nemi barges and Fiumicino boats. See Boetto 2006; Steffy 1994, 71-2; Testaguzza 1970, 129-47.

tradition of ship construction straddles these two periods in general Mediterranean ship construction – 1) the period of convention and 2) the period of transition. It is within this context of both continuity and change in ship construction (a context that is also reflected in the political environment of the Mediterranean), that the boatbuilders of northwestern Adriatic laced vessels practiced their craft. Considering this context, the laced vessels of the northwestern Adriatic represent a localized tradition of construction that does not follow the pattern prevalent throughout the Mediterranean. However, it was not the only localized form of ship construction. Other variations in ship construction,[397] other departures from the characteristic Mediterranean pattern of hull, have been identified and detailed within the geographical and temporal boundaries of the Roman Empire, including the bottom-based or "Celtic" tradition of central Europe.[398]

**Mortise-and-Tenon Vessels of the Region**

Within the northwestern Adriatic region, a small number of mortise-and-tenon vessels have been found that are contemporary with the laced vessels. During the excavation of a Roman villa in Monfalcone, an abandoned mortise-and-tenon boat was uncovered.[399] The boat itself has not been directly dated, but the villa with which it was associated dates to between the first and third centuries C.E. This vessel was preserved at 10.7 m (35 ft) in length and 3.8 m (12 ft) in width. It has a shallow keel that is rectangular in section, and fairly thick hull planking (4.5-5.5 cm). The Monfalcone boat does not use the contemporary framing system of alternating floors and half-timbers noted throughout the Mediterranean. Instead, the preserved floor timbers (sided 11cm and molded 9cm) are spaced about 16.5 cm apart, considerably tighter spacing than is generally seen

[397] Sometimes called "provincial shipbuilding" (De Weerd 1978).
[398] E.g. the Bevaix boat, the Zwammerdam barges, etc. See Arnold 1978; De Weerd 1978; Hocker 1991; Marsden 1977.
[399] Bertacchi 1976.

in framing systems during this period. Unfortunately, neither the sides of the vessel nor any upper portions of the frames (futtocks) was preserved.

A shipwreck six miles off the coast of Grado was discovered in 1986, and subsequently excavated sporadically over the next 12 years. The wreck, a small merchantman with an amphora cargo of at least 600 amphoras carrying fish sauce, has been dated to either the first half of third century C.E.[400] or to the middle of the second century C.E.[401] and is commonly known in modern scholarship as the *Iulia Felix*[402] Roman ship. The preserved dimensions are similar to those of the Monfalcone boat. The *Iulia Felix* hull is preserved to a length of 13.1 m (43 ft) and to a width of 6.1 m (20 ft). The garboard strakes are 5 cm thick; the remaining planking ranged in thickness from 4.5 to 2.5 cm. The mortise-and-tenon joints were irregularly spaced but averaged about 7-8 cm. The keel has a trapezoidal section with keyed hook scarves used to connect it to the posts, a feature that, as Beltrame and Gaddi note, is also seen on other wrecks of this period.[403] Unlike the Monfalcone boat, the framing system of the *Iulia Felix* wreck follows the common alternating floors and half-frames prevalent throughout the Mediterranean. The frames are spaced 14-17 cm apart, were crafted from naturally curved branches (some of which still have the bark preserved), and were joined to the planking using wooden treenails and nails of iron and bronze. A variety of wood species were used in the construction of the Iulia Felix hull, including elm (keel, garboard and second strakes), pine (posts, hull planking, framing, and pegs), olive (treenails and tenons), oak (tenons), fir (keelson, ceiling planking, and other wooden elements not crucial to the structural integrity of the hull), and larch (hull planking). Beltrame and Gaddi argue that the use of larch, a

[400] Silvestri et al. 2008, 331.
[401] Beltrame and Gaddi 2007, 138.
[402] Why this name is given to this shipwreck is unclear and not mentioned in any of the sources consulted for this research.
[403] Beltrame and Gaddi 2007, 138.

species that grows in the Italian Alps, for some of the hull planking indicates that this was a locally built vessel, pointing out that Vitruvius also states this wood was commonly used in this region.[404]

Finally, in 2012, in the province of Precenicco, only a few miles away from the Stella 1 laced shipwreck, a wooden plank-built river boat, radiocarbon dated to the 11th century C.E., was found abandoned near a former branch of the Stella River.[405] The flat-bottomed keelless hull is preserved to a length of about 8 m (26 ft) and has a gradual turn of the bilge (not a hard chine as is often seen in river barges). The planking of the vessel is joined together with cylindrical dowels or coaks,[406] similar to the method used on several similarly dated vessels excavated recently at Yenikapı, Turkey.[407] The framing system of the Precenicco barge consisted of alternating L-shaped floor timbers, a system that is again parallel to other wrecks of the 11th century including the Serçe Limanı glass wreck and several Yenikapı wrecks.[408] This boat was excavated in 2014 and publication of the remains is still underway, so no additional details are available at this time.

These vessels have many elements in common with the mortise-and-tenon shipbuilding tradition of the Mediterranean during this period, although some show signs of derivation (such as the framing system used in the Monfalcone wreck). Overall, these hulls reference a similar tradition of shipbuilding that was widespread throughout the Mediterranean and transitioned in-step with broader shifting trends in hull construction.

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404 Beltrame and Gaddi 2007, 145.
405 Capulli 2015.
406 These terms are used synonymously in publications of these wrecks to reference the same hull component.
407 Capulli 2015; Kocabaş 2015, 12; Pulak et al. 2015, 46-7.
408 Capulli 2015. The Yenikapı wrecks with L-shaped frames include: YK 14, YK 5, YK 1, and YK 24 (Pulak et al. 2015, 61).

## Laced Vessels of the Region

Although a handful of other types of boats have been discovered in the northwestern Adriatic, it is the laced boats that dominate the archaeological record of the region over a period of at least 800 years (and were likely in use for considerably longer).

There are three traditions of laced hull construction in the ancient Mediterranean, here delineated as the Greek laced, the eastern Adriatic, and the northwestern Adriatic. There are significant differences in the details of construction between the vessels attributed to each of these that, in my opinion, warrant separating them into three distinct traditions (see Table 4.1). Currently, there are at least six vessels attributed to the Greek laced tradition, which have been found throughout the Mediterranean, from the southeastern coast of Spain to the western coast of Turkey, and date primarily to the sixth century B.C.E.[409] The hallmark construction features of this tradition include the use of tetrahedral recesses as the entrance to diagonal lacing channels, regularly spaced dowels to align the planks prior to lacing, simple semicircular edge cavities for the exit from the lacing channels along the plank edge, and frames with a distinct morphology[410] lashed to the hull planking. Greek laced vessels were, in general, small- to medium-sized seagoing vessels with present, if rudimentary, keels. In addition to the fully laced vessels of the Greek laced tradition, there are at least five other boats that represent a clear transition from the Greek laced method of construction to the mortise-and-tenon joinery method that would come to dominate the Mediterranean.[411] These transitional vessels only use lacing for difficult areas of the hull (garboard strakes and hood ends) or for repairs.

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[409] The Giglio (Bound 1985, 1991), Cala Sant Vicenç (Nieto and Santos 2009), Pabuç Burnu (Polzer 2009), Bon Porte (Pomey 1981), Jules Verne 9 (Pomey 1999, 2001), and Gela 1 (Panvini 2001) shipwrecks.

[410] The frames of Greek laced ships have a distinct cross-section being wider and rounded at the top and narrower at the base. It is suggested that this shape facilitates the lashing to the hull planking.

[411] The Ma'agan Mikhael (Kahanov and Pomey 2004), César 1 (Pomey 2001), Gela 2 (Panvini 2001), Jules Verne 7 (Pomey 1999, 2001), and Grand Ribaud F (Long et al. 2001, 2001) shipwrecks.

**Table 4.1: Comparison of Mediterranean Laced Traditions of Ship Construction**

| | | **Greek Laced Tradition** | **Northwestern Adriatic Tradition** | **Eastern Adriatic Tradition** |
|---|---|---|---|---|
| Lacing System | Entrance Channels | Tetrahedral cavities | Simple holes | Simple holes |
| | Exit Channels / Edge Cavities | Semi-circular | Trapezoidal or rectangular cavities | Simple holes |
| | Lacing Pattern | Cross-stitched X | Cross-stitched X | Simple loop |
| | Channel Diameter | 0.6-0.8 cm | 1.0-2.5 cm | <1 cm |
| | Channel Spacing | 4-5 cm | 6-10 cm | 2.0-2.5 cm |
| Framing System | Method of Fastening to Hull Planking | Lashed | Wooden treenails* | Wooden treenails |
| | Cross-Section | Rounded wide tops, narrow bases | Rectangular | Rectangular |
| | Spacing | About 65-90 cm | About 30-50 cm | About 40-50 cm |
| | Additional Joinery of Planks | Horizontal dowels between plank seams | Iron nails (occasional use to fasten hood ends to posts) | None |

* Exception: Comacchio hull, the frames of which were both lashed and treenailed to the hull planking.

Currently, there are at least eight vessels attributed to the eastern Adriatic tradition, which have been recovered primarily along the coast of modern day Croatia, but also includes a river barge from modern day Slovenia.[412] The recent discovery of a laced boat at Zambratija, which was radiocarbon dated to c. 1200 B.C.E., is the oldest known laced boat in the Mediterranean and belongs to the eastern Adriatic tradition.[413] Most of the finds from this tradition, however, come from the Roman imperial period, dating between the first century B.C.E. and the third century

[412] The Nin (1, 2, and 3; Brusić 2006; Brusić and Domjan 1985), Caska Bay (Radić-Rossi and Boetto 2011), Llubjlana (Boetto and Rousse 2011; Gaspari 2009), Zambratija (Uhac et al. 2015), and Pula (1 and 2; Uhac et al. 2015) shipwrecks.

[413] Uhac et al. 2015.

C.E.[414] The key construction element that distinguishes this tradition is the simple loop lacing pattern (the Greek laced and northwestern Adriatic both employ the cross-stitched "X", or banded-X, lacing pattern). While there is less recognizable consistency in the construction details between the vessels of this tradition, the trend seems to be toward small, vertical lacing channels (less than 1 cm in diameter) spaced very close together (about 2 cm apart). In contrast to Greek laced boats, the frames of the eastern Adriatic tradition are rectangular in section and connected to the hull planking with wooden treenails. With the exception of the Llubjlana barge in Slovenia, the other vessels in this tradition appear to be small coastal boats with relatively moderate-sized keels and rounded hulls.

There is a possible ninth example that can be associated with the eastern Adriatic tradition – the hull planks from the island of San Franceso del Deserto in the Venice lagoon. These two planks from a laced vessel were excavated from a hydraulic structure that dates between the second and fourth centuries C.E. and are typically classified with other Roman-era northwestern Adriatic laced boats. However, the lacing channels are less than 1 cm in diameter (0.7 cm and 0.9 cm) and are spaced approximately 2-3 cm apart, features which more closely align with the eastern Adriatic tradition. The lacing pattern is no longer preserved[415] so it is not possible to verify if these planks were joined with a simple loop, but the size and spacing of the lacing channels strongly suggest that these remains were salvaged from an eastern Adriatic laced boat.[416] Therefore, the San Francesco del Deserto hull remains will not be considered within the analysis of northwestern Adriatic boats.

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[414] It is impossible to say whether this tradition of laced construction was in continual use in the region of the eastern Adriatic or if it was revived over its known history.
[415] In fact, I found no cordage during my brief examination of these planks.
[416] It is not surprising that an eastern Adriatic laced boat would be found along the northwestern Adriatic coast, particularly as the presence of keels indicates they primarily sailed in coastal waters or on the open sea. It is probable that such a craft could have been wrecked during a journey to Venetic ports and the hull planking salvaged and incorporated into structures in the lagoon.

In comparison to the other Mediterranean laced traditions, the northwestern Adriatic tradition has more archaeological remains, with 19 attributed finds (see Table 4.2). All known vessels are keelless flat-bottomed boats, though they range considerably in overall size. In regards to the details of construction, the northwestern Adriatic laced tradition shares some features in common with the Greek laced – the diagonal lacing channels and the cross-stitched "X" lacing pattern; however, the northwestern Adriatic tradition lacks the tetrahedral recesses and the regularly spaced dowels to align the planking. In addition, the edge cavities that create the exit for the lacing channel along the plank edge are cut into trapezoids in the northwestern Adriatic tradition. Furthermore, the lacing channels are larger in diameter (from 1.0-2.5 cm on average) and spaced further apart (about 6-10 cm on average) than the channels of both the Greek laced and eastern Adriatic laced traditions. Finally, the frames, similar to the eastern Adriatic tradition, are rectangular in section and largely fastened to the hull planking with wooden treenails.[417]

It is unclear when the inhabitants of the northwestern Adriatic adopted laced hull construction. As stated, the earliest find attributed to this tradition is the wooden fragment from the Venice Lagoon which was dated by radiocarbon technique to about the fifth century B.C.E. While there is no reason to question the accuracy of the scientific date at this point, it is questionable whether this fragment was used in the construction of a boat. The next earliest find, the remains from Cavanella d'Adige, are also problematic.[418] However, the date of deposition of the Comacchio shipwreck is firmly established. Thus, this tradition was in use from at least the

[417] The exception to this is the Comacchio wreck the frames of which were both lashed and treenailed to the hull planking (still rectangular in section).

[418] Tiboni (2009a) interprets the remains found at Cavanella d'Adige as part of a flat-bottomed hull. While I do think this is a likely interpretation, the presence of dowel holes along the sides of this flat-bottom warrant further investigation. As reported by Tiboni, these holes would have attached something that extended below the hull. This feature does not make sense if these wooden remains are a hull, however these side pieces with the downward-facing dowel holes might have been a later addition to facilitate incorporation into the secondary hydraulic structure. In other words, the dowel-attached piece was not part of the original construction of the hull.

first century B.C.E. and I propose that it dates much earlier than has been substantiated via the archaeological record. As the presence of a laced boat within the broader region of the upper Adriatic in the Bronze Age has been confirmed, it is reasonable to speculate that laced construction methods were being used in the northwestern Adriatic during the pre-colonial period.

Reports of a very large (50 meter-long!) laced boat were rumored to have been found in 1922 in the Po Delta near Pomposa.[419] Unfortunately, this vessel was subsequently destroyed without further documentation. The first northwestern Adriatic laced boat was excavated in 1956,[420] and more remains continue to be discovered up to the current day, with a laced barge excavated in 2013 at Padovetere in the surrounding territory of Comacchio.[421] Ten hull remains come from primary contexts – representing shipwrecks or abandoned hulls. Six discreet finds of hull remains are from secondary contexts, being reused mostly as part of hydraulic structures such as canal walls and riverside docks. And four hull remains are without archaeological context as they washed ashore after a large storm or were casually found by individuals outside of archaeological excavations. Of the finds attributed to this tradition of boatbuilding, nine are partially complete or fragmentary hulls. The other 10 finds are comprised of one to three articulated fragments of hull planking or frames and an assortment of disarticulated hull planking and frames. The partial and fragmentary hulls, from which come the most reliable data on overall form and function, were excavated from both primary and secondary contexts.

[419] Berti 1986, 24; Bonino 1968, 209.
[420] Bonino 1968.
[421] Beltrame and Costa 2015.

**Table 4.2: Northwestern Adriatic Laced Vessels in Alphabetical Order by Findspot**

| WRECK | Location | Remains | Proposed Function | Proposed Date | Evidence for Date | Context | References |
|---|---|---|---|---|---|---|---|
| Altino | Veneto Region, near Venice | bottom of hull / mostly complete hull (?) | likely for inner waterways | unknown | | primary (?); found near an ancient canal and Stile River | unpublished |
| Canale Anfore I | Friuli-Venezia Giulia Region, Aquileia | two planks | likely for inner waterways | 1st century C.E. | stratigraphy | primary; found in the ancient canal | Beltrame 2000, 2002a; Bertacchi 1990 |
| Canale Anfore II | Friuli-Venezia Giulia Region, Aquileia | three planks | likely for inner waterways | CAL 164 B.C.E. - 21 C.E. / end of 2nd - beginning of 3rd century C.E. | 14C date of frame / stratigraphy | primary; found in the ancient canal | Beltrame and Gaddi 2013 |
| Cavanella D'Adige | Veneto Region, South of Venice | bottom of hull (?) | likely for inner waterways | 2nd or 1st century B.C.E. | stratigraphy and comparison to other vessels | secondary; used in the construction of a wall along the river side | Tiboni 2009 |
| Cervia | Emilia-Romagna Region, Po Valley | fragmentary hull (7 fragments of planking and 5 frames) | coastal ? | 4-6th or 7th century C.E. | associated anchor (Beltrame argues for 7th cent date) | primary | Beltrame 1996-97, 2000, 2002a; Bonino 1968,1971,1985; Maioli 1986 |
| Comacchio | Emilia-Romagna Region, Po Valley | mostly complete hull | coastal and riverine craft | end of 1st century B.C.E. | artifacts (stamp on ingots) | primary; wrecked along river bank | Beltrame 1996-97, 2000, 2002a; Berti 1990; Bonino 1985 |
| Concordia Sagitaria | Veneto Region, northeast of Venice, Portoguaro | disarticulated plank in three pieces | | | | secondary; used in the construction of a canal | unpublished |
| Corte Cavanella I | Veneto Region, South of Venice | partially complete hull | likely for inner waterways | end of 1st to beginning of 2nd century C.E. | amphora type Forlimpopoli | primary (?); discovered under the foundation of collapsed structure | Beltrame 1996-97, 2000, 2002a; Sanesi 1985, 1986, 1990-91; Sanesi et al. 1986 |
| Corte Cavanella II | Veneto Region, South of Venice | bottom of hull (?) | likely for inner waterways | terminus post quem of 1st century C.E. | dupondio (coin) di Nerva dated to 97 C.E. | secondary; used in the construction of a dock alongside the river | Beltrame 1996-97, 2000, 2002a; Sanesi et al. 1986 |

**Table 4.2: Northwestern Adriatic Laced Vessels in Alphabetical Order by Findspot, cont.**

| WRECK | Location | Remains | Proposed Function | Proposed Date | Evidence for Date | Context | References |
|---|---|---|---|---|---|---|---|
| Meolo I | Veneto Region, near Venice | one floor timber in 3 pieces | | unknown | | possibly primary; found in an ancient river bend | Beltrame 2002a; Favero 1991 |
| Oderzo | Veneto Region, inland north of Venice | two planks | | end of the 2nd century C.E. | stratigraphy (?) | secondary; used in the construction of an ancient hydraulic system | Beltrame 2002a; Trovo 1996; |
| Padova | Veneto Region, inland at Padova | a few planks | | Augustan | stratigraphy | secondary; used in the construction of a wall along the river bank | Balista and Ruta Serafini 1993; Beltrame 2002a; Beltrame 1996-97 |
| Padovetere | Emilia-Romagna Region, Po Valley | mostly complete hull (?) | coastal and riverine craft? | terminus ante quem of 5th century C.E. | associated ceramics in layers above hull | primary | Beltrame 2015 |
| Pomposa-Borgo Caprile | Emilia-Romagna Region, Po Valley | fragmentary pieces | coastal? | 11th century C.E. | medieval type amphora | possibly primary; found under the lagoon of Pomposa | Alfieri 1968; Basch 1976; Berti 1986; Bonino 1968, 1971, 1985 |
| Stella 1 | Friuli-Venezia Giulia Region, inland Stella River | mostly complete hull | riverine craft / barge | CAL 82 - 232 C.E. / 1st quarter of the 1st century C.E. | 14C dating of frame / artifacts (stamp on ceramic roof tiles) | primary; wrecked in the Stella River | Beltrame 2002a; Castro and Capulli 2011; Vitri et al 1999, 2003 |
| Venice Lagoon | Veneto Region, Barena del Vigno, Venice | one fragmentary wooden piece | | 590-470 B.C.E. | 14C dated | unknown; found washed ashore? | Beltrame 2002a; Dorigo 1983 |
| Venice Lido I | Veneto Region, Venice | fragmentary hull (25 pieces of bottom planks) | coastal (?) | 1-144 C.E. | 14C dated | unknown; found washed ashore after a storm | Beltrame 1996, 1996-97, 2001, 2002a |
| Venice Lido II | Veneto Region, Venice | one plank | coastal (?) | unknown | | unknown; found washed ashore about 100 meters from Venice Lido I and may be from the same boat | Beltrame 2002a |
| Venice Lido III | Veneto Region, Venice | 10 disarticulated hull fragments | coastal (?) | 1st to 2nd century C.E. | 14C dating of multiple timbers and cordage | washed ashore on Lido after a storm in November 2012 | Willis and Capulli 2014 |

*The Shipwrecks*

The shipwrecks from the northwestern Adriatic laced tradition represent two disparate types of hulls. The Stella 1 barge is a mostly complete flat-bottomed river barge preserved at a length of just over 5m (16 ft), with a hard chine connecting the bottom planking to the side planking.[422] The boat was carrying a primary cargo of locally produced ceramic roof tiles (of the *tegula*/*imbrex* variety discussed in Chapter 3). The stamps of the manufacturing site applied to these tiles provide a date in the first quarter of the first century C.E. The Comacchio ship, on the other hand, is a rounded hull with a smooth turn of the bilge.[423] The vessel has been reconstructed to a length of about 21 m (70 ft) with a thickened keel plank, but no true keel, ensuring that its fairly flat bottom would still be maneuverable in the shallow waterways of the region. Bonino identifies this ship as a coastal and riverine craft.[424] It was carrying a primary cargo of 102 lead ingots from Spain, with an assortment of other materials including amphoras of various types carrying foodstuffs, North Italic sigillata pottery, and boxwood logs.[425] These vessels exemplify two of the different types of laced merchant vessels that were in use in the region and display the versatility of the tradition to fashion watercraft to suit different needs. The form of the vessel recently excavated from near the small church of Santa Maria in Padovetere, which is reportedly preserved to a length of 15 m, appears to be similar to the Comacchio ship.[426]

*Other Fragmentary Hulls*

Of the six other partially complete hulls, two of these are likely coastal and riverine trading vessels like the Comacchio ship.[427] The preserved remains of these likely coastal traders were

[422] Castro and Capulli 2011, 2016.
[423] Bonino 1985, 1990b.
[424] Bonino 1985.
[425] Berti 1990.
[426] Beltrame 2015.
[427] The Pomposa Borgo-Caprile hull remains and the Cervia hull. See Bonino 1968, 1978, 1985.

over 10 m and 12-15 m respectively.[428] Four partial hull remains likely represent vessels similar to the Stella 1 barge.[429] Two of these fragmentary hulls[430] were reused in hydraulic structures[431] and the other two were likely abandoned hulls or wrecked hulls without associated cargo. The barge-type vessels range in size from about 4 to 8 m, although the Altino boat has not yet undergone a complete excavation so its full dimensions are unknown.

*Disarticulated Hull Fragments*

About half of the dataset for the northwestern Adriatic laced tradition is comprised of mostly disarticulated hull fragments.[432] These hull fragments range in date from the end of the first century B.C.E. to the third or fourth centuries C.E. They range in length from about 1 m to 10 m, and span all three contexts – primary, secondary, and without archaeological context. As the Canale Anfore I and II hull fragments were discovered in an ancient canal, they may come from a barge intended for use in the canals, which permits an understanding of the size of some of the canal barges – in this case, over 10 m (33 ft). The Venice Lido finds (I, II, and III) are another interesting discovery; they show signs of teredo worm damage and are of larger dimensions (planking thickness, size of the lacing hulls, etc.) than other vessels/remains in this tradition, and as such may represent seagoing craft (see Appendix A for a catalogue of the Venice Lido III timber assemblage).

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[428] Bonino 1968, 1978.

[429] Including the Altino boat, Corte Cavanella I and II boats, and the Cavanella d'Adige hull remains. See Beltrame 1996-97, 2000, 2002; Sanesi et al. 1986; Tiboni 2009a.

[430] The Corte Cavanella II boat and Cavanella d'Adige hull remains.

[431] Both of these remains are the flat-bottom portion of a laced boat and were incorporated into later dock and quay structures.

[432] Including the hull fragments from Padova, Oderzo, Venice Lido (I, II and III), Meolo, Concordia, Aquileia (Canale Anfore I and II remains), and the possible hull fragment from the Venice Lagoon. See Balista and Ruta Serafini 1993; Beltrame 1996, 1996-97, 2000, 2002; Beltrame and Gaddi 2013; Bertacchi 1990; Favero 1991; Trovo 1996; Willis and Capulli 2014.

The materials, construction details, maintenance and repair, use-life, and discard of these 20 vessels will be developed in further detail in Chapter 5. In brief, these hull remains complement the evidence provided by the textual, epigraphic, and iconograpic records. The artifacts of the northwestern Adriatic tradition of laced construction present a broad range of overall vessel dimensions, from about 5 m (16 ft) to over 21 m (69 ft). All of the fragmentary hulls are typical of keel-less flat-bottomed boats, although the transition from the bottom to the side is varied. In this regard, all of the vessels of the northwestern Adriatic tradition mirror the Patavini boats from Livy's account of Cleonymus' attack on the region. Furthermore, the hydraulic structures that incorporated hull planking[433] from laced vessels date largely from the first century B.C.E. to the second century C.E., coinciding with the general expansion of the canal system in the region.

## **Mixed Construction**

The first century B.C.E. Comacchio hull exhibits a special case of mixed construction, combining the traditions of mortise-and-tenon joinery with that of laced joinery.[434] This vessel is preserved up to the first wale and the entire bottom of the vessel was constructed using the northwestern Adriatic laced tradition. However, cut into the top of the first wale were regularly spaced mortises, causing scholars to postulate that the portion of the hull above this point would have been built entirely using mortise-and-tenon joinery.[435] The combination of these two traditions of hull construction would have created a vessel with a flexible bottom and rigid sides.

[433] As these hull planks have intact treenails that no longer function in the dock structures, they are clearly reused from a laced vessel and not an example of laced construction used primarily in hydraulic structures. The one possible exception to this are the two planks from Oderzo, but the incomplete documentation of this find complicates any definitive identification of laced planking as primary to the canal construction.
[434] Interestingly, the recently excavated Padovetere ship also has mortise-and-tenon joints incorporated into the hull in the stern area (Beltrame 2015). Future publications of this wreck will elucidate the use of mixed construction in northwestern Adriatic laced hulls.
[435] Bonino 1985, 1990b.

This type of mixed construction is not without parallel, for example the Ma'agan Mikhael and Jules Verne 7 wrecks combined Greek laced and mortise-and-tenon joineries, but these were transitional vessels and the lacing was restricted to the hood ends of the vessel, a portion that consistently presents difficulties to the ancient boatbuilder. Of course, as no section of the Comacchio hull above the wale is preserved, it is impossible to say for certain that lacing was not used in the superstructure, even if the strake following the wale was attached using mortise-and-tenon joinery. However, what the Comacchio ship does provide evidence for is the coexistence of these two separate traditions of boatbuilding likely within the same shipyard. Therefore, either the builders of these separate traditions collaborated on this vessel (and presumably others) or the builders in this region were capable of using both methods of construction.

## A MORE COMPLETE PANORAMA

No one line of evidence – textual, epigraphic, iconographic, or artifactual – individually permits a clear picture of the nautical landscape, but together they form a more complete panorama of the waterways, boats, and boatbuilders of the northwestern Adriatic region. The textual sources, epigraphic evidence, and iconography of the region situate the use of and need for the boats that are scattered throughout the archaeological record. Textual sources speak to the pervasiveness of the waterways that connected the region, the importance of watercraft along these waterways, and the cultural memory of local ascendancy over the paludal environment (in victory over foreign sailors) that persisted into the colonial period. During the pre-colonial period, Venetic inscriptions and iconography also hint at this underlying reliance on waterways and perhaps portray the amphibious lifeways of (at least some) local individuals. During the colonial period, there is a rise in ship representations that mostly follow Roman forms, and even a reference to a *faber navalis* at Aquileia, which together might suggest an increase in maritime traffic in the region and increased economic ties with other sectors of the Roman Empire. Throughout, Aquileia continues to showcase its role as a key center for the diffusion of Roman cultural elements into the landscape, as such, a node of cultural entanglement.

The description of Patavini boats from Livy's account permits a cautious connection to the laced boats of the region, and suggests that they were used (and perhaps built) by the local inhabitants of Patavium (Padua). This tie, albeit tentative, is the only link between the archaeological remains of laced boats and the ethnic identity of the people who used them. The full assemblage of excavated hull remains within the region – both laced and mortise-and-tenon joined hulls – highlights the unique nautical landscape in comparison to the Mediterranean as a whole. The predominance of laced boats in the archaeological record of the region underscores the presence of a community of boatbuilders who were connected to broader Mediterranean methods (particularly when the mixed construction of the Comacchio ship is considered), but chose to preserve their own tradition of ship construction. This community of laced boatbuilders cannot be definitively identified within the textual, epigraphic, and iconographic sources of the region. Thus, the products of this community, that is the remains of the laced boats they built, are singular in their potential to contribute significantly to our knowledge of their lifeways and identities; they are a repository of the actions, the communal effort, and the decisions of these craftsmen, none of which is preserved in the texts, inscriptions, and iconography of the region.

# CHAPTER V

## *CHAINES OPERATOIRES* OF THE NORTHWESTERN ADRIATIC LACED TRADITION OF BOATBUILDING

The remains of northwestern Adriatic laced vessels, these old bits of wood and fiber, are roadmaps to the decision-making strategies and situated learning processes of the ancient builders. The regional social conditions within which these ancient builders learned and practiced the skills of their craft have been reviewed in the previous chapters. In this chapter, the *chaîne opératoire*, the technical stages or operational sequences, of this tradition of boatbuilding is developed fully in order to highlight trends within the tradition and pinpoint the significant stages or sequences in the construction that are most relevant to understanding the community of builders. As stated in Chapter 2, since any technical feature of these manufactured vessels could contain clues to the strategies of the builders, all have been considered, although only some are emphasized. At each phase of the building process, the strategy (or strategies) of northwestern Adriatic laced boatbuilders is regarded as a potentially heterogeneous, complex mixture of entangled decisions. In addition, each technological feature discussed here is considered to be neither purely functional or purely symbolic, but instead as potentially multi-layered, both serving a function within the viability of the boat as a watercraft but also representing the choices of the builder relative to his identity as part of a community of builders of a particular style of (water)craft.

Through the *chaîne opératoire* approach,[436] it is the goal of this chapter to explore each technological stage – 1) resource procurement, 2) manufacture, 3) use, 4) maintenance, and 5) discard – in order to elucidate the decision-making strategies of the ancient builder. Resource

[436] Please see Chapter 2 for the development of the *chaîne opératoire* within archaeology and my rationale for applying it to this research.

procurement and manufacture are emphasized here, as these stages can be tied most directly to the community of builders, but a discussion of the final three stages, and how they may relate to the original builders, is also included. The technical features identified within the two initial stages (e.g. material selection of hull planking, diameter of lacing channels, and spacing of the frames) are compared primarily by vessel type, chronology, and subregion (defined below) in order to detect trends in the tradition. These technical details of the northwestern Adriatic laced tradition are also compared to vessels of the Mediterranean mortise-and-tenon joinery method of ship construction.

In order to identify patterns in the data across this tradition, I organized each set of hull remains into a discrete category by vessel type, chronology, and subregion. First, distinct finds of the northwestern Adriatic laced tradition were assigned to one of two vessel types based on 1) the location of their final deposition[437] and 2) having shared characteristics[438] with either of the two known type vessels. The Comacchio ship serves as the type vessel for a coastal trader and the Stella 1 barge serves as the type vessel for a river barge.

Second, the chronological order is based primarily on the date of deposition as opposed to date of felling or harvesting of materials (via radiocarbon dating), as most distinct finds have not undergone radiocarbon dating. Where only a radiocarbon date is known, that date is used to establish the terminus post quem of the artifact. Finally, hull remains are grouped by the location of their final deposition into the modern day regions of Italy (here understood as subregions of the northwest Adriatic) – Emilia-Romagna, Veneto, and Friuli-Venezia Giulia – so that their construction features can be analyzed by geographic distribution. While the modern boundaries of

[437] If along the coast then delineated as a coastal trader, if along a canal or river, then a primarily inland vessel.
[438] E.g. overall preserved length.

these subregions would have held no significance during the period when these boats were built, their use permits a general geographical grouping – around the Po Delta, near the Veneto lagoon, and in the plains surrounding Aquileia – that may have been meaningful in antiquity. Within the subregional comparisons, vessels are arranged in geographic order with the northeastern most finds at the top of the table and the southernmost at the bottom of the table, so that other geographical groupings and trends can be considered.

## RESOURCE PROCUREMENT

Resource procurement is the first stage of the *chaîne opératoire* and entails not only what materials were used in the construction of these vessels, but also the point of origin from which the builders obtained them. Once again, as discussed in Chapter 4, the joinery and framing systems in particular are discussed in detail to define, analyze, and compare the northwestern Adriatic laced tradition with other shipbuilding practices of the ancient Mediterranean. Unfortunately, no fragmentary or mostly complete laced hull has been sampled exhaustively for species identification and, in fact, some assemblages of hull remains have not had any of their materials identified. Thus, the complete make up of a vessel of this tradition cannot be ascertained and important comparative data between individual finds are still missing. Of the 19 likely boat remains of the northwestern Adriatic tradition, 12 of these finds have been partially analyzed for wood and fiber identification (see Table 5.1a).[439] While not exhaustive, over 100 samples were analyzed from the Comacchio wreck, which permits a more complete picture of material use

[439] The materials identification of the San Francesco del Deserto hull remains, normally attributed to the northwestern Adriatic laced tradition, has been removed from this study as it is likely that these planks belong in the eastern Adriatic tradition (see discussion in Chapter 4).

within a single vessel. Despite the inconsistent analysis of materials in recent research, several patterns regarding resource procurement within the tradition can be observed.

The principal elements of northwestern Adriatic laced vessels that are preserved in the archaeological record include hull planking, frames (both floor timbers and futtocks), and the materials of the lacing system (seam wadding, cordage, and pegs). Other primary elements of a ship (such as deck beams, deck planking, spars, and steerage) are not preserved in any of the recovered remains and so cannot be considered.[440] As hull planking and frames speak primarily to the joinery and framing systems of the tradition, the surviving hull remains, and the subsequent wood and fiber identifications conducted, permit a direct assessment of these two key elements of a shipbuilding tradition and the materials the builders selected to incorporate into each aspect.

**Hull Planking**

Within the sampled remains of northwestern Adriatic laced boats, elm clearly was favored for hull planking (see Table 5.1a). This preference has been noted previously, but continues to be confirmed with additional analyses and new discoveries.[441] Furthermore, while not all elm planks have been identified to the species level, those that have are consistent with field elm (*Ulmus campestris*, also referenced as *Ulmus minor Mill*). Within the Comacchio remains – the most exhaustive database of materials use for a fairly complete northwestern Adriatic laced vessel – 29 hull planks were analyzed and all were identified as elm (*Ulmus cf. minor*).[442] Within the Stella 1

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[440] The Comacchio remains contain additional hull features, including portions of the stem and sternpost and rigging elements, however the singularity of these finds (at this time) within the northwestern Adriatic tradition, in addition to the "mixed construction" nature of the Comacchio hull, does not permit any conclusions to be drawn from these features and generalized to the laced tradition.

[441] Beltrame 2002a and 2002b; Beltrame and Gaddi 2013, 303. Not included in Beltrame's previous publications are the results of wood identification of the Stella 1 barge, the Venice Lido III timber assemblage, Canale Anfore II remains, and the most recent Padovetere boat.

[442] Castelletti et al. 1990, 150, Table 1.

barge, all sampled bottom planks, including a repair plank, were also made of field elm.[443] The only vessel of this tradition without a positive identification of the use of elm for the majority of the hull planking is the Corte Cavanella II boat. The planking of these remains was identified as red fir or larch. However, it is unclear how the type of wood was determined (i.e., in the field by eye, microscopically in the laboratory, etc.).[444] This uncertainty, combined with the consistency seen in all other samples identified by trained botanists in a dedicated dendroarchaeological laboratory, leads me to question the accuracy of the identifications of the Corte Cavanella II remains.[445]

The use of elm, a hardwood, for hull planking is fairly unique to the northwestern Adriatic laced tradition. With a couple of exceptions, most other ancient Mediterranean boatbuilders used softwoods (such as pine, fir, or cypress) to plank the hulls of their vessels.[446] Elm is generally straight-grained and fairly resistant to fungal invasion.[447] It is difficult to split or cleave due to its internal structure of interlocking fibers, but is sawn easily and has a high tolerance for submerged/aquatic conditions.[448] In fact, Gale and Cutler describe elm wood as "extremely durable

[443] See Appendix D for Nili Liphschitz's reports on wood species used in the Stella 1 barge, as well as the Canale Anfore II hull remain and Venice Lido III timber assemblage.

[444] Beltrame (2002a, 361) states that Prof. Giulini performed the identification, but provides no credentials for this individual nor any laboratory with which he is associated nor any other information regarding how the analyses were performed. It is also of note that the Pomposa Borgo-Caprile remains, which were uncovered in 1956, were described in Alfiero's original excavation notes as being entirely of oak, but this identification has not been confirmed (or even discussed) in subsequent publications (Berti 1986, 25).

[445] I only recently received permission to sample the Corte Cavanella II remains, so will be able to clarify these results in future publications.

[446] See Giachi et al. 2003 for a discussion of wood use in ancient Mediterranean shipbuilding. The Madrague de Giens boat, dated to the first century B.C.E. and wrecked off the coast of southern France, used elm for the inner layer of planking (Couvert 1978; Gianfrotta and Pomey 1981, 268-70). Elm was also used for the hull planking of the Mahdia ship, also dated to the first century B.C.E. and wrecked off the coast of Tunisia (Gianfrotta and Pomey 1981, 268-70). Finally, as discussed in Chapter 4, elm was used for the keel and first two strakes of the Iulia Felix wreck (Beltrame and Gaddi 2007, 145).

[447] Giachi et al. 2003, 280; Tsoumis 1991, 459.

[448] Gale and Cutler 2000, 264.

when permanently wet."[449] The properties of elm (its hardness, elasticity, tension resistance, and high density) made it an ideal wood for various purposes in the ancient Mediterranean, including furniture, tools, carts, chariot wheels, and olive presses, in addition to shipbuilding.[450] Theophrastus, a Greek natural historian of the fourth century B.C.E., reports that elm is ideal for cutwaters and "bentwood" (perhaps referring to frames?), but does not mention its use as hull planking.[451]

While most of the hull planking of northwestern Adriatic laced vessels has been identified as elm, there are exceptions to this practice. One of the side planks of the Stella 1 barge and two plank fragments of the Venice Lido III timber assemblage were made of oak. One of the Venice Lido III plank fragments was likely a repair or hood end, while the other was too damaged to ascertain its role in the original hull. Oak is a harder and more durable wood than elm, but also more difficult to work.[452] The builders of this tradition obviously preferred hardwoods to form the shell of their vessels, and perhaps selected elm as it tends to be taller and more straight-grained in comparison to oak, which thus produces longer runs of quality planking.[453] It seems that oak was reserved for specific purposes, such as the side strakes of a low draft vessel, repairs, and/or hood ends.

## Framing

The frames of this tradition are obtained from various sections of the tree, including branches, naturally occurring bends or bifurcations of the tree (typically where a branch joins the

[449] Gale and Cutler 2000, 264.
[450] Gale and Cutler 2000, 264; Tsoumis 1991, 459.
[451] Theophr. *Hist. pl.* 5.7.3.
[452] Tsoumis 1991, 459.
[453] Giachi et al. 2003, 280-81.

trunk), and halved or quartered sections of the trunk itself.[454] The selection of the section of the tree to be used may be dependent on the framing element and its location in the hull. For example, the floor timbers of the Comacchio ship were made from halved sections of the trunk, whereas the futtocks were made from quartered sections, bifurcations, and large branches.[455] As with the hull planking, a suggestive partiality in choice of wood for the framing of these vessels is noted (again see Table 5.1a). Almost all of the frames examined from the remains of northwestern Adriatic laced vessels were of oak (*Quercus robur* when the species is known). All 23 of the examined floor timbers and 14 of the 17 examined futtocks of the Comacchio ship were identified as oak; the other three futtocks were made of elm.[456] The use of oak for framing, as well as elm, is quite common throughout the Mediterranean, particularly from the first century B.C.E.[457] While oak is not easy to work, it can be cleaved without difficulty, and its noted durability made it a favorite choice for a variety of purposes in antiquity as today.[458]

Besides the three futtocks of elm from the Comacchio ship, the Stella 1 barge may also deviate from the trend toward oak as common ash (*Fraxinus excelsior*) was used to fashion at least one of the floor timbers.[459] Unfortunately, since I was only permitted to sample one of the 14 preserved frames, it is unknown whether the use of ash is an anomaly of the Stella 1 barge or only this particular frame. In other ancient Mediterranean ships, ash was used for some of the frames of the Pisa C and F vessels, both mortise-and-tenon joined ships dating to the first and second century C.E. respectively, for most of the floor timbers of the Llubjlana barge, an eastern Adriatic

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[454] Castelletti et al. 1990, 136-37; Castro and Capulli 2016, 35.
[455] Castelletti et al 1990, 137. The floor timbers of the Stella 1 barge also seem to be fashioned from the trunks of young trees (Castro and Capulli 2016, 35).
[456] Castelletti et al. 1990, 150, Table 1.
[457] Again, see Giachi et al 2003 for a discussion of ancient Mediterranean wood use in shipbuilding.
[458] Gale and Cutler 2000, 204-5; Tsoumis 1991, 459.
[459] See Appendix D. One disassociated timber fragment from the Stella 1 wreck site was identified by Marco Rottoli as oak; this piece was identified as a possible futtock (Vitri et al. 2003, 326, 336, fig. 3).

laced boat dated to the first century C.E., for the frames of the Kizilburun shipwreck, a Hellenistic mortise-and-tenon joined marble carrier wrecked off the coast of Turkey, and also for some of the framing of the Yenikapı 4 galley.[460] Although it is less durable than oak, ash is rated highly in strength and toughness and dries considerably faster than oak.[461] As the frames of the Stella 1 barge were fashioned from young trees,[462] it is possible that the builders selected young ash trees that could be prepared more quickly (faster drying and easier shaping than oak) to save time and labor costs.

Five different types of wood were used for the manufacture of treenails to attach the frames to the hull planking. Only four treenails of the Comacchio wreck were sampled, but all four were identified as dogwood (*Cornus* sp.).[463] The builders of the Stella 1 barge used two differently sized treenails to secure at least five of the frames – a smaller treenail 1.2 cm in diameter and a larger treenail 1.8 cm in diameter.[464] Only one of each sized treenail was sampled; the smaller treenail was made of silver fir (*Abies alba*) while the larger was of kermes oak (*Quercus coccifera*).[465] Across the northwestern Adriatic laced tradition, treenails were fashioned also from lime[466] (*Tilia* sp.) and willow (*Salix* sp.). A total of seven examples of this tradition have identified wood types for their surviving treenails; the most frequently used material was dogwood, occurring in four northwestern Adriatic laced vessels. Oak and lime were used in two examples of this tradition, and silver fir and willow were identified in only one set of remains each.

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460 Boetto and Rousse 2011, 185; Giachi et al. 2003, 272-74; Liphschitz and Pulak 2009, 169; Littlefield 2012, 58.
461 Tsoumis 1991, 459.
462 Capulli and Castro 2011, 19-28.
463 Castelletti et al. 1990, 148, Table 1. While the floor timbers were lashed to the planking with rope plaits, the futtocks were secured with wooden treenails.
464 Castro and Capulli 2011, 19-28.
465 See Appendix D.
466 Commonly known as linden in North America.

Common dogwood (*Cornus sanguinea*), a medium to large shrub, is quite hard, but less frequently used for the manufacture of goods because of its size restrictions.[467] Lime, on the other hand, is a lightweight wood, although it has fair strength relative to its weight and dries quickly.[468] Pliny the Elder calls lime wood the softest of all woods, but worm-proof and useful though of limited height, and particularly well-suited for basketry and carvings.[469] He, however, does not mention its use in shipbuilding. Based on published archaeological remains, there are no known instances of either dogwood or lime wood being employed in Mediterranean shipbuilding outside the northwestern Adriatic laced tradition.[470] According to Theophrastus, shipbuilders incorporated lime wood into the deck planking of galleys.[471] Unfortunately, galleys are rare in the archaeological record and none has yet been discovered with intact deck planking of lime wood. However, few hull remains have undergone exhaustive sampling and many have received only cursory examination (only one sample analyzed per hull component), so lime wood and dogwood may have been incorporated into other hulls.

**Lacing System**

Two different types of fibrous material make up the key elements of the lacing system of northwestern Adriatic laced boats – the seam wadding and the cordage. Unfortunately, fibers are preserved in the archaeological record even less frequently than wood, so while the hull remains of 12 laced boats of this tradition have undergone laboratory analysis to identify the materials, only four finds have undergone fiber identification. The seam wadding, preserved only in three

[467] Gale and Cutler 2000, 86.
[468] Tsoumis 1991, 460
[469] Plin. *HN* 16.25.65, 16.76.207, 16.77.209.
[470] Giachi et al. 2003, Table 3; Parker 1992, 39-459.
[471] Theophr. *Hist. pl.* 5.7.6-7.

cases, has been identified in each instance as bast fibers (likely of *Tilia* sp.). Lime bast commonly was used for many purposes in the ancient Mediterranean, in particular for the manufacture of ropes, but also for making paper and baskets.[472] In the eastern Adriatic laced tradition, both the seam wadding and the cordage were made of lime bast.[473] The cordage of all examined northwestern Adriatic laced boats, however, was manufactured from esparto grass (*Stipa tenacissima*), native to Spain and North Africa.[474] The significance of the incorporation of esparto grass into these laced hulls is developed in greater detail below.

The third element of the lacing system is the pegs that plug the lacing channels, securing the cordage and seam wadding in place. Based on analysis of recovered pegs, there is considerable diversity in the choice of wood for this small element, but they seem to be shaped most often from branches.[475] Seven different types of wood thus far have been identified as the raw material for manufacture of the pegs of this tradition. Fourteen pegs from the Comacchio vessel were analyzed and identified as lime, dogwood and ash.[476] The majority of sampled pegs (11 of the 14) were of lime. The use of multiple wood types for the pegs of a single vessel is noted in almost half (three of the eight) of the sampled hull remains; in the other five instances only one peg was examined from the remains. Therefore, it is likely that the builders of these vessels commonly, if not almost always, fashioned the pegs from the various available wood resources. A total of eight examples of this tradition have identified wood types of pegs; the most frequently used materials to manufacture pegs were fir (*Abies alba*), dogwood, and lime, occurring in three northwestern

[472] Plin. *HN* 16.14; Gale and Cutler 2000, 255-56.
[473] Boetto and Rousse 2011, 183.
[474] *Lygeum spartum* has a similar physical and anatomical structure to *Stipa tenacissima*. While it also grows in Spain and North Africa, *Lygeum spartum* is also found in other arid environments around the Mediterranean including southern Italy. The similarity between these grasses warrants further exploration.
[475] The exceptions to this trend are at least two of the 11 pegs sampled from the Venice Lido III which were cut from larger branches or perhaps even the trunk of a tree. See Castelletti et al. (1990, 148) for a discussion of the pegs from the Comacchio wreck.
[476] Castelletti et al. 1990, 146-8, Table 1.

Adriatic laced vessels. Spruce (*Picea abies*) was used in two examples of this tradition, and ash, boxwood (*Buxus* sp.), and cypress were identified in only one set of remains each.

Both fir and spruce have similar properties. They are softer and less durable than pine, but they are worked easily and dried quickly.[477] These softwoods commonly were used in shipbuilding, particularly for planking, but also for other non-structural elements as they were light, fine and straight grained, and could produce sizeable longitudinal elements.[478] If the *Iulia Felix* ship was indeed built in the region, then the manufacture of fir and spruce planking likely also occurred in the region. Perhaps their use as treenails and pegs for laced boats represents a secondary product for the timber industry – that is, the trees were used primarily to make planking from the trunks, and then the branches and twigs were fashioned into these smaller elements as a secondary product for this region.

**Other Elements**

While the hull planking, framing, and lacing system comprise the principal features of northwestern Adriatic laced vessels, there are other elements that have been analyzed. One curious feature of the Comacchio vessel, for example, is that the seam wadding was wrapped in wool.[479] A more common feature in shipbuilding in both of the preserved shipwrecks of the northwestern Adriatic laced tradition (the Comacchio and Stella 1 wrecks) is the inclusion of a layer of ceiling planking. Nine ceiling planks were sampled from the Comacchio ship and identified as elm, oak, and walnut (*Juglans regia*).[480] The majority of planks were of elm. Perhaps this was a deliberate decision on the part of the builders to incorporate wood into the ceiling planking that could be

[477] Tsoumis 1991, 458.
[478] Gale and Cutler 2000, 375; Giachi et al. 2003, 275, 279.
[479] Castelletti 1990, 157-60.
[480] Castelletti et al. 1990, 144-46, Table 1.

used to repair the hull if needed (oak could also serve this purpose), or this simply might have been a product of available timber within the shipyard. Only one of the ceiling planks from the Stella 1 hull was analyzed and identified as spruce.[481]

In addition to wood and fiber resources, resinous materials are a common feature of ancient shipbuilding, used for waterproofing the hull. Some kind of pitch or other coating was noted on some examples of the northwestern Adriatic laced tradition, including the Comacchio hull, the Cervia remains, and the Pomposa Borgo-Caprile remains, but only the coating from the Stella 1 hull has been analyzed by gas chromatography mass spectrometry in order to determine the nature of this material. The results of this analysis indicated the presence of conifer resin, most likely pine.[482]

## Discussion

The selection of resources for individual elements of northwestern Adriatic laced hulls to date has proven to have remained remarkably consistent over the course of the tradition's long history, particularly in regards to the hull planking, frames, cordage, and seam wadding. This consistency in resource procurement over the span of at least 600 years (from the Comacchio ship to the Cervia hull remains) is noteworthy and highlights the fidelity of the process of knowledge transfer which occurred during the training of new builders in the tradition.

By comparison, the resources used to manufacture treenails and pegs within this tradition of laced hull construction were more varied and potentially present traces of builder decisions in resource procurement by each specific community of builders, time, subregion, or type of vessel. The materials used for the production of both treenails and pegs have been identified for six hull

[481] Vitri et al. 2003, 336, fig. 3.
[482] White, pers.comm.

remains. Of these, three instances incorporate the same wood type for both components: the builders of the Comacchio ship fashioned at least some of both from lime, those of the Stella 1 barge used fir to make at least some of both, and the builders of the Venice Lido III vessel(s) employed dogwood for at least some of both components. The other three archaeological finds only had a limited number of samples collected for materials identification. Interestingly, the most complete hulls of this tradition that have been analyzed for wood species identification – the Comacchio ship and Stella 1 barge – both use one type of wood interchangeably between pegs and treenails. This may indicate either a preference for a particular material[483] or greater availability of this resource at (or near) the manufacturing site.

While there are no detectable trends in resource choices for pegs and treenails over time (see Table 5.1b), there may be patterns based on the subregion and/or the type of vessel (see Tables 5.1c and 5.1d respectively). Lime wood was identified as a resource for pegs and treenails only in the hull remains of likely coastal traders, while the likely river and canal barges contained pegs and treenails made with only dogwood and fir. Furthermore, lime wood was not identified for the pegs or treenails of any of the laced vessels found in the Friuli plain near Aquileia.

Is the incorporation of lime wood for the manufacture of pegs and treenails a factor of functionality of different types of vessels or local preference/availability or some combination of both? It is also key to note here that the interchangeable wood type of the Comacchio ship was lime while that of the Stella 1 barge was fir, once again highlighting either a difference in subregion or vessel type or both. Considering Pliny's description of lime, noted above, as resistant to worms,

[483] This is unlikely in the case of the Comacchio ship as there seemed to be a clear preference of lime for pegs and dogwood for treenails. In this instance it is more likely that dogwood was fashioned into pegs as well because it was an available and acceptable substitute.

its wood would be ideal for use in seagoing vessels. In this sense, a partiality for lime wood in coastal traders would be a reasonable choice on the part of the builders.

As for the possibility of subregional trends, lime trees were available in the Friuli plain, as evidenced by the presence of lime bast fibers for the seam wadding of the Stella 1 barge, but the wood was not incorporated into its hull suggesting that if the use of lime was a factor of the location of manufacture, it would be due to the preference of the local community of builders and not to an inability to access the resource. The absence of laced coastal traders recovered from the Friuli region complicates and potentially impedes the interpretation of the patterns in these data. Of course, it is important to bear in mind that the site of final deposition of a vessel does not necessarily correspond to the site of its manufacture, particularly in regards to coastal traders which likely had a far greater range than the canal and river barges.[484] The highly mobile nature of ships, unfortunately, stymies, but arguably does not prevent, the ability to detect meaningful patterns by subregion. These trends could be further explored with additional sampling from these vessels as well as other recent and as yet unexcavated finds, such as the Padovetere, Corte Cavanella I, and Altino hull remains.

[484] The coastal traders, with the Comacchio ship as the type example, were designed to sail whereas the river barges, with the Stella 1 barge as the type ship, were designed to be manually propelled, whether by punting, paddling, rowing or towing. There is no archaeological evidence for how the Stella 1 barge was propelled, but the absence of a mast step or any rigging elements indicates it was not designed to be sailed. It might have been paddled, rowed, and/or towed (Casson 1965).

## Table 5.1a: Materials Identification of Northwestern Adriatic Laced Vessels in Alphabetical Order

| WRECK | WOOD TYPE | | | | | FIBERS | |
|---|---|---|---|---|---|---|---|
| | Hull Planking | Ceiling Planking | Frames | Treenails | Pegs | Cordage | Seam Wadding |
| Canale Anfora I | *Ulmus* sp.[1] | ----- | ----- | ----- | not identified | not identified | not identified |
| Canale Anfora II | *Ulmus campestris*[2] | ----- | *Quercus robur*[2] | *Cornus sanguinea*[2] | *Abies alba*[2] | Cf. *Stipa tenacissima*[3] | Bast fibers, cf. *Tilia cordata*[3] |
| Cervia | *Ulmus* sp.[1] | ----- | *Quercus* cf. *robur*[1] | ----- | lost | not identified | not identified |
| Comacchio | *Ulmus* cf. *minor*[4] | *Ulmus* cf. *minor; Juglans regia; Quercus* cf. *robur*[4] | *Quercus* cf. *robur; Ulmus* cf. *minor*[4] | *Cornus* sp.[4] | *Tilia* sp.; *Cornus* sp.; *Fraxinus* sp.[4] | *Stipa tenacissima*[4] | Lime Bast[4] |
| Corte Cavanella II | Red Fir/ Larch[5] | ----- | ----- | ----- | Cypress[5] | ----- | ----- |
| Meolo I | ----- | ----- | Oak[6] | Oak[6] | ----- | ----- | ----- |
| Padova | *Ulmus* cf. *minor*[7] | ----- | ----- | not identified | not identified | ----- | ----- |
| Padovetere | *Ulmus* sp.[8] | ----- | *Quercus robur*[8] | *Quercus ilex*[8] | *Buxus* sp.[8] | unpublished | unpublished |
| Stella 1 | *Quercus* sp. and *Ulmus* sp.[9]; *Ulmus campestris*[2] | *Picea abies*[9] | *Fraxinus excelsior*[2]; *Quercus* sp. (possible futtock)[9] | *Abies alba* (small); *Quercus coccifera* (large)[2] | *Abies alba, Cornus sanguinea*[2] | *Stipa tenacissima*[3 & 9] | Bast fibers, cf. *Tilia cordata*[3 & 9] |
| Venice Lido I | *Ulmus* sp.[1] | ----- | *Quercus* cf. *robur*[1] | *Salix* sp.[1] | *Tilia* sp.[1] | not identified | ----- |
| Venice Lido II | Elm[1] | ----- | ----- | ----- | *Tilia* sp.[1] | not identified | ----- |
| Venice Lido III | *Ulmus campestris; Quercus robu* r[2] | ----- | ----- | *Cornus sanguinea; Tilia cordata/T. platyphyllos*[2] | *Cornus sanguinea; Abies alba; Picea abies*[2] | *Stipa tenaccisima*[3] | ----- |

1. Identified at Laboratorio Dendrodata Verona
2. Identified by Nili Liphschitz, Institute of Archaeology, The Botanical Laboratories, Tel Aviv University
3. Identified by the author, Paleoethnobotany Laboratory, Texas A&M University
4. Identified by Lanfredo Castelletti, Alfio Maspero, Sila Motella, and Mauro Rottoli, Laboratorio di Archaebiologia dei Musei Civici di Como
5. Identified by Prof. Giulini
6. Laboratory and/or researcher not given (see Beltrame 2002, 370-71).
7. Identified by Sila Motella de Carlo, Laboratorio di Archeobiologia dei Musei Civici di Como
8. Identified by Marco Marchesini, archeobotanico Soprintendenza Beni Archeologici Emilia-Romagna
9. Identified by Mauro Rottoli, Laboratorio di Archeobiologia dei Musei Civici di Como

## Table 5.1b: Materials Identification of Northwestern Adriatic Laced Vessels in Chronological Order

| WRECK | WOOD TYPE | | | | | FIBERS | |
|---|---|---|---|---|---|---|---|
| | Hull Planking | Ceiling Planking | Frames | Treenails | Pegs | Cordage | Seam Wadding |
| Comacchio | *Ulmus* cf. *minor*[4] | *Ulmus* cf. *minor; Juglans regia; Quercus* cf. *robur*[4] | *Quercus* cf. *robur; Ulmus* cf. *minor*[4] | *Cornus* sp.[4] | *Tilia* sp.; *Cornus* sp.; *Fraxinus* sp.[4] | *Stipa tenacissima*[4] | Lime Bast[4] |
| Padova | *Ulmus* cf. *minor*[7] | ----- | ----- | not identified | not identified | ----- | ----- |
| Stella 1 | *Quercus* sp. and *Ulmus* sp.[9]; *Ulmus campestris*[2] | *Picea abies*[9] | *Fraxinus excelsior*[2]; *Quercus* sp. (possible futtock)[9] | *Abies alba* (small); *Quercus coccifera* (large)[2] | *Abies alba, Cornus sanguinea*[2] | *Stipa tenacissima*[3 & 9] | Bast fibers, cf. *Tilia cordata*[3 & 9] |
| Canale Anfora I | *Ulmus* sp.[1] | ----- | ----- | ----- | not identified | not identified | not identified |
| Corte Cavanella II | Red Fir/ Larch[5] | ----- | ----- | ----- | Cypress[5] | ----- | ----- |
| Canale Anfora II | *Ulmus campestris*[2] | ----- | *Quercus robur*[2] | *Cornus sanguinea*[2] | *Abies alba*[2] | Cf. *Stipa tenacissima*[3] | Bast fibers, cf. *Tilia cordata*[3] |
| Venice Lido I | *Ulmus* sp.[1] | ----- | *Quercus* cf. *robur*[1] | *Salix* sp.[1] | *Tilia* sp.[1] | not identified | ----- |
| Venice Lido III | *Ulmus campestris; Quercus robu r*[2] | ----- | ----- | *Cornus sanguinea; Tilia cordata/T. platyphyllos*[2] | *Cornus sanguinea; Abies alba; Picea abies*[2] | *Stipa tenaccisima*[3] | ----- |
| Padovetere | *Ulmus* sp.[8] | ----- | *Quercus robur*[8] | *Quercus ilex*[8] | *Buxus* sp.[8] | unpublished | unpublished |
| Cervia | *Ulmus* sp.[1] | ----- | *Quercus* cf. *robur*[1] | ----- | lost | not identified | not identified |
| Date Unknown: | | | | | | | |
| Meolo I | ----- | ----- | Oak[6] | Oak[6] | ----- | ----- | ----- |
| Venice Lido II | Elm[1] | ----- | ----- | ----- | *Tilia* sp.[1] | not identified | ----- |

See Table 5.1a for identification details.

## Table 5.1c: Materials Identification of Northwestern Adriatic Laced Vessels by Subregion

| | WRECK | WOOD TYPE | | | | | FIBERS | |
|---|---|---|---|---|---|---|---|---|
| | | Hull Planking | Ceiling Planking | Frames | Treenails | Pegs | Cordage | Seam Wadding |
| **Friuli-Venezia Giulia** | Canale Anfora I | *Ulmus* sp.[1] | ----- | ----- | ----- | not identified | not identified | not identified |
| | Canale Anfora II | *Ulmus campestris*[2] | ----- | *Quercus robur*[2] | *Cornus sanguinea*[2] | *Abies alba*[2] | Cf. *Stipa tenacissima*[3] | Bast fibers, cf. *Tilia cordata*[3] |
| | Stella 1 | *Quercus* sp. and *Ulmus* sp.[9]; *Ulmus campestris*[2] | *Picea abies*[9] | *Fraxinus excelsior*[2]; *Quercus* sp. (possible futtock)[9] | *Abies alba* (small); *Quercus coccifera* (large)[2] | *Abies alba, Cornus sanguinea*[2] | *Stipa tenacissima*[3 & 9] | Bast fibers, cf. *Tilia cordata*[3 & 9] |
| **Veneto** | Meolo I | ----- | ----- | Oak[6] | Oak[6] | ----- | ----- | ----- |
| | Venice Lido I | *Ulmus* sp.[1] | ----- | *Quercus* cf. *robur*[1] | *Salix* sp.[1] | *Tilia* sp.[1] | not identified | ----- |
| | Venice Lido II | Elm[1] | ----- | ----- | ----- | *Tilia* sp.[1] | not identified | ----- |
| | Venice Lido III | *Ulmus campestris; Quercus robur*[2] | ----- | ----- | *Cornus sanguinea; Tilia cordata/T. platyphyllos*[2] | *Cornus sanguinea; Abies alba; Picea abies*[2] | *Stipa tenaccisima*[3] | ----- |
| | Padova | *Ulmus* cf. *minor*[7] | ----- | ----- | not identified | not identified | ----- | ----- |
| | Corte Cavanella II | Red Fir/ Larch[5] | ----- | ----- | ----- | Cypress[5] | ----- | ----- |
| **Emilia-Romagna** | Comacchio | *Ulmus* cf. *minor*[4] | *Ulmus* cf. *minor; Juglans regia; Quercus* cf. *robur*[4] | *Quercus* cf. *robur; Ulmus* cf. *minor*[4] | *Cornus* sp.[4] | *Tilia* sp.; *Cornus* sp.; *Fraxinus* sp.[4] | *Stipa tenacissima*[4] | Lime Bast[4] |
| | Padovetere | *Ulmus* sp.[8] | ----- | *Quercus robur*[8] | *Quercus ilex*[8] | *Buxus* sp.[8] | unpublished | unpublished |
| | Cervia | *Ulmus* sp.[1] | ----- | *Quercus* cf. *robur*[1] | ----- | lost | not identified | not identified |

See Table 5.1a for identification details.

# Table 5.1d: Materials Identification of Northwestern Adriatic Laced Vessels by Vessel Type

| | WRECK | WOOD TYPE | | | | | FIBERS | |
|---|---|---|---|---|---|---|---|---|
| | | Hull Planking | Ceiling Planking | Frames | Treenails | Pegs | Cordage | Seam Wadding |
| Coastal Trader | Comacchio | *Ulmus* cf. *minor* [4] | *Ulmus* cf. *minor; Juglans regia; Quercus* cf. *robur* [4] | *Quercus* cf. *robur; Ulmus* cf. *minor* [4] | *Cornus* sp. [4] | *Tilia* sp.; *Cornus* sp.; *Fraxinus* sp. [4] | *Stipa tenacissima* [4] | Lime Bast [4] |
| | Cervia | *Ulmus* sp. [1] | ----- | *Quercus* cf. *robur* [1] | ----- | lost | not identified | not identified |
| | Padovetere | *Ulmus* sp. [8] | ----- | *Quercus robur* [8] | *Quercus ilex* [8] | *Buxus* sp. [8] | unpublished | unpublished |
| | Venice Lido I | *Ulmus* sp. [1] | ----- | *Quercus* cf. *robur* [1] | *Salix* sp. [1] | *Tilia* sp. [1] | not identified | ----- |
| | Venice Lido II | Elm [1] | ----- | ----- | ----- | *Tilia* sp. [1] | not identified | ----- |
| | Venice Lido III | *Ulmus campestris; Quercus robur* [2] | ----- | ----- | *Cornus sanguinea; Tilia cordata/T. platyphyllos* [2] | *Cornus sanguinea; Abies alba; Picea abies* [2] | *Stipa tenaccisima* [3] | ----- |
| River / Canal Barge | Stella 1 | *Quercus* sp. and *Ulmus* sp. [9]; *Ulmus campestris* [2] | *Picea abies* [9] | *Fraxinus excelsior* [2]; *Quercus* sp. (possible futtock) [9] | *Abies alba* (small); *Quercus coccifera* (large) [2] | *Abies alba, Cornus sanguinea* [2] | *Stipa tenacissima* [3 & 9] | Bast fibers, cf. *Tilia cordata* [3 & 9] |
| | Canale Anfora I | *Ulmus* sp. [1] | ----- | ----- | ----- | not identified | not identified | not identified |
| | Canale Anfora II | *Ulmus campestris* [2] | ----- | *Quercus robur* [2] | *Cornus sanguinea* [2] | *Abies alba* [2] | Cf. *Stipa tenacissima* [3] | Bast fibers, cf. *Tilia cordata* [3] |
| | Corte Cavanella II | Red Fir/ Larch [5] | ----- | ----- | ----- | Cypress [5] | ----- | ----- |
| Unknown | Padova | *Ulmus* cf. *minor* [7] | ----- | ----- | not identified | not identified | ----- | ----- |
| | Meolo I | ----- | ----- | Oak [6] | Oak [6] | ----- | ----- | ----- |

See Table 5.1a for identification details.

All the identified arboreal resources incorporated into the construction of northwestern Adriatic laced vessels are available along this coast today.[485] Based on paleoenvironmental reconstructions of the region, all these resources also would have been locally available during the period in which these builders were active.[486] Furthermore, analysis of the pollen trapped inside the seam wadding material from the Stella 1 barge and the Canale Anfore II hull remains, likely representing the environment immediately surrounding the manufacturing site, confirmed the presence of at least three of the materials identified in these vessels (*Ulmus, Quercus,* and *Tilia*).[487] It is interesting to note that those resources most immediately available are also three of the four most consistent resources used across the tradition. The palynological study is discussed in more detail below. The only non-local resource identified within the materials used in the construction of these vessels is the esparto grass cordage, a significant phenomenon that warrants further development here.

## **<u>The Use and Spread of Esparto Grass</u>**

Pliny the Elder, in a passage about the various medical remedies of the *genista* or broom plant, a common European deciduous shrub, briefly alludes to the use and spread of esparto grass:

> Genista also is used for cords… I wonder whether this is the plant that Greek writers have called sparton… and whether Homer had it in mind when he said that "the ships' cords (sparta) were loosed."[488] It is certain that the Spanish or African esparto grass was not yet in use, and though ships were made with sewed seams, yet it was with flax that they were sewed and never with esparto.[489]

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[485] Longo and Martini 2002; Tsoumis 1991, 458-61;

[486] Bosi et al. 2011; Kaltenreider et al. 2010; Marchesini and Marvelli 2009; Mercuri et al. 2015.

[487] Pine pollen was also identified in the seam wadding samples, but as pine pollen can travel great distances, it is not a good indicator of the more immediate surrounding landscape.

[488] Original latin of the quotation: "cum dixit navium sparta dissoluta".

[489] Plin. *HN* 24.40 translated by Jones (1949, 51).

Harris Rackham, a commentator on the works of Pliny, describes the ancient author as "diligent, accurate, and free from prejudice" with a "naturally scientific mind," and his work as "a storehouse of scattered facts exhibiting the history of man's reaction to his environment."[490] This passage above represents some of these "scattered facts," as Pliny was prone to digress, especially into the origin of invention, throughout his *Natural History*.[491] While presenting the mundane usage of the *genista* plant, he wanders into debates on the proper translation of Homer, the origin of the Greek use of esparto grass, and the superiority of this material for nautical uses, especially for laced boats, or *sutiles naves* in Pliny's terminology. An analysis of these digressions highlights the importance of Roman imperialism for the spread of esparto grass in the Mediterranean basin and contextualizes the usage of this material by northwestern Adriatic laced boatbuilders.

*Spartum* and *Genista*

In the aforementioned passage, Pliny discusses two different ancient plants, both local to the Mediterranean basin, but with disparate geographical distribution. W.H.S. Jones remarks on the difficulty of identifying the exact plant in Pliny's botanical descriptions; Pliny himself was not a botanist and, for the most part, was relaying information garnered from Greek sources.[492] According to Jones, mistakes, misunderstandings, and confusion are rife throughout this portion of the text, and so, in his translation, he employed a system of using "the English name when the risk of error is slight," and retaining "the Latin when the risk [of error] is great."[493]

Interpretations of Pliny's accuracy and reliability have fluctuated over time. David Sutton, similar to Jones, contends that errors crept into the text due to Pliny's lack of scientific training

[490] Rackham 1949, ix-x.
[491] Rackham 1949, ix.
[492] Rackham 1949, xvii.
[493] Jones 1949, xix.

and first-hand observations, although he highlights how *Natural History* remained the "single most important source of information on the subject until the revival of learning in the Renaissance."[494] However, Gavin Hardy and Laurence Totelin argue that not only did Pliny have first-hand experience studying plants throughout the Mediterranean – during his time in the army (in Germany) and as a procurator in France, North Africa, and Spain – but that this training made him an authority on botany in the ancient world and "not just a bookish scholar."[495] While they recognize that cross-referencing modern and ancient names of plants can become problematic when interpreting Pliny's text, they claim that the ancient author included detailed descriptions and synonyms "to minimise the effects of unstable nomenclature."[496]

As Jones retained the Latin name of the genista plant, its exact identification is less certain. John Bostock and H.T. Riley report the identification of the plant in this chapter as the broom-plant or Spanish broom – the *Spartium junceum* of Linnæan taxonomy.[497] Spanish broom does have medicinal properties as a diuretic, purgative, and emetic, similar to what is described by Pliny in the remainder of this passage,[498] but the stems have also been used for constructing baskets, mats, ropes, and cordage.[499] Though it is called "Spanish" broom, in fact, it is dispersed widely across the Mediterranean region; found throughout southern Europe, including mainland Greece.[500] While Jones is reluctant to establish *genista* as Spanish broom, Pliny clearly distinguishes this species from the *spartum* of Book 19 in this passage.

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[494] Sutton 2007, 43.
[495] Hardy and Totelin 2015, 58-9.
[496] Hardy and Totelin 2015, 119.
[497] Bostock and Riley 1855.
[498] Plin. *HN* 24.40.
[499] Gale and Cutler 2000, 249.
[500] Foster 2006, 38.

The *spartum*, however, to which Pliny devotes over three chapters of his *Natural History*,[501] has been identified as esparto grass (*Stipa tenacissima*),[502] which also, confusingly, has the modern common name of Spanish broom.[503] Esparto grass grows naturally in a limited region of southeastern Spain and northwestern Africa, and has been used, both in the archaeological and ethnographic record, for the construction of besom, rope, cordage, and basketry.[504] Pliny reports that esparto grass grows in an arid climate and is used by local Spaniards for bedding, torches, shoes, and garments.[505] Furthermore, in his description of the optimum processing method, Pliny states that it is particularly well-suited for marine use and is actually nourished (*alitur)* by being submerged in water, making it ideal for the rigging of ships.[506]

*Interpreting Homer*

In the above passage about the *genista* plant, Pliny references the Greek term – σπάρτα – from Homer's *Iliad*.[507] The translation of this term has evolved throughout the centuries as scholars both ancient and modern have continued to study Homer's epics. Modern scholars have translated σπάρτα as the tackling of the ship. A.T. Murray's translation of this phrase from the *Iliad*, "and lo, our ships' timbers are rotted, and the tackling loosed,"[508] closely resembles Samuel Butler's, "the timbers of our ships are rotted; their tackling is sound no longer."[509] However, this interpretation of σπάρτα is in direct contradiction to the consensus of ancient scholars as reported by Pliny, who

[501] Plin. *HN* 19.7-10.
[502] Bostock and Riley 1855; Rackham 1938, 436.
[503] For the sake of clarity within this dissertation, *spartum* (*Stipa tenacissima*) is only called esparto grass as the common name, and *genista* (*Spartium junceum*) is called broom-plant.
[504] Gale and Cutler 2000, 360.
[505] Plin. *HN* 19.7.26-27.
[506] Plin. *HN* 19.8.29-30
[507] Hom. *Il*. 2.135.
[508] Murray 1924.
[509] Butler 1898.

identified linen as the substance of the ships' rigging, and said "that the word *sparta* used by Homer means 'sown'."[510]

While modern scholars translate the verse of Homer liberally, they are more precise and conservative with their interpretation of Pliny's Latin translation of Homer. The Latin translation of the Greek that Pliny provides – *navium sparta dissoluta* – has been translated by Jones as above, "the ships' cords were loosed," and by Bostock and Riley as "'the sparta' coming asunder." Literally, this phrase can be translated, "the ships' loosened spartum (lit. the plant as presented above)." But was Pliny actually translating the Greek σπάρτα to the Latin *spartum*, or was he simply transliterating the Greek term into the Latin alphabet? Considering that Pliny supports an interpretation of the Homer passage as 'sown' (as in sowing seeds),[511] a literal translation of the Latin is unhelpful. Bostock and Riley's transliteration of the Greek term, as opposed to attempting a straight translation of the Latin, is perhaps the safest interpretation of this passage. In fact, the etymology of the Latin term *spartum* from the Greek term σπάρτον (*sparton*) causes much confusion, as indeed it is known to have done from the first century B.C.E. and perhaps earlier.

*The Variable Meanings of Σπάρτα (Sparta)*

Aulus Gellius (*NA* 17.3), a Latin grammarian of the second century C.E., records an encounter between a learned young man and a few less-educated ones, in which the relationship between the terms *spartum* and σπάρτα was discussed using the same Homeric passage that Pliny addressed. This learned young man remarked that the Greeks would not have had the use of *spartum* until many years after the fall of Troy. The less-educated countered this statement by quoting the verse from Homer, laughing that the learned young man's copy of the *Iliad* was

[510] Plin. *HN* 19.6.25 translated by Rackham (1938, 437).
[511] Plin. *HN* 19.6.25.

incomplete. The debate was settled when the learned young man produced the twenty-fifth book of *Antiquitates rerum humanarum* (the original of which is lost to us today) by Marcus Terentius Varro, a Roman scholar of the first century B.C.E., and read the following excerpt:

> I believe that σπάρτα in Homer does not mean sparta but rather σπάρτοι, a kind of broom which is said to grow in the Theban territory. In Greece there has only recently been a supply of spartum, imported from Spain. The Liburnians did not make use of that material either, but as a rule fastened their ships together with thongs,[512] while the Greeks made more use of hemp, tow, and other cultivated plants (sativis), from which ropes got their name of sparta.[513]

The learned young man of Gellius' narrative proceeded to interpret Varro's linguistic argument, stating that the discrepancy in the Homeric passage could be explained by a variation in accent, either due to a mistake in the original text of Homer or due to the adoption of a different accent when words passed from being a general term to a proper name.[514]

These ancient interpretations of the translation of σπάρτα are collated in the modern Greek lexicon. According to Henry Liddell and Robert Scott, σπάρτος could be either an adjective meaning "sown or scattered" or the proper name for esparto grass. However, the feminine and neuter forms, σπάρτη and σπάρτον respectively, also can be translated simply as "rope," or specifically as "rope made from esparto grass." Therefore, the form in Homer – σπάρτα, the neuter nominative plural form of σπάρτον – could mean "sown," "rope," or a specific "rope made from esparto grass."[515]

Interestingly, it is the neuter form σπάρτον that is the etymological root of the Latin term *spartum*, also a neuter noun.[516] The inflection mentioned in Varro of σπάρτοι, which appears to be the masculine nominative plural form of σπάρτος and thus would be translated literally as esparto

512 The original latin for Liburnian ship construction: naves loris suebant.
513 Varro *Antiquitates rerum humanarum* 25 in Gel. *NA* 17.3.4-5 translated by Rolfe (1946, 213).
514 Gel., *NA* 17.3.5 translated by Rolfe (1946, 213).
515 Liddell and Scott 1983, 644.
516 Lewis and Short 1879.

grasses, also has an alternative meaning of the sown-men from Thebes.[517] The plant that Varro refers to is described similarly to the *genista* of Pliny's Book 24 discussed above, identified as a broom plant available in mainland Greece (*Spartium junceum*). Therefore, it is possible that σπάρτοι could be referencing the broom-plant, as Varro has suggested.

Modern scholars debate the meaning of this same Greek term within the work of Xenophon, who wrote a treatise *On Hunting* during the late fifth to early fourth centuries B.C.E. While describing the proper way to create a caltrop,[518] Xenophon recommends a σπάρτου (*spartou*) noose and cord.[519] William Yates in 1843 suggests that σπάρτου indicates the broom plant (*Spartium junceum*).[520] While E.C. Marchant and G.W. Bowersock in their 1925 translation of Xenophon claim that esparto grass is the only accurate translation for this term,[521] in 1946 Marchant only provides Yates' identification of *Spartium junceum* in the footnotes.[522] The form used in this context – σπάρτου – could be the genitive singular of either σπάρτος or σπάρτον, with all the same possible variations in significance as discussed above for the Homer passage. A clue to the identification of this plant might lie within Xenophon's text itself. Xenophon recommends this particular plant for the noose and cord because it does not rot,[523] a characteristic which, according to Pliny, is more indicative of esparto grass than the broom-plant.[524] However, in this same passage, Pliny states that hemp and not esparto grass is preferred for land uses.[525] If this passage in Xenophon is a reference to esparto grass, it would be the earliest evidence for the use

[517] Liddell and Scott 1983, 644.
[518] A trap for catching deer.
[519] Xen., *Scripta Minora*, On Hunting 17.3.13
[520] Yates 1843, 319.
[521] Marchant and Bowersock 1925.
[522] Marchant 1946, 425.
[523] Xen. *Scripta Minora*, On Hunting 17.3.13 translated by Marchant (1946, 425).
[524] Plin. *HN* 19.8.29-30
[525] Plin. *HN* 19.8.30

of this plant by Greeks in the written record. Unfortunately, it is not possible at this stage to ascertain this identification.

The unstable nature of ancient nomenclature continues to plague modern scholarship. Did either Homer or Xenophon intend to say "rope of esparto grass" in their texts when they wrote σπάρτα and σπάρτου, respectively? Were Pliny and Varro accurate in their arguments that Homer, at least, did not? The accurate identification of these terms with a specific plant is crucial to understanding the availability of esparto grass in the Mediterranean outside the regions where it grew.

By the first century B.C.E, Strabo records not only that an area of Spain produces large fields of σπάρτον (*sparton*), but that it is shipped in large quantities to Italy.[526] This is the first definite occurrence of a form of σπάρτον that indicates esparto grass in the written record. Furthermore, it suggests a considerable market for esparto grass in the central Mediterranean, requiring large shipments from Spain. This phenomenon coincides with the earliest usage of the Latin term *spartum*. The first occurrences of *spartum* in Latin literature are from the first century B.C.E in Varro[527] (albeit in a secondary context in Gellius' second century C.E. writings), Vitruvius,[528] and Livy.[529]

*The Spread of* Spartum *Abroad during the Roman Era*

According to the literary record, when did esparto grass become available outside the Iberian Peninsula? Gellius's passage states merely that the importation of esparto grass would have been "many years/seasons (*multis tempestatibus*)" after the fall of Troy.[530] Pliny argues that the

[526] Strabo *Geog* 3.4.9
[527] Varro *Antiquitates rerum humanarum* 25 in Gel. *NA* 17.3.4
[528] Vitr. *De Arch*. 7.3.2
[529] Livy *AUC* 22.20.6 and 26.47.9
[530] Gel. *NA* 17.3.1

Greeks would not have had access to esparto grass until after the First Punic War (264-241 B.C.E.).[531] He also cites the absence of a discussion of esparto grass by Theophrastus (who died in the early third century B.C.E.) as evidence that he was unaware or unfamiliar with the plant, and thus, that the use of esparto grass by the Greeks occurred after his time.[532] However, modern scholars contradict this statement by Pliny, proposing that Theophrastus did describe esparto grass in his *Historia plantarum*.[533] Varro states, “In Greece there has only recently been a supply of *spartum*, imported from Spain.”[534] As Varro is known to have spent some time in Athens, this statement is likely based on first-hand experience.

A study of these ancient authors then suggests that Greek use of the plant began sometime between the late third and first centuries B.C.E, while the literary record as a whole indicates knowledge of the plant by the Greeks possibly as early as the fourth century B.C.E. Nevertheless, it seems quite clear that the literary record advocates a sudden increase in exportation of esparto grass from the territory of Spain after the First Punic War.

As mentioned above, Strabo records that large shipments of esparto grass were being transported to Italy, though Pliny seems to think that transport of the material over a long distance was too costly.[535] Livy provides further details in his description of the Second Punic War (218-201 B.C.E.). In Book 22, after defeating New Carthage (modern day Cartagena), the Romans “sailed to Longuntica, where they found a great quantity of esparto grass, which Hasdrubal had got together for the use of his ships.”[536] Such a supply was worth mentioning as it represented a strategic military and economic advantage to the victorious Romans, and thus was included in

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[531] Plin. *HN* 19.7.1
[532] Plin. *HN* 19.10
[533] Bostock and Riley 1855; Rackham 1938, 440.
[534] Varro *Antiquitates rerum humanarum* 25 in Gel. *NA* 17.3.4 translated by Rolfe (1946, 211).
[535] Strabo *Geog* 3.4.9; Plin. *HN* 19.8.30
[536] Livy *AUC* 22.20.6 translated by Foster (1919, 267).

Livy's account. Again, in Book 26, the capture of esparto grass from transport ships, along with other valuable supplies (including arms, ship timber, grain, and metals), caused Livy to remark, "so that in the midst of these great resources for the war that were captured New Carthage itself was the smallest part of it all."[537] Both of these passages suggest shipments of the raw material itself, as opposed to a finished product like rope.

Overall, ancient authors agree that esparto grass is uniquely suited to marine use, and is associated primarily with ships, the outfitting of fleets, and a general nautical use. Furthermore, the expanded exportation of esparto grass during the third to first centuries B.C.E. appears to be connected to supplying the needs of the Roman fleet. The spread of esparto grass, therefore, to the central and eastern Mediterranean is a result of Rome's conquest of Spain.

The materials used to manufacture the cordage of Mediterranean laced boats (Greek, eastern Adriatic, and northwestern Adriatic), in many ways, corroborates the evidence already discussed from the written sources. The archaeological record tentatively confirms Pliny's statement that the Greeks did not use esparto grass to construct their sewn hulls. The cordage used on the Jules Verne 9, a Greek laced vessel dated to the sixth century B.C.E., has been identified as flax,[538] whereas the northwestern Adriatic laced vessels of the Roman era used esparto grass. The Cala Sant Vicenç laced vessel, dated to the late sixth century B.C.E. and generally belonging to the Greek tradition of laced construction, had esparto grass cordage. However, this ship, which was wrecked off the coast of Spain loaded with Iberian amphoras, was likely constructed, or perhaps repaired, locally in Spain and thus was able to take advantage of local products.[539]

[537] Livy *AUC* 26.47.9-10 translated by Moore (1919, 181).
[538] Pomey 1999, 149, 150 n. 3.
[539] Nieto and Santos 2009, 54–5, 163-89.

Unfortunately, scholars have not yet identified the plant materials from the other excavated Greek laced vessels to the species level, so the comparative material is limited.[540]

Finally, supporting Pliny's third century B.C.E date as the commencement of the spread of esparto grass to Greece, the earliest archaeological evidence for esparto grass in the central Mediterranean is from cordage found as part of the ship's tackle (not used in the construction) on the third century B.C.E. Punic wreck at Marsala, Sicily.[541] Furthermore, as mentioned in Chapter 4, the Roman era eastern Adriatic laced vessels from Nin, Croatia (ancient Liburnia) were laced using flax or yellow-barked willow, corroborating Varro's statement as recorded in Gellius that the Liburnians did not use esparto grass.[542] Combined, the literary and archaeological evidence support the argument that the availability of esparto grass in the central Mediterranean, and thus to the community of builders of northwestern Adriatic laced boats, was a direct result of Roman imperial expansion.

## MANUFACTURE

Once the raw materials were procured, they were then cut, shaped, and otherwise worked, into the needed forms. Tree trunks, branches, and twigs were fashioned into planks, frames, pegs, and treenails. Bast fibers were processed into seam wadding, and esparto grass was spun into cordage. In addition, each element needed to be crafted by the builders in such a way that they would fit together to make a functional watercraft.

[540] The Gela wreck and Ma'agan Mikhael ship both had remains of cordage, however the material of the former was identified as simply a plant fiber and the that of the latter as a monocotyledonous plant (which includes grasses, reeds, and rushes), likely *Ruscus hypophyllum* or *Ruscus hypoglossum* (evergreen shrubs). For the Ma'agan Mikhael ship, the identification of a monocotyledonous plant, likely an evergreen shrub, does mean that it was not sewn with flax (which is dicotyledonous) as Pliny suggests. See Panvini (2001) for the Gela wreck and Shimony and Werker (2003) for the Ma'agan Mikhael ship.
[541] Frost 1981, 93.
[542] Brusić and Domjan 1985, 77.

Of course, it was not necessary for all the resources to have been acquired prior to any construction occurring on the vessel. As Matthew Walls demonstrates in his ethnoarchaeological study of Inuit kayak-making, "the steps involved in making are not strictly 'chained' together."[543] There may be a flow to the process by which an artifact, such as a boat, is made, but there is also an inherent fluidity, a non-structure, to human behavior. For the builders of northwestern Adriatic laced vessels, the structure of the process was likely based on the manufacturing site and/or the needs of the particular community of builders. Considering the range of types of vessels within this tradition, as known from the archaeological record, a manufacturing site may have been a bustling shipyard with several boats under construction, all at various stages, and a large workforce of shipwrights, assistants, and apprentices. A manufacturing site of this tradition may also have been a small tract of farmland where a family unit built a small barge to transport their agricultural products to market, or anything else along this spectrum. Some builders might have worked from a stock of readily-available supplies, frequently replenished, while others fashioned each element as it was obtained. An analysis of the quality of the wood, surviving tool marks, and dimensions of each element should permit a better understanding of the manufacturing stage of the *chaîne opératoire* of northwestern Adriatic laced vessels.

While the *chaîne opératoire* of northwestern Adriatic laced tradition certainly had some fluidity in practice, some steps had to occur before others were possible and the general sequence of construction can be inferred from vessel remains. For example, the presence of edge-joining required the assembly of the shell (or at least part of the shell) prior to the insertion of the frames.[544]

543 Walls forthcoming.

544 This does not necessarily mean that the entire shell must be constructed first; for instance, with the Comacchio ship, the floor timbers cover the hull planking up to the first wale, so the floors could have been inserted before additional strakes were added above the wale. Based on the preserved remains of this tradition, a substantial portion of the shell was laced together prior to the addition of the frames.

The following relates the general sequence of actions necessary to build a vessel of the northwestern Adriatic laced tradition.

## Hull Planking

Once the tree was selected and felled, planks were sawn either tangentially (sawn flat) or radially (quarter sawn).[545] In the Comacchio ship, the hull planking most commonly was cut tangentially (15 of 25 planks examined), and far from the center of the tree.[546] In the Venice Lido III timber assemblage, there is almost equal distribution of cuts, with six of the ten hull planks cut tangentially and four cut radially.[547] The one plank from the Canale Anfore II hull remains that I sampled was cut along the radial plane. Furthermore, based on a published image of the complete remains, most of these planks were likely also quarter sawn.[548] Filipe Castro and Massimo Capulli do not state along which plane each plank of the Stella 1 barge was sawn, but they do comment on the overall good quality of the timbers with few knots and straight grain.[549] Finally, one of the planks from the Venice Lido III timber assemblage showed possible signs of the use of an adze, likely to thin the plank to match others in the hull.[550] At this stage in the research, it is not possible to adduce builder preference for how each plank was fashioned. The Comacchio ship and Venice

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[545] Saw marks have been noted on the Comacchio ship (Castelletti et al. 1990, 136), the Canale Anfore I and II hull remains (Beltrame and Gaddi 2013, 298-99), the Stella 1 barge (Castro and Capulli 2016, 33-4), and the Venice Lido III timbers (hull planking fragments 1, 4, 7, and 9. The surfaces of these plank fragments were highly deteriorated due to environmental conditions, mostly abrasion, so tool marks were difficult to observe). It is also important to note here that it is by no means certain, or even likely, that the builders selected and felled the tree themselves. This was likely the purview of *dendrophori* discussed in Chapter 3.

[546] Castelletti et al. 1990, 136.

[547] Hull planking fragments 1, 2, 5, 7, 10, and 11 are sawn flat while Fragments 3, 4, 8, and 9 were quarter sawn.

[548] See Beltrame and Gaddi 2013, fig. 11.

[549] Castro and Capulli 2016, 34. The images in the Ship Lab report (Castro and Capulli 2011) show planks cut along both the tangential and radial planes.

[550] Hull planking fragments 9 and 10.

Lido III assemblage may suggest that builders incorporated available pre-cut lumber, regardless of how it was sawn.[551]

The hull planks of northwestern Adriatic laced vessels varied in width from about 12 to 40 cm (see Table 5.2a). The length of planks is established with greatest accuracy in the mostly complete hull remains where (close to) entire strakes are preserved. In the smaller river and canal barges (Cavanella d'Adige, Corte Cavanella II, and Stella 1) the observed maximum length of individual planks is between 4 and 5 m, although a single plank 10 m in length was part of the Canale Anfora I hull, also a likely canal barge. By contrast, the longest plank in the Comacchio hull, a coastal trader, was over 16 m. The most common scarf observed on hull planking of this tradition is the diagonal scarf (seen in the Venice Lido I[552], Padova,[553] and Comacchio[554] hull remains), although a couple examples of S-scarfs have also been noted (in the Venice Lido I[555] and Canale Anfore I[556] hull remains). Also, a hooked scarf was used to join the sternpost of the Comacchio hull to the keel plank.[557] The builders of the Comacchio hull used nails to fix the diagonal scarfs of the planking, while the other examples of preserved scarfs were joined by lacing. The Stella 1 barge has no scarfs preserved along its length.[558]

Most of the bottom planks of the Stella 1 barge are cut straight, being of more or less equal width along their length, but two planks (F4 and F5) vary considerably in width along their length

[551] It is possible that radial and tangential cuts were used differentially within the hull (such as radial cuts for a keel plank and garboard strakes and tangential cuts for side planking), but this level of detail has not been published for the Comacchio ship.
[552] Beltrame 1996, 2002, 357.
[553] Beltrame 2002a, 366.
[554] Berti 1990, 29.
[555] Beltrame 1996, 2002, 357.
[556] Beltrame 2002a, 358.
[557] Berti 1990, 29.
[558] Castro and Capulli 2016, 11-12, figs. 3a and 3b.

(Fig. 5.1).[559] Looking more broadly at other finds within the tradition, some hull planking remains preserve enough of the original plank edge to represent fairly accurately the original cut of the planking, while others are too degraded to determine the planks' original dimensions. A study of the former reveals examples where runs of planking were cut fairly straight, including the Canale Anfora I and II, Comacchio, Corte Cavanella II, and Oderzo hull remains, as well as examples that are highly variable,[560] including the Venice Lido I, Padova, and Cavanella d'Adige hull remains. It is possible that the latter examples have variable widths along their lengths as the builders avoided weaknesses in the wood or (re)used irregular or damaged timbers.

Planking thickness ranged from 2 cm to about 10 cm, although most planks are 5 cm thick or less. The thickest planks are from the Venice Lido I hull remains and are arguably the central portion (a keel plank) of a seagoing hull, as Carlo Beltrame contends.[561] This conclusion is supported by the dimensions of hull planking fragment 1 of the Venice Lido III timber assemblage (Fig. 5.2), which is about 5 cm thick along one edge and 7.5 cm thick along the other, likely representing a garboard strake (transitioning from a thickened keel plank, or perhaps even a true keel, to the remainder of the bottom planking). These fragmentary remains from Venice Lido could possibly have belonged to more seaworthy vessels than the Comacchio ship.[562] Perhaps unsurprisingly, planking thickness varies in relationship to the proposed type of vessel with coastal traders having on average thicker planking (around 4-5 cm) than river and canal barges (around 2-3 cm).

[559] Castro and Capulli 2016, fig. 3a.
[560] Not including expected narrowing of hood ends or scarfs.
[561] Beltrame 2002a, 358.
[562] The thickness of the keel plank of the Comacchio ship is not individually reported. The given planking thickness of the vessel is reported as 5 cm.

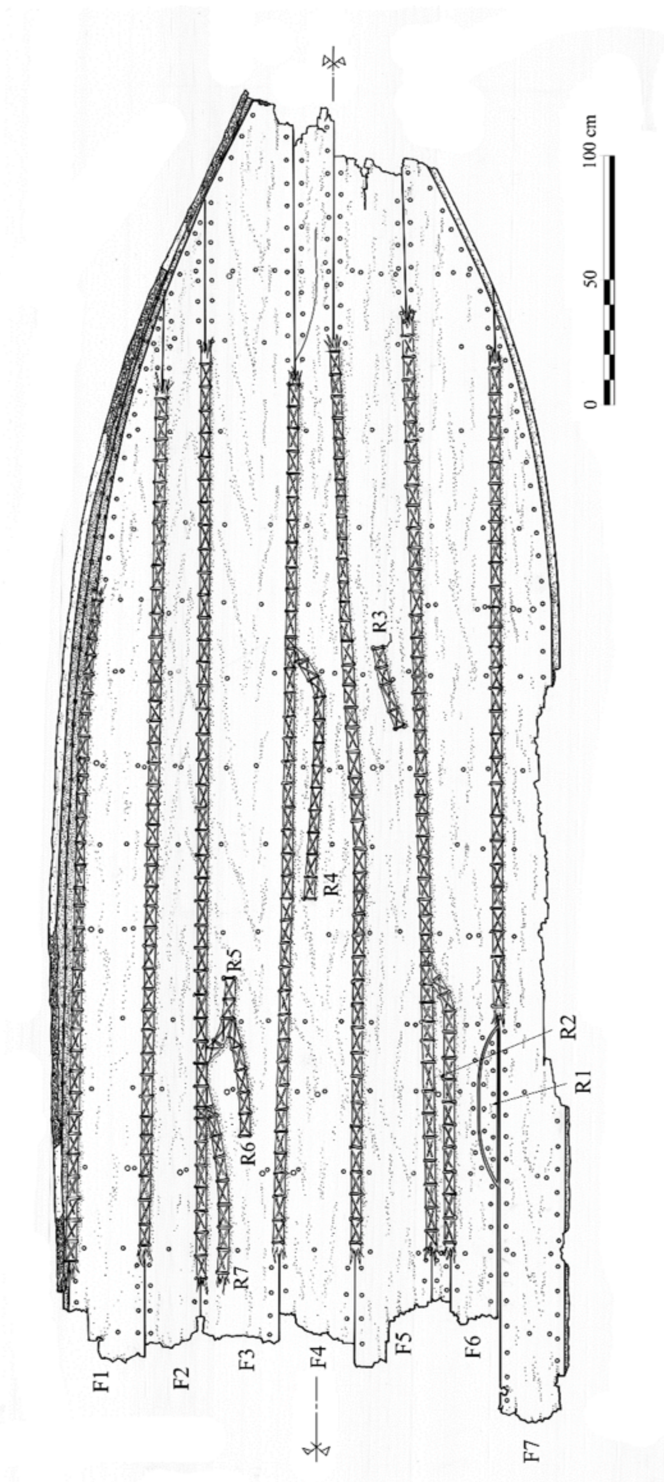


Figure 5.1: Hull planking plan of the Stella 1 barge (Castro and Capulli 2016, fig. 3a).

Figure 5.2: Distinct tapering of hull planking fragment 1 of the Venice Lido III timber assemblage (photo by author)

**Lacing Channels and Edge Cavities**

Once a plank was cut to size, the elements of the lacing system were added along the edges. Lacing channels were drilled and/or gouged diagonally from the internal face to the edge of the plank (see Fig. 5.3).[563] Then, cavities along the plank edge, where the lacing channel exits, were cut to widen the opening to the channel, possibly to facilitate the lacing process by permitting a larger margin of error when aligning the channels of adjacent planks. These edge cavities typically are carved into trapezoidal or rectangular openings, most likely with a chisel (Fig. 5.4).[564] There are examples where the builders worked around weaknesses in the wood by setting the lacing channels further back from the edge (Fig. 5.5).[565] On the Stella 1 barge, the lacing channels

[563] Bow drill marks were noted in the lacing channels of several remains, including hull planking fragment 8 and 11 of the Venice Lido III assemblage, as well as the Canale Anfore I remains (see Beltrame and Gaddi 2013, 297 for the latter). Castro and Capulli (2016, 34) state that the holes were drilled but do not directly comment on tool marks within the channels. Gouge marks were observed on hull planking fragments 1, 2, and 8 of the Venice Lido III assemblage. It was also noted on examination of these timbers that several lacing channels were smooth, with tool marks likely worn away over the life of the vessel.
[564] Chisel marks were observed along the edge cavities of several of the Venice Lido III timbers, hull planking fragment 1 in particular.
[565] Seen in both the Stella 1 barge (Castro and Capulli 2016, 34) and the Venice Lido III timber assemblage (Fragment 4).

were set so far back from the edge along the internal face that they exited on the external face of the plank (instead of at the edge of the plank). In order to protect the cordage from abrasion, the builders cut grooves running from the exit point (on the external face) to the edge of the plank so that the cordage was sheltered (Fig. 5.6).[566]

As stated, all lacing channels are oriented diagonally, ranging in angle from 45 to 55 degrees. The lacing channels range in diameter from 1.0 to 2.8 cm, with no discernable pattern by date, subregion, or type of vessel (see Tables 5.2b, 5.2c, and 5.2d). There also does not seem to be any correlation to other construction features (such as plank thickness or spacing). In fact, several singular finds have widely variable channel diameters, including the Canale Anfore I and II hull remains, with ranges of 1.5-2.5 and 1.6-2.8 cm respectively.[567] This variation in diameter may represent the level of precision of the tools used by individual communities of builders, different diameter drills/gouges used for planks based on their position in the hull, or different shipbuilders/apprentices.[568] The spacing of lacing channels is typically between 5 and 10 cm, but within individual vessels or hull remains the range in spacing of channels is typically less than 3 cm.[569] Again, there is no detectable variation in spacing of the lacing channels by time, subregion, type of vessel, or any other observed construction feature. This suggests a common system of measurement across the builders of this tradition, albeit likely an informal one such as finger widths.

[566] Castro and Capulli 2016, 34.
[567] Beltrame and Gaddi 2013, table 1.
[568] The Canale Anfore I and II hull remains represent articulated runs of only a few planks (thus of a similar position in the hull); for these remains, it is likely that the range in diameter is due to imprecision in tools. However, for the Venice Lido III timber assemblage, most planks have lacing channels that vary only by 1-2 mm within individual planks. The range noted in Table 5.5 largely is distorted by the repair lacing channels in fragment 8, but may also be skewed as it is uncertain whether all these planks originated from the same vessel.
[569] The Cervia and Canale Anfora hull remains have a range of about 4 cm.

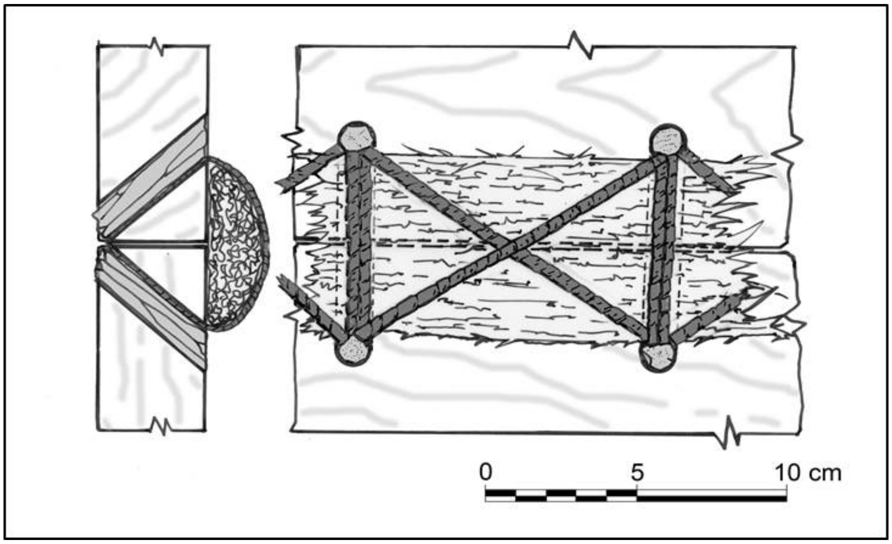


Figure 5.3: Schematic drawing of lacing system based on the Stella 1 barge (Castro and Capulli 2011, fig. 9)

Figure 5.4: Edge cavities of hull planking fragment 1 of the Venice Lido III timber assemblage (photo by author).


Figure 5.5: Lacing channels staggered to avoid weaknesses in the wood of hull planking fragment 4 of the Venice Lido III timber assemblage (photo by Mirco Cusin).

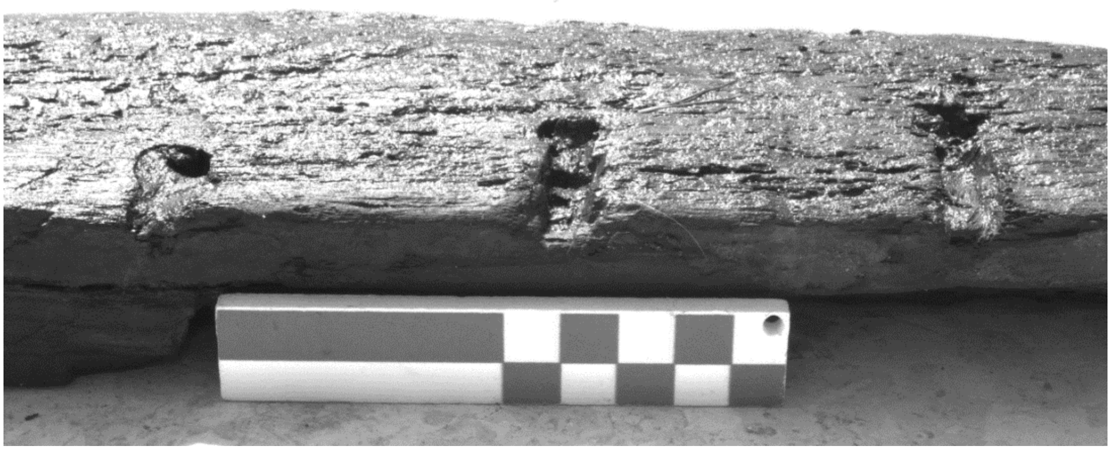

Figure 5.6: Grooves carved into the external face of the hull plank of the Stella 1 barge to protect the cordage (Castro and Capulli 2016, fig. 6f).

**Table 5.2a: Dimensions of the Hull Planking and Lacing System of Northwestern Adriatic Laced Vessels in Alphabetical Order**

| WRECK | Hull Planking | | | | Lacing Channels | |
|---|---|---|---|---|---|---|
| | Max Length (m) | Width (cm) | Thickness (cm) | Edge Cavities | Diameter (cm) | Spacing (cm) |
| Altino | ~2 | | | | ~1.2-1.5 | ~8-9 |
| Canale Anfora I | 10 | 12-38 | 3.5-4 or 2[a] | trapezoidal | 1.5-2.5 | 4-9 |
| Canale Anfora II | 2 | 26 | 2 | trapezoidal | 1.6-2.8 | 8 |
| Cavanella D'Adige | 4.5 | 16-36 | 3-3.5 | | 1.0 | |
| Cervia | 1 | | 3-4.5 | nearly trapezoidal | 1.5-2.0 | 5-9 |
| Comacchio | 17 | 17-29 | 5 | trapezoidal and rectangular | 1.8 | 6-8 |
| Concordia Sagitaria | 1 | 16-20 | | | | |
| Corte Cavanella II | 4 | ~20-30 | 3 | rectangular | 0.8-1.5 | 6 |
| Oderzo | 2 | | | | | ~10 |
| Padova | 4 | 3-30 | 2.5 | | smaller than treenails | 6 |
| Pomposa-Borgo Caprile | | 21-27 | 5 | | | |
| Stella 1 | 5 | 25 | 2.5-3.5 | semi-circular to trapezoidal | 1.2 | 8-10 |
| Venice Lagoon | 1 | | 4.5 | | | |
| Venice Lido I | 2 | 14-40 | 4-10 | trapezoidal | 1.5 | 8-10 |
| Venice Lido II | ~0.5 | ~11 | 2 | | 1.0 | ~9 |
| Venice Lido III | 2 | 14-36 | 2.5-7.5 | trapezoidal | 1.3-2.7 | 5-8 |

a- Beltrame and Gaddi (2013) report two different planking thickness measurements for this find.

Measurements are approximated to facilitate a general comparison across finds of the tradition. Numbers are rounded to the whole number (or half cm for thickness and diameter), as precise measurements are not available for all finds. The ~ symbol is used to denote measurements that were taken from photographs or construction drawings.

**Table 5.2b: Dimensions of the Hull Planking and Lacing System of Northwestern Adriatic Laced Vessels in Chronological Order**

| WRECK | Hull Planking | | | | Lacing Channels | |
|---|---|---|---|---|---|---|
| | Max Length (m) | Width (cm) | Thickness (cm) | Edge Cavities | Diameter (cm) | Spacing (cm) |
| Cavanella D'Adige | 4.5 | 16-36 | 3-3.5 | | 1.0 | |
| Comacchio | 17 | 17-29 | 5 | trapezoidal and rectangular | 1.8 | 6-8 |
| Padova | 4 | 3-30 | 2.5 | | smaller than treenails | 6 |
| Stella 1 | 5 | 25 | 2.5-3.5 | semi-circular to trapezoidal | 1.2 | 8-10 |
| Canale Anfora I | 10 | 12-38 | 3.5-4 or 2[a] | trapezoidal | 1.5-2.5 | 4-9 |
| Corte Cavanella II | 4 | ~20-30 | 3 | rectangular | 0.8-1.5 | 6 |
| Oderzo | 2 | | | | | ~10 |
| Canale Anfora II | 2 | 26 | 2 | trapezoidal | 1.6-2.8 | 8 |
| Venice Lido I | 2 | 14-40 | 4-10 | trapezoidal | 1.5 | 8-10 |
| Venice Lido III | 2 | 14-36 | 2.5-7.5 | trapezoidal | 1.3-2.7 | 5-8 |
| Cervia | 1 | | 3-4.5 | nearly trapezoidal | 1.5-2.0 | 5-9 |
| Pomposa-Borgo Caprile | | 21-27 | 5 | | | |
| **Unknown Date:** | | | | | | |
| Altino | ~2 | | | | ~1.2-1.5 | ~8-9 |
| Concordia Sagitaria | 1 | 16-20 | | | | |
| Venice Lagoon | 1 | | 4.5 | | | |
| Venice Lido II | ~0.5 | ~11 | 2 | | 1.0 | ~9 |

a- Beltrame and Gaddi (2013) report two different planking thickness measurements for this find.

Measurements are approximated to facilitate a general comparison across finds of the tradition. Numbers are rounded to the whole number (or half cm for thickness and diameter), as precise measurements are not available for all finds. The ~ symbol is used to denote measurements that were taken from photographs or construction drawings.

**Table 5.2c: Dimensions of the Hull Planking and Lacing System of Northwestern Adriatic Laced Vessels by Subregion**

| | WRECK | Hull Planking | | | | Lacing Channels | |
|---|---|---|---|---|---|---|---|
| | | Max Length (m) | Width (cm) | Thickness (cm) | Edge Cavities | Diameter (cm) | Spacing (cm) |
| **Friuli-Venezia Giulia** | Canale Anfora I | 10 | 12-38 | 3.5-4 or 2[a] | trapezoidal | 1.5-2.5 | 4-9 |
| | Canale Anfora II | 2 | 26 | 2 | trapezoidal | 1.6-2.8 | 8 |
| | Stella 1 | 5 | 25 | 2.5-3.5 | semi-circular to trapezoidal | 1.2 | 8-10 |
| **Veneto** | Concordia Sagitaria | 1 | 16-20 | | | | |
| | Oderzo | 2 | | | | | ~10 |
| | Altino | ~2 | | | | ~1.2-1.5 | ~8-9 |
| | Venice Lagoon | 1 | | 4.5 | | | |
| | Venice Lido I | 2 | 14-40 | 4-10 | trapezoidal | 1.5 | 8-10 |
| | Venice Lido II | ~0.5 | ~11 | 2 | | 1.0 | ~9 |
| | Venice Lido III | 2 | 14-36 | 2.5-7.5 | trapezoidal | 1.3-2.7 | 5-8 |
| | Padova | 4 | 3-30 | 2.5 | | smaller than treenails | 6 |
| | Cavanella D'Adige | 4.5 | 16-36 | 3-3.5 | | 1.0 | |
| | Corte Cavanella II | 4 | ~20-30 | 3 | rectangular | 0.8-1.5 | 6 |
| **Emilia-Romagna** | Pomposa-Borgo Caprile | | 21-27 | 5 | | | |
| | Comacchio | 17 | 17-29 | 5 | trapezoidal and rectangular | 1.8 | 6-8 |
| | Cervia | 1 | | 3-4.5 | nearly trapezoidal | 1.5-2.0 | 5-9 |

a- Beltrame and Gaddi (2013) report two different planking thickness measurements for this find.

Measurements are approximated to facilitate a general comparison across finds of the tradition. Numbers are rounded to the whole number (or half cm for thickness and diameter), as precise measurements are not available for all finds. The ~ symbol is used to denote measurements that were taken from photographs or construction drawings.

**Table 5.2d: Dimensions of the Hull Planking and Lacing System of Northwestern Adriatic Laced Vessels by Vessel Type**

| | WRECK | Hull Planking | | | | Lacing Channels | |
|---|---|---|---|---|---|---|---|
| | | Max Length (m) | Width (cm) | Thickness (cm) | Edge Cavities | Diameter (cm) | Spacing (cm) |
| Coastal Trader | Comacchio | 17 | 17-29 | 5 | trapezoidal and rectangular | 1.8 | 6-8 |
| | Cervia | 1 | | 3-4.5 | nearly trapezoidal | 1.5-2.0 | 5-9 |
| | Pomposa-Borgo Caprile | | 21-27 | 5 | | | |
| | Venice Lido I | 2 | 14-40 | 4-10 | trapezoidal | 1.5 | 8-10 |
| | Venice Lido II | ~0.5 | ~11 | 2 | | 1.0 | ~9 |
| | Venice Lido III | 2 | 14-36 | 2.5-7.5 | trapezoidal | 1.3-2.7 | 5-8 |
| River / Canal Barge | Stella 1 | 5 | 25 | 2.5-3.5 | semi-circular to trapezoidal | 1.2 | 8-10 |
| | Altino | ~2 | | | | ~1.2-1.5 | ~8-9 |
| | Canale Anfora I | 10 | 12-38 | 3.5-4 or 2[a] | trapezoidal | 1.5-2.5 | 4-9 |
| | Canale Anfora II | 2 | 26 | 2 | trapezoidal | 1.6-2.8 | 8 |
| | Cavanella D'Adige | 4.5 | 16-36 | 3-3.5 | | 1.0 | |
| | Corte Cavanella II | 4 | ~20-30 | 3 | rectangular | 0.8-1.5 | 6 |
| Unknown | Concordia Sagitaria | 1 | 16-20 | | | | |
| | Oderzo | 2 | | | | | ~10 |
| | Padova | 4 | 3-30 | 2.5 | | smaller than treenails | 6 |
| | Venice Lagoon | 1 | | 4.5 | | | |

a- Beltrame and Gaddi (2013) report two different planking thickness measurements for this find.

Measurements are approximated to facilitate a general comparison across finds of the tradition. Numbers are rounded to the whole number (or half cm for thickness and diameter), as precise measurements are not available for all finds. The ~ symbol is used to denote measurements that were taken from photographs or construction drawings.

The use of horizontal dowels to align planks prior to lacing, a standard feature of the Archaic Greek laced tradition, was incorporated sparingly into at least three northwestern Adriatic laced hulls. The Stella 1 barge had two round holes about 0.6-07 cm in diameter drilled into the plank edge. Castro and Capulli interpreted these features as evidence for the use of cylindrical dowels to reinforce the joint between the bottom plank (plank 7) and the first strake of the side planking (Fig. 5.7); no other dowel holes were noted anywhere else in the vessel.[570] A horizontal dowel was also noted in the planking of the Canale Anfore II hull remains.[571] And finally, Beltrame notes the presence of a cavity at the end of one of the timbers of the Venice Lido I assemblage that would accommodate a horizontal dowel.[572] The cavity in the Venice Lido I timber, however, is exposed on the internal surface of the plank so if it held a dowel it would provide only minimal support to align the planks.

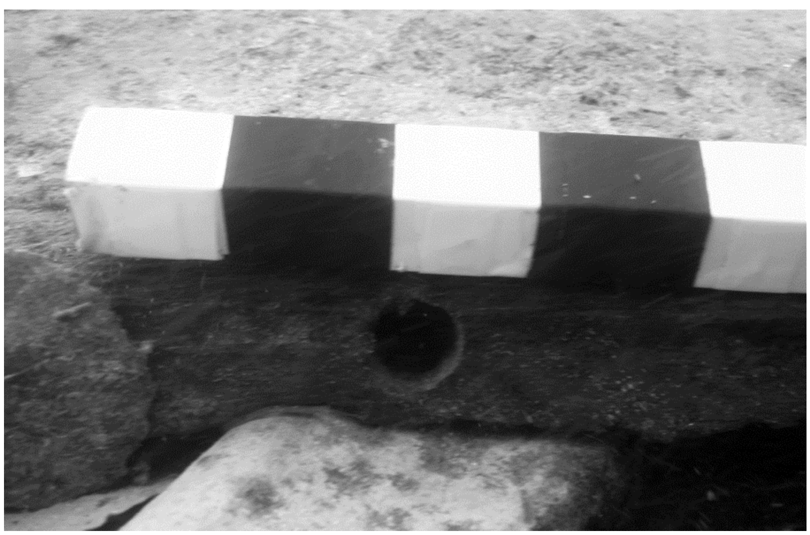

Figure 5.7: Hole for a dowel on the Stella 1 barge (Castro and Capulli 2016, fig. 5).

[570] Castro and Capulli 2016, 34.
[571] Beltrame and Gaddi 2013, 299, 301, fig. 14.
[572] Beltrame 2002a, 373, fig. 30.

**Cordage and Seam Wadding**

In order to manufacture the cordage and seam wadding used to bind the planks together, it was necessary first to extract the fibers from the harvested esparto grass and lime tree respectively. The fibers of esparto grass are found in the leaves and not in the stems, as is common with other natural fibers used to make cordage (including flax and hemp), so processing is not such an arduous task.[573] Similar to stem fibers, initially the esparto grass is retted, or soaked in water (often sea water), for a long time.[574] While no exact length of time is given for the retting of esparto grass, flax and hemp typically are retted for about two to three weeks when processed in natural environments (using rivers, ponds, lakes, etc.).[575] The retting time for any plant is dependent upon the environmental conditions of the retting site, temperature in particular, and the properties of individual crops.[576] However, instead of the need to scutch or beat the material to release the fibers, the fibers of esparto grass may be extracted easily after retting is completed.

At this stage, the fibers are formed into rope through a process called laying, whereby the fibers are twisted or spun likely either by hand, thigh rolling, or spindle.[577] Individual fibers are twisted in a single direction into yarns and then the yarns are twisted in the opposite direction to form a strand. Strands are then twisted in the original direction to form rope.[578] The oscillation of the direction of twisting "creates the tension that holds the rope together and gives it strength."[579] The direction of the final twist determines whether the cordage has an s-twist (leaning to the left) or a z-twist (leaning to the right).[580] The samples of cordage collected from the Venice Lido III

[573] Kirby 1963, 1-4, 424-45.
[574] Kirby 1963, 424-25.
[575] Kirby 1963, 26-7, 55-6.
[576] Kirby 1963, 24.
[577] Charlton 1996, 10-11.
[578] Charlton 1996, 10-11.
[579] Charlton 1996, 12.
[580] Charlton 1996, 10-11.

timber assemblage are all two-strand s-twist cordage of 0.4-0.6 cm diameter (see Fig. 5.8). Beltrame and Dario Gaddi report that the cordage from the Canale Anfore II hull remains is also a two-strand cord; based on my own examination of these remains, the cord has a z-twist.[581] Both two-strand s-twist and three-strand z-twist cordage of esparto grass were found on the mid-third century B.C.E. Marsala shipwreck.[582]


Figure 5.8: Peg and pieces of cordage from hull planking fragment 1 of the Venice Lido III timber assemblage (photo by Mirco Cusin).

[581] Beltrame and Gaddi 2013, 298. The authors reported the ropes as being comprised of eight twisted strands of two threads each. This seems a highly unlikely scenario as two-strand and three-strand rope is the most common found in archaeological sites (see Charlton 1996, 58-68). The confusion is likely an issue of semantics or translation of terms between English (language of publication) and Italian (authors' native language). It is my interpretation that the authors intended to communicate that there were eight sections of cordage preserved, each a two-strand cord. My own observations of the materials support this description of the cordage.

[582] Frost 1981, 93-4.

The lime bast fibers would have been processed in a similar way to the esparto grass. Once the bark was harvested from the tree, it would have been retted for about 4-6 weeks.[583] Once again, seawater is preferred for retting as it does not degrade the quality and strength of the lime bast fibers.[584] After retting, the fibers were peeled off from the bark. However, instead of being finely spun into yarn to make cord or rope, the fibers were bunched, loosely twisted, and placed along the seam between two hull planks already prepared with lacing channels and edge cavities. Strips of bast fiber can still be detected in the remnants of seam wadding from the Canale Anfore II hull remains and the Stella 1 barge (see Figs. 5.9 and 5.10). The seam wadding from the Comacchio wreck was wrapped in wool prior to being set on the seams.


Figure 5.9: Seam wadding from the Canale Anfore II hull remains (photo by author).

[583] Myking et al. (2005, 68) describe two other methods of releasing the bast fibers of lime without retting. However these produced stiff fibers and retting was the most common method.
[584] Myking et al. 2005, 68.

Figure 5.10: Seam wadding from the Stella 1 barge (photo by Kotaro Yamafune).

Once the seam wadding was placed between two prepared hull planks, then cordage was passed through the channels. Ethnographic studies of laced shipbuilding tend to show at least two lacers working in tandem – one on each side of the growing vessel (Fig. 5.11).[585] The number of passes made with the cordage varies across hull remains (and likely even by the position of the strake in the hull), but the overall banded-X pattern of lacing was used consistently across vessels of this tradition where the lacing pattern is preserved (Fig. 5.12). In a single lacing channel of the Canale Anfore II remains, cordage was passed through at least nine times – five passes horizontally to the adjacent hole, two passes diagonally to the opposite hole forward, and two passes diagonally to the opposite hole aft (the distinct strands of cordage can be seen and counted in Fig. 5.9).[586] A similar lacing scheme seems to be in place in the Comacchio ship and Stella 1 barge, although the exact number of passes could not be counted.[587] Venice Lido III hull planking fragment 1 had up

[585] Insoll 1993, fig. 5; Prins 1986.
[586] Beltrame and Gaddi 2013, fig. 15.
[587] Berti 1990, fig. 4; Castro and Capulli 2011, fig. 8.

to 12 strands of cordage preserved within a single lacing channel, while hull planking fragments 2, 3, and 10 had only three strands of cordage preserved.[588] If these fragmentary planks were all originally part of a single vessel (a likely presumption at this stage in my research), then the builders would have secured certain areas of the hull with more cordage than other sections. If hull planking fragment 1 was a garboard strake (as argued above), then its function in providing central longitudinal support may explain the additional lacing.

After the lacing was completed, the channels were plugged with tapered pegs (Figs. 5.13 and 5.14). Some of the pegs of Venice Lido III hull planking fragment 1 exhibit the use of chocks, here an angular wedge within the peg (Fig. 5.15). Chocks were used to tighten the join and are most often observed in treenails. This is the first known instance of chocks being used in laced construction. Once the lacing was secured with pegs, a layer of pitch, likely pine resin for the Stella 1 barge at least, was applied to the internal seams of the hull.

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[588] The number of strands preserved per lacing channel does not necessarily reflect the number of passes made during original construction or repair. Three lacing channels of hull planking fragment 1 were sampled – the first sampled channel yielded 12 strands of cordage, the second at least five strands, and the last at least seven. A similar situation was noted for hull planking fragment 8, where the first lacing channels sampled yielded seven strands of cordage and the second yielded only three. There is likely an issue with preservation.

Figure 5.11: Builders of a laced boat in Gao, Mali work in tandem to repair the lacing (Insoll 1993, fig. 5).

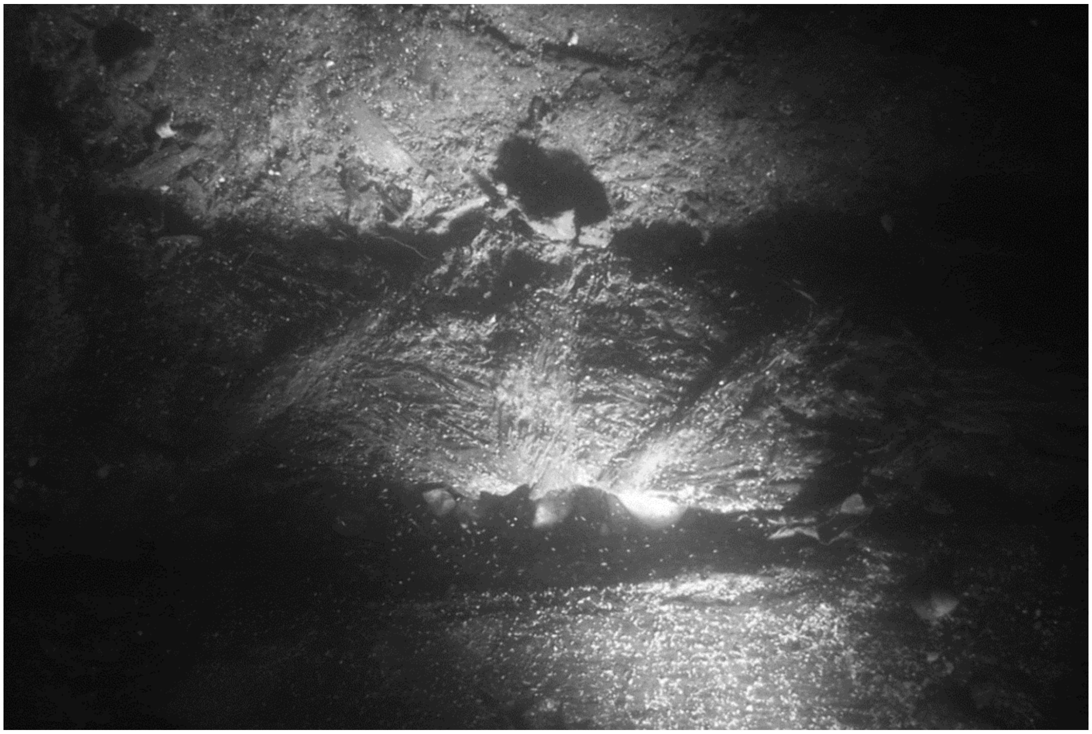

Figure 5.12: The banded-X lacing pattern on the Stella 1 barge (Castro and Capulli 2011, fig. 8).

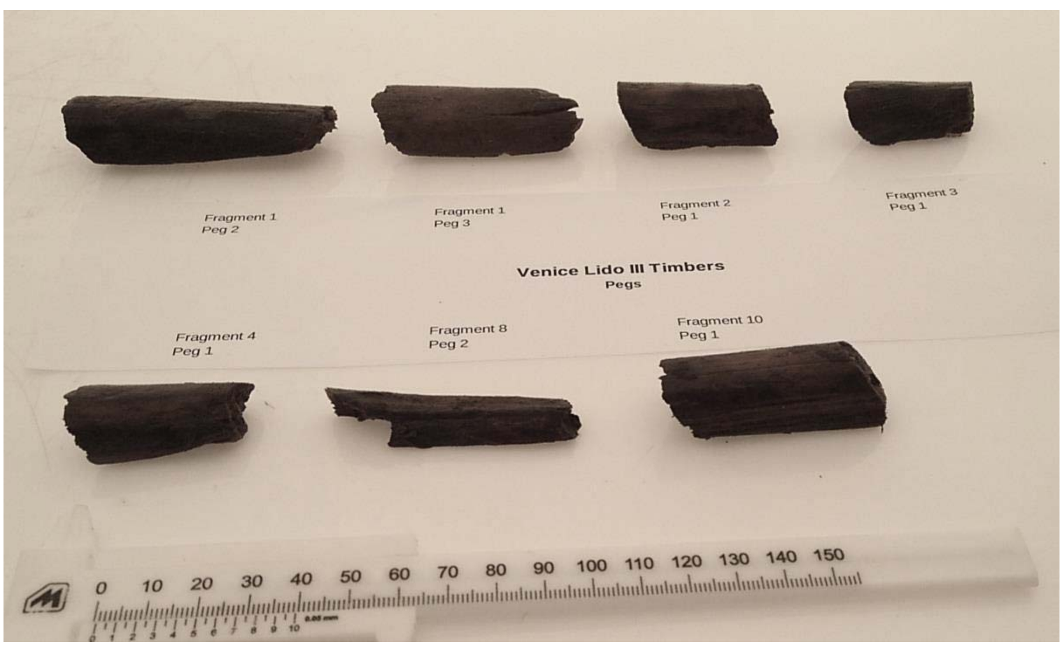


Figure 5.13: Tapered pegs from the Venice Lido III timber assemblage (photo by author).

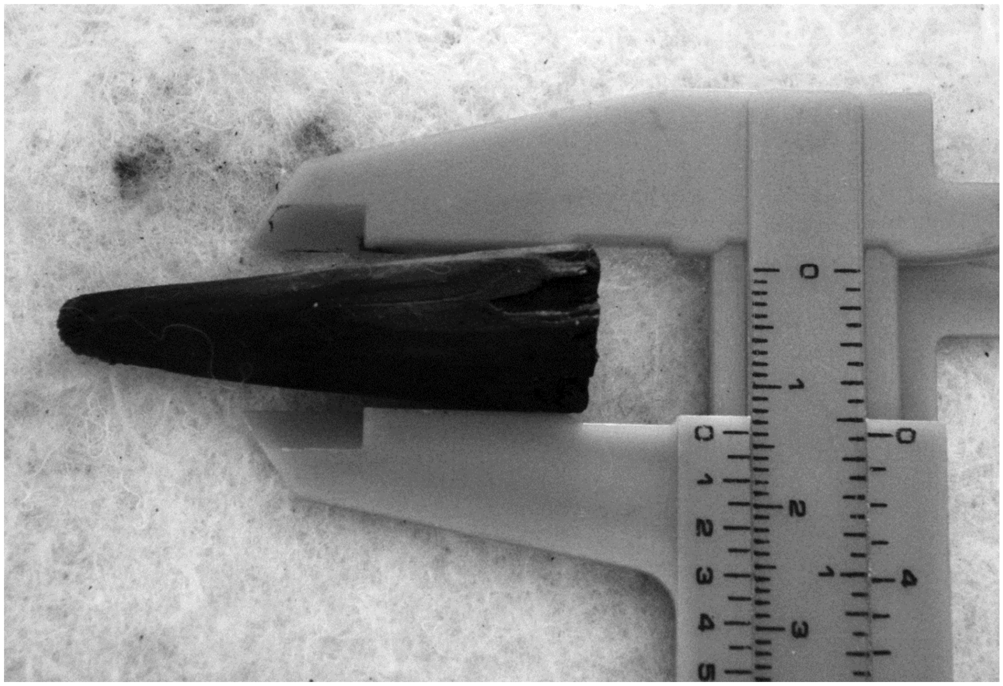

Figure 5.14: Tapered peg from the Stella 1 barge (Castro and Capulli 2016, fig. 6d).

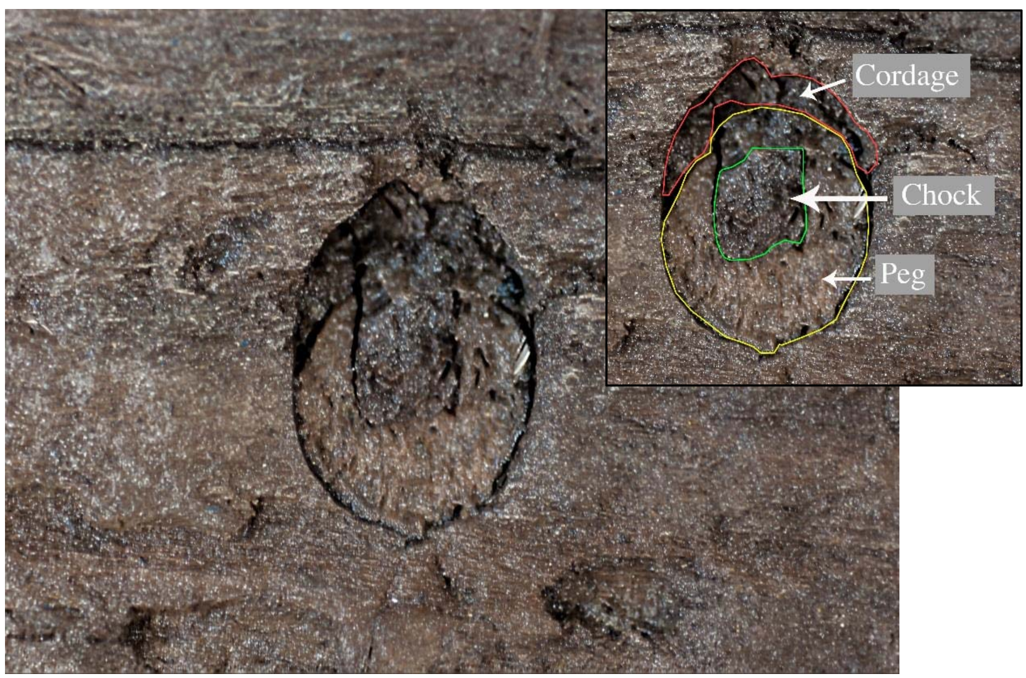


Figure 5.15: Chock in one of the pegs of hull planking fragment 1 of the Venice Lido III timber assemblage (photo by Mirco Cusin).

## Framing System

When the laced shell was at least partially constructed, the frames were added to provide lateral support to the hull. The presence of notches on the underside of the frames, to accommodate the seam wadding, indicates that each frame was made to fit into a specific location in the pre-formed shell. Whether the frames were manufactured while the planks were being assembled or after a significant portion of the shell was constructed is difficult to ascertain. The enlarging of existing notches could indicate that frames were cut to general dimensions to fit into the hull and then adjusted as necessary before final placement.[589] There are both saw and adze marks on the frames of the Stella 1 barge, and the notches generally were cut out with an adze.[590] Castro and Capulli identify limber holes on the frames of the Stella 1 barge in addition to the notches for the lacing system; several of these limber holes were made by sawing two vertical lines a few centimeters apart and then removing the wood in between with blunt force.[591] The floor timbers of the Comacchio ship were cut from trunks, while the futtocks were fashioned from naturally bent crooks.[592]

All frames are rectangular in cross-section and have the aforementioned notches along the bottom face. These notches take a variety of shapes – triangular, rectangular, trapezoidal, and arched. Frames are sided about 5-12 cm and molded about 6-16 cm (see Table 5.3a).[593] In any individual frame, the molded dimension is generally 1-4 cm more than the sided dimension.[594] The pattern of the frames is only preserved in four examples of this tradition, and of these only two are

[589] However, enlargement could also indicate re-use of the timber from an earlier hull.
[590] Castro and Capulli 2016, 35.
[591] Castro and Capulli 2016, 35-6.
[592] Bonino 1985, 93.
[593] An exception to this is the reported dimensions of the rib of the Cavanella d'Adige remains. Tiboni (2009a) states that the rib has a sided dimension of 1.5 cm; it is unclear whether this is a typo in the text, a misinterpretation of a find as a rib, or if this dimension is accurate and the frames of the vessel were this slight in size. The accompanying photo does not clarify this issue.
[594] Venice Lido I has a molded dimension that is 8 cm greater than the sided dimensions.

published (the Stella 1 barge and Comacchio ship). These two hulls present two different framing patterns. The Stella 1 barge has made-frames of floor timbers (some L- or U- shaped), with futtocks attached via flat scarfs and wooden treenails (Fig. 5.16 and 5.17).[595]

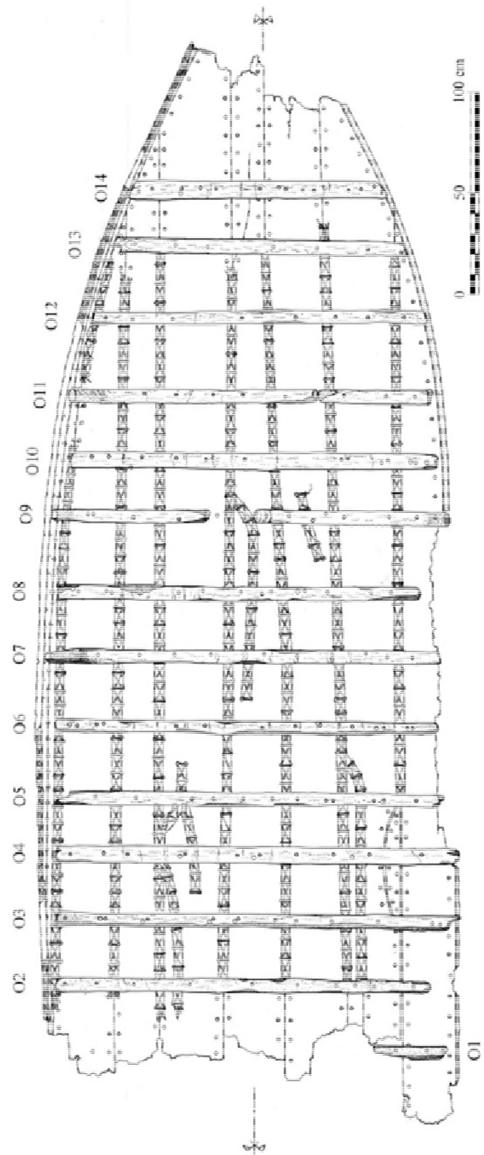


Figure 5.16: The framing pattern of the Stella 1 barge (Castro and Capulli 2016, fig. 3c).

[595] Castro and Capulli 2016, 34-6, fig. 8. Based on unpublished photos of the Altino boat, the framing system seems to follow the pattern of the Stella I barge, although no attached futtocks were observed.

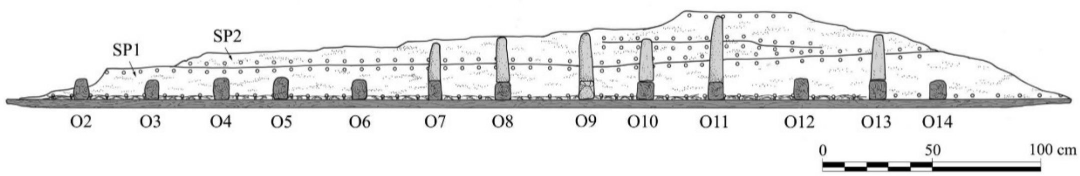


Figure 5.17: Futtocks and side planks of the Stella 1 barge (Castro and Capulli 2016, fig. 3b).

This framing pattern shares some similarities with river boats of central Europe in the bottom-based tradition (sometimes called "Celtic" tradition), such as the Zwammerdam barges, although these vessels tend to have paired L-shaped floors.[596] The builders of the Comacchio ship, by contrast, while also employing large U-shaped floor timbers, extended the sides by inserting futtocks between the floor timbers instead of attaching them directly to the floor timbers (Fig. 5.18).[597] Intriguely, the recently excavated northwestern Adriatic laced boat at Padovetere followed a third framing pattern of paired L-shaped floor timbers, evocative of most central European river boats.[598] The diversity of framing patterns and the similarities noted with the Celtic tradition of boatbuilding suggest that this element of construction was susceptible to modification and perhaps to external influence as well. Although northwestern Adriatic laced boats employed different framing patterns, none of them followed the typical alternating-floors-and-half-frames pattern that dominated Mediterranean shipbuilding at this time.

With the exception of the Comacchio vessel, the frames of this tradition were secured to the planking primarily by means of wooden treenails, which vary in size from 1.0 to 2.0 cm in

[596] De Weerd 1978.
[597] Berti 1990, 29, 32, fig. 14; Bonino 1985, 91.
[598] Beltrame and Costa 2015.

diameter.[599] The treenails of the Stella 1 barge are of two distinct sizes – 1.2 cm and 1.8 cm. As discussed above these variably-sized treenails were manufactured from different species of wood; they were also used both in the same frame, the larger ones being more sparingly used.[600] Castro and Capulli propose that the larger treenails were used to reinforce weak joints.[601] The treenails of any given hull built in this tradition are typically larger than the pegs of the same hull. The exception to this trend is the Venice Lido III timber assemblage,[602] where the pegs (18-23 mm) are larger than the preserved treenails (11-18 mm).[603] The Venice Lido I assemblage may have a similar disparity between its pegs and treenails, but the dimensions of the treenails have not been reported.[604]

The spacing of the frames within the hull is quite variable across the tradition. Some fairly complete hull remains have frames that are spaced as close together as 25-30 cm, as in the Stella 1 barge and Altino boat, and as far apart as 60-100 cm, as in the Corte Cavanella I and II hull remains. Hull planking fragments, such as the Venice Lido I and III timber assemblages, contain evidence for frame spacing based on preserved treenails. These finds have treenails spaced about 29-74 cm and 32-57 cm respectively. The frame spacing of this tradition as preserved within the archaeological record appears to trend toward the greater distance. Seven of the 14 examples of this tradition with evidence for frame spacing have frames spaced over one-half meter (50 cm) apart, three finds have frames spaced about 40-45 cm apart, and four examples have evidence of frame spacing less than 35 cm.

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599 In the Comacchio ship, the floor timbers are lashed to the planking and the futtocks are treenailed to planking.
600 Castro and Capulli 2011, 19-28.
601 Castro and Capulli 2011, 21.
602 Here excluding Fragment 8, which likely represents a separate vessel.
603 The greatest disparity is in Fragment 2, where the pegs are 2.0 cm in diameter and the treenail is 1.1 cm.
604 The published drawings and photos are not high enough resolution to permit an estimation of the dimensions; the treenails do appear to be of equal or lesser size than the lacing channels in some images.

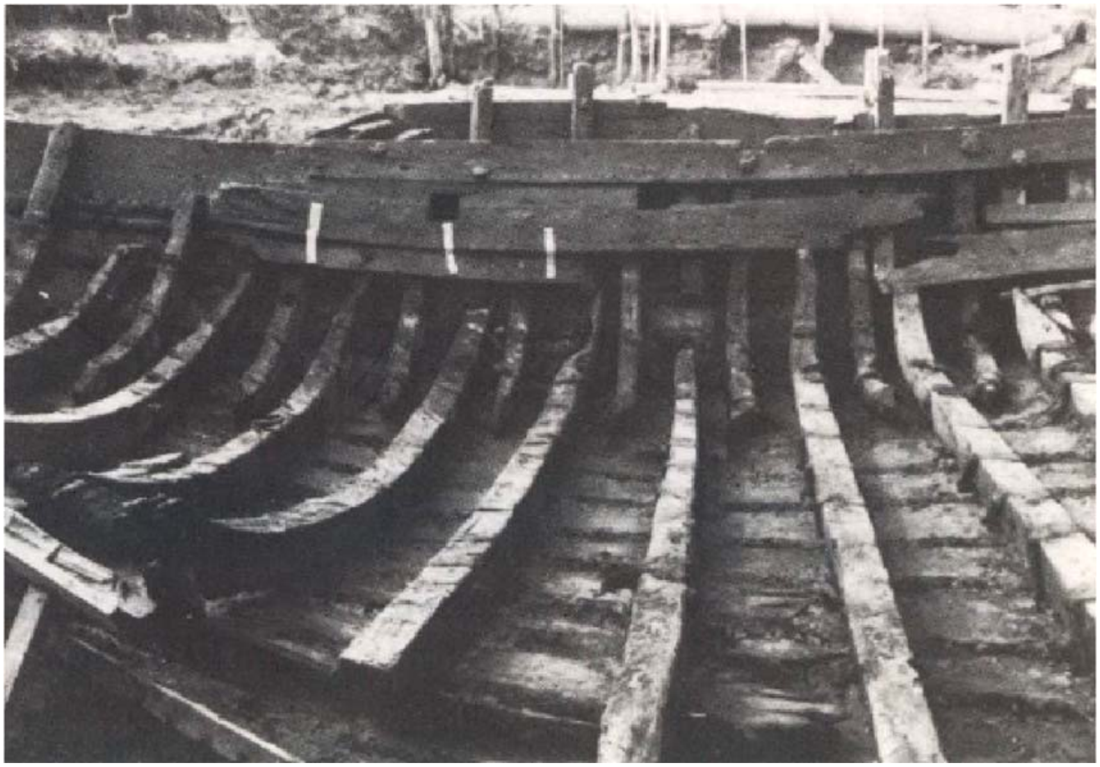

Figure 5.18: Framing pattern of the Comacchio wreck with futtocks placed between the floor timbers (Berti 1990, fig. 14).

Spacing of the frames within the shell of the hull does not seem to be indicative of the date of the hull remains, subregion, or vessel type (see Tables 5.3b, 5.3c, and 5.3d). For example, vessels that are likely coastal traders have frames spaced from about 25 cm (Cervia remains) to 45 cm (Comacchio ship) to an average of 65 cm (Venice Lido I assemblage). Similar variation is seen in the likely river or canal barges. Furthermore, both the earliest (Cavanella d'Adige remains) and the latest (Pomposa Borgo-Caprile remains) finds have frames spaced about 40-45 cm apart. Frame spacing may be a factor of perceived quality of hull planking or the primary body of water for which the vessel was built (canal or river or coast), both of which are difficult to ascertain from archaeological remains.

**Table 5.3a: Dimensions of the Framing System of Northwestern Adriatic Laced Vessels in Alphabetical Order**

| WRECK | Frames | | | | Treenails |
|---|---|---|---|---|---|
| | Sided (cm) | Molded (cm) | Spacing (cm) | Shape of Notches | Diameter (cm) |
| Altino | ~10 | | ~25-30 | triangular | ~2.0 |
| Canale Anfora I | ----- | ----- | 65 | ----- | 2.0 |
| Canale Anfora II | 6-7 | 7-10 | ----- | triangular, arched toward end | ----- |
| Cavanella D'Adige | 5 | 1.5 | 44 | | |
| Cervia | 6-9 | 9-12 | 8-27 | | 2.0 |
| Comacchio | 12 | 16 | 45 | rectangular, trapezoidal at turn of bilge | |
| Corte Cavanella I | | | 60-100 | | |
| Corte Cavanella II | ----- | ----- | 73 | ----- | 1.7 |
| Meolo I | ~5 | ~6 | ----- | triangular | 1.0 |
| Padova | ----- | ----- | 55 | ----- | |
| Pomposa-Borgo Caprile | | | 40 | | |
| Stella 1 | 5-9 | 6-10 | 25 - 30 | triangular, with rectangular limber holes | 1.2 / 1.8 |
| Venice Lido I | 7 | 15 | 29-74 | arched | |
| Venice Lido III | ----- | ----- | 32 / 57 | ----- | 1.1-2.0 |

Measurements are approximated to facilitate a general comparison across finds of the tradition and rounded to the whole number (one decimal for treenail diameter), as precise measurements are not available for all finds. The ~ symbol is used to denote measurements that were taken from published photographs or construction drawings. Cells are left blank when the information is not reported; a dash indicates that the information is not preserved in the hull remains.

**Table 5.3b: Dimensions of the Framing System of Northwestern Adriatic Laced Vessels in Chronological Order**

| WRECK | Frames | | | | Treenails |
|---|---|---|---|---|---|
| | Sided (cm) | Molded (cm) | Spacing (cm) | Shape of Notches | Diameter (cm) |
| Cavanella D'Adige | 5 | 1.5 | 44 | | |
| Comacchio | 12 | 16 | 45 | rectangular, trapezoidal at turn of bilge | |
| Padova | ----- | ----- | 55 | ----- | |
| Stella 1 | 5-9 | 6-10 | 25 - 30 | triangular, with rectangular limber holes | 1.2 / 1.8 |
| Canale Anfora I | ----- | ----- | 65 | ----- | 2.0 |
| Corte Cavanella I | | | 60-100 | | |
| Corte Cavanella II | ----- | ----- | 73 | ----- | 1.7 |
| Canale Anfora II | 6-7 | 7-10 | ----- | triangular, arched toward end | ----- |
| Venice Lido I | 7 | 15 | 29-74 | arched | |
| Venice Lido III | ----- | ----- | 32 / 57 | ----- | 1.1-2.0 |
| Cervia | 6-9 | 9-12 | 8-27 | | 2.0 |
| Pomposa-Borgo Caprile | | | 40 | | |
| **Unknown Date:** | | | | | |
| Altino | ~10 | | ~25-30 | triangular | ~2.0 |
| Meolo I | ~5 | ~6 | ----- | triangular | 1.0 |

Measurements are approximated to facilitate a general comparison across finds of the tradition and rounded to the whole number (one decimal for treenail diameter), as precise measurements are not available for all finds. The ~ symbol is used to denote measurements that were taken from published photographs or construction drawings. Cells are left blank when the information is not reported; a dash indicates that the information is not preserved in the hull remains.

**Table 5.3c: Dimensions of the Framing System of Northwestern Adriatic Laced Vessels by Subregion**

| | WRECK | Frames | | | | Treenails |
|---|---|---|---|---|---|---|
| | | Sided (cm) | Molded (cm) | Spacing (cm) | Shape of Notches | Diameter (cm) |
| **Friuli-Venezia Giulia** | Canale Anfora I | ----- | ----- | 65 | ----- | 2.0 |
| | Canale Anfora II | 6-7 | 7-10 | ----- | triangular, arched toward end | ----- |
| | Stella 1 | 5-9 | 6-10 | 25 - 30 | triangular, with rectangular limber holes | 1.2 / 1.8 |
| **Veneto** | Meolo I | ~5 | ~6 | ----- | triangular | 1.0 |
| | Altino | ~10 | | ~25-30 | triangular | ~2.0 |
| | Venice Lido I | 7 | 15 | 29-74 | arched | |
| | Venice Lido III | ----- | ----- | 32 / 57 | ----- | 1.1-2.0 |
| | Padova | ----- | ----- | 55 | ----- | |
| | Cavanella D'Adige | 5 | 1.5 | 44 | | |
| | Corte Cavanella I | | | 60-100 | | |
| | Corte Cavanella II | ----- | ----- | 73 | ----- | 1.7 |
| **Emilia-Romagna** | Pomposa-Borgo Caprile | | | 40 | | |
| | Comacchio | 12 | 16 | 45 | rectangular, trapezoidal at turn of bilge | |
| | Cervia | 6-9 | 9-12 | 8-27 | | 2.0 |

Measurements are approximated to facilitate a general comparison across finds of the tradition and rounded to the whole number (one decimal for treenail diameter), as precise measurements are not available for all finds. The ~ symbol is used to denote measurements that were taken from published photographs or construction drawings. Cells are left blank when the information is not reported; a dash indicates that the information is not preserved in the hull remains.

**Table 5.3d: Dimensions of the Framing System of Northwestern Adriatic Laced Vessels by Vessel Type**

| | WRECK | Frames | | | | Treenails |
|---|---|---|---|---|---|---|
| | | Sided (cm) | Molded (cm) | Spacing (cm) | Shape of Notches | Diameter (cm) |
| Coastal Trader | Comacchio | 12 | 16 | 45 | rectangular, trapezoidal at turn of bilge | |
| | Cervia | 6-9 | 9-12 | 8-27 | | 2.0 |
| | Pomposa-Borgo Caprile | | | 40 | | |
| | Venice Lido I | 7 | 15 | 29-74 | arched | |
| | Venice Lido III | ----- | ----- | 32 / 57 | ----- | 1.1-2.0 |
| River / Canal Barge | Stella 1 | 5-9 | 6-10 | 25 - 30 | triangular, with rectangular limber holes | 1.2 / 1.8 |
| | Altino | ~10 | | ~25-30 | triangular | ~2.0 |
| | Canale Anfora I | ----- | ----- | 65 | ----- | 2.0 |
| | Canale Anfora II | 6-7 | 7-10 | ----- | triangular, arched toward end | ----- |
| | Cavanella D'Adige | 5 | 1.5 | 44 | | |
| | Corte Cavanella I | | | 60-100 | | |
| | Corte Cavanella II | ----- | ----- | 73 | ----- | 1.7 |
| Unknown | Meolo I | ~5 | ~6 | ----- | triangular | 1.0 |
| | Padova | ----- | ----- | 55 | ----- | |

Measurements are approximated to facilitate a general comparison across finds of the tradition and rounded to the whole number (one decimal for treenail diameter), as precise measurements are not available for all finds. The ~ symbol is used to denote measurements that were taken from published photographs or construction drawings. Cells are left blank when the information is not reported; a dash indicates that the information is not preserved in the hull remains.

**Table 5.3e: Dimensions of the Framing System of Northwestern Adriatic Laced Vessels by Frame Spacing with Hull Planking Thickness**

| | WRECK | Frames | | | | Treenails | Hull Planking |
|---|---|---|---|---|---|---|---|
| | | Sided (cm) | Molded (cm) | Spacing (cm) | Shape of Notches | Diameter (cm) | Thickness (cm) |
| 25-35 cm | Altino | ~10 | | ~25-30 | triangular | ~2.0 | |
| | Cervia | 6-9 | 9-12 | 8-27 | | 2.0 | 3-4.5 |
| | Stella 1 | 5-9 | 6-10 | 25 - 30 | triangular, with rectangular limber holes | 1.2 / 1.8 | 2.5-3.5 |
| | Venice Lido III (Fragment 1) | ----- | ----- | 32 | ----- | 1.8-2.0 | 7.5 / 5 |
| 40-45 cm | Cavanella D'Adige | 5 | 1.5 | 44 | | | 3-3.5 |
| | Comacchio | 12 | 16 | 45 | rectangular, trapezoidal at turn of bilge | | 5 |
| | Pomposa-Borgo Caprile | | | 40 | | | 5 |
| 55-100 cm | Padova | ----- | ----- | 55 | ----- | | 2.5 |
| | Venice Lido III (Fragment 8) | ----- | ----- | 57 | ----- | 2.0 | 6 |
| | Canale Anfora I | ----- | ----- | 65 | ----- | 2.0 | 2 |
| | Corte Cavanella II | ----- | ----- | 73 | ----- | 1.7 | |
| | Venice Lido I | 7 | 15 | 29-74 | arched | | 3 |
| | Corte Cavanella I | | | 60-100 | | | 3.5-4 or 2 |

Measurements are approximated to facilitate a general comparison across finds of the tradition and rounded to the whole number (one decimal for treenail diameter), as precise measurements are not available for all finds. The ~ symbol is used to denote measurements that were taken from published photographs or construction drawings. Cells are left blank when the information is not reported; a dash indicates that the information is not preserved in the hull remains.

The thickness of hull planking may also have influenced the builders' spacing of the frames (see Table 5.3e). A suggestive pattern is possible whereby thinner hull planking is combined with more closely spaced frames in the Stella 1 barge and Cervia hull in comparison to thicker hull planking combined with frames spaced further apart, as in the Comacchio boat, Pomposa Borgo-Caprile hull remains, and the Venice Lido I timber assemblage. However, some vessels combine both thinner hull planking and widely spaced frames (Padova remains, Canale Anfore I remains, and Corte Cavanella II boat). Perhaps these vessels were intended for use only in sheltered waterways, such as canals and lagoons, and required only minimal lateral support.

Drawing conclusions based on incomplete remains, however, is risky. In the Comacchio hull, the spacing of the frames varied based on their position in the hull, with frames toward the extremities spaced closer together than the frames in the center (spaced as far apart as 60 cm amidships). The Comacchio ship, therefore, helps to contextualize other incomplete examples of this tradition, such as the Cervia, Venice Lido, and Pomposa Borgo-Caprile hull remains. The frame spacing preserved in these hull fragments may not represent the average frame spacing of the vessel from which they came. As more mostly complete vessels are excavated (such as the Padovetere ship, Altino boat, and Corte Cavanella I boat), a clear pattern might emerge. Of course, there is always the possibility that frame spacing was a matter of community (or even individual) preference and training or perhaps even availability of materials.

## **Other Internal Timbers**

Once the frames were in place, additional internal timbers were added. Both the Comacchio ship and the Stella 1 barge had ceiling planking placed over the frames. All the ceiling planking of the latter was removable (i.e., not fixed to the frames), while the central ceiling plank of the former was nailed to the frames.[605] In addition, the ceiling planking of the Comacchio ship had a series of Roman numerals carved into the upper face at one end. According to Fede Berti, these Roman numeral markings are contemporary with the construction of the vessel, and probably were used to re-place these planks when they were removed to access the interior of the hull.[606]

Other than the ceiling planking, no other internal timbers are preserved on the Stella 1 barge. On the Comacchio ship, however, a keelson and seven port-side stringers, with square recesses for the upper beams, are preserved. The stringers were nailed to the futtocks to provide additional longitudinal support.[607] According to Marco Bonino, there is also evidence for cross beams and partial decks.[608] While a mast step was not preserved in the Comacchio hull, several sheave blocks were found during the excavation; these rigging elements suggest that the vessel was sailed.[609]

## Location and Season of Manufacture

In order to explore the location and season of manufacture of the materials of the lacing system, and perhaps of the hull itself, a pollen analysis of the seam wadding and cordage from sampled hull remains was performed. Over three summers, a total of 19 samples were collected from three northwestern Adriatic laced vessels; these include cordage samples from eight of the ten hull planking fragments of the Venice Lido III timber assemblage, cordage and seam wadding samples from both an original seam and a repair seam of the Stella 1 barge, and cordage and seam wadding samples from the Canale Anfore II hull remains. Of these 19 samples, 11 yielded at least 50 grains of identifiable pollen, and only three samples did not produce enough pollen to support

[605] Berti 1990, 32; Bonino 1985, 93; Castro and Capulli 2016, 36.
[606] Berti 1990, 32.
[607] Berti 1986, 26; 1990, 32; Bonino 1985, 93.
[608] Bonino 1985, 93
[609] Cornelio Cassai 1990.

speculative conclusions or reinforce observed trends.[610] All samples were measured to a consistent weight (1 gm)[611] and processed according to standard practices for extracting pollen from an archaeological sediment sample.[612] See Appendix B for a full description of the extraction method and pollen identifications.

*Interpreting Pollen*

The study of archaeological pollen has become an integral part of many site analyses. Pollen has been a powerful tool in revealing cultigens for sites of domestication, and for reconstructing past environments.[613] The contents of storage and transport containers, such as amphoras on shipwrecks, have been identified through pollen analysis.[614] Even bilge mud has been shown to contain clues to ships' cargoes through the application of palynology.[615]

But what do the pollen microfossils trapped within the cordage and seam wadding material of these northwestern Adriatic hull remains represent? Other scholars have conducted pollen analysis on ancient watercraft with variable success. Diot was able to differentiate various harvesting locations of the moss used in the construction and repair of a 16th-century river boat based on a pollen analysis of the moss caulking.[616] Muller has argued that the pollen trapped in the resins of three Mediterranean shipwrecks reflects the vegetation surrounding the shipyard itself, and furthermore proposed a location for the construction of the *Baie-de-l' Amitie* shipwreck based

[610] While only five samples yielded a traditional 200 grain pollen count, it should be noted this standard is intended for soil analysis (among others) and not necessary to draw valid conclusions for archaeological material.
[611] The available cordage material for some hull remains restricted the weight of all samples so that consistency could be maintained. It is likely for future studies that a larger sample size would yield more definitive results.
[612] Pearsall 2000.
[613] Pearsall 2000, 249-51, 264-69.
[614] Bryant and Murray 1982; Gorham and Bryant 2001.
[615] Bryant 1995; Gorham and Bryant 2001.
[616] Diot 1994.

on the presence of a specific pollen grain (*Platanus*).[617] Unfortunately, Muller did not take into account that resins are often a mixture of various conifers from disparate locations, thus complicating any interpretation of the pollen.

In order to interpret the results of a pollen analysis, it is critical to understand how and when the pollen was integrated into the examined material. Pollen microfossils could have become incorporated into these materials at any point after the fibers were exposed: for the cordage, that would be after the leaves of the esparto grass sprouted; for the seam wadding, that would be after the harvesting of the bark from the lime tree. I argue, however, that it is likely that the majority of microfossils present in these materials were introduced during the manufacturing of the materials, in particular, during the retting stage. As the fibers soaked for several weeks, they would have accumulated the local pollen present in the body of water. The esparto grass then was spun tightly into cordage, while the lime bast was lumped and twisted together and then sealed with resin.[618] For both materials, the pollen from the retting site likely was locked into place at this stage. The relatively short duration of processing for these fibers could permit an identification of the season of manufacture.

To a lesser extent, the pollen microfossils may represent the environment where the boat was used as pollen in the bilge water could have permeated the resinous lining of the seam wadding and the twisting of the cordage to become trapped inside. A preliminary pollen analysis of cordage and seam wadding material from the same place on the Stella 1 barge, however, yielded two distinct pollen make-ups, reflecting disparate environments. Since these samples of cordage and wadding were both used in construction of the same vessel, the discrepancy in palynomorphs from

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[617] Muller 2004, 347-48.

[618] In order to release pollen from pitch or resin, a solvent must be used during the initial stages of processing. This was not done so that only pollen from the processing of the lime bast would be present.

each indicates different manufacturing sites, as opposed to different locations of use and deposition. In order to privilege pollen from the manufacturing site even further, seam wadding samples were extracted from the core of the wad and cordage samples were rinsed off lightly then untwisted to release the interior pollen grains. While an exact recreation of the environment cannot be reconstructed based on a pollen analysis of archaeological material, the pollen microfossils can offer clues as to the location of the manufacturing of the material, possibly the same as the construction site of the boats themselves.

*Pollen Results*

The samples of seam wadding material from the Stella 1 barge were acquired from both an original seam and a repaired seam.[619] The principal taxa present in these samples (see Fig. 5.19) include grasses (POACEAE, 16-34% of total count, with 18-22% of grasses being possible or very likely cultivated species),[620] APIACEAE (carrot family, 0-9%, although this was fairly variable across samples), and stinging nettle (*Urtica*, 6-25%). There was a low percentage of other taxa (such as ASTERACEAE,[621] BRASSICACEAE,[622] and Cheno-Am[623]). With the exception of hackberry (*Celtis*), there are otherwise low percentages of arboreal taxa.[624]

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[619] A preliminary analysis of one seam wadding and one cordage sample collected during the summer of 2011 was conducted in 2013 to test the preservation of pollen and the viability of an analysis. Two samples of seam wadding and two samples of cordage were collected in the summer of 2014 for an expansion of this study. These 2014 samples are considered the primary samples, and the 2011 samples are discussed here in support of the 2014 data.

[620] The standards set by Andersen 1978 were used to group POACEAE pollen into three categories: wild grasses, possible cultivated species (overall size 32-45 microns and annulus diameter of 8-10 microns), and very likely cultivated species (grain size over 40 microns and annulus diameter over 10 microns).

[621] Family of flowering plants including sunflowers, daisies, and dandelions. Some species are used for oils, herbs, teas, etc. while others are considered invasive (i.e., weeds).

[622] Known as the mustard family, it includes many important food products such as cabbage, broccoli, cauliflower, turnip, horseradish, and, of course, mustard.

[623] A classificatory group that includes the family CHENOPODIACEAE (goosefoot family) and the genus Amaranthus, which includes ornamental flowering plants and weeds. Their pollen grains are very similar in appearance and difficult to distinguish from each other.

[624] Comprising only about 25% of the total pollen count.

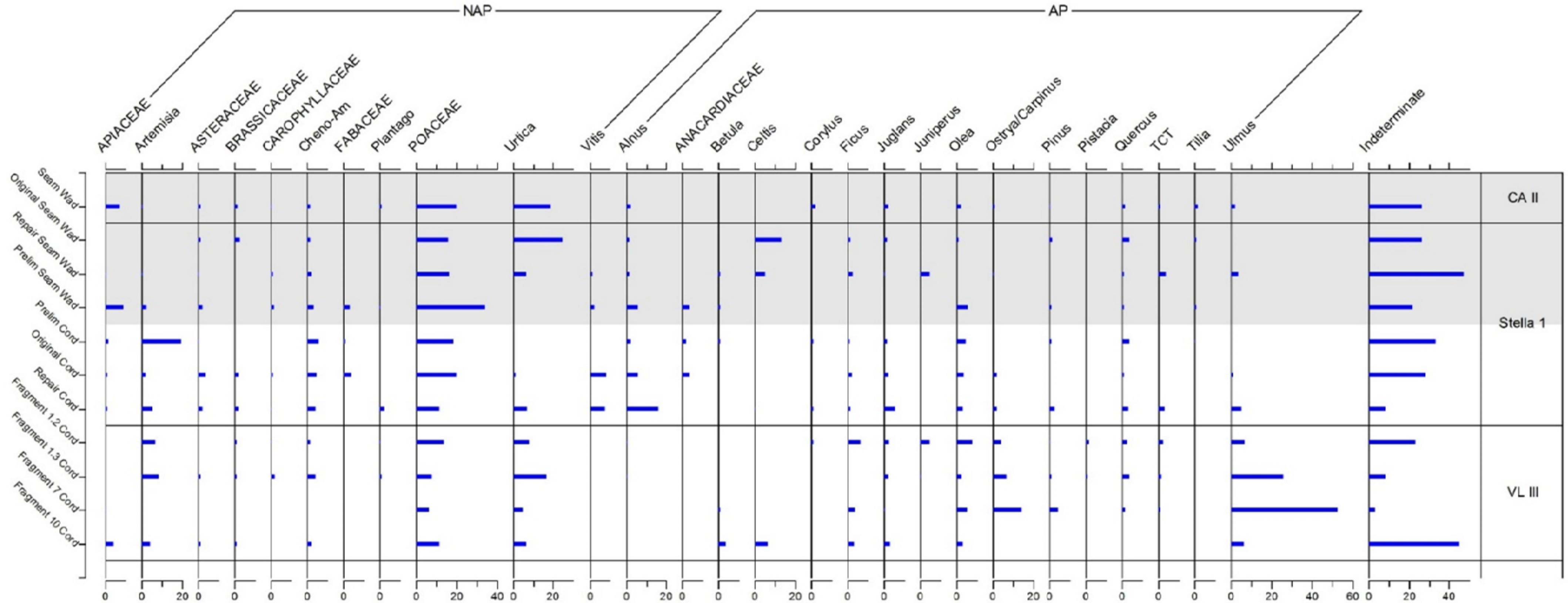


Figure 5.19: Pollen percentages of samples with over 50 identifiable grains (selected taxa over 1.5%). Shading indicates disparate fibrous material (seam wadding in gray, cordage unshaded). Samples are further zoned by vessel or hull remains (CA II = Canale Anfore II hull remains, Stella 1 = Stella 1 river barge, VL III = Venice Lido III hull remains). TCT includes the families TAXODIACEAE, CUPRESSACEAE, and TAXACEAE, commonly lumped together due to similar morphology. Indeterminate pollen grains were too deteriorated to permit identification.

As with the seam wadding sample, the cordage samples from the Stella 1 barge were taken from both a repaired seam and original seam. The cordage from the Stella 1 barge included a large percentage of *Artemisia*[625] and other ASTERACEAE (6-27%), a fair amount of grasses (12-20%, almost all wild species), and a notable percentage of *Vitis*[626] (8%) and Cheno-Am (4-6%). The two samples of cordage from original seams varied markedly in relation to arboreal taxa (24% for the sample from the original seam and 46% for the sample from the repair seam). The repair seam sample has significantly more alder (*Alnus*) and slightly more elm (*Ulmus*) and walnut (*Juglans*) than the sample from the original seam.

Unfortunately, the cordage sample taken from the Canale Anfore II hull remains did not yield enough viable pollen to warrant discussion. The seam wadding from the Canale Anfore II hull remains had a high frequency of grasses (21% of POACEAE count is a possible cultivated species and about 5% is very likely a cultivated grass) and stinging nettle. The only other taxon with more than 2% of the total count is APIACEAE (7%). Although the arboreal taxa only comprise 19% of the total count, there are 14 identifiable genera of trees. These mostly represent a mixed deciduous forest (*Quercus, Ulmus, Tilia, Alnus*)[627] alongside likely cultivated trees such as *Olea* (olive) and *Juglans*.

Only four samples of cordage from the Venice Lido III timber assemblage contained more than 50 identifiable pollen grains. The principal taxa present in these samples, with the exception of the one taken from hull planking fragment 7, include grasses (only 11-14%, almost entirely wild grasses with only 4 possible and 1 very likely cultivated grains noted across all samples), *Artemisia* and other ASTERACEAE (5-10%), and *Urtica*[628] (5-17%). Other noteworthy taxa include Cheno-

[625] Hardy shrubs that include wormwood and sagebrush.
[626] Grapevines.
[627] Oak, elm, lime or linden, and alder.
[628] Commonly known as stinging nettles.

Am (2-4%) and a limited amount of other common cultivated plants (such as BRASSICACEAE, APIACEAE, and FABACEAE[629]). Arboreal pollen was highly represented in three of the four samples, comprising over 40% of the total pollen count (43-84% arboreal pollen). The arboreal genera include *Ulmus, Ficus, Juniperus, Olea, Ostrya/Carpinus*,[630] and *Quercus*.

Two grains of *Lagerstroemia* (crepe myrtle) were identified in one of the hull planking fragment 1 samples. The presence of this genus represents modern contamination as the crepe myrtle was not introduced to Europe until the 14th century.[631] However, the overall pollen spectrum of this sample strongly correlates to other samples from this hull planking fragment. Thus, it is likely that contamination was minimal; still caution must be used in drawing conclusions from this sample.

*Discussion*

In many ways, the pollen counts presented here correspond with broad pollen spectra of the Mediterranean region. The high frequency of grass pollen grains is to be expected in most pollen counts. However, other wind-pollinated genera commonly overrepresented in pollen counts, *Pinus* in particular, are present in this study only to a limited degree.

Overall, the seam wadding samples from both the Stella 1 barge and the Canale Anfore II hull remains compare favorably with paleoenvironmental reconstructions of northeastern Italy. The low percentage of *Tilia* pollen in the likely *Tilia* bast may point to the likelihood that the inner cambium, or bast, was harvested after the trunk was separated from the pollen producing parts of the tree, and therefore the pollen microfossils are a by-product of the construction, or "shipyard", environment and not the cultivation environment of the material itself.

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[629] The bean family, including also peas, soybeans, peanuts, chickpeas, as well as weeds.
[630] Commonly known as hop-hornbeam and hornbeam respectively.
[631] Pooler 2006, 855.

The pollen represented in the seam wadding samples of these two vessels can be divided generally into two categories, the arboreal pollen (*Quercus, Alnus, Celtis, Populus, Ficus, Olea, Carpinus, Juniperus, Ulmus, etc.*) and the genera that relate to agricultural products (*Vitis, Olea, Artemisia*, *Cerealia*, and likely many members of the Cheno-Am), with the olive tree (*Olea*) possibly fitting into either category. A study of two contemporaneous sites in southern Campania used a similar division of pollen microfossils to discuss the cultivated and uncultivated components of the environment, noting the coexistence of agriculture and woodland management within a single landscape during the Roman era.[632]

The low frequency of most arboreal taxa indicates either the remote presence of a deciduous mixed oak forest or that the bast fibers were processed before or after the typical flowering period of most deciduous species (May-June). Several other studies of Roman sites in Italy have identified deciduous forest vegetation within the pollen microfossils.[633] Oak and alder, in particular, were amongst the most prevalent pollen grains in studies by Giachi et al. of the Roman harbor at Pisa, as well as the findings of Kaltenrieder et al. at Lago della Costa in the Po Valley region of northeastern Italy during the first century C.E.[634]

The pollen microfossils from the seam wadding material of the Stella 1 barge and Canale Anfore II hull remains compare especially well with the Lago della Costa site and the Piazza Garibaldi at Parma, also in northern Italy. Piazza Garibaldi was characterized mostly by mixed oak woods, with conifers and broadleaved trees (*Pinus, Betula, Abies*) in the hills and mountains of the Apennines, as well as some hygrophilous woods (*Alnus*), with cereal fields, legumes, medicinal and spice plants, grapevines and fig trees cultivated during Roman times.[635] The cereal

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[632] Allevato et al. 2012.
[633] Allevato et al. 2012, 2010; Bosi et al. 2011; Giachi et al. 2003; Kaltenrieder et al. 2010.
[634] Giachi et al. 2003, 270-71; Kaltenrieder et al. 2010, 684-85.
[635] Bosi et al. 2011, 1628-29.

fields of the Roman era at Piazza Garibaldi are mirrored in the seam wadding samples by the high percentage of possible and likely cultivated grass pollen, the medicinal and spice plants by *Artemisia* and Cheno-Am pollen grains, the grapevines directly represented by *Vitis*, and possible orchards of *Olea*. Furthermore, the presence of a high altitude boreal to temperate forest – represented by spruce (*Abies*), birch (*Betula*), and beech (*Fagus*) – also noted at other Italic sites, appears to be a minor component of the surrounding environment of these samples.[636] Finally, a hygrophilous environment is indicated not only by *Alnus* (Alder), but also the presence of *Plantago*,[637] suggesting another minor component of a wet (fluvial or lacustrine) landscape.

Thus, the area surrounding the manufacturing site of the seam wadding material of the Stella 1 barge and Canale Anfore II hull remains, and likely of the vessels themselves, appears to consist primarily of cultivated grasslands, the likely presence of a mixed oak deciduous forest, with encroaching elements of both high altitude and hygrophilous environments. The Friuli-Venezia Giulia region, where both examples of this tradition were recovered, is characterized by a large flat plain of cultivated grasslands abutting directly against the Italian Alps, with groundwater coalescing into major fluvial systems towards the Adriatic coast. The environmental evidence suggested by this pollen analysis supports the location of the shipyard of both of these vessels in the Friuli-Venezia Giulia region. Unfortunately, no known paleoenvironmental reconstruction of this region has been published, so a direct comparison to local sites, such as Aquileia, is not possible at this time.

Regrettably, some of the most frequent pollen taxa in this data set – the grasses and the stinging nettles – are not useful for determining the season of manufacture as both have long

[636] Allevato et al. 2012, 2010; Giachi et al. 2003; Kaltenrieder et al. 2010.
[637] Commonly known as plantains (although should not be confused with the banana-like plant) or fleaworts.

periods of pollen shedding (up to 10 months, February through November, for grasses).[638] The high frequency of hackberry in the Stella 1 barge may indicate that the material was processed in the late spring, whereas the high frequency in both the Stella 1 barge and the Canale Anfore II hull remains of APIACEAE pollen, which has two periods of pollen shedding, could signify a season of manufacture in either late spring or late summer.[639] Considering the overlap between *Celtis* and APIACEAE pollen shedding periods, a manufacturing season in late spring is more likely of the two.

Overall, most of the cordage samples from both the Stella 1 barge and the Venice Lido III timber assemblage compare favorably with paleoenvironmental reconstructions of southeastern Spain. The particularly significant elements of the pollen spectra that correlate to the dry or semi-arid environment of southeastern Spain are the higher frequency of ASTERACEAE type (including *Artemisia*), as well as higher Cheno-Am and wild grasses.[640] The cordage samples from the Stella 1 barge also contained a high percentage of *Vitis* (8%), as well as higher percentages of wild grasses than those found in the samples from the Venice Lido III timbers. The high percentage of *Vitis* likely indicates the presence of a vineyard in the immediate area of the manufacturing site.[641] This may also indicate that the fibers were processed during the summer (likely in June) to correspond in peaks in not only *Vitis* pollen production, but also in ASTERACEAE and Cheno-Am.

[638] Longo and Martini 2002, 33-4, 38, fig. 5.
[639] Longo and Martini 2002, 38, fig. 7.
[640] See Carrion et al. 1998 and Tallon-Armada et al. 2014 for paleoenvironmental reconstructions of southeastern Spain. North Africa as a possible manufacturing location cannot be ruled out at this stage as pollen spectra also have a high degree of ASTERACEAE and Cheno-Am types, but the presence of high-altitude (such as *Abies*) makes North Africa a less likely candidate. Furthermore, the lacuna of paleoenvironmental reconstructions of Roman North Africa problematizes comparisons.
[641] Turner and Brown (2004) found that over 2% *Vitis* in the total pollen count likely indicates the presence of a vineyard.

The large percentage of elm in several of the Venice Lido III cordage samples, particularly from hull planking fragment 7, may indicate a retting site in or near a riparian woodland, where *Ulmus,* along with *Carpinus* and *Alnus*, commonly grow. It is also likely that the cordage was processed during early spring (particularly in March) when *Ulmus* pollen counts are at their highest.[642] An early spring manufacturing season for at least some of the cordage from the Venice Lido III timber assemblage may also explain the low pollen concentration in most of the collected samples. However, low pollen counts may also be due to small sample size. The complete lack of expected pollen grains in Hull Planking Fragment 7 (including *Artemisia*, other ASTERACEAE types, and Cheno-Am), as well as an overall low number of identified genera (only 15 taxa were identified), could also be attributed to the grass being spun into cordage prior to the high point in most flowering seasons. If this particular cord was processed very early in the spring, then these other genera would not be actively producing pollen and their inclusion in the sample would be less likely.[643] Of course, the possibility that this material was not manufactured in southeastern Spain must also be considered. It is possible that this cord was manufactured or underwent repair while in northeastern Italy, unbound, re-retted and/or spliced with another length of cord, with new pollen local to the northwestern Adriatic littoral being introduced in the process. Lastly, the high counts of elm pollen may be due to the cordage being processed in the same location that the elm timber was also processed, that is, in a timber yard or even the shipyard of northwestern Adriatic laced boats.

Finally, there were no compelling differences between the materials used on the repair seam versus the original seam in the Stella 1 barge. There are more genera identified in both materials (cordage and seam wadding) of the repair seam when compared to the original seam,

[642] Longo and Martini 2002, 38, fig. 2.
[643] Longo and Martini 2002, 32-3, fig. 7.

and the cordage sample from the repair seam has a higher frequency of arboreal taxa, but it is difficult to draw conclusions from the limited number of samples examined here.[644] Instead, it is likely that both materials (cordage and seam wadding) in all seams were each manufactured at the same time and place. Furthermore, the similarity of pollen trapped in the seam wadding samples of this boat likely indicates that the sampled repair seam was laced at the same time as the original seams of the vessel (whether this was during routine maintenance or the original construction cannot be ascertained).

Altogether, this pollen analysis suggests that most of the esparto grass cordage was likely manufactured in Spain and then shipped to Italy. As such, the examination of this material does not contribute to an understanding of when and where the vessel it laced together was constructed. The pollen trapped in the seam wadding material, however, likely does reflect the location (and to a limited degree the season) of manufacture of the vessel. Further analysis of this material, particularly from other vessels of this tradition, holds promise for refining our understanding of the manufacturing stage of northwestern Adriatic laced vessels.

## USE, MAINTENANCE, AND DISCARD

The other three technical stages or operational sequences of northwestern Adriatic laced vessels are use, maintenance, and discard. The archaeological evidence for the use and discard of these watercraft were addressed in Chapter 4. To reiterate, the only evidence that survives in the archaeological record is for their use as cargo carriers. The remains indicate that these laced vessels served as river and canal barges, as well as larger trading vessels. Their known cargoes include

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[644] Twenty-four identified types in the wadding from a repair seam versus 14 identified types in the wadding from an original seam and 26 identified types in the cordage from a repair seam versus 19 identified types in the cordage from an original seam.

the locally produced roof tiles of the Stella 1 barge and the eclectic cargo of the Comacchio boat including over 100 lead ingots from Spain, boxwood logs, and amphoras likely carrying foodstuffs.[645] However, there is a well-documented bias in the archaeological record of ancient boats and ships for merchant vessels, particularly carrying inorganic cargoes. Northwestern Adriatic laced vessels possibly were used for other purposes – such as to transport organic cargoes (e.g. humans, agricultural products, timber, and livestock), as rowed galleys, or as fishing boats. Unfortunately, these uses are rarely preserved in the archaeological record, so cannot be verified at this stage in the research (if ever). Finally, as discussed earlier, there were various methods for discarding the hull remains, the final operational stage. The hulls were wrecked and/or abandoned and hull planking was salvaged and reused in other construction projects.

**Maintenance**

A cursory overview of the laced vessels of this tradition reveals an abundance of evidence for maintenance, primarily of the hull planking, as almost all the partial and fragmentary hulls of this tradition have clear signs of repair. These repairs include stitching up cracks in the planking as well as more substantial breaks. The exception to this trend may be the Comacchio wreck; no repairs are mentioned in the final publication and no definitive evidence for repairs can be detected in published photos or construction drawings of the hull. It is possible that the Comacchio ship was a fairly new vessel when it was wrecked.

However, despite this abundance of laced cracks and breaks to the hull planking, it is almost impossible to determine if these cracks and breaks were original to the building of the vessel (incorporating damaged planking) or truly represent subsequent maintenance of the hull.

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[645] Berti 1986, 28-32; Castro and Capulli 2016, 31; Vitri et al. 2003, 329-31.

While it is not likely that the builder would have used cracked or damaged planking originally, this possibility cannot be ruled out in most cases. There are a few examples of definite maintenance to the hull planking of northwestern Adriatic laced vessels. In the Stella 1 hull, a section of one frame was removed in the middle of the vessel, likely to access a crack in the hull planking that subsequently was re-laced or repaired (see Fig. 5.16).[646]

Hull planking fragment 8 of the Venice Lido III timbers also shows signs of repair. Although the edges of this fragment are highly damaged, there are areas on either side of the lacing channels (along one edge) that could accommodate more channels but do not; the lacing system simply stops mid-plank. Furthermore, there appear to be two boring or gouging directions for the present lacing channels along this edge (see Figs. 5.20 and 5.21).[647]

Figure 5.20: The external face of hull planking fragment 8 of the Venice Lido III timber assemblage showing two channels cut in opposite directions (photo by author).

[646] Castro and Capulli 2016, 33-4.
[647] Fashioned in opposite directions – one angled down from the lengthwise center of the plank and one angled down from the edge of the plank.

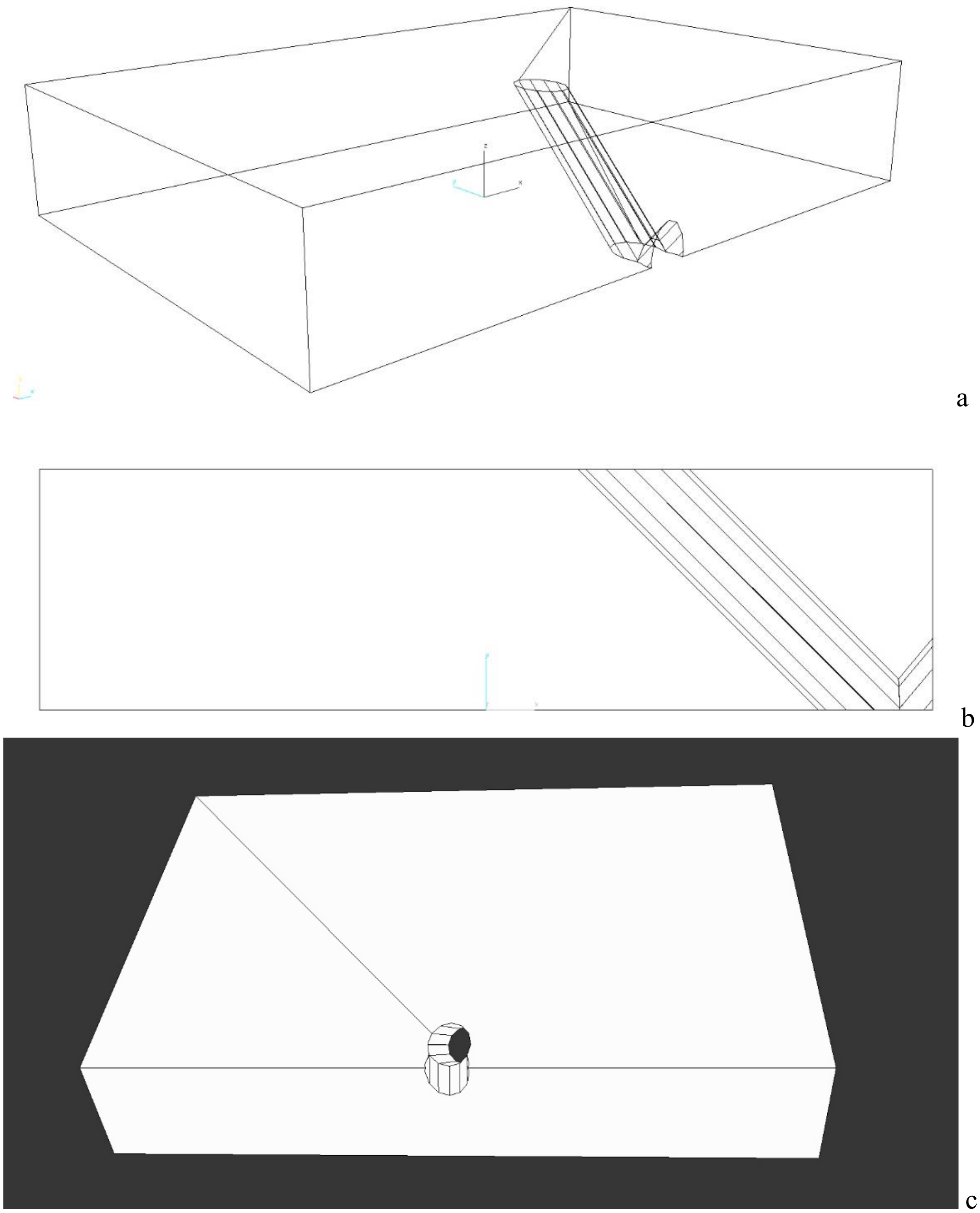

Figure 5.21: Schematic drawings of the two opposing channels along the repaired edge of Venice Lido III hull planking fragment 8. Three views: (a) perspective view with the internal face of the plank at the top, (b) side view with the internal face at the top, and (c) top view with external face of the plank at the top, mirroring the image in Fig. 5.20 (drawing by Seth Willis).

These peculiar features of construction likely indicate an ancient repair to this plank during the life of the vessel. The original plank would have been considerably wider than its current preserved width. At some point in its life, the middle section of the plank was damaged and a repair was necessary. Eleven channels were drilled to attach a repair plank in the center section of what remained of the plank.[648] Since this plank was still attached to the hull, normal edge cavities could not be carved, so instead a gouge was used to punch out holes to open up an edge cavity or secondary channel due to limited access to the plank edge. In this manner, the channels running in opposing directions were fashioned and a repair section of planking was added. During deposition or post-deposition, the plank broke lengthwise along the repair; the area that lacks lacing channels at each end of the preserved fragment represents the portion of the plank that was still intact at a larger width in the hull of the vessel.

Does maintenance of the hull reflect the work and decisions of the original builders or the subsequent users of the vessel, if these were indeed separate entities? As there are no major differences noted between the size, orientation, and spacing of the lacing channels between sections of repair and original seams, it is likely that those repairing the hull would also have been capable of building one (or at least participate in the building if not be responsible for the ultimate design, a "shipwright"). Furthermore, the same tools needed to make the repairs would also have been used by the boatbuilding community. Thus, using the available archaeological evidence, it is not possible to distinguish from original builders and subsequent repairers. For several vessels – particularly the smaller river and canal boats – the original builders and subsequent repairers may have been identical as the boats likely did not travel long distances from their building sites and any damages could be triaged for a short return journey to the building site. However, some

[648] These holes would have been drilled to the bottom of the plank, angled down from the lengthwise midline of the plank.

presumed coastal traders also show signs of repair, such as the Venice Lido III timber assemblage. As these vessels had the potential to travel further from their original building sites, it could be possible that at least one of the sailors aboard ship was trained in enough of the building practices of the northwestern Adriatic laced tradition to fashion new lacing channels and repair any cracks that occurred during the journey.

## DECISION-MAKING STRATEGIES

There is a consistency in the manufacturing process of northwestern Adriatic laced vessels – saw the planks, drill or gouge out the channels, cut out edge cavities, align the planks, set the seams, lace in a criss-cross pattern, plug the holes, and repeat. Whirl and spin. Scrape and bore. Turn, twirl, gouge. Twist and slop. Pierce, thread, pull. Flex and tug. String and stretch. Coil, wrench, bind, snip. Repeat. These are the actions, the motions, of this ancient boatbuilding community. The rhythm of the bow drill. The slap of the caulking. The rasp of the lacing. Loop by loop, plank by plank, these builders worked their craft, built new vessels using old methods, and trained new generations in the tradition.

In shell-based boatbuilding traditions, the fashioning of planks into a shell is arguably the vital process. In this regard, the hull remains of northwestern Adriatic laced vessels have very few, if any, similarities with boats and ships of contemporary Mediterranean shipbuilding practices. As has been discussed throughout this chapter, the builders of northwestern Adriatic laced vessels had various options for each technical stage of the *chaîne opératoire*. At the broadest level, they could have employed the more prevalent mortise-and-tenon joinery building tradition – the Comacchio ship proves that northwestern Adriatic laced builders either collaborated with other builders knowledgeable in this Mediterranean joinery system or that they themselves were adept in it. However, even at the individual stages of the *chaîne opératoire*, such as the procurement of raw materials, or in the minutiae of construction features, such as the size and spacing of the lacing channels, other potential solutions were available to the ancient builder. Instead, these materials and construction features represent intentional choices on the part of this community of builders. The features of the *chaîne opératoire* that remain stable over time and across the region indicate the foundational aspects of the tradition, the ones that were passed down most carefully and assiduously from one generation to the next. On the other hand, the dynamic features potentially represent individual builder decisions or community strategies.

The stable features of this tradition of boatbuilding include the flat-bottom nature of all vessels; the preference for hardwoods for hull planking and frames, lime bast fibers for the seam wadding, and likely esparto grass for cordage;[649] the banded-X lacing pattern; the diameter and spacing of lacing channels, likely reflecting the use of a consistent if organic unit of measurement, and the expansion of the edge cavities. The variability seen in the size and spacing of the lacing channels likely is related more to minor aberrations in handcrafted tools and the natural proportions of builders' bodies than it is to an actual difference in practice (at least that can be detected in the archaeological record). These features comprise the most basic aspects of the tradition and required attentive and deliberate training strategies on the part of active builders in order to transfer them faithfully from one generation to the next for over 800 years.

The selection of materials for northwestern Adriatic laced shells brings this tradition into stark contrast with that of mortise-and-tenon joined shells. Within the latter, the joints tended to be made of hardwoods (tenons frequently of oak), while the hull planking was of softwoods (most frequently pine). Instead, within the northwestern Adriatic tradition, the pattern is reversed – the

[649] The limited number of remains that have identified cordage material makes it impossible to evaluate the stability of a preference for this material across time, but so far it has proven stable across subregion and vessel type.

joints are soft (fibers) and the hull planking is hard (elm and oak). Elm planking was long-lasting, but the grass cordage and bast wadding required regular maintenance. This dichotomy between hard and soft, rigid and flexible, durable and ephemeral, is both intriguing and confounding. What advantage did the builders perceive in this arrangement? Or was it such a longstanding practice that its merits were more sociocultural, embedded within the identities of this community of builders, than purely functional?

Lastly, based on the pollen analysis of the seam wadding from the Stella 1 barge and Canale Anfore II remains, these vessels at least were likely built in early spring and perhaps near the waterway that would be at least one of their primary pathways over the course of their life-histories. Additional palynological studies of more vessels (and more samples per vessel) are needed in order to verify and establish this as a trend within the tradition.

Despite the stability of many aspects of this tradition of boatbuilding, there are several dynamic features that were observed in the surviving remains. While all known vessels are flat-bottomed, they have various hull shapes. The builders could use this method of construction to make small, hard-chined barges or large, rounded hulls. Discrete dynamic elements of the tradition also include the choice of woods for pegs and treenails, the number of passes with cordage, the general framing pattern, how wood was sawn into planks or shaped into frames, the types of scarfs used to fashion longer runs of planking, and unique features (such as the use of one or two horizontal dowels to reinforce the connection in a specific area, the use of chocks in hull planking fragment 1 of the Venice Lido III assemblage, and the lashing of the floor timbers and the numbering of the ceiling planks on the Comacchio ship). These elements likely represent individual builder or community preferences, solutions, and ingenuity.

Finally, even though there is little evidence for the influence of Mediterranean practices on this local tradition of boatbuilding, the community(ies) of builders did not exist in isolation.

The diversity of practices observed in relation to framing patterns suggest that this element of construction was particularly sescptible to modification and perhaps shows signs of external influence, linking northwestern Adriatic laced builders to the Celtic tradition of central Europe. Interestingly, even though builders of these vessels were flexible as to how frames were placed within the pre-formed laced hull, there is as yet no evidence for their use of alternating floors and half frames. The absence of the general Mediterranean pattern of framing in northwestern Adriatic laced hulls, coupled with its presence in the likely locally built *Iulia Felix* ship, suggest that the builders of these laced boats made a negative choice, that is, not to adopt the pattern of alternating floor timbers and half frames into their practice.

Furthermore, the use of esparto grass cordage as arguably the key feature of these boats, the very element holding them together, connected the builders with the trade networks established by Roman imperialism, and as such the builders became reliant on wider mechanisms of exchange and power imbalances outside the region where they practiced their craft. Thus, even though northwestern Adriatic laced vessels represent a local tradition, one that likely existed prior to Roman colonization of the region or even Roman expansion into Spain, the builders of these vessels became entangled in these broader colonial (and commercial) processes.

The foundational (stable) features of the tradition were the general guidelines for all northwestern Adriatic laced builders, their most basic mental template of what comprised a laced vessel of their tradition. The dynamic aspects, the variability in, for example, framing patterns and selection of materials for pegs, reflect the training and decisions of individual communities of builders within the broader tradition. As such, embedded within the *chaîne opératoire* of the northwestern Adriatic laced tradition are both a general strategy or approach to boatbuilding and multiple innovative solutions and preferences within that strategy, revealing both a regional boatbuilding community and distinct groups of builders within the community.

# CHAPTER VI

# CONSTRUCTING IDENTITY

The *chaîne opératoire* analysis of Chapter 5 revealed both stable and dynamic features within the northwestern Adriatic laced boatbuilding tradition, but their direct correlation to facets of identity is as yet unsubstantiated. In addition, there remain several unexplored aspects of the building process. It may seem simplistic to make the observation that not all the laced boatbuilders' actions and behaviors of the *chaîne opératoire* are visible in or on the physical components of the boats they built, however it is a constant hurdle that archaeologists face when examining the material remains. Ethnoarchaeology is an avenue through which archaeologists hope to recover some of these missing pieces, test the efficacy and potency of various middle-range theories, and refine interpretations of the archaeological record. The ethnography of modern laced boats could speak to a number of unanswered questions: How many builders are typically part of the team that builds a single vessel? What are the roles and/or tasks of individuals within this team of builders? Are the builders full-time boatbuilders and/or do they have another line of work? Is there a primary building season? Are patterns of technical variation related to social or cultural factors?

Unfortunately, ethnographic research on modern laced vessels largely has not considered the relationship between technical behavior and aspects of group identity. Eric Kentley's study of the East Indian *masula* surf boat (explored in detail below) is one of the few that consider the boatbuilding community along with the construction details of the vessels, however his conclusions are limited. Thus, I also use anthropological approaches to understanding sociocultural factors of other technologies as a comparative tool to fill in the missing gaps in the ethnography of modern laced boats. In this chapter, I return to the literature on technology and identity, with particular emphasis on the research of Olivier Gosselain and Laure Degoy, and explore in more detail the sociocultural patterning of technical variation. In addition, I review the ethnographic sources of modern laced boats in southern Asia in an effort to tease out common technological and behavioral patterns across the laced tradition of boatbuilding. Combined, these two datasets (ethnoarchaeological research on technology and identity and ethnographic studies of laced boats) inform the situation of northwestern Adriatic laced boatbuilding communities in antiquity.

This chapter stretches across fairly significant geographic distances, as the ethnoarchaeological case studies are largely from sub-Saharan Africa and India and the ethnographies of modern laced boats are from southern Asia. While I am not proposing that all decision-making strategies and identity-building processes are identical across time and space, I do contend that these two datasets provide insightful analogies to the shared human experience of creating, maintaining, and negotiating identities through embodied practice.

## BUILDING THINGS AND IDENTITY

Marcia-Anne Dobres and Christopher Hoffman assert, "A dynamic view of technology brings to the fore the social activities, interrelations, and tensions involved in the ongoing modification of natural resources into cultural products. While technology clearly is material, it is enacted within culturally and historically specific contexts of dynamic social interactions and meaning-making."[650] As northwestern Adriatic laced builders fashioned their vessels, they also actively built a community of practice and a shared cultural heritage centered on the individual actions and communal interactions of the laced boat *chaîne opératoire*. In other words, by building

[650] Dobres and Hoffman 1994, 215.

things, they also built a group identity. This link between technical behaviors and aspects of sociocultural identity is a topic of much discussion in recent anthropological literature.

## Learning and Practice

As discussed in Chapter 2, the practitioners of a craft – builders, technicians, artisans, and specialists – are part of communities of practice, producing material objects, but also reproducing the community itself as they maintain and reproduce their shared dispositions, or *habitus.* Techniques, or technical behaviors, are the result of particular learning processes, of the "socially acquired dispositions" that comprise the *habitus*, and it is through participation in a community of practice that an individual learns the techniques necessary to practice his/her craft.[651] Practitioners must acquire and internalize a vast wealth of knowledge and a broad range of skills in order to master their craft. For example, modern Yucatecan Mayan potters, as Dean Arnold portrays, not only know the qualities of various clays within their region, but also over 50 types of wood and their relative qualities as firing agents, the ecological zones in which to procure the required materials, the local weather patterns and how they affect the quality of materials, and so on.[652] This extensive knowledge base is augmented by kinesthetic skills, those bodily movements, tool use, and applications of force that physically transform raw materials into finished objects. The full learning process – both the cerebral and corporeal experience – reproduces a shared mental template and socially engaged actions while producing the object of the craft.

Gosselain, through a study of a group of potters in southwestern Niger, researches how learning and practice intersect and shape technological traditions. The training of female potters in this region follows a general pattern, but is not a rigid process. While most potters learned

[651] Dietler and Herbich 1994.
[652] Arnold 1991, 325.

pottery-making from their biological mother, a few were taught by another relative, and a very few were trained by a non-relative.[653] Again most potters, but not all, began their training between the ages of six and twelve in their home village (that is, where they were born or raised), but some potters learned the craft later in life, after marriage, in the village of their husband.[654]

The potters of this region do not recognize a formal apprenticeship in pottery-making where individuals arrive as novices with no experience with pottery-making and are educated in the proper forms, methods, materials, and social norms of the local ceramic tradition. Instead, most of the process is seen emically as "giv[ing] help" not as learning.[655] The apprentice first helps with non-critical tasks, such as clay extraction and processing, and progressively takes on more complex tasks, such as firing.[656] These tasks tend to be done communally, as a family, district, or some other grouping of potters.[657] The most critical stage, the final task to be mastered, and the only one that is seen as "actual learning" is the shaping technique.[658] During this final stage of the informal apprenticeship, the teacher directly engages in the apprentice's education, "correcting her errors and movements and, quite often, holding the apprentice's hands so that the latter can physically sense the correct movements and hand positions."[659] Gosselain argues that the communal stage of the learning process transfers and reinforces local norms while the intimacy of the final stage – mastering the shaping technique – creates "affective ties" with their teacher and likely explains "why potters usually consider their shaping technique a heritage."[660] Furthermore, according to Gosselain, this learning process affects the patterning of technical variation, with clay

[653] Gosselain 2008, 158.
[654] Gosselain 2008, 158, 160.
[655] Gosselain 2008, 160.
[656] Gosselain 2008, 160.
[657] Gosselain 2008, 160.
[658] Gosselain 2008, 160.
[659] Gosselain 2008, 161.
[660] Gosselain 2008, 161.

processing recipes reflecting local norms and shaping techniques representing "material correlates of social identities."[661] Thereby, understanding both the specific learning environment as well as general didactic trends in human behavior can lead to a better understanding of the acquired and practiced technical repertoires, and the resulting variability in practice and product.

**Technical Repertoires: Variation and Patterning of Technical Behavior**

Several scholars have explored the relationship between technology and identity in studies of modern indigenous populations and traditional technologies. Pierre Lemonnier, who in many ways spearheaded current anthropological approaches to the study of technology, conducted ethnographic fieldwork in Papua New Guinea among the Anga, observing the patterns of technical variation in the making of pig traps and bark capes.[662] Individuals within these communities of craftspeople are often aware of the practices and resources of other technicians even if their own materials and behaviors differ.[663] He demonstrated that variation in technology (both the *chaîne opératoire* and the finished product) is often an overt expression of social difference, a deliberate choice on the part of the craftspeople to distinguish themselves from their neighbors.[664] As Dobres and Hoffman summarize, "The absence of any particular technical trait does not necessarily mean a lack of knowledge of it, but, instead, may signify a strategy marking social difference."[665] In this instance, technical variation represents intentional strategies to mark a group identity. And as such, when these technicians made their pig traps and bark capes, they were also fashioning part of their identity.

[661] Gosselain 2008, 170.
[662] Lemonnier 1990, 35.
[663] Lemonnier 1990, 35.
[664] Lemonnier 1990, 35.
[665] Dobres and Hoffman 1994, 221.

This pioneering study by Lemonnier laid the groundwork for broader considerations of the role of technology in identity formation and maintenance. However, Lemonnier also cautions researchers, reminding us that "to suggest that technical behavior can be reduced to the exclusive production of meaning is an absurdity."[666] Technology cannot, and should not, be divorced from its materiality, but it, like group identity, is also socially and culturally constructed. An anthropological approach to technology considers the effects of both material aspects and sociocultural components on the *chaîne opératoire* and finished product, as well as how that manufactured object recursively defines and reifies the community of practitioners. As Degoy proposes, there are a "vast array of anthropological factors embedded in creating technical variation."[667]

Over the past 25 years since Lemonnier opened the door for similar studies, researchers of ceramic technologies have been perhaps the most prolific in responding to this approach. Returning to Gosselain's ethnographic study of Nigerien potters, elements of technical variation in the ceramic tradition of the region were correlated to various factors of the potters' social identity. He found that clay processing, in particular the material used for temper, was tied to social identity, stating, "Processing recipes are thus comparable – in discourse at least – to 'technical signatures' that distinguish members of specific potting communities."[668] As mentioned above, this fidelity to particular recipes may be associated with an adherence to shared norms within the community of practice, but it does also demarcate social boundaries within the potter communities of the area. Gosselain also noted that, to a limited extent, consumer demand is a driving force in clay processing recipes as some potters remarked on the links between materials selection and

[666] Lemonnier 1990, 29.
[667] Degoy 2008, 220.
[668] Gosselain 2008, 163.

customer expectations.[669] Beyond the clay processing stage of the Nigerien pottery *chaîne opératoire*, there were two shaping techniques noted in the study region, and, in situations where potters are aware of both, these shaping techniques are socially demarcated (that is, the other technique is ascribed to a separate social group) and have functional attributes (that is, perceived advantages or disadvantages to the technique).[670] Interestingly, Gosselain emphasizes that on the macroscale (the full geographical study area), these distinctions are lost; they are noticeable only on the microscale (between discrete villages/subregions within the study area).[671]

In another example, Silvia Forni argues that pots among the Babessi of Cameroon are an important marker of local identity.[672] These pots are preserved in a context of traditional technology despite an influx of foreign factory-produced cast aluminum and enamel wares.[673] While the latter are replacing locally produced pots for domestic uses, clay "country" pots are reserved for use in traditional rituals.[674] To the Babessi, symbolically pots *are* people and reinforce their vision of God who formed man out of clay.[675] This technology holds social meaning for both the potters and the consumers, becoming entwined in a network of social relationships beyond the community of practice, "once made, purchased, and used, Babessi pots may acquire roles and meanings that go beyond the intentions of their makers."[676]

This relationship between technical behavior and identity is not confined to modern communities; it is possible to detect patterns of identity within archaeological assemblages and translate the ethnographic record into insightful diagnoses of past societies. Karen Vitelli noted

[669] Gosselain 2008, 163.
[670] Gosselain 2008, 166-69.
[671] Gosselain 2008, 164-71.
[672] Forni 2007.
[673] Forni 2007, 49.
[674] Forni 2007, 49.
[675] Forni 2007, 44, 51.
[676] Forni 2007, 52.

distinct patterns in the assemblages of Neolithic Greek pottery. In the Early Neolithic assemblage of Franchthi cave, Vitelli used clay recipes and firing techniques to identify four to five individual potters.[677] Drawing on the ethnographic record, she further argued that the ability to manipulate clay was akin to magic and earned these early potters the role of and an identity as shamans.[678] The assemblages of the Middle Neolithic, on the other hand, represent a sizeable and diverse array of forms that required a high degree of technical knowledge and showcased innovation.[679] Then, in the Final Neolithic, almost all pots are coarse cooking ware, utilitarian vessels with enough frequency and variability between pieces to suggest that every household had a potter.[680] Vitelli contends that through these changes in ceramic assemblages, it is possible to trace the evolution of the social identity of Neolithic Greek potters from earliest shaman-potter to highly skilled specialist-potter to housewife-potter.[681]

## **The Potters of Southeast India**

The Andhra Pradesh region of southeastern India is host to a variety of indigenous crafts, including both a local ceramic tradition as well as a tradition of laced boatbuilding. As such, a study of the potters of Andhra Pradesh offers a key point of comparison for understanding and interpreting patterns of technical behavior in social and cultural terms that are most salient in the area. Degoy studied the relationship between technical traditions and cultural identity in rural specialist potter communities of the Andhra Pradesh region, and contends that "various sociological scales must be considered in order to interpret technical variation in terms of cultural

677 Vitelli 1999, 190.
678 Vitelli 1995, 1999, 191-93.
679 Vitelli 1999, 193-96.
680 Vitelli 1999, 198.
681 Vitelli 1999.

identity."[682] She looked particularly at the technical variation present in the forming stage of the *chaîne opératoire*, which has often proved significant in relationship to social and cultural boundaries.[683] She then analyzed the distribution of technical behaviors of the forming process by various aspects of identity including gender, subcaste division, endogamous unit, and dialectal and linguistic group.

Degoy was able to correlate variability in technical behavior most strongly to subcaste identity, matrimonial networks, and dialectal boundaries. First, through extensive research in the Andhra Pradesh region, Degoy identified 10 subcastes within the broader potter's caste of the study area. The forming processes of handmade jars were demonstrated to be a factor of subcaste division. The Kapu Kummari subcaste form jars by "drawing a lump of clay" while the Telaga Kummari use the technique called "slab building" to fashion jars. This differentiation of subcaste through technical behavior is mirrored in other social practices. These two subcastes do not intermarry and they do not share food, which Degoy claims "is a sign of strong social differentiation in India."[684] However, the potters of these two subcastes do not consciously distinguish themselves from each other by using different forming methods, as they are unaware that the difference exists.[685] This ignorance may be due to the general lack of interaction between members of this subcaste, so even though the technical variation is not a conscious assertion of subcaste identity, the presence of two forming techniques in close geographical proximity does highlight a very real social segregation of peoples of different subcaste identity.

Second, further exploration demonstrated that the forming techniques were also associated with matrimonial networks, in that the spread of the slab-building technique ran parallel to

[682] Degoy 2008, 200.
[683] Arnold 1985; Gosselain 1998, 2000, 2001.
[684] Degoy 2008, 215.
[685] Degoy 2008, 215.

intermarriages between subcastes.[686] Here, the endogamous unit extended beyond the strict subcaste division and was a more significant social boundary in explaining the transmission of the slab-building technique. Finally, the posture of the potter while beating out the vessel varies widely; these positions include sitting with outstretched legs, sitting cross-legged, and sitting with one leg crossed and one outstretched.[687] Additionally, potters employ various means to support the growing pot during the forming stage – rolled goatskin, basketry mat, or a position between the foot and thigh of the potter. These variations in technical behavior during the beating out process, that is the beating posture and means of support, are linked to dialectal boundaries, and are recognized by local potters as forming regional differences.[688]

**<u>Materializing Identity</u>**

Gosselain has established three categories for pottery *chaînes opératoires* and the various aspects of identity for which they serve as repositories. Each category relates to the visibility and malleability of the technical behavior, first on the finished product, second in action during the *chaîne opératoire*, with the third category – the fashioning stage – being virtually invisible. When considering the first two categories, Gosselain argues that the "manufacturing steps that are both particularly visible and technically malleable are easily transmissible through postlearning interactions and should display a tendency to fluctuate through time … to reflect more superficial, situational, and temporary facets of identity."[689] In other words, the more visible the technique is in the final product or the more visible the process is to outsiders, the more it is likely to change across time and space. On the other hand, the fashioning stage, primarily comprising repetitive

[686] Degoy 2008, 217.
[687] Degoy 2008, 220.
[688] Degoy 2008, 219-20.
[689] Gosselain 2000, 191.

movements which aggregate over time into “motor habits”, is more stable and likely denotes the most fundamental “rooted” aspects of identity, which Gosselain associates with kinship, language, gender, and class.[690]

In his 2000 publication, Gosselain proposed that the fashioning stage is more intimately and deeply tied to primary learning or apprenticeship and does not tend to incorporate postlearning features. More recently, however, he acknowledged that the fashioning stage is just “as liable to be slightly or more deeply altered” as technical behaviors in the other categories or in other stages of the *chaîne opératoire*.[691] This malleability, nonetheless, does not undermine the significance of the fashioning stage in relation to group identity; in fact, its key role as an “inheritance” to potters is most often the reason why they tend to obfuscate any changes and insist upon the stability of the technical behaviors they currently practice. Gosselain’s typology of techniques and their relationship to facets of identity is a useful starting point for interpreting the variation seen in the technology of boatbuilding.

## ETHNOGRAPHIC PARALLELS OF LACED BOATS

These anthropological studies of other technologies provide a precedent for the link between constructing identity concurrently with constructing things, but they do not speak directly to the laced boatbuilding community of practice. Fortunately, laced ship construction has continued into the modern era[692] in small pockets around the globe. Ethnographic studies of modern laced boats may help to reveal common social or behavioral factors that contribute to the

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[690] Gosselain 2000, 193.
[691] Gosselain 2008, 170.
[692] The 20th and 21st centuries.

preservation of this method of boatbuilding in the context of other dominant forms, and pinpoint certain aspects of identity that are closely entwined with the laced boat *chaîne opératoire*.

Many travelers and a handful of scholars have recorded their contemporary experiences with laced boats from the 16th century up to the modern day. One of the principal maritime ethnographers of the early 20th century was James Hornell. Hornell examined traditional or "primitive" craft of the Pacific and Indian Oceans during the first half of the 20th century. His seminal work, *Water Transport*, tracks the origins and evolution of watercraft broadly, including the *mtepe* and *masula* laced boats, of which the latter is explored in considerable detail below.[693] Another notable nautical ethnographer is Basil Greenhill, whose work *Boats and Boatmen of Pakistan* is based on fieldwork conducted over five years during the 1950s.[694] Greenhill broadly surveyed the boats and users of this particular area, including a brief account of the laced vessels found there, mostly the laced *balam* of East Pakistan (current day Bangladesh).[695] One of the most thoroughly studied laced vessels is the *mtepe* of the Bajuni peoples of Somalia. As the *mtepe* went out of use during the first part of the 20th century, current scholarship has tried to recreate its form through historical records and models. The work of Robert M. Adams is the most recent compilation of this effort, containing a discussion of the various sources and interpretations of this vessel type.[696] Furthermore, Gerhard Kapitän's work cataloguing and recording the traditional boats of Sri Lanka was recently edited and published by Gerald Grainge; included within his inventory are the laced *oruwa* and *paruwa*.[697]

Finally, the most comprehensive study of laced vessels to date is by A.H.J. Prins, published as *A Handbook of Sewn Boats.* In this work, Prins conducted a comparative analysis of

[693] Hornell 1970, 192-3, 273.
[694] Greenhill 1971, 184
[695] Greenhill 197, 115-16.
[696] Adams 1985a and 1985b.
[697] Kapitän et al. 2009.

archaeological, historical, and contemporary laced (or sewn) vessels. His theoretical approach of diffusionism is clear within the first few pages of the book, as he outlines four hierarchical levels of observation:[698]

Boatbuilding = activity
Hull = trait complex
Seam = trait
Stitch, dowel, etc. = item

This hierarchy is presented as an analytical tool to compare the variations in laced construction methods observed in archaeological remains and ethnographic accounts and to track the geographical distribution of these trait complexes (hulls). Prins further defines these construction variations by categorizing them according to four main traits: clinker versus carvel built, continuous sewing versus discontinuous stitching, the use of dowels between strakes, and the use of pegs to plug sewing holes.[699] The permutations of these traits create discrete categories by which Prins analyzes their distribution. Prins was hoping to show the diffusion of these permutations from a geographical center, but this hypothesis is not supported and a central point for any of the permutations is not identified.[700] While his diffusionistic approach is inherently problematic, the volume and scope of his study makes it a valuable resource for any study of laced boats.

Unfortunately, most of the ethnographic accounts of modern laced boats reviewed above focus primarily, if not exclusively, on the construction elements of the boats themselves and make only passing references, if any, to the social, cultural, and/or economic context of their builders. The richness of ethnoarchaeological research of other technologies, particularly the current research in ceramic technologies, is not available for modern laced boats.[701] Although the

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[698] Prins 1986, 23.
[699] Prins 1986, 27-8.
[700] Prins 1986, 168.
[701] I see ethnoarchaeological studies of modern laced boats that evaluate the influence of sociocultural factors on technical behaviors as a potentially rich avenue for future research.

ethnography of modern laced boatbuilders is limited, by evaluating the *chaînes opératoires* of modern laced vessels in the same general class as northwestern Adriatic laced vessels (Prins' permutations 9 and 10),[702] perhaps trends significant to socioeconomic and cultural factors can be sifted from the functionality of the construction method.

## **Modern Laced Boat *Chaînes Opératoires***

Are there any trends in the *chaînes opératoires* that connect laced traditions of boatbuilding? Here, I focus on the first two stages of the modern laced boat *chaîne opératoire* – resource procurement and manufacture – as they can be tied most closely to the builders. Before expanding on these two technical stages, an interesting pattern in the use-life of modern laced boats warrants a brief mention. There seems to be a correlation between fishing communities and a continued local laced technology. A notable exception is the *balam* freighter of Bangladesh, but its design is, according to Greenhill, based on the method used to build smaller laced fishing canoes.[703] A laced plank boat found along the Goa coast of India is used primarily for transporting sand, but in the same region extended dugouts with laced washstrakes are built more frequently and engage exclusively in fishing activities.[704]

While some modern laced vessels were used for various purposes during their life history, they are often employed primarily as fishing vessels in modern populations. Prior to its disappearance in the early 20th century, the *mtepe* of Kenya was essentially restricted to fishing duties at the end of its life-history.[705] A similar circumstance can be understood in respect to both the *oruwa* of Sri Lanka and the *masula* of southeastern India (discussed in detail below), both of

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[702] These permutations include watercraft that are built with edge-to-edge planking, a continuous lacing pattern, and the use of pegs or plugs to stopper the lacing channels (Prins 1986, 28).
[703] In Prins 1986, 107.
[704] Shaikh et al. 2011, 79, table 1.
[705] Lydekker 1919, 90-1; Prins 1986, 74.

which at one time functioned in other capacities.[706] On the other hand, some types of modern laced boats, such as the *kambari* of Oman, seem to have only ever been fishing watercraft, at least in the known historical record.[707]

*Resource Procurement*

The materials used in the construction of modern laced vessels are often handcrafted and consist primarily of local materials. For example, the traditional construction materials for the *mtepe* were entirely local: the ship's timbers and mast were fashioned out of mango wood harvested from the swamps by the boatbuilders themselves, the cordage was manufactured from coconut fibers (known as coir), as well as the ropes for lashing and rigging, the seam wadding was made of palm fibers, and a resin of mangrove bark was used to waterproof the strake seams, and a matting of mkoma palm fibres was woven into a square sail.[708] Adams notes that, during its decline, some of the *mtepe's* handcrafted products were being replaced with factory-made goods, including synthetic rope for coir fiber cordage and commercial pitch for the pounded mangrove bark resin.[709] It is not clear, however, whether the builders of the *mtepe* had previously manufactured the coir fiber cordage and pounded mangrove bark resin themselves or purchased it from local craftsmen. This trend in replacing local resources with manufactured synthetic products is also noted in other laced vessels. In a brief survey of laced *oruwas* along a beach near Ambalantota, Sri Lanka, I noted the combination of fiberglass hulls replacing the traditional wooden dugout and synthetic rope replacing coir fiber cordage (see Figs. 6.1 and 6.2).

[706] Balfour 1871, 557; Folkard 2000, 457; Kentley 2003, 122, 125, 164, 178; Prins 1986, 105.
[707] Agius 2002, 81.
[708] Adams 1985a, 31-2; Lydekker 1919, 88, 91.
[709] Adams 1985a, 32.

There are some exceptions to the traditional use of local products. For example, the planks of the laced *kambari* of Oman are fashioned from imported mango wood from the Malabar Coast, while the ribs and pegs are formed from local trees (the *arir* or *athab* and *hfut* respectively).[710] The use of imported timber is anything but anomalous for this area of the world, as Severin states, "Nearly all materials for shipbuilding in Oman have been imported from the Indian subcontinent, Oman being lacking in suitable timber for large boatbuilding."[711] Considering Oman's long history of importing materials for ship construction, the *kambari* actually stands out for its use of local woods for the scantlings (ribs, pegs, etc.).


Figure 6.1: A laced *oruwa* of Sri Lanka with a fiberglass hull and wooden washstrake. (Photo by author.)

[710] Agius 2002, 80.
[711] Severin 1985, 279.

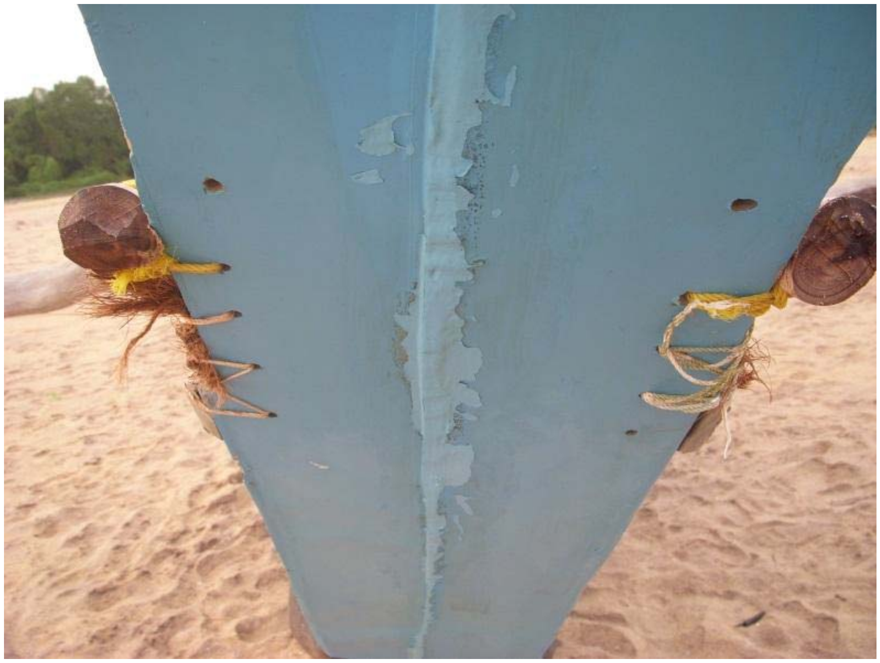

Figure 6.2: Use of factory-made synthetic rope on a laced *oruwa* of Sri Lanka. Photo by author.

This exploitation of local, handcrafted materials may suggest a preference for traditional ecological knowledge and locally manufactured goods over those foreign. However, the incorporation of factory-made products in some modern laced vessels indicates that resource procurement may be guided primarily by economic factors. Gosselain also correlated the selection of materials to economic strategies in the ceramic *chaînes opératoires* of southern Cameroon potters.[712]

*Manufacture*

As seen in Chapter 5, there are several elements to the manufacturing stage of a laced vessel – broadly the cutting of the planks, the drilling of the lacing channels, the joining of the seams, and the fashioning and inserting of the frames and other internal timbers. Based on the

[712] Gosselain 1998, 90-1.

ethnoarchaeological studies of Degoy and Gosselain, body positions and tools used during these processes have been shown to be particularly significant reflectors of sociocultural meaning. Unfortunately, body positions are generally not described and recorded only in still photographs, which predominately show the joining of the seams, or the lacing of the planks together. These images show two or more lacers, situated on either side of the hull; this arrangement of two lacers working in tandem on opposite sides of the growing hull is the most frequent observation made by ethnographers of modern laced boatbuilding practices.[713]

These images show the man inside the boat generally seated in a cross-legged position, although the "stitchers" of Agatti, who built the Omani *Sohar*, sat facing the bow or stern (Fig. 6.3), the lacers of the Gao canoe in Mali sat facing the sides of the vessel (Fig. 5.10), and the lacers of the Kerala canoes sat either at an angle (Fig. 6.4) or with their hips facing the bow or stern and their torsos oriented toward the sides (Fig. 6.5).[714] A compounding factor is that these builders were working on different sections of the vessel – Agatti stitchers on the keel-garboard joint, Gao lacers on the turn of the bilge, and Kerala lacers on the bottom and side planking. The man outside the vessel is also in a range of positions – squatting, sitting, standing, leaning forward, leaning back, etc. A thorough examination of body position throughout the construction of a vessel is necessary in order to distinguish whether body positions are related to type of seam, local normative behavior of the community, or simply individual preference.

[713] Insoll 1993, fig. 5; Kentley 2003, fig. 5.12. Observations of the arrangement of lacers can be found in Adams 1985a, 36; Kentley 2003, 147-50, and Severin 1985, 283, 285.
[714] Pomey 2012; Insoll 1993, fig. 5; Severin 1985, fig. 17.1 and 17.2.

Figure 6.3: Agatti stitchers lacing the Omani Sohar (Severin 1985, 17.1).

Figure 6.4: Lacers of the Kerala canoes in an angled position (Pomey 2012).

Figure 6.5: Lacers of the Kerala canoes in a twisted position (Pomey 2012).

Adams describes the process of lacing a *mtepe*, originally observed by Hornell: "The man on the inside threaded the palm leaf needle through a hole in the strake to the man on the outside of the hull who took several turns of the line around a stick to aid in pulling the cord taut. Then the man on the inside drove a peg in the hole only deep enough to maintain tension on the line while the cordage was passed back through the next hole."[715] Tim Severin, who oversaw the building of the laced dhow in Oman in 1980, described the lacing process as follows:

> The stitchers divided into pairs, the 'inside' and the 'outside' man [sic]. The 'inside' man was always the senior and directed the work. The 'outside' man had little more to do than turn the end of the cord, poke it back through the correct hole in the plank, and keep on tension as the inside man drew it up as tightly as possible. The matching holes in the edges of the two planks to be joined were … drilled at a slight angle so that the cord as it was taken up, should slide smoothly without passing over a crippling edge… The greatest importance was paid to the tension of the cord by hauling on it with the short mangrove wood levers and pounding the rope with mallets while under tension.[716]

The tools indicated for use in the lacing process in these descriptions include a needle, which is attached to the cordage and used to thread it through the lacing channels, a stick of wood, which is used to pull the cord taut, temporary pegs and some form of mallet or hammer to drive them into place. Insoll notes the use of an instrument similar to a poker by the builders of laced canoes at Gao (in the Republic of Mali, Africa) to feed the palm fiber cordage through the lacing channels.[717] While both the *mtepe* lacers and Agatti stitchers use a wooden stick to pull the cord taught, the lacers of Kerala canoes wrap the cordage around a mallet and, placing the head of the mallet against the planking, pull up on the handle to tighten the cordage.[718] Both the combination of tools and the form of individual tools used in the lacing process are unique in each of the observed communities of builders. How shared tool-use is among builders of the same tradition cannot be answered without further ethnographic research.

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715 Adams 1985a, 36.
716 Severin 1985, 283, 285.
717 Insoll 1993, 345.
718 Pomey 2012, 21:57 min.

The tools used to facilitate the passage of the cordage through the lacing channels – needles and pokers – are evocative of the abundant bronze artifacts identified as writing styluses dedicated at Venetic sanctuary sites. These instruments have a sharpened tip and a flattened end, range in size from 135 to 260 mm, and commonly have holes or rings attached to the wider end.[719] Could these artifacts represent lacing needles and be the votive offerings of northwestern Adriatic boatbuilders?

Only a few studies note specific chronological details, such as the season in which these laced boats are/were built and the duration of the construction process. The laced fishing vessels of Bangladesh are dismantled when the monsoon season begins and re-laced in November, with the commencement of the dry season.[720] The laced canoes of Gao are built and repaired in the two months prior to their season of use, and maintenance work is done by the owner of the vessel, although it is unclear whether the owner is also the original builder.[721] The timber used in the construction of traditional laced craft along the Goa coast of India is seasoned for 15 days and the boats are constructed by two to four builders over the course of one to two months.[722] Prins and Adams both note that the lacing and pegs of the *mtepe* were replaced annually and that individual vessels had a lifespan of about three to four years, however there is no indication of when original construction or maintenance occurred.[723] Adams does state that the entire construction process of the *mtepe* – from procurement of the resources to the outfitting of the vessel – was completed within two to three months.[724]

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[719] Fogolari and Prosdocimi 1988, 279-82.
[720] Prins 1986, 107.
[721] Insoll 1993, 346-7.
[722] Shaikh et al. 2011, 79. The only indication of the size of these laced plank boats is a carrying capacity of 10-12 tons (Shaikh et al. 2011, table 1).
[723] Adams 1985a, 15, 36; Prins 1986, 72.
[724] Adams 1985a, 54. Lydekker (1919, 91) described an average *mtepe* as being 60 feet long (with a 35 foot long keel), 18 feet wide and a depth of 6 feet 6 inches.

In 2013, under the direction of Patrice Pomey, construction of a replica of the Jules Verne 9 Greek laced boat began.[725] The experimental process of building this replica, christened *Gyptis*,[726] provides additional data on chronological factors relevant to laced hull construction. The wood for *Gyptis* was selected from local forests in France, steamed for three months, and then dried for two years.[727] The hull itself – 9.85 m in length and 1.88 m in beam – was manufactured over the course of 10 months.[728] Approximately 2000 hours were required to drill the approximately 10,000 lacing channels; while most of this work was accomplished with modern electric drills, a custom chisel was used to carve out the accompanying tetrahedral recesses (see pages 114-15 for a brief description of the characteristics of the Greek laced tradition).[729] An additional 5000 hours, between four carpenters, were required to complete the hull.[730] The lacing of the vessel was executed primarily by volunteers; Pomey states that the most efficient lacing method involved threading the channel with two strands of cordage and then making another pass with a single strand.[731] About 24 meters of cordage were necessary to lace a meter of hull; the lacing of the entire shell required almost five kilometers.[732]

Although the *Gyptis* is based on an ancient Mediterranean tradition of laced boatbuilding, and is thus geographically as well as chronologically closer to the northwestern Adriatic laced tradition, it includes several elements that likely entail a longer construction period. More closely

[725] Pomey 2014.
[726] Interestingly, this name is drawn from the origin myth of the founding of Marseille, where the Jules Verne 9 hull remains were discovered. According to the tale, Gyptis, the daughter of a local ruler, chose Protis, a Greek trader, to be her husband. As a wedding gift, Gyptis' father granted his new son-in-law land near the coast to found a colony – Massalia, which became modern-day Marseille (see Pompeius Trogus's version of the origin myth preserved in Justin (43.3)).
[727] Mouton 2014, 64.
[728] Mouton 2014, 64; Pomey 2014, 26.
[729] Pomey 2014, 24; Thuilier 2014, 79.
[730] Thuilier 2014, 79.
[731] Pomey 2014, 24.
[732] Mouton 2014, 65-6.

spaced lacing channels (and thus more channels per meter of hull), the use of regularly spaced dowels between the planks, and the absence of edge cavities (requiring a greater degree of precision when aligning the lacing channels) likely increases the overall work hours required to complete a hull. In this regard, although the laced boats of southern Asia are separated from northwestern Adriatic laced vessels by over 4000 miles and about 2000 years, they may more accurately parallel many elements of the manufacturing stage.

## **The Laced Boatbuilders of Southeast India**

Arguably the most complete ethnographic account of a community of modern laced boatbuilders is that done by Kentley in 1983 and 1984. Kentley recorded the forms and functions of the *masula*,[733] a type of laced boat along the eastern coast of India, during three months of fieldwork spread over two years.[734] Although his primary goal was to record the technical variations observed in the *masula* type of laced vessel, he did include a limited discussion of the builders of these vessels and attempted to explain the variations by social, cultural, or economic contexts.

The *masula* is a frameless laced boat; in fact, it is the *only* laced plank boat to be found currently along the eastern coast of India (see Fig. 6.6).[735] The earliest image of a *masula* is a sketch by Thomas Bowrey in the 17th century (Fig. 6.7), which has stylized hash marks representing the lacing on the exterior of the hull.[736] The *masula* was an object of peculiarity to

[733] "Masula" is a term used by Europeans in their accounts of India's eastern coastal area to describe a particular sewn vessel they encountered there; the name holds no meaning to the builders or users of the craft ( Kentley 2003,120-1). Kentley states the term was potentially derived from the name of the town Machilipatnam along this coastline. As this indigenous community of builders have no name to distinguish this specific sewn craft from other boats which use metal fasteners, the westernized term will be used here.
[734] Kentley 2003, 120.
[735] Kentley 2003, 127-8.
[736] Kentley 2003, 122.

the European traveler, and thus generated several descriptions over the centuries. Observers recorded a wide range of overall dimensions for the *masula*, with lengths ranging from 7.5 m to over 12 m, length-to-beam ratios ranging from 2.91 (somewhat average ratio for a cargo carrier) to 5.80 (representing a narrower hull), and depths from about half a meter (quite shallow) to almost 2.5 m.[737]

Figure 6.6: A *masula* surf boat from the eastern Indian littoral (Kentley 2003, fig. 5.15).

[737] Kentley 2003, 127.

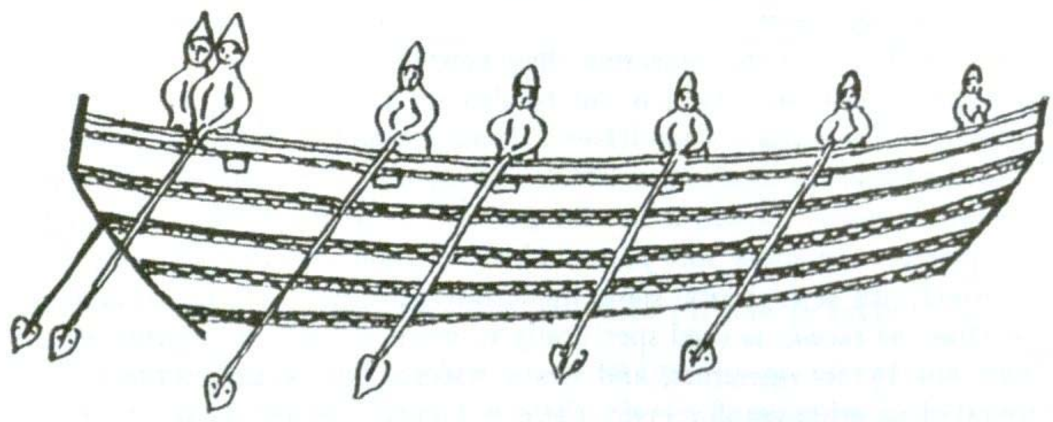

Figure 6.7: Earliest sketch of a *masula* by Thomas Bowrey (Kentley 2003, fig. 5.2).

By the time of Kentley's ethnographic study, *masulas* were found in a discontinuous distribution along the coast from Paradeep in the north to Chachapadi in the south.[738] The builders of the *masula* are ethnically either Tamil or Teluga, and primarily Hindu, although some builders are Muslim; the builders are of the same caste as fishermen, and occasionally are fishermen themselves. [739] There is no formal training period to become a *masula* builder that has been recorded. A builder is taught the trade by his relative, typically his grandfather.[740] Curiously, as Kentley mentions, the "skill skips a generation."[741] *Masula* builders are not involved in other types of building activities, such as the making of furniture or the construction of houses.[742] While a community of builders does exist in a quarter of Bimlipatnam, this arrangement seems to be rather anomalous.[743] Generally, builders live in a particular fishing village and travel around to the neighboring villages as needed.[744]

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[738] Kentley 2003, 128.
[739] Kentley 2003, 135.
[740] Kentley 2003, 135.
[741] Kentley 2003, 135.
[742] Kentley 2003, 135.
[743] Kentley 2003, 135, 143.
[744] Kentley 2003, 135.

*Resource Procurement*

Records of the *masula*'s construction materials are also widely variable. According to Nicolaas Witsen in 1690, the *masula* was laced with coir rope and "caulked with dammer (a tree gum resin)."[745] J.W. Edye in 1834 also noted cordage of coir yarn, but cited a wadding of coir used in the seams between the planks as opposed to the tree gum resin.[746] Henry Folkard in 1870 again confirmed the use of coconut fibers for the ligatures, but he also had a different interpretation of the seam wadding, this time being layers of cotton.[747] Furthermore, Folkard described "a flat narrow strip of tough fibrous wood" positioned over the inside strake seam.[748] In 1926, Hornell mentioned a wadding of coir, the same as Edye, and the absence of the wooden batten in Folkard's description.[749] There is still further disagreement about the nature of the seam wadding; other recorded materials including a type of grass, plantain-leaf stalks, and dry straw.[750] Unfortunately, it is impossible to know whether these variants represent inaccurate information, an evolution of materials, diverse preferences for resources by different builders, or some combination of all these factors. During his recent fieldwork, Kentley noted that the cordage was made of coir fibers spun into two-ply rope and that dried marsh grass was used for the seam wadding in most instances.[751] Other materials, such as coir rope, but also plastic bags and strips of tire rubber, were used along certain seams (top seam, joints between strakes and posts).[752] The materials to plug the lacing channels were balls of coir or tapered wooden pegs, although Kentley does not identify the type of wood used to manufacture the latter.

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[745] Kentley 2003, 122.
[746] Edye 1834, 8.
[747] Folkard 1870, 309.
[748] Folkard 1870, 309.
[749] Hornell 1927, 58.
[750] Kentley 2003, 126.
[751] Kentley 2003, 127.
[752] Kentley 2003, 69.

Variations were also noted in wood resource selection. According to Kentley,[753] builders in the northern sector used sal or shala tree (*Shorea robusta*), Indian laurel (*Ficus microcarpa*), or teak (*Tectona grandiis*) for the central longitudinal member (keel plank), with the former being the most common.[754] Posts were manufactured from black plum (*Syzygium cuminii*), hull planks from mango (*Mangifera* sp.), and cross beams from casuarina (*Cashuarina equisetifolia*).[755] However, builders in the central sector preferred Indian fig (*Ficus glomerata*) for the bottom three strakes and mango, tamarind (*Tamarindus indica*), sacred fig (*Ficus religiosa*), or banyan (*Ficus bengalensis*) for the remaining strakes.[756] There is even more variability in the *masulas* from the southern sector. Most builders in this region prefer aini (*Artocarpus hirsuta*) for the keel plank, posts, and bottom three strakes, although some favor Pashu paduk (*Pterocarpus indicus*), and others choose Indian laurel.[757] Mango is used commonly for the upper strakes in this region, and any available wood is used for the crossbeams.[758] Whereas builders of the northern and central sectors use coir fiber cordage and marsh grass seam wadding, in the southern sector, builders primarily employ coir fibers for the seam wadding material of *masulas*, with a covering of dried marsh grass.[759]

The relative physical properties of each species does not seem to be a primary factor in materials selection as, in some cases, builders identified dissimilar woods as interchangeable for the same element of the hull. For example, mango and tamarind – both used by builders of the central sector for bottom planking – have different physical properties. Tamarind is highly durable,

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[753] It is unclear whether the reported species identification is based on samples collected from vessels or the statements of interviewed boatbuilders. The latter may be more likely as Kentley (2003, 120) states, "much of this report is based on interviews."
[754] Kentley 2003, 137.
[755] Kentley 2003, 137.
[756] Kentley 2003, 145.
[757] Kentley 2003, 152, 155.
[758] Kentley 2003, 153.
[759] Kentley 2003, 152.

but its grain is wavy and it is difficult to work, whereas mango tends to be more straight-grained and easily worked, but is only moderately durable to perishable.[760] Furthermore, for the keel plank, the builders of the northern sector identify Indian laurel – a softer non-durable wood – as a substitute for sal or teak – both extremely durable hardwoods, the latter of which is particularly resistant to marine borers.[761] Instead, Kentley attributes the differences in materials selection to "relative costs and availability."[762] This economic explanation for resource procurement is in line with current *chaîne opératoire* research.

*Manufacture*

The boats are constructed in the village itself and not on the beach.[763] The prospective owner supplies the wood; including mill-sawn timber tangentially cut.[764] A typical construction crew consists of one master builder or shipwright and several assistants; the master builder does all the woodwork while the assistants are tasked with the lacing.[765] As the technique of lacing is well-known to the fishermen, some master builders use local labor as lacing assistants, while others have a team that travels with them from village to village.[766] In general, Kentley estimates that one master builder and three lacers can complete a vessel in seven days.[767] This is supported by Suryanarayana, who in 1977, as part of his governmental survey of marine fisheries, tracked the time of *masula* construction – a larger *masula* taking two men seven days to build and the smaller version taking five days.[768]

[760] Meier 2015.
[761] Lim et al. 2004, 2-3; Meier 2015; Orwa et al. 2009.
[762] Kentley 2003, 145.
[763] Kentley 2003, 135.
[764] Kentley 2003, 135.
[765] Kentley 2003, 135.
[766] Kentley 2003, 135.
[767] Kentley 2003, 135.
[768] Suryanarayana 1977, 26.

The *masula* master builder employs relative dimensions to measure out a new boat, using handspans and fingerwidths to determine the length of the planking and the distances between sewing holes, respectively.[769] Kentley states that, using a bow drill, builders are capable of boring the line of lacing channels along the plank edge primarily by eye, maintaining a general spacing of three fingerwidths.[770] The channels of the bottom strake are drilled first, and then the channels of the adjacent strake are marked out so that they correspond with the actual spacing of channels.[771] Kentley notes the use of charcoal to mark the planks in the central sector.[772] While most channels are drilled vertically through the plank, for certain sections of the vessel, such as the join between the strakes and the posts, channels are drilled obliquely.[773]

The women of the builder community at Bimlipatnam spin the coir into rope themselves; other builders from the region outside the Bimlipatnam community buy coir cordage from local manufacturers.[774] Similar to the builders of the *mtepe*, *masula* builders also use a needle to feed the cordage through the lacing channels. A short length of nylon fishing line is attached to the end of the coir rope, and then the line is passed through the eye of a metal needle.[775] Also similar to *mtepe* builders, temporary wooden pegs are used to maintain tautness of the cordage as the lacing progresses.[776] Broadly, a lacing sequence starts amidships; once a length of rope is secured in place (via metal punch, wooden batten, or temporary wooden peg), two men (A and B) engage in the following sequence of movements:[777]

[769] Kentley 2003, 135.
[770] Kentley 2003, 142.
[771] Kentley 2003, 142.
[772] Kentley 2003, 142, 147.
[773] Kentley 2003, 147.
[774] Kentley 2003, 145.
[775] Kentley 2003, 148.
[776] Kentley 2003, 150.
[777] The photographs published in Kentley 2003 do not permit an examination of the body positions of the lacers.

[The man A] feeds the line … The man B pulls down on the rope, twisting a batten round it. The man A then knocks a peg in. B lays an appropriate amount of dried grass along the seam between the pairs of holes and passes the needle through the upper hole of the adjacent pair. A will pull through and B will knock a peg into this hole. A now lays dried grass on his side and passes the needle back through the lower hole he originally fed through. With B hauling down on the rope, A knocks a peg into the hole.[778]

Kentley does not comment on the relationship between the two lacers or whether one takes leadership during this stage of the construction, as with the Omani stitchers. However, other similarities are noted between the observed lacing practices of *masula* builders and those of the builders of other modern laced vessels. On regular seams of *masulas*, the lacing sequence continues from amidships all the way to the post and then is "backtracked" along the same length, with the cordage passing six times through each channel. Kentley distinguished two lacing patterns among *masula* boatbuilders. Method 1 creates a double web, that is, a cross-stitched or banded-X pattern on both sides of the hull (Fig. 6.8).[779] This method is employed by builders of the northern and central sectors, and seam wadding is placed along both the internal and external seams.[780] Method 2, used by builders of the southern sector, produces only a single web on the interior of the hull (Fig. 6.9).[781] The lacing pattern explains the lack of seam wadding on the external portion of the hull of southern sector vessels; there is no web to hold the wadding in place.

Channels are plugged in general only up to the waterline and the final strake is never plugged.[782] The channels are considerably farther apart along the top seam, and typically only "half-sewn", that is, the sequence is not "backtracked" as along regular seams.[783] The top "half-

[778] Kentley 2003, 149-50.
[779] Kentley 2003, 148-50.
[780] Kentley 2003, 136, 148-50.
[781] Kentley 2003, 156-57.
[782] Kentley 2003, 142.
[783] Kentley 2003, 142, 146.

sewn" seam has a wadding of rope instead of dried marsh grass.[784] In the northern and central sector, a metal punch is used to insert the balls of coir which act as the pegs, securing the lacing and plugging the channels.[785] Tapering wooden pegs are used for the same purpose in the southern sector.

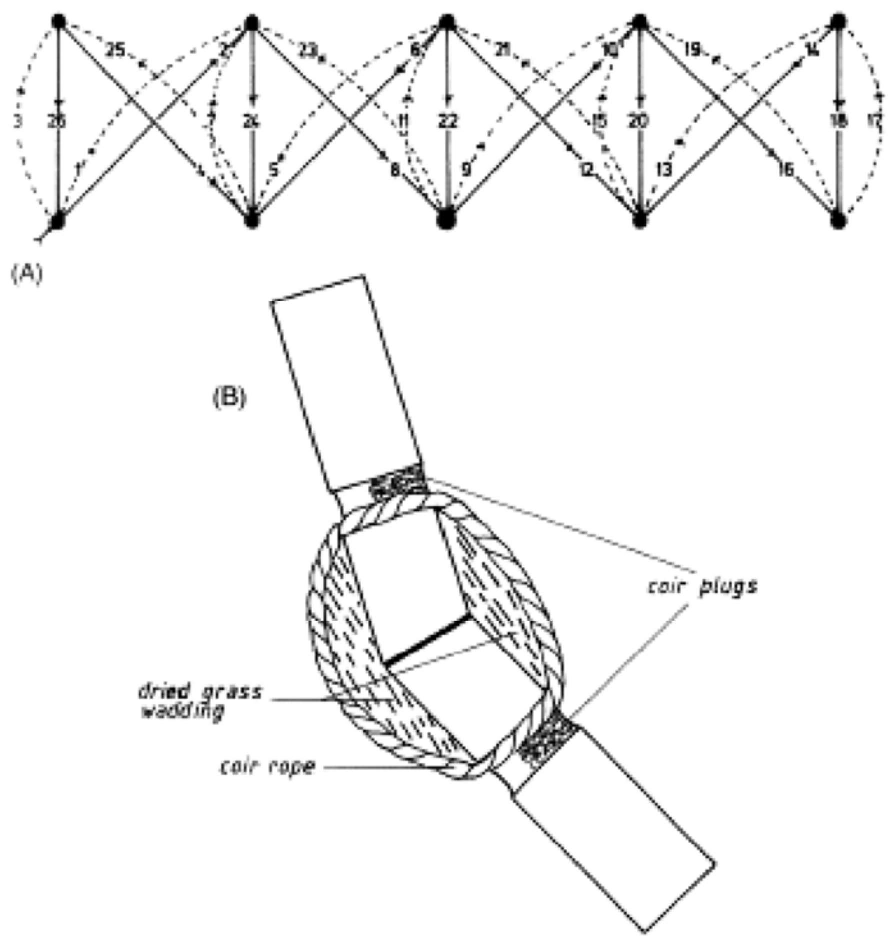


Figure 6.8: Method 1 lacing pattern and cross-section of a seam of a *masula* (Kentley 2003, fig. 5.13).

[784] Kentley 2003, 146, 150, 158.
[785] Kentley 2003, 142.

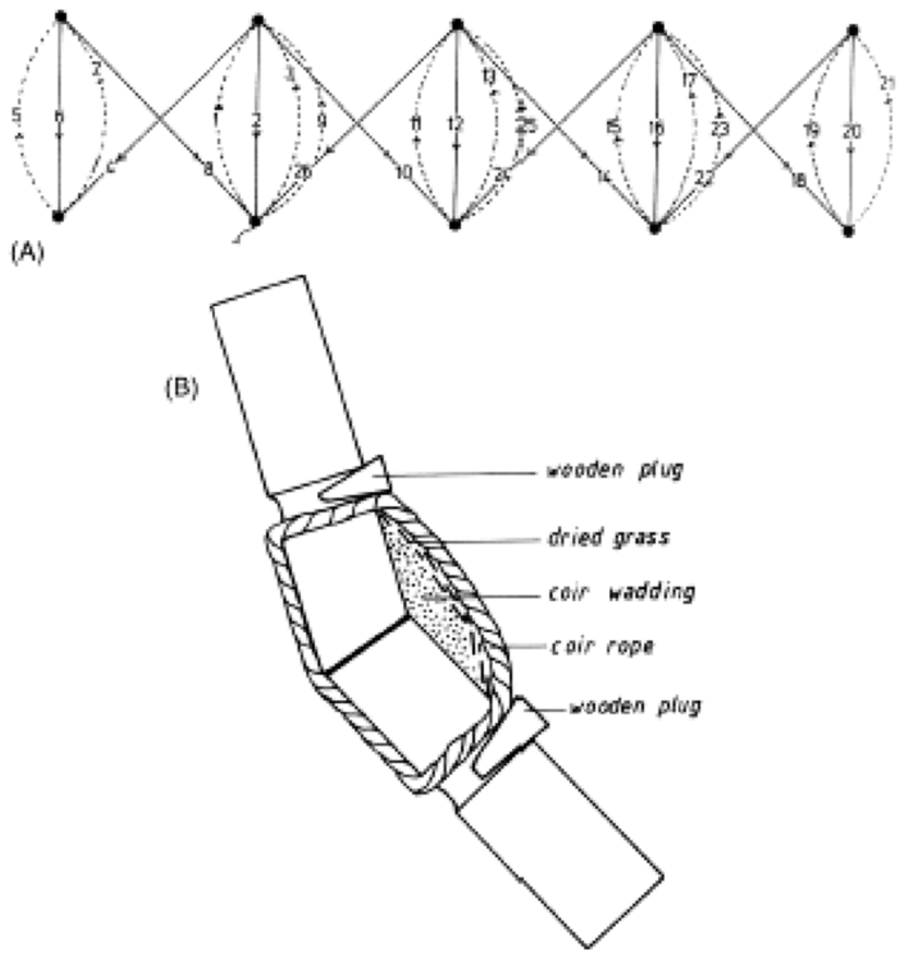


Figure 6.9: Method 2 lacing pattern and cross-section of a seam of a *masula* (Kentley 2003, fig. 5.18).

A 2:1 mixture of pitch and tar is applied on the third and fourth strakes of the *masulas* of Tamil Nadu in the southern sector; this compound is used only on the strakes and not on the seams.[786] There is no other evidence of waterproofing agents on *masulas*. Finally, *masula* builders use quite a diverse array of decorations to complete their vessels – carved stems (rare), green pennants (religious affiliation with Islam) or straw garlands attached to the stem, painting of the

[786] Kentley 2003, 162.

upper strakes in a variety of patterns, owners' or officials' names, and numbers (an outdated registration system with local government) and/or motifs (including the oculus) painted on the external hull.[787] In keeping with Gosselain's categories, the most visible and easily malleable aspects of a technological tradition – decorative techniques – show remarkable variety across time and space.

While the original construction of *masulas* occurs in the village, maintenance of the vessels is conducted on the beach. *Masulas* require regular upkeep of the lacing, particularly of the garboard strake.[788] Furthermore, the entire vessel is re-laced annually in the off-season months (October and November).[789] The dried marsh grass is especially prone to rot and must be replaced when the hull is re-laced.[790] Kentley does not mention whether a master builder is necessary for annual re-lacing of vessels, or if the fishermen owners are able to perform the task by themselves. Various unusual materials are incorporated into certain portions of external seams of southern sector boats (where no seam wadding is present normally) during the repair of worn planking. These materials could include bicycle tire inner tubes, old flip flops, and palm leaves.[791] Hull planking is commonly reused throughout all regions. Kentley noted older hull planks being reincorporated into elements such as thwarts and stern decking.[792] I observed a similar practice in Sri Lanka as well, where one of the surveyed *oruwas* had a laced washstrake incorporated into its hull as a stern bench (Fig. 6.10). In one notable example, Kentley describes how the timbers of an old laced boat used for fishing were repurposed to build a laced ferry boat at 1/8th the cost of a new vessel.[793]

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787 Kentley 2003, 162-63.
788 Kentley 2003, 135.
789 Kentley 2003, 135.
790 Kentley 2003, 140.
791 Kentley 2003, 157.
792 Kentley 2003, 140.
793 Kentley 2003, 140.

Although, in essence, the *masula* remains a frameless laced plank-built craft with crossbeams regardless of geographical location, as noted above, several elements of *masula* boatbuilding exhibit regional variation: there is a broad range of materials selected for specific components of the vessel, the lacing holes can be sealed with balls of coir or with wooden plugs, the seam wadding can consist of dried marsh grass or coir fibers, and the lacing itself could follow one of two different patterns.[794]

Figure 6.10: Reused laced washstrake as the stern bench of a laced *oruwa* of Sri Lanka. (Photo by author.)

[794] Kentley 2003, 158.

In addition to these aforementioned technological variations, there are additional disparities in practice. Builders in the southern sector use thick planks for the bottom three strakes, which requires bending by heat.[795] The heating process entails the use of additional resources and the performance of additional actions on the part of the builders. In order to prevent splitting, the planks to be heated are first prepared by being coated in castor oil and sprinkled with red sand.[796] A pit is dug, a fire built, and once the timber has reached the appropriate temperature, then "several men will push down hard with a crowbar across the surface of the plank while others haul up the longer end."[797] As the team of builders for a *masula* is typically two to four men, this method of bending the bottom planks with heat would require the inclusion of more people in the building process. Furthermore, while builders in the northern and central sectors insert battens between the planks to maintain the proper angle while the planks are laced together, the builders of the southern sector use an externally fixed clamp.[798]

These technological variations are broadly correlated to ethnolinguistic groups, with Telugu builders working primarily in the northern and central sectors, and Tamil builders operating in the southern sector.[799] However, Kentley organizes *masulas* into three classes, arguing that the most significant features of these vessels are the form of the second strake (stealer versus tapering plank), the post/keel plank connection (keel plank laps below post versus keel plank laps above post), the number of oarsmen to each oar (only one versus multiple), as well as the method of lacing.[800] It is through this classificatory system that he established the three discrete sectors of

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[795] Kentley 2003, 153.
[796] Kentley 2003, 153.
[797] Kentley 2003, 153.
[798] Kentley 2003, 147, 155.
[799] Unfortunately, this correlation cannot be confirmed without consulting Kentley's original notes/data, as he does not state that all northern and central sector builders are in fact Telugu and that all southern sector builders are Tamil.
[800] Kentley 2003, 136.

building practices: northern, central, and southern. Within this system, the *masulas* of the northern and central sectors principally differ only in the type of second strake that the builders employ, although Kentley does note other technical differences, such as the method of attachment of the inner rail, the beveling of the keel plank or garboard, and the shape and taper of the posts.[801]

As the builders of both the northern and central sectors are at least primarily Telugu, the variation observed in the design of their vessels is not a factor of ethnolinguistic identity. In fact, Kentley claims that there are "no political, cultural or economic differences" between the boatbuilders of the northern sector and central sector types of *masula*.[802] Kentley notes that these builders are also part of the same fisherman caste and predominantly Hindu; it is uncertain how the technical variants are distributed in relation to the small enclave of Muslim builders.[803] However, based on Degoy's study (discussed above), technical variation along this coast of India is often associated with dialectal groupings, subcaste divisions, and matrimonial networks. It does not appear that Kentley collected this level of anthropological data in association with his ethnographic study of the *masula* boatbuilders. Therefore, it is possible that these variations in technical behavior could be an aspect of social identity that went unrecorded.

A few of the *masula* boatbuliders, similar to Andhra Pradesh potters, are aware of the regional patterning of technical behavior. When asked why the variation existed on either side of the Vamsadhara River, the geographical border between the northern and southern sectors, *masula* builders asserted that the observed practices are the tradition of each group or that their designs are more suitable for the waters along their own coast.[804] As an explanation for the differential usage of the two methods of lacing, one builder from the southern sector indicated that Method 1

[801] Kentley 2003, 145.
[802] Kentley 2003, 146.
[803] Kentley 2003, 135.
[804] Kentley 2003, 146.

was more expensive (presumably because it uses more wadding material and more cordage), and is used sparingly in the southern sector because owners could not afford to have their entire vessel laced in this manner.[805]

*Associated Rituals*

While only two to four individuals tend to take part in the manufacturing stage of the *chaîne opératoire* of *masula* laced boats, the commencement of the building process and the launch of a new *masula* are village-wide affairs, involving members of the wider fishing community. Construction begins on an auspicious day with the laying of the keel-plank, which is strewn with offerings of flowers, *betel*, and plantains.[806] Burning incense creates the ambience within which the keel plank is consecrated by the smashing of a coconut while prayers are offered.[807] The first journey of a *masula* is always symbolic rather than practical in nature (i.e., no fishing takes place during the initial launching) and is accompanied by a launching ceremony.[808] Kentley describes this ceremony as follows:

> Once the construction is complete, the boat is dragged to the shore. On the sheer strake near the bow, or on the stem post, a smear of milk, sandalwood paste and turmeric is made, in the centre of which a *taluk* (the red dot Hindu women put on their forehead) is placed. Those present take a *taluk* from the same dish. The owner has plantains, *betel* and sweets distributed. The builder will then take a small chip of wood from the smeared area and give it to the owner, who will place it among his household deities. Finally, a coconut is broken over the bow and the boat will be launched for a symbolic (rather than a fish-catching) journey.[809]

These rituals emphasize the pivotal role of the *masula* within the life of the community. The building of the vessel is integrated into the religious structure through ritual and symbols. The

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[805] Kentley 2003, 158.
[806] Kentley 2003, 135.
[807] Kentley 2003, 135.
[808] Kentley 2003, 135-6.
[809] Kentley 2003, 136.

builder is a central part of the launching ceremony, and the boat itself is endowed with meaning as at least a small piece of it is installed among the household deities. As such, the *masula* is stitched into the fabric of the community, as a marker of its identity.

## A COMMUNITY OF BUILDERS

As evidenced by the ethnographic record, a laced boat is an inherently social entity. In recorded practice, it is not constructed by just one man; at least two are required to pass the thread from one side of the vessel to the other. This is a trait that is likely shared among boatbuilders of many traditions. Even kayak builders of Greenland, who construct a boat designed and tailored for a specific individual, practice their craft as part of a community, or at least in view of the community of fellow kayak builders.[810] Furthermore, laced boatbuilding technologies require the maintenance of traditional knowledge and skills through the social structure of the boatbuilding community. To date, scholars primarily have explained the preservation of traditional laced vessels within a community based on the material advantages of the boat itself. However, humans are more than a material being, and in order to understand fully the nature of this preservation, the sociocultural must be taken into account. This is not to say that material explanations are not also meaningful. Instead, the significance of this work is to supplement the discussion by attempting to understand the potential social and cultural factors contributing to the continuation of laced boatbuilding traditions within colonial contexts.

Anthropological approaches demonstrate that craftsmen and artisans often use technical behaviors to create and maintain group identity. Ethnographic research on the community of practice of laced boatbuilders reveals trends in resource procurement and manufacturing stages of

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[810] Walls forthcoming.

the *chaîne opératoire.* Combined they provide insight into the technical variation seen in the northwestern Adriatic laced tradition in Chapter 5 and provide clues as to the nature of the building process and the community of practice.

Based on the evidence garnered from ethnographic accounts of modern laced boatbuilding communities, teams of at least two to four men were likely involved in the construction of smaller craft, such as the Stella 1 river barge, and perhaps teams of over 10 men on larger coastal traders, such as the Comacchio ship. Construction and maintenance likely took place in the month or so prior to the season of use. In this regard, ethnography supports the tentative finds of the palynological study, presented in Chapter 5, which propose a season of manufacture in early spring. There was likely a division of labor, with different individuals responsible for woodworking and lacing, and a hierarchy among these workers based on their experience and skill level.

The clustering of preferences for different wood types for pegs and treenails, which parallels the clay processing recipes of Nigerien potters acting as technical signatures, may demarcate real social boundaries between separate builder communities and/or may reflect adherence to local norms. This also may explain the two framing patterns of northwestern Adriatic laced builders, particularly if "peg signatures" are found to overlap with "framing signatures". Finally, the motor habits developed during the process of lacing up a vessel, done in tandem with a fellow builder, and the preference of tools used to facilitate this lacing process, likely would have mirrored those of a builder's original learning environment and part of their inheritance that they then passed on by training new builders.

Identity is informed by the sum of an individual's sensory experiences in life, by what a person does, how he or she does it, and the other persons with whom an individual engages in these activities. Even though it was designed for pottery *chaînes opératoires* and to analyze macroscale variation across a wide geographic region (subcontinental) for an extended period (thousands of years), Gosselain's three levels of technical variation provide a possible interpretation of the aspects of identity embedded within the dynamism and stability of technical behaviors of northwestern Adriatic laced boatbuilders. As discussed above, shaping traditions within ceramic technologies are consistently associated by potters with an expression of social identity. Within the northwestern Adriatic laced tradition, the shaping techniques used to fashion the lacing system (resulting in the size and spacing of the lacing channels and the expansion of the edge cavities) are remarkably stable, as predicted by Gosselain's model, and may represent those most deeply rooted facets of identity. As such, the consistency and persistence of a definable tradition of laced boatbuilding in the northwestern Adriatic likely represents a community of builders who actively and intentionally preserved their inheritance as a facet of their identity, through the twists and strokes and passes of cord that bound together more than just a boat.

# CHAPTER VII

# CONCLUSION

In conclusion, let us examine the results of this study in terms of the broader discussion of the process(es) of cultural change within a colonial context (the fourth research objective). But first, let us review the three research objectives that were explored in the previous chapters: 1) to contextualize the northwestern Adriatic tradition of laced construction within the broader socioeconomic framework of the region and the increasing interconnectedness of the Mediterranean world, 2) to reconstruct the technological stages of northwestern Adriatic laced vessels through a *chaîne opératoire* framework in order to understand the decision-making strategies of the ancient builders, and 3) to explore how local cultural identity(ies) were formed and maintained during the various technological stages and decisions of northwestern Adriatic laced vessel *chaînes opératoire*s.

In other words, what can be concluded about this tradition of boatbuilding, the context in which these vessels were built, and the significance of the tradition within the ancient community of builders? The predominance of laced boats in the archaeological record of the northwestern Adriatic region underscores the presence of a community of boatbuilders who were connected to broader Mediterranean methods (particularly when the mixed construction of the Comacchio ship is considered), but chose to preserve their own tradition of ship construction. This community of laced boatbuilders is invisible within the textual, epigraphic, and iconographic sources of the region. Only the products of this community, that is the remains of the laced boats they built, have the potential to contribute significantly to our knowledge of their lifeways and identities; these vessels are a repository of the actions, the communal effort, and the decisions of these craftsmen, none of which is preserved in the texts, inscriptions, or iconography of the region.

## THE NORTHWESTERN ADRIATIC TRADITION OF LACED BOATBUILDING

The archaeological remains of the northwestern Adriatic laced tradition include 19 discrete finds – some are mostly complete hulls from shipwreck sites, some are reused planking incorporated into hydraulic structures, and some are hull fragments without archaeological context. From this varied assortment of timbers, I have extracted detailed information on the key elements that comprised this tradition and related them to the ancient community of builders.

These timbers show consistent elements that help define the tradition as well as dynamic elements that may reveal the individual or group preferences of specific builders. The features of the *chaîne opératoire* that remain stable over time and across the region are the flat-bottomed nature of all vessels; the preference for hardwoods for hull planking and frames, lime bast fibers for the seam wadding, and likely esparto grass for cordage; the banded-X lacing pattern; the diameter and spacing of lacing channels, likely reflecting the use of a consistent if organic unit of measurement, and the expansion of the edge cavities. This consistency in resource procurement and manufacture over a span of at least 600 years (from the Comacchio ship to the Cervia hull remains) is noteworthy and highlights the fidelity of the knowledge transfer process which must have occurred during the training of new builders in the tradition. The small degree of variability seen in the size and spacing of the lacing channels likely is related more to minor aberrations in handcrafted tools and the natural proportions of builders' bodies than it is to an actual difference in practice. On the other hand, the dynamic features of this tradition include various hull shapes, choice of wood for pegs and treenails, number of passes with cordage, general framing pattern, and unique elements (such as the use of chocks). These features likely represent individual builder or community preferences, solutions, and ingenuity.

Thus, embedded within the *chaîne opératoire* of the northwestern Adriatic laced tradition are both a general strategy or approach to boatbuilding and multiple innovative solutions and preferences within that strategy, revealing both a regional boatbuilding community and distinct groups of builders within the community. Builders of northwestern Adriatic laced vessels had various options for each technical stage of the *chaîne opératoire*. At the most fundamental level, they could have employed the more prevalent mortise-and-tenon joinery building tradition – the Comacchio ship proves that northwestern Adriatic laced builders either collaborated with other builders knowledgeable in this Mediterranean joinery system or that they themselves were adept in it.

While builders of this tradition were familiar with the mortise-and-tenon joinery method used throughout the Mediterranean, they chose to continue employing their laced system of joinery. In fact, the tradition of laced construction in the northwestern Adriatic, with soft joints (fibers) and hard hull planking (elm and oak), is actually a direct reversal of Mediterranean mortise-and-tenon construction, where the joints are hard (tenons of oak) and the hull planking is soft (pine). This raises the question: What advantage did the builders perceive in this arrangement? This combination of flexibility and durability is well-suited to the shallow waterways of the region, but what sociocultural factors might have influenced the preservation of this tradition? To explore this question, we turn now to the political, social, and economic context of the northwestern Adriatic region.

**THE CONTEXT**

This tradition of laced boatbuilding did not exist in isolation. The boatbuilders following this tradition were operating in the context of drastic changes to the economic, social, and political landscape, many of which are reflected in changing material culture. Most of the hull remains from the northwestern Adriatic tradition date to the period of Roman colonization. While currently there is only limited archaeological evidence – the sixth- or fifth-century B.C.E. wooden fragment from the Venice Lagoon – to suggest that the northwestern Adriatic laced tradition of boatbuilding predates Roman colonization of the region, textual evidence suggests that the Patavians had similar boats in the fourth century B.C.E., although the joinery system was not described. The recent discovery of an eastern Adriatic laced vessel dating to the Bronze Age may speak to the antiquity of laced boatbuilding techniques in the broader region of the upper Adriatic. As such, it is very likely that this method of hull construction represents a local tradition, preserved by the local inhabitants of the region that was already in use when Roman settlers established Aquileia in 181 B.C.E.

The local inhabitants, known to the outside contemporary world as the Veneti, lived in urban centers in the Po River valley and near the lagoons along the coast. Textual sources speak to the pervasiveness of the waterways that connected the region, the importance of watercraft along these waterways, and the cultural memory of local ascendancy over the paludal environment (the victory of the Patavians over Cleonymus) that persisted into the colonial period. During the pre-colonial period, Venetic inscriptions and iconography also hint at this underlying reliance on waterways and perhaps portray the amphibious lifeways of (at least some) local individuals, stressing the importance that boats (and perhaps their builders) would have had within the society.

The Veneti had a developed sense of civic identity, with localized religious practices and an established social hierarchy. There is little evidence for an ethnic identity connecting the Veneti across urban communities within the region during the pre-colonial period. The discovery of lead missiles inscribed with "*Otergyium*" at the siege of Asculum during the Social Wars (91-88 B.C.E.) reinforces the existence of civic identity over ethnic identity in the colonial period. Tying this back to the laced boats of the region, a predilection toward civic identity leads to an expectation of regional patterning in construction features reflecting multiple communities of practice in the region. In this regard, the hypothesis that "peg signatures" serve as markers of disparate communities of practice is in line with the local context.

Furthermore, the Veneti, in their position at the crossroads between various other people groups, had a long history of contact with Etruscans, Greeks, and Celts and of incorporating some of the cultural features of these peoples into the fabric of Venetic material culture. This acquisition of foreign cultural elements pre-dates the cultural assimilation of Roman traits, although the degree is not the same. By the first century B.C.E., Roman presence in the region of Veneto was pervasive and had affected many aspects of the Venetic way of life, including political structure, urban landscape, economy and industry, religious and ritual practices, burial rites, and the language of public use. During the colonial period, there is also a rise in ship representations that mostly follow Roman forms, and even a reference to a *faber navalis* at Aquileia, which together might suggest an increase in maritime traffic and overt administrative organization in the region, as well as increased economic ties with other sectors of the Roman Empire.

Roman influence can also be detected within the material remains of northwestern Adriatic laced vessels. While this method of laced boatbuilding is largely a local tradition, using primarily local resources and only minimally incorporating broader Mediterranean technology of mortise-and-tenon joinery, Roman influence is apparent in the incorporation of esparto grass cordage. Combined, the literary and archaeological evidence support the argument that the availability of esparto grass in the central Mediterranean, and thus to the community of builders of northwestern Adriatic laced boats, was a direct result of Roman imperial expansion. The use of esparto grass cordage as the very element holding these boats together, connected the builders with the trade networks established by Roman imperialism, and as such the builders became reliant on wider mechanisms of exchange and power imbalances outside the region where they practiced their craft.

As such, the boatbuilders of this tradition were operating in a context of increasing interconnectivity with the various peoples, customs and technologies of the wider Mediterranean basin. They were also practicing their craft in a context of continual and progressive entanglement whereby foreign cultural elements were drawn into the local cultural fabric. However, it is likely that the builders of northwestern Adriatic laced boats, although entangled in the forces of Roman imperialism, were largely detached from the political machinations that drove local elite males to increasingly identify as Roman. In the absence of a politically-induced motivation to become Roman, the builders as part of a non-elite portion of the population, may have retained more elements of their local cultural identity. Thus, the preservation of a local form of craftsmanship may be tied to the preservation of their identities as members of a craft community. But is there precedence for linking technical behavior to group identity? This leads us to ethnographic studies of modern laced boats and the ethnoarchaeological parallels for building identity alongside building things.

## BUILDING MORE THAN JUST A BOAT

The ethnographic record of modern laced boats, although limited in their evaluation of sociocultural factors, revealed patterns in manufacture and resource procurement that are informative to the situation of the northwestern Adriatic laced boatbuilders. The primary exploitation of local, handcrafted materials is consistent within both modern and ancient communities of laced boatbuilders and seems to suggest a preference for traditional ecological knowledge and locally manufactured instead of foreign goods. However, the incorporation of "foreign" elements – factory-made products in some modern laced vessels and esparto grass cordage in the northwestern Adriatic laced boats – indicates that resource procurement also may be guided by economic factors of cost and availability. Furthermore, the pokers and needles used to facilitate lacing in modern boatbuilding communities are evocative of the bronze instruments dedicated at Venetic sites, currently identified as writing styluses, which might signify a previously undetected link between the archaeological record and the ancient community of boatbuilders.

Kentley's study of the *masula* surf boat and its builders uncovers definable patterns in the decision-making strategies of discrete building communities. Although he was not able to link these patterns to definitive sociocultural factors, this is likely due to the minimal amount of data he collected on the boatbuilders. His research, however, did highlight the significance of the vessel and the building process to the whole village and the ways in which the broader community incorporated the boat into the local ritual landscape. In order to further explore sociocultural influences on technical behavior, I examined anthropological approaches to technology within the ethnoarchaeological literature to evaluate how technological craftsmanship in general contributes to or reflects the formation and maintenance of local cultural identities.

As discussed, identity is informed by the sum of individuals' sensory experiences in life, by what they do, how they do it, and the other persons with whom they engage in these activities. Practice theory emphasizes the shared human experience of creating, maintaining, and negotiating identities through embodied practice. It is through participation in a community of practice that an individual acquires the knowledge base and learns the kinesthetic skills – those bodily movements, tool use, and applications of force that physically transform raw materials into finished objects – necessary to practice his/her craft.

Many scholars – Lemmonier, Gosselain, Degoy, and others – have demonstrated that variation in technology (both the *chaîne opératoire* and the finished product) often is an overt expression of social difference, a deliberate choice on the part of the craftspeople to distinguish themselves from their neighbors. The dynamic features of the tradition, particularly the clustering of preference for different wood types for pegs and treenails, which act as technical signatures and whose use may demarcate real social boundaries between separate builder communities and/or may reflect adherence to local norms, is paralleled by the clay processing recipes of Nigerien potters, which serve as markers of their social identity. Furthermore, a builder's original learning environment, these separate communities of practice, would likely have determined the motor habits used during the process of lacing up a vessel and their preference of tools used to facilitate this lacing process. These techniques and tools make up part of a builders' inheritance that they then passed on by training new builders.

In addition, shaping traditions within ceramic technologies are consistently associated by the potters as an expression of their social identity. Within the northwestern Adriatic laced tradition, the shaping techniques used to fashion the lacing system (resulting in the size and spacing of the lacing channels and the expansion of the edge cavities) are remarkably stable, as predicted by Gosselain's model, and likely represent those most deeply rooted facets of identity. As such, the consistency and persistence of a definable tradition of laced boatbuilding in the northwestern Adriatic may represent a community of builders who actively and intentionally preserved their inheritance as a facet of their identity. When examined within the context of increasing interconnectivity and the entanglement of the builders into the forces of Roman imperialism, this preservation of identity alongside a tradition of boatbuilding takes on additional meanings and speaks to the processes of cultural change within a colonial context.

## PROCESSES OF CULTURAL CHANGE WITHIN A COLONIAL CONTEXT

Returning now to the final research objective: how does this research contribute to the larger discourse in the academic community on the process(es) of cultural change within colonial contexts? This research was designed to answer Michael Dietler's call to consider "locally relevant social categories ... and socially situated interests"[811] by studying a community of boatbuilders within a focused geographical region and fairly established chronological parameters who have their own set of situated interests. As such, this study reflects an anthropological interest in specific people groups and the postcolonial affinity for the intentionally myopic. The entanglement of the Veneti into the process of expanding Roman imperialism and the incorporation of Roman cultural elements into the local landscape was not inevitable. There is nothing inherent in either Roman power structures or material culture that irrevocably compelled the unfolding of events. In fact, the perspective of Roman imperialism as a grand sweeping force that overpowered the ancient world overlooks the very real and very singular experiences of individuals and communities. The peoples of the northwestern Adriatic and builders of these local laced boats, however, did become entangled in the processes of Roman expansion, and this research highlights some of the consequences of that encounter, or perhaps better yet, those encounters.

The textual and archaeological records present a unique relationship between the Veneti and the Romans as friends, allies, and perhaps even distant kin, metaphorically if not biologically, if the origin myths of Antenor (Veneti) and Aeneas (Romans) reflect a shared understanding between the two groups. The devotion of the Veneti is a prevalent theme in Roman literature and perhaps an emic sentiment as well if the mile markers along the Via Postumia are indicative of local loyalties. On the ground, this relationship was augmented by the gradual accumulation of Roman material culture over the course of several centuries. Based on the piecemeal and lengthy process of changing material culture, Luciano Bosio and Kathyrn Lomas argue that it represents a voluntary assimilation of Roman cultural traits on the part of the Veneti.[812] Furthermore, Lomas stresses the flexible and dynamic concept of personal identity reflected in material culture of the

811 Dietler 2010, 76.
812 Bosio 1981, 237; Lomas 2007a, 38.

region and the strong receptivity on the part of the Veneti toward adapting foreign elements to express a distinctive local cultural identity throughout their pre-colonial history.[813]

Currently, there is no evidence to support a claim that the relationship between these populations was anything other than this depiction of general harmony. However, the regional archaeological record and the preservation of the northwestern Adriatic laced tradition of boatbuilding does promote a nuanced understanding of this spirit of amicability and social cooperation, that of discrepant experience. The *stelae Patavinae*, and to some extent the life and writings of Patavium's most famous citizen, Livy, underscore the proclivity of local elite males to identify as Roman, whereas elite females were instead the keepers of traditional practice. Thus, elite women had a different experience of Roman imperialism than elite men.

The builders of northwestern Adriatic laced boats also had their own unique experience of the imperial process. By practicing their craft within a community of fellow builders of the tradition, they learned, inherited, and passed on a tradition that tied them to a craft community spanning centuries. In this sense, their experience of Roman imperialism was marginal, if not arguably nonexistent. Yet, they were not entirely isolated. The diversity of practices observed in relation to framing patterns suggest that this element of construction was particularly sescptible to modification and perhaps shows signs of external influence, linking northwestern Adriatic laced builders to the Celtic tradition of central Europe. Furthermore, their collaboration with builders of mortise-and-tenon technology or their limited adoption of the technique connected them with larger Mediterranean methods of ship construction. Finally, their use of cordage spun from grass grown far outside their region joined them to the broader economic structures established by Roman conquest.

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[813] Lomas 2009, 23.

It is uncertain how aware the builders of this tradition were of these phenomena or how much their connection to these larger machinations influenced their daily lives. However, the preservation of this tradition, perhaps as an aspect of their group identity as builders, emphasizes the importance of the local community to their most fundamental experiences. The practice of building a laced boat – the cutting of the lacing channels, the shared work of passing, pulling, and tying the cordage, the bodily motions of joining one plank to the next over a series of ingrained movement – created a shared experience that linked each builder to a community of practice that spanned across centuries. During the building process, the ebb and flow of Roman imperial expansion and cultural influence, at least momentarily, was suspended.

## SIGNIFICANCE OF THE RESEARCH

The ultimate goal of this research is to showcase the efficacy of incorporating anthropological thought into a hull study. In particular, I hope to have demonstrated the potential of applying the *chaîne opératoire* framework – the sequence of actions and mental processes through which an artifact is manufactured, from the acquisition of the raw materials to final discard of the artifact – alongside the literature on communities of practice to analyze a discrete tradition of boatbuilding. There are certain clear advantages to this approach, including its efficient and accessible organizational scheme, attention to the decision-making processes at each technical stage, and an emphasis on practice – the actions, kinesthetic motions, and learned behaviors that shaped an underlying mental template shared by the community of practice. It should be remembered, however, that the building process is not always sequentially chained together as this, in some ways, idealized schema would suggest. Ethnographic research on modern laced boatbuilders, in fact, reveals the fluidity of actual practice, with holes drilled and cavities carved in tandem with the lacing. Yet the overall *chaîne opératoire* approach, which asserts that technical features offer clues to the lifeways and identities of a community of builders, transforms utilitarian artifacts, such as boats, into roadmaps to the decision-making strategies and situated learning processes of ancient builders.

Finally, this dissertation has highlighted key areas of future research and the importance of collecting certain types of data. An ethnoarchaeological study of modern laced boatbuilding communities, or pockets of traditional boatbuilders broadly, has the potential to illuminate the sociocultural factors that influence patterning of technical behavior. Kentley's research on the *masula* surf boat represents an important first step, but more detailed data on subcastes, matrimonial networks, and other sociocultural factors, as well as a comprehensive study of body positions and tool use, could uncover significant explanations of technological variability in boatbuilding. Additionally, conducting more exhaustive sampling of ancient hull remains could result in a better understanding of builder preferences in resource procurement and distinguish multiple "recipe signatures" linked to discrete communities; for the northwestern Adriatic tradition of laced boatbuilding, further identification of materials for each element (and especially for pegs and treenails) could potentially demonstrate the existence of at least two, and likely more, distinct communities of practice. Finally, an expansion of the pollen analysis included in this study, with larger sample sizes (at least 2gm) as well as more samples from more hull remains, could refine our understanding of the location and season of manufacture of the cordage and seam wadding materials. Perhaps, once a sizeable database of seam wadding pollen spectra is accumulated, discrete boatbuilding areas within the northwestern Adriatic region could be identified.

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# APPENDIX A

## VENICE LIDO III ASSEMBLAGE

## CATALOG OF TIMBERS

All measurements are given in centimeters, unless otherwise noted. For basic measurements, maximum preserved dimension is given. Ranges and averages are noted for channel spacing and channel diameter. Common names and scientific names of identified species presented. Abbreviations used are as follows:

Pres. L. – preserved length in centimeters unless otherwise stated
Pres. W. or W. – width in centimeters
Th. – thickness in centimeters
Chan. Dia. – diameter of the lacing channel in centimeters
Chan. Spac. – spacing between the lacing channels in centimeters

### Hull Planking Fragment #1

Elm (*Ulmus campestris*)

Pres. L. 91.00 W. 22.20 Th. 7.45 and 4.80
Thick Edge: Chan. Dia. 2.40 Chan. Spac. 5.40-8.30 (avg. 7.05)
Thin Edge: Chan. Dia. 2.70-2.30 (avg. 2.50) Chan. Spac. 5.30-7.20 (avg. 6.18)
Pegs: Dogwood (*Cornus sanguinea*) Cordage: Esparto grass (*Stipa tenacissima*)
Treenail: Linden/Lime (*Tilia cordata/T. platyphyllos*) Chock: Dogwood (*Cornus sanguinea*)

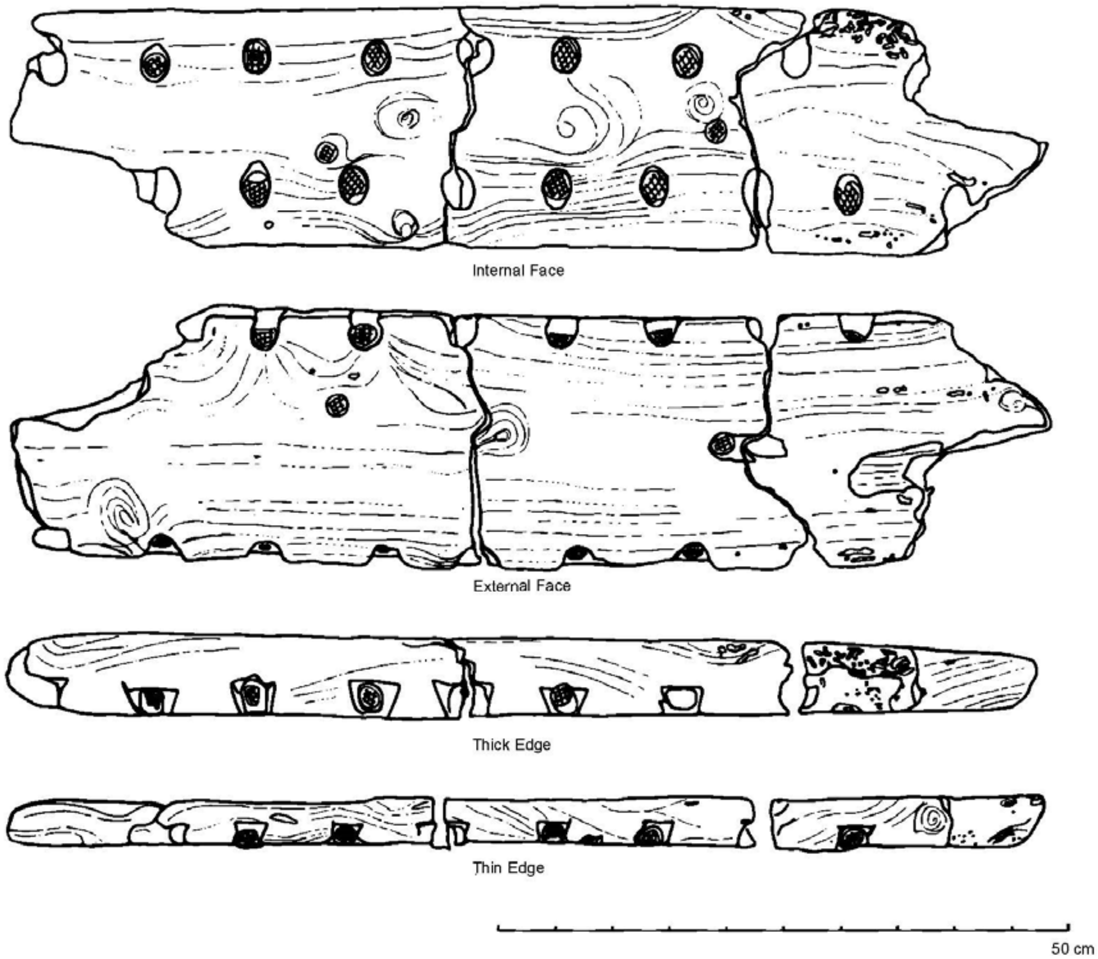
Fragment of hull planking in three pieces. Lacing system preserved along both edges. One plank edge considerably thicker than the other. Seven lacing channels preserved along both edges. Lacing channels along the thicker edge are on average smaller, spaced further apart, and more steeply graded. Channels along both edges about the same average distance from the edge, and noticeably larger than those of other planks in this set. Edge cavities significantly larger along the thicker edge. Some edge cavities show signs of extra cuts (mistakes? realignments?). Chocks noted in three pegs. S-twist cordage. Twelve, seven, and five pieces of cordage preserved in three sampled channels. Fairly significant teredo damage. Shells imbedded in plank surface. Sawn flat. Cross-section clearly visible where plank was broken along width. Plank cut from approximate center of log. Nineteen rings counted toward the thicker edge and 26 rings counted toward the thinner edge. Several knots noted on both faces. Possible saw marks along the interior face and the thicker edge. Long striations along inside of lacing channel (impression [of peg?]). Some

gouge marks noted along exterior face (tool marks or damage during vessel's life or after demise?). Two treenails preserved, both fairly small in comparison to pegs. Treenails staggered along width of plank. Plank fragment may be garboard strake or from the turn of the bilge.
Parallels: Cervia remains, Comacchio ship, Venice Lido I hull remains.
Date: Plank – 140-260 C.E. and 270-330 C.E. (2σ calibrated 14C date, Beta Analytic Laboratory); Plank – 27-40 C.E., 48-180 C.E., and 185-214 C.E. (2σ calibrated 14C date, Arizona AMS Laboratory); Cordage – 40 B.C.E-87 C.E. and 105-120 C.E. (2σ calibrated 14C date, Arizona AMS Laboratory)


**Internal Face** (photo by Mirco Cusin)


**External Face** (Photo by Mirco Cusin)

Venice Lido III Timber Assemblage
Hull Planking Fragment #1
17 June 2014



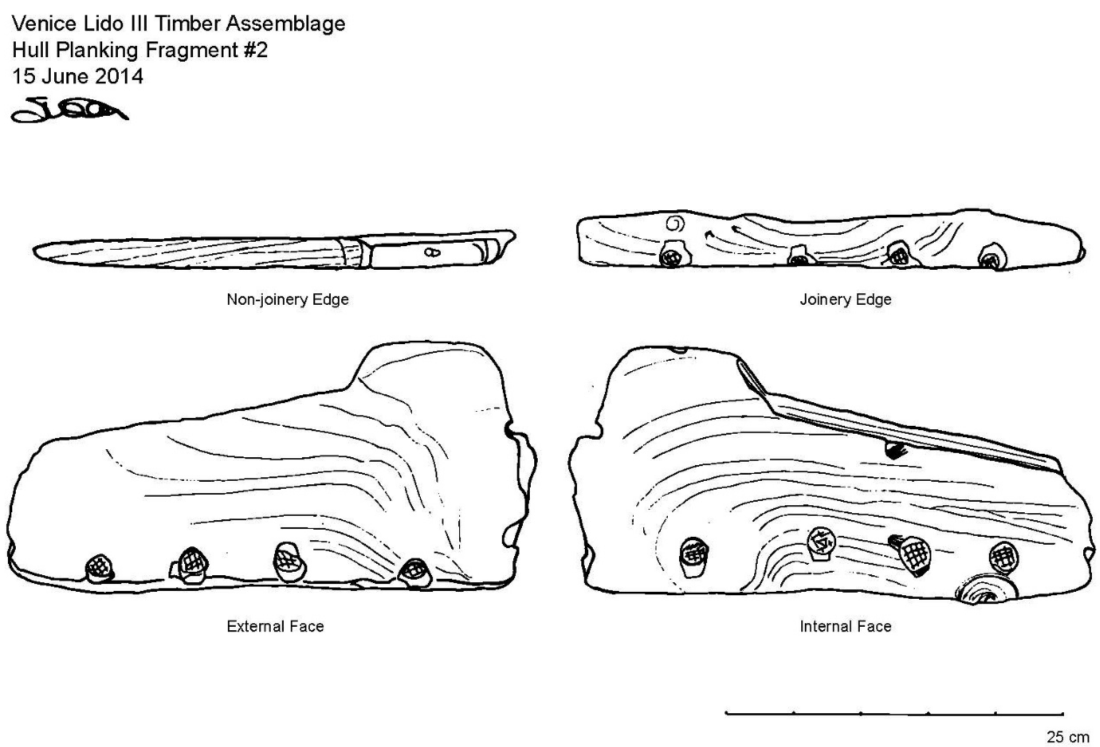
**Hull Planking Fragment #2** Elm (*Ulmus campestris*)

Pres. L. 39.10 Pres. W. 18.20 Th. 4.86
Chan. Dia. 2.20-1.96 (avg. 2.06) Chan. Spac. 4.36-7.40 (avg. 5.67)
Peg: European Fir (*Abies alba)* Cordage: Esparto grass (*Stipa tenacissima*)
Fragment of hull planking with four intact lacing channels along one edge (all complete with pegs and cordage). Plank broken at lacing channels leaving two exposed on each end (likely a recent break). Other edge broken with no fastenings. Full width not preserved. Drilled vertical hole along narrow end about 5cm from the broken edge (likely too small to be for treenail). One possible partial treenail hole (about 11 mm in diameter) along wide end. Lacing channels staggered (perhaps to avoid knots) and not worn entirely in line with the plank edge. One channel of lacing system drilled into large knot. Edge cavities only minimally expanded. S-twist cordage. Three pieces preserved in channel. Broken edge shows clear radial section with 14 rings counted. Sawn flat. Roughly hewn. Gouge marks – not bore marks – noted in lacing channels. Grain pattern obscured by two large knots. Shells impressions in internal plank surface. Some teredo damage.

Parallels: Cervia remains, Comacchio ship, Venice Lido I and II hull remains.
Date: Plank – 40 B.C.E.-130 C.E. (2σ calibrated 14C date, International Chemical Analysis Laboratory)


**Internal Face** (Photo by Mirco Cusin)


**External Face** (Photo by Mirco Cusin)



**Hull Planking Fragment #3** Elm (*Ulmus campestris*)

Pres. L. 23.7 W. 13.7 Th. 2.93
Chan. Dia. 2.02 Chan. Spac. 5.86-5.19 (avg. 5.53)
Peg: European Fir (*Abies alba)* Cordage: Esparto grass (*Stipa tenacissima*)

Small fragment of hull planking with one fully intact lacing channel along one edge (peg and cordage preserved). Other edge slightly rounded and thicker. Plank broken at lacing channels leaving two partially intact on each end. No treenails or other fasteners noted. Edge with joinery appears beveled or rounded (likely result of natural processes). Edge cavities distorted due to beveling/rounding. Rounded knob at one end of non-joinery edge (again likely result of natural processes). S-twist cordage. Only two pieces preserved in channel. Full width not preserved. No knots noted. Quarter sawn. Lacing channels smooth. Possible teredo damage.

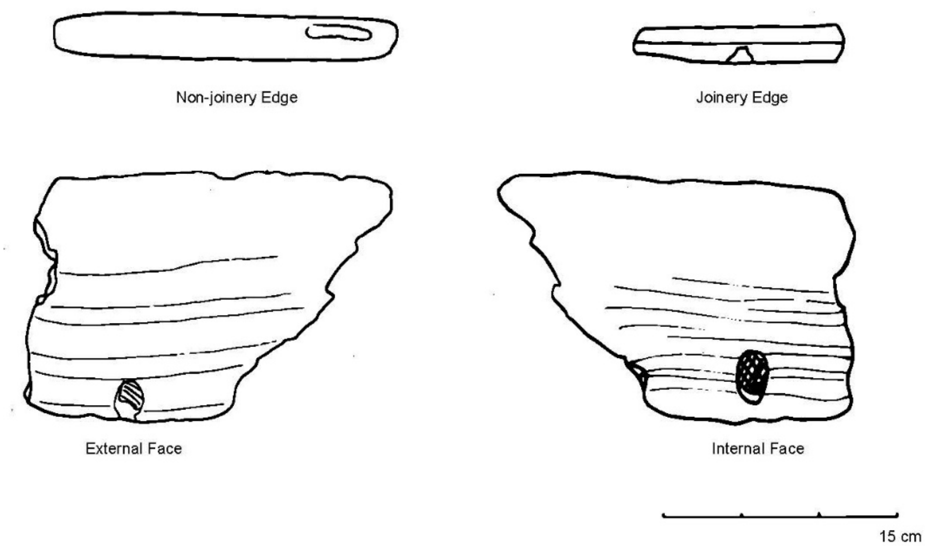
Parallels: Cervia remains, Comacchio ship, Venice Lido I and II hull remains.
Date: Plank – 90-340 C.E. (2σ calibrated 14C date, International Chemical Analysis Laboratory)



**Internal Face** **External Face**

(Photos by Mirco Cusin)

Venice Lido III Timber Assemblage
Hull Planking Fragment #3
13 June 2014



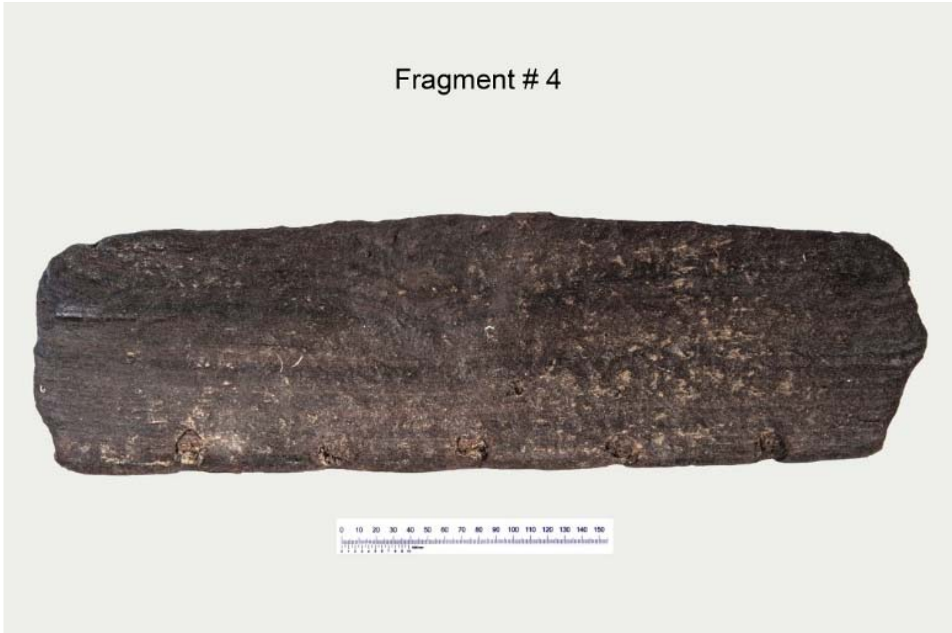
**Hull Planking Fragment #4** Elm (*Ulmus campestris*)

Pres. L. 51.00 W. 14.00 Th. 3.50
Chan. Dia. 2.10-1.90 (avg. 1.98) Chan. Spac. 6.55-5.50 (avg. 6.18)
Peg: European Fir (*Abies alba)* Cordage: Esparto grass (*Stipa tenacissima*)

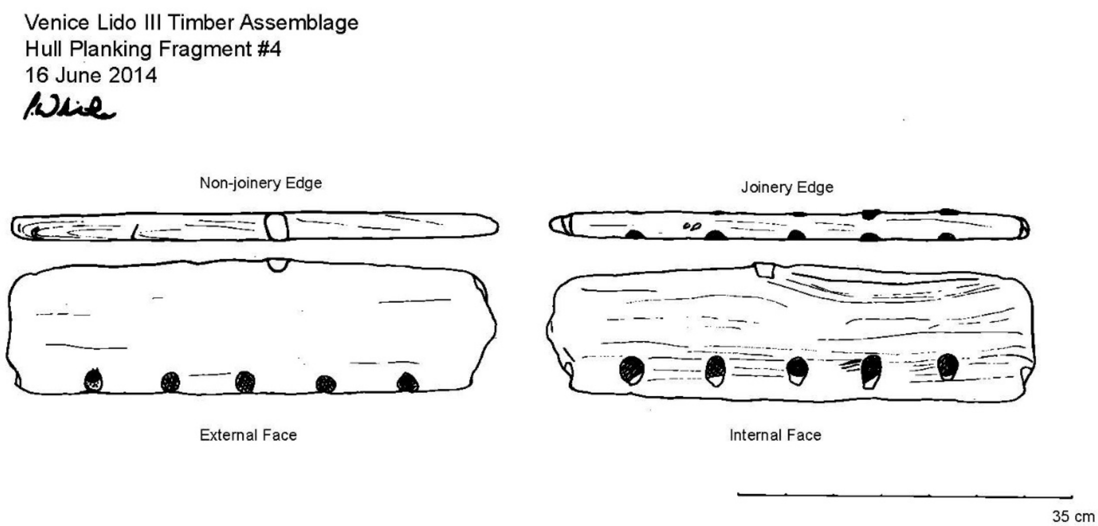
Small fragment of hull planking with five intact lacing holes along one edge (peg and cordage preserved). Plank broken at lacing channels leaving two partially intact on each end. Some channels squared to edge of plank (natural wear of cordage or intentional shaping?). Edge with joinery appears beveled or rounded (likely result of natural processes). Edge cavities distorted due to beveling/rounding. No treenails or other fasteners noted. Patch of material along non-joinery edge (about 2cm wide) wrapping around edge. Possible terminal timber of vessel (rail or gunwale). Quarter sawn. One knot noted. Possible saw marks along internal face. Possible chisel marks along non-joinery edge. Lacing channels smooth. S-twist cordage. Three pieces preserved in sampled lacing channel. Surfaces heavily pitted and eroded. Some shells and other marine debris embedded in surface.

Parallels: Cervia remains, Comacchio ship, Venice Lido I and II hull remains.
Date: Plank – 41 B.C.E.-71 C.E. (2σ calibrated 14C date, Arizona AMS Laboratory)


**Internal Face** (Photo by Mirco Cusin)




**External Face** (Photo by Mirco Cusin)



**Hull Planking Fragment #5** English Oak (*Quercus robur*)

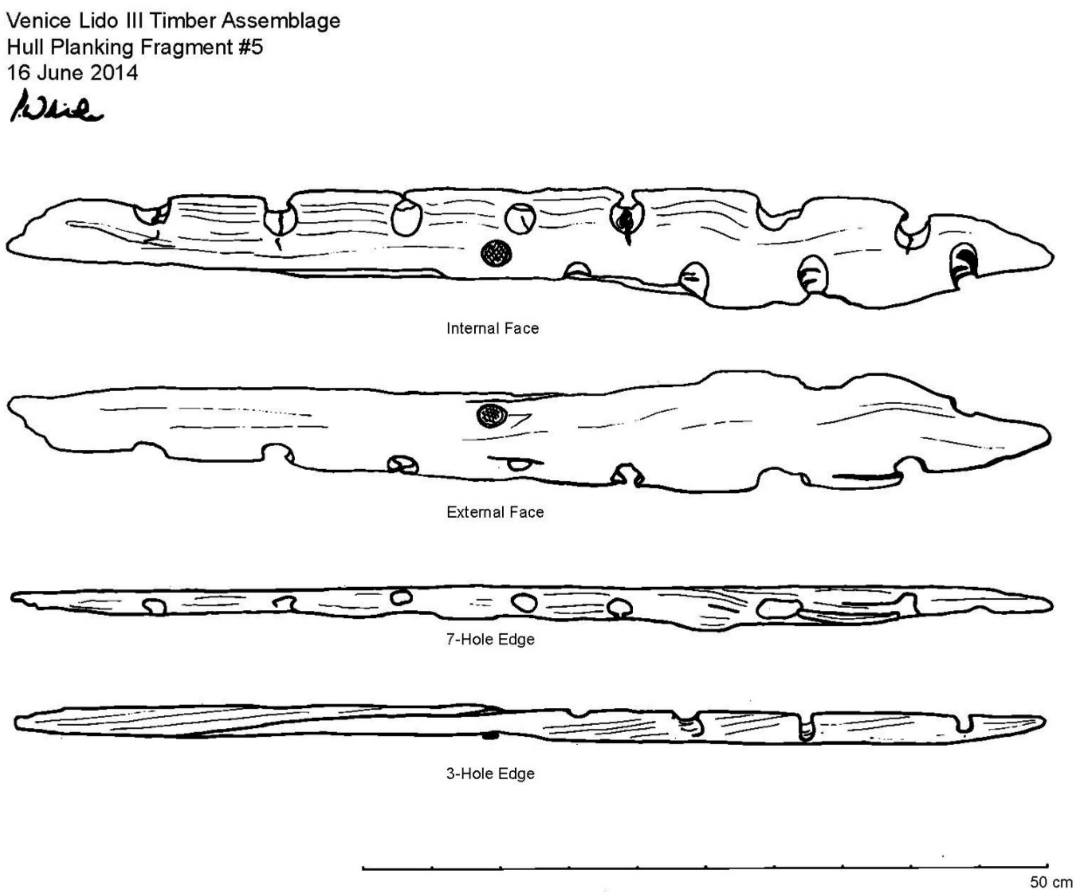
Pres. L. 75.80 Pres. W. 10.20 Th. 3.40
Chan. Dia. 1.80-2.00 (avg. 1.90) Chan. Spac. 5.60-8.50 (avg. 7.12)
Peg: Dogwood (*Cornus sanguinea*) Cordage: Esparto grass (*Stipa tenacissima*)
Treenail: Dogwood (*Cornus sanguinea*)

Distinctly shaped fragment of hull planking likely representing a hood end or repair. Fragment severely distorted since last year. Measurements presented here based on 2013 measurements (instead of 2014). Lacing channels intact along one edge for full length of timber and along other edge for about half the length. Timber broken along this half section. Two pegs and cordage preserved in 2013 (one of each sampled at that time), however other peg and cordage no longer intact in 2014. Edge cavities not well preserved. One treenail preserved. No cross-section visible. Eleven rings counted along radial section of broken edge. Surfaces distorted and tool marks not possible to identify.

Parallels: Cervia remains, Comacchio ship, Venice Lido I and II hull remains.
Date: Plank – CAL 170-400 C.E. (2σ calibrated 14C date, International Chemical Analysis Laboratory)


**Internal Face** (2014; photo by Mirco Cusin)

**Internal Face** (2013, photo by author)



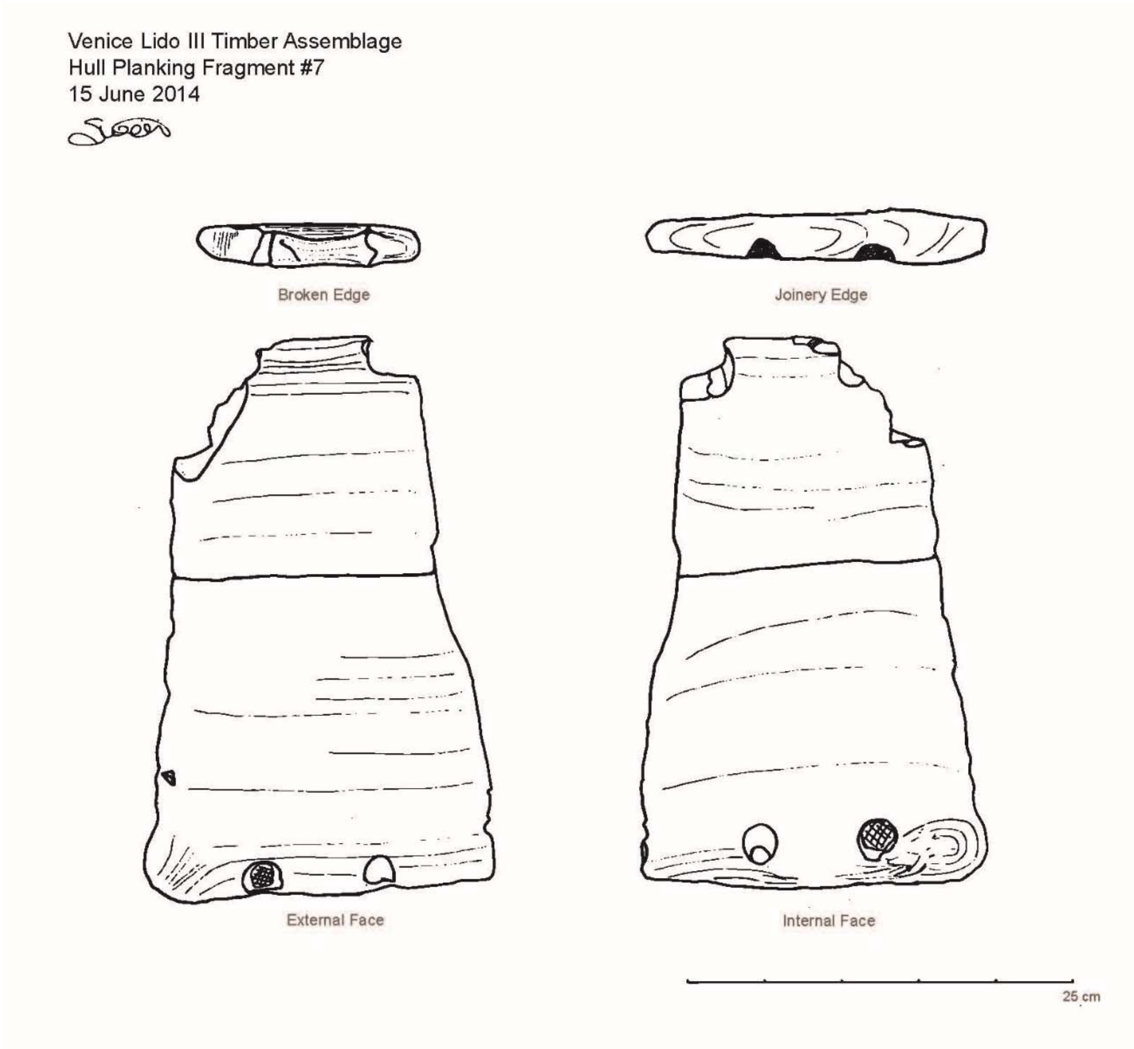
**Hull Planking Fragment #7** Elm (*Ulmus campestris*)

Pres. L. 22.40 W. 36.10 Th. 3.40
Chan. Dia. 2.05-2.40 (avg. 2.23) Chan. Spac. 5.30-7.00 (avg. 6.06)
Peg: Norway Spruce (*Picea abies)* Cordage: Esparto grass (*Stipa tenacissima*)

Short, but wide section of hull planking in two pieces with two intact lacing channels along one side (peg and cordage intact), and two partial lacing channels along other side. Plank broken along lengthwise centerline. Both intact edge cavities trapezoidal though slightly rounded (likely due to post depositional erosion). One knot noted at corner with intact lacing hole. Possible saw marks along internal and external faces. No treenails or other fasteners noted. Surface pitted with possible teredo damage. Preserved plank width exceeds other recovered timbers of the tradition (most others 10-30 cm in width).
Parallels: Cervia remains, Comacchio ship, Venice Lido I and II hull remains.
Date: Plank – 100 B.C.E.-120 C.E. (2σ calibrated 14C date, International Chemical Analysis Laboratory)



**Internal Face** **External Face**
(Photos by Mirco Cusin)



Venice Lido III Timber Assemblage
Hull Planking Fragment #7
15 June 2014
Broken Edge
Joinery Edge
External Face
Internal Face
25 cm

**Hull Planking Fragment #8** Elm (*Ulmus campestris*)

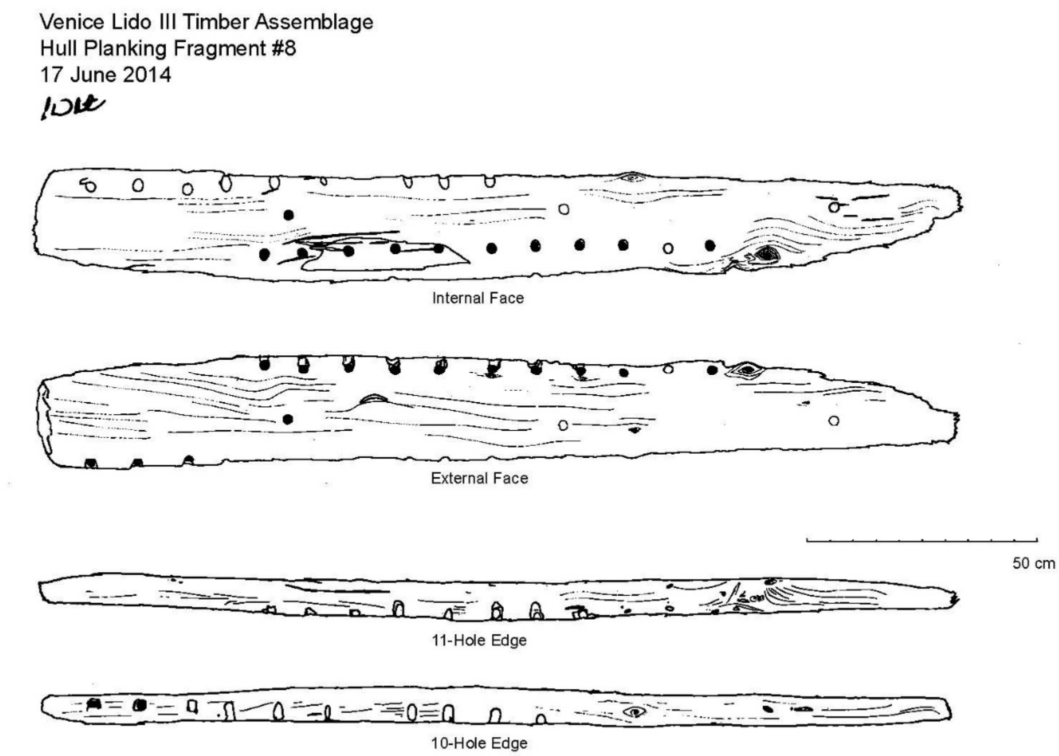
Pres. L. 2.00 m Pres. W. 22.70 Pres. Th. 6.10
Original Edge: Chan. Dia. 2.10-2.05 (avg. 2.08) Chan. Spac. 9.10-6.20 (avg. 7.88)
Repair Edge: Chan. Dia. 2.00-1.25 (avg. 1.80) Chan. Spac. 9.50-6.40 (avg. 7.77)
Pegs: Dogwood (*Cornus sanguinea)* Cordage: Esparto grass (*Stipa tenacissima*)
Treenail: Dogwood (*Cornus sanguinea)*

One long plank with lacing channels intact along both edges (11 intact along one edge and 10 along other edge). Plank edges highly eroded. Surface of plank appears "hairy" with long thin strips flaking off. Almost all original surface is gone. Shows signs of repair. Space for additional channels along 11-hole edge with intact channels cut in two directions and set further back from edge. Grain fairly straight along the internal and external faces. Neither ends nor edges survive in good enough condition to see cross-section. Quarter sawn. One large and three small knots noted on external face and one large knot on internal face. Three preserved treenail holes (two with treenails intact). Entrance to lacing channels round in shape and smaller than those in other timbers of this set. Possible bow drill marks in two lacing channels. S-twist cordage. Seven pieces of cordage preserved in one sampled lacing channel and three pieces in second sampled channel.

Parallels: Cervia remains, Comacchio ship, Venice Lido I hull remains.
Date: Plank – 54 B.C.E.-75 C.E. (2σ calibrated 14C date, Arizona AMS Laboratory); Cordage – 19-14 B.C.E. and 1-129 C.E. (2σ calibrated 14C date, Arizona AMS Laboratory)


**Internal Face** (Photo by Mirco Cusin)


**External Face** (Photo by Mirco Cusin)



**Hull Planking Fragment #9** Elm (*Ulmus campestris*)

Pres. L. 28.80 Pres. W. 15.40 Pres. Th. 3.70
Chan. Dia. 2.20 Chan. Spac. 7.30-6.70 (avg. 7.00)

Small fragment of hull planking in two pieces with two lacing channels partially preserved along one edge. No edge joinery along other edge. No pegs or cordage preserved. All edges are rounded. Only one lacing hole intact enough for measurement. Edge cavities are not preserved. Cross-section is clearly visible along the break. Forty rings counted. Center of log located at edge with no joinery. Possible adze mark along internal face. Long striation on interior of mostly intact lacing channel. Possible saw mark on external face. Possible chisel marks along end. No treenails or other fasteners noted. Rounding likely indicates tremendous amount of post-deposition fluvial action.

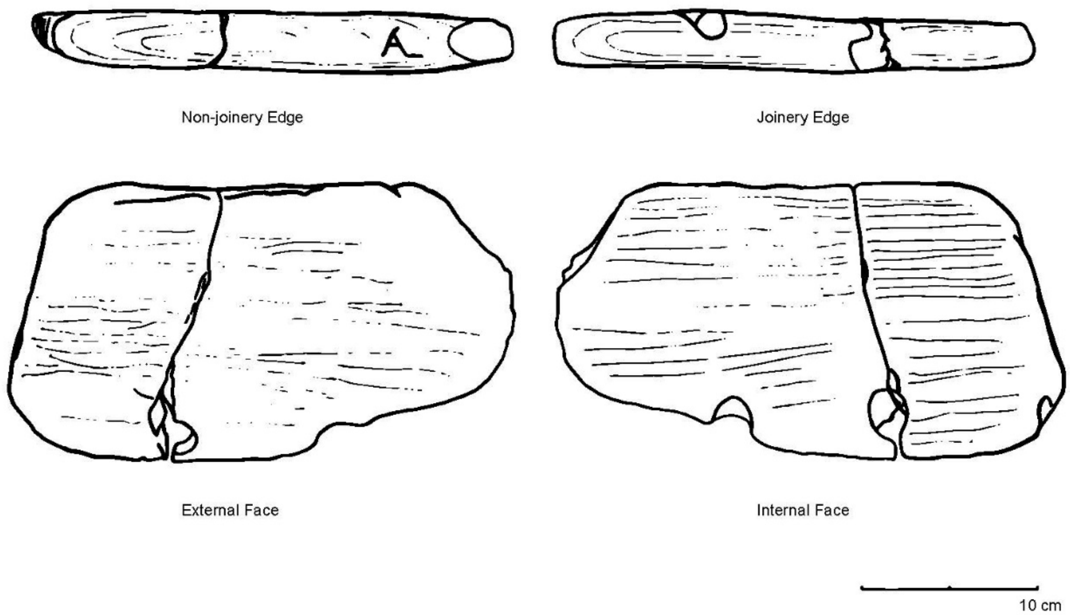
Parallels: Cervia remains, Comacchio ship, Venice Lido I and II hull remains.
Date: Plank – 71-223 C.E. (2σ calibrated 14C date, Arizona AMS Laboratory)



**Internal Face** **External Face**

(Photos by Mirco Cusin)

Venice Lido III Timber Assemblage
Hull Planking Fragment #9
15 June 2014



**Hull Planking Fragment #10** Elm (*Ulmus campestris*)

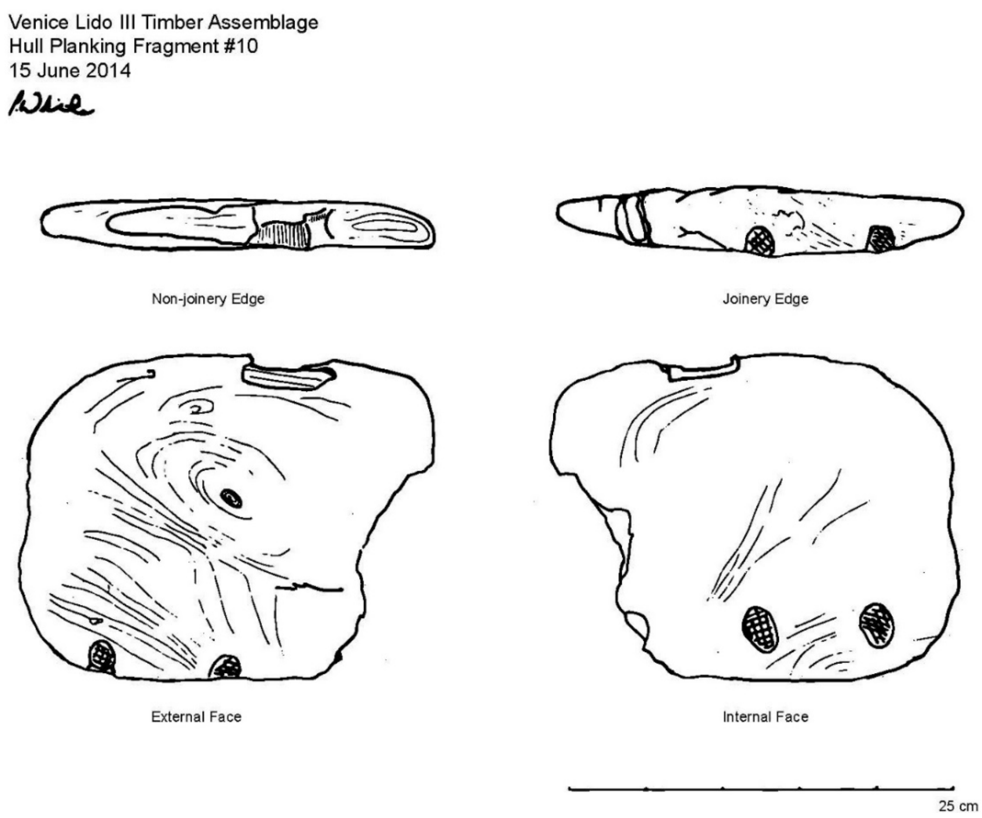
Pres. L. 27.40 W. 21.60 Th. 4.60
Chan. Dia. 2.00 Chan. Spac. 6.20-5.60 (avg. 5.90)
Peg: European Fir (*Abies alba)* Cordage: Esparto grass (*Stipa tenacissima*)

Thick piece of hull planking with two intact lacing channels along one edge. Fragment broken along lacing channel at one end but not at the other. No intact lacing channels along the other edge. Large chunk broken off non-joinery edge. Joinery edge squared while non-joinery fairly rounded. One edge cavity distinctly trapezoidal while other slightly rounded. Grain pattern shows center of log toward non-joinery edge. Fifteen rings counted. Surface highly pitted, obscuring surface details. Possible adze mark on external face. Shells embedded in internal face. No treenails or other fasteners noted. Thickness aligns well with Fragment 1 and spacing of lacing channels also comparable to Fragment 1.

Parallels: Cervia remains, Comacchio ship, Venice Lido I and II hull remains.
Date: Plank – 80-310 C.E. (2σ calibrated 14C date, International Chemical Analysis Laboratory)


**Internal Face** (Photo by Mirco Cusin)


**External Face** (Photo by Mirco Cusin)



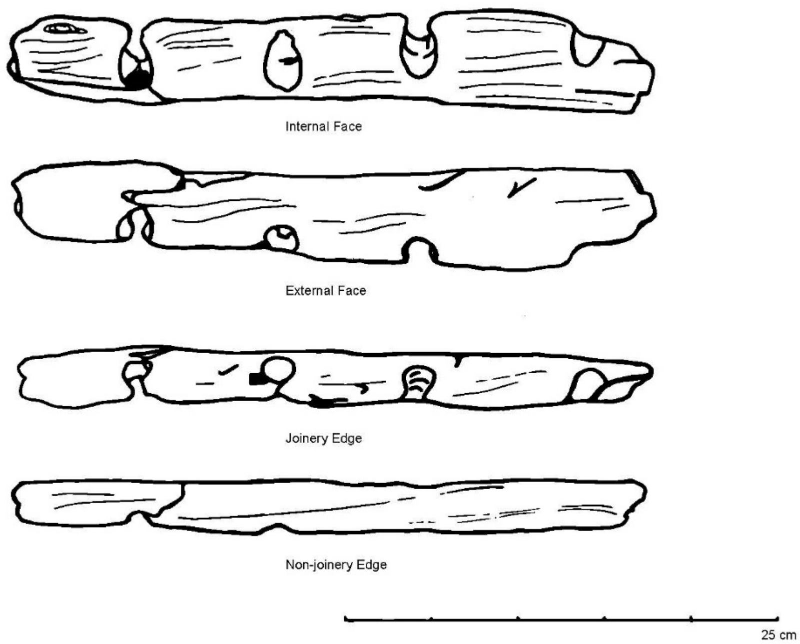
**Hull Planking Fragment #11** English Oak (*Quercus robur*)

Pres. L. 37.30 Pres. W. 5.90 Th. 3.00
Chan. Dia. 1.91-2.00 (avg. 1.95) Chan. Spac. 5.90-8.00 (avg. 6.60)

Small fragment of hull planking in two pieces with four lacing channels. Represents just the lacing edge of a plank. No pegs or cordage preserved. No edge cavities preserved. No treenails or other fasteners noted. Eleven rings counted in cross-section along break. Circular score marks (possible bow drill marks) on inside of lacing channels. Appears as if it belongs with Fragment 5, also made of oak, but all attempts to find a join between them failed.
Parallels: Cervia remains, Comacchio ship, Venice Lido I and II hull remains.
Date: Plank – 66-217 C.E. (2σ calibrated 14C date, Arizona AMS Laboratory)


**Internal Face** (Photo by Mirco Cusin)

Venice Lido III Timber Assemblage
Hull Planking Fragment #11
16 June 2014



# APPENDIX B

# POLLEN: EXTRACTION METHOD AND IDENTIFICATION

## SAMPLES FOR POLLEN ANALYSIS

Over 2 summers, 17 samples were collected for pollen analysis to supplement the sample of seam wadding and cordage material collected from an original seam of the Stella 1 barge in 2011.

**Venice Lido III Timbers (VL III)**

| | | | | |
|---|---|---|---|---|
| 18 June 2013 | | | Fiber # | Pollen # |
| Cordage (Frag 5) | S1 | S#13001 | VL 1 | 15 |
| Cordage (Frag 7) | S4 | S#13004 | VL 2 | 14 |
| Cordage (1st peg, Frag 8) | S7 | S#13007 | VL 3 | 6 |
| Cordage (1st peg, Frag 1) | S10 | S#13010 | VL 4 | 2 |
| | | | | |
| 20 June 2014 | | | | |
| Cordage (2nd peg, Frag 1) | | S#14009 | VL 5 | 11 |
| Cordage (3rd peg, Frag 1) | | S#14016 | VL 6 | 17 |
| Cordage (Frag 2) | | S#14008 | VL 7 | 16 |
| Cordage (Frag 3) | | S#14014 | VL 8 | 10 |
| Cordage (Frag 4) | | S#14019 | VL 9 | 7 |
| Cordage (2nd peg, Frag 8) | | S#14034 | VL 10 | 9 |
| Cordage (Frag 10) | | S#14037 | VL 11 | 8 |

**Canale Anfore II (CA II)**

| | | | | |
|---|---|---|---|---|
| 18 June 2014 | | | Fiber # | Pollen # |
| Seam Wadding | | S#14044 | CA 1 | 12 |
| Cordage | | S#14045 | CA 2 | 13 |

**Stella I (St I)**

| | | | | |
|---|---|---|---|---|
| 19 and 20 July 2014 | | | Fiber # | Pollen # |
| Seam Wadding (repair seam) | | S#14059 | St 3 | 3 |
| Cordage (repair seam) | [20 Jul] | S#14060 | St 4 | 5 |
| Seam Wadding (original seam) | | S#14061 | St 5 | 4 |
| Cordage (original seam) | [20 Jul] | S#14062 | St 6 | 1 |

## EXTRACTION METHODS

11 Mar 2015

Weighed out approximately 1 gram of all 17 archaeological samples of cordage and seam wadding material. Five of the 17 samples did not have enough material for a 1 gram sample; in these cases everything collected was processed (except with the Canale Anfore samples, where the samples were dry). The weights are listed below:

| Pollen ID | Sample # | Weight |
|---|---|---|
| 1 | 14062 | 0.35 g |
| 2 | 13010 | 1.01 g (2 pieces of cordage) |
| 3 | 14059 | 1.08 g |
| 4 | 14061 | 1.16 g |
| 5 | 14060 | 0.61 g |
| 6 | 13007 | 1.06 g (1 piece of cordage) |
| 7 | 14019 | 1.09 g (2 pieces of cordage) |
| 8 | 14037 | 1.14 g (3 pieces of cordage, all available) |
| 9 | 14020 | 1.17 g (1+ piece of cordage) |
| 10 | 14014 | 0.91 g (all, 2-3 pieces of cordage) |
| 11 | 14009 | 1.01 g |
| 12 | 14044 | 0.25 g (dry sample) |
| 13 | 14045 | too light to register (dry sample) |
| 14 | 13004 | 1.78 g (disarticulated sample) |
| 15 | 13001 | 1.07 g (4-½ pieces of cordage) |
| 16 | 14008 | 1.05 g (2 pieces of cordage, all available) |
| 17 | 14016 | 1.02 g (2 pieces of cordage) |

**Set 1 (Pollen #1-10)** was processed over the course of 4 days:

11 Mar 2015

Put in KOH solution
Heated in block for 10 minutes
Spin and decant (5 min spin)
Two rinses in $H_2O$ (5 min spins)
Put in 15% HCL and stirred
Sieved through 150 micron mesh with water
Spin and decant with water (5 min spin)
Put in HF (48%) and let sit overnight

12 Mar 2015
After 16 hours in HF, diluted with water
Spin and decant 2x with water (5 min spin)
Checked for flurosilicates which were only present in small amounts
Washed with HCL (15%) (2 min spin)
Washed with H2O (3 min spin)
Agitated vigourously
Washed with ETOH (3 min spin)
Agitated vigorously
Washed with glacial acetic acid (5 min spin)

13 Mar 2015
Mixed an acetolysis solution and poured into samples
Heated in a block for 8 mins, stirring once
Neutralized with glacial acetic acid (spin and decant, 5 min)
Washed with glacial and H2O (5 min spin)
Washed 2x with H2O (5 min spin)
Stained in H2O (5 min spin)
Washed in ETOH (5 min spin)
Rinsed into 1 dram vial
Put in 2-3 drops of glycerin
Put a toothpick in each vial and let sit for over 24 hours for alcohol to evaporate

17 Mar 2015
As several samples still had a lot of debris, I put them back into 15 ml centrifuge tubes and screened them through 100 micron mesh, spin and decant (5 min)
Screened and sonicated with 10 micron mesh
Rinsed back into 1 dram vial
Put in 2-3 drops of glycerin
Put a toothpick in each vial and let sit for over 24 hours for alcohol to evaporate

**Set 2 (Pollen #s 11-17)** was processed over the course of 2 days and followed the basic procedures that were followed for Set 1. All spins were 5 minutes and the screening/sonicating with a 10 micron mesh was not done as small particulates were not an issue to identifying pollen grains and it was feared that sonication might damage fragile fossil pollen.

<u>18 Mar 2015</u>
Put in KOH solution
Heated in block for 10 minutes
Spin and decant (5 min spin)
Two rinses in H2O (5 min spins)
Put in 15% HCL and stirred
Sieved through 150 micron mesh with water
Spin and decant with water (5 min spin)
Put in HF (48%) and let sit overnight

<u>19 Mar 2015</u>
After 16 hours in HF, diluted with water
Spin and decant 2x with water (5 min spin)
Checked for flurosilicates which were only present in small amounts
Washed with HCL (15%) (5 min spin)
Washed with H2O (5 min spin)
Agitated vigourously
Washed with ETOH (5 min spin)
Agitated vigorously
Washed with glacial acetic acid (5 min spin)
Mixed an acetolysis solution and poured into samples
Heated in a block for 8 mins, stirring once
Neutralized with glacial acetic acid (spin and decant, 5 min)
Washed with glacial and H2O (5 min spin)
Washed 2x with H2O (5 min spin)
Stained in H2O (5 min spin)
Washed in ETOH (5 min spin)
Screened through 100 micron mesh, spin and decant (5 min)
Rinsed into 1 dram vial
Put in 2-3 drops of glycerin
Put a toothpick in each vial and let sit for over 24 hours for alcohol to evaporate

The large fraction was retained when samples were screened through both the 150 and 100 micron meshes. The large fraction of the 100 micron mesh was placed in a petri dish and examined immediately for signs of pollen. Three samples had one pollen grain that was noted in this large fraction:

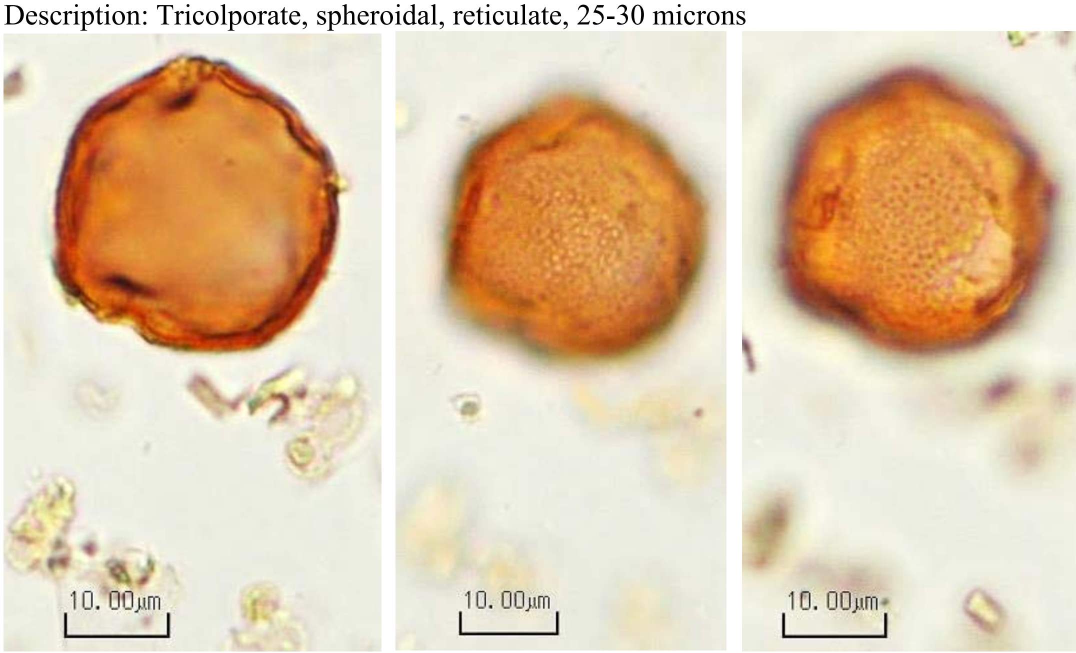
#4 - 1 Pinus noted
#9 - possible Ficus (or other Moraceae) noted
#11 - possible Quercus noted

Once it was noted that the 100 micron large fraction was mostly, if not entirely, devoid of pollen, it was discarded. The 150 micron large fraction is currently being stored and can be checked if necessary.

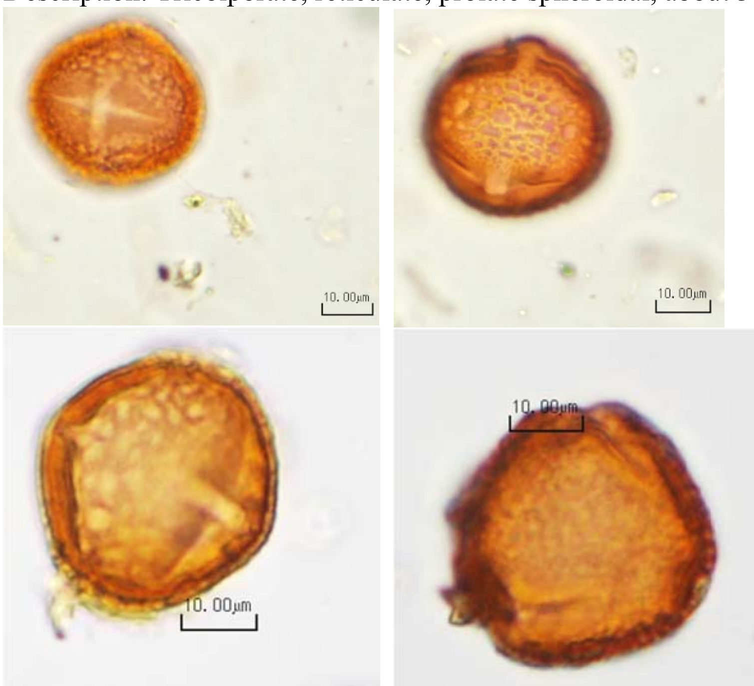
## IDENTIFICATIONS

ANACARDIACEAE

Genus: Pistacia
Description: Tricolporate, spheroidal, reticulate, 25-30 microns

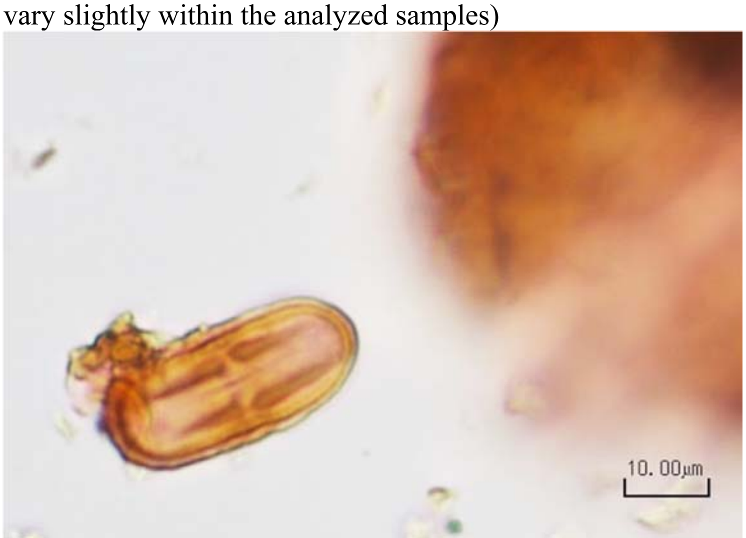


Genus: Unspecified
Description: Tricolporate, reticulate, prolate spheroidal, about 30 microns



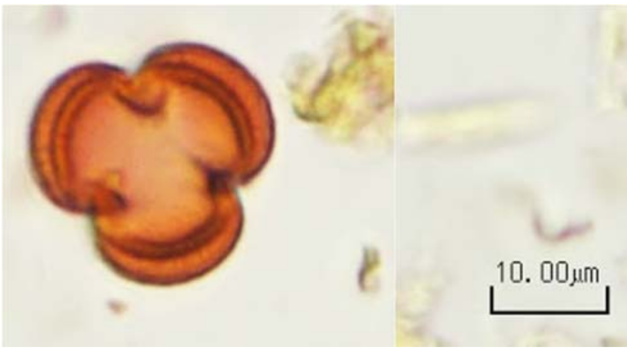

APIACEAE

Genus: various
Description: Tricolporate, strongly prolate, psilate, about 28 microns (ornamentation and size vary slightly within the analyzed samples)



ASTERACEAE

Genus: Artemesia
Description: Tricolporate, echinate, thick tapered wall with large columella, about 18-22 microns

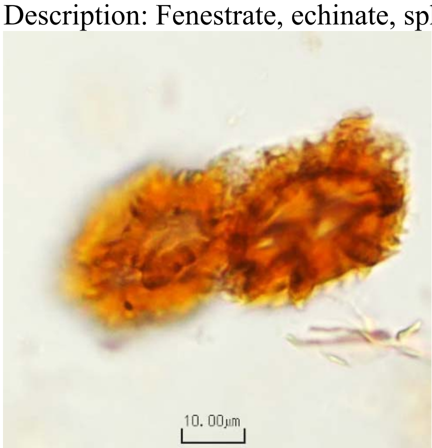




Genus: Centaurea
Description: Tricolporate, echinate, about 30 microns

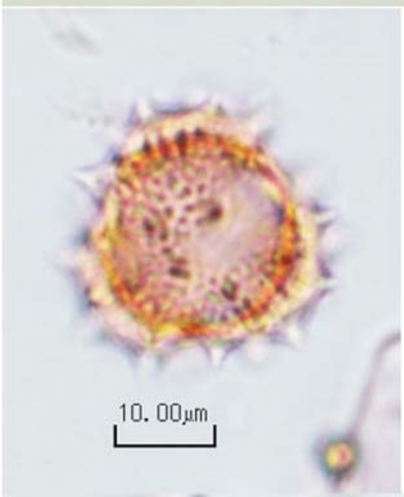


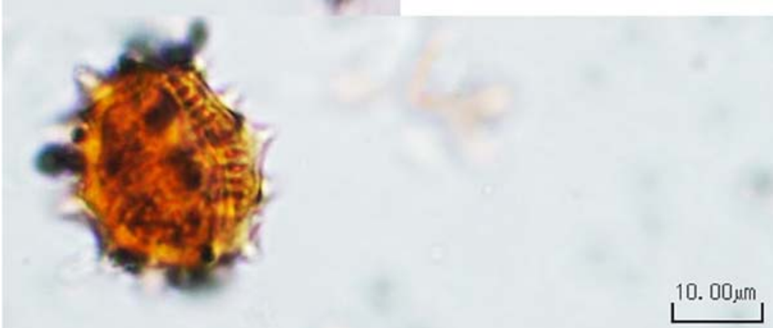
Sub-Tribe: Lactuceae
Description: Fenestrate, echinate, spherical, about 25 microns

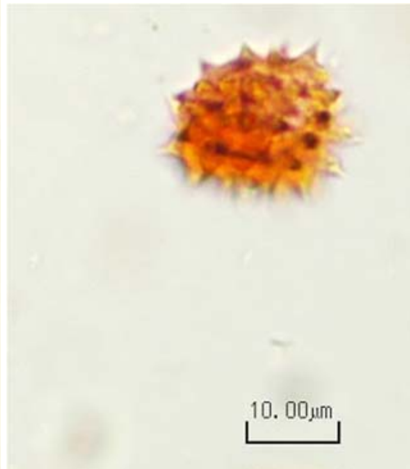


Genus: various
Description: Spherical, echinate



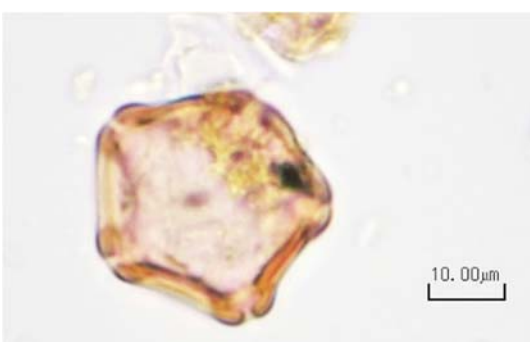


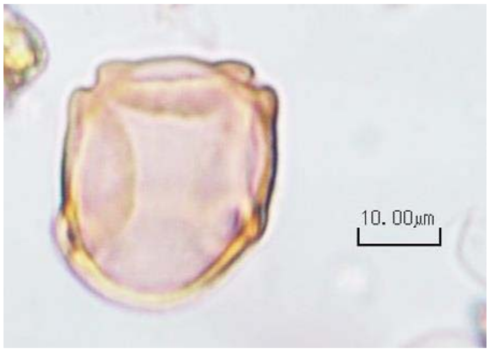





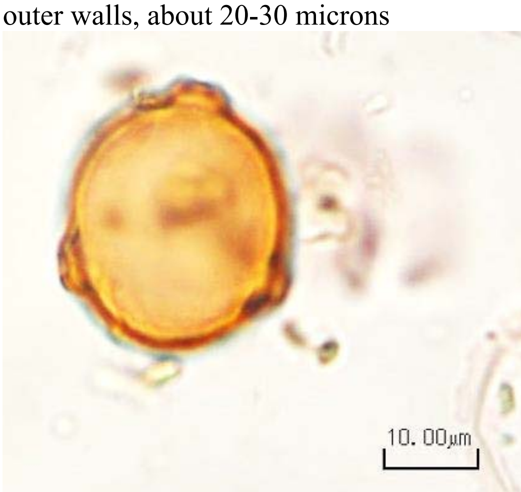

BETULACEAE

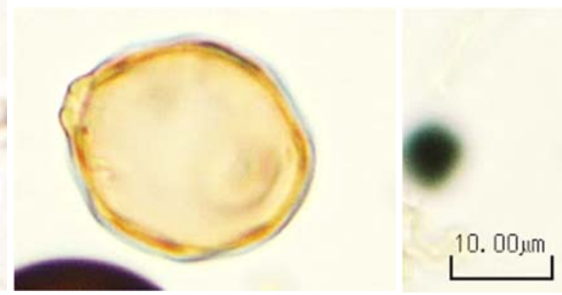
Genus: Alnus
Description: Stephanoporate, 5- and 4-pored grains, oblate, distinctive thickened lines or arches between pores, scabrate, 20-30 microns





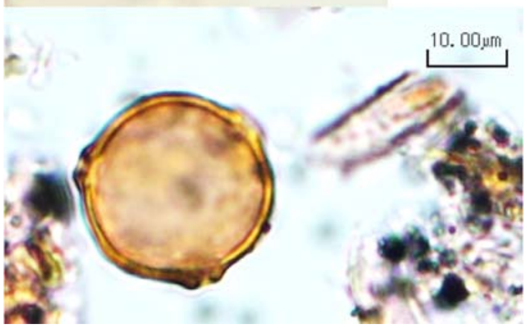

Genus: Betula
Description: Triporate, oblate, spherical - triangular, pores with chambers separating inner and outer walls, about 20-30 microns

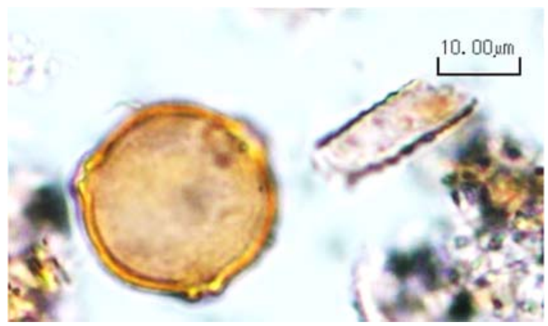



Genus: Corylus
Description: Triporate, sub-oblate (equatorial) and sub-triangular (polar), pores are not well defined, about 20-30 microns

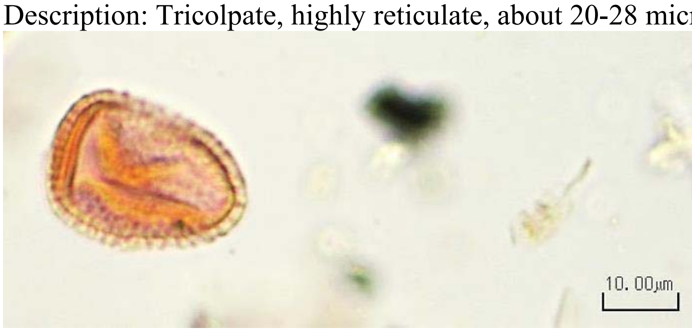
Ostrya/Carpinus:
Description: 3-4 porate, oblate-spheroidal, well-defined pores but no chamber present as in Betula, about 20-25 microns

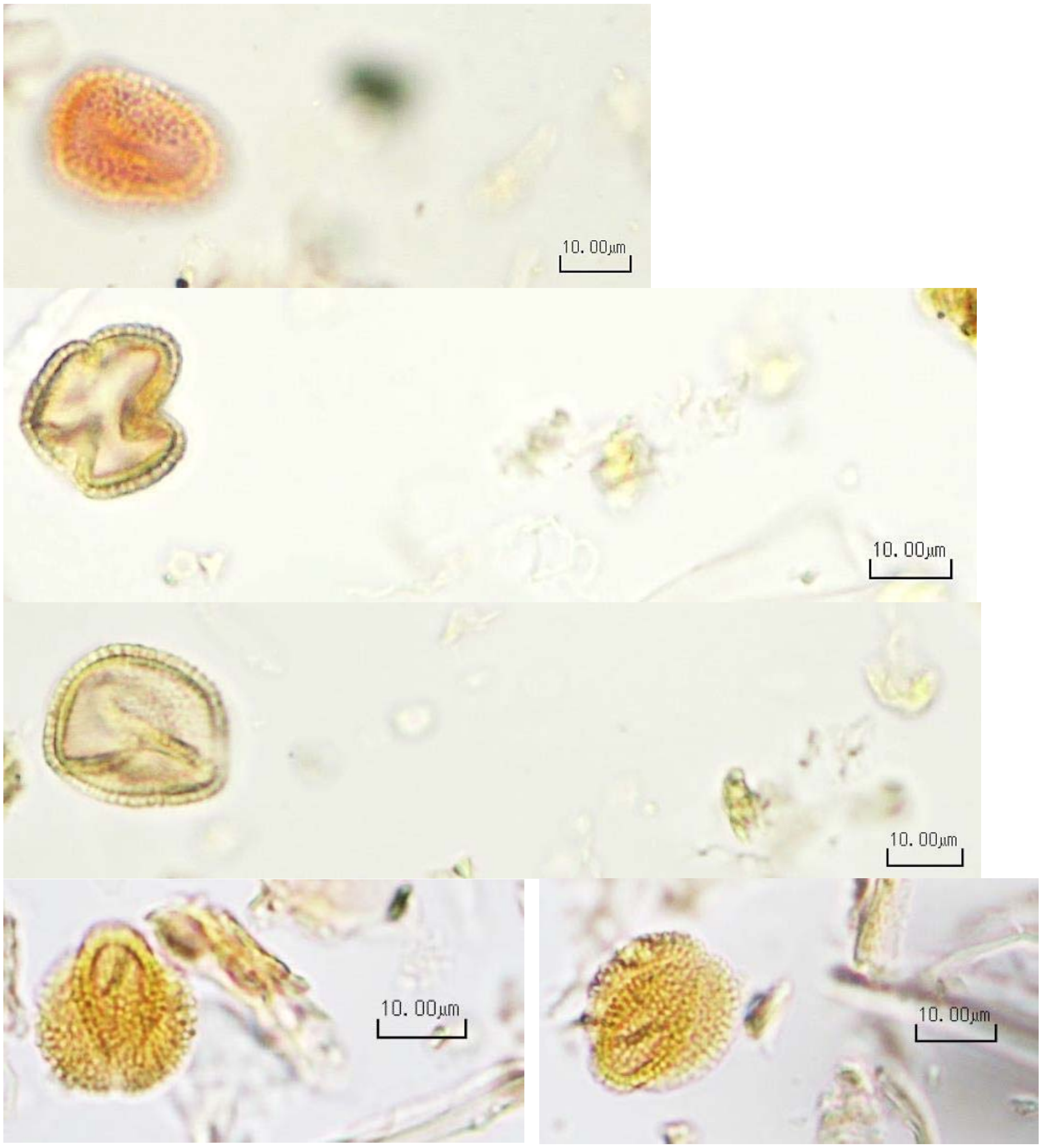




BRASSICACEAE

Genus: various
Description: Tricolpate, highly reticulate, about 20-28 microns




10. 00μm
10. 00μm
10. 00μm
10. 00μm
10. 00μm

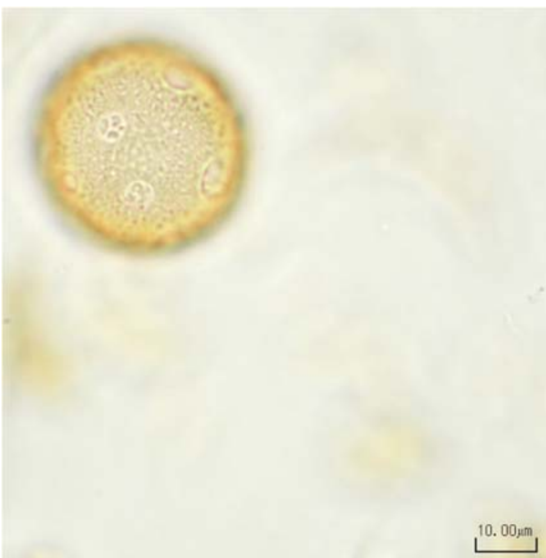
CAMPANULACEAE

Genus: unspecified
Description: Stephanoporate, spheroidal, echinate, about 20 microns



CARYOPHYLLACEAE

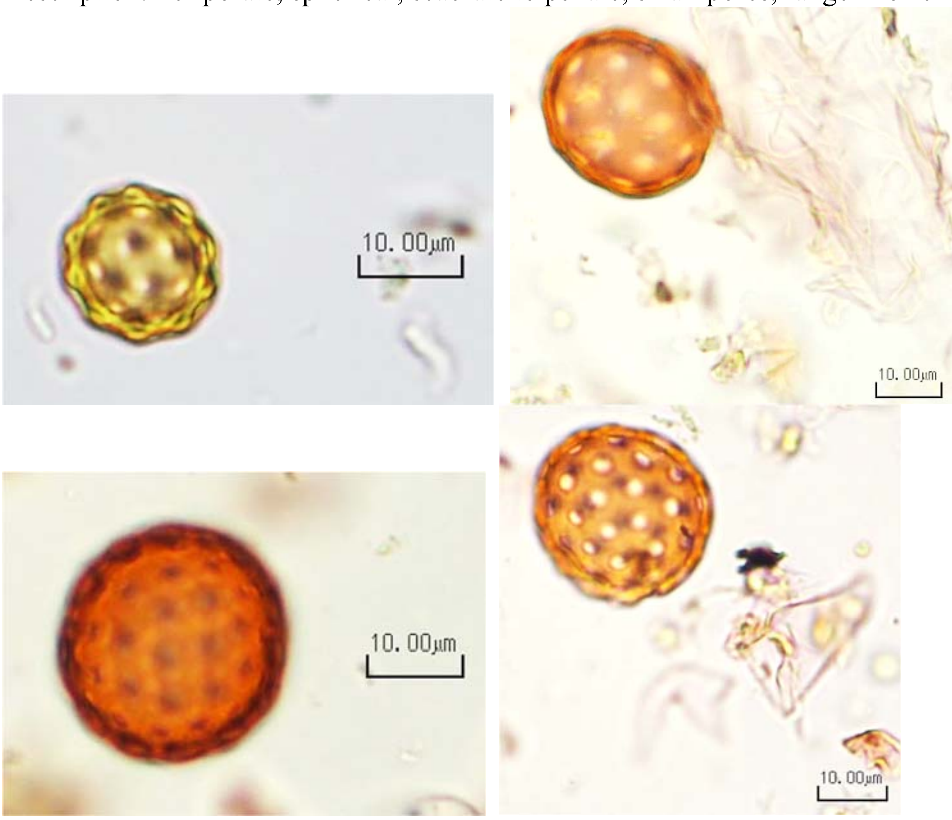
Genus: cfr. Silene
Description: Periporate, oblate-spheroidal, microechinate, large pores, about 30 microns




CHENOPODACEAE-Amaranthus

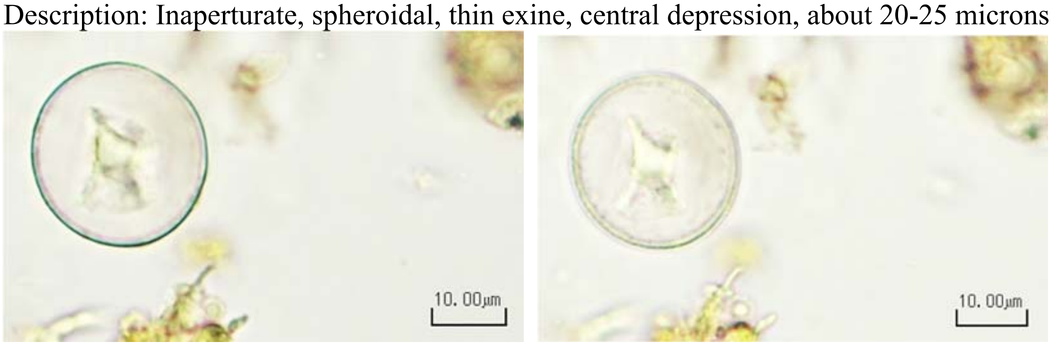
Description: Periporate, spherical, scabrate to psilate, small pores, range in size 12-25 microns



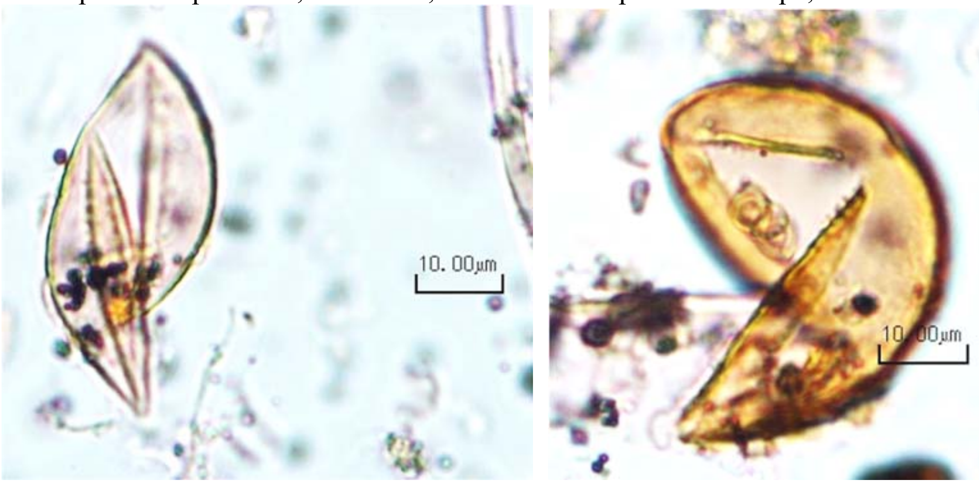

CUPRESSACEAE

Genus: Juniperus

Description: Inaperturate, spheroidal, thin exine, central depression, about 20-25 microns

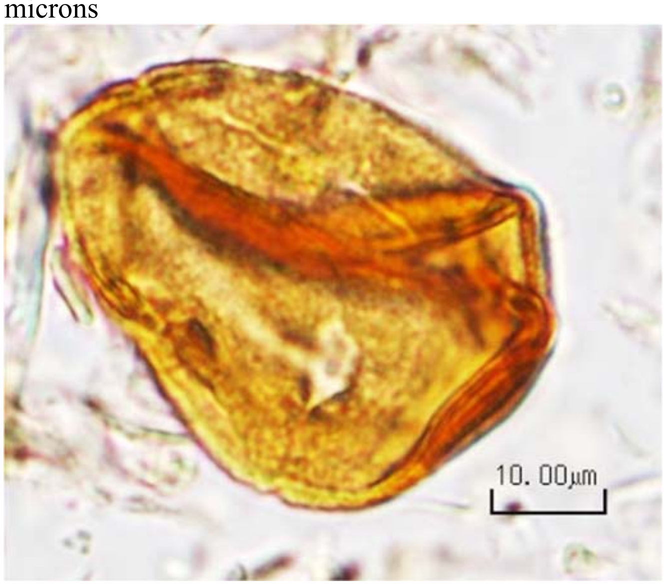


Composite: General TCT, likely Juniperus
Description: Inaperturate, thin exine, characteristic “pac-man” shape, 20-30 microns




CYPERACEAE

Genus: Carex
Description: Circular to wedge shaped, large irregular apertures covered with tectum, 35-40 microns

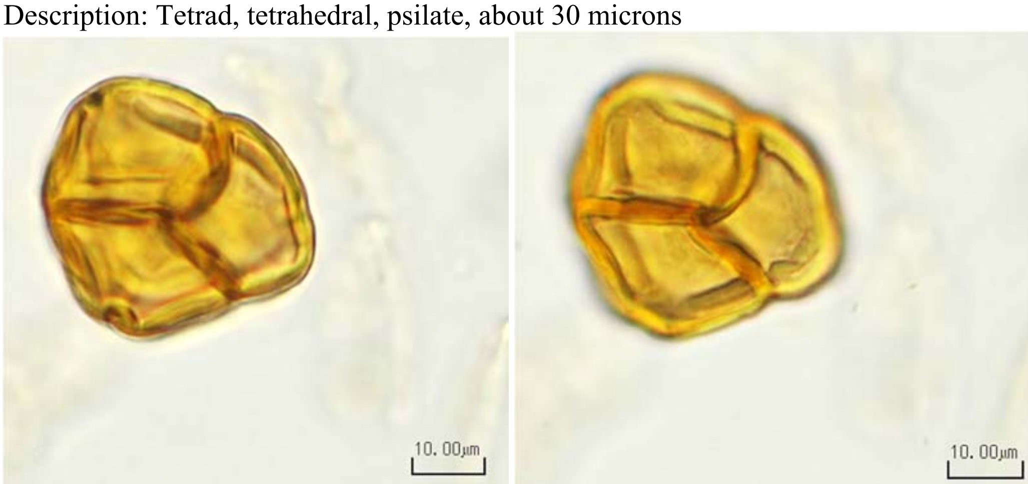


EPHEDRACEAE

Genus: Ephedra
Description: Polycolpate/stephanocolpate, pointed oval shape, about 45 microns

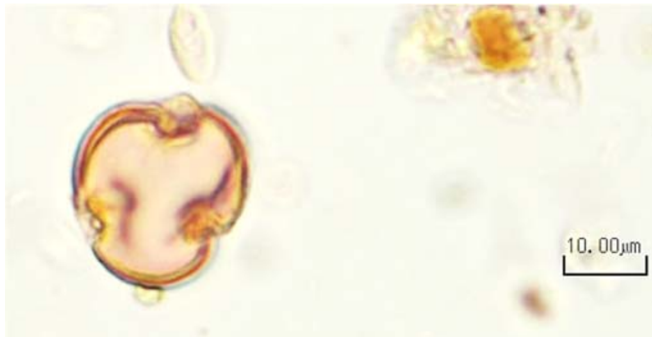

ERICACEAE

Description: Tetrad, tetrahedral, psilate, about 30 microns

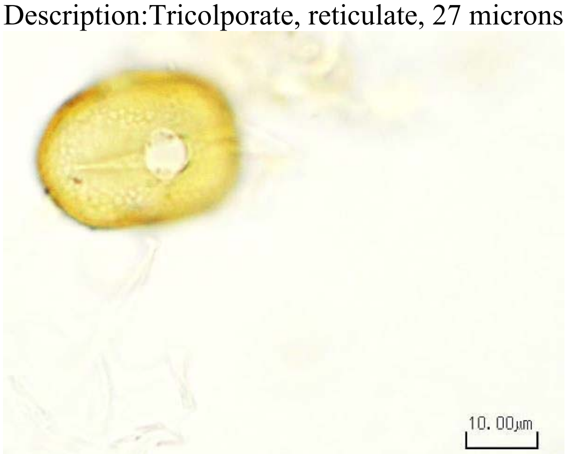


FABACEAE

Genus: Astragalus
Description: Tricolporate, prolate, psilate, about 25 microns

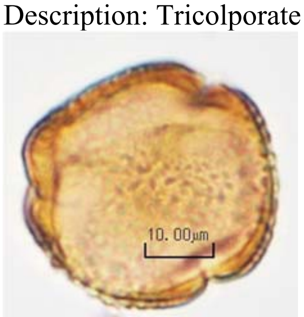



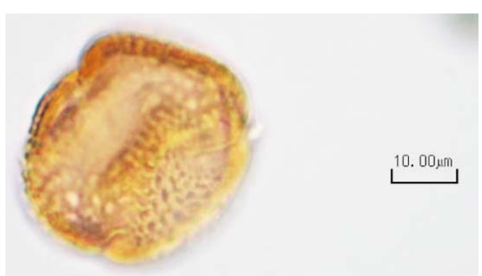

Genus: Trifolium
Description:Tricolporate, reticulate, 27 microns





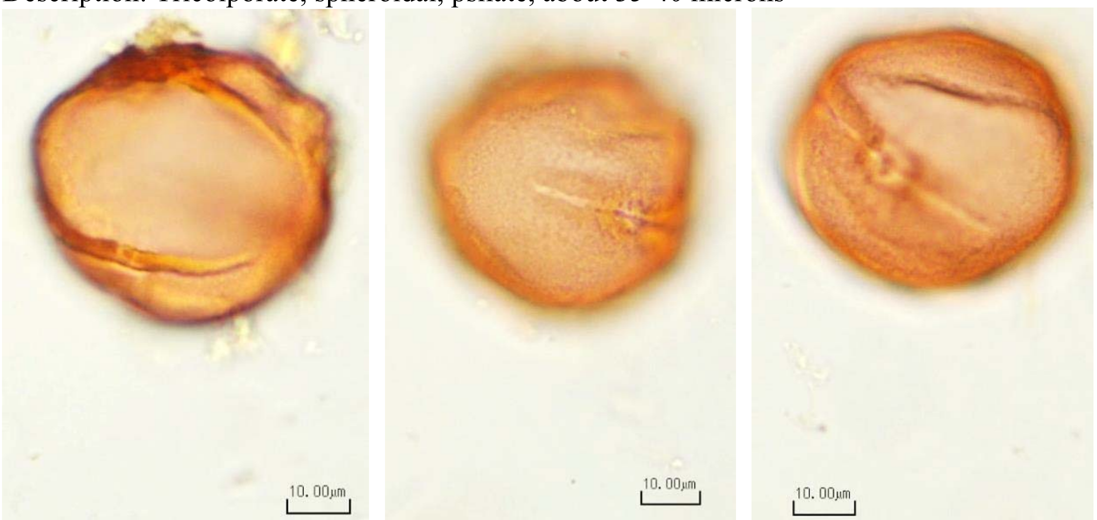
Genus: unspecified
Description: Tricolporate (tricolpate), reticulate, thickened exine near pores, 33 microns



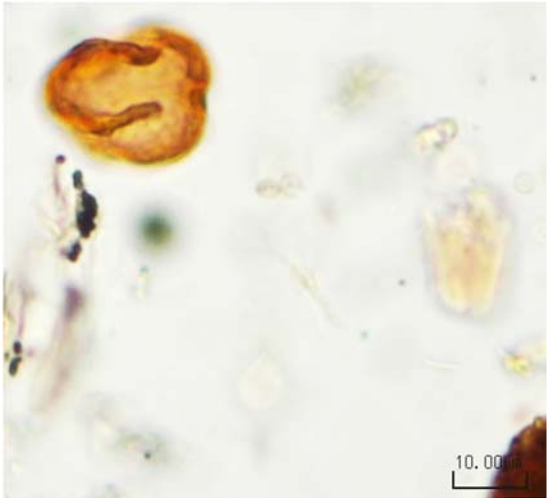



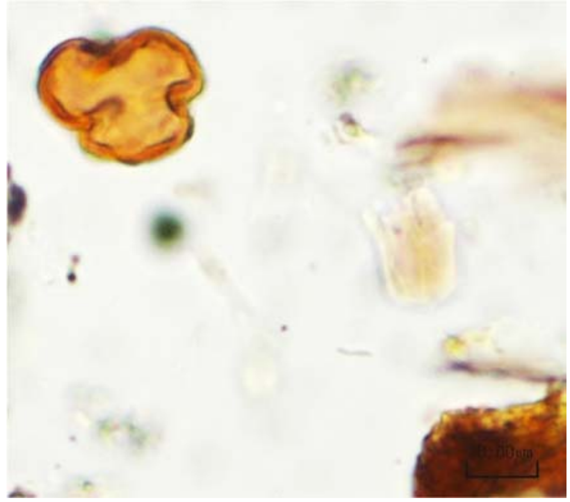
FAGACEAE

Genus: Fagus
Description: Tricolporate, spheroidal, psilate, about 35-40 microns



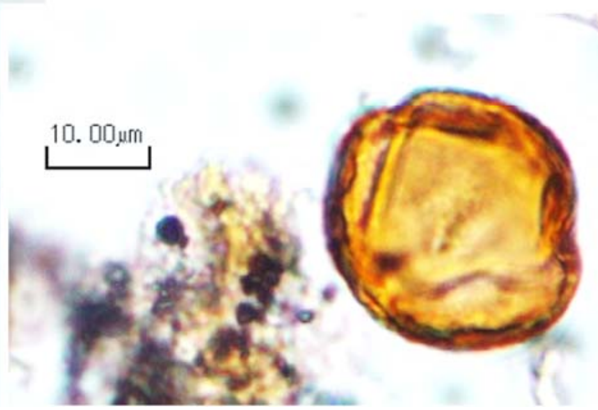

Genus: Quercus
Description: Tricolpate, prolate, short furrows often bent at equatorial region, scabrate, range in size 18-25 microns





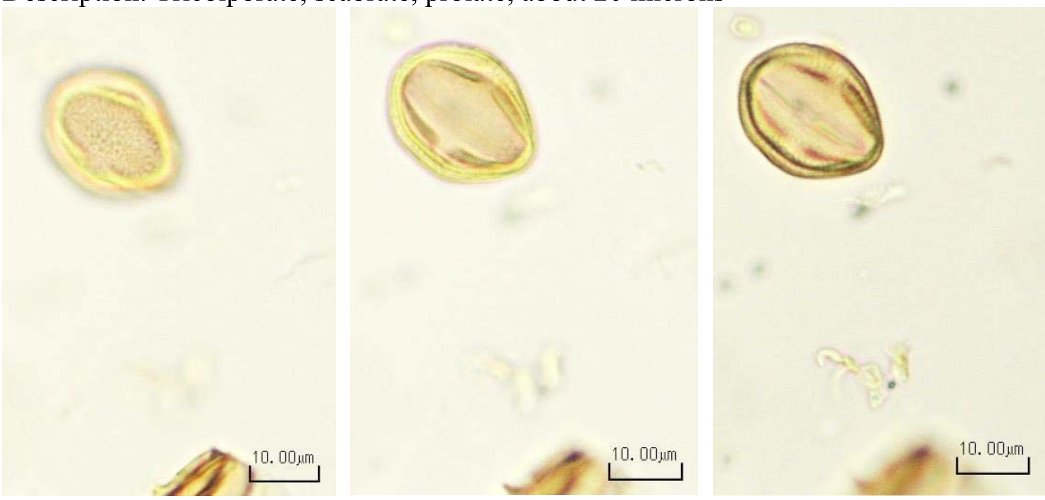

10. 00μm


10. 00μm


10. 00μm

HYPERICACEAE

Genus: Hypericum
Description: Tricolporate, scabrate, prolate, about 20 microns

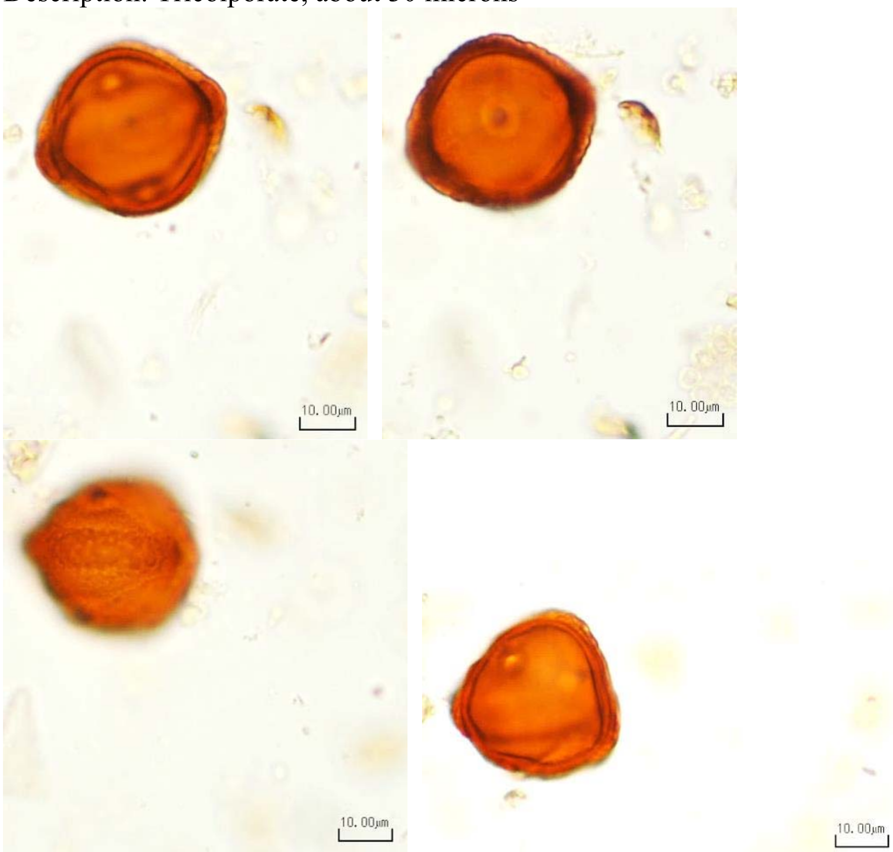



JUGLANDACEAE

Genus: Juglans
Description: Pantocolporate, spherical, 30-35 microns

LYTHRACEAE

Genus: Lagerstroemia
Description: Tricolporate, about 30 microns

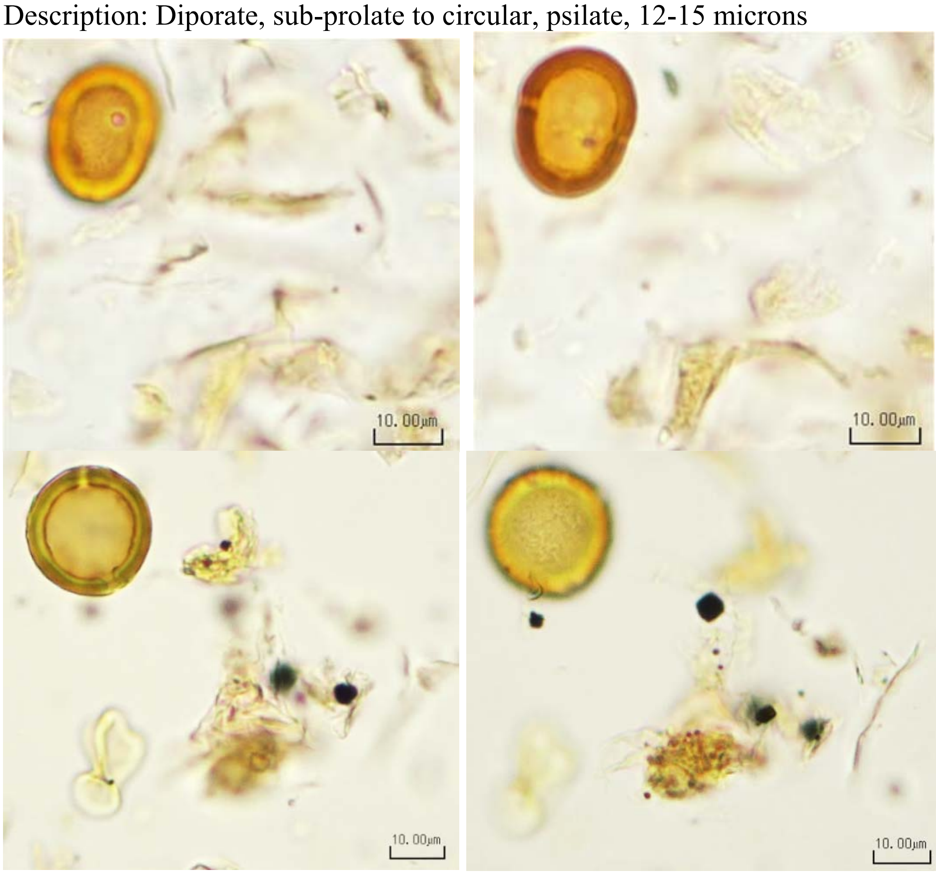


MALVACEAE

Genus: Tilia
Description: Tricolporate, oblate-circular, thickened exine at the pores, 30-35 microns

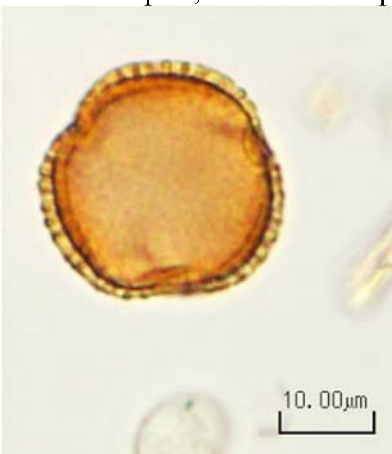

MORACEAE

Genus: Ficus
Description: Diporate, sub-prolate to circular, psilate, 12-15 microns



OLEACEAE

Olea: Tricolpate, sub-oblate to spheroidal, highly reticulate, 18-22 microns





PINACEAE

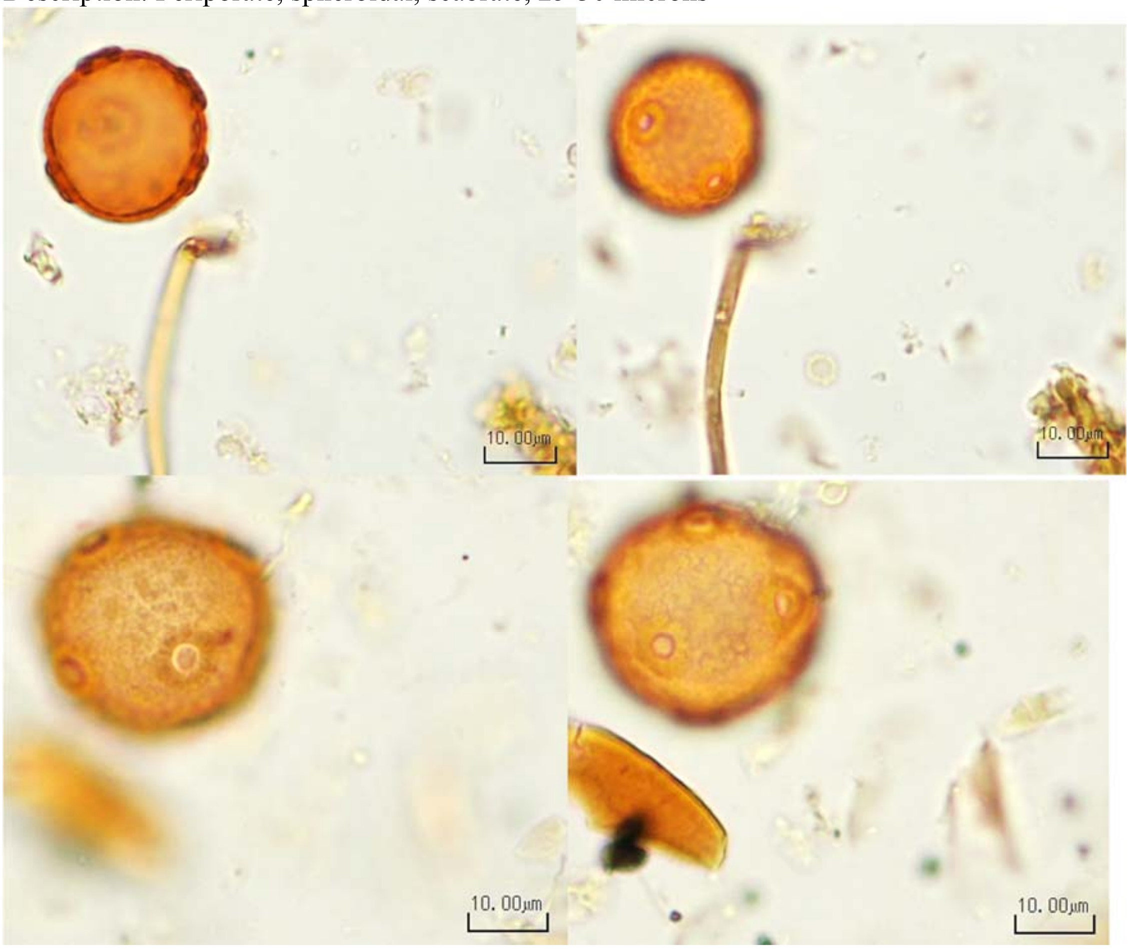
Genus: Abies
Description: Bisaccate/vesiculate, greater than 80 microns, wall thickening opposite the bladders


Genus: Pinus
Description: Bisaccate/vesiculate, about 60-75 microns


PLANTAGINACEAE

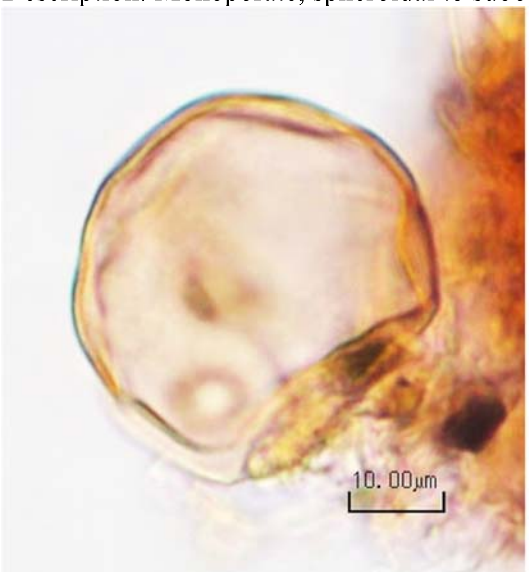
Genus: Littorellia
Description: reticulate, spheroidal, 25 microns


Genus: Plantago
Description: Periporate, spheroidal, scabrate, 25-30 microns



POACEAE

Genus: various
Description: Monoporate, spheroidal to suboblate, psilate to scabrate, 25-50 microns





POLYGONACEAE

Genus: Polygonum
Description: Periporate, spherical, reticulate, 30-45 microns



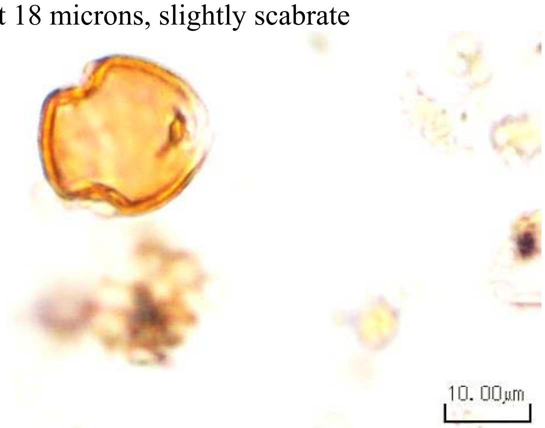
Genus: Rumex
Description:Tricolpate, oblate-spheroidal, scabrate, about 30-35 microns

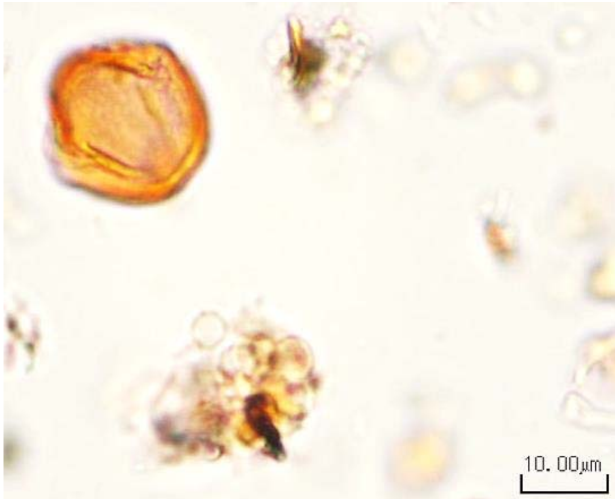

ROSACEAE

Genus: Rosa
Description: Tricolpate, subprolate to prolate, thickened colpi, about 25 microns

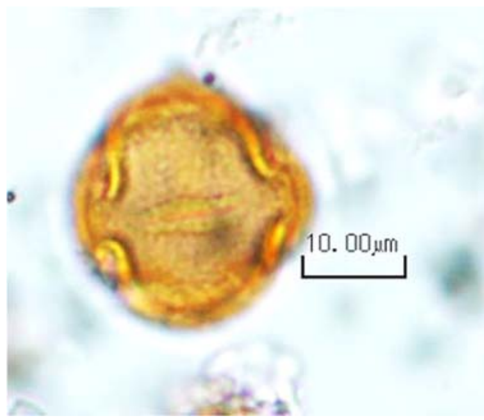



Genus: Rubus
Description: Tricolporate, about 18 microns, slightly scabrate



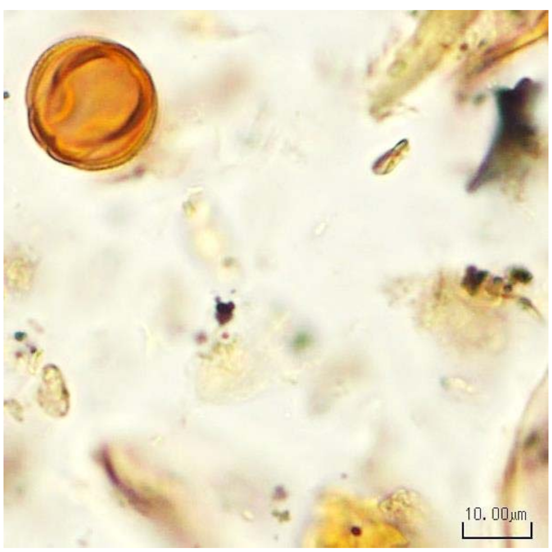

Genus: unspecified
Description: Tricolpate, scabrate, about 18-20 microns


RUBIACEAE

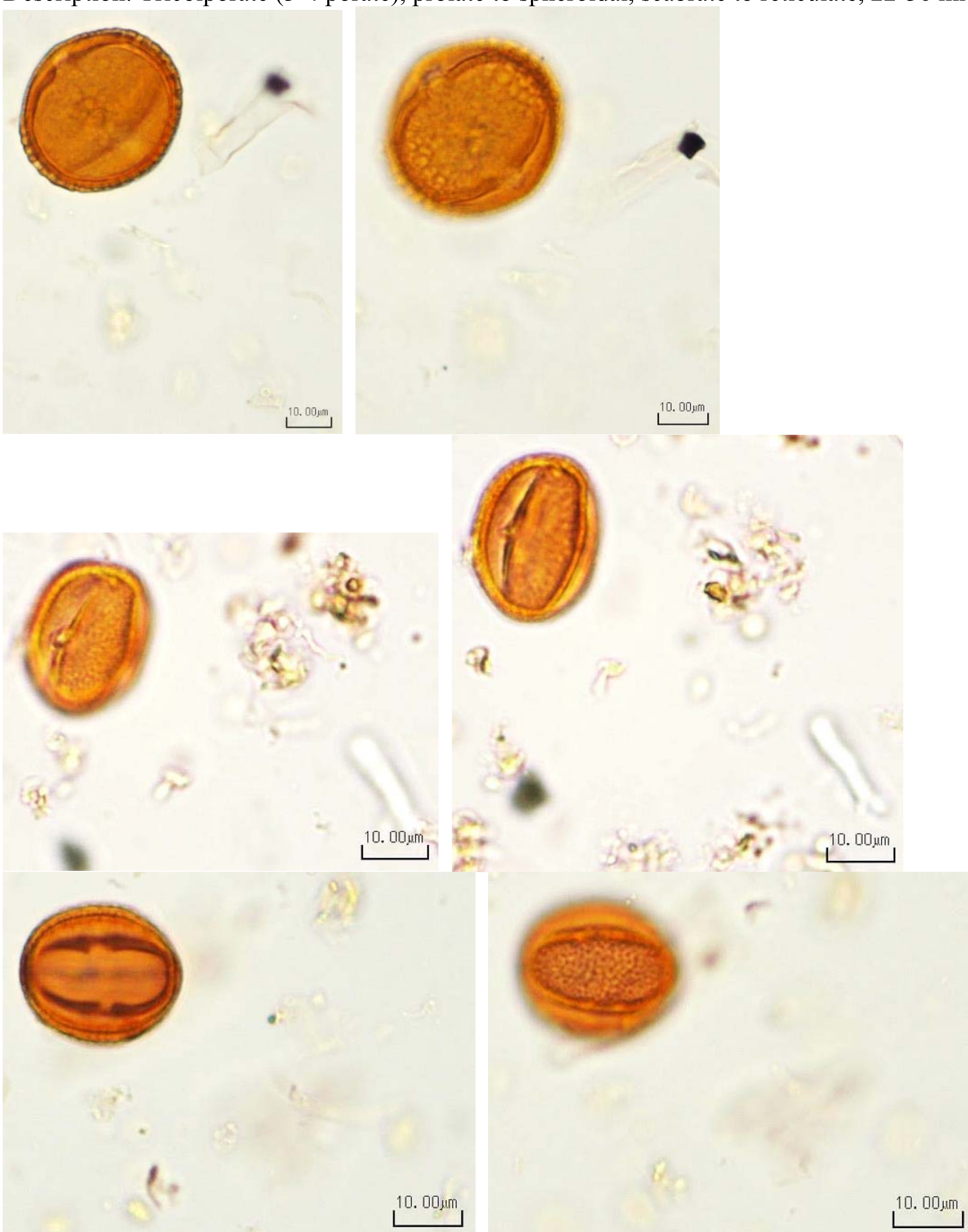
Genus: cfr. Galium
Description: Polycolpate, psilate, 12-18 microns






RUTACEAE

Genus: various
Description: Tricolporate (3-4 porate), prolate to spheroidal, scabrate to reticulate, 22-36 microns



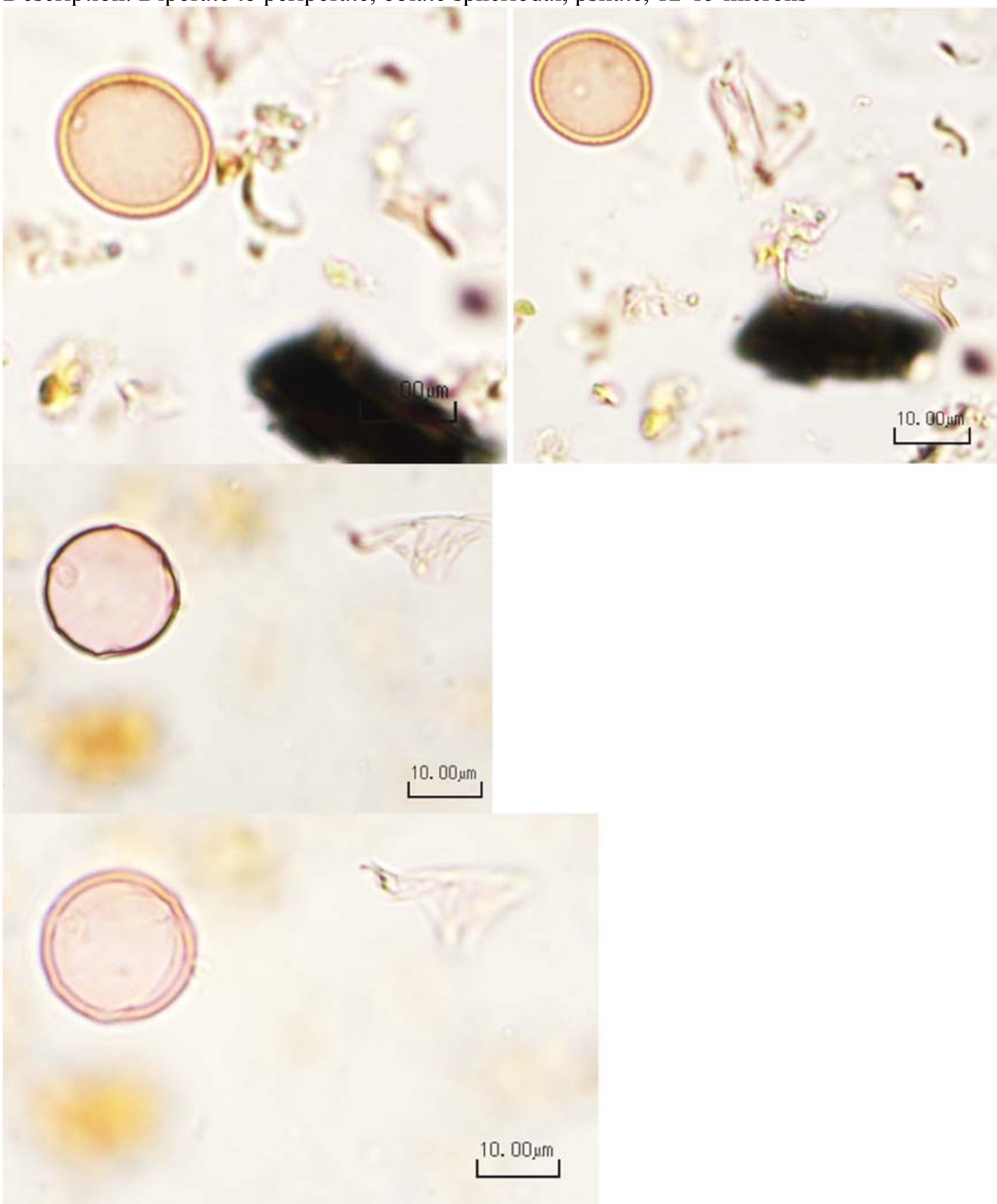
ULMACEAE

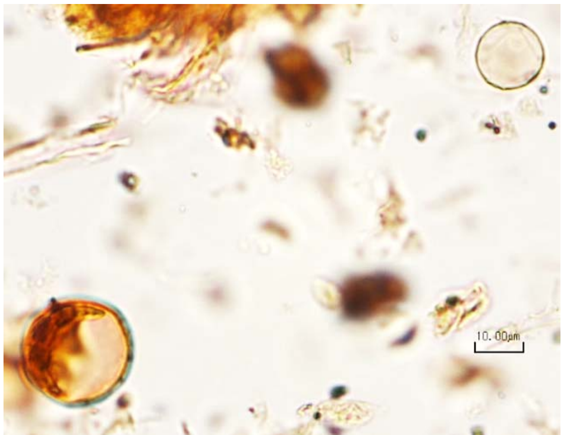
Genus: Celtis
Description: Stephanoporate (3-4 porate), psilate to scabrate, spherical oblate, 30-35 microns

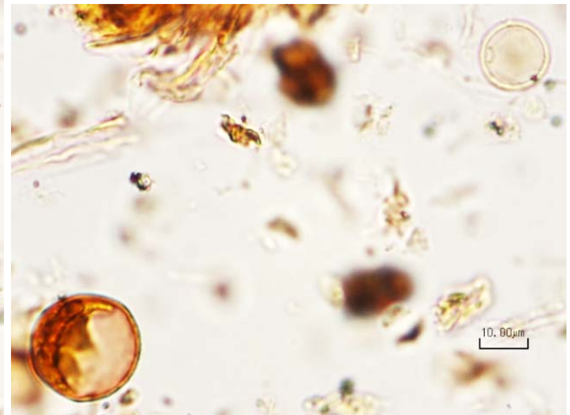
Genus: Ulmus
Description: Stephanoporate (5-6 porate), rugulate, about 30-35 microns

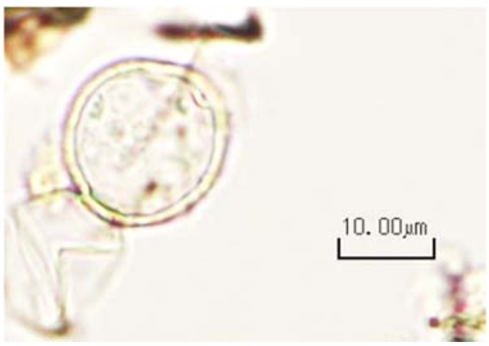

URTICACEAE

Genus: Urtica
Description: Diporate to periporate, oblate spheriodal, psilate, 12-15 microns










VITACEAE

Genus: Vitis
Description: Tricolporate, suboblate, distinct equatorial shape (six-pointed star), psilate, about 18 microns

## APPENDIX C

## FIBERS: PROCESSING METHOD AND IDENTIFICATION

12 March 2015

Over the course of two summers of fieldwork in northern Italy, 20 samples were collected for fiber identification from three separate remains of northwestern Adriatic laced boats. This report presents the findings of the identification of the fibers used for the seam wadding and cordage of those three remains.

### PROCEDURE

All samples were put into a 10% solution of glacial acetic acid and sonicated for approximately 15-30 seconds, centrifuged, and rinsed. This process was repeated two to five times until the rinsing solution ran clear. Sample number 14045, the cordage from the Canale Anfore remains, was still too dirty to identify after these procedures, perhaps due to dry storage. This sample was soaked in a 5% solution of sodium hexametaphosphate for approximately X hours, and then rinsed with water. All procedures followed recommendations from Pearsall (2000).

Once samples were cleaned, they were mounted on slides and identified based on the reference collection available in the Paleoethnobotany Lab at Texas A&M University, my own reference sample of esparto grass collected in southern Spain (near Valencia), and other published reference materials (Gale and Cutler 2000).

### RESULTS

**Venice Lido III Timbers (VL III)**
Collected: 18 June 2013 and 20 June 2014

| Sample | Number | Species Identification |
|---|---|---|
| Fragment 1 Cordage (1st peg) | S#13010 (S10) | *Stipa tenacissima* |
| Fragment 1 Cordage (2nd peg) | S#14009 | *Stipa tenacissima* |
| Fragment 1 Cordage (3rd peg) | S#14016 | *Stipa tenacissima* |
| Fragment 2 Cordage | S#14008 | *Stipa tenacissima* |

**Venice Lido III Timbers (VL III), cont.**

| Sample | Number | Species Identification |
|---|---|---|
| Fragment 3 Cordage | S#14014 | *Stipa tenacissima* |
| Fragment 4 Cordage | S#14019 | *Stipa tenacissima* |
| Fragment 5 Cordage | S#13001 (S1) | *Stipa tenacissima* |
| Fragment 7 Cordage | S#13004 (S4) | *Stipa tenacissima* |
| Fragment 8 Cordage (1st peg) | S#13007 (S7) | *Stipa tenacissima* |
| Fragment 8 Cordage (2nd peg) | S#14020 | *Stipa tenacissima* |
| Fragment 10 Cordage | S#14037 | *Stipa tenacissima* |

**Canale Anfore II (CA II)**
Collected: 18 June 2014

| Sample | Number | Species Identification |
|---|---|---|
| Seam Wadding | S#14044 | Cfr. Tilia sp. bast fibers |
| Cordage | S#14045 | indeterminate[1] |

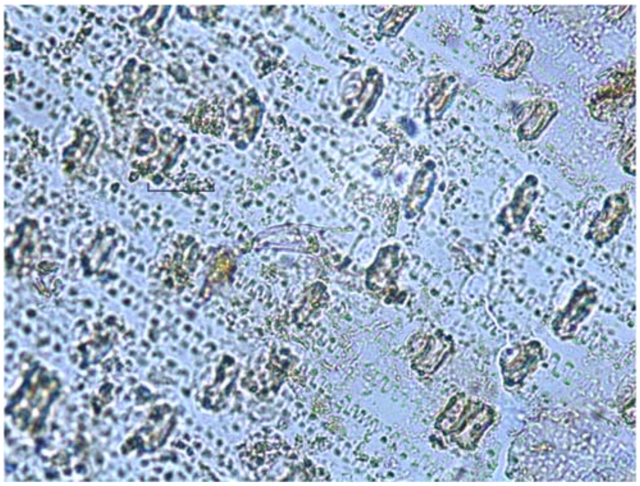
**Stella I (St I)**
Collected: 19 and 20 July 2014

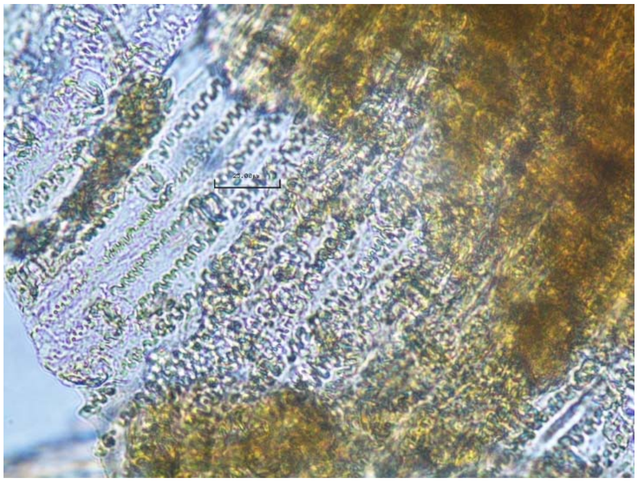
| Sample | Number | Species Identification |
|---|---|---|
| Seam Wadding (repair seam) | S#14059 | Cfr. Tilia sp. bast fibers |
| Cordage (repair seam) | S#14060 | *Stipa tenacissima* |
| Seam Wadding (original seam) | S#14061 | Cfr. Tilia sp. bast fibers |
| Cordage (original seam) | S#14062 | *Stipa tenacissima* |

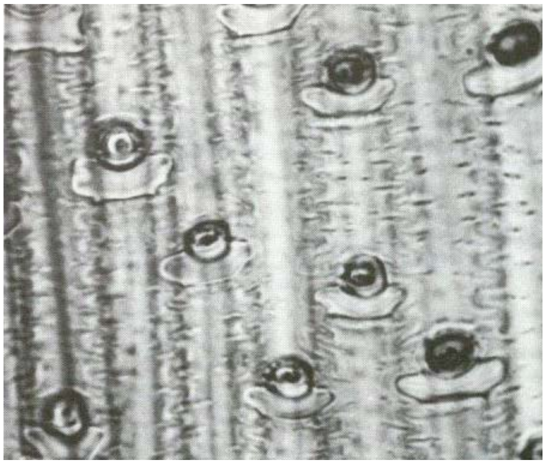
[1] The cordage sample collected from the Canale Anfore II remains was too damaged to identify based on visual examination; this is possibly due to the dry storage conditions. No diagnostic features were detected using light microscopy, but it is possible that phytoliths or DNA may permit an identification

## IDENTIFICATIONS

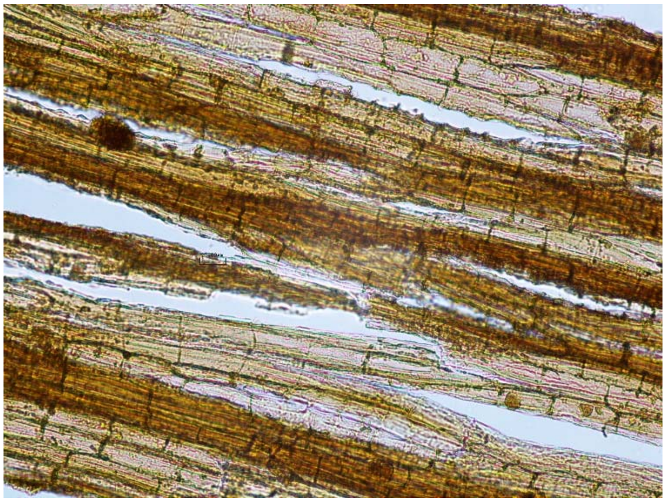
*Stipa tenacissima,*


Stella 1

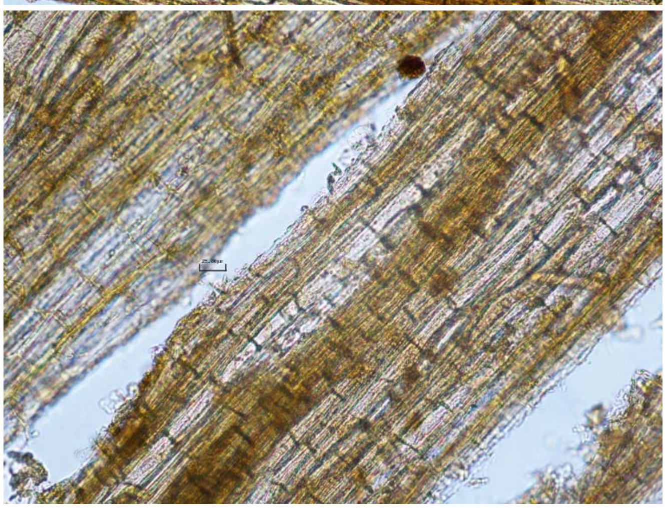

Venice Lido III (Frag 3)


Reference sample (Gale and Cutler 2010)

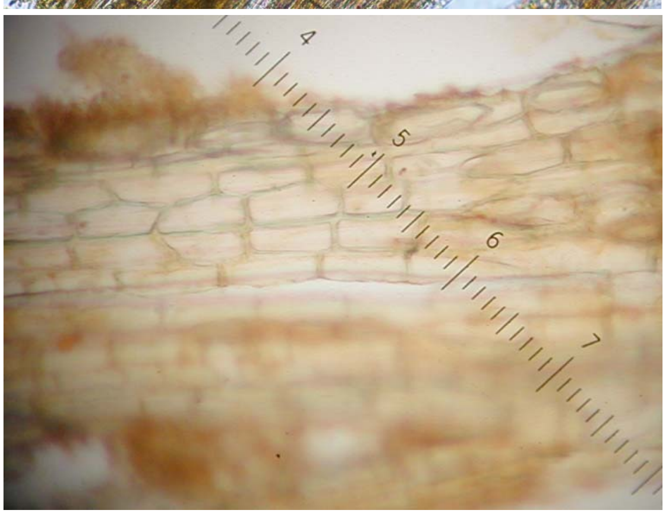
Bast fibers, cfr. *Tilia* sp.



Canale Anfore II

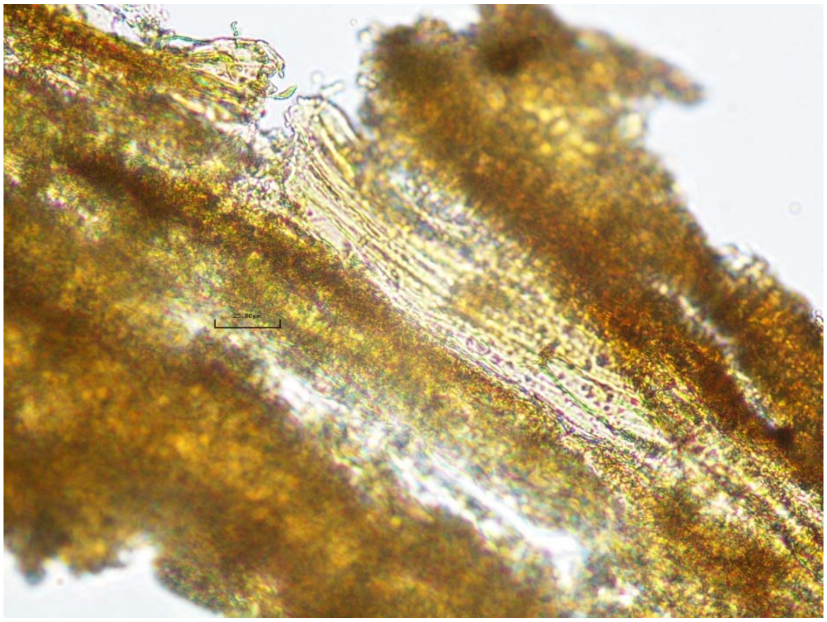


Stella 1




Reference Sample, *Tilia americana*

Indeterminate, Cordage from Canale Anfore II



# APPENDIX D

# WOOD SPECIES IDENTIFICATION BY NILI LIPHSCHITZ

## Dendroarchaeological Investigations: 621. Stella 1, San Francesco del Desorto and Venice Lido III timbers

Nili Liphschitz

Institute of Archaeology – The Botanical Laboratories, Tel Aviv University, 10.03.14

### Introduction

**Stella 1 Wreck:** The wreck is dated to the 1st quarter of the 1st century AD based on the stamps of the ceramic roof tile cargo. It was discovered in the Stella River, one of the main arteries of the Fruili Venezia Giulia region of northeastern Italy. It is a flat-bottomed barge with extant hull remains approximately 5m long and 2m wide.

**San Francesco del Deserto timbers:** These timbers, consisting of two planks, were found in a secondary context as part of an ancient hydraulic system dates to sometime after the 2nd to 4th centuries AD based on dendrochronology of the wooden posts. The planks themselves have not been radiocarbon dated. The timbers were discovered on the island of San Francesco del Deserto in the Venice lagoon.
The two planks are approximately 3m long and range in width from 8-25cm.

**Venice Lido III timbers:** Only one of the eight timbers in this collection has been dated: Fragment 1 gave a date of AD 270-330 by radiocarbon dating. These timbers washed ashore on the beach of Venice Lido, the barrier island between the lagoon and the Adriatic Sea, in November 2012. They may not all be from the same laced vessel. These are the third set of laced boat timbers that have washed ashore on Venice Lido. Only 4 of the 8 timbers were sampled last summer. This is a highly variable set of timbers in regards to their dimensions ranging in length from approximately 2m to 0.2m and widths ranging from 36cm to 7cm. (Staci Willis, p.c.).

**Material and Methods**

Twenty one wood samples were taken on 2013 for identification: 10 samples were from Venice Lido III timbers, 7 samples were from San Francesco del Deserto timbers and 4 samples were from Stella 1 wreck (Table 1a-c). Samples of Stella 1 and of Venice Lido III were kept in water until their examination, whereas samples of Venice Lido III are pegged.

Cross and longitudinal, tangential and radial sections were made for each sample with a sharp razor blade. Identification of the wood up to the species level, based on the three-dimensional structure of the wood was made by microscopic analysis of these sections. Comparison was made with reference sections prepared from systematically identified, recent trees and shrubs and with anatomical atlases.

**Results and Discussion**

**==================**

**<u>Stella 1 wreck:</u>**

As we can see from the results (Table 1a) of the few samples originating of Stella 1 wreck the plank is made of *Ulmus campestris* whereas one possible peg and one possible treenail are made of softwood - *Abies alba* and another possible peg is made of a hardwood - *Cornus sanguinea.*

**Table 1a:**

Tree species identification (samples taken on summer 2013)

**<u>Stella 1 wreck:</u>**

| Sample no. | Hull component | Tree species |
|---|---|---|

| | | |
|---|---|---|
| S24 | Possible peg 1 | *Abies alba* |
| S25 | Possible peg 2 | *Cornus sanguinea* |
| S26 | Possible Trunnel | *Abies alba* |
| S27 | Plank fragment 6 | *Ulmus campestris* |

Stella 1 barge was found in 1981. This vessel was first excavated in 1998 during a one-week long campaign but no samples were taken. In 1998 and 1999 the archaeologists recorded the hull remains during a two-week campaign. Six wood samples were identified in 1998 and six others in 1999: (http://nauticalarch.org/blogs/anaxum-project/2012/11/06/stella-1-shipwreck/).

| # | 1998 | 1999 |
|---|---|---|
| e1 | *Ulmus* sp. | *Picea abies* Karst. |
| e2 | *Alnus glutinosa/incana* | *Quercus* sp.; *Quercus sp. sez.* Robur |
| e3 | *Alnus* sp. | *Ulmus* sp. |
| e4 | *Juglans regia* L. | Cfr. *Tilia* sp. |
| e5 | *Salix* sp. | Cfr. *Stipa tenacissima* L. |
| e6 | *Vitis vinifera* L. | *Cornus /Viburnum* |

Marco Rottoli of the Laboratory of Archaeobiology of the Civic Museum of Como (Laboratoria di Archeobiologia dei Musei Civici di Como) made those wood identifications. The samples included on the 1998 report were various debris discovered among the cargo material, representing branches, seeds, etc., and are not samples taken from the hull remains themselves. The 1999 report reflects the various hull components as follows:

e1 was taken from ceiling planking;

e2 was taken from hull planking and a dis-articulated piece in general association with the wreck which may represent a futtock;

e3 was taken from hull planking;

e4 was taken from a roll of fibrous material used in the sewing system, likely represents the wad of material placed over the seam;

e5 was taken from the same roll of fibrous material, likely represents the cordage;

e6 was taken from the same roll of fibrous material, may be part of the seam wadding or may be an accidental inclusion.

In 2011 excavations of Stella 1 took place for six weeks and the hull remains were recorded in details as much as possible. At that time the hull was completely recorded and then reburied (Staci Willis, p.c.). The four samples identified were retrieved on that occasion.

Hull planking found and identified on 1998-99 was made of *Ulmus campestris* and another plank fragment identified now was also made of this tree species.

**Venice Lido III timbers:**

Ten wood samples including pegs, planks and one treenail were identified. All pegs except one were made of *Cornus sanguinea*, one peg was made of *Picea* abies, two planks were of *Ulmus campestris*, one plank was of *Quercus robur* and a treenail was made of *Tilia cordata/Tilia platyphyllos* (Table 1b).

**Table 1b:**

Tree species identification (samples taken on summer 2013)

**Venice Lido III timbers:**

| Sample no. | Fragment identification | Hull component | Tree species |
|---|---|---|---|
| S2 | VLIII P5 | Peg | *Cornus sanguinea* |
| S3 | VLIII P5 | Plank | *Quercus robur* |
| S5 | VLIII P7 | Peg | *Picea abies* |
| S6 | VLIII P7 | Plank | *Ulmus campestris* |
| S8 | VLIII P8 | Plank | crushed |
| S9 | VLIII P8 | Peg | *Cornus sanguinea* |
| S11 | VLIII P1 | Peg | *Cornus sanguinea* |
| S12 | VLIII P1 | Plank | *Ulmus campestris* |
| S13 | VLIII P1 | Trunnel | *Tilia cordata/T.platyphyllos* |
| S14 | VLIII P1 | Inside peg | *Cornus sanguinea* |

Since 1993 till 1996 numerous fragments of a sewn boat were rescued in front of the Venice Lido (Beltrame 1997). The vessel from which they come may have been wrecked while entering the harbour of Malamocco, which during the Roman Age was at the mouth of Brenta River. The finds consist of various sections of planking, one floor timber and many smaller fragments. All planking is entirely made of *Ulmus* (elm). A fragment of the floor timber is made of *Quercus robur* and has diagonal holes along the edge of the panels which are closed by lime (=*Tilia* ) treenails.

(Beltrame, C., 1997. Sutiles Naves of Roman Age: New Evidence and Technological Compositions with Pre-Roman Sewn Boats. In: J. Litwin (ed.), Down the River to the Sea, VIIIth International Symposium on Boat and Ship Archaeology, Gdansk, 1997, pp. 91-96. cf. p. 91).

As we can see from the present results (Table 1b) the same tree species were used as hull construction timbers as in the previous examinations.

**San Francesco del Deserto timbers:**

The three pegs were made of *Abies alba*, two planks were made of *Ulmus campestris* and the two treenails were made of *Tilia cordata/T.platyphyllos* (Table 1c).

**Table 1c:**

Tree species identification (samples taken on summer 2013)

**San Francesco del Deserto timbers:**

| Sample no. | Fragment identification | Hull component | Tree species |
|---|---|---|---|
| S16 | SFD T214 | Small peg | *Abies alba* |
| S17 | SFD T214 | Large peg | *Abies alba* |
| S18 | SFD T214 | Plank | *Ulmus campestris* |
| S19 | SFD T214 | Trunnel | *Tilia cordata/T.platyphyllos* |
| S20 | SFD T222 | Peg | *Abies alba* |
| S21 | SFD T222 | Plank | *Ulmus campestris* |
| S22 | SFD T222 | Trunnel | *Tilia cordata/T.platyphyllos* |

Use of the same tree species for the same hull components is obvious. *Ulmus campestris* was used for planks, *Abies alba* was used for some pegs in Stella 1 and San Francesco del Deserto, while *Cornus sanguinea* was used for pegs of the Venice Lido III. Wood of *Tilia cordata/T.platyphyllos* was used for treenails in San Francesco del Deserto and in Venice Lido III.

**Dendroarchaeological Investigations: 627. Stella 1, Canale Anfora II and Venice Lido III timbers**

Nili Liphschitz

Institute of Archaeology – The Botanical Laboratories, Tel Aviv University, 16.02.15

**Introduction**

**Stella 1 wreck:** The wreck is dated to the 1st quarter of the 1st century AD based on the stamps of the ceramic roof tile cargo. It was discovered in the Stella River, one of the main arteries of the Fruili Venezia Giulia region of northeastern Italy. It is a flat-bottomed barge with extant hull remains approximately 5m long and 2m wide.

**Canale Anfora II wreck:** The wreck is dated to the Roman Period to the 1st – 2nd centuries AD. It was discovered in 1988 in Italy, in Aquileia on the spot of Canale Anfora. Fragments of Roman sewn-plank boats have been found, during rescue excavations, in the *Canale Anfora*, an artificial channel used by Roman ships to enter the Roman city of Aquileia. Remains were found in both 1988 and 2005 at the same site. Elements of what were probably two boats are analyzed and compared to other finds of Roman sewn boats found along the coast of the Veneto and Friuli Venezia Giulia regions. They are evidence of the use of this technique, instead of the more widespread mortise-and-tenon system, in the quite limited area of the Northern Adriatic. These boats were used both for inland and for maritime navigation (C. Beltrame and D. Gaddi, 2013. Fragments of Boats from the *Canale Anfora* of Aquileia, Italy, and Comparison of Sewn-Plank Ships in the Roman Era; IJNA 42:296-304).

**Venice Lido III timbers:** Only one of the eight timbers in this collection has been dated: Fragment 1 gave a date of AD 270-330 by radiocarbon dating. These timbers washed ashore on the beach of Venice Lido, the barrier island between the lagoon and the Adriatic Sea, in November 2012. They may not all be from the same laced vessel. These are the third set of laced boat timbers that have washed ashore on Venice Lido. Only 4 of the 8 timbers were sampled last summer. This is a highly variable set of timbers in regards to their dimensions ranging in length from approximately 2m to 0.2m and widths ranging from 36cm to 7cm. (Staci Willis, p.c.).

## Material and Methods

Twenty nine wood samples were taken on 2014 for identification: 17 samples were from Venice Lido III timbers, 4 samples were from Canale Anfora II timbers and 8 samples were from Stella 1 wreck (Table 1a-c). All samples of Stella 1, Canale Anfora II and Venice Lido III were kept in water until their examination.

Cross and longitudinal, tangential and radial sections were made for each sample with a sharp razor blade. Identification of the wood up to the species level, based on the three-dimensional structure of the wood was made by microscopic analysis of these sections. Comparison was made with reference sections prepared from systematically identified, recent trees and shrubs and with anatomical atlases.

## Results and Discussion

==================

**Stella 1 wreck:**

The 8 samples taken on 2014 from Stella 1 wreck included a frame, two treenails, two pegs, and three bottom hull planks. As we can see from the results (Table 1a) the frame was made of *Fraxinus excelsior,* the pegs and one treenail were of *Abies alba*, one treenail was of *Quercus coccifera* and the bottom hull planks were of *Ulmus campestris*.

**Table 1a:**

Tree species identification for samples taken on summer 2014

| Sample no. | Hull component | Tree species |
|---|---|---|
| S#14051 | Frame (O3) | *Fraxinus excelsior* |
| S#14052 | Treenail (small) | *Abies alba* |
| S#14053 | Treenail (large) | *Quercus coccifera* |
| S#14054 | Peg (original seam) | *Abies alba* |
| S#14055 | Bottom hull plank (repair) | *Ulmus campestris* |

| | | |
|---|---|---|
| S#14056 | Peg (Repair seam, R2) | *Abies alba* |
| S#14057 | Bottom hull plank, left of repair (F5) | *Ulmus campestris* |
| S#14058 | Bottom hull plank, right of repair (F6) | *Ulmus campestris* |

Stella 1 barge was found in 1981. This vessel was first excavated in 1998 during a one-week long campaign but no samples were taken. In 1998 and 1999 the archaeologists recorded the hull remains during a two-week campaign. Six wood samples were identified in 1998 and six others in 1999: (http://nauticalarch.org/blogs/anaxum-project/2012/11/06/stella-1-shipwreck/).

| # | 1998 | 1999 |
|---|---|---|
| e1 | *Ulmus* sp. | *Picea abies* Karst. |
| e2 | *Alnus glutinosa/incana* | *Quercus* sp.; *Quercus sp. sez.* Robur |
| e3 | *Alnus* sp. | *Ulmus* sp. |
| e4 | *Juglans regia* L. | Cfr. *Tilia* sp. |
| e5 | *Salix* sp. | Cfr. *Stipa tenacissima* L. |
| e6 | *Vitis vinifera* L. | *Cornus /Viburnum* |

Marco Rottoli of the Laboratory of Archaeobiology of the Civic Museum of Como (Laboratoria di Archeobiologia dei Musei Civici di Como) made those wood identifications. The samples included on the 1998 report were various debris discovered among the cargo material, representing branches, seeds, etc., and are not samples taken from the hull remains themselves. The 1999 report reflects the various hull components as follows:

e1 was taken from ceiling planking;

e2 was taken from hull planking and a dis-articulated piece in general association with the wreck which may represent a futtock;

e3 was taken from hull planking;

e4 was taken from a roll of fibrous material used in the sewing system, likely represents the wad of material placed over the seam;

e5 was taken from the same roll of fibrous material, likely represents the cordage;

e6 was taken from the same roll of fibrous material, may be part of the seam wadding or may be an accidental inclusion.

In 2011 excavations of Stella 1 took place for six weeks and the hull remains were recorded in details as much as possible. At that time the hull was completely recorded and then reburied (Staci Willis, p.c.). The four samples identified were retrieved on that occasion.

Hull planking found and identified on 1998-99 was made of *Ulmus campestris* and another plank fragment identified now was also made of this tree species.

The results of the timber samples identified on 2013 were as follows:

| Sample no. | Hull component | Tree species |
|---|---|---|
| S24 | Possible peg 1 | *Abies alba* |
| S25 | Possible peg 2 | *Cornus sanguinea* |
| S26 | Possible Trunnel | *Abies alba* |
| S27 | Plank fragment 6 | *Ulmus campestris* |

As is evident from the results of 2013 and 2014 the builders used the same tree species for the same hull components.

**Venice Lido III timbers:**

The 17 wood samples including 8 pegs, 5 planks and 2 treenails were identified for samples taken of Venice Lido III in 2014. Pegs were made of *Cornus sanguinea* and *Abies alba,* the planks except one were of *Ulmus campestris* and a single plank was made of *Quercus robur*.

**Table 1b:**

| Sample no. | Hull component | Remarks | Tree species |
|---|---|---|---|
| S#14001 | 2nd Peg | Fragment 1 | *Cornus sanguinea* |
| S#14002 | 3rd Peg | -"- | *Cornus sanguinea* |
| S#14006 | Plank | Fragment 2 | *Ulmus campestris* |
| S#14007 | Peg | -"- | *Abies alba* |
| S#14012 | Plank | Fragment 3 | *Ulmus campestris* |
| S#14013 | Peg | -"- | *Abies alba* |
| S#14017 | Plank | Fragment 4 | *Ulmus campestris* |
| S#14018 | Peg | -"- | *Abies alba* |
| S#14022 | Treenail | Fragment 5 | *Cornus sanguinea* |

| | | | |
|---|---|---|---|
| S#14028 | Plank | Fragment 8 | *Ulmus campestris* |
| S#14029 | 2nd Peg | -"- | *Cornus sanguinea* |
| S#12030 | Treenail | -"- | *Cornus sanguinea* |
| S#14033 | Plank | Fragment 9 | *Ulmus campestris* |
| S#14035 | Plank | Fragment 10 | *Ulmus campestris* |
| S#14036 | Peg | -"- | *Abies alba* |
| S#14040 | Plank | Fragment 11 | *Quercus robur* |
| S#14026 | Peg | Unknown fragment | crushed |

Tree species identification of samples taken on summer 2013 from Venice Lido III included:

| Sample no. | Fragment identification | Hull component | Tree species |
|---|---|---|---|
| S2 | VLIII P5 | Peg | *Cornus sanguinea* |
| S3 | VLIII P5 | Plank | *Quercus robur* |
| S5 | VLIII P7 | Peg | *Picea abies* |
| S6 | VLIII P7 | Plank | *Ulmus campestris* |
| S8 | VLIII P8 | Plank | crushed |
| S9 | VLIII P8 | Peg | *Cornus sanguinea* |
| S11 | VLIII P1 | Peg | *Cornus sanguinea* |
| S12 | VLIII P1 | Plank | *Ulmus campestris* |
| S13 | VLIII P1 | Trunnel | *Tilia cordata/T.platyphyllos* |
| S14 | VLIII P1 | Inside peg | *Cornus sanguinea* |

Since 1993 till 1996 numerous fragments of a sewn boat were rescued in front of the Venice Lido (Beltrame 1997). The vessel from which they come may have been wrecked while entering the harbour of Malamocco, which during the Roman Age was at the mouth of Brenta River. The finds consist of various sections of planking, one floor timber and many smaller fragments. All planking is entirely made of *Ulmus* (elm). A fragment of the floor timber is made of *Quercus robur* and has diagonal holes along the edge of the panels which are closed by lime (=*Tilia* ) treenails.

(Beltrame, C., 1997. Sutiles Naves of Roman Age: New Evidence and Technological Compositions with Pre-Roman Sewn Boats. In: J. Litwin (ed.), Down the River to the

Sea, VIIIth International Symposium on Boat and Ship Archaeology, Gdansk, 1997, pp. 91-96. cf. p. 91).

As we can see from the present results (Table 1b) the same tree species were used as hull construction timbers as in the previous examinations made in 2013.

**Canale Anfora wreckII:**

Although only few wood samples were examined of the Canale Anfora wreck II, The plank was made of *Ulmus campestris,* the frame was of *Quercus robur*, the peg was made of *Abies alba* and the treenail was of *Cornus sanguinea*.

**Table 1c:**

| Sample No. | Hull component | Tree species |
|---|---|---|
| S#14042 | Plank | *Ulmus campestris* |
| S#14043 | Peg | *Abies alba* |
| S#14047 | Frame | *Quercus robur* |
| S#14048 | Treenail | *Cornus sanguinea* |

The hull of the wrecks which have been examined was built of the very same tree species, which were used for the same hull components.

## APPENDIX E

## RADIOCARBON ANALYSES

### LIST OF SAMPLES FOR RADOCARBON ANALYSIS

| | Sample # | 2σ CAL 14C Date |
|---|---|---|
| Venice Lido III Timbers | | |
| HP Frag 1 Plank | VLIIIFrag1SI | 140-260 C.E. and 270-330 C.E.# |
| HP Frag 1 Plank | 14004 | 27-40 C.E., 48-180 C.E., and 185-214 C.E* |
| HP Frag 1Cordage | 14009 | 40 B.C.E-87 C.E. and 105-120 C.E.* |
| HP Frag 2 Plank | 14011 | 40 B.C.E.-130 C.E.+ |
| HP Frag 3 Plank | 14015 | 90-340 C.E.+ |
| HP Frag 4 Plank | 14021 | 41 B.C.E.-71 C.E.* |
| HP Frag 5 Plank | 14025 | 170-400 C.E.+ |
| HP Frag 7 Plank | 14027 | 100 B.C.E.-120 C.E.+ |
| HP Frag 8 Plank | 14031 | 54 B.C.E.-75 C.E.* |
| HP Frag 8 Cordage | 14034 | 19-14 B.C.E. and 1-129 C.E.* |
| HP Frag 9 Plank | 14032 | 71-223 C.E.* |
| HP Frag 10 Plank | 14039 | 80-310 C.E.+ |
| HP Frag 11 Plank | 14041 | 66-217 C.E.* |
| Canale Anfore II Hull Remains | | |
| Frame | 14046 | 164 B.C.E.-21 C.E.* |
| Seam Wadding | 14044 | 404-357 B.C.E. and 285-235 B.C.E.* |
| Stella I River Barge | | |
| Frame | 14066 | 82-232 C.E.* |
| Seam Wadding | 14061 | 53-215 C.E.* |

* Samples sent to Arizona AMS Laboratory
\+ Samples sent to International Chemical Analysis, Inc. (ICA)
\# Samples sent to Beta Analytic Laboratory

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**Fax: 305 663 0964**
**Beta@radiocarbon.com**
**www.radiocarbon.com**

**Darden Hood**
**President**

**Ronald Hatfield**
**Christopher Patrick**
**Deputy Directors**

September 17, 2013

Dr. Staci Willis
Texas A&M University
Department of Anthropology
MS 4352 TAMU
College Station, TX 77843-4352
USA

RE: Radiocarbon Dating Result For Sample VLIIIFrag1S1

Dear Dr. Willis:

Enclosed is the radiocarbon dating result for one sample recently sent to us. It provided plenty of carbon for an accurate measurement and the analysis proceeded normally. The report sheet contains the method used, material type, and applied pretreatments and, where applicable, the two-sigma calendar calibration range.

This report has been both mailed and sent electronically. All results (excluding some inappropriate material types) which are less than about 42,000 years BP and more than about ~250 BP include a calendar calibration page (also digitally available in Windows metafile (.wmf) format upon request). Calibration is calculated using the newest (2009) calibration database with references quoted on the bottom of the page. Multiple probability ranges may appear in some cases, due to short-term variations in the atmospheric 14C contents at certain time periods. Examining the calibration graph will help you understand this phenomenon. Don’t hesitate to contact us if you have questions about calibration.

We analyzed this sample on a sole priority basis. No students or intern researchers who would necessarily be distracted with other obligations and priorities were used in the analysis. We analyzed it with the combined attention of our entire professional staff.

The cost of the analysis was charged to the MASTERCARD card provided. Thank you. As always, if you have any questions or would like to discuss the results, don’t hesitate to contact me.

Sincerely,

Darden Hood
Digital signature on file

BETA ANALYTIC INC.
DR. M.A. TAMERS and MR. D.G. HOOD
4985 S.W. 74 COURT
MIAMI, FLORIDA, USA 33155
PH: 305-667-5167 FAX:305-663-0964
beta@radiocarbon.com

# REPORT OF RADIOCARBON DATING ANALYSES

Dr. Staci Willis — Report Date: 9/17/2013

Texas A&M University — Material Received: 9/6/2013

| Sample Data | Measured Radiocarbon Age | 13C/12C Ratio | Conventional Radiocarbon Age(*) |
|---|---|---|---|
| Beta - 358584 | 1780 +/- 30 BP | -25.2 o/oo | 1780 +/- 30 BP |

SAMPLE : VLIIIFrag1S1
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (wood): acid/alkali/acid
2 SIGMA CALIBRATION : Cal AD 140 to 260 (Cal BP 1810 to 1690) AND Cal AD 270 to 330 (Cal BP 1680 to 1620)

---

Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard.

The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. On rare occasion where the Conventional Radiocarbon Age was calculated using an assumed delta 13C, the ratio and the Conventional Radiocarbon Age will be followed by "*". The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.

# CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-25.2:lab. mult=1)

**Laboratory number:** **Beta-358584**

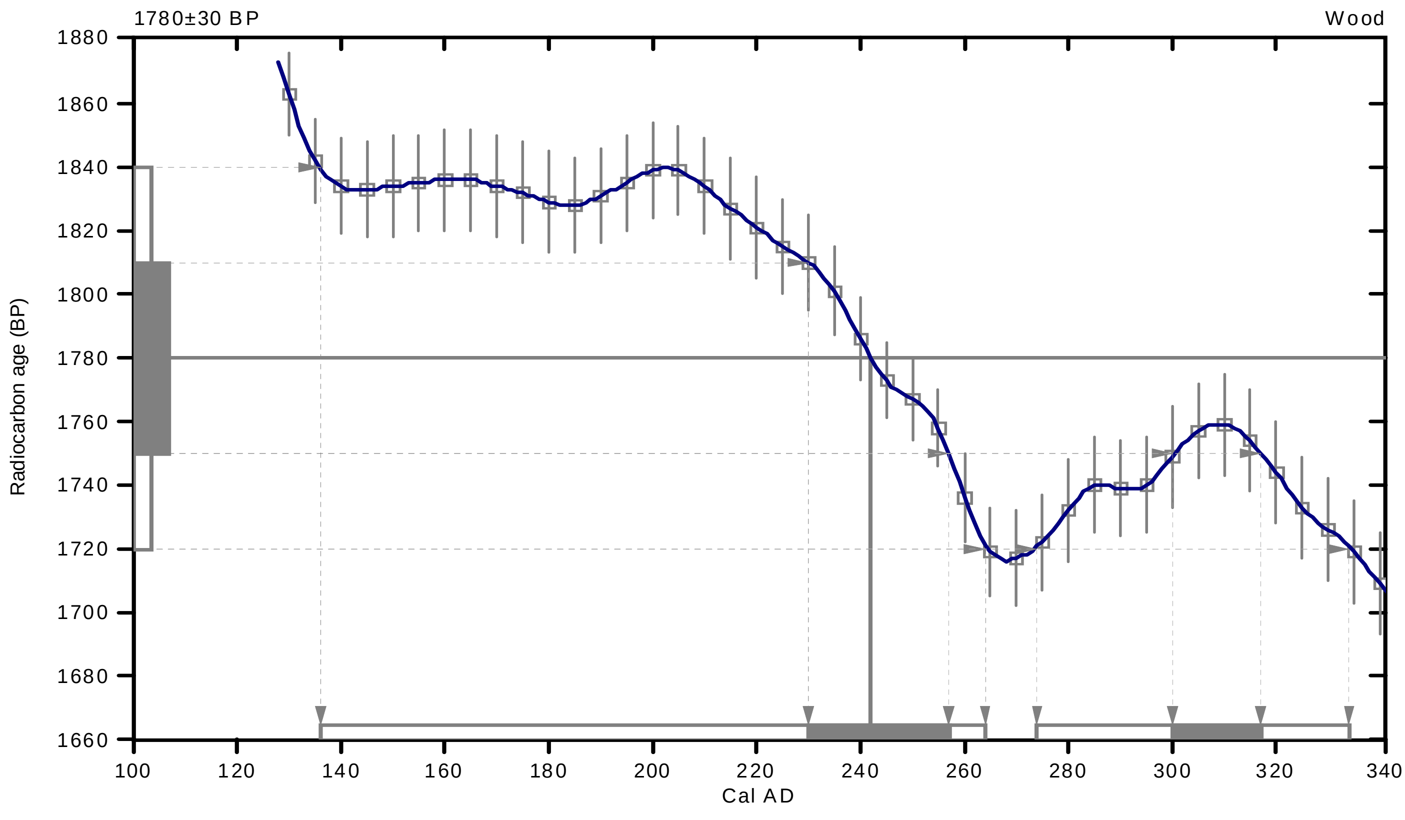
**Conventional radiocarbon age:** **1780±30 BP**

**2 Sigma calibrated results:** **Cal AD 140 to 260 (Cal BP 1810 to 1690) and**
**(95% probability)** **Cal AD 270 to 330 (Cal BP 1680 to 1620)**

Intercept data

Intercept of radiocarbon age
with calibration curve: Cal AD 240 (Cal BP 1710)

1 Sigma calibrated results: Cal AD 230 to 260 (Cal BP 1720 to 1690) and
(68% probability) Cal AD 300 to 320 (Cal BP 1650 to 1630)




References:

***Database used***

*INTCAL09*

***References to INTCAL09 database***

*Heaton,et.al.,2009, Radiocarbon 51(4):1151-1164, Reimer,et.al, 2009, Radiocarbon 51(4):1111-1150, Stuiver,et.al,1993, Radiocarbon 35(1):137-189, Oeschger,et.al.,1975,Tellus 27:168-192*

***Mathematics used for calibration scenario***

*A Simplified Approach to Calibrating C14 Dates*

*Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322*

THE UNIVERSITY OF ARIZONA
COLLEGE OF SCIENCE
ACCELERATOR MASS SPECTROMETRY LAB

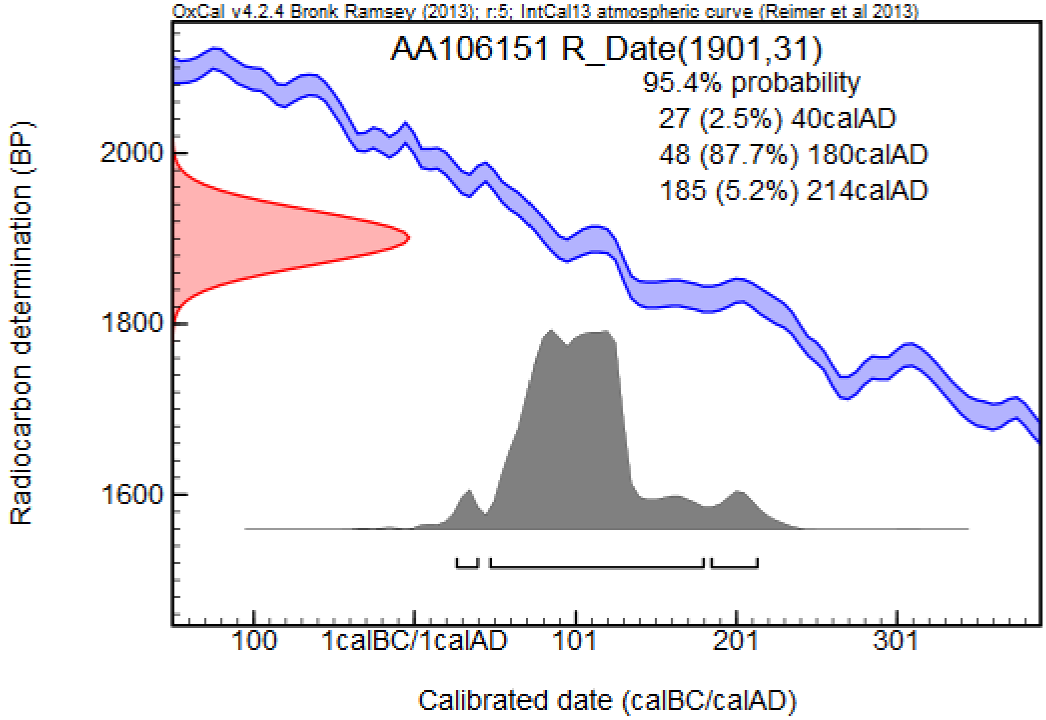
# DATA REPORT

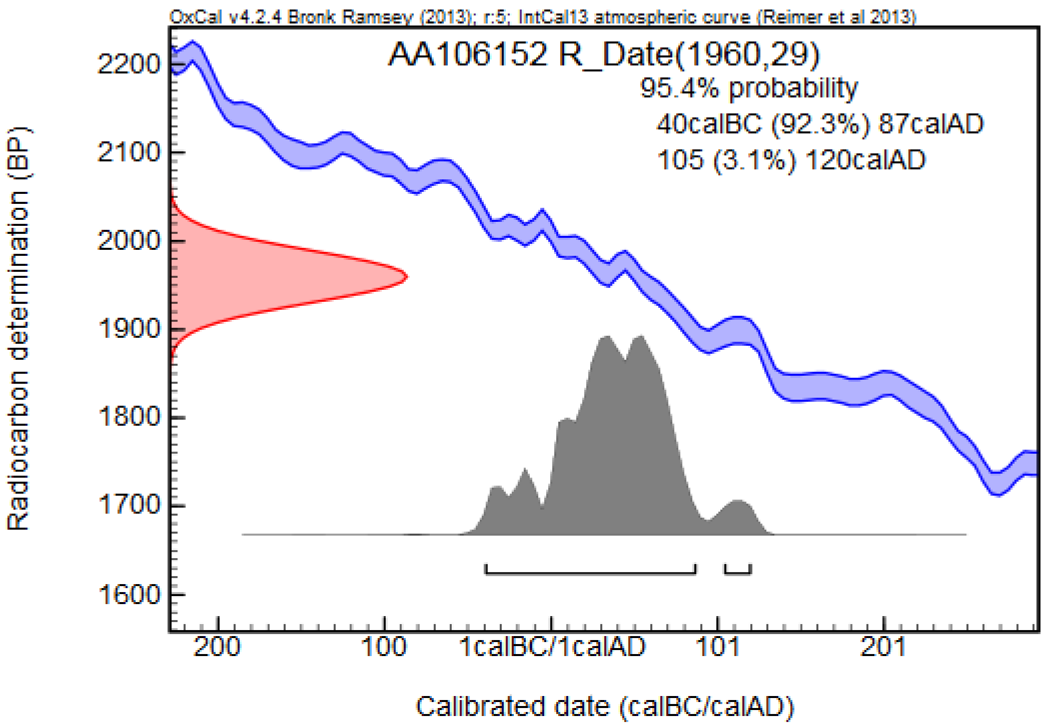
## *"radiocarbon age BP"*

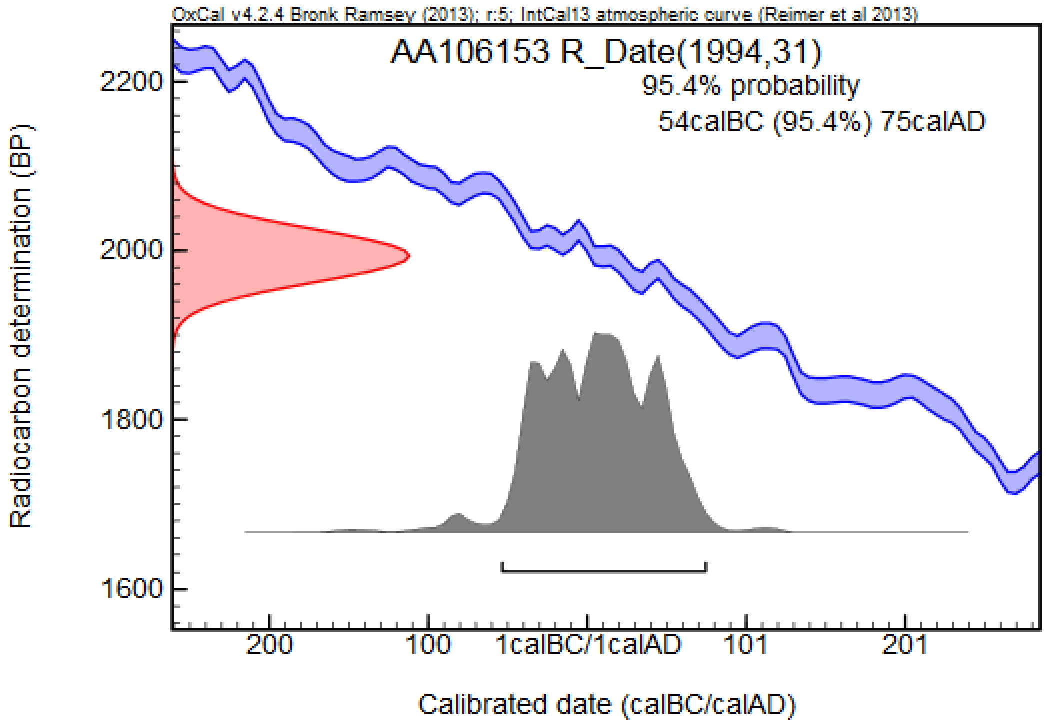
1118 E. 4th St.
PO Box 210081
Tucson, AZ 85721-0081,USA

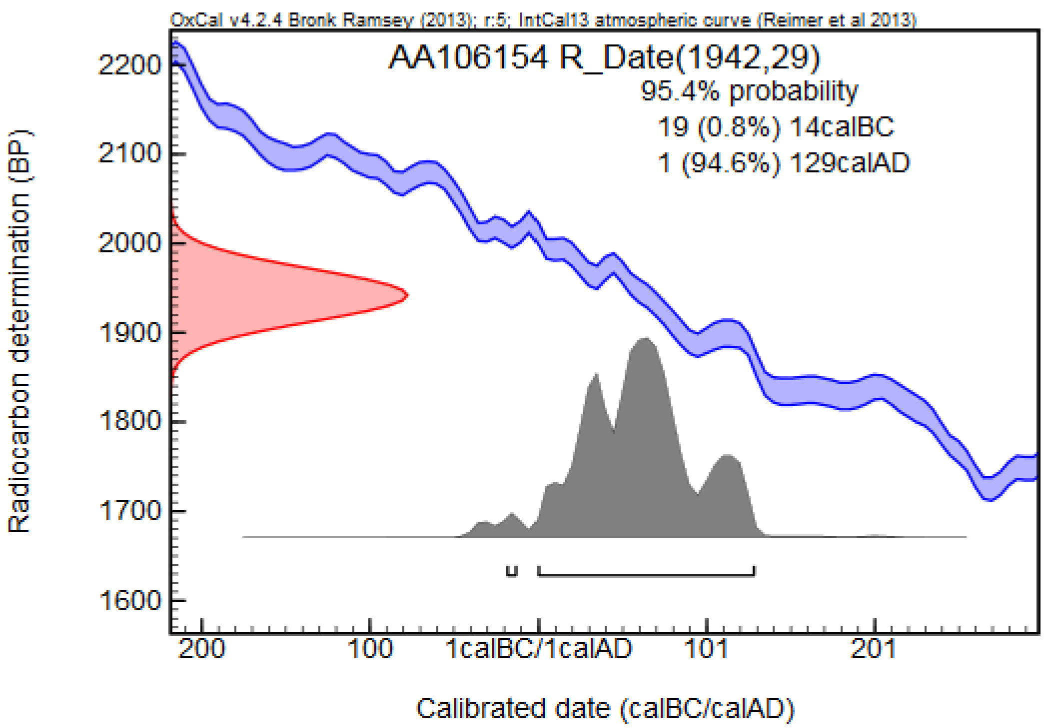
(520) 621-6810 (phone)
(520) 621-9619 (fax)
AMS@physics.arizona.edu

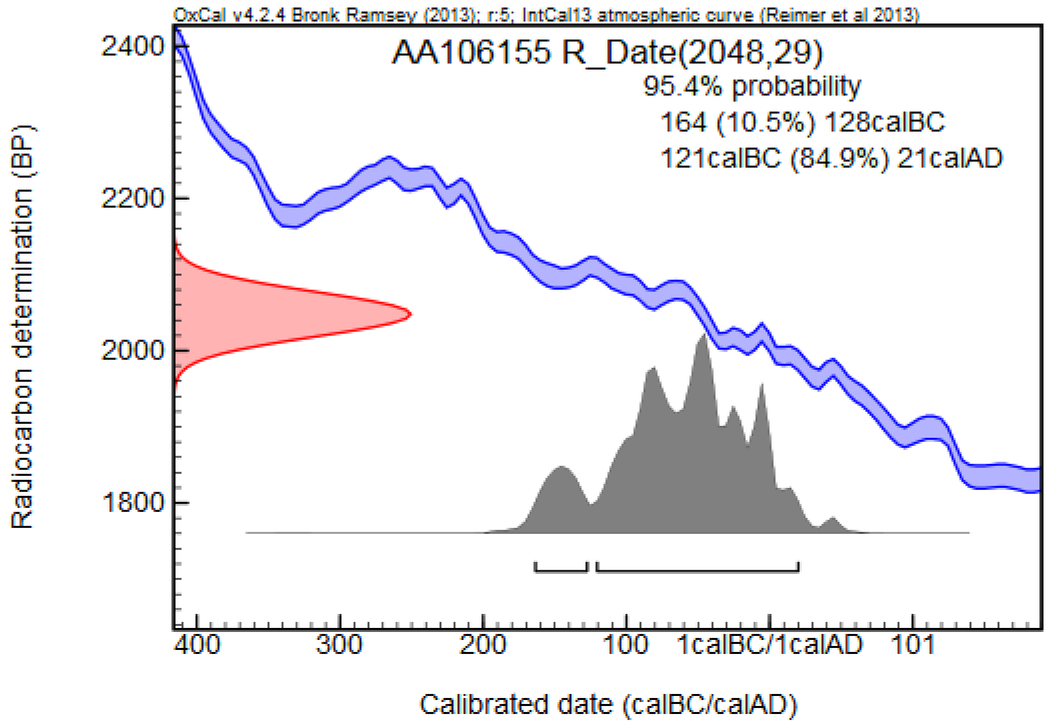
| AA | lab # | sample ID: | Contact 1 | MASS | d13C value | F(d13C) | +- F(d13C) | 14C age BP | +- 14C age |
|---|---|---|---|---|---|---|---|---|---|
| AA106151 | X28954 | 14004 | Willis, S. | 1.36mg | -25.5 | 0.7893 | 0.0031 | 1,901 | 31 |
| AA106152 | X28955 | 14009 | Willis, S. | 1.30mg | -26.1 | 0.7835 | 0.0029 | 1,960 | 29 |
| AA106153 | X28956 | 14031 | Willis, S. | 1.67mg | -26.2 | 0.7802 | 0.0030 | 1,994 | 31 |
| AA106154 | X28957 | 14034 | Willis, S. | 1.35mg | -26.3 | 0.7852 | 0.0029 | 1,942 | 29 |
| AA106155 | X28958 | 14046 | Willis, S. | 1.62mg | -27.9 | 0.7749 | 0.0028 | 2,048 | 29 |
| AA106156 | X28959 | 14061 | Willis, S. | 1.54mg | -26.7 | 0.7899 | 0.0029 | 1,895 | 29 |
| AA106157 | X28960 | 14066 | Willis, S. | 1.44mg | -26.0 | 0.7936 | 0.0029 | 1,857 | 29 |

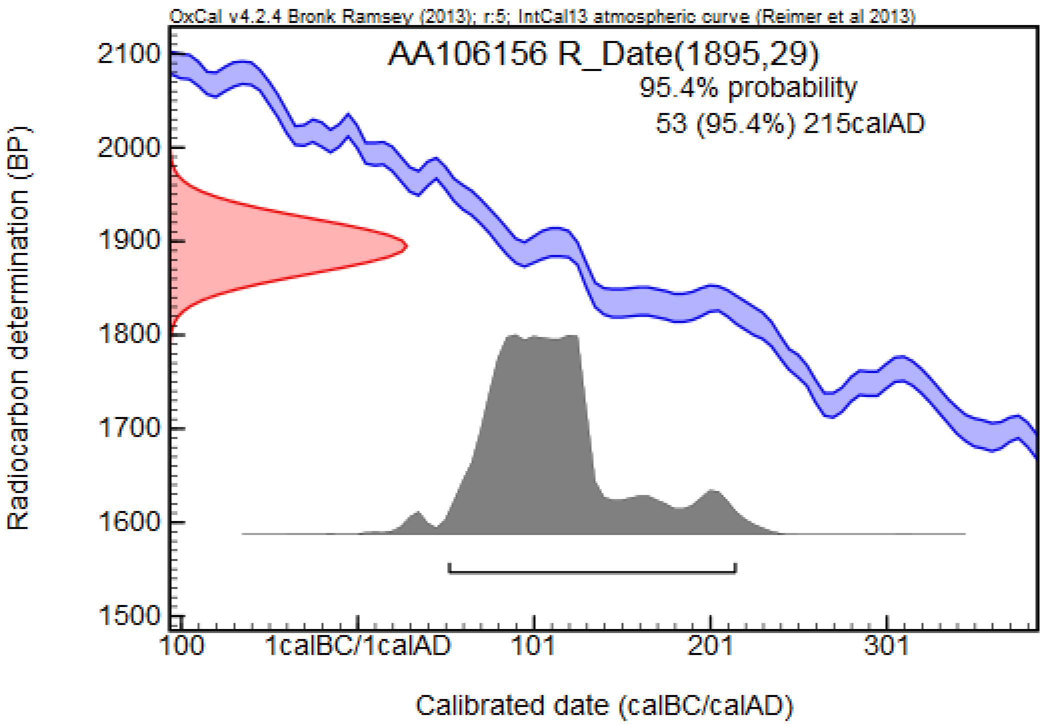

OxCal v4.2.4 Bronk Ramsey (2013); r:5; IntCal13 atmospheric curve (Reimer et al 2013)
AA106151 R_Date(1901,31)
95.4% probability
27 (2.5%) 40calAD
48 (87.7%) 180calAD
185 (5.2%) 214calAD
Radiocarbon determination (BP)
2000
1800
1600
100
1calBC/1calAD
101
201
301
Calibrated date (calBC/calAD)

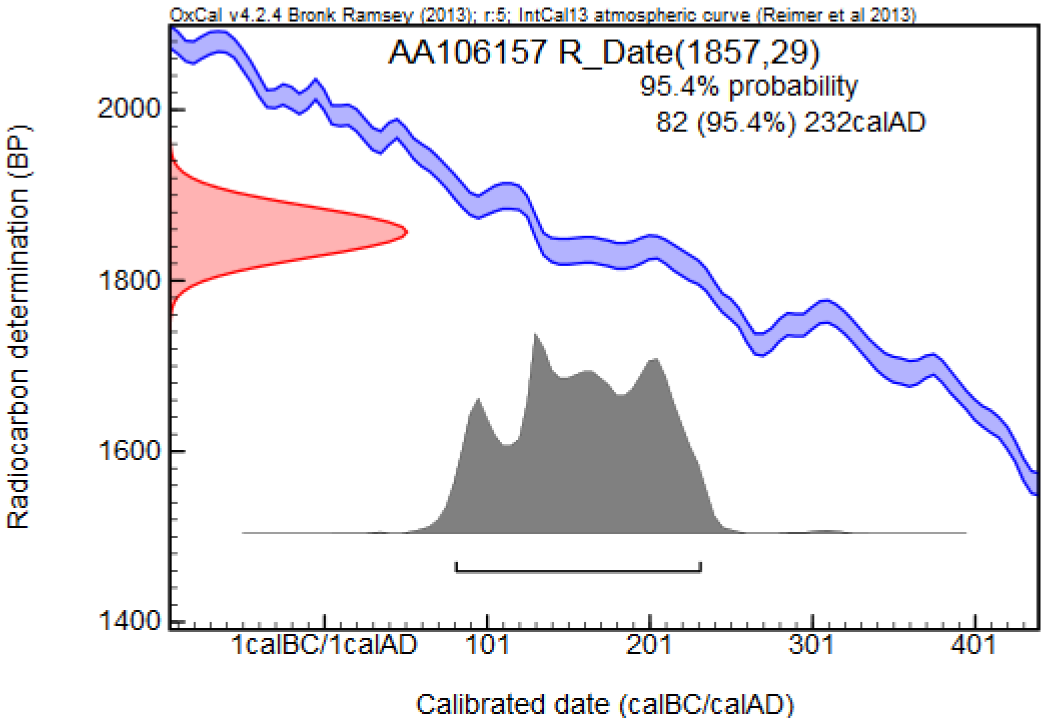

OxCal v4.2.4 Bronk Ramsey (2013); r:5; IntCal13 atmospheric curve (Reimer et al 2013)
AA106152 R_Date(1960,29)
95.4% probability
40calBC (92.3%) 87calAD
105 (3.1%) 120calAD
Radiocarbon determination (BP)
2200
2100
2000
1900
1800
1700
1600
200
100
1calBC/1calAD
101
201
Calibrated date (calBC/calAD)


OxCal v4.2.4 Bronk Ramsey (2013); r:5; IntCal13 atmospheric curve (Reimer et al 2013)
AA106153 R_Date(1994,31)
95.4% probability
54calBC (95.4%) 75calAD
Radiocarbon determination (BP)
2200
2000
1800
1600
200
100
1calBC/1calAD
101
201
Calibrated date (calBC/calAD)


OxCal v4.2.4 Bronk Ramsey (2013); r:5; IntCal13 atmospheric curve (Reimer et al 2013)
AA106154 R_Date(1942,29)
95.4% probability
19 (0.8%) 14calBC
1 (94.6%) 129calAD
Radiocarbon determination (BP)
2200
2100
2000
1900
1800
1700
1600
200
100
1calBC/1calAD
101
201
Calibrated date (calBC/calAD)

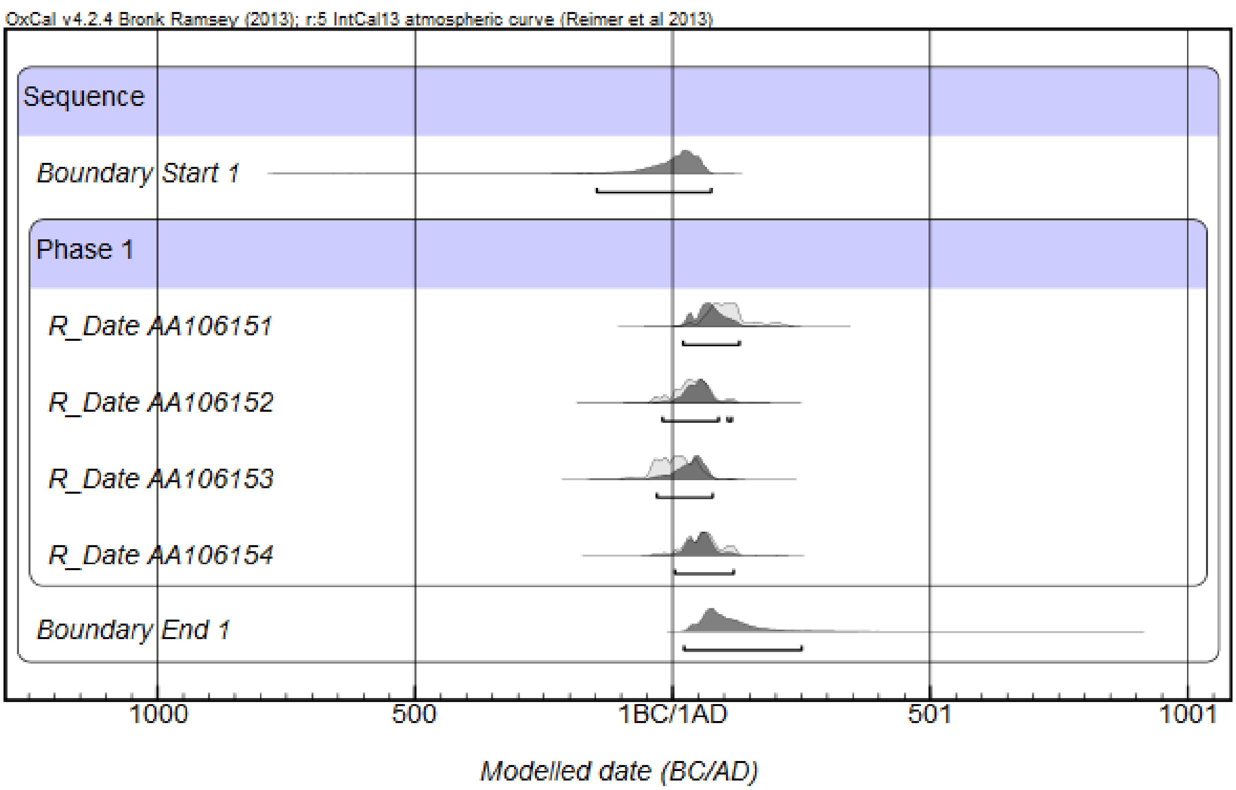

OxCal v4.2.4 Bronk Ramsey (2013); r:5; IntCal13 atmospheric curve (Reimer et al 2013)
AA106155 R_Date(2048,29)
95.4% probability
164 (10.5%) 128calBC
121calBC (84.9%) 21calAD
Radiocarbon determination (BP)
2400
2200
2000
1800
400
300
200
100
1calBC/1calAD
101
Calibrated date (calBC/calAD)


OxCal v4.2.4 Bronk Ramsey (2013); r:5; IntCal13 atmospheric curve (Reimer et al 2013)
AA106156 R_Date(1895,29)
95.4% probability
53 (95.4%) 215calAD
Radiocarbon determination (BP)
2100
2000
1900
1800
1700
1600
1500
100
1calBC/1calAD
101
201
301
Calibrated date (calBC/calAD)


OxCal v4.2.4 Bronk Ramsey (2013); r:5; IntCal13 atmospheric curve (Reimer et al 2013)
AA106157 R_Date(1857,29)
95.4% probability
82 (95.4%) 232calAD
Radiocarbon determination (BP)
2000
1800
1600
1400
1calBC/1calAD
101
201
301
401
Calibrated date (calBC/calAD)

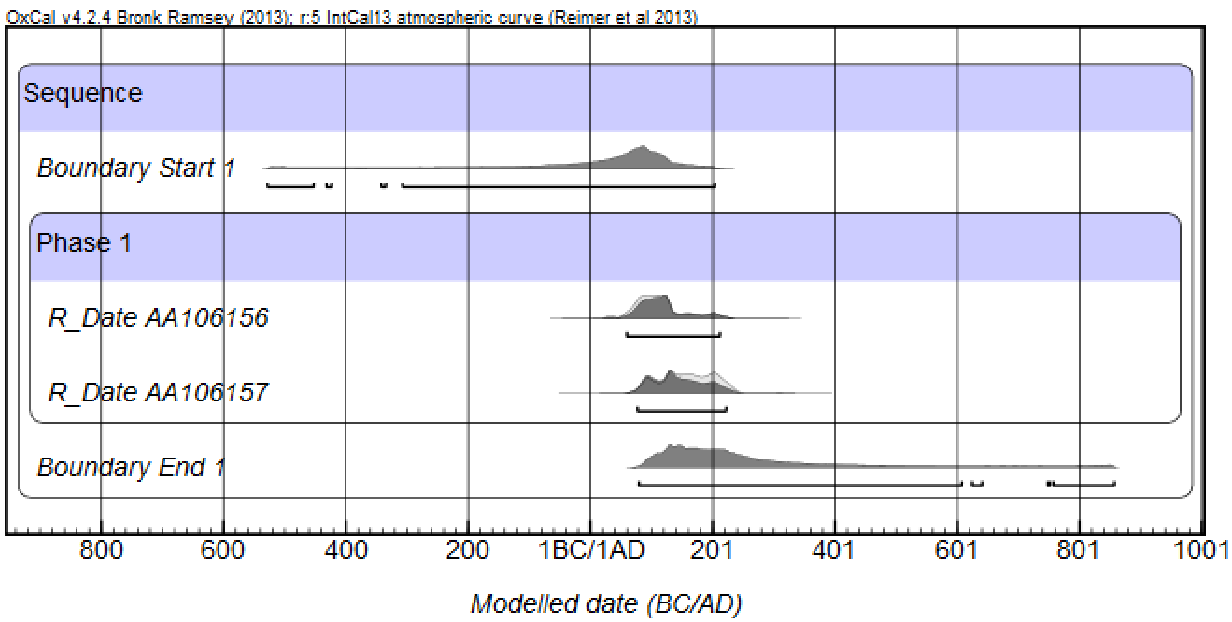
Bayesian Model of AA106151-54

| Name | Unmodelled (BC/AD) | | | Modelled (BC/AD) | | | Indices $A_{model}$=97.2 $A_{overall}$=100.2 | | | | | Select | Page break |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Show all / Show structure | from | to | % | from | to | % | $A_{comb}$ | A | L | P | C | All / Visible | |
| ▼ Sequence | | | | | | | | | | | | ☑ 2 | ☐ |
| Boundary Start 1 | | | | -148 | 75 | 95.4 | | | | | 95.1 | ☑ 3 | ☐ |
| ▼ Phase 1 | | | | | | | | | | | | ☑ 4 | ☐ |
| R_Date AA106151 | 27 | 214 | 95.4 | 21 | 130 | 95.4 | | 84.7 | | | 99.4 | ☑ 5 | ☐ |
| R_Date AA106152 | -40 | 120 | 95.4 | -20 | 115 | 95.4 | | 114.3 | | | 99.5 | ☑ 6 | ☐ |
| R_Date AA106153 | -54 | 75 | 95.4 | -32 | 78 | 95.4 | | 90.9 | | | 99.1 | ☑ 7 | ☐ |
| R_Date AA106154 | -19 | 129 | 95.4 | 5 | 119 | 95.4 | | 114.4 | | | 99.5 | ☑ 8 | ☐ |
| Boundary End 1 | | | | 23 | 251 | 95.4 | | | | | 96 | ☑ 9 | ☐ |



Bayesian Model of AA106156-57

| Name<br>Show all<br>Show structure | Unmodelled (BC/AD) | | | Modelled (BC/AD) | | | Indices<br>$A_{model}$=97<br>$A_{overall}$=98.2 | | | | | Select<br>All<br>Visible | Page break |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | from | to | % | from | to | % | $A_{comb}$ | A | L | P | C | | |
| ▼ Sequence | | | | | | | | | | | | ☑ 2 | ☐ |
| Boundary Start 1 | | | | -529 | 204 | 95.4 | | | | | 97.7 | ☑ 3 | ☐ |
| ▼ Phase 1 | | | | | | | | | | | | ☑ 4 | ☐ |
| R_Date AA106156 | 53 | 215 | 95.4 | 60 | 213 | 95.4 | | 99.1 | | | 99.7 | ☑ 5 | ☐ |
| R_Date AA106157 | 82 | 232 | 95.4 | 78 | 223 | 95.4 | | 98.3 | | | 99.7 | ☑ 6 | ☐ |
| Boundary End 1 | | | | 80 | 858 | 95.4 | | | | | 98.1 | ☑ 7 | ☐ |



THE UNIVERSITY OF ARIZONA
COLLEGE OF SCIENCE
ACCELERATOR MASS SPECTROMETRY LAB

# DATA REPORT

*"radiocarbon age BP"*

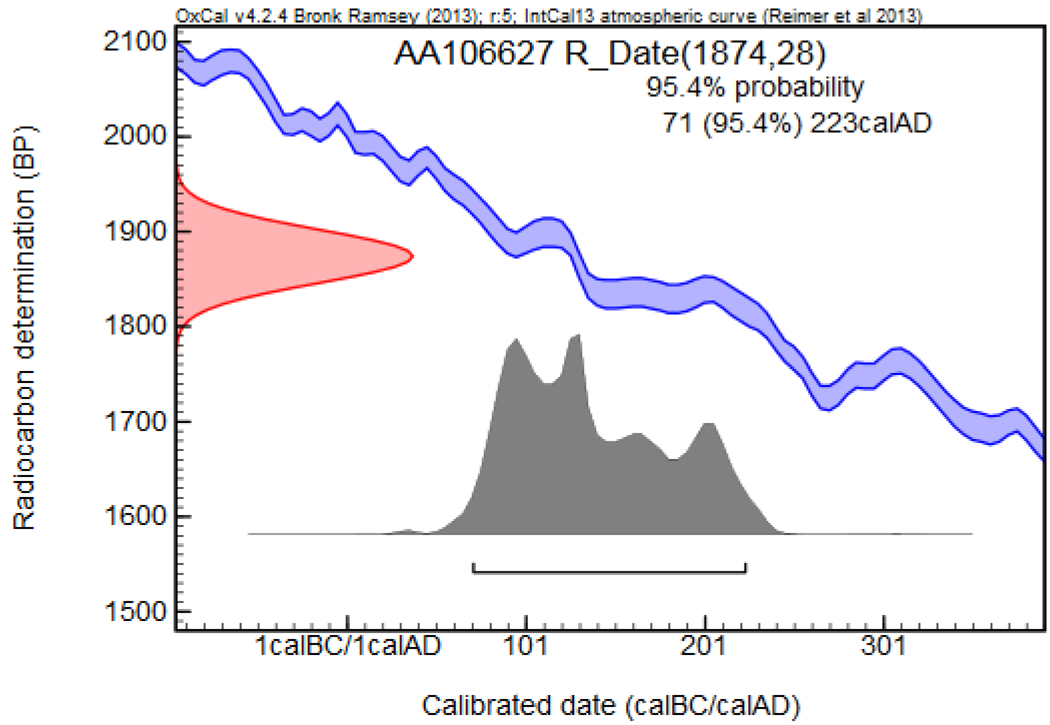
1118 E. 4th St.
PO Box 210081
Tucson, AZ 85721-0081,USA

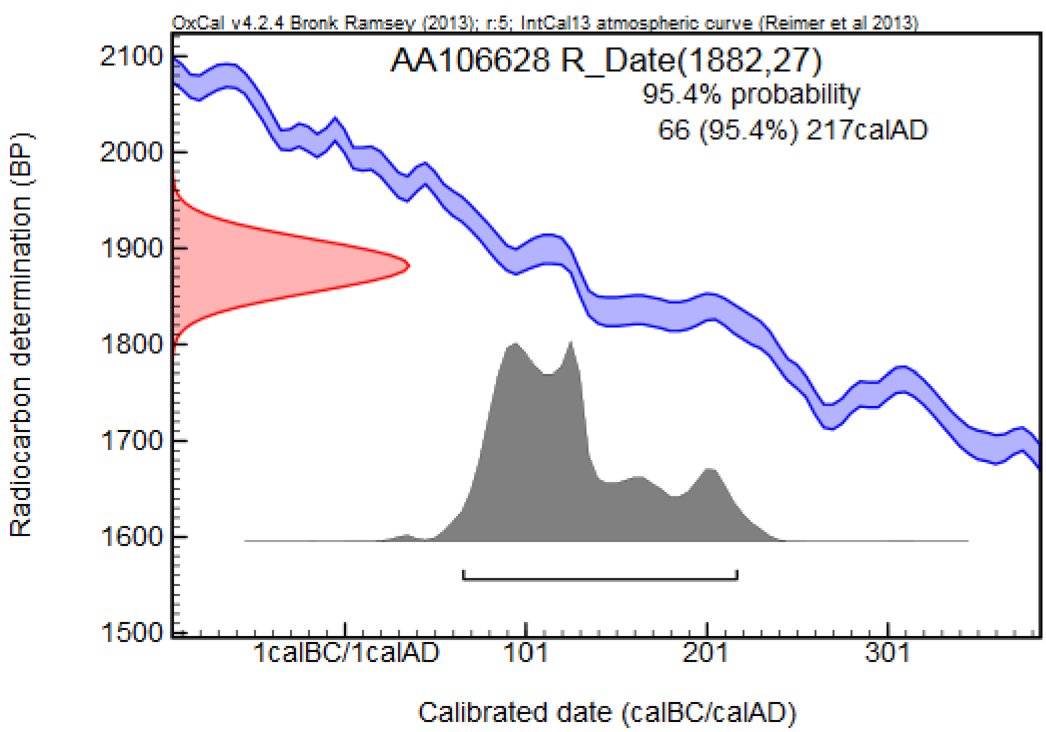
(520) 621-6810 (phone)
(520) 621-9619 (fax)
AMS@physics.arizona.edu

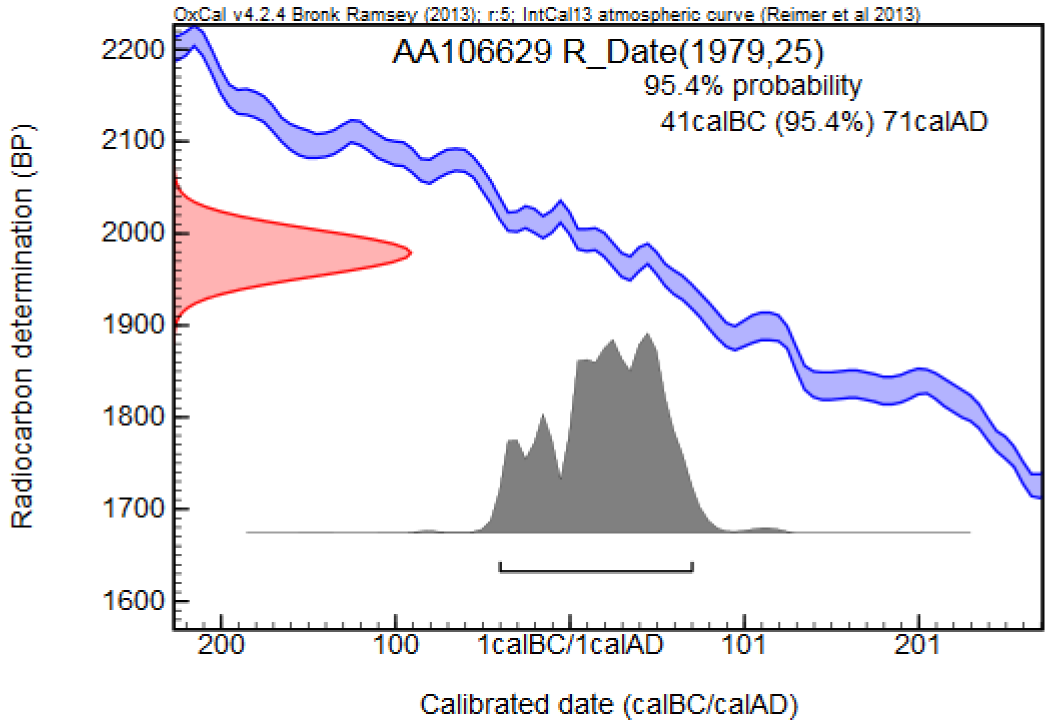
| AA | lab # | sample ID: | Contact 1 | MASS | d13C value | F(d13C) | +- F(d13C) | 14C age BP | +- 14C age |
|---|---|---|---|---|---|---|---|---|---|
| AA106627 | X29241 | 14032 | Willis, S. | 1.82mg | -28.1 | 0.7919 | 0.0027 | 1,874 | 28 |
| AA106628 | X29242 | 14041 | Willis, S. | 1.62mg | -27.7 | 0.7911 | 0.0027 | 1,882 | 27 |
| AA106629 | X29243 | 14021 | Willis, S. | 1.75mg | -28.1 | 0.7817 | 0.0024 | 1,979 | 25 |
| AA106630 | X29244 | 14044 | Willis, S. | 1.45mg | -27.2 | 0.7519 | 0.0023 | 2,291 | 25 |

13 October 2015

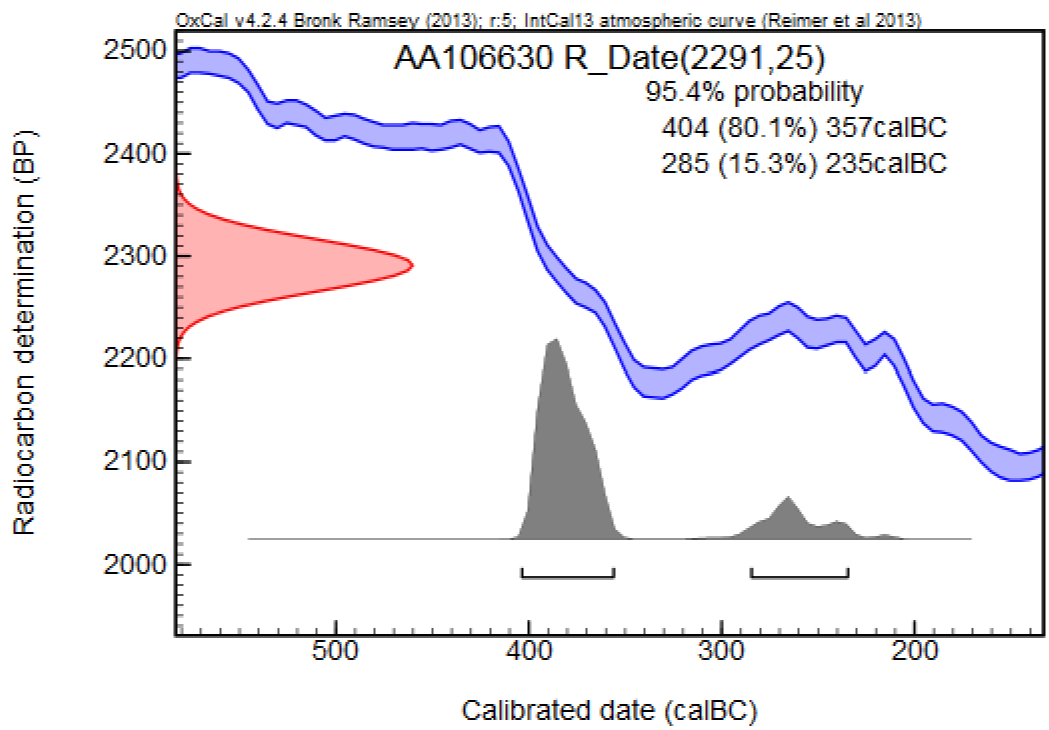
Willis, S. AA106627-30: Calibration plots - IntCal13 data set, OxCal 4.2.4 software





OxCal v4.2.4 Bronk Ramsey (2013); r:5; IntCal13 atmospheric curve (Reimer et al 2013)
AA106629 R_Date(1979,25)
95.4% probability
41calBC (95.4%) 71calAD
Radiocarbon determination (BP)
2200
2100
2000
1900
1800
1700
1600
200
100
1calBC/1calAD
101
201
Calibrated date (calBC/calAD)

OxCal v4.2.4 Bronk Ramsey (2013); r:5; IntCal13 atmospheric curve (Reimer et al 2013)
AA106630 R_Date(2291,25)
95.4% probability
404 (80.1%) 357calBC
285 (15.3%) 235calBC
Radiocarbon determination (BP)
2500
2400
2300
2200
2100
2000
500
400
300
200
Calibrated date (calBC)

**International Chemical Analysis Inc.**
1951 NW 7th Ave
STE 300
Miami, FL U.S.A 33136

# Summary of Ages

**Submitter Name:** Staci Willis
**Company Name:** Texas A&M University
**Address:** Dept of Anthropology, MS 4352 College Station, TX 77843

| ICA ID | Submitter ID | Material Type | Pretreatment | Conventional Age | Calibrated Age |
|---|---|---|---|---|---|
| 15W/0470 | 14011 | Wood | AAA | 1950 +/- 40 BP | Cal 40 BC to 130 AD |
| 15W/0476 | 14039 | Wood | AAA | 1830 +/- 30 BP | Cal 80-310 AD |

- Calibrated ages are attained using INTCAL13: **IntCal13 and Marine13 Radiocarbon Age Calibration Curves 0–50,000 Years cal BP.** *Paula J Reimer, Edouard Bard, Alex Bayliss, J Warren Beck, Paul G Blackwell, Christopher Bronk Ramsey, Caitlin E Buck, Hai Cheng, R Lawrence Edwards, Michael Friedrich, Pieter M Grootes, Thomas P Guilderson, Haflidi Haflidason, Irka Hajdas, Christine Hatté, Timothy J Heaton, Dirk L Hoffmann, Alan G Hogg, Konrad A Hughen, K Felix Kaiser, Bernd Kromer, Sturt W Manning, Mu Niu, Ron W Reimer, David A Richards, E Marian Scott, John R Southon, Richard A Staff, Christian S M Turney, Johannes van der Plich*t. **Radiocarbon 55(4), Pages 1869-1887**.
- Unless otherwise stated, 2 sigma calibration (95% probability) is used.
- Conventional ages are given in BP (BP=Before Present, 1950 AD), and have been corrected for fractionation using the delta C13.

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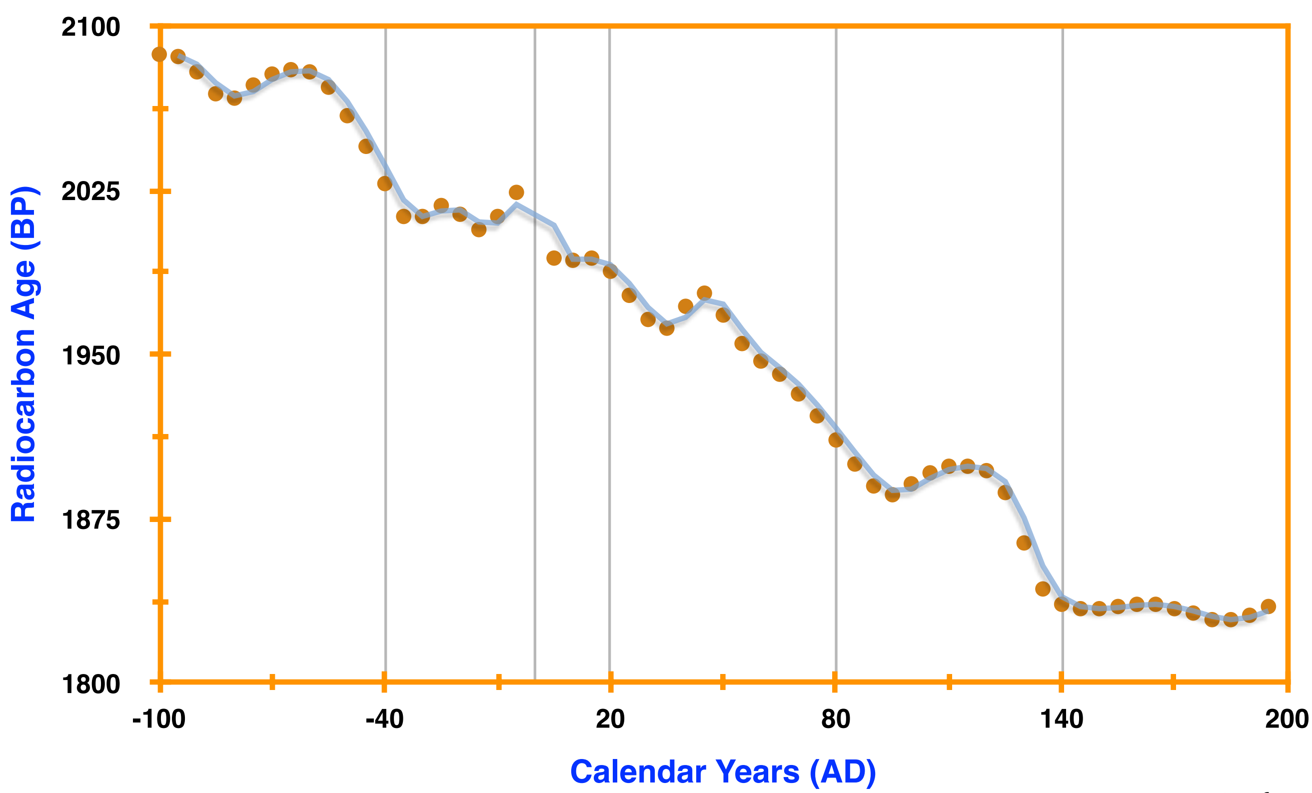
# Sample Report

**Submitter Name**: Staci Willis
**Company Name**: Texas A&M University
**Address**: Dept of Anthropology, MS 4352 College Station, TX 77843

| | | | |
|---|---|---|---|
| Date Received | April 29th, 2015 | Material Type | Wood |
| Date Reported | June 17th, 2015 | Pre-treatment | AAA |
| ICA ID | 15W/0470 | C13/C12 | -21.1 o/oo |
| Submitter ID | 14011 | Conventional Age | **1950 +/- 40 BP** |

| | |
|---|---|
| Calibrated Age | **Cal 40 BC to 130 AD** |



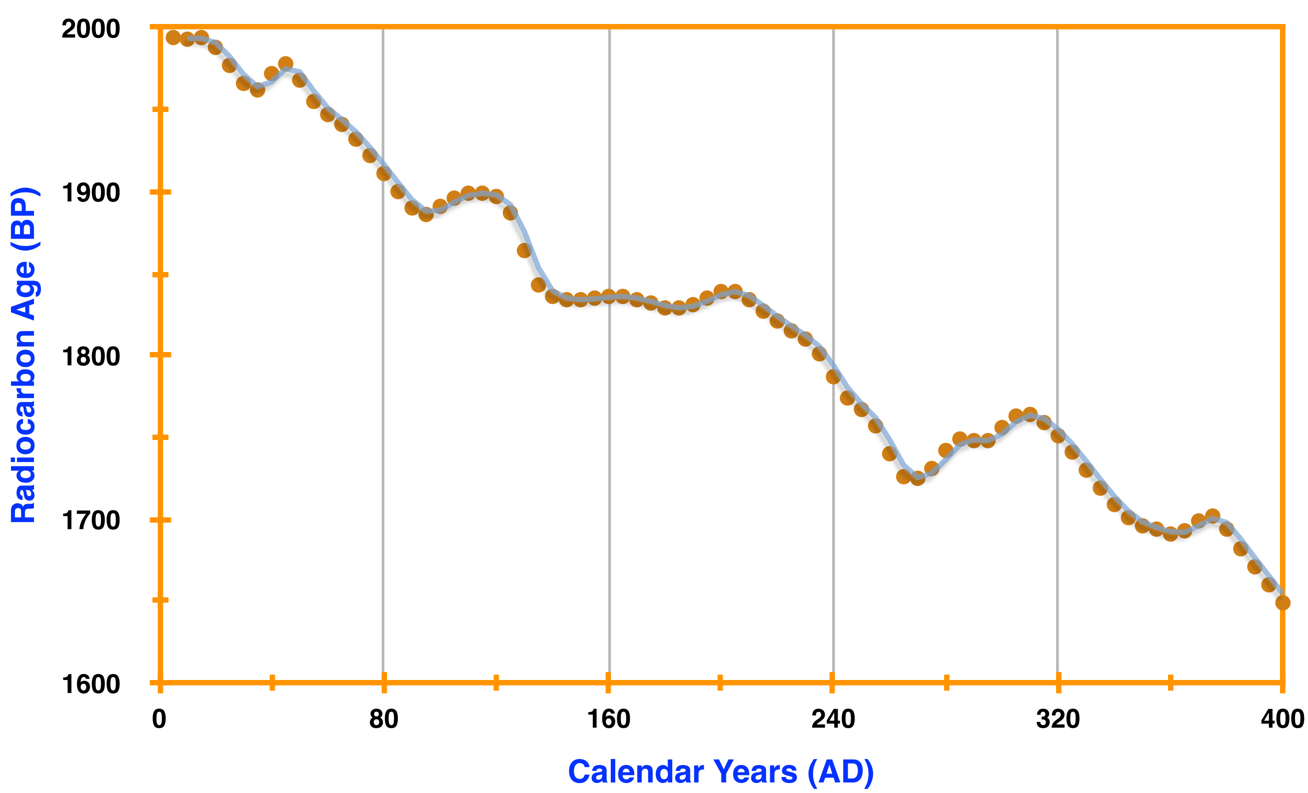
**International Chemical Analysis Inc.**
1951 NW 7th Ave
STE 300
Miami, FL U.S.A 33136

# Sample Report

**Submitter Name**: Staci Willis
**Company Name**: Texas A&M University
**Address**: Dept of Anthropology, MS 4352 College Station, TX 77843

| | | | |
|---|---|---|---|
| **Date Received** | April 29th, 2015 | **Material Type** | Wood |
| **Date Reported** | June 17th, 2015 | **Pre-treatment** | AAA |
| **ICA ID** | 15W/0476 | **C13/C12** | 24.5 o/oo |
| **Submitter ID** | 14039 | **Conventional Age** | **1830 +/- 30 BP** |

| | |
|---|---|
| **Calibrated Age** | **Cal 80-310 AD** |



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Miami, FL U.S.A 33136

# QC Report

**Submitter Name:** Staci Willis
**Company Name:** Texas A&M University
**Address:** Dept of Anthropology, MS 4352 College Station, TX 77843

| | | | |
|---|---|---|---|
| **Date Submitted** | April 29th, 2015 | **Date Reported** | June 17th, 2015 |
| **QC 1 Sample ID** | **IAEA C7** | **QC 2 Sample ID** | **IAEA C8** |
| **QC Expected Value** | 49.35 +/- 0.50 pMC | **QC Expected Value** | 15.05 +/- 0.20 pMC |
| **QC Measured Value** | 49.50 +/- 0.30 pMC | **QC Measured Value** | 15.10 +/- 0.10 pMC |
| **Pass?** | **YES** | **Pass?** | **YES** |

- pMC = Percent Modern Carbon.
- IAEA = International Atomic Energy Agency.

**International Chemical Analysis Inc.**
1951 NW 7th Ave
STE 300
Miami, FL U.S.A 33136

# Summary of Ages

**Submitter Name:** Staci Willis
**Company Name:** Texas A&M University
**Address:** Dept of Anthropology, MS 4352 College Station, TX 77843

| ICA ID | Submitter ID | Material Type | Pretreatment | Conventional Age | Calibrated Age |
|---|---|---|---|---|---|
| 15W/0471 | 14015 | Wood | AAA | 1800 +/- 40 BP | Cal 90-340 AD |
| 15W/0473 | 14025 | Wood | AAA | 1740 +/- 40 BP | Cal 170-400 AD |
| 15W/0474 | 14027 | Wood | AAA | 1990 +/- 40 BP | Cal 100 BC to 120 AD |

- Calibrated ages are attained using INTCAL13: **IntCal13 and Marine13 Radiocarbon Age Calibration Curves 0–50,000 Years cal BP.** *Paula J Reimer, Edouard Bard, Alex Bayliss, J Warren Beck, Paul G Blackwell, Christopher Bronk Ramsey, Caitlin E Buck, Hai Cheng, R Lawrence Edwards, Michael Friedrich, Pieter M Grootes, Thomas P Guilderson, Haflidi Haflidason, Irka Hajdas, Christine Hatté, Timothy J Heaton, Dirk L Hoffmann, Alan G Hogg, Konrad A Hughen, K Felix Kaiser, Bernd Kromer, Sturt W Manning, Mu Niu, Ron W Reimer, David A Richards, E Marian Scott, John R Southon, Richard A Staff, Christian S M Turney, Johannes van der Plich*t. **Radiocarbon 55(4), Pages 1869-1887**.
- Unless otherwise stated, 2 sigma calibration (95% probability) is used.
- Conventional ages are given in BP (BP=Before Present, 1950 AD), and have been corrected for fractionation using the delta C13.

**International Chemical Analysis Inc.**
1951 NW 7th Ave
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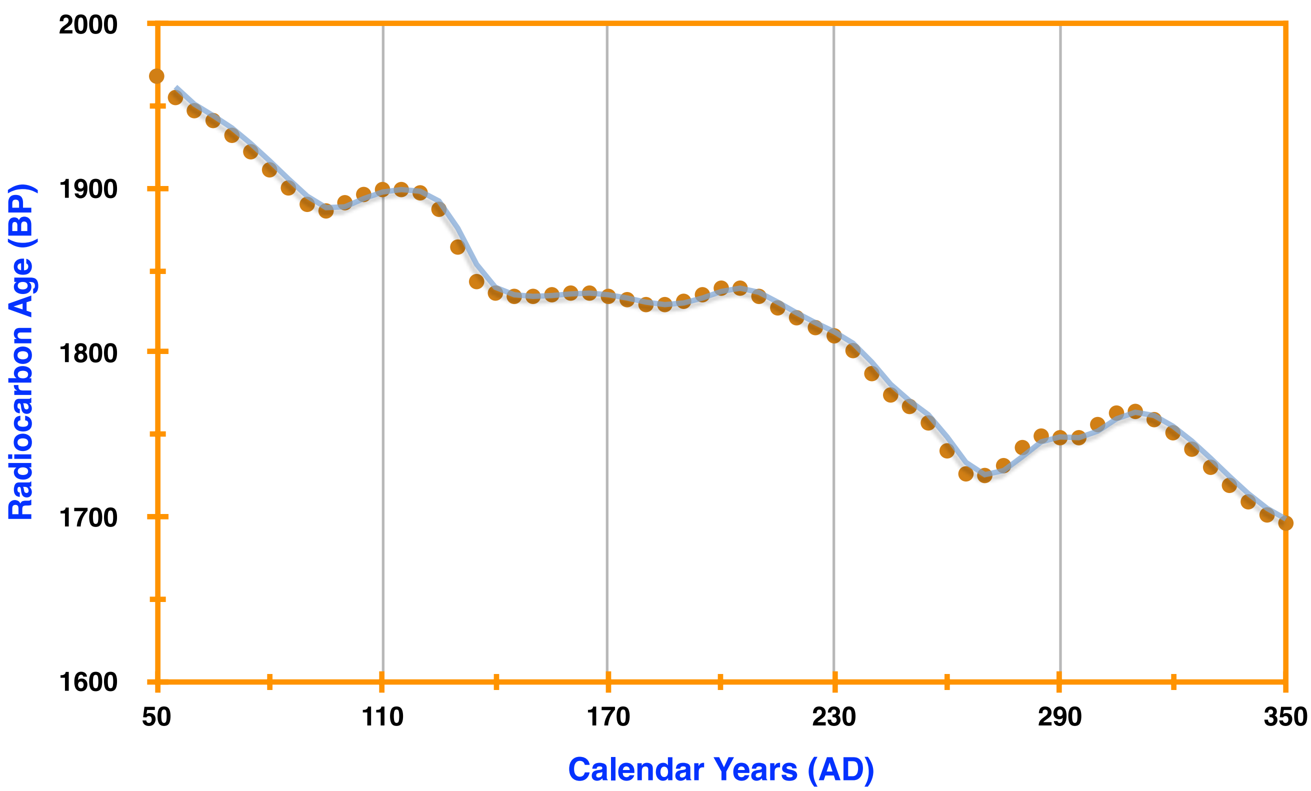
Miami, FL U.S.A 33136

# Sample Report

**Submitter Name**: Staci Willis
**Company Name**: Texas A&M University
**Address**: Dept of Anthropology, MS 4352 College Station, TX 77843

| | | | |
|---|---|---|---|
| Date Received | April 29th, 2015 | Material Type | Wood |
| Date Reported | June 29th, 2015 | Pre-treatment | AAA |
| ICA ID | 15W/0471 | C13/C12 | -19.7 o/oo |
| Submitter ID | 14015 | Conventional Age | **1800 +/- 40 BP** |

| | |
|---|---|
| Calibrated Age | **Cal 90-340 AD** |



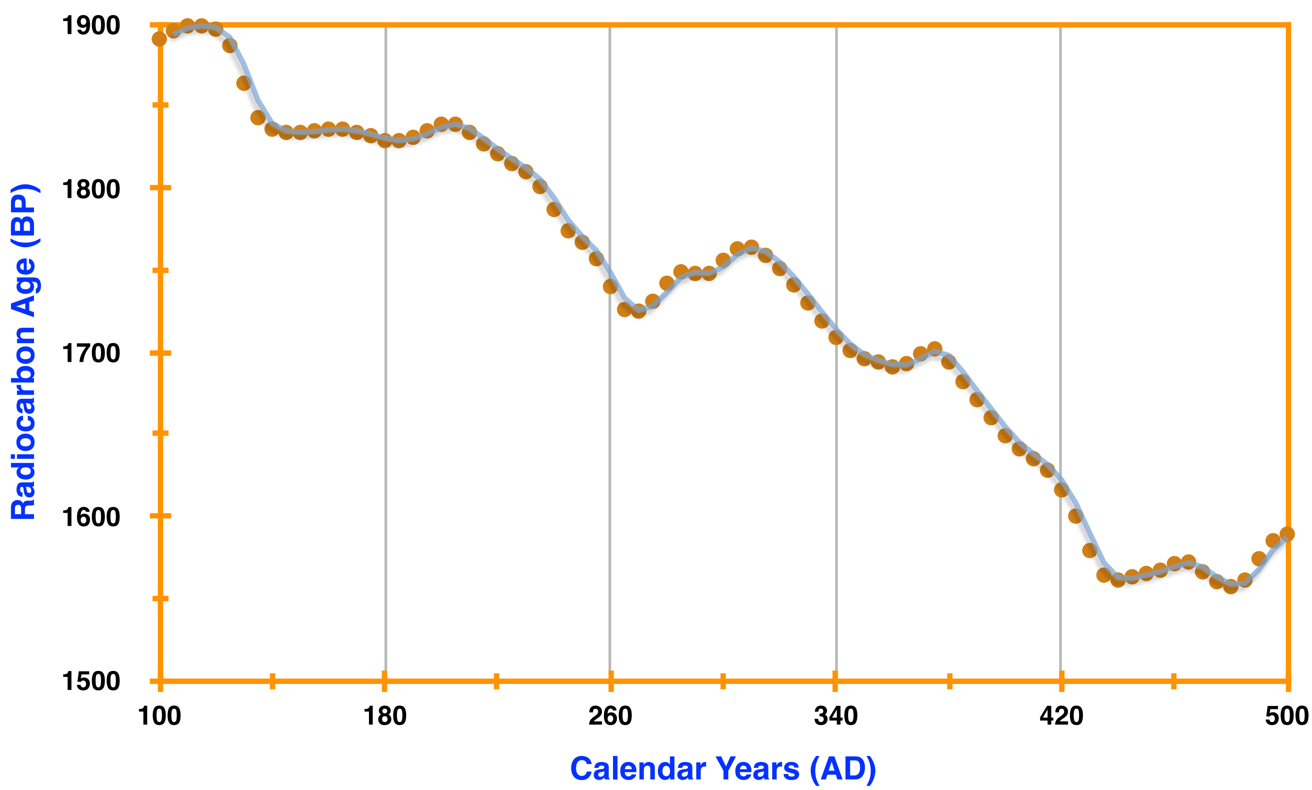
**International Chemical Analysis Inc.**
1951 NW 7th Ave
STE 300
Miami, FL U.S.A 33136

# Sample Report

**Submitter Name**: Staci Willis
**Company Name**: Texas A&M University
**Address**: Dept of Anthropology, MS 4352 College Station, TX 77843

| | | | |
|---|---|---|---|
| **Date Received** | April 29th, 2015 | **Material Type** | Wood |
| **Date Reported** | June 29th, 2015 | **Pre-treatment** | AAA |
| **ICA ID** | 15W/0473 | **C13/C12** | -21.5 o/oo |
| **Submitter ID** | 14025 | **Conventional Age** | **1740 +/- 40 BP** |

| | |
|---|---|
| **Calibrated Age** | **Cal 170-400 AD** |



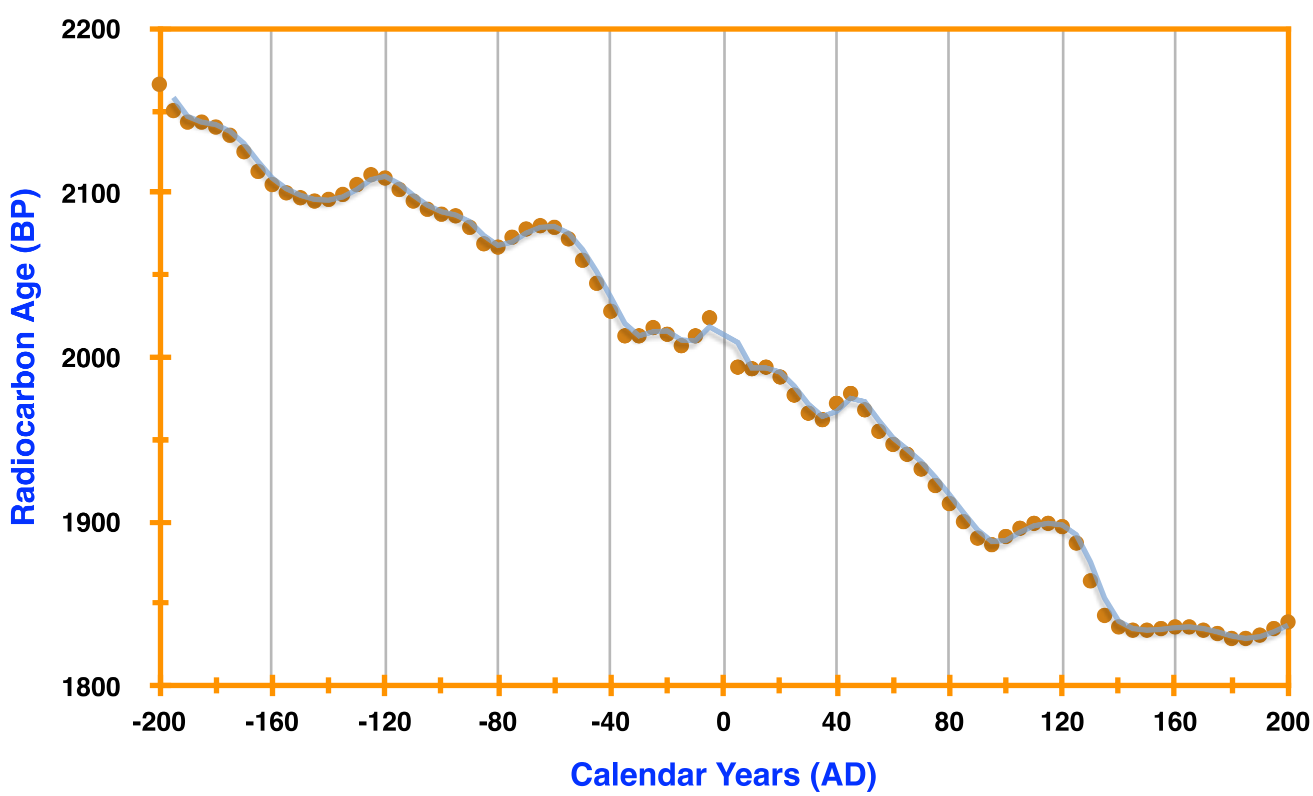
**International Chemical Analysis Inc.**
1951 NW 7th Ave
STE 300
Miami, FL U.S.A 33136

# Sample Report

**Submitter Name**: Staci Willis
**Company Name**: Texas A&M University
**Address**: Dept of Anthropology, MS 4352 College Station, TX 77843

| | | | |
|---|---|---|---|
| **Date Received** | April 29th, 2015 | **Material Type** | Wood |
| **Date Reported** | June 29th, 2015 | **Pre-treatment** | AAA |
| **ICA ID** | 15W/0474 | **C13/C12** | -24.1 o/oo |
| **Submitter ID** | 14027 | **Conventional Age** | **1990 +/- 40 BP** |

| | |
|---|---|
| **Calibrated Age** | **Cal 100 BC to 120 AD** |



**International Chemical Analysis Inc.**
1951 NW 7th Ave
STE 300
Miami, FL U.S.A 33136

# QC Report

**Submitter Name:** Staci Willis
**Company Name:** Texas A&M University
**Address:** Dept of Anthropology, MS 4352 College Station, TX 77843

| | | | |
|---|---|---|---|
| **Date Submitted** | April 29th, 2015 | **Date Reported** | June 29th, 2015 |
| **QC 1 Sample ID** | **IAEA C7** | **QC 2 Sample ID** | **IAEA C8** |
| **QC Expected Value** | 49.35 +/- 0.50 pMC | **QC Expected Value** | 15.05 +/- 0.20 pMC |
| **QC Measured Value** | 49.30 +/- 0.30 pMC | **QC Measured Value** | 15.10 +/- 0.10 pMC |
| **Pass?** | **YES** | **Pass?** | **YES** |

- pMC = Percent Modern Carbon.
- IAEA = International Atomic Energy Agency.