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A Comparison of Ancient Mediterranean Metal Structural Fittings

Evan Galen Sharp
Wilfrid Laurier University

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A Comparison of Ancient Mediterranean Metal Structural Fittings

by
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Bachelor of Arts, University of Waterloo, 2007

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Abstract

The construction of shelter is one of the basic activities that allows humans to survive. It is, moreover, one of the principal means by which we identify the occupation of a place by peoples who came before us. In the world of the ancient Mediterranean, methods and techniques flowed among populations as readily as any other commodity, and their manifestations bear witness to cultural contact as much as any transported religious, commercial, or military object. Moreover, since the construction of shelter is an activity common to all, functional techniques were a universally sharable knowledge. A collection and comparison of the material remains of these techniques provides clues about the contact between populations, and might contribute support to other evidence for contact. Questions of the cultural significance of the subject material are also posed and, as much as possible with the material gathered, answered. This study presents evidence for technique-sharing among ancient peoples in the form of surviving metal structural fixtures of similar types from different geographic regions and timeframes in order to demonstrate that finding commonalities among these geographically and temporally disparate objects is potentially profitable to the understanding of inter-cultural ties across the Mediterranean basin. Owing to the slow rate of change in the subject material over time, and the wide geographic area involved, the scope of the project is relatively large; it includes remains from throughout the Mediterranean sphere and from the Greek Classical through Early Byzantine periods.

ACKNOWLEDGEMENTS

The production of a work such as this one could scarcely be attempted without the help of many. Over the years that I have spent working on this, I have received invaluable support, in almost every form, from a long list of people. Dr. Gerry Schaus, my advisor, has of course been at the core of my work providing encouragement, feedback, and source material. My thesis committee, Drs. Christopher Simpson and Craig Hardiman, deserve high praise for their advice and edits. I must thank Drs. Alexis Young, Joann Freed, Michele Daviau, and Karljurgen Feuerherm as well as my colleagues David Stark and Jacqueline McDermid who were all instrumental in either the finding of my sites, the development of my ideas, or the organization of the final work. The staff at all of the TUG libraries deserve mention for their help with the endless volumes I had shipped to me, repeatedly. Pam Schaus, for her help with my maps. Mike Fury, Jason Cunningham, and Nathan Douglas at Adventure Guide Inc. all have my great thanks for helping me make time over the years. I thank Jeff Bently for his careful edits, advice, and friendship as well as Morgan Edwards for his friendship and endless humour. I must mention Valerie Smith, who first taught me the meaning of *discipulus*. My unending gratitude goes to my parents who always believed in me and have supported my academic endeavours since the beginning. Lastly I must thank Lara, to whom I dedicate this work, who has been in my heart all along.

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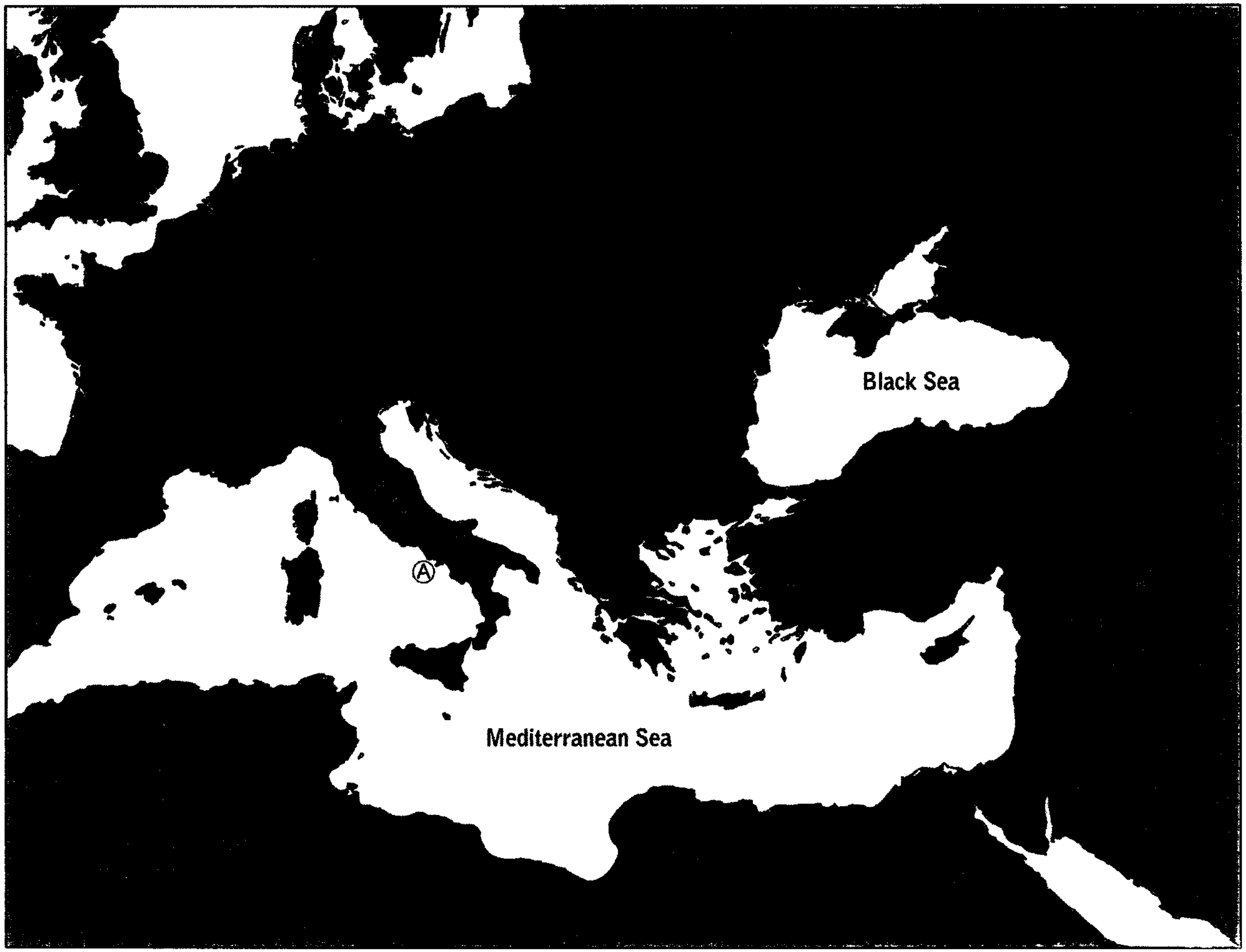

Map 1: The Greater Mediterranean

A. Pompeii
B. San Giovanni di Ruoti
C. Cyrene
D. Sardis
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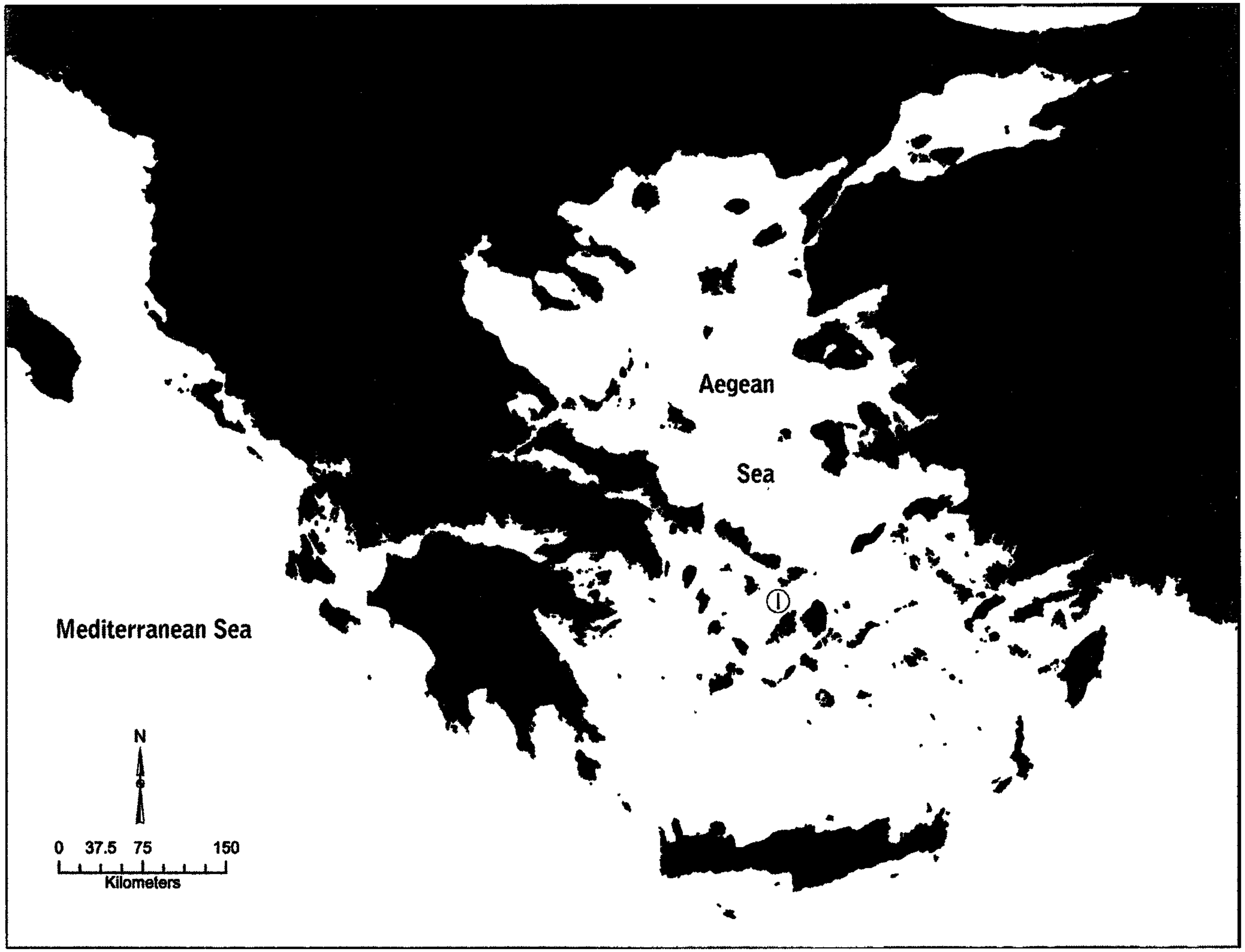

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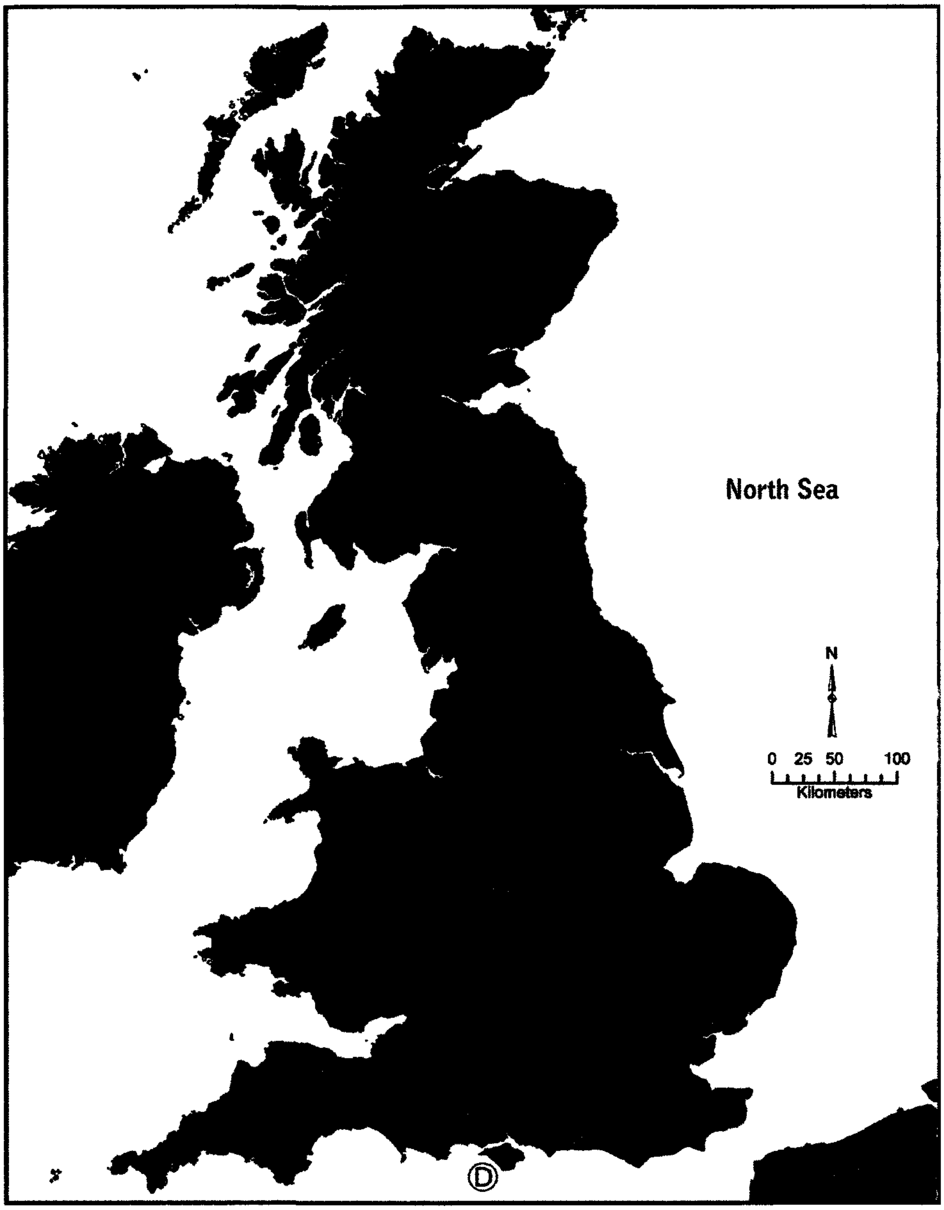

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INTRODUCTION[2]

Purpose

The survival of human beings is reducible to three basic necessities: food, water, and shelter. Since from our earliest days we have been a species which manipulates our environment to suit our needs, it was very early on that we began to create shelter rather than simply seek it. No incarnation of human community has ever been free of this third requirement and shelter has always been found or constructed. Beginning as a basic need for protection from Nature and each other, shelter has evolved into an aspect of cultural expression, a reflection of social organization, and an example of technological achievement.

It is in pursuit of an understanding of this last that this study is undertaken. The Mediterranean basin was one of the most formative regions for construction methods. A practical and empirical approach to problems of construction led ancient builders to develop and share methods which were so effective that they have been employed for millennia, even to today as testified by our use of concrete, metals, and timber. Accordingly, an investigation of these ancient methods promises not only to inform our modern derivative techniques, but leads to new questions about everyday ancient practices.

One of the most significant questions with regards to construction in the ancient world is the use of timber. Although for over a century it has been stone which attracted scholarly attention, owing reasonably enough to the fact that the most prominent remains of antiquity are ruins of monumental stone edifices, the use of wood in antiquity must have

[2] The style used for this study, including references, typography, and abbreviations, follows the submission guidelines for the *American Journal of Archaeology* 111 (2007) 3-34.

been at least equally, if not more, pervasive. The reality of timber's survival characteristics, however, has made the study of ancient carpentry a patchwork field of liberal archaeological interpretation, literary and artistic descriptions, and chance finds.

As a contribution to this question, the present study is in part a compilation and in part a comparison of metal structural fixtures from across the Mediterranean. The purpose of this work is to discuss the extent to which metal fixtures were used in ancient wood-construction techniques and how these fixtures were otherwise employed as part of a structure's form and function. By comparing the various types and styles of fixture from a wide geographic area over a long period of time, it is hoped that patterns will be evident so as to suggest the dissemination of construction techniques over time. While methods used for framing a roof might change very little over several centuries, simpler challenges of construction such as hanging and securing doors are seen to exhibit more development, which is worthy of investigation.

A secondary goal of this study is to address any questions about the cultural significance of these objects. Although we may now consider a nail or a hinge to be a mundane and common artefact of everyday life, this might not necessarily have been the case in antiquity. Finally, it is intended that a door be left open at the conclusion of this study for a more comprehensive look at these objects which might determine more conclusively how, where, and why they were used by ancient builders in the Mediterranean.

Current Research

No concentrated research on wood-use structural hardware has been carried out to date. Though there are many works on ancient construction methods, even more recently on ancient carpentry specifically, and much publication of metal fixtures, there is as yet no treatment of how the two subjects overlap, especially from a pan-Mediterranean perspective. A comparison of the two areas has, as far the author knows, never been attempted. This is surprising because there has clearly been interest in wood as a construction material as far back as the early 1900s.[3] The few publications on construction since then have generally passed over wood techniques, as in Jean-Pierre Adam's *Roman Building* and the seminal Greek construction manual by Anastasios Orlandos, *Les matériaux de construction*;[4] which gave only generalizations and unqualified conclusions.

Even in more modern works, notably Roger Ulrich's recent *Roman Woodworking*, a volume of thorough scholarship, the question of fasteners and fittings is given only passing comment as part of a broader focus.[5] Ulrich's book is so detailed in its presentation of Roman carpentry techniques that the limited presentation of metal seems intentional, illustrating the author's view that Roman builders preferred to rely on the wood-only joinery and socket-based structural techniques.[6]

Meanwhile, such a view would be in line with literary evidence that we have on the subject. In his wide-ranging technical treatise, Vitruvius makes mention of using nails in the

[3] In the preface to his 1955 manual on Greek construction methods, Orlandos (1968b, i) describes his own fascination with the topic and that of his mentors in the previous half century.
[4] Adam 1999; Orlandos, 1968b.
[5] Ulrich, 2007.
[6] In the introduction, Ulrich (2007, 1) makes mention of the Roman craftsman's skill at joinery without metal with some emphasis.

finishing of ceilings, floors, and walls, but never in structural joints.[7] Julius Caesar writes about iron nails that we would consider to be the size of modern railway spikes being used in his ships, but only for the securing of the rower's benches.[8] The writings of Roman authors at any rate give us the impression that metal fixtures were for minor tasks and finishing touches only. To the contrary, archaeological investigation has left no doubt that from an early date, nails and other fasteners, decorative and structural, were in common use in the ancient world, as the evidence presented below will testify.

At the same time, since the earliest works of modern archaeology, there has been a tradition of publishing at least a representative catalogue of fixtures and small metal objects from an excavation in an appropriate volume or article. This indicates a prevalence of fixtures which contradicts the previous two assertions. These 'small finds' publications range in detail and organization, from the elaborate schema used for the finds at Isthmia by Isabelle Raubitschek to the fairly straightforward categories imposed by Joseph and Maria Shaw on the finds from Kommos.[9] This hints at the inherent difficulty in archaeological interpretation, i.e. how best to deal with these objects. Given the variability in what might be found, a site-by-site approach to small finds has really been the only option.

Additionally, there are a staggering number of excavations which, although carried out with the best techniques available at the time, have often been only partially published, if at all. An ideal example of this is the Egyptian town of Karanis, located in the Fayoum. Though a fascinating site from which many papyri have come, the excavation results by the

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[7] Vitr. 5.10.3, 7.3.1 (ceilings); 7.1.2 (floors); 7.3.11 (walls);
[8] Caes. B.G. 3.13.3.
[9] Raubitschek 1999; Shaw 2000, 373.

University of Michigan from 1924 to 1935 were never properly published. The movable finds were portioned out to the University's Kelsey Museum collection, held at Cairo's National Museum, and various provincial museums in Egypt. The notes reside in a drawer in Ann Arbor as a testament to incomplete work. Luckily in Karanis' case, a number of scholars have attempted to come to terms with the data by reconstructing the excavation from the notes and finds, though this is not as common as could be hoped for. These studies have been published in appropriate volumes, though they lack the encompassing interpretations which are often the duty of the original excavators. The few mentions of Karanis in this study are based on consulting the volume on topography and architecture by Elinor Husselman; no study of the actual fixtures from Karanis, which doubtlessly existed due to the wood mentioned by Husselman, has yet been published. [10]

Yet another difficulty lies with large and on-going excavations such as those at Corinth, the Athenian Agora, Vindolanda, Pompeii, and other sites. In these cases, publications have been produced before the excavations were completed. The result is that the books and articles available to study these sites are in some cases out of date and in a few instances totally wrong. The only solution for these problems is to make the best of the material available and to contact the current excavators for general updates (as was done in the case of Vindolanda with the project leader, Andrew Birley). A site-by-site discussion of limiting factors is hardly appropriate in the context of the project though, so the reader must be aware that any of the evidence presented here is not necessarily up to date or complete.

[10] The puzzling omission of parts of Karanis in the published record is clarified by Minnen (1994) and Husselman (1979).

Methods, Parameters, & Organization

Since we are approaching the material of this investigation from a new angle, there arises the question of how to organize and use the evidence available for our purpose. A factor to take into account is the different levels of detail presented by different authors. Between the developments in scholarly practice over time, the hardly comparable conditions at various sites, and the discrepancy in number and quality of finds at different sites, one can only go so far to reach conclusions based on consistent analyses. As has been noted in the introduction of many volumes on 'Small Finds', there is a fine line between useful classification and confusing schematization. Additionally, an appropriate scope is always necessary to establish a focus and make the conclusions useful and contextual. That being said, the cross-cultural and broad geographical nature of this study has required the consideration of a wide range of evidence from a wide range of contexts. The parameters used in this study are consequently quite broad when compared to similar material interpretations. This approach is appropriate, however, when we consider that the purpose of the investigation is to produce relatively broad conclusions about very common objects.

Objects considered in this study have been dated anywhere from the mid 7th century B.C.E. through the 6th century C.E., and were not limited to any one regional provenance within the Mediterranean region. This extremely broad scope was arrived at during the research for this paper due in part to the scarcity of well-published finds and a wish for variety in the subject matter. This essentially unrestricted scope has been beneficial for three reasons: (1) it has been possible to include sites from almost all regions of the Mediterranean, which in turn has strengthened the cross-cultural conclusions; (2) it has allowed for speculation with respect to the continuity of the form and use of objects over a long period of Antiquity; (3) it has allowed for the conclusion or hypothesis about certain patterns of influence between cultural groups with regards to technique and object form.

Although a criticism could be made about how the wide inclusion of material might degrade the value of the results, this criticism lacks substance. As more sites were added for comparison purposes, a greater commonality was found in the material, which served to reinforce the overall findings. In a future study which would seek to be more comprehensive and conclusive, mitigation of this would be required in the form of more specific parameters overall or a deeper organization of regional sub-groups of finds. For the sake of this study, however, the 'wide-open' scope has proven beneficial.

Site selection for the source material was based on what could be found in published form. This applied equally to sites with and without finds. Limiting factors for which sites were included in the study were the languages in which the author could reliably read the publication, attempting to ensure an even distribution across the Mediterranean, and what could be found with the resources at the author's disposal. The sites from which the source material has been drawn are admittedly not an ideal sample of excavations in the Mediterranean. Significant gaps appear in Spain, Gaul (France, Germany, etc.), the Near East (Turkey, Syria, etc.), and North Africa (Algeria, Tunisia, Libya, etc.), while at the same time many sites were found and excluded in Great Britain and Greece. As principally an initial investigation into the character of ancient Mediterranean fixtures, the study succeeds in indicating the validity of studying the subject matter without necessarily being hindered by a less than complete geographic or temporal sample. Certainly in a future study, along with a more specific scope, a greater and more distributed sample of sites would be required to support more specific conclusions.

With regards to the method used to reach conclusions in this study, the obvious must be stated: poor survival of metal objects from antiquity has always been problematic for quantitative study of them. Soil conditions vary greatly with respect to acidity, moisture content, organic factors, and mineral deposits so that survival of metal objects can be different across even a single site. Questions of how common a given object was in antiquity are always affected by the fact that the number of them produced and used in antiquity is not necessarily well represented by how many can be found today. More specifically, because of the ancient (and modern) practice of scavenging metal objects for re-use, and the unreliable recording of small finds in older archaeological excavations, the data we have for analysis are unacceptably compromised. When compiled into a database for analysis, it was found that even sites with a relative abundance of finds often did not yield enough to be statistically viable.

In place of a quantitative study therefore, a more qualitative approach has been taken. Objects of each type are collected into representative descriptions by object type and site, and then compared in form and function to other objects of similar type within a region. The sites and regions, meanwhile, are ordered chronologically from oldest to most recent. The cultural/regional findings, within their temporal context, are then discussed in a broader sense to arrive at pan-Mediterranean conclusions. The ordering of specific sites and greater regions chronologically has the added benefit of clarifying changes over time, since one of the goals of this study is to explore possible development in the subject material. Similarly, the reader may well wonder why the primary organization of material is by object type rather than by age or findsite. The reason for this is to facilitate the identification and discussion of similarities and differences among the types of object before considerations of context obscure the details. The explicit goal of this study is to compare the subject material without these other defining characteristics, which have previously kept these objects out of focus as a form of evidence in their own right, to explore what might be interesting and useful when context is then reconsidered.

Finally, some of the chronological terminology used in this study must be specifically defined. Much of the material discussed has only been dated to certain cultural periods, the actual dates of which are not necessarily agreed upon across disciplines. The following timeline should suffice to clarify the various periods referred to unless otherwise noted.

(Greek) Archaic Period: 700 – 480 B.C.E.
(Greek) Classical Period: 480 – 323 B.C.E.
Hellenistic Period: 323 – mid 1st century B.C.E.
Early Imperial Period: mid 1st century B.C.E. – end of 3rd century C.E.
Late Imperial Period: 4th century – 476 C.E.
Byzantine Period: 476 C.E. – end of Byzantine autonomy

TACKS, NAILS, AND SPIKES

The character of what can be described as 'fasteners' in the ancient Mediterranean is a balance of utility and aesthetics. The securing of two pieces of wood or of some object to a surface was sometimes carried out with only the end result in mind, but at other times with a sensitivity to the decorative potential of nail heads. These fasteners, like all metal objects in antiquity, were handmade. They consequently exhibit an inconsistency of form which is at first overwhelming when compared with the modern standardization of mass-produced objects. Precise lengths and diameters for typical uses did not exist as such, and "what was available" on an *ad hoc* basis is generally what was used. A structured typology for the whole collection is therefore of less value than general observations which can be made by comparing the types of fastener found across the various sites. By comparing the objects based on relative frequency within each site and between sites, more valid generalizations can be arrived at rather than tenuous quantitative conclusions which are based on a questionably small sample.

With regards to frequency of use in construction, we can see superficially that fasteners were not as prolific as they are today. The typically low number of finds in addition to the sophisticated wood-only joinery which has been uncovered suggests a tradition of not always relying on metal fasteners.[11] This observation, however, is juxtaposed to the economic consideration that driving a nail is cheaper than having a carpenter carve a mortise, thus, not surprisingly, massive hoards of nails have been

[11] Ulrich 2007, 59.

found.[12] As we shall see over time, there tended to be an increase in the number of fasteners used, especially with the spread of the Roman Empire and the proliferation of Roman construction methods.

At the same time, arriving at a secure understanding of exactly how and where within a structure a builder might opt to use a fastener, proves to be very difficult for three reasons: (1) given the poor survival characteristics of iron, one of the most common utility metals in antiquity, it is doubtless the case that an untold number of fasteners from ancient times are presently no more than iron-oxide dust; (2) metal being as hard to come by as it was in antiquity, there must be innumerable instances of fixtures and fasteners having been removed from structures either by the owners when they abandoned them or by plunderers afterwards for reuse. This naturally undermines even the most careful quantitative study of fixtures (or any metal object for that matter) with the aim of determining actual use from find frequency; (3) the variety of building styles and techniques in antiquity make it unlikely that a concise conclusion along the lines of 'Romans always tied their floor-joists with a nail at least 4 centimetres long' will ever be possible. It is rather more probable that we will eventually come to an understanding of the place that metal fasteners held in an ancient structure given certain conditions such as the competence of the builder, money available for materials, and time allowed for construction. With this understanding, cross-referencing different cultures and geographic regions could eventually yield a basis for arguing contact and technique sharing among them.

[12] Manning 1972a.

Greece

Kommos

The treatment of nails found at Kommos on Crete is very detailed and gives an excellent picture of their use within the Greek sanctuary.[13] Although the site was occupied as early as the middle of the Minoan period, the relevant finds for us are from the Archaic, Classical/ Hellenistic, and Roman periods. These are defined by the excavators using various occupation phases; generally signified by a new construction layer. The dates for the Archaic occupation are c. 700 to 600 B.C.E., the Classical/ Hellenistic 600 to 50 B.C.E., and the Roman from 50 B.C.E. until the abandonment of the site ca. 200 C.E.[14]

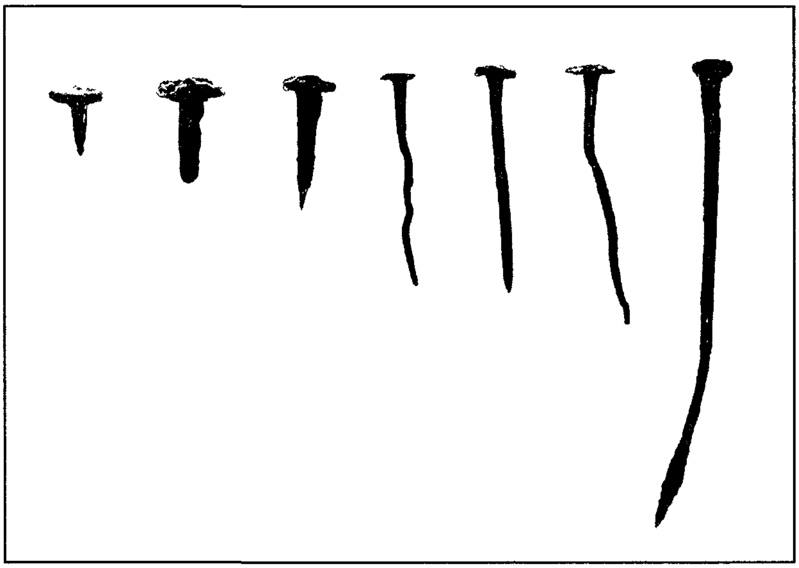

Figure 1 From left to right, type 4, type 1, and type 3 nails from Kommos Shaw 2000, pl 5

[13] Shaw 2000, 373.

[14] These date ranges are further described according to the relevant construction event, see Shaw 2000, 2.

In addition to a well-organized typology, the excavation yielded a large sample of objects which lend themselves to quantitative analysis. The evidence recovered, however, is tempered by the theory that iron survival would have been particularly poor at Kommos due to salty sea-spray. Four types of nails were established for the Kommos finds (Figure 1).

1. Labelled the 'common nail', these are a medium-sized nail of bronze or iron with a normally rounded, disc-like head and a round or square shaft. This type represents approximately 40% of the nails uncovered.
2. Large iron nails or 'spikes', often found in fragments. The large heads and thick shafts help to identify this type. These represented approximately 15% of the nails found.
3. Long bronze nails characterized by a round shaft that becomes square towards the point. These objects warranted their own type because of their relatively thin shafts and unique round-to-square form. They comprise approximately 15% of the total.
4. Small nails, 'tacks', usually of bronze but with some iron as well. Disproportionately large heads and short shafts suggest a non-structural purpose.

	Archaic			Classical / Hellenistic			Roman		
Type	Bronze	Iron	Total	Bronze	Iron	Total	Bronze	Iron	Total
1	5	5	10	11	3	14	10	13	23
2					7	7		10	10
3	2		2	5		5	9		9
4				18	2	20	4	1	5
Total	7	5	12	34	12	46	23	24	47
Total	105								

Table 1 Kommos nails by period, metal, and type, complied from Shaw (2000)

Although the iron to bronze ratio has been indeterminably affected by iron's poor survival at Kommos, totals for each type and metal are nevertheless worthwhile, Table 1 illustrates these totals. Of specific interest are the total number of nails from each period, and the summary number of spikes in the Classical and Roman periods. Additionally, by consulting the partial catalogue presented in the Kommos publication, Table 2 was developed to illustrate the changes in shaft section for each type of nail over time.

As we can see, not only did the frequency of nail use in general increase over time, but the use of square-shafted nails became more common. Since the excavators at Kommos used a construction phase to mark the beginning of the Roman occupation of the site, we can take the increase in square finds from this phase as a reliable indicator of Roman vs. non-Roman technique.

	Archaic			Classical / Hellenistic			Roman		
Type	Square	Round	Total	Square	Round	Total	Square	Round	Total
1		3	3	6	1	7	7	3	10
2	1		1	1	3	4	3		3
3		1	1		3	3	5	5	10
4				2	4	6	5		5
Total			5			20			28

Table 2 Kommos finds by period, type, and shaft section, compiled from Shaw (2000)

Isthmia

Only a few bronze and iron nails from Isthmia are discussed in detail by Isabelle Raubitschek.[15] It is likely because of this that they are not sorted into types as elsewhere. Though the volume does include an appendix which lists some 191 tack, nail, and spike objects in both bronze and iron, the information useful to us is limited to dimensions. These objects are factored into the quantitative discussion below.

[15] Raubitschek 1999, 140.

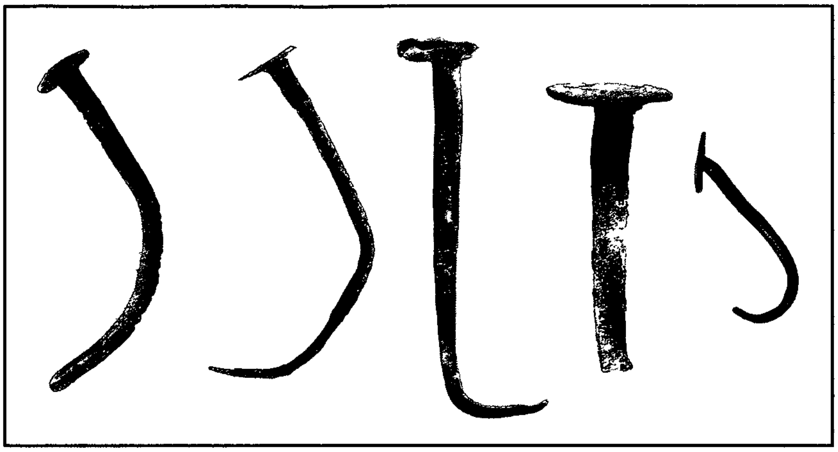

Figure 2 Bronze nails from Isthmia Raubitschek 1999, pl 77

The 5 bronze nails described in detail are all relatively large (Figure 2). All but one have a flat head, the other having a rounded head. All have a square shaft and were between 4.0 cm and 15.0 cm in length. Two larger spikes were also found; they warrant the label 'spike' because of heavy heads and shafts in comparison to the 'nails'. Both spikes had rounded heads and square shafts; they are 4.8 cm and 9.0 cm long respectively, and come from dates throughout the periods attested in the publication; two nails and a spike were Classical, one nail and one spike were Hellenistic, and two nails were Roman.

Three iron spikes were also described. Both had rounded heads and square shafts (Figure 3). Their lengths are 16.2 cm and 12.2 cm respectively. Both were dated to the Classical period. Many more bronze and iron objects were listed, however, in five appendix tables which sort the objects by length. No descriptions were given, but some quantitative data are possible, see Table 3.

.Since the bulk of the Isthmia material is not described, we cannot tell if certain trends in nail form are consistent there. What is evident, however, is that iron was the more common material, and that fasteners were in abundant use in the Classical and later periods in connection with the wooden components of monumental structures as discussed by Raubitschek.[16]

Length	Bronze	Iron
Tack (< 3.5 cm)	22	15
Nail (3.5 cm > 10cm)	31	87
Spike (> 10 cm)	0	27

Table 3 Catalogued Isthmian nails by type and metal, compiled from Raubitschek (1999)

Corinth

Gladys Davidson, in publishing the small finds at Corinth, notes that although nails of iron were by far the most common, their poor survival and difficulty of cleaning has meant that the majority of nail objects actually in the Corinthian catalogue are of bronze. These nails and tacks come from all levels at Corinth and, according to Davidson, all "varieties" (which this author has taken to mean forms).[17]

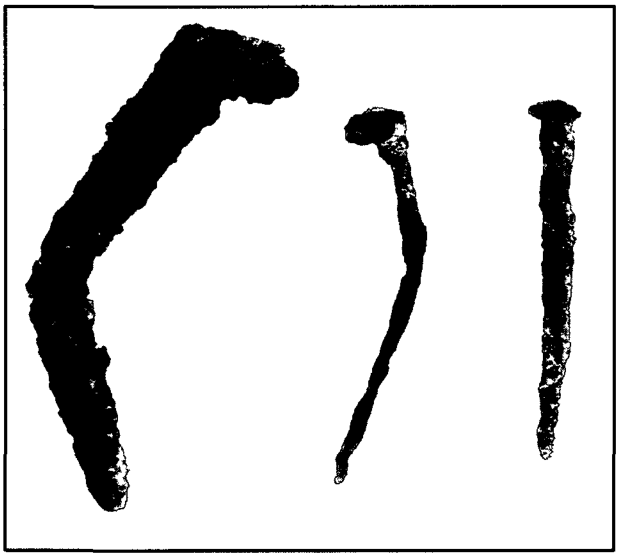

Figure 3 Iron spikes from Isthmia Raubitschek 1999, pl 78

[16] Raubitschek 1999, 132.
[17] Davidson 1952, 140.

The Corinthian objects are not segregated into any schema by Davidson, who employs the labels "tack", "nail", and "spike" somewhat inconsistently. There may be some connection between the diameter of the shaft and the application of these terms, a description of the objects' "heaviness" in a sense. This, however, is not articulated by the author and so must remain vague. To produce some idea of the representative catalogue's contents, they have been sorted into categories based on metal and length (Table 4). With regards to date, five of the objects were from Hellenistic levels, seven were Imperial (1^{st} to 3^{rd} century C.E.), while the rest were Late Roman or Byzantine.

Type	Iron	Bronze	Total
Tack (< 2 cm)	0	9	9
Nail (2 cm > 7 cm)	0	10	10
Spike (> 7 cm)	2	8	10
Total	2	27	29

Table 4 Corinthian nails by metal and type, compiled from Davidson (1952)

Of note also are two bronze rivets and one lead spike. The rivets are 2.3 cm and 3.7 cm respectively, making them large as rivets go. Both are identified as Roman, from approximately the 1^{st} century C.E. The lead "nail" is particularly curious due to its size. At 7.3 cm, it could only have been used for the type of heavy application usually reserved for iron spikes. A square head and rectangular shaft give it the appearance of a rail spike. It is hard to imagine a lead object functioning this way, however, so the object was more likely a coincidently shaped ingot, or else a form of rivet as well. Dated to the tenth or eleventh century C.E, this object is essentially Byzantine.

In line with Davidson's comments, the whole catalogue is biased towards bronze objects. Metal-segregation should be essentially discounted since we cannot know how much more iron there was in antiquity than bronze. Notwithstanding this, it is interesting to note that there is a good proportion of both metals, with a difference of only 20%.

Stymphalos

Approximately 600 iron nails were inventoried at the Sanctuary at Stymphalos during excavations. These represent approximately two thirds of the total found according to the manuscript notes of Munaretto.[18] Of note is the fact that this is the largest collection of iron nails yet made from a Greek context, though the finds at Kommos are cited as comparable. Lead and bronze tacks were also found at Stymphalos. These are much fewer in number. The dating for Stymphalian construction materials is complex since the city experienced at least one renaissance over its occupation. The majority of finds, however, likely originate in the city's *floruit* between the 4th and 2nd centuries B.C.E.

The typology for the Stymphalos finds combines and adapts the classification schemes developed by Robinson at Olynthus and by W.H. Manning for Roman sites in Britain to create a highly schematized breakdown of the objects. The goal was to compare frequency of various nail types in order to help in reconstructing the Sanctuary's structures. Groups of nails in the typology are defined based on the diameter of their head and shaft, as well as overall length. Of the 600 nails inventoried, approximately 300 were

[18] A study of the nails at Stymphalos by G. Schaus and M. Munaretto is forthcoming. A draft of the chapter was generously provided for this study by G. Schaus.

measured and catalogued using this typology. Beyond the descriptions given, nails were further sorted into sub groups based on overall size and head size.

Group I includes those with large heads (2.4 – 5.8 cm), and shanks measuring from 0.4 to 1.0 cm. Although Munaretto admits that these would be well-described as "bosses", and indeed they fit well with examples described below, it seemed more appropriate to keep the Stymphalos material together since the typology and associated conclusions are closely related.

Group II objects have regular or mid-sized discoid heads (0.65 – 3.2cm), shafts that vary in thickness from 0.35cm to 1.2 cm, and an overall length up to 12.5 cm.

Group III objects have small discoid heads (0.55 – 1.7 cm), shaft diameters from 0.25 to 1.8 cm, and a maximum length of 9.0 cm (most measured between 3.0 cm and 6.0 cm).

Group IV includes all tacks (heads between 0.4 cm and 2.7 cm, maximum length of 5.2 cm).

Group V consists of nails with bent over or curled heads (heads measuring 1.1 cm – 2.4 cm, shaft diameters from 0.5 cm to 0.9 cm, maximum length is 12.0 cm).

Group VI is made up of non-tapering "bolts".

A puzzling find that deserves mention is a single lead nail recovered in the Stymphalos sanctuary site. This object joins a very limited collection of lead nails found at other sites. While the leading interpretation of these nails is that they were dedicatory objects, too soft to be driven as iron and bronze nails are, the absence of contextual ceremonialization or ornamentation typically found on objects with a clearer dedicatory purpose makes them more of a mystery.[19]

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[19] For an example of a more obviously dedicatory nail, see Simpson 1997, 55.

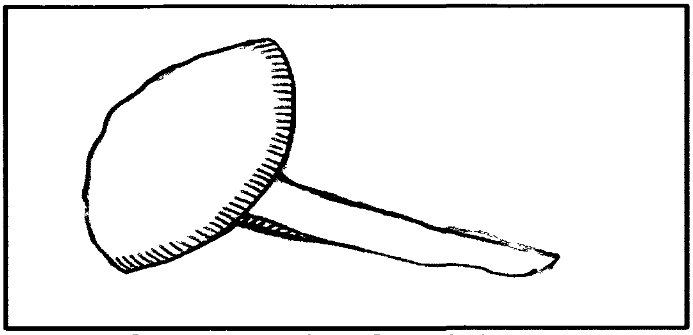
Figure 4 Group 1 nails from Stymphalos

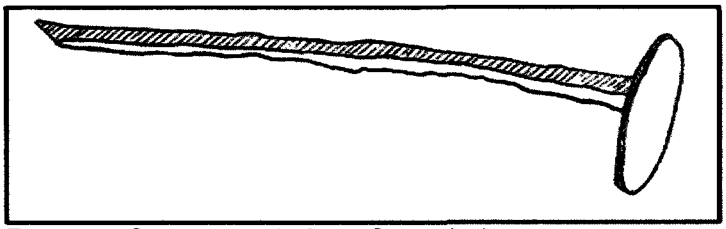
Figure 5 Group 2 nails from Stymphalos

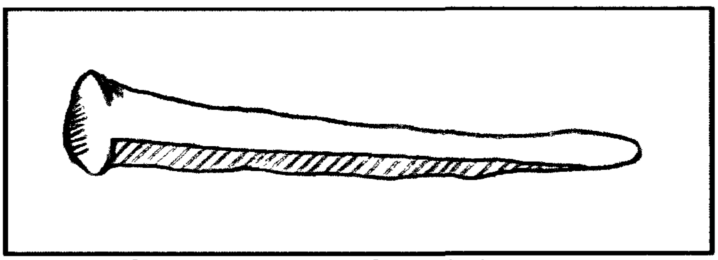
Figure 6 Group 3 nails from Stymphalos

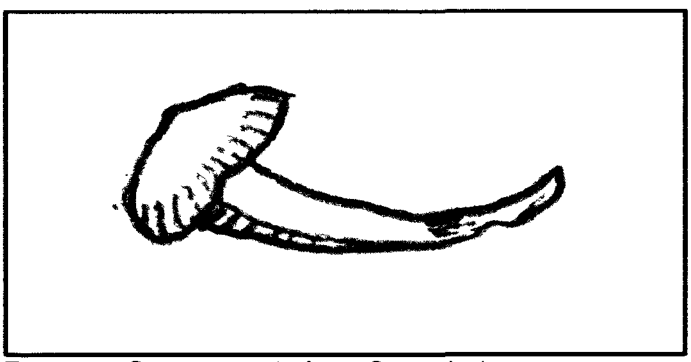
Figure 7 Group 4 nails from Stymphalos

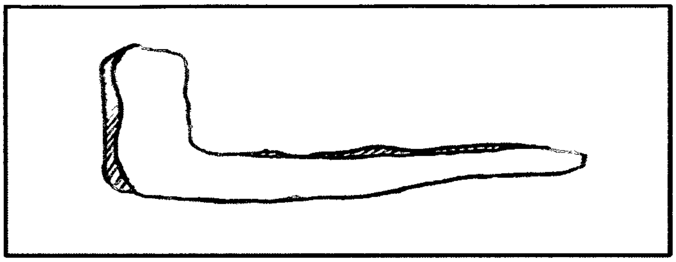

Figure 8 Group 5 nails from Stymphalos

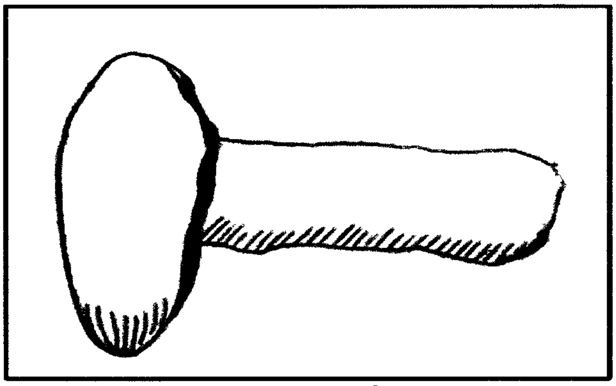

Figure 9 Group 6 nails from Stymphalos

The Stymphalos material provides an excellent example of how a site with numerous finds, and not just nail finds, should be treated. Excellent detail in recording each object, including findspot for examining distribution, ensures that the ancient site can be reconstructed with a high level of accuracy and insight.

In addition to the nails, four bronze T-staples were uncovered. Three were found in the sanctuary area of the site while the fourth was found along the ruined city wall. The staples are all square in section and range in size from 1.4 x 2.3 cm to 4.6 x 4.3. It is interesting that while there were similar objects found at Sardis and Fishbourne, these were all made of iron; the Stymphalos finds are the only examples of bronze T-staples found in this study.

Olynthus

The Olynthus excavation, led by David Robinson in the early 1930s, is one of the most complete excavations of a late Classical Greek city yet published. That being said, there are significant problems with the quantitative data in the publication. Before even discussing the nails found there or the descriptors which Robinson employed to organize them, these problems should be explained.

The primary difficulty lies in the number of nails as a whole. The catalogue presented in volume ten of the Olynthus publication, which Robinson says is "representative", contains 172 nails: 122 bronze, 47 iron, and three lead.[20] Meanwhile, a supposedly comprehensive catalogue compiled by Nick Cahill based on Robinson's notes in 2007 was found to contain more than 183 nails: 92 bronze, 91 iron, none in lead, and an uncertain number made of iron or bronze but with a quantity value such as ">1", "several",

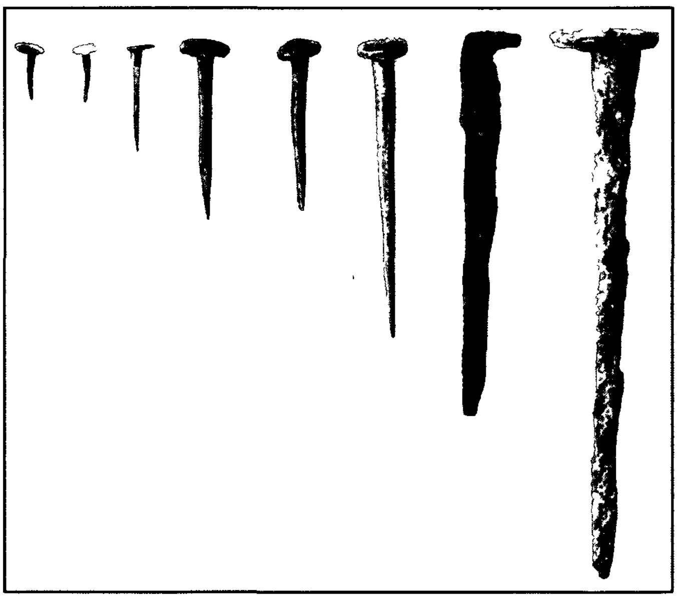

Figure 10 Tacks, nails, and spikes from Olynthus Robinson 1941a, pls 92, 94, 95

[20] Robinson 1941a, 309.

or "?".[21] It does follow that Cahill's comprehensive database should contain more objects than Robinson's representative catalogue, but it does not follow that there should be fewer bronze nails and no lead nails. Accordingly, this numeric discrepancy puts into question any conclusions that might be reached with regards to the frequency of use for nails of a certain material. On the other hand, if trends in the Olynthus data line up with trends from other sites with regards to metal used, it is more likely that Olynthus follows the rule rather than being an exception.

With respect to the types of nail found, Robinson did not create a typology as he did with some other fixtures. Rather, the nails are presented with a short description which identifies them as a "Spike", "Nail", or "Tack", and adjectives to describe the form of the head and shaft (Figure 10). Cahill's database does not include this information, so the summarization of these characteristics below comes from this author's own work on Robinson's less-complete catalogue.

When trying to observe some pattern in the types of nails found, in order to determine if there was a more common size or shape employed in antiquity, the labels applied by Robinson are of little use. Although the number of objects labelled "tack", "nail", or "spike" do coincide with the listed number of objects of appropriate size, there is a significant inconsistency between the two. For example, more than half of the objects are labelled "spike" in Robinson's catalogue. Sorted by complete length, 54% (55 of 102) of the nails are indeed longer than 7.0 cm. However, roughly a third of the objects measuring > 7.0 cm are labelled "nail". Similarly, the term "tack" has been applied to 14% (25 of 175) of

[21] Cahill 2007.

the objects. Coincidentally, 14% (24 of 175) are less than 3.0 cm long. Yet five of those measuring < 3.0 cm are labelled "nails"; one is even a "spike". In all, it must be concluded that the descriptions of the nails, are not reliable for determining a pattern in their form. That being said, it is worth noting that just over half of the nails had rounded heads while another third had flat heads; the remaining were broken or a description of their head shape was not recorded. Thus, a fair enough distribution of head shapes existed to negate the significance of any one head-shape overall.

With regards to shaft type, not all descriptions written by Robinson included whether the preserved shaft was square, rectangular, or rounded. Out of 175 nail object descriptions, only 101 (51 %) contained a shaft description. Of the bronze objects, 83 of the 124 objects had descriptions: 58 objects had rounded shafts while 26 had squared shafts. Of the iron objects, 16 of the 48 objects had descriptions: two had rounded shafts while 14 had squared shafts. Though there is considerable doubt introduced by the relatively low number of descriptions, it is interesting to note that rounded shafts were much more common among bronze objects while squared shafts were much more common among iron shafts at Olynthus.

Italy

Insula of Menander at Pompeii

Hundreds of nails were found during the excavation of the Insula of Menander at Pompeii, made of both iron and bronze.[22] These finds have been organized in such a way that quantitative tabulations are not possible from the most recent publication. Objects

[22] Allison 2006, 475.

have been collected based on context rather than type, and catalogue entries consist of an unrecorded number of individual specimens in a single grouping.[23] These are, moreover, difficult to date because of the issues of dating at Pompeii in general; however, the dating established for the Insula itself allows us to confine the nails to the last two centuries B.C.E. and the first half of the 1st century C.E.[24]

Some ambiguity exists with regards to what was considered a nail versus what was considered a "stud" in the eyes of the interpreter. There is also a number of identified "bosses" which have an analogy in Greek decorative bosses; a relationship to be explored in the chapter below. The studs are characterized by thin, flat, disproportionately large heads on a short round shaft; usually only one or two centimetres in length. In the context of this study, these have been treated as a variety of tack. Accordingly, although these studs are interpreted as having a decorative purpose by Allison, they will be treated along with similar specimens as nails here.

The nails proper range in length from approximately 3.0 cm to 13.0 cm. Measurements are approximate since scaled plates were used to determine length. They are characteristically square in section, with a hammered "mushroom" head. Diameters of the heads and shafts were not provided.

[23] Allison (2006, 3) gives an explanation of this approach and a justification for its utility over more canonical organizational approaches.
[24] See Ling's (1997, 17) discussion of the problems encountered when trying to establish firm dates at this site.

San Giovanni di Ruoti

At the excavation of San Giovanni, 546 nails were counted and discussed with the building materials by Alastair Small.[25] With only a few noted exceptions, Small describes these as Manning's Type 1; *viz.* a common Roman nail that is square in section, tapering to its point with a round or rectangular head. The exceptions are a few which were round in section and a few which were unusually long. The typical length was between 3.0 cm and 6.0 cm, with exceptional nails as short as 2.0 cm and as long as 17.0 cm.

The majority of the nails were in the Period 3 layers (400 – 550 C.E.), which corresponds to a large-scale demolition and reconstruction of the site. The preceding periods of occupation (beginning in the 1st century C.E.) yielded much less material; however, the scale of construction on the site was also (if not proportionally) less as well. Interestingly, none of the 19 bent nails were found in the earlier contexts of the site, and appear only in the topsoil layers and in the Period 3 destruction layer.

Also found at San Giovanni were 12 iron T-staples that are interpreted as being primarily for the mounting of ceramic box tiles.[26]

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[25] Small 1994.
[26] Small 1994, 145.

Lydia and Africa

Sardis

The publication of Sardis metalwork finds up to 1974 indicates that nails were very numerous in antiquity, and were found "in almost every major building"; particularly from Roman and Byzantine contexts.[27] The understanding of nails from Sardis presented here is based on the representative catalogue given in the publication on the metal objects from Sardis.[28]

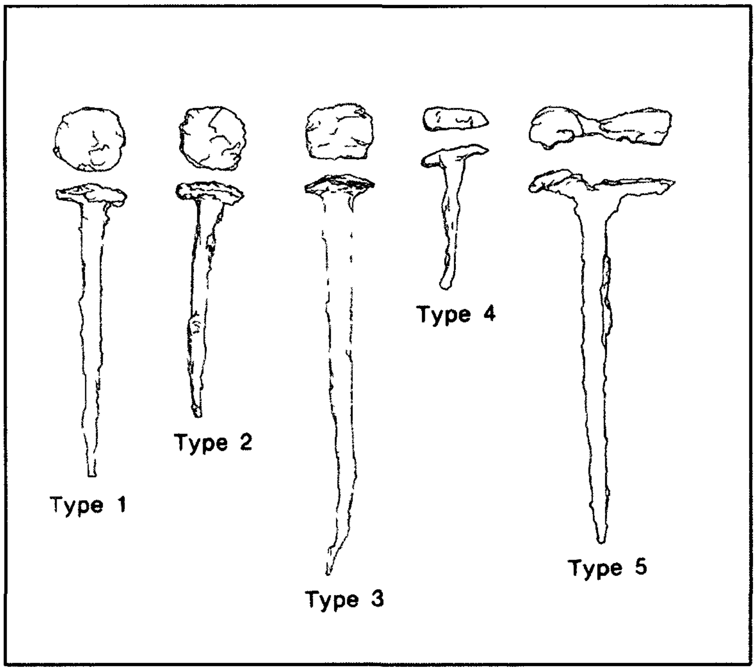


Figure 11 Type 1 - 5 nails from Sardis Waldbaum 1983, pl 21

[27] Waldbaum (1983, 35) defines the "Late Roman" and "Early Byzantine" periods as 280 – 400 C.E. and 400 – 616 C.E. respectively.

[28] Waldbaum 1983; J S. Crawford (1990) produced a volume on just the "shops" at Sardis which treated one of the colonnaded commercial streets. This book presents numerous metal fixtures in the context of a mercantile space. After consulting the concordance in this volume, however, it appears that at least some of the finds were actually being re-published with an updated interpretation given their more precise context. Accordingly, the 1983 publication by Waldbaum remains the 'primary' source for fixtures from Sardis in general, while objects unique to the shops volume are noted as such where relevant.

The general character of the nails from Sardis is summarized as iron only, with squared tapering shafts, in varying lengths. There is also a note from the author that most nails probably belong to the roofing substructure of the buildings in which they were found. This being said, Waldbaum divides the Sardis finds into five categories based on their heads, and one 'catch-all' for the small tacks and rivets (Figure 11):

1. Round and domed.
2. Round and flat.
3. Square and flat.
4. Rectangular and flat.
5. 'T-shaped', split, and spread.
6. Tacks

Waldbaum compares the finds at Sardis to those from a site on the Isle of Wight, in the English Channel, noting the great similarity with 3rd – 5th century Roman nails.[29] Waldbaum adopts the interpretations of that excavator, H.F. Cleere, as to the probable uses of each type at Sardis. Type 1 nails were believed to be for fixing large structural timbers, owing to their length; Type 2 were an uncommon intermediary for heavy-duty affixing; Type 3 and 4, the most common, were the usual multi-purpose nails for joining smaller timbers and affixing other fittings like hinges and face-plates; and Type 5 were a form of timber dog used in connection with sleeper beams or masonry. Type 6 objects, "tack-like fasteners", were not discussed at length, but it can be assumed that tacks and rivets were either used decoratively or in the construction of furnishings.

The representative catalogue by Waldbaum is divided by date, but is almost arbitrary due to its incompleteness. Six iron nails between 1.9 cm and 9.7 cm are dated to the Lydian Period (c. 6th B.C.E.), 17 iron nails between 5.0 cm and 39.5 cm are dated to the

[29] Cleere 1958.

Late Roman Period, and seven iron nails between 11.6 cm and 17.0 cm are dated to the Early Byzantine Period. There are also 15 tacks mentioned, two are from the Early Byzantine Period while the rest are Roman, 1.0 cm – 1.9 cm.

Crawford, on the other hand, divides the nails into just two categories: (1) iron, thin and long with a small head, and (2) iron, short with a large round head.[30] His aim was not to present a catalogue, so no descriptions beyond these are given. With regards to number of finds, some shops at Sardis alone produced as many as 44 nails, while others yielded none at all.

Cyrene

The sanctuary to Demeter and Persephone at Cyrene was excavated and published in good detail by a University of Pennsylvania team.[31] The dating for the site is quite involved due to the long occupation of Cyrene. All of the finds discussed here, however, are from Roman layers, generally 1st century B.C.E. to 3rd century C.E.

Approximately 60 bronze nails were found at the sanctuary. These range in size from tack-like pins to fixing nails. The published catalogue is only representative, but the two types attested are short tacks with broad, flat heads, and round nails with circular convex heads. The lengths of the representative objects range from 0.7 cm to 3.7 cm.

Iron nails were found to be even more common. More than 85 are mentioned in the publication though none were illustrated or discussed in detail. In general, they are

[30] Crawford 1990, 52.
[31] Warden 1990.

described as having a medium-sized head and a shaft averaging 2.5 cm long.[32] More than 85 iron nails are also mentioned and are noted to have been more common than bronze examples. These are said to have small heads and clearly meant for penetrating wood.

Also appropriately discussed here are the rivets. Approximately a dozen rivets in bronze and lead were found, some with their backing. The backers were circular while the rivets themselves were between 1.0 cm and 2.0 cm long.

Karanis

Despite the lack of publication of nails from Karanis, there is at least one mention of their use in the volume on topography and architecture.[33] The doors and windows at Karanis were constructed of an appropriate number of wood planks fastened vertically into the panel of a door by wooden battens. This fastening was done with nails that were likely of iron (Figure 12).[34] Though the nails are not described, we can project that they would be slightly longer than a tack, but certainly not a spike, probably between 3.0 and 5.0 cm. From Figure 12, the heads of the nails can be discerned as round, with a diameter greater than 1.0 cm. The dating of the Karanis site places these finds in the 1st century C.E. when the town was newly occupied by Romans.

[32] Warden 1990, 45
[33] Husselman 1979.
[34] The description, and substantive evidence, given by Robinson (1941b, 252, 257) with regard to Greek doors in the Classical period is comparable.

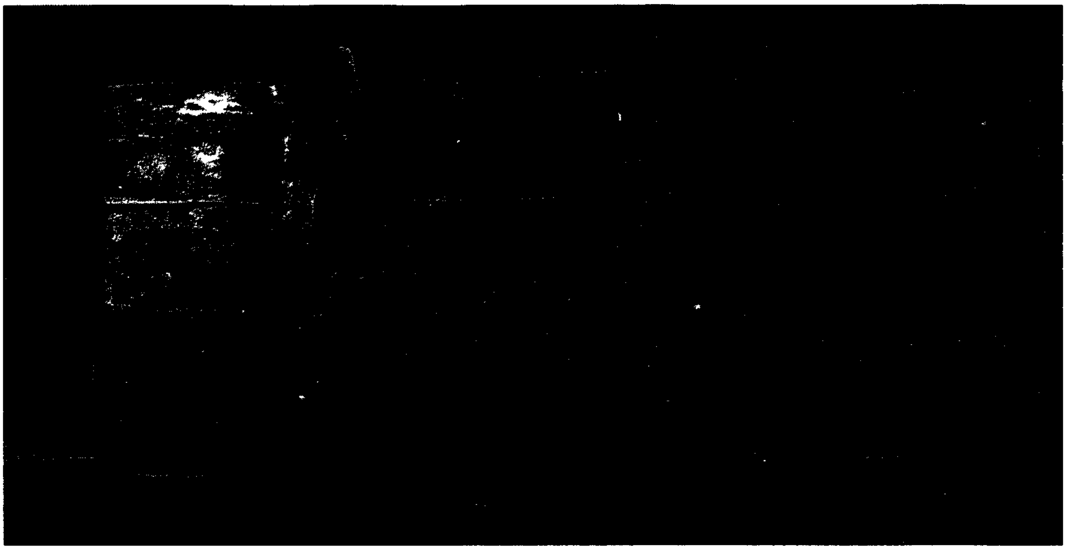


Figure 12 A batten door from Karanis Husselman 1979, pl 53

The British Isles

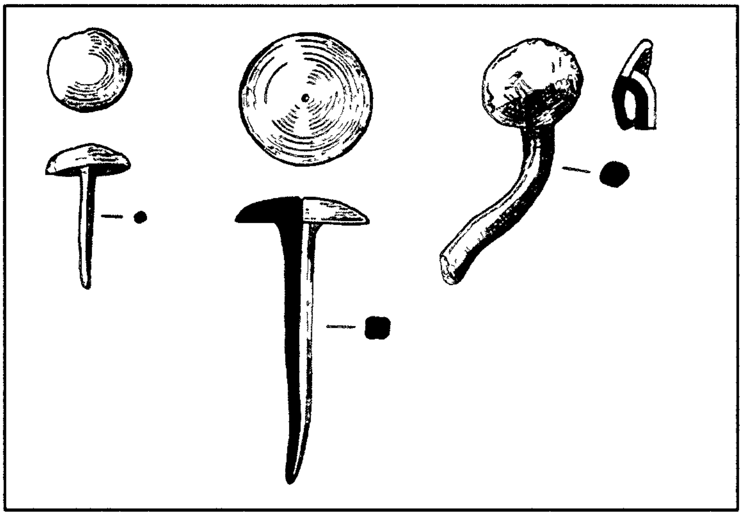
Verulamium

Both bronze and iron nails were found in abundance at Verulamium. The bronze objects were studied by the leader of the dig, Sheppard Frere, while the iron was discussed by W.H. Manning in the context of his long work on Romano-British metalwork.[35] Usefully, the dating for Verulamium is very narrow as well. The first identifiable Roman period at the site begins ca. 49 C.E. The last distinctly Roman occupation is within the Antonine dynasty, i.e. the mid 2nd century C.E. As a result, the evidence from this site is a usefully narrow 'snapshot' of technique and method in a Roman setting.

[35] Frere 1984; Manning 1972a.

Two categories were created for the iron specimens, while the bronzes were treated more individually owing to the unique nature of each one. In some cases a bronze type has been compared to one of the iron nail types, but they are generally treated as belonging to one of their own five groups based on decoration and size. It is also worth noting that some bronze objects labelled as nails are similar to what have been called 'bosses' elsewhere. The distinguishing factor, since there are objects similar to bosses at Verulamium as well

Figure 13 Bronze nails from Verulamium Frere 1984, fig 18



(called "studs" by Manning), is the level of decoration and the two-part construction of the Greek bosses (a decorative bronze head affixed to an iron shaft after it has been partially driven-in) which is not present in the Verulamium objects. These British examples are a single piece, with the decorative head having been attached to the shaft before the fastener was driven.

Over 30 bronze nails were discovered at Verulamium and were described as "plain" (Figure 13). No dimensions are given for any of the bronze nails, though the illustrations indicate that the heads were quite large compared to the length of the shaft. The three decorative examples are unique. The first has a globular (spherical) head of gold which is pierced to receive the bronze shaft. No dimensions are given. The second and third decorated nails are both shaped and proportioned more like tacks; a round flat head with a short, tapering, square shaft. These also have gilt heads which feature a 'cuneiform' swirl pattern on top.

The iron nails are not quantified in the Verulamium publication, though the subjective description of their frequency indicates that both types were abundant. Type I nails are square in section with a tapering shaft. Larger specimens have round, conical, or pyramidal heads, while smaller examples have almost flat heads. Type II nails are rectangular in section with a tapering shaft, triangular heads and marked shoulders, giving them the appearance of modern upholstery tacks. Manning notes that both types have a length between 2.5 and 3.5 cm, and that Type I were the more common.

In addition to the nails, a relatively significant number of timber dogs were uncovered which are worth discussion here.[36] Eight objects in all, the dogs range in length from 4.3 cm to 11 cm long. All are of iron and are essentially the same U-shaped object used in modern carpentry; see Figure 83.

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[36] Manning (1972b) calls them 'common', and cites Gadebridge Park Villa as another large find-site.

Fishbourne

Fishbourne yielded a large number of iron nails which are discussed by Barry Cunliffe in the site's publication.[37] In addition to a few decorative bronze nails, an assortment of iron nails and T-staples make Fishbourne among the richest sites in Britain for iron small finds. The *terminus ante quem* for the occupation of the site is a burn layer from approximately 270 C.E., which allows for all the objects to be considered within a narrow time frame, the Roman occupation having only begun in 43 C.E.

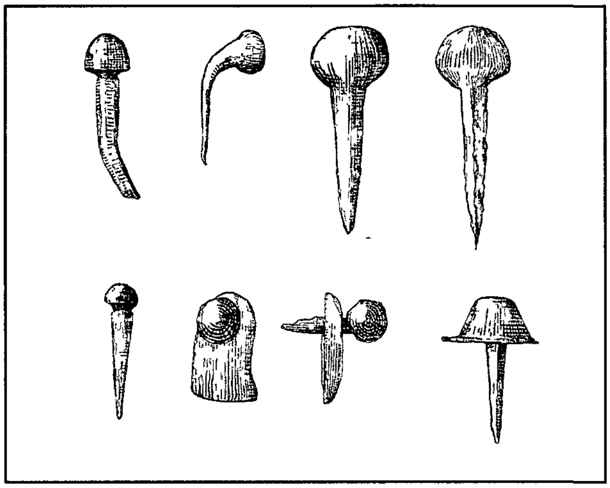

Figure 14 Odd bronze nails from Fishbourne Cunliffe 1971, fig 52

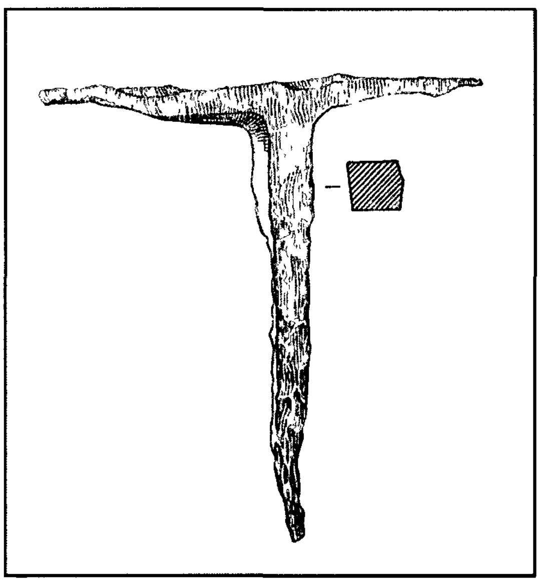

Figure 15 Iron T-staple from Fishbourne Cunliffe 1971, fig 55

The bronze nails are almost all unique at the site (Figure 14). One group, consisting of eight specimens, is all small (less than 4.0 cm) decorative pieces. They have globular heads and look more like thumbtacks than nails; this could indicate that they were used in a piece of furniture rather than a structure. Another 7 objects are unique; they range from 5.0 cm to 8.5 cm long, and run the gamut from square to

[37] Cunliffe 1971, 126.

round shafts, conical to flat heads and tapered to straight shafts. Although the existence of individual bronze spikes could indicate a pattern of use for them, the fact that more common iron examples were found alongside them tell us that these are more likely odd one-offs than a typically-employed fastener. Possible reasons for their use could be decoration, religious symbolism, or *ad hoc* repair.

The iron nails and spikes are divided into six groups according to length. These are 25.0 cm, 15.0 cm, 12.0 cm, 9.0 cm, 6.0 cm, and 4.0 cm respectively. It is not said what lengths were most common, though a pit-hoard of 40 of the 25.0 cm spikes was uncovered. Many were found in the floor of the destruction layer, which led the excavators to believe they were a part of the roof framing which collapsed when it burnt. The nails and spikes predominantly have mushroom-shaped heads and round, tapering shafts. Three examples of a square-shafted spike were also found.

The iron T-staples have been dated to the 2nd and 3rd centuries. They are approximately 10.0 cm long and square in section (Figure 15).

Brading Villa, Isle of Wight

Almost 100 iron nails were found at the excavation site of a villa in the Isle of Wight in good enough condition to survive cleaning and conservation. Though the site was excavated in the late 19th century, these were republished with an updated interpretation by H.F. Cleere in a more recent paper.[38] Dating is problematic for the finds since the site itself was never properly dated. Cleere makes the supposition that it was constructed in the

[38] Cleere 1958.

first few centuries C.E. by Roman settlers, and fell out of use as a matter of course by the 5th century. The nails have been sorted into four main types (Figure 16):

1. Large nail, between 15.0 cm and 30.0 cm long, squared tapering shaft, head is a squat cone; 22 examples.
2. Large nail, between 18.0 cm and 28.0 cm long, squared tapering shaft, head is linear but thick; 8 examples.
3. General-purpose nail, between 5.0 cm and 16.0 cm long, squared tapering shaft, flat head; 52 examples.
4. Timber dog, between 3.0 cm and 21.0 cm long, squared in cross section; 6 examples.

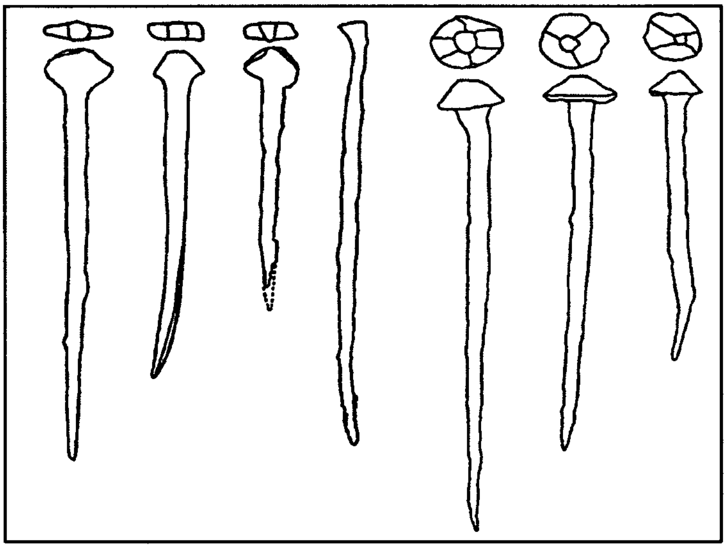

Figure 16 Type 1 - 3 nails from the Brading Villa Cleere 1958, fig 1 and 2

Conclusions

Although there is great variety exhibited in the form of the fasteners described above, the more closely we look at individual objects, even those from very disparate times and sites, the more similarities are seen. Moreover, the patterns of form and use can be elaborated on which complement these similarities.

In Greece, where we find the oldest objects, bronze is found more than anywhere else in the Mediterranean yet iron still remains the more common material overall. Similarly, although there are proportionally more examples of round-shafted nails, the squared shaft remains prevalent. Little can be said about changes in nails over time in Greece. Objects from the 7th and 2nd centuries B.C.E. are essentially the same. The hammered-out mushroom head is the most common head-type, with a good representation of the flat-head in smaller specimens and the square-head in larger specimens. With regards to size, many examples exist of objects only 2.0 cm or 3.0 cm long up to over 12.0 cm long; however, the common lengths are between 3.0 cm and 10.0 cm.

There is insufficient evidence to say that the higher incidence of bronze objects and round-shafted objects in Greece is connected, although the greater malleability of bronze may have made fashioning round-shafted nails easier. This is a theory which warrants a more thorough investigation in a study with more emphasis on specific metal use in construction.

In Italy, where Pompeian finds are essentially contemporaneous with the youngest Greek finds, we see the most common fixture is also the square-sectioned iron nail. Most nails there were between 3.0 cm and 10.0 cm long. The head forms are less uniform however. In Pompeii we see rounded heads while at San Giovanni the head type is a squared shape. A reason for this could be the great difference in date: Pompeian finds are as old as the Hellenistic and Early Imperial periods while San Giovanni finds date to the Late Imperial period. The fact that there is a continuity of form among nails at all, over such a wide period, gives support to the idea that this square-shafted iron nail was a Roman construction norm, even if a change in the head type did occur. These two sites could represent snapshots of an overall development of the Roman nail from a driven, square-shafted, iron stake into the square-headed iron nail of later periods. As in Greece, more evidence and comparison is required.

In Africa and Lydia, where dating spans the scope of this study, nails are found to be very common and of many types. Despite the least consistent publication of material, we can conclude from the finds at Sardis and Cyrene that square-shafted nails were most common and that iron was the material of choice. Round-headed nails, which in specimens over 2.0 cm in length has been seen to be synonymous with a hammered-out mushroom-shaped head, are noted by excavators to be the most common.

In the British Isles, where some of the most recent material was unearthed, we can conclude that iron nails were also the fitting of choice in timber construction. Nails in Britain most commonly have a squared shaft and a hammered-out mushroom-shaped head where the size of the nail makes this possible. Bronze objects are present also, but generally in smaller numbers, evidently with a more decorative use. This pattern supports the interpretation that as the Romans settled in the conquered British islands, they employed mostly mass-produced, cheap, iron nails.[39] Moreover, driving a nail is easier than cutting a mortise, and the economy of the new province would have more readily supported the use of inexpensive nails and quick techniques in buildings of both civilian and military character. The fact that all the sites considered in Britain are of Roman Imperial date supports the proposal that the Romans preferred to use squared iron nails.

[39] With legions idle too, they lent themselves well to busy-work, see Manning 1972b.

Also in Britain, we find a special abundance of timber dogs. This might be explained by considering that elsewhere in the Roman Empire we find a building style that incorporates much more stone and masonry than in Britain. With plentiful timber resources, all-timber construction was plausibly much more common in Britain, leading to a greater need for the timber dog. Such timber dogs are used to join heavy timber members quickly and effectively without the need for complex carpentry.[40]

One aspect of nail use which should be mentioned is the practice of bending protruding nail points over. It has been proposed that this was an intentional and common practice in ancient carpentry.[41] One can reasonably argue that the purpose of this was to secure the joint even in the event that the nail hole widened or rotted-out. From a diagnostic point of view, we are able to use the distance from the nail head to an obvious right-angle bend in the shaft to determine the thickness of what was being joined. In rare cases, the right-angle of metal provides enough surface area that corrosion preserves the wood, even to the point that the species can be identified. While this level of analysis is not yet standard practice in the interpretation of small finds, it does demonstrate clearly that such careful attention to these fasteners can be instrumental in creating very accurate reconstructions of the structure and furnishings at a given site.

With the clear prevalence of square-shafted nails, especially at Roman sites, it seems important to ask why this was the preferred shape. Two reasons why ancient craftsmen

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[40] This is supported by many excavations which reveal simple timber construction in the early centuries of Roman occupation; with more substantial stone construction as later Imperial improvements. See De la Bédoyère 1991, 16, Reece 1980, 80, and Birley 1977, 76,103.

[41] Schaus and Munaretto discuss this in the chapter on iron nails in the forthcoming study of small finds from Stymphalos.

might have preferred square nails are, first, to prevent rotation of the joint that was created. A square nail would have greatly resisted rotation, especially if bent over as discussed above, so that both the nail itself and the objects bound would have been less prone to loosening. The second reason is that square nails would have been easier and quicker to produce. While no scholarly study has yet been done on the manufacture of fixtures, we can look at the principles of metal smithing to see that a round-shafted nail would be more time consuming to make. While all nails need to be sharpened and to have their heads hammered out, not all shafts are made equal. Since a cast nail would crack when driven, hammering the round shaft would be the only way to achieve sufficient strength. The shaft would need to be hammered and rotated many times to create a cylindrical shape. A square-shafted nail on the other hand, needs only to be cut to length before sharpening. It has been suggested that an exuded wire could be cut in much the same way, but this is problematic: if the metal is soft or thin enough to be drawn into wire, it is likely not thick or hard enough to maintain its shape when driven as a nail. So while a round nail would truly need to be hand-made in a very individual way to be strong enough for use, square nails could be produced in batches, cut from the same length of bar; in a sense being mass-produced. This question is important when determining both a use pattern for nails of different shapes as well as for discussions of origin and manufacture. An experimental approach, using ancient smithing techniques, is likely the only way to demonstrate the point conclusively.

In summary, it is evident that in the ancient Mediterranean from the Iron Age to the end of the Roman Empire, square-shafted iron nails were the most common fastener used in timber construction. Although these varied in length according to application, from short tacks of approximately 1.0 cm, to long spikes of greater than 10.0 cm, the most common nails were between 3.0 cm and 10.0 cm long. The heads of these nails were usually mushroom-shaped and were simply hammered-out during manufacture.

Further, we can conclude that the bronze nail held a wide variety of roles in antiquity which made it a commonplace object as well, from delicate tacks, which would almost certainly have had a decorative purpose, to large spikes which might have been religious or simply opportune in their selection for use. The size and form of these objects varies almost uniformly from square to round-shafted, flat to triangular-headed, pin to spike sized so that no common form can be put forward as most common.

BOSSES AND DECORATIVE PIECES

The door boss is one of the most recognizably Greek structural adornments, and can indicate a Greek influence on a structure's construction and occupation. On the other hand, many cultures in antiquity indulged in decorating their structures with fittings which had a decidedly aesthetic purpose; so that labelling the boss a Greek cultural indicator might be somewhat presumptuous. Some work has been published previously on both the practical role of the Greek door boss and its place in a larger decorative tradition.[42] The boss will be treated here in line with those discussions, with the aim of determining how widespread the tradition was in antiquity, and if its presence was tied to any particular context.

Greece

Isthmia

A variety of door bosses were discovered at Isthmia.[43] Somewhat surprisingly, the majority are made entirely of iron, but some bronze specimens exist also. The iron bosses date as early as the Archaic period while the date of the bronzes is unknown. All bosses are round, with a turned-down rim. They averaged 5.0 cm in diameter, though a few were as small as 3.8 cm, and as large as 6.5 cm. 19 of the iron bosses had flat tops while ten had rounded mushroom-shaped heads (Figure 18). These distinct styles are proposed by Raubitscheck to be part of a transitional development from early rounded iron pieces, likely shaped this way by being hammered as with iron nail heads discussed above, to flat-

[42] Robinson (1941b, 252) comments on the character of Greek doors, and the role of bosses, in the Classical period from vase paintings and stone representations. Orlandos (1968, 104) discusses the role of the boss as a decorative development of the nails used to fashion doors.
[43] Raubitschek 1999, 138, 175.

headed and ornamental bronze pieces (Figure 17). Though dates of the Isthmia material cannot confirm this and the number of specimens is too low to speak relatively, Raubitscheck's observations are worth considering in comparison to other Greek and Mediterranean sites.

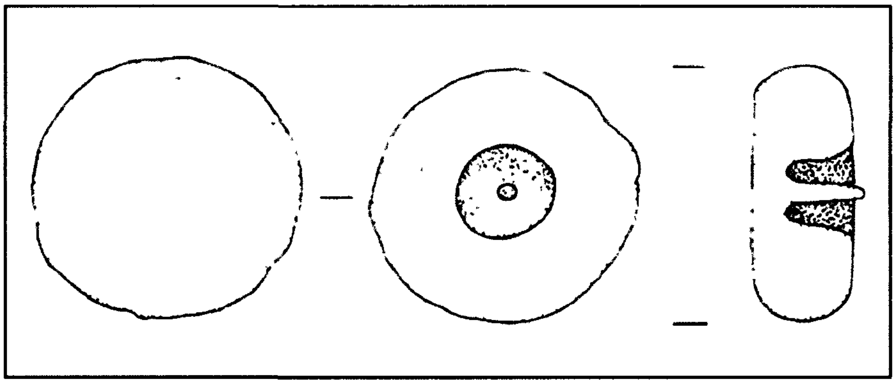

Figure 17 'Transitional' iron boss from Isthmia Raubitschek 1999, fig 28

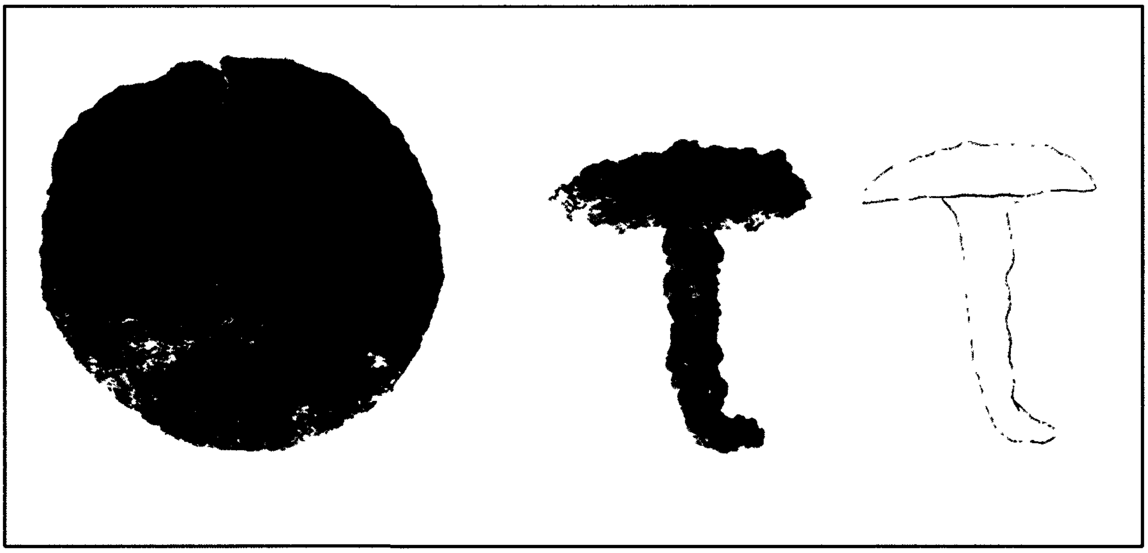

Figure 18 'Domed' iron boss from Isthmia Raubitschek 1999, pl 76

Corinth

The decorative pieces identified by Davidson at Corinth are described in terms of their place within Robinson's Olynthus typology. Davidson notes that all of the bosses are from Classical or Hellenistic contexts, and that any found in a Roman level probably originated in the Hellenistic period.[44]

The ten objects catalogued in the Corinth publication appear to have been selected in order to demonstrate Davidson's claim that the material closely parallels that from Olynthus; she notes that more bosses were discovered than the excavators had expected, yet we find that she only described a few. Of the ten, one is described as Olynthus Type 1, six are described as Olynthus Type 2, three are described as Olynthus Type 3, and one is described as Olynthus Type 4. Their diameters range from 1.9 to 5.9 cm. (See below "Olynthus" for descriptions of the Types.)

Delphi

"Dozens" of bronze bosses are mentioned in Pierre Perdrizet's study of the small bronzes from an early excavation of Delphi by the French School at Athens.[45] These are all described as being bronze caps on an iron pin. They range in form from a simple hollow dome shape to more elaborately pointed convex ones. The size of the bosses is between 4.0 and 5.0 cm in diameter.

[44] Davidson 1952, 140; see Robinson (1941a) for the typology.
[45] Perdrizet 1908, 123.

Olynthus

The typology for decorative bosses presented by Robinson for the examples found at Olynthus is one of the most often referred to among later discussions of this object type.[46] Four categories were established for simple comparison and discussion (Figure 19):

1. Bronze boss with a plain convex head, between 2.8 cm and 6.0 cm in diameter, some are filled with lead; 70 examples.
2. The central part of the boss is convex, as Type 1, but there is a wide, flat rim either plain or ornamented with incised grooves, between 3.0 cm and 4.0 cm in diameter, 9 examples.
3. Convex boss narrowing to a high pointed knob at the top, ornamented with more or less elaborate mouldings, between 0.9 cm and 2.0 cm in diameter; 14 examples.
4. Completely iron, rounded mushroom head, between 3.5 cm and 6.0 cm in diameter; 32 examples. Because the majority of bosses had bronze heads attached to iron shanks, it was appropriate to group together the few iron-headed bosses regardless of their form.

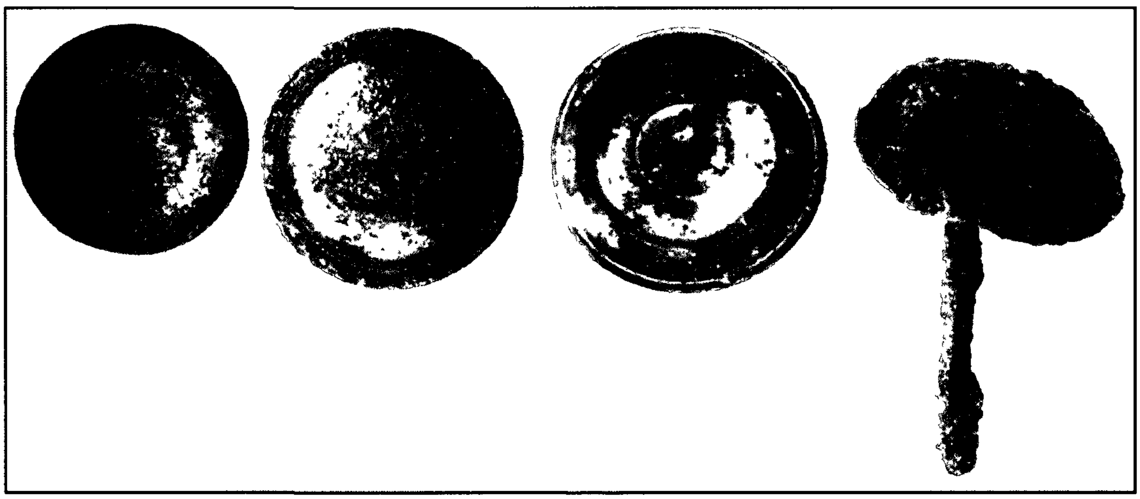

Figure 19 Left to right, type 1 - 4 bosses from Olynthus Robinson 1941a, pl 70 - 74

[46] Robinson 1941a, 260.

Italy

Insula of Menander

There are several types of object found during the excavation of the Insula of Menander which can be interpreted as decorative pieces in line with the door bosses and studs found elsewhere. These have been collected and described, according to findspot by Penelope Allison.[47]

Figure 20 Bronzes with iron studs from Pompeii Allison 2006, pl 60

Unlike most scholars, Allison did not create a system of categorization or standardized description for the finds she collected. As a result, it falls to us to make sense of the finds and interpret them in the context of similar material. Overall, several hundred objects were labelled either "stud", which in the context of Allison's work refers to any nail or bolt-like object, or "boss", which was used to denote the subsequently-added bronze heads. Studs were universally made of iron, while bosses were almost always bronze.

[47] Allison 2006, 471.

To be more specific about the character of the Pompeian finds, we can clearly see that by far the most common decorative fixture was a bronze boss attached to an iron shaft. These bosses were almost always in the shape of a 'wide-brimmed hat', and between 1.5 and 5.0 cm in diameter (Figure 20). The iron shafts were almost universally square in section, 0.05 cm to a side, and broken off. It is interesting to note that in most cases the stud and boss were found still attached as a single object.

Although other decorative fittings are listed by Allison in the appendices of her book, no descriptions beyond simple labels such as "ornaments", "plate", and "fittings" are given. Although some of these mystery objects appear in tables generically titled "Bronze fittings" or "Lead", the slightly more detailed title of "Iron and wood fittings" indicates to us that the 150 odd objects in that table were affixed to wooden structural components.[48]

Lydia

Sardis

Only three bosses are documented from Sardis. Two are a pair from the Sardis synagogue, the other is a one-off from a shop. All three are bronze mouldings on an iron spike (Figure 21). Though they date to the 4th century C.E., all follow the canon of Classical and Hellenistic Greek door bosses. Waldbaum cites examples from Olynthus, Corinth, Delphi, and Delos as comparable.[49]

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[48] Allison (2006, 465) created a separate table for positively-identified furniture fittings, which supports the theory that these other objects were structural in application.
[49] Waldbaum 1983, 64.

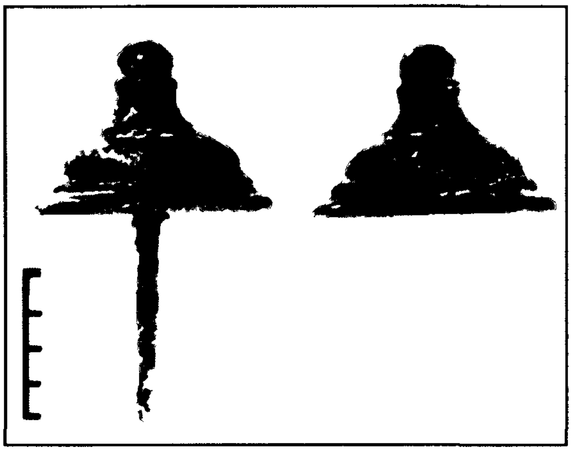

Figure 21 Bronze bosses with iron studs from Sardis Waldbaum 1983, pl 18

A fairly unique find at Sardis was a number of decorative lock plates in bronze (Figure 22). These differ from similar pieces discussed with the actual locks in that the Sardis finds seem to have been quite separate from their associated locking mechanisms.

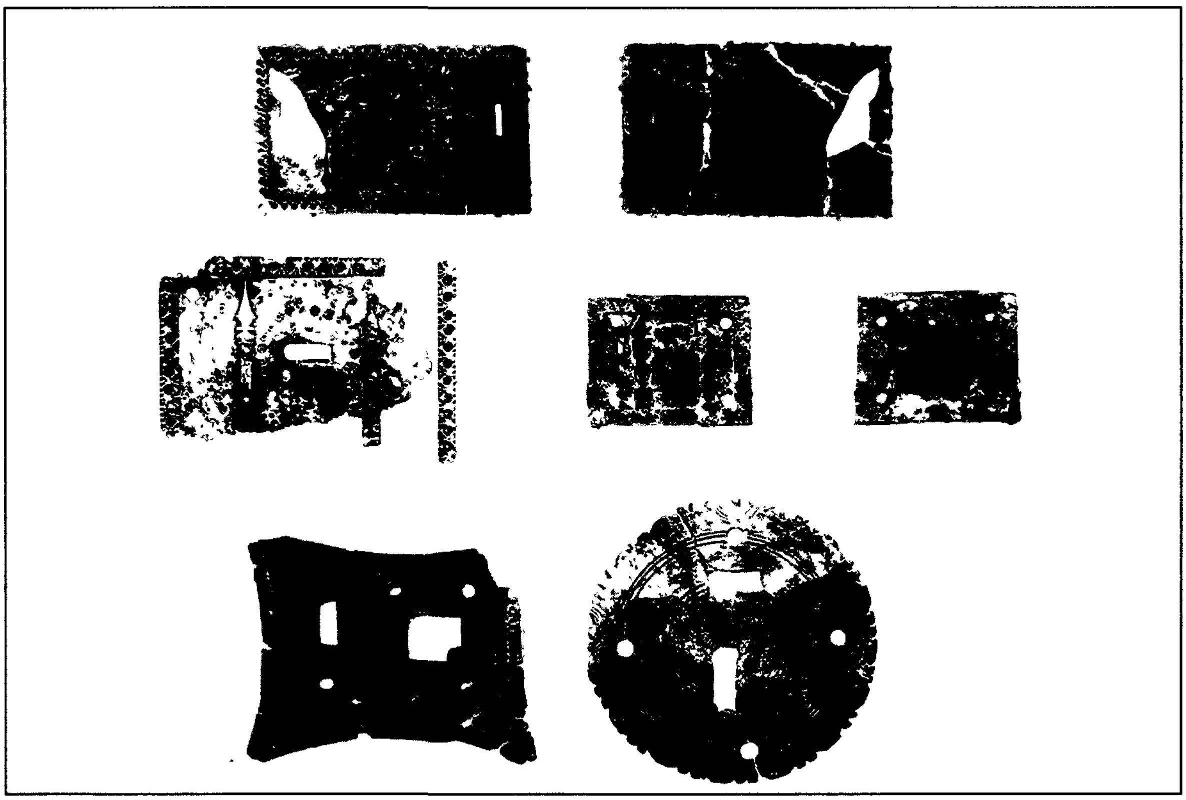

Figure 22 Decorative lock plates from Sardis Waldbaum 1983, pl 24

Akin to plain reinforcement plates which surround a hole through which there may have been a pull-string or which was used as a keyhole for a lift-lock, these plates are decidedly decorative, with incised and repoussé patterns; even lock-related imagery. Ten examples are described in the Sardis publication, with the majority dating to the Early Byzantine period. They are both rectangular and round, and range in size from 3.2 x 2.15 cm to 6.2 x 10.0 cm.

The British Isles

Verulamium

The interesting collection of decorated studs from Verulamium exemplify a type of object which might have been commonplace at Imperial Roman military sites. R. Goodburn describes six decorated examples and refers to over 80 other catalogued finds.[50] It is unclear if these decorated pieces were bi-partite as has been noted with Greek decorative bosses. The intricacy of the surviving head designs makes a case for the heads having been attached after the shaft was driven; however, the thickness of the heads would argue otherwise (Figure 23). Regardless of their installation method, the bosses are closely dated in the 2nd, 3rd, and 4th centuries C.E. respectively. Two of them feature busts of male figures. One is perhaps the Emperor Domitian according to Goodburn, while the other is unrecognizable. The three remaining bosses display stylized floral patterns.

[50] Frere 1984, 45.

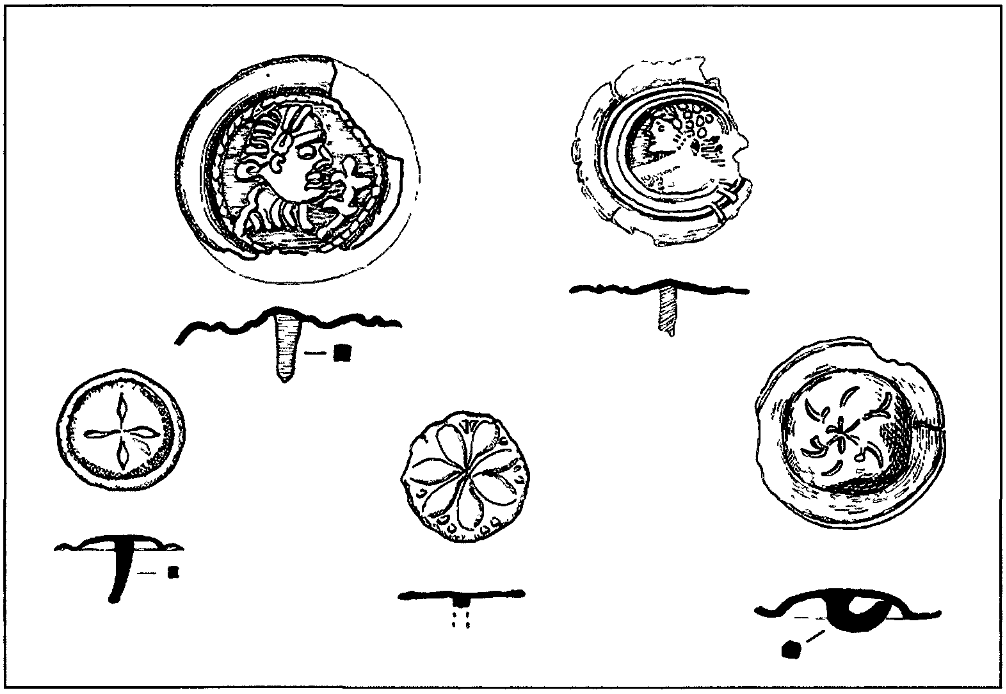

Figure 23 Decorative studs from Verulamium Frere 1984, fig 17

Conclusions

It is clear that the door boss is the most common and obvious form of structural decoration surviving from Antiquity. From early examples in the Archaic and Classical periods through the end of Roman influence, the door boss seems to have undergone little in the way of changes.

The origins of the boss are thought by Robinson to be the dressing of nail heads in early batten-construction doors. The use of bronze as the finishing metal, because it could be worked more intricately than iron and polished to a high shine, supports the idea that this was a way to turn the necessity of nail heads into a medium of decoration. He estimates, based on vase paintings and his own findings, that the typical Hellenistic house's front door would contain 30 bosses, arranged in rows along the battens.[51] Naturally we may surmise that such ornamentation was the privilege of well-to-do homeowners, but the number of bosses found overall suggests that they were, in simple form at least, quite commonplace.

Gerald Schaus has suggested that the bosses may have served a practical role at times as well.[52] In many Muslim countries it can be observed that at the homes of people who have completed the hajj to Mecca, a leather covering on their front door may be decorated with colourful tacks which in some ways resemble ancient bosses. This could be an historical coincidence or the result of an old convenience – early Muslims making use of their fashionable door bosses for an alternative cultural practice – however, this could also be a modern remnant of a practice of hanging a leather covering on doors. Schaus argues that the leather may have been both attractive and practical, since a covering would have protected the wood and slowed its weathering. We may surmise that one reason for the rarity of door fixtures from ancient sites is the ancient consideration of doors as a form of furniture to be taken by an owner when vacating the property.[53] This indicator of value as a possession supports the practice of protecting it with a leather covering, and seeing to the seasoning of the wood by slowed drying.

The size of door bosses in antiquity did not seem to fall into any kind of pattern or scale. At some sites bosses were found be quite large (> 5.0 cm in diameter) , while at

[51] Robinson (1941b, 257) cites also some examples of bosses present on stone temple doors. Since these could serve little structural purpose, the most rational explanation seems to be that the stone doors are in imitation of the older tradition of decorating wooden temple doors.
[52] G. Schaus, pers. comm. 2010.
[53] Robinson 1941b, 257.

others relatively small (~ 1.0 cm). Just as inconsistent was the form of these objects. Though all were circular and convex to a degree, differences of height, taper, and rim made for an eclectic collection. The underside was also sometimes filled with lead. One trend seems to be that early on, door bosses were fashioned entirely of iron, with the familiar bronze cap appearing sometime in the Classical period; fully iron examples were found in the older strata at both Isthmia and Olynthus. This makes sense if we accept the idea that the bronze attachments were a dressing for the plain iron nail head.

HANDLES, PULLS, AND REINFORCEMENTS

Unlike fasteners, handles, pulls, and reinforcements are a more optional addition to a structure. All three, moreover, can be made from non-surviving materials such as wood, rope, or bone. Indeed, as was pointed out in the opening chapter, a highly pragmatic approach to construction and maintenance in antiquity no doubt led to the majority of such fittings being made with the cheapest and most available materials.

That being said, the significantly greater durability of metal fixtures as well as the aesthetic appeal of polished surfaces were no doubt reasons for the investment in more expensive fittings. Accordingly, we find the use of metal for handles, pulls, and reinforcement to be consistent if not prolific. Below is a summary of published finds from a number of sites to demonstrate this pattern. A comparison of the objects themselves and a discussion of the distribution follows.

Greece

Isthmia

At least one door pull or knocker and several keyhole reinforcements were among the finds at Isthmia.[54] All are made of bronze, dated to the Classical period, and described as well-preserved.

The door pull is circular, 35.5 cm in diameter, and 2.5 cm thick. The mounting plate is flat on the reverse and decorated on the obverse with seven concentric circles. The ring is a solid cast loop of bronze, and is passed through a hole in the mounting plate (Figure 24).

[54] Raubitschek 1999, 136.

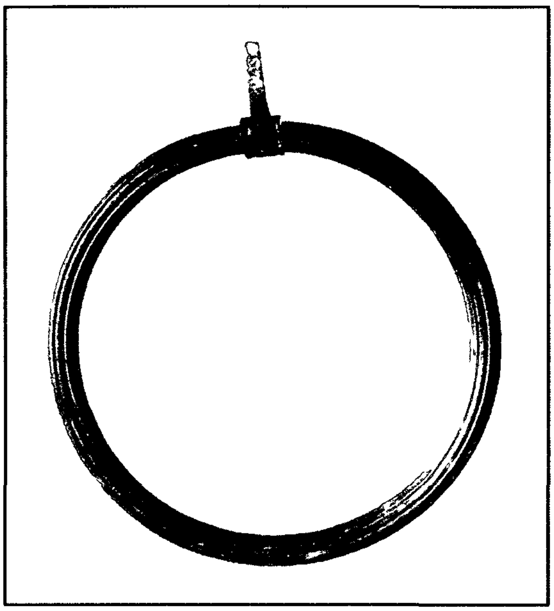

Figure 24 Door pull from Isthmia, mounting plate not pictured Raubitschek 1999, pl 74

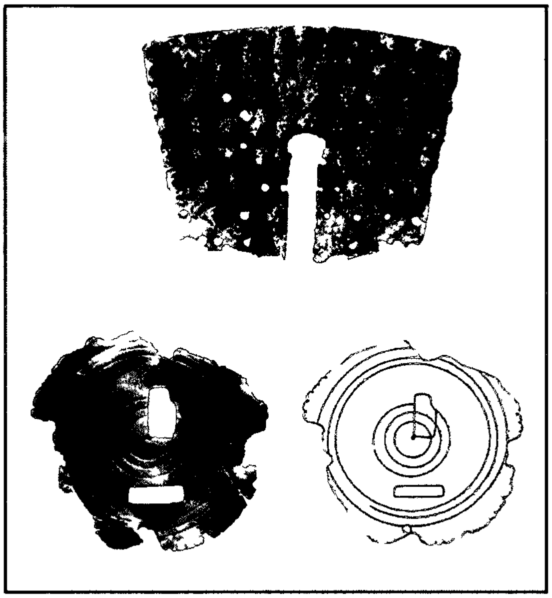

Figure 25 Two of the keyhole reinforcements from Isthmia Raubitschek 1999, pl 74

Three keyhole reinforcements were also described. Two are rectangular while the third is discoid (Figure 25). The largest is 6.8 cm x 9.0 cm, the other rectangular plate is 6.2 cm x 3.5 cm, the circular plate is 7.2 cm in diameter. The nails used to mount the plates are the decoration for one of the plates while the others have incised concentric circles. The former possesses 76 holes, some with corroded nail heads still in situ. The other two plates have four and five mounting-holes by comparison.

Stymphalos

A good example of an iron door handle was found at Stymphalos (Figure 26). Dating to the Classical period, the handle is 9.1 cm long and square in section. A globular accent is present in the middle of the grip, which also is curved inward. The handle was clearly mounted as one piece since a collar is present on the top and bottom where the handle would have been flush when passed through the door.[55]

A loop-headed spike made of iron was also found which would have been of sufficient size to form the handle for a shutter or door. The loop is 2.1 cm in diameter while the overall length of 4.0 cm. Schaus notes that this object might also have been part of a key or clothing pin, and that is was obviously cast.

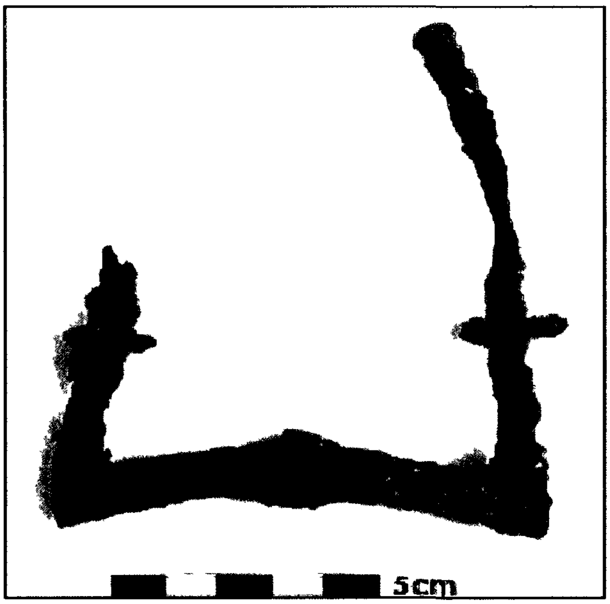

Figure 26 Door Handle from Stymphalos
Provided by G Schaus

[55] Provided by G. Schaus from material for forthcoming volume on Stymphalos. Schaus notes parallels at Olynthus, such as those discussed above, and at Corinth (Davidson 1952, nos. 895 and 901), which were not discussed due to their interpretation as being from furniture.

Finally, both iron and bronze plate reinforcements were found at Stymphalos. Distinguished from pottery mends, all such plates are described as having been nailed or riveted to something wooden. The iron specimens are generally oval, with two rivet holes, some being round while others are rounded rectangles. In one case the rivets are preserved, they are square in section and also made of iron. The plates measure 6.7 cm x 3.5 cm to 5.0 cm x 2.5 cm. Two examples of iron bolts with large 'washers' are grouped with these plates. Acting as large rivets, these bolts were rectangular in section with rounded heads. The bronze specimens have more the character of attached disks (more circular and oval) than the rectangular iron plates. Being typically smaller, the bronze objects were mounted with either one or two nails or rivets and all measure less than 5cm to a side. In all, seven iron and 10 bronze plate-objects are catalogued by Schaus.

Olynthus

Several bronze discs were found at Olynthus and discussed by Robinson with the small finds.[56] Though some are decidedly decorative, more bear evidence of their utilitarian purpose. These are grouped into two types based on weight and probable use. Type 1, of which there are ten examples, are circular pieces of bronze, flat or with a slightly convex

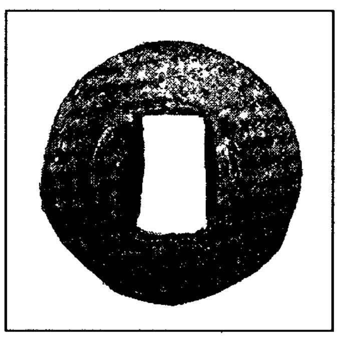

Figure 27 Bronze handle mount from Olynthus Robinson 1941a, pl 83

[56] Robinson 1941a, 278.

outer surface. The surface is pierced by several holes, generally three or more evenly spaced around the outside edge and often one more in the centre. Type 1 objects are described by Robinson as handle mountings (Figure 27). Type 2, of which there are 14, are flat bronze discs turned up slightly at the rim and somewhat heavier than discs of Type 1. Their outer surface is decorated with incised concentric circles. There are several small holes near the rim and occasionally a hole in the centre. Some may have been parts of mirror-covers, others for affixing leather or wood to a surface; the best modern analogy is a bevelled washer.

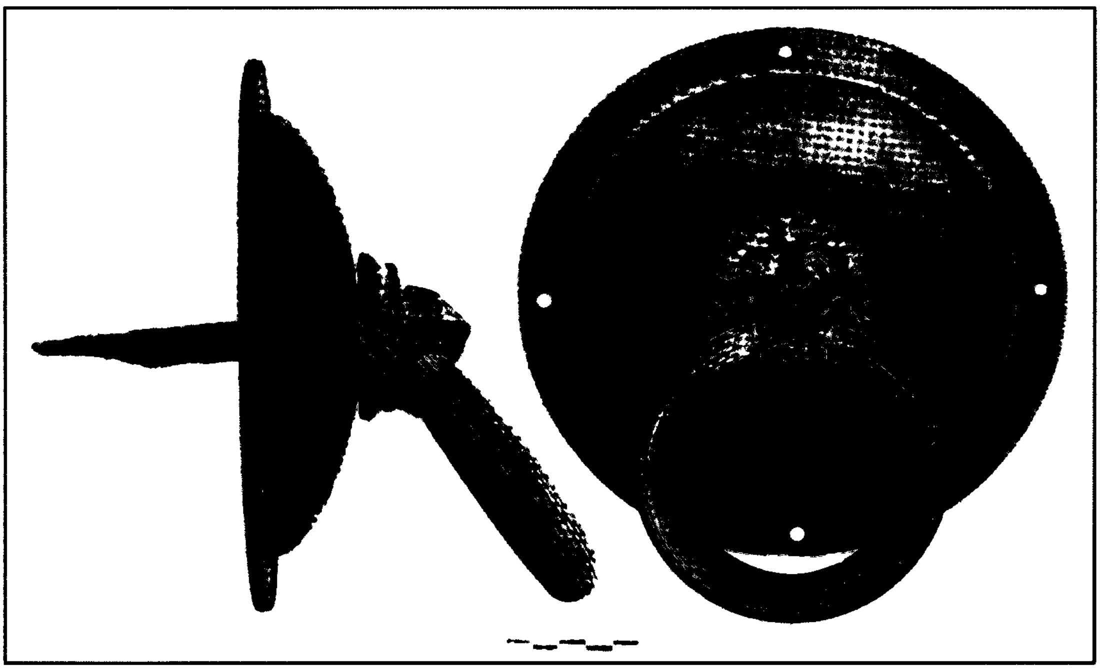

Figure 28 Lion's Head door knocker from Olynthus Robinson 1941a, pl 66

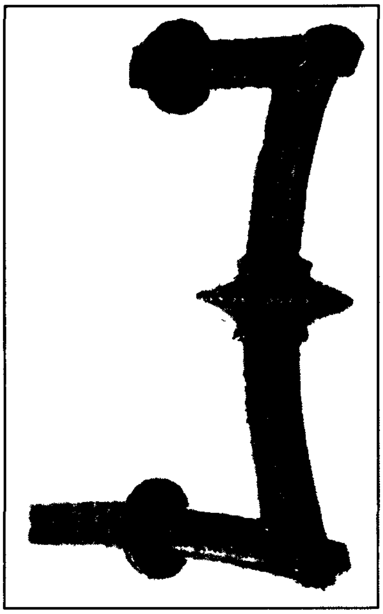

Figure 29 Door handle from Olynthus Robinson 1941a, pl 65

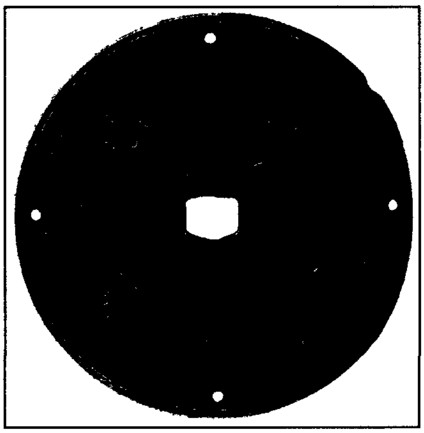

Figure 30 Decorative keyhole reinforcement from Olynthus Robinson 1941a, pl 82a

Many bronze and iron handles were interpreted by Robinson as being exclusively for use on furniture.[57] Roughly half are of the "drop handle" type, comprising a worked metal dowel, while the rest are more recognizable as modern "grip handles", having a fixed protruding bar to be grasped (Figure 29). Though the drop handle is well-suited to furnishings, it does not seem impossible that these could have been used in cabinetry or in

[57] The only handle to be specifically interpreted by Robinson for use on a door is cat. no. 988. This is explained by Robinson (1941b, 257) as being in part due to the Greek practice of removing doors as furniture, see *infra* n. 115.

more utilitarian places on the structure. The fact that all the grip handles were labelled as furnishing objects is worth reconsidering since this heavier design is highly appropriate for handling doors and window coverings. Most of the objects are bronze, but examples of iron exist also. They range in size from just a few centimetres to more than ten centimetres in length.

Two large door knockers were fortuitous finds; both are unique. The first knocker is from one of the finer houses in the city; 10.7 cm in diameter, the ring of the knocker is held in the mouth of a male lion's head which is emerging from the mounting plate (Figure 28). The second knocker is more plain, 8.9 cm x 11.0 cm, and has been interpreted as a stylized flying bird.[58]

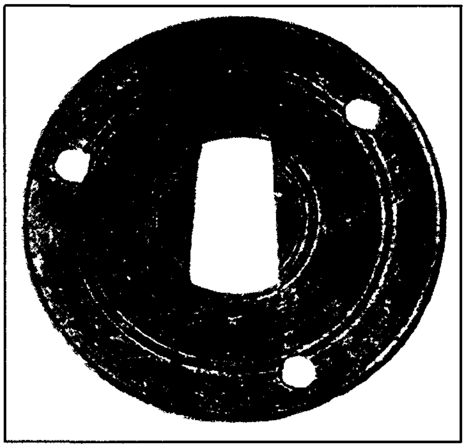

Figure 31 Bronze latchstring plate from Olynthus Robinson 1941a, pl 82

The latchstring plate is a bronze disc 14.7 cm in diameter and 3.0 cm thick (Figure 31). Nail holes run the course of the rim and show that it was decoratively attached to the door. A large square hole in the centre of the plate was the course for the latchstring. The

[58] Robinson 1941a, 249.

decoration on the plate itself is a separate piece of bronze in the likeness of a square palmette, riveted around the hole.

Because it does not fit with any other type of object in the study, it seems appropriate to list here the latchstring keeper which was found. This was a small bronze lump with two eyelets at each side. Being 3.3 cm x 2.7 cm in size, it would have been attached to a latchstring which passed through one of the plates described above. It would then keep the thong from slipping back through the hole in the door when released.

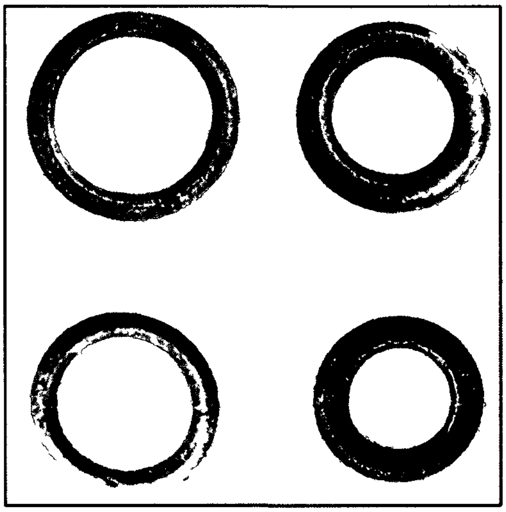

Figure 32 Reinforcement rings from Olynthus Robinson 1941a, pl 62

31 additional rings and reinforcement plates were catalogued. It is unnecessary to describe them individually, though it is worth noting that they ranged in size from 4 cm to 5 cm in diameter. These finds consisted of parts of bosses, pull-rings, handles, and decorative plaquettes.[59]

Keyhole reinforcements were another common find at Olynthus (Figure 30). They were predominantly made of bronze, though a few iron specimens were found. Three types of reinforcement are described by Robinson as being circular bronze reinforcement rings

[59] Robinson 1941a, 291.

with two, three, or four mounting prongs on the reverse (Figure 32). The rings were 3.0 cm in diameter on average. It is unclear if these rings were all door-mounted; however, Robinson notes that the varied findsite of these rings indicates that not all doors possessed them and that other objects, for example locked chests, might have as well. Of the 46 objects catalogued, only two were found in the vicinity of a building's main entrance. This is not to say that locked doors could not have been placed within the house; there is in fact an indication that these were more common in connection with a cellar-sized room.

Figure 33 Joint reinforcement from Olynthus Robinson 1941a, pl 88

Two iron joint reinforcements were also found (Figure 33). These are rhomboid in shape and were clearly nailed to some indeterminable woodwork to add strength (9.0 cm x 6.3 cm and 5.0 cm by 6.3 cm). They were found in the remains of the Archaic temple and they date either to the Archaic or Classical period.

Italy

The Insula of Menander at Pompeii

Without exception, the handles and pulls catalogued from Pompeii can be classified into just two types.[60] This consistency suggests that these were the only type of such fitting in use there at the time of the Vesuvius eruption.

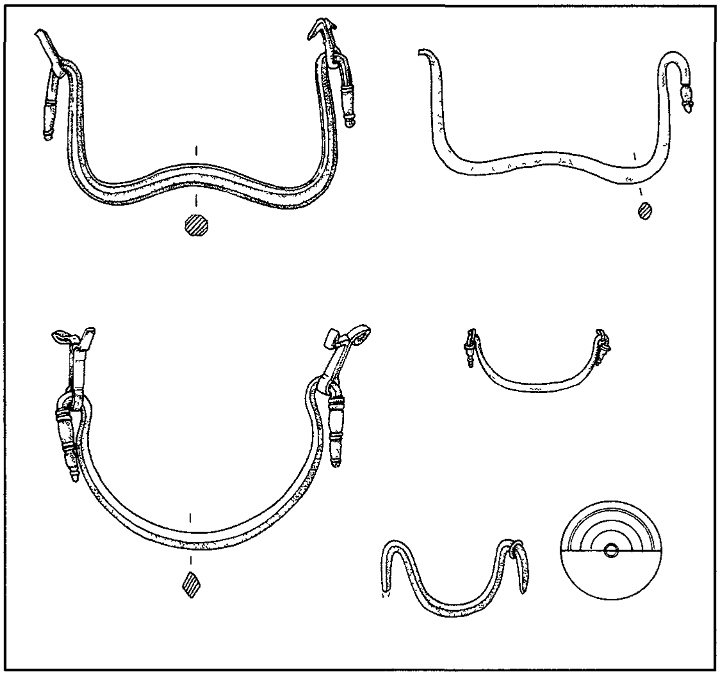

Figure 34 Drop handles from Pompeii Allison 2006, pl 64

The first type is a drop handle, a single dowel of iron or bronze was hammered into serpentine shape such that two closed hooks or loops are formed at each end, with a broad curved length through the middle (Figure 34). This type of handle could easily have been used in a number of applications, from cupboards and doors to chests and cooking pots. 19 examples of this are identified.

[60] Allison 2006, 469.

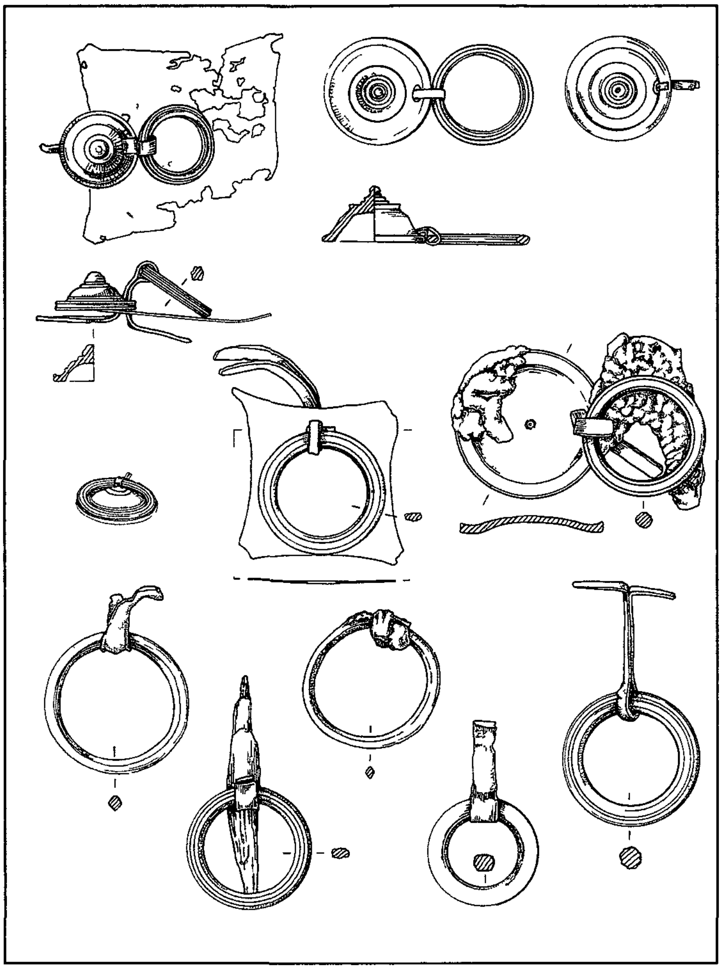

Figure 35 Ring pulls from Pompeii Allison 2006, pl 65

The second type is the ring pull (Figure 35). Predominantly made of bronze, 38 examples were catalogued. Either in one piece (a large spit-pin which has been formed into a loop) or two (a ring affixed by an eyelet to the surface), ring pulls were more common than drop hinges. Being more practical for structural applications, we can hazard that these were employed for doors, shutters, cupboards, etc. One highly decorative bronze specimen in particular, likely affixed to a main door, is the mounting for a ring pull which has been worked with great detail into the shape of a male lion's head.[61]

With regards to keyhole reinforcements, Pompeii offers us only a few specimens comparable to other sites. In general, those finds catalogued are rectangular strips of bronze only 0.01 cm or 0.02 cm thick, with evidence of having been pierced by nails or rivets in the form of holes or corroded heads. Less than a dozen examples are catalogued. What is both interesting and useful about these is that the type of key and lock can sometimes be determined by looking at the shape and orientation of the keyhole. More is said about key shapes and locking mechanisms in the following chapter.

Plate reinforcements were rare at Pompeii, serving to both bind the wood behind together as well as protect its surface from any outside wear. This may have been in a high-traffic area such as doorways or in a structurally significant place like a joist-joint. Roughly a dozen examples are catalogued (Figure 36). That these were rectangular, mounted with

Figure 36 Plate reinforcement from Pompeii Allison 2006, pl 36

[61] Allison 2006, pl. 67.5; see Allison 2006, pl. 19.8, for a good example of a non-decorative ring-pull.

nails through piercing in the plate, and could be as large as 15.0 cm to a side. No determination of their thickness is possible, although we can presume that structural reinforcements would have been thicker than protective shodding.

San Giovanni di Ruoti

A number of bronze ferrules were found at San Giovanni which could have been keyhole reinforcements or latchstring plates.[62] These ferrules are generally less that 3.0 cm in diameter, created by folding over the rim of a rounded sheet to create a tube or ring (Figure 37).

Also found was at least one bronze reinforcing plate, a sheet of metal 5.2 cm long by 2.0 cm wide, 1.0 cm thick which shows evidence of being nailed or riveted to a wooden surface in a semi-circular shape.

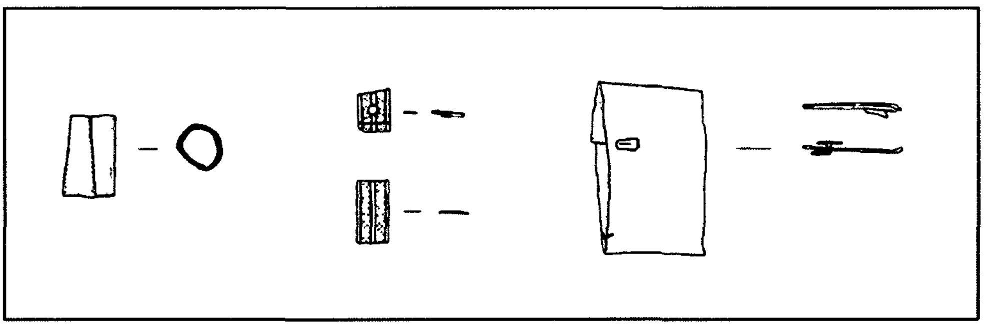

Figure 37 Bronze ferrules from San Giovanni di Ruoti Simpson 1997, illus 34

[62] Simpson 1997, 50.

The British Isles

Verulamium

Three 'knob pulls' were found at Verulamium and interpreted by R. Goodburn in the site publication.[63] It is unfortunate that dimensions are not given for these objects since it is difficult to tell if they were used for doors, shutters, drawers, or some kind of lid. Examining the form of the pulls, all three are hardly different from what might be found in a modern home. One is spherical while the other two are conical (Figure 38). Concentric rings produce the decorative effect. All are made of iron, and date to the 2nd or 3rd century C.E.

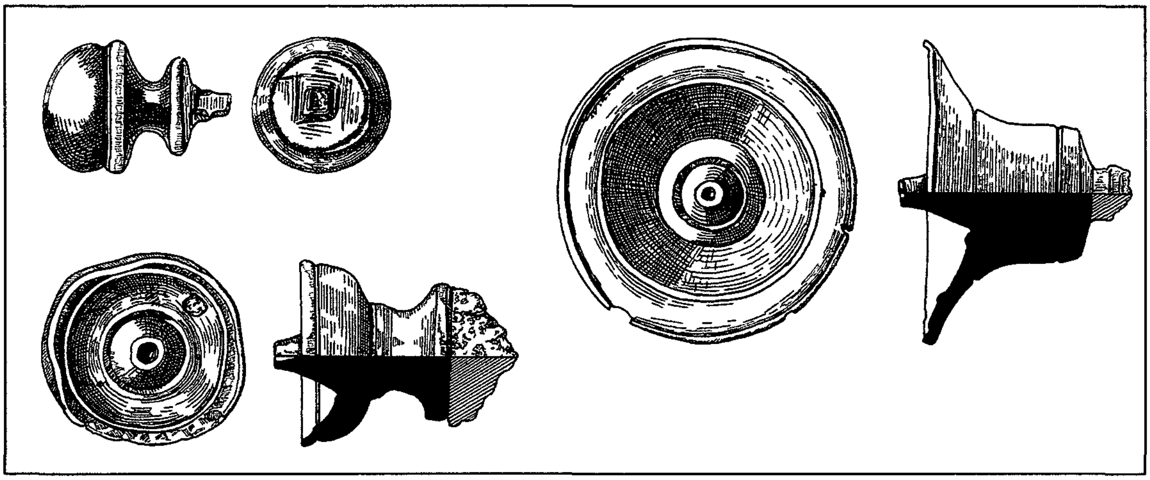

Figure 38 Knob pulls from Verulamium Frere 1984, fig 20

[63] Frere 1984, 51.

Conclusions

With regards to handles and pulls, the evidence provides a limited picture of what was in use. Essentially three types of fixture were in place to give users something to grab. These show little change over time and seem to be more a function of the individual structure than the time or place.

The drop handle was an easily-made object which could be used in a number of different contexts; it has perhaps been interpreted too often as solely a furniture fixture. As a chest handle it would have swung down against the box out of the way, while as a door, shutter, or cupboard handle, it would have been quick and cheap while offering more substance than a ring pull. Having been common at Olynthus in the Classical period and still so in Italy in the Early Imperial period, it is not difficult to argue that the simplicity of the fixture made it a commonplace object through the whole period studied and beyond.

Surprisingly, the ring pull was found to be ubiquitous. These were most often of the two-piece type, comprising a driven mounting (usually some form of split-pin nail) and welded loop. This design offered the possibility of decoration, as with the handsome large door knocker from Olynthus and the lion head loop holder at Pompeii.[64] Eyelet type single-piece objects were found as well. Though being harder to fashion and delicate by construction, these were less common.

The grip handle enjoyed surprisingly limited use. Although a great many were catalogued at Olynthus, most other sites yielded only one or two poorly preserved specimens. This suggests either that Robinson's interpretation of the grip handle as a

[64] Robinson 1941a, 242, cat. no. 989; Allison 2006, cat. no. 1146.

furniture fixture is correct (the handles moved with their furniture so as to be less often preserved intact), and that the handle was in only limited use after the Classical period, or that this study was not comprehensive enough to include an indicative number of objects.

Reinforcements, meanwhile, are not so clearly described. The two types of reinforcement in evidence, plates and keyholes, have a fairly random frequency that suggests that they were not a standard type of fixture, but rather an ad hoc addition when required. Greek sites show a high number of keyhole plates, but Robinson comments that the Olynthus finds are unusual and provide contradictory evidence.[65] At the Roman military site investigated, keyhole rings were the only reinforcement; which is reasonable given the limited availability of 'luxury' construction materials such as metal fittings. At Pompeii, on the other hand, we find many examples of reinforcements with ambiguous purpose. It is clear that these were available when needed, but not necessarily always installed. The limited finds of reinforcements at Sardis are puzzling, but not without explanation if we consider that the two found were of iron. If this is taken to indicate that most such fittings were of iron, then poor survival can be used to explain the relatively few finds.

[65] Robinson (1941b, 260) comments on the unusually high number of keyhole reinforcements at Olynthus.

HINGES AND DOOR PIVOTS

Probably the most functional parts of a structure, and certainly its most mechanical, in antiquity were the windows and doors. The need for a closable opening was felt as much in antiquity as today, and creating a durable pivot was an important part of a complete structure. The means of creating this pivot is, in fact, one of the few areas where we see a development over time in this study, and is certainly an avenue of further research in its own right.

Beyond the obvious need for doors, there are numerous places in a building where there was a need for a hinge or pivot. Windows, in some climates, require closing, and storage generally needs securing. These needs were met in a variety of ways which reflected the capabilities and knowledge of the metalworkers themselves and the design of the structures in which the fittings were installed.

One difficulty when interpreting these objects is assessing whether a given object was for use structurally, or as part of some furnishing. Generally the size and weight of the object is used by scholars to determine how an item should be classified; however, these interpretations can be tenuous at times when evaluating pivot objects.

Below is a summary of published finds from several sites which demonstrate the variety of techniques in this type of fitting. Following the summary is a discussion of the development of these objects and their pattern over time across the Mediterranean.

Greece

Isthmia

An iron and a lead door pivot socket were found at Isthmia (Figure 39).[66] The lead pivot is larger, being 5.3 cm in diameter. The iron socket is only 4.5 cm in diameter. The iron piece dates to the Classical period, while the lead is uncertain. Both are a cup-shaped piece of metal found in a cutting of a foundation block.

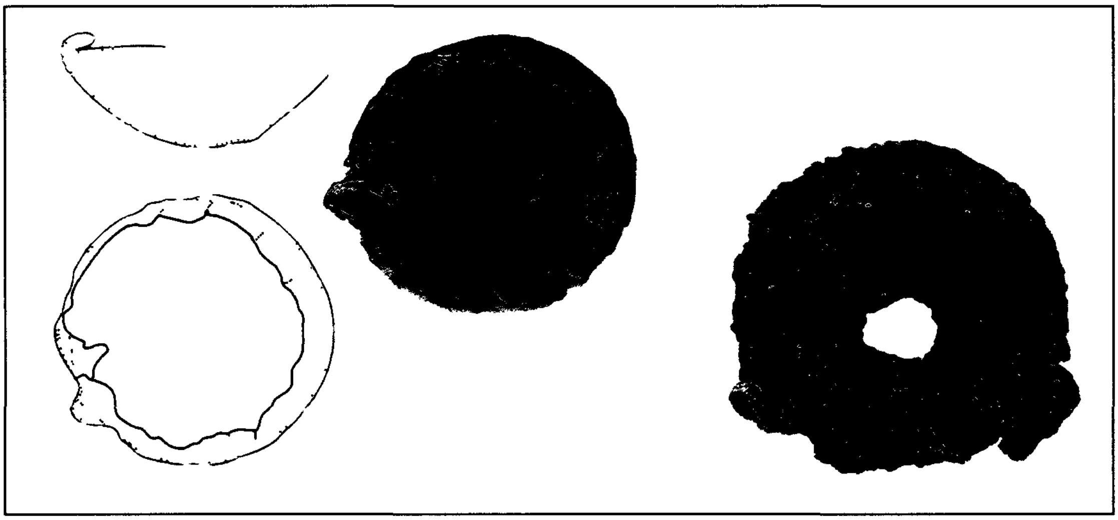

Figure 39 Door pivot sockets (left in lead, right in iron) from Isthmia Raubitschek 1999, pl 75

A primitive iron strap hinge was also found in situ. Though badly corroded, two pronged plates of iron were found bent around an iron nail. Measuring approximately 15.0 cm x 8.0 cm, the hinge has been dated to the Archaic or Classical period (Figure 40).

[66] Raubitschek 1999, 138.

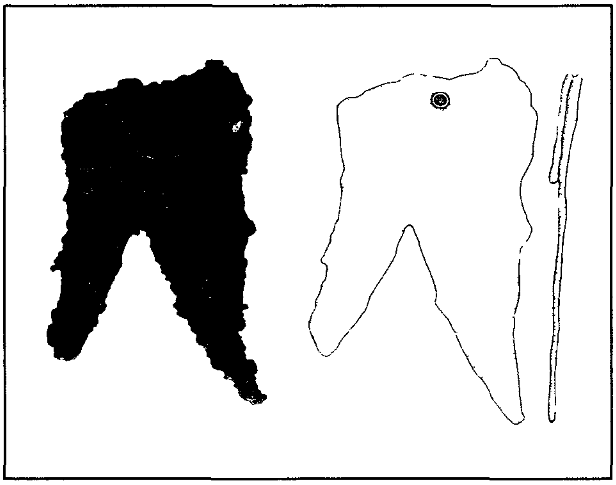

Figure 40 Iron hinge from Isthmia Raubitschek 1999, pl 74

Olynthus

Though only two door pivots were clearly identified at Olynthus, their good survival makes them excellent examples of the most common door-hinging method in the ancient Mediterranean.[67] The pivots were square plates of bronze with a circular depression in the centre to guide the actual pivot (Figure 41). Both are approximately 7 cm square, 1 - 2 cm

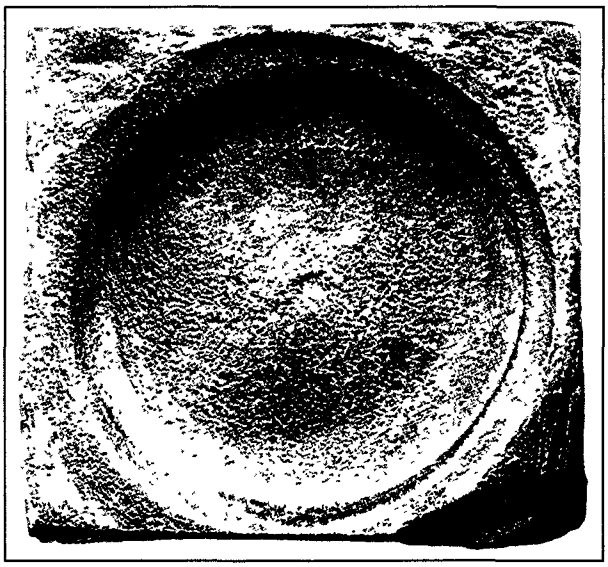

Figure 41 Bronze door pivot socket from Olynthus Robinson 1941a, pl 85

[67] Robinson 1941a, 295.

thick, and the depression is 5 – 6 cm in diameter.

13 other objects were found which, despite being obviously associated with hinging, cannot be positively identified.[68] All are cubic or cylindrical pieces of metal, smaller than 5.0 cm, bisected by holes on one or two axes. Being mounted on a stud or frame, these could have provided the pivot for a pin or loop attachment.

Though several bronze strap hinges were found, none are large or heavy enough to have been used structurally. Robinson suggests that they are from wooden chests or other furniture.

Italy

The Insula of Menander at Pompeii

Many excellent examples of pivot objects were found at Pompeii and catalogued by Penelope Allison.[69] Most interesting of these were the well-preserved strap hinges which show us the high level of refinement that Roman metal workers had achieved with these objects (Figure 42). Beyond being well preserved, a variety of types were found too, which indicates that several influences were at work in Pompeiian construction.

[68] Robinson 1941a, 299
[69] Allison 2006, 465.

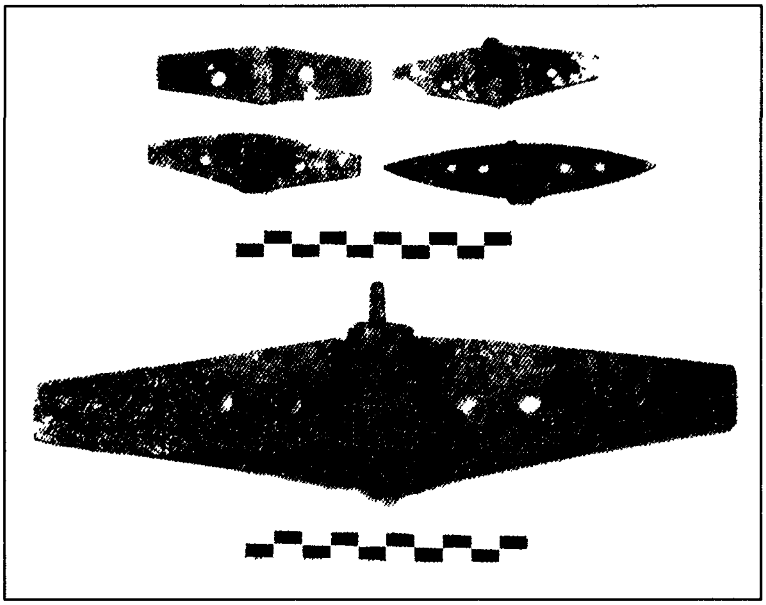

Figure 42 Strap hinges from Pompeii Allison 2006 pl 15

52 strap hinges were catalogued by Allison. Only ten of these are iron while the rest are bronze. Examining them more closely, we see a definite canon: each hinge leaf is between 4.0 cm and 6.0 cm long, and from 3.0 to 6.0 cm wide at its widest point. All specimens which were illustrated displayed the same tapering leaf design; widest at their 'knuckle' and tapering either to a rectangular or pointed end.[70] Strap hinges at Pompeii had either 2/3 or 1/2 knuckles, depending on their overall size and, conceivably, their intended function. Hinges were obviously mounted with driven nails, as attested to by the one or two holes in each leaf. These holes are generally between 0.5 cm and 1.0 cm in diameter.[71]

With respect to door pivots, the number of sockets and post "feet" compared to the number of strap hinges suggests that the Insula of Menander was in a period of transition

[70] See Allison 2006, pl. 15, for examples of each shape.

[71] Since diameters for the nails at Pompeii were unavailable, these holes give us a clue to the size of nails that Roman builders might have been using for purposes such as hanging doors.

from one method of door hanging to the other. Only 15 objects associated with a shod-post style door pivot were found, while probably half of the strap hinges are of a sufficient heft to support a door if used in tandem. The pivots themselves, as catalogued, generally comprise a square bronze or iron baseplate into which a circular recess has been worked or worn (Figure 43). Accompanying the baseplate is a cylinder or circular plate which would have been fitted to the wooden door post. Only one of these finds is depicted by Allison, so this description is assumed from the one example.[72]

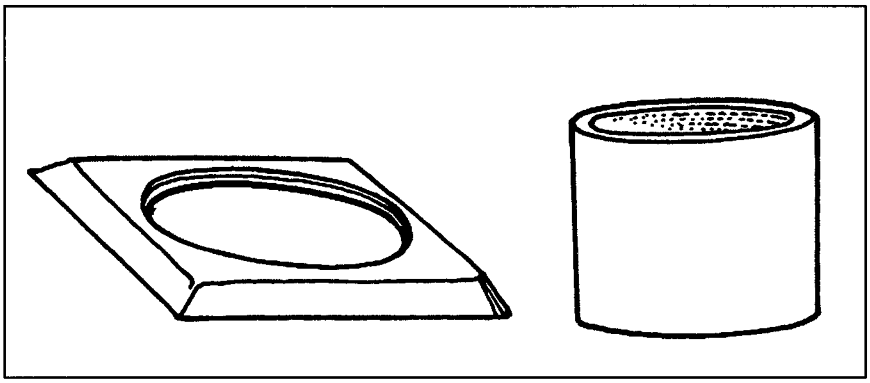

Figure 43 Reconstruction of Pompeiian door pivot Allison 2006, fig 53 1

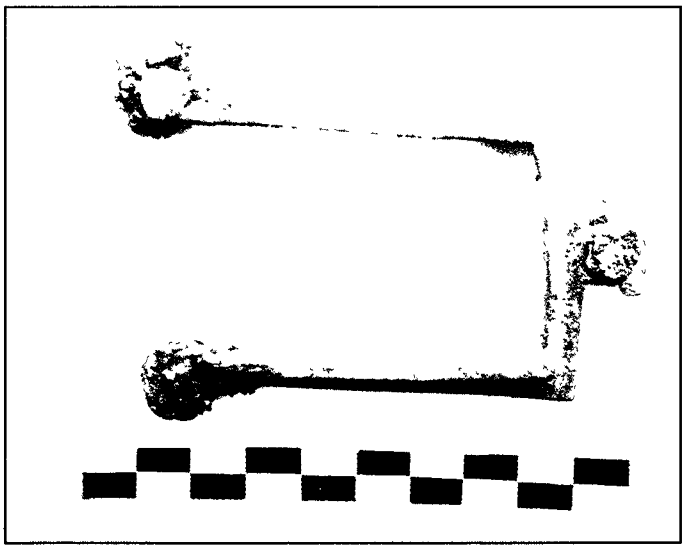

Figure 44 *Guardispigolo* from Pompeii Allison 2006, pl 17

[72] Allison 2006, pl. 18.5.

Finally, the finds of *guardispigoli* are intriguing, since their exact function has yet to be established. On the one hand they might be a furniture fixture meant to function as some kind of clamp, embellishment, or protection.[73] On the other hand, it has been proposed that these were doorframe fittings which were either part of the pivot or served as a doorjamb.[74] Whatever their function, 14 were catalogued, all of bronze. The *guardispigoli* are approximately 10.0 cm long and 5.0 cm across. They all exhibit the same bevelled edge on the inside of the U-shape, and the same circular eyelets at the apex and ends (Figure 44). The specimens visible in the plates are so similar in fact that a single craftsman or shop may have produced all of the *guardispigoli* for the Insula; it is not unlikely that they were installed at the same time when the structure was built or during an earlier renovation.

San Giovanni di Ruoti

A single strap hinge was found at San Giovanni. Made of bronze, it is approximately 4.0 cm long by 2.6 cm wide. The leaves are trapezoidal and show only a single nail hole; this and the small size preclude use for hanging a door. Interpreted by Simpson as being for a shutter or chest lid, he compares the object to iron examples found at Fishbourne by Cunliffe.[75]

A single fragmentary strap hinge was also found, the remains of which are 4.8 cm long (Figure 45). [76]

[73] Though he does not use the term *guardispigolo*, Mols (1999, 100) is likely referring to these; Allison 2004, 53.
[74] Allison 2006, 26 (along with S. Mols by pers. comm. 2001).
[75] Simpson 1997, 51.
[76] Simpson 1997, 52.

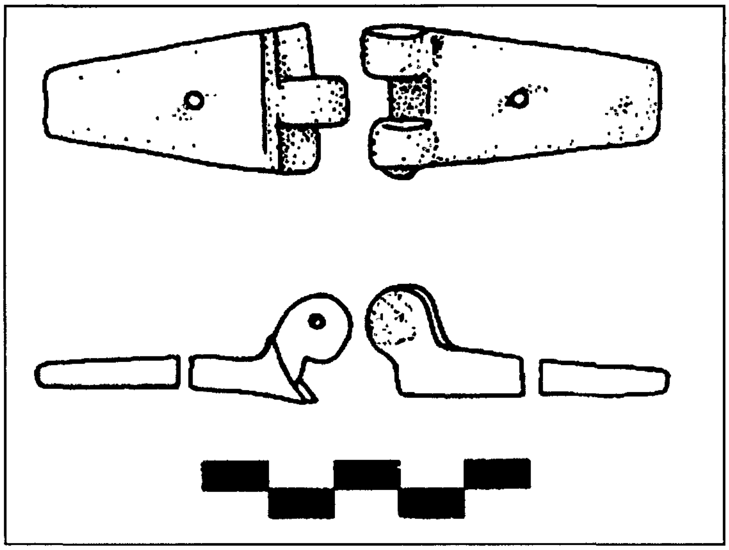

Figure 45 Reconstruction of strap hinge from San Giovanni di Ruoti Simpson 1997, illus 35

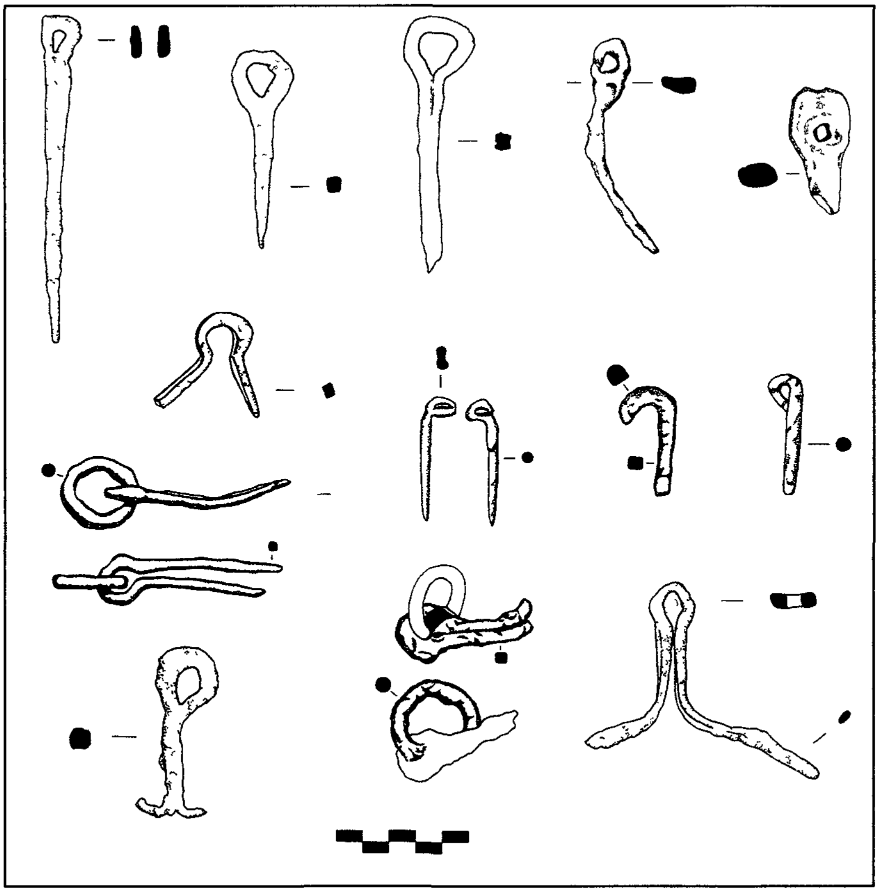

Figure 46 Loop-headed spikes from San Giovanni di Ruoti Simpson 1997, illus 36

A number of loop-headed spikes and split-pin staples were also found (Figure 46).[77] The spikes are of iron and are heavy enough to have been driven into mortar. The prevailing interpretation is that they were placed in wood as pivots for wall-flaps or as tethering for animals. These measure between 4.8 and 12.5 cm and were square in section. The split-pin staples seem to have been for a similar purpose but for lighter-duty application indoors, hanging objects from ceiling or wall, etc. These were between 5.5 cm and 8.5 cm and made of both iron and bronze.

Lydia and Africa

Sardis

The remains of door pivots from Sardis indicate that the shod-post method was in use. Door "shoes", as described by Waldbaum, comprise an iron ring and spike attached to the bottom of a timber post. Only four examples are given; however, they are enough get an idea of the common type: an iron ring approx. 5.0 cm in diameter and just less than 4.0 cm in height, placed between the door pivot and the bottom of the lintel socket, an iron spike (Sardis 'type 3') ca. 5.5 cm long is then driven into the butt end of the post itself (Figure 47). All are dated by the excavator to the Early Byzantine occupation.[78] Crawford notes that all doors in the shops district were bivalve, as evidenced by iron door pins and sockets (6 cm – 9 cm in diameter), set in lead, on both sides of the sills.[79]

One butterfly hinge made of copper was also found (Figure 48). It was 5.5 cm x 3.4 cm with a preserved nail head in each corner of the wings (Sardis 'type 6'), dated to the

[77] Simpson 1997, 52.
[78] Waldbaum 1983, 63.
[79] Crawford 1990, 9.

Late Roman period of occupation. This was the only hinge-like attachment to be deemed structural by the excavator. Other hinges and hinge-straps were believed to be box and casket-fittings.[80]

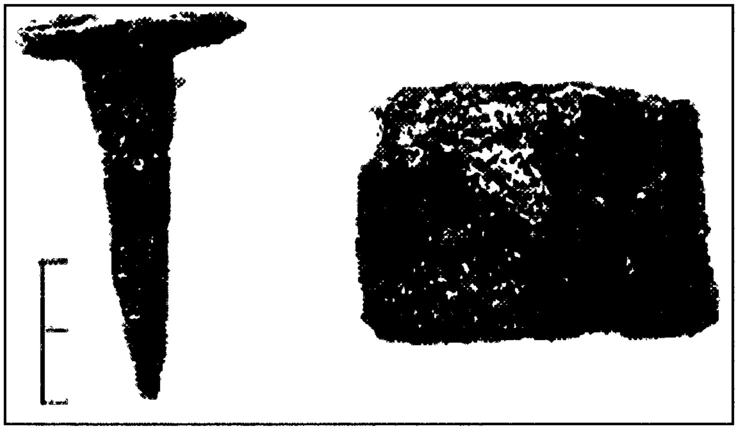

Figure 47 Door pivot pieces from Sardis Waldbaum 1983, pl 18

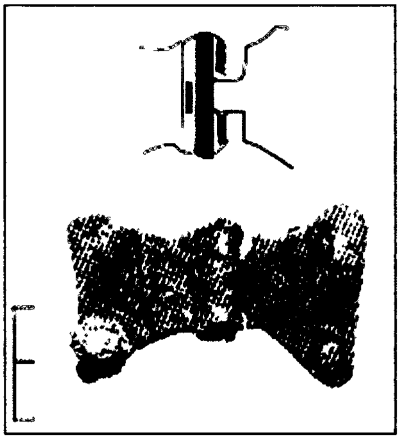

Figure 48 Butterfly hinge from Sardis Waldbaum 1983, pl 18

Karanis

Though no fixtures from Karanis have been published, there is discussion by Elinor Husselman of wooden door and window openings from which we can infer the presence of some objects. Though wood was not a common building material at Karanis, Husselman's reconstruction of the building techniques indicates that inhabitants did use it for framing

[80] Waldbaum 1983, 64.

windows, roofs, and doors in addition to tying the adobe wall masonry together. The roofing is of little interest to us, since socket-construction was used to anchor the beams of split palm. Upper floors were often reeds, palm fonds, or earth, while laid brick or bound thatch was the roof covering of choice. Nevertheless, the doors and windows present the opportunity for fixtures to have been used.[81] The dating for houses at Karanis is broad and imprecise. The two periods of greatest activity, with the most expansion and occupation, were the 'C' and 'B' levels, which correspond to the middle of the 1st century C.E. through the end of the 3rd century C.E. During this time, alternating prosperity and recession caused several periods of renewal and abandonment in the town. The cultural context for the town in this period is therefore Romano-Egyptian.

Figure 49 Door pivot socket *in situ* at Karanis Husselman 1979, pl 45

[81] Husselman (1979, 7) cites doors, door frames (lintels and jambs), window shutters, window sills, and stair treads as all having the potential to be constructed of wood, but only the window shutters and doors were likely to have carried hinge or pivot fittings.

The best evidence for pivots at Karanis is the presence of the familiar socket in the threshold blocks of doors (

Figure 49). From these cuttings we can see that doors were sometimes bi-valve (
Figure 81) and sometimes singular, and functioned the way most doors at this time did: a door was mounted to a post which turned in a socket. It is unclear though whether metal was used to smooth the pivot's action or if the doorpost was unshod in the stone socket. Even less clear is the presence of constructed means of closing windows. Husselman notes that the usual method might have been to force a woven basket, or some similar deformable object, into the opening. Two examples of closable windows are noted however. In these cases, unshod wooden pegs set into cuttings in the window frame served as the pivots for a wooden shutter.

The British Isles

Verulamium

Three forms of Romano-British hinge are identified by W.H. Manning among the finds at Verulamium.[82] They are all made of iron and are either more abundant or, more likely, survived better than at any other site discussed. Most interesting is that the doors are interpreted as having been hung with strap-hinges instead of door-pivots. The three types classified by Manning are as follows:

1. The drop hinge: an L-shaped staple is trapped through a U-shaped staple to create a pivot (Figure 50).
2. The loop linked hinge: two straps terminate in perpendicular interlocking loops to create a pivot (Figure 51).
3. The strap hinge: two straps terminating in congruent loops pivot on a pin inserted into the loops (Figure 52).

[82] Frere 1984.

Almost all of the objects were found in the Antonine fire debris, post 250 C.E. Manning notes that they were affixed largely with Verulamium Type 1 nails. Lengths from 8.1 cm to 13.2 cm.

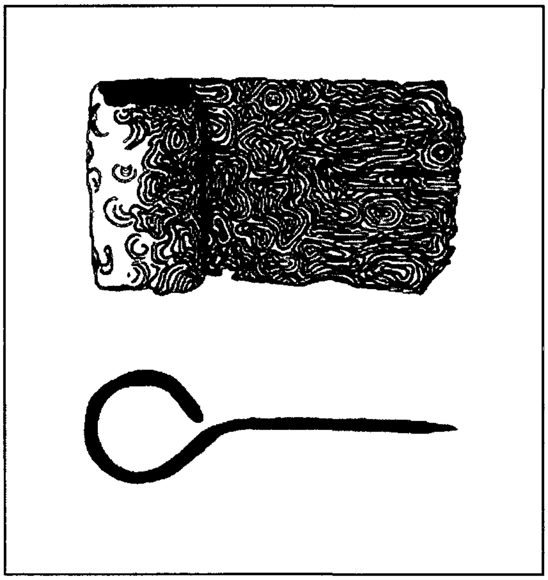

Figure 50 Drop hinge from Verulamium Frere 1984, fig 42

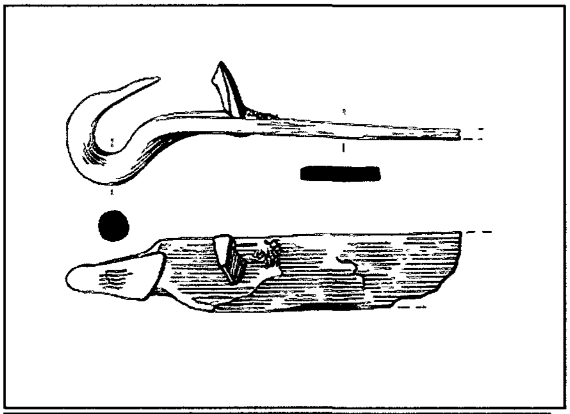

Figure 51 Loop linked hinge from Verulamium Frere 1984, fig 42

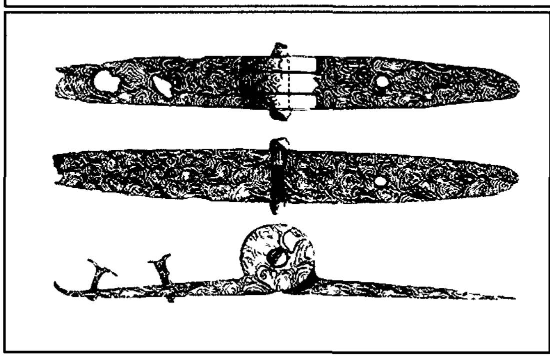

Figure 52 Strap hinge from Verulamium Frere 1984, fig 42

Fishbourne

A number of hinges were found at Fishbourne which give an excellent illustration of the hinging mechanisms used by Romans in the 1st, 2nd, and 3rd centuries C.E. All of the objects were found in the destruction layer, which hints at a later rather than earlier date within the occupation period.

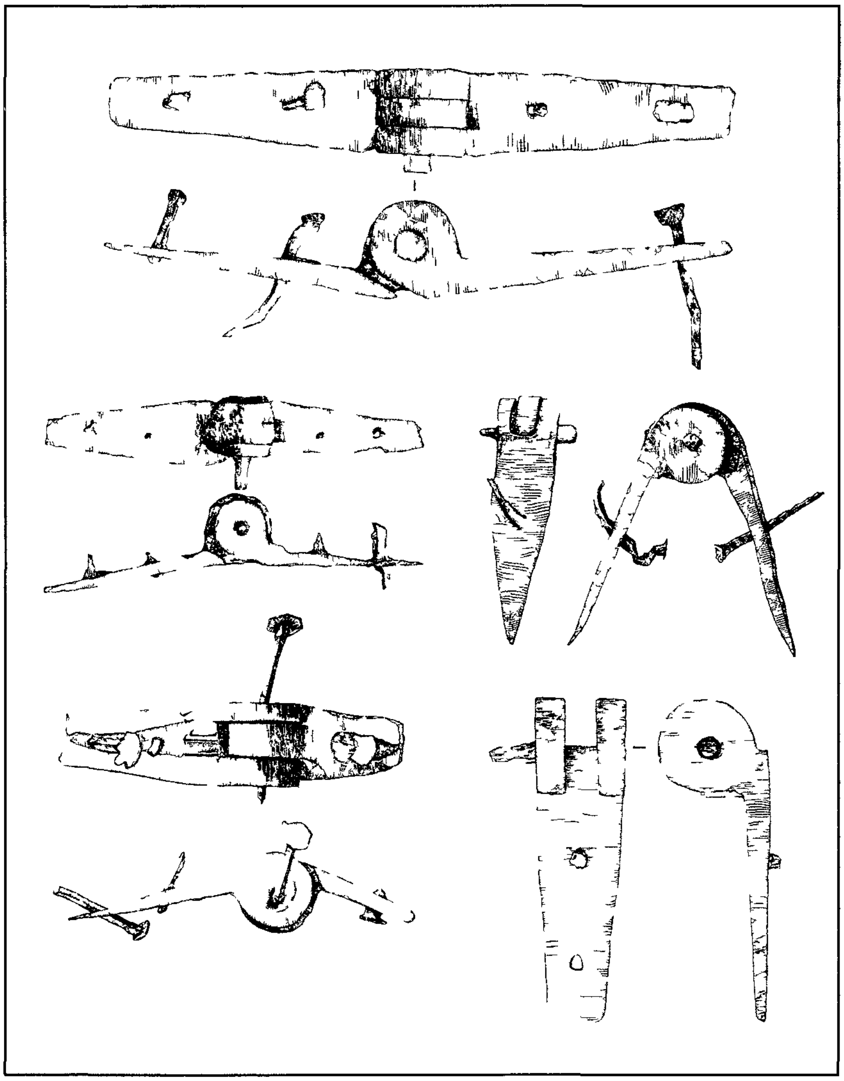

Figure 53 Strap hinges from Fishbourne Cunliffe 1971, fig 56

The five iron strap type hinges which were published in the excavation report are the only other type of door pivot besides the post-and-socket style. Being between approximately 16.0 cm and 9.0 cm long, and held in place by two nails through each leaf, these hinges could easily have supported the weight of a door if used in tandem or trios. All specimens exhibit evidence of their mounting-nails in the form of corroded heads or protruding shafts (Figure 53). Interestingly, the pivot pin, which appears to be a forged rivet in four of the hinges, has been replaced with a bent-over nail in one of them.[83]

At least one loop-linked hinge, made of iron, was also found. Comprising two eyeleted straps hooked together, this pivot could not have been sturdy enough for a door, but might have hinged a window or wall-flap from above. The hinge measured approximately 27.0 cm in length. Three iron nails are preserved penetrating the leaves, which shows us that is was mounted with two nails at either end of each leaf (Figure 54).[84]

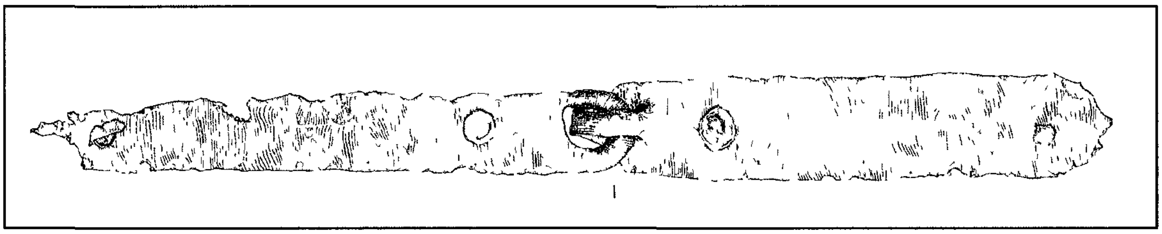

Figure 54 Loop-linked hinge from Fishbourne Cunliffe 1971, fig 57

Brading Villa, Isle of Wight

The excavation of a villa in Brading, on the Isle of Wight, yielded eight examples of iron 'hook and loop' door hangers (Figure 55); a fixture which was likely very common all over, but is poorly attested outside of Britain.[85] Although Cleere notes the purpose of these hangers is still somewhat vague, he suggests that they might have been used as a simple form of hinging for doors and gates. The fixtures are L-shaped, with one square and one

[83] Cunliffe 1971, 128.
[84] Cunliffe 1971, 131.
[85] Cleere 1958, 59.

rounded branch. Theoretically the square prong was driven into a wooden doorframe while the rounded branch provided the pivot for a corresponding brad or split-pin loop in the door. The hooks range in length from 5.0 cm to 7.6 cm.

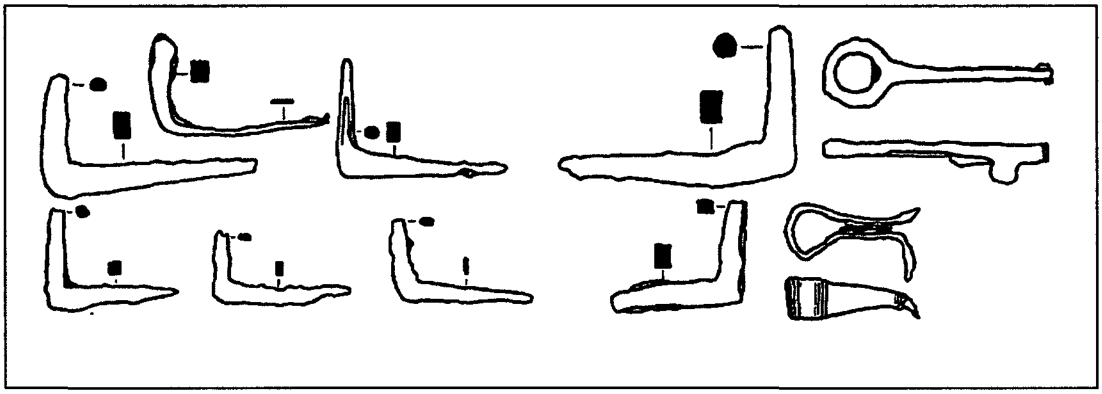

Figure 55 Door 'hooks' from the Brading villa Cleere 1958, fig 4

In addition to the door hangers, six iron strap hinges were catalogued. These are well preserved and similar to other Romano-British examples (Figure 56). The largest of these are 20.0 cm long and approximately 3.0 cm wide; suitable for hanging a large wooden door or gate. Nail fragments on all the specimens indicate that they were mounted with two iron nails through each leaf.

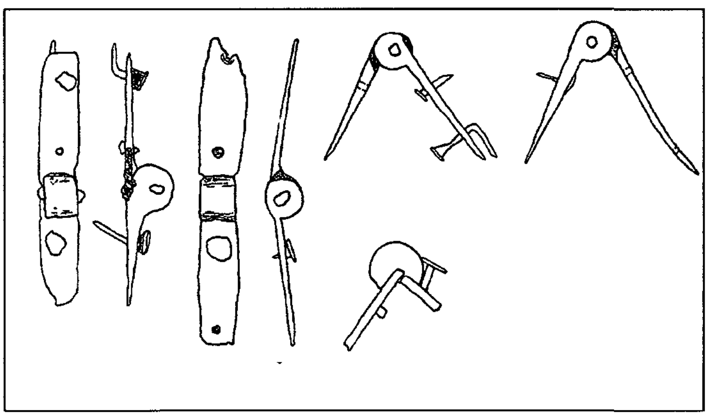

Figure 56 Iron strap hinges from the Brading villa Cleere 1958, fig 5

Conclusions

Essentially two types of pivoting fixture have been discovered in the ancient Mediterranean. The older of the two, the shod-post pivot, seemed to enjoy almost universal use until approximately the end of the 1st century B.C.E. After this, use of the shod-post pivot continued, as attested by its use in the Late Imperial and Byzantine periods at Sardis, Italy, and Britain, but it was replaced by the strap hinge as Roman techniques were adopted. Conversely, although there is a Classical example of a primitive strap hinge from Isthmia, the fixture was clearly not perfected or used commonly until the century before the Common Era, when Roman craftsmen seem to have refined a style of hinge strong enough to be widely useful. During and after the 1st century C.E., Roman-style strap hinges are found at many sites, indicating that Roman influence carried the technique to other regions. Since the strap hinge is apt for more than hanging doors, we can speculate that previous hinging needs, such as shutters, which were previously satisfied with looped eyelets, ring-pulls, or textiles, could have been served by light strap hinges from then on. Given the relationship between architecture and other fixtures, such as the nails used for mounting, more investigation into this development is clearly warranted.

SECURITY

Probably the most commonly studied fixtures are keys and locks. Together referred to here as 'security' objects, these fixtures have fascinated scholars in recent years so that much information, and even some coherent typologies, have been proposed for some regions. Of great interest is the fact that locks were both structurally mounted, generally inside the wall adjacent to the doorway, or self-contained in the form of a padlock. It is not yet clear what dictated the use of one method over the other.

Below is a summary of security-related finds from many sites in the Mediterranean followed by a discussion comparing them. See Appendix A for a more detailed description of the various lock mechanisms encountered.

Greece

Isthmia

A number of keys were found at Isthmia which cannot be positively identified as structural versus for use on furnishings.[86] It is reasonable, however, to assume that the smaller specimens were used with a smaller locking mechanism, and so would not have been used on something as heavy as a door. Given this, just three items need to be considered here: one bronze key, Hellenistic, solid-cast and measuring 5.9 cm in length (Figure 57) with a Z-shape and four drilled holes; likely for use in a tumbler lock and two iron keys, Hellenistic and Classical, 4.4 cm and 8.0 cm in length, L-shaped with a ring at one end; likely for use in a slide lock (Figure 58). Though there are few specimens, the variation and sophistication of the finds suggests an advanced knowledge of securing techniques.

[86] Raubitschek 1999, 136.

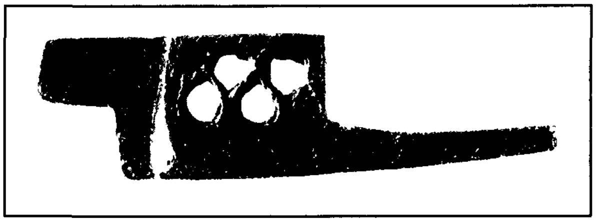

Figure 57 Bronze key from Isthmia
Raubitschek 1999, pl 75

Figure 58 Iron key from Isthmia
Raubitschek 1999, pl 75

Corinth

Of the many keys described in the Corinth publication, only a few are relevant for us, since many have been dated from the 10th century C.E. onwards, and are examples of early medieval technology rather than ancient. The locks are poorly described and are Early Byzantine in date. In the preamble on locks and keys, Davidson groups the keys into three "varieties" as a means of roughly categorizing them. Of interest here are Type (a) (Roman, 1st to 3rd century C.E.) and Type (b) (Roman, 3rd and 4th century C.E.). These describe the type of small Roman keys which have become commonplace at many 1st to 3rd century Roman sites (Figure 59).[87]

[87] Davidson 1952, 137; cf. Birley 1997, Cunliffe 1971, and Manning 1985.

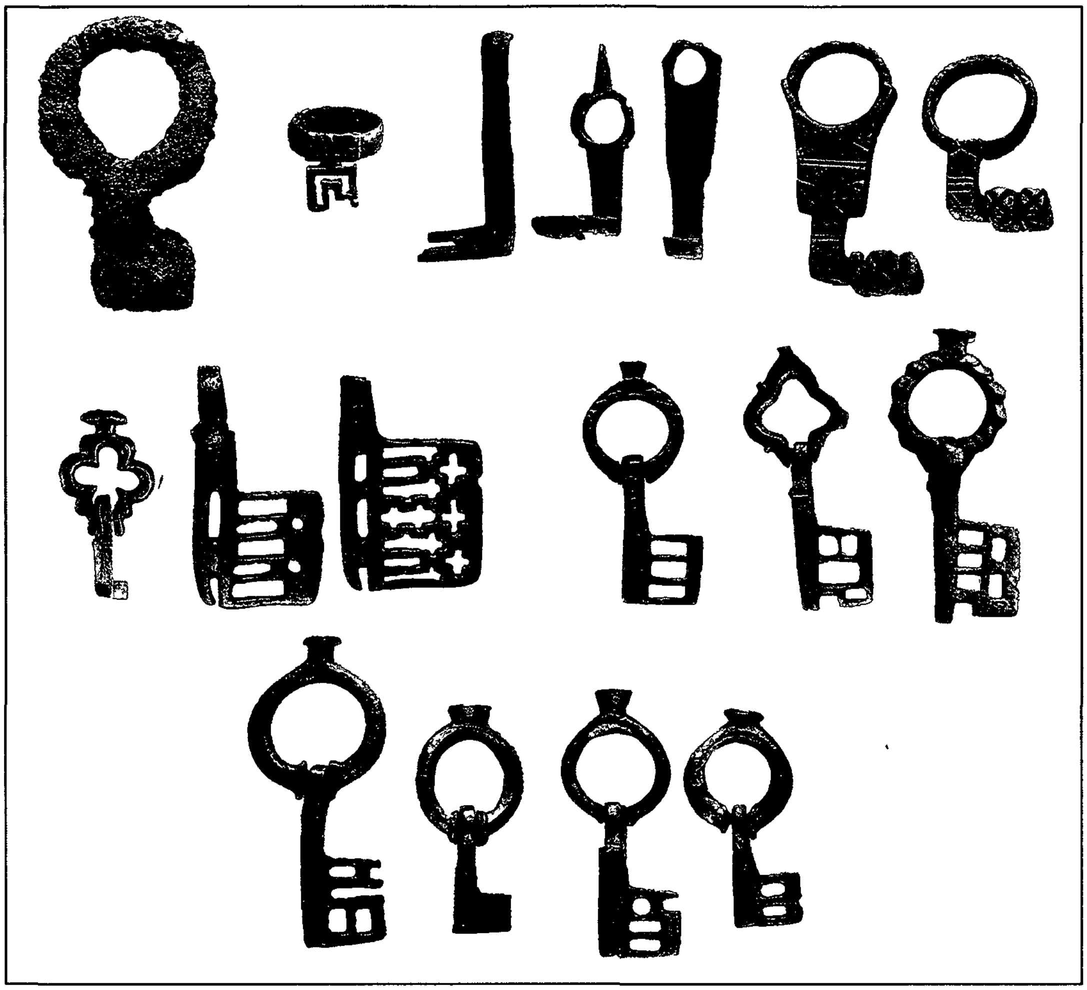

Figure 59 Various keys from Corinth Davidson 1952, pl 70

Both Type (a) and (b) keys are L-shaped and for use in a primitive tumbler lock. Called Slide-Keys, the two types identified by Davidson are essentially W.H. Manning's "Type 1 L-Shape".[88] Because of Manning's persuasive categorization and Davidson's proposed date ranges, it is easy to conclude that the Corinth Type (b) key is essentially a later form of the Corinth Type (a). Three examples of Davidson's Type (a) and six examples of Type (b) are described in the Corinth publication. These are all of bronze with the exception of one Type (b) key, which is of iron (Figure 59, top left). The Roman Corinth

[88] Manning 1985, 92.

keys range evenly in length from 2.8 cm to 5.9 cm. Note that although only nine keys are described by Davidson, many more appeared in the publication's plates.[89]

Stymphalos

Three or four "hook" keys were found at Stymphalos which probably had a practical function in either the Temple or Building A of the acropolis sanctuary, although a votive or ceremonial function cannot be ruled out.[90] In comparison to similar keys from Olympia and Mt. Lykaon, the four iron objects have most of the characteristics of Lakonian keys, but are rudimentary even for keys of that type. A squared iron bar is bent into a loop at one end to form the grip while the opposing end is bent at 90° to form the bit. The Stymphalos examples are broken, but their preserved lengths are 8.9 cm, 4.6 cm, 8.6 cm, and 5.0 cm respectively.

Olynthus

Since the metal padlock was not yet a common device in the Classical period, the primary means of locking doors at Olynthus seems to have been the slide lock. One complete key and a fragment of a key for this type of lock were found. The complete specimen is bronze, 7.0 cm long, and Z-shaped (Figure 60, middle). There is evidence that it was fitted to the end of a wooden handle. The fragment is long enough to determine the shape of the bit.

[89] Davidson 1952, pl. 70 and 71.

[90] Excerpt descriptions of the Stymphalos keys were generously provided by G. Schaus from the forthcoming publication of that site.

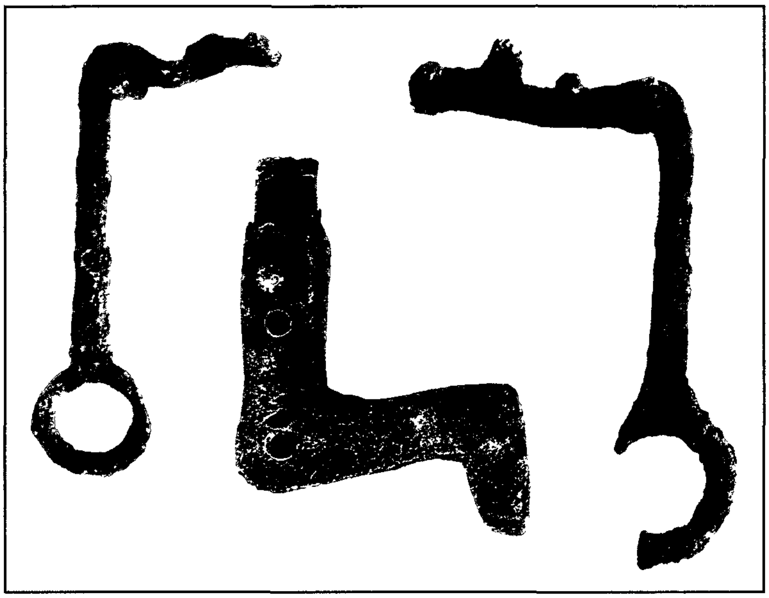

Figure 60 Lakonian and slide keys from Olynthus Robinson 1941a, pl 165

Also found were seven Lakonian keys from the Classical period, the oldest ever uncovered (Figure 60, left and right). All are made of iron and have three or four teeth at different angles. Each example varies with respect to the length of the handle and bit, though none are longer than 11.0 cm.

Italy

Insula of Menander at Pompeii

Given the urban context of the Insula of Menander, it is not surprising that there was an obvious preoccupation amongst its inhabitants with security. Concentrations of people generally breed problems of security and the centre of Pompeii was no different. A great number of fixtures and objects associated with security were catalogued by Penelope Allison and are described below.[91]

Only one of the14 catalogued keys from the Insula are bronze; the rest are iron. Most of these are discernibly L-shaped, though others are too corroded to tell for sure what type of lock they might have turned (Figure 62). As with other Roman keys of this period, they appear to have been cast and then filed to the more precisely required shape. All of the keys from the Insula are less than 12.0 cm long and have a rectangular-sectioned shaft.

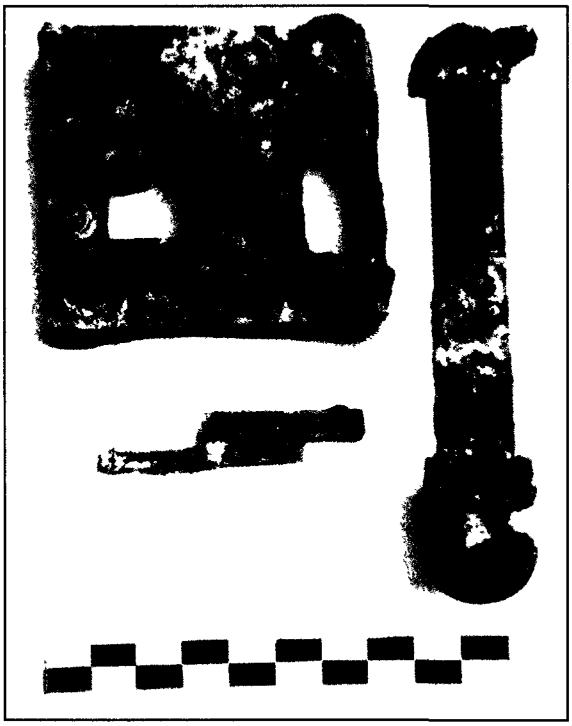

Figure 61 Remains of a Roman padlock from Pompeii Allison 2006, pl 71

Allison describes 47 locks or lock fragments, but only 18 lock plates. It is worth observing that Allison chose to combine the finds of locks and lock plates into a single table, presumably since the presence of either is evidence of a security device. For the sake of distinguishing unfixed locks, which might have been on a chain or bolt, from structurally

[91] Allison 2006, 466.

integrated locks which might have been a part of a door or doorframe (evidenced by a lock plate), it should be noted that there are more than twice as many locks as lock plates.[92]

Interestingly, the round, rectangular, or square lock plates are without exception made of bronze (Figure 63), while the square locks are predominantly of iron. As has been suggested above with regards to more than one other object type, polished bronze was likely preferable in antiquity to iron, which would explain why structure-mounted pieces such as lock plates might have been exclusively fashioned from bronze.

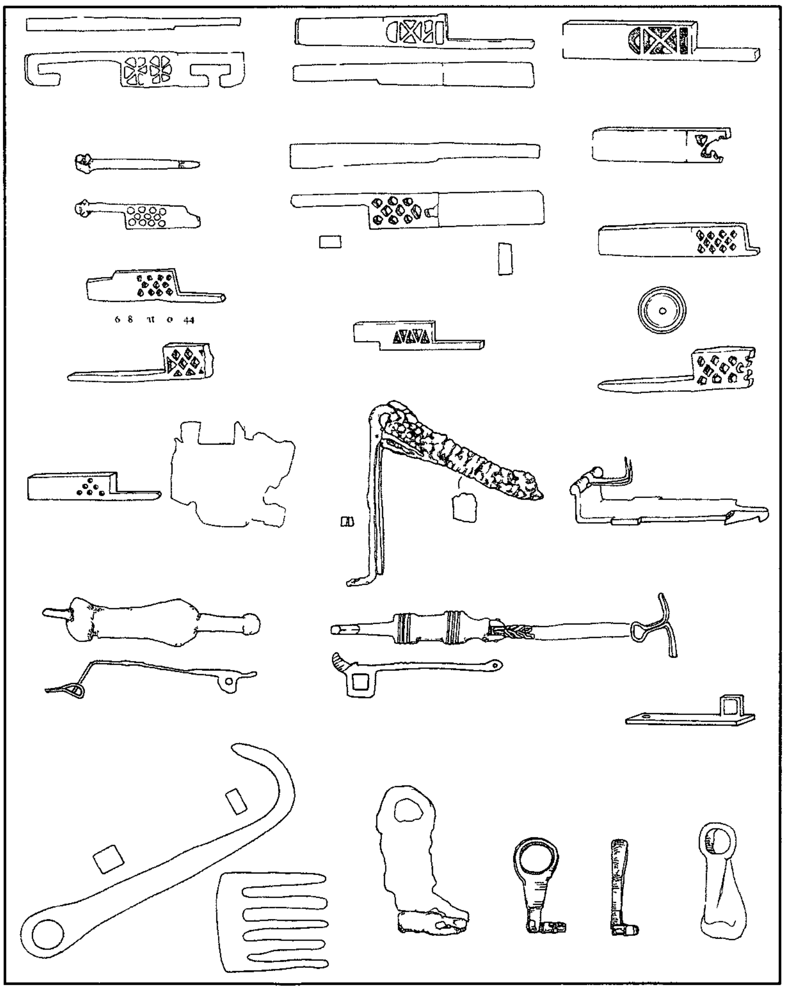

Figure 62 L-Shaped keys from Pompeii Allison 2006, fig 63

[92] Allison 2006, 466.

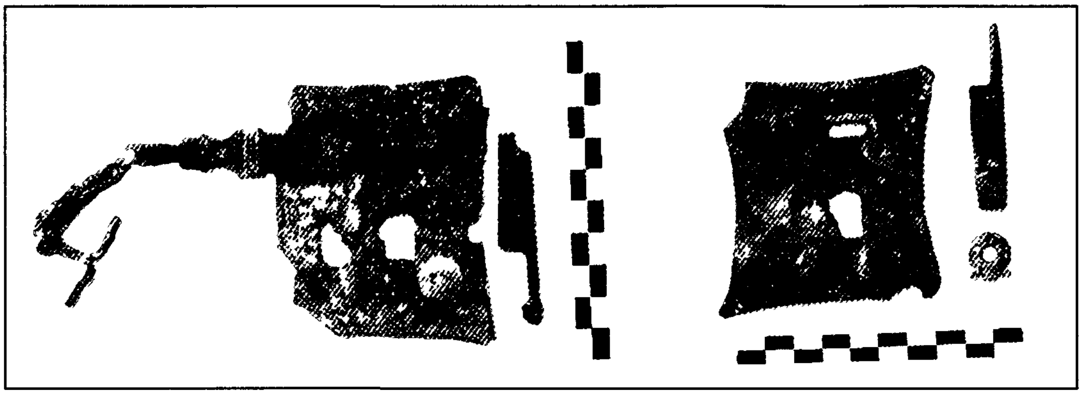

Figure 63 Remains of a mounted lock plate from Pompeii Allison 2006, pl 93

Allison describes the three types of lock mechanism in use at the Insula: a simple tumbler lock, a more complex tumbler lock which had to lift the tumblers first, and then two types of slide lock which are comparable with barb-spring locks (Figure 61, Figure 64).[93] Obviously there was sufficient technology and metalworking skill available at Pompeii to produce varying degrees of security depending on the application.

The dimensions and form of the locks follow the pattern also seen at Romano-British sites: Padlocks are generally square, approximately 10.0 cm to a side and a few centimetres thick. The position of the keyhole depends on the type of mechanism within the casing. The mechanism and functioning of the mounted locks is less clear, since all we generally have of them are their plates.

[93] Allison 2006, 31.

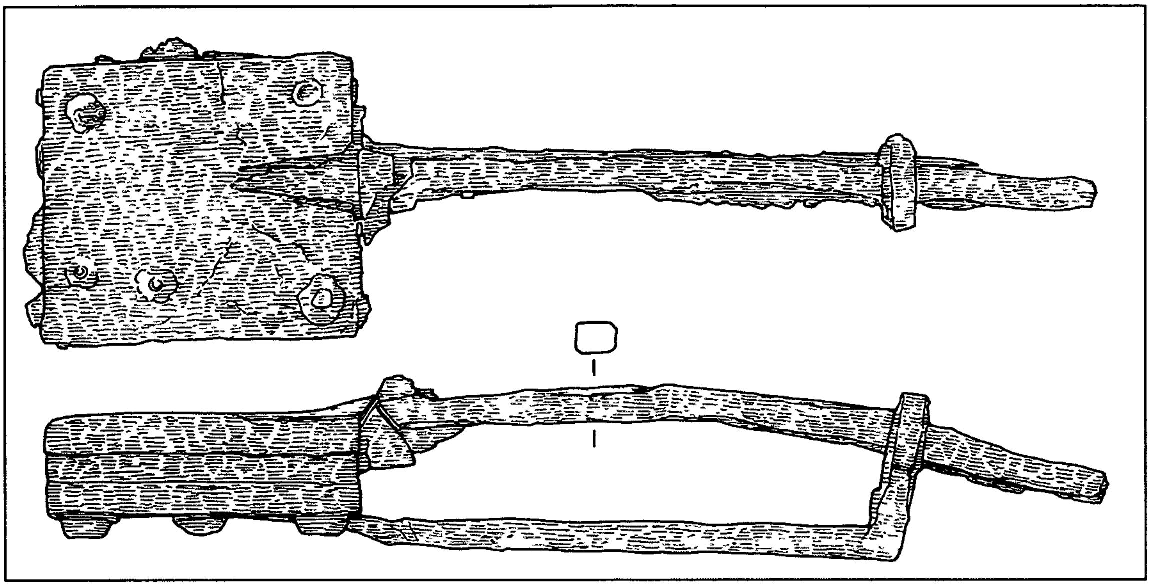

Figure 64 Barb-spring padlock from Pompeii Allison 2006, fig 57

San Giovanni di Ruoti

Seven keys of iron and bronze as well as a single lock plate are the only security finds from San Giovanni (Figure 65). Two of the keys are broken so that neither their type

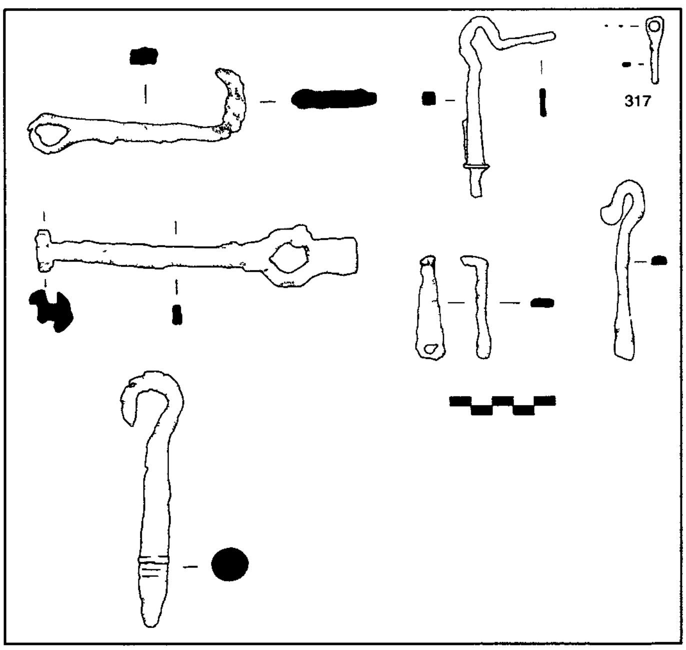

Figure 65 Keys from San Giovanni di Ruoti Simpson 1997, illus 35

nor original length can be determined. Among the intact keys, one is for a tumbler lock, two are latch-lifters, one is a slide key, and one is a rotary key. The lengths for the intact keys range from 5.0 cm to 15.4 cm, and are likely a function of the corresponding lock's size and weight. The lock plate is fragmentary and of iron, 0.5 cm thick.

Lydia and Africa

Sardis

Numerous objects associated with security were found at Sardis. The locks themselves are examples of the complex devices being manufactured towards the end of the Roman period. One shop excavated at Sardis has been interpreted as a locksmith's due to the number and variation of devices and parts found there.[94] Both iron and bronze objects are attested, though all are described as quite badly corroded. The locks are divided into two types, rectangular (Figure 66, top two rows and bottom right) and cylindrical (Figure 66, bottom left), by Waldbaum. Though the rectangular type is more common, there is a good representation of both. The mechanisms of these locks are not clearly discernible, but from the position of keyholes on the cases, there seem to be examples of both lever and tumbler locks meant to be opened with both T-shaped and L-shaped keys (Figure 67). The size of these devices ranges from the smallest rectangular lock at just 3.8 cm x 4.1 cm to the largest cylindrical example at 5.0 cm x 10.0 cm. Waldbaum compares the types of lock found with examples from Britain, at Verulamium, Caerleon, and Fishbourne particularly.[95]

[94] Building E 10 / 11 in Crawford 1990, 73.
[95] Waldbaum 1983, 69.

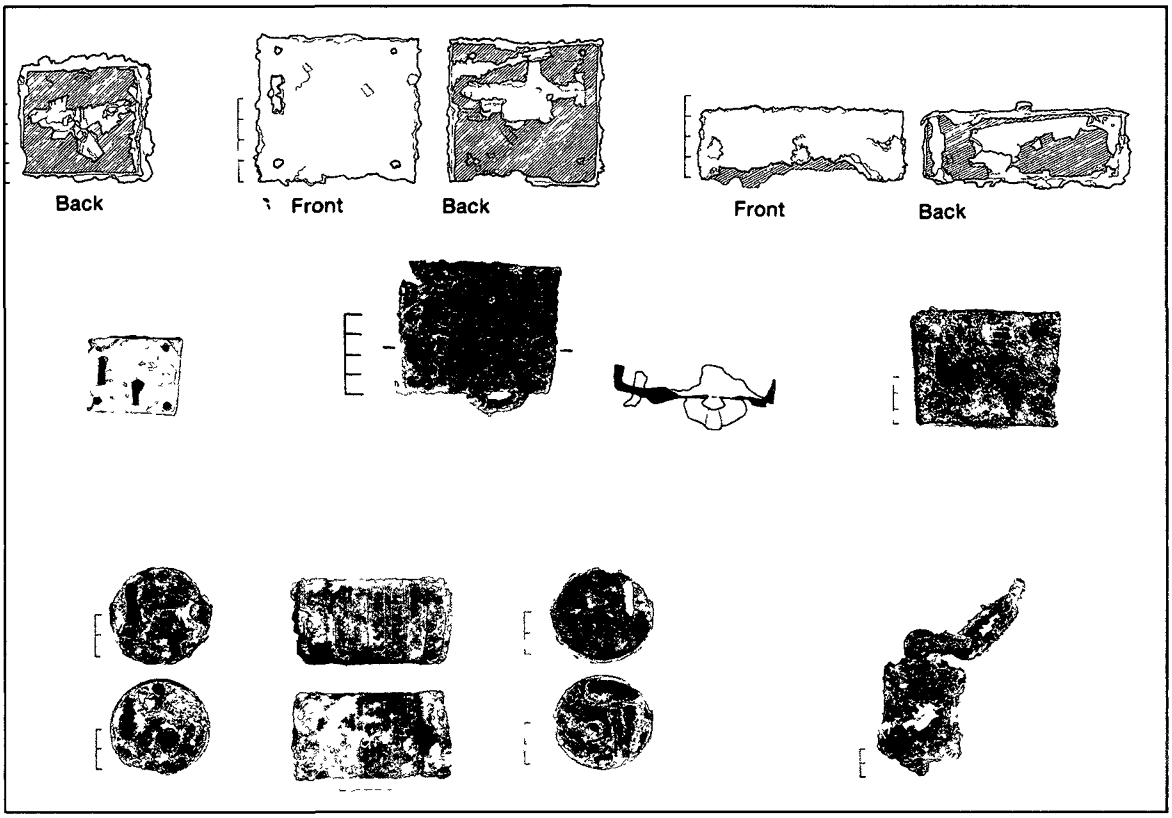

Figure 66 Rectangular and cylindrical locks from Sardis Waldbaum 1983, pl 23

The keys from Sardis were made of both iron and bronze (Figure 67). Waldbaum concludes that the largest were surely for doors and larger padlocks, of both tumbler and lever types, while the smaller keys, which comprise the majority, were for boxes and trunks. Examples of the Roman ring-key were found (Figure 67, third from top right). The larger keys were up to 13.0 cm long, while the smallest were barely 1.0 cm. The keys are dated largely to the Late Roman and Early Byzantine periods. [96]

[96] Waldbaum 1983, 74.

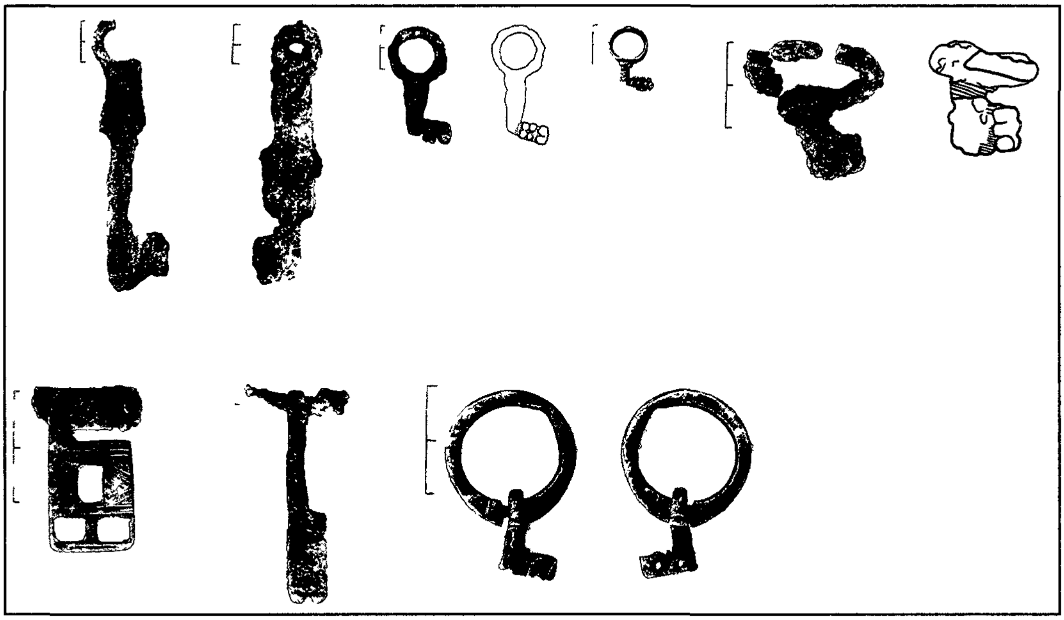

Figure 67 Various keys from Sardis Waldbaum 1983, pl 25

One iron latch from the Late Roman period was also found (Figure 68). This consisted of a flat bar with a pronounced hook at one end. The pivot was an iron nail fitted through a hole at the end of the bar opposite the hook. The receptacle for the hook was not found. The full length is 21.0 cm, a height 2.5 cm, and a thickness of 0.7 cm.[97]

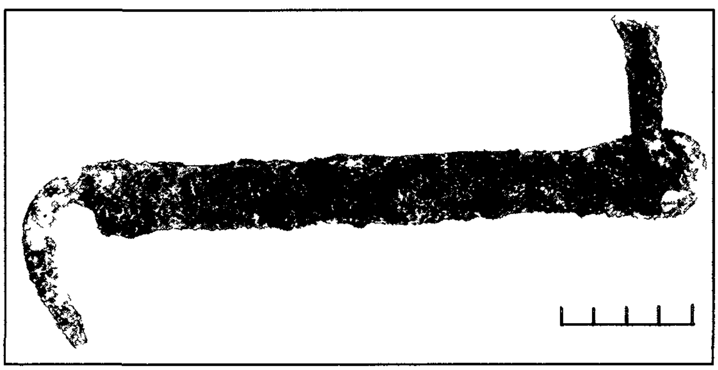

Figure 68 Iron latch from Sardis Waldbaum 1983, pl 18

[97] Waldbaum 1983, 64.

Karanis

Though no actual objects have been published from Karanis, as discussed above, Husselman proposes that the so-called "Homeric Lock", also known as a slide lock (Figure 69), was in use at the site.[98]

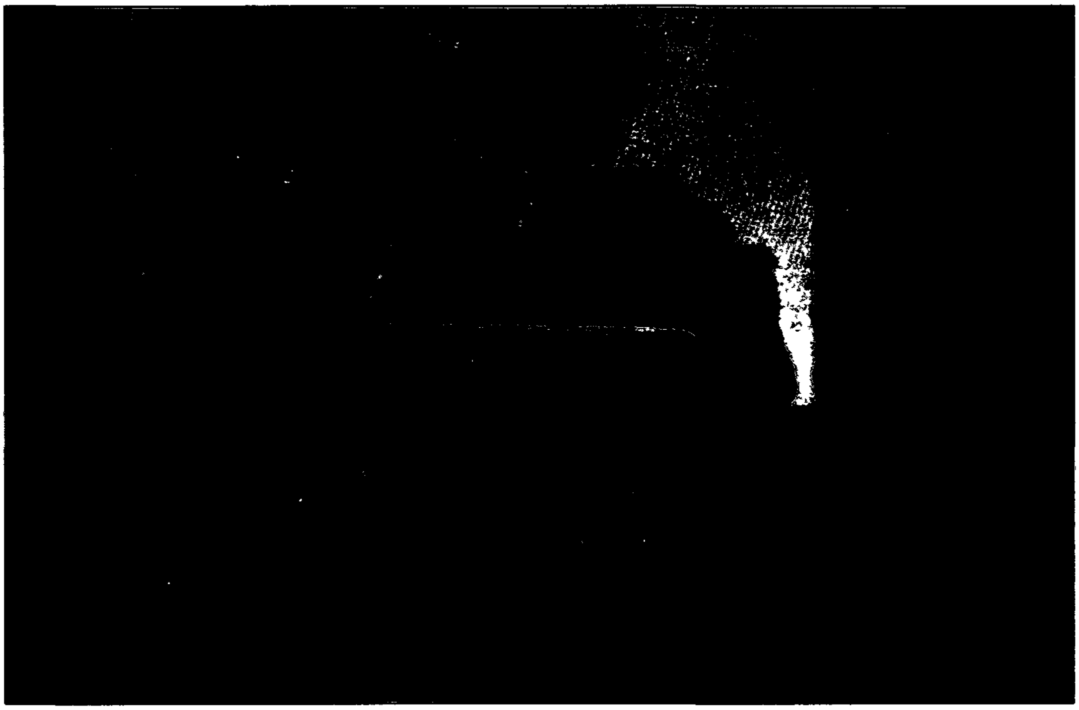

Figure 69 Wooden bolt for slide lock in its doorway casing at Karanis Husselman 1979, pl 48

The British Isles

Verulamium

Both bronze and iron locks and keys were uncovered at Verulamium. Discussed by R. Goodburn and W.H. Manning in S. Frere's publications of Verulamium, the published finds comprise an assortment of Imperial Roman security technology.[99]

[98] Husselman 1979. See Appendix A for description.
[99] Goodburn 1984, 19; Manning 1972b.

Two ring-keys (Figure 70) are discussed first, both from the 4th century. These operated lever-locks which were not found. The keys are of iron, and show signs of wear on the ring which suggest that they were worn day-to-day as jewellery.

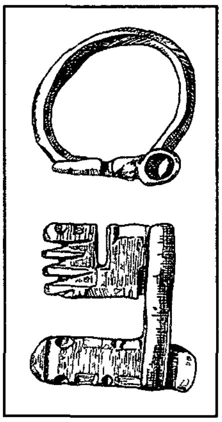

Figure 70 A Roman ring-key from Verulamium Frere 1984, fig 18

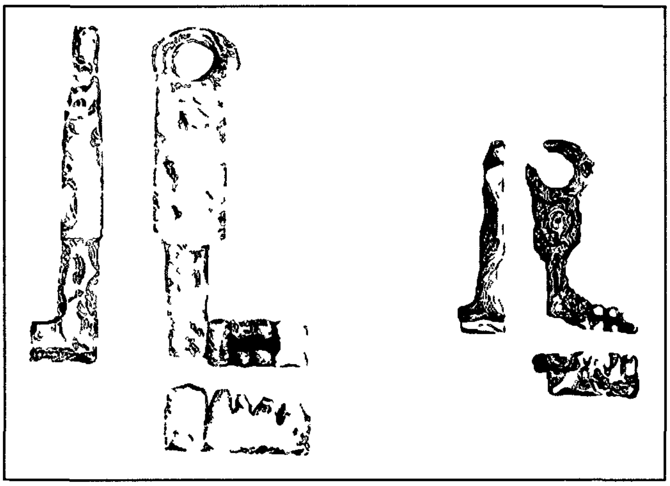

Figure 71 L-shaped tumbler lock keys from Verulamium Frere 1984, fig 41

Two tumbler-lock keys (Figure 71) and two tumbler-lock bolts were found, dating from the 2nd to 4th centuries. These were probably cast and then filed to the more specifically required shape.

A third key that was found is particularly interesting due to its chipped lion's head handle. Made of iron, the head of a roaring lion erupts from a square of calyx leaves. This decorated bolt in a military context implies particular importance, if not ceremonial value, for the secured goods. Common soldiers' chests would likely not be so ornate unless they themselves were spoils. No information is given about the findsite of this object to help us, but speculation about this being the paymaster's key or the key to a legate's private property is not unreasonable.

The remaining bronze objects are indeterminable lock components. Due to the softness of bronze, it might have been preferred for tumbler-lock bolts, as the three examples here, so that the holes for the tumblers could be easily worked on a very fine level. The same softness, however, has made them more prone to damage so that they are now difficult to interpret.

The iron objects are an assortment of fragmentary lock casings and corroded keys. Manning positively distinguishes four types of lock as being used, though no mechanisms survive completely. These are latch-lifters, lever locks, barb-spring padlocks, and tumbler locks. The lock casings indicated that padlocks were largish, approximately 10.0 cm to a side on average, and consisted of the mechanism being sandwiched between two plates of iron or bronze. There is one example of a lever padlock which was in a cylindrical casing. The size of the keys, of which there were all four types, range in size. The shortest example was just 5.5 cm long, while the longest was 22.0 cm long. The size of the key was naturally a function of the size of the lock, which was no doubt dictated by its use. We can therefore conclude that all of these types of locks were used interchangeably in a variety of situations.

Fishbourne

A number of iron keys were discovered at Fishbourne and discussed by Barry Cunliffe in the site's publication,[100] while a remarkably intact iron padlock was also found which was interpreted by W.H. Manning.[101] The seven keys vary in length and type (Figure 72). The longest is approximately 13.0 cm while the shortest is just 4.5 cm. Most are L-shaped, though there is one T-shaped example. Six of the keys are for use in a slide lock, while one in particular is for activating a rotary lock, according to Cunliffe.

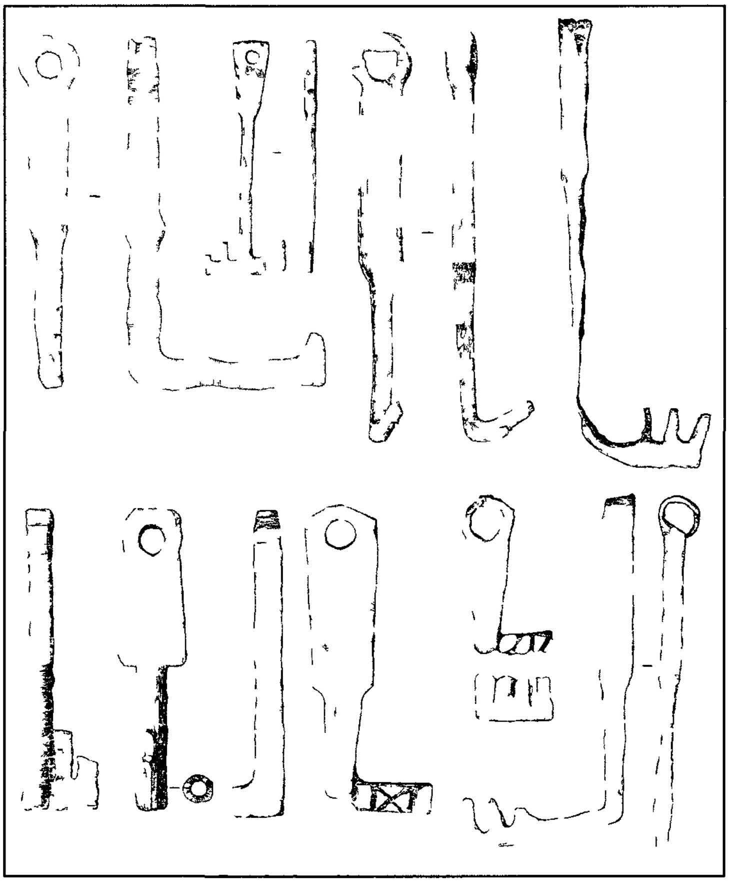

Figure 72 T-shaped and L-shaped keys from Fishbourne Cunliffe 1971, fig 58

[100] Cunliffe 1971, 131.
[101] Cunliffe 1971, 140.

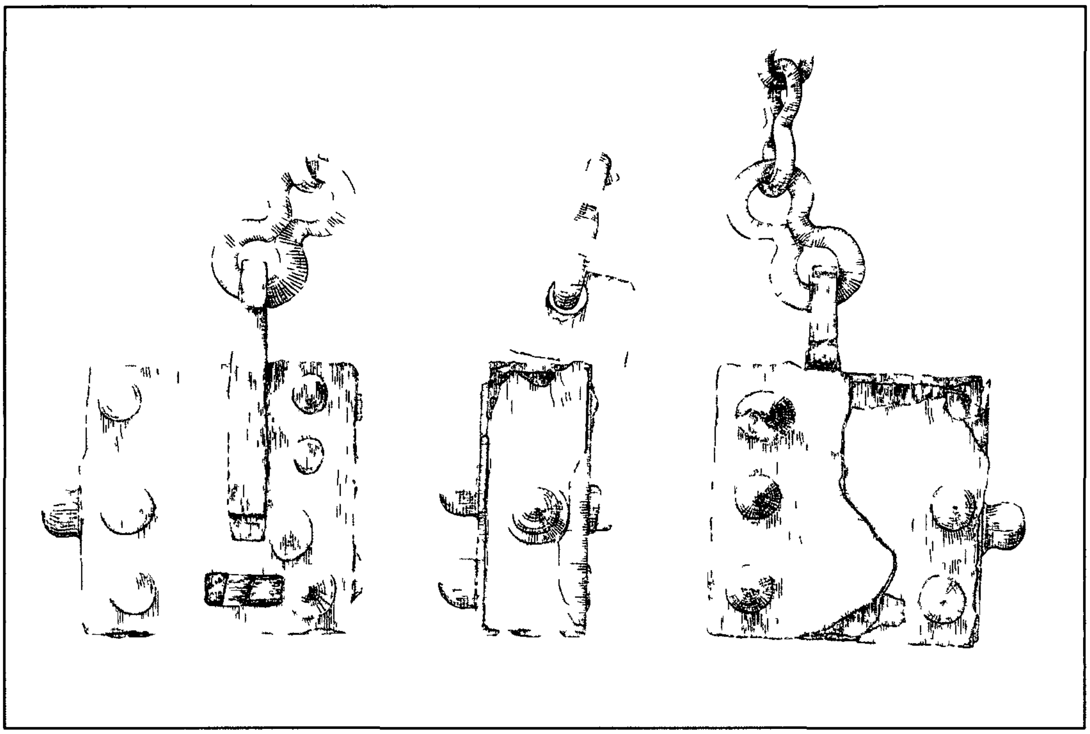

Figure 73 A Roman padlock from Fishbourne Cunliffe 1971, fig 64

The iron padlock is a uniquely well-preserved example of a lever-lock (Figure 73). Through x-ray photography, Manning was able to propose a description of the original mechanism. First of all, the keyhole was hidden and protected by a thin plate of iron which needed to be rotated aside to insert a key. With the key inserted, its shaft would have been rotated to force a spring aside. With the spring lifted, the bolt would have been free to slide out of the casing. The key could have been removed and the lock closed simply by pushing the bolt back in beyond the spring-loaded catch. The level of sophistication displayed by this object is an example of the abilities of Roman metal smiths in this period.

Brading Villa, Isle of Wight

A number of security objects were found at the Brading Villa on the Isle of Wight.[102] Among these are a number of iron rods which are suggested by H. F. Cleere to be latch-lifter keys. He notes some alternative interpretations of the rods as *strigils* or cauldron handles, but argues for them being latch lifters based on their weight and curvature.

Less vague than the latch lifters are five iron keys with bronze handles for use in tumbler and barb-spring locks. These are described as being between 5.0 cm and 11.5 cm long and badly corroded.

Vindolanda

The Vindolanda finds are of particular significance because of the excellent preservation at the site.[103] An anaerobic environment allowed for the survival of numerous locks, keys, and bolts in iron and bronze, even bone and wood, occasionally in situ. Moreover, the locks did not simply survive to be type-identified, but were preserved in such a condition that many of their mechanisms could be examined. As a consequence, there is both a large number and large variety of finds from Vindolanda that shed light on Roman locking techniques as well as technical metal working skills. Of note is that the excavators at Vindolanda used the system of categorization established by W.H. Manning in his survey of iron objects in the British Museum.[104]

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[102] Cleere 1958, 61.
[103] Birley 1997. Correspondence with the author has revealed that since the publication of the 1997 volume, roughly 50 more keys and several locks have since come to light.
[104] Manning 1985.

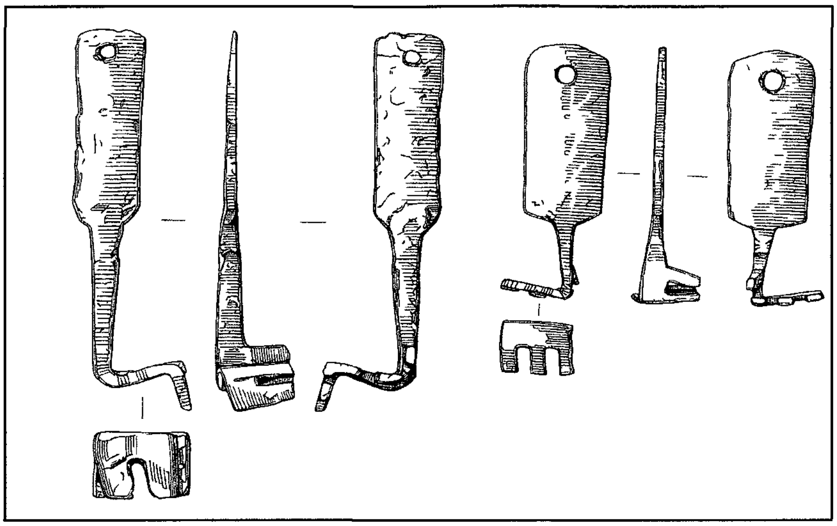

Figure 74 Keys for use in a barb-spring padlock from Vindolanda Birley 1997, fig 1

The context of these finds is largely military since the majority of material has come from the 1st and 2nd century C.E Roman fort that stood at Vindolanda. Being one of the longer-established forts, certainly longer than some of the smaller barracks along Hadrian's Wall (it predates the wall), the Vindolanda fort was accompanied by a small town. From this town we have finds from religious, commercial, and domestic contexts as well. Looking first at the keys, the first type discussed by Birley is the barb-spring key for use in a padlock (Figure 74). Most of the ten iron keys are from Vindolanda Period V and VI (120 – 180 C.E.). The barb-spring key being necessarily of a single form, there is not much variation in shape; though half of the keys have only one bit while the rest have two or three. In length the keys range from 8.5 cm to 15.1 cm.

The slide keys, for use in a door-mounted slide lock, are subdivided into two groups: L-shaped and Z-shaped bits. The former contains four iron examples from the last three periods of occupation (160 to 400 or later C.E.), ranging in length from 11.9 cm to 17.6 cm.

The latter possessed nine iron and bronze examples from all periods except the first (90 to 400 or later C.E.), and were between 5.3 cm and 11.2 cm in length.

Lift keys are the most frequent form found at Vindolanda; variations within this type of key, however, owing to variations in the lift-lock mechanism, make for three sub-types: T-shaped keys, L-shaped keys, and latch-lifters (Figure 75). The T-shaped key is found from

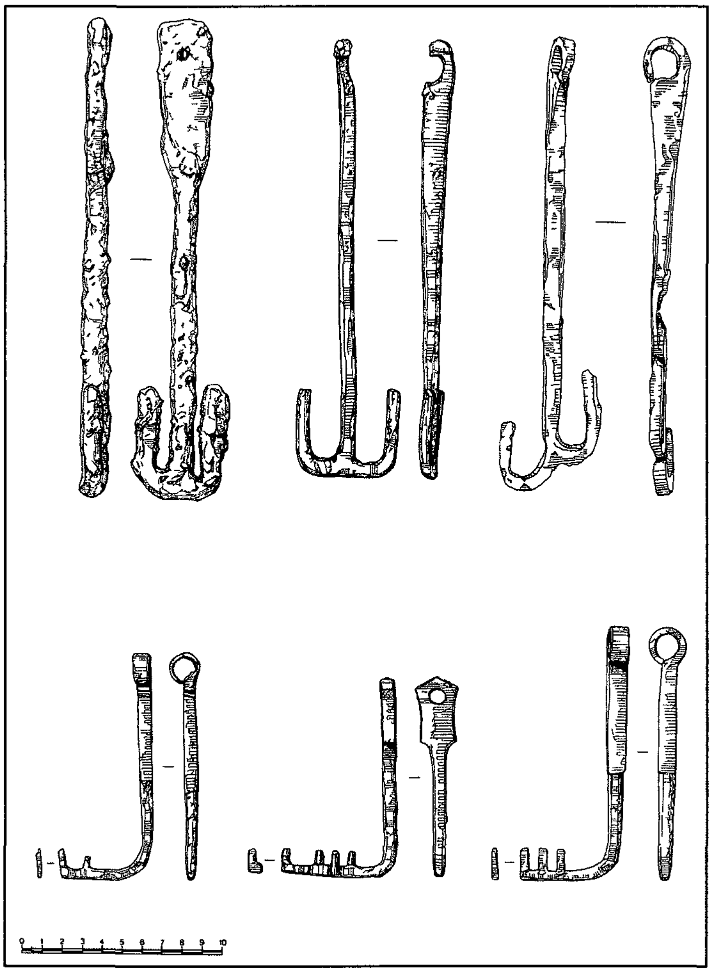

Figure 75 Lift keys from Vindolanda Birley 1997, fig 4

period IV onwards (105 to 400 or later C.E.) and the seven examples are exclusively made of iron. In length the T-shaped keys range from 4.0 cm to 23.5 cm. The twenty examples of L-shaped lift keys date from Period II onward (90 to 400 or later C.E.) with a concentration in the Antonine period. The length of L-shaped keys ranges from 9.1 cm to 17.1 cm. Of the latch-lifter, finally, there are only two iron examples, dating late in the site's occupation, with lengths of 5.9 cm and 9.5 cm respectively.

The rather novel Roman ring (or 'finger') key appears six times in the Vindolanda catalogue, all being dated from Period VI onwards (160 to 400 or later C.E.). All but two keys are of bronze; the others are of iron. Notably, the keys which still possess their bits are for use in a tumbler lock (Figure 76).

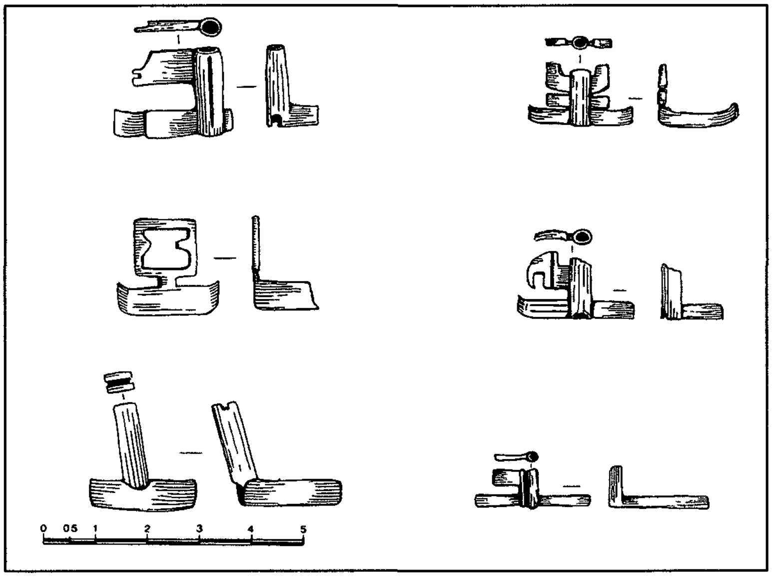

Figure 76 Roman ring keys from Vindolanda Birley 1997, fig 7

Finally, though they are not strictly speaking a part of this study, bone and wood latch-lifters were also a "common find" at Vindolanda according to Birley. The relative frequency of these objects is affected by the fact that conditions for their preservation only existed in certain strata. That being said, there were six wood and five bone examples from Periods III, IV, and V (97 to 140 C.E.). They range from 5.0 cm to 14.1 cm in length.[105]

[105] Birley 1997, 22.

Turning now to the locks from Vindolanda, the first object we shall discuss is the dubious 'lock-pin' (Figure 77). As explained by Birley, the inclusion of twenty small bronze objects with the locks was done without conviction of their belonging there. Though a common find at Romano-British sites, the exact purpose of the decorative pins is not certain. They may have been used to hold the faceplates of locking mechanisms in place; however, their generic shape could lend itself to several other purposes as well. Even if mistakenly named "lock-pins", they are certainly fixtures of some kind and warrant consideration in this investigation.[106]

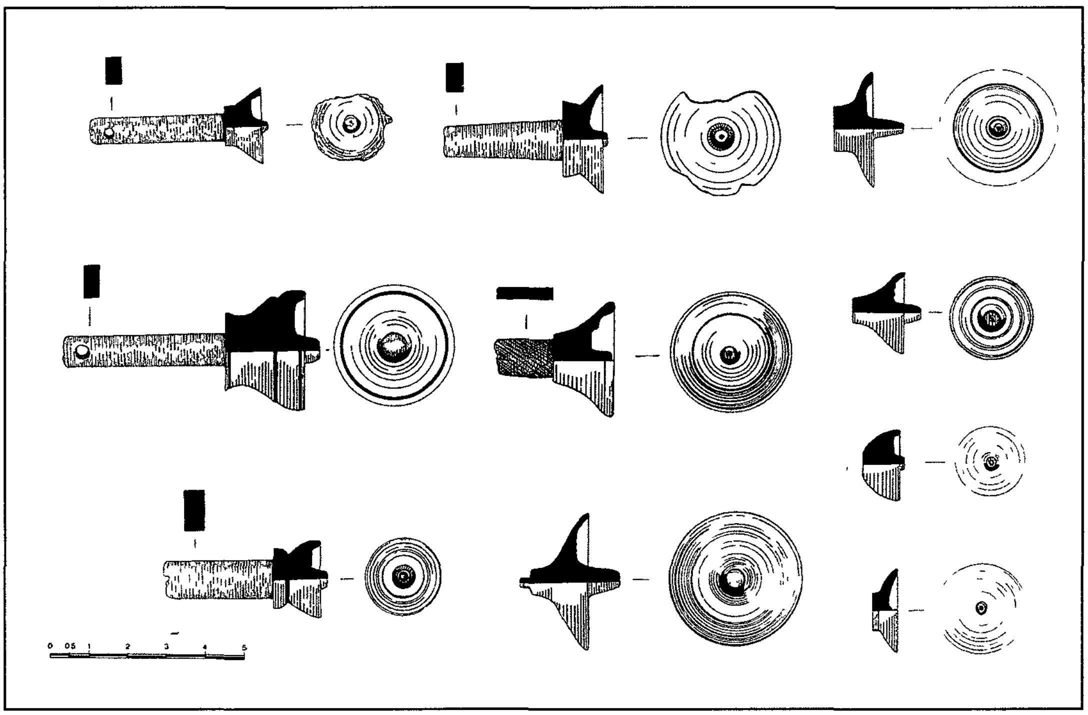

Figure 77 Lock pins from Vindolanda Birley 1997, fig 11

[106] Birley 1997, 30, Austen 1991, 205.

Though some of the pins possess heads similar to verifiable decorative bosses, they all lack the tell-tale iron nail associated with that type of object. Additionally, the pin shafts themselves are often too thick to be driven, and are clearly designed to be fitted into a drilled hole. Lastly, four of the finds are complete enough to clearly discern a hole through the shaft at the opposite end to the head where the pin could have been fastened with a bisecting pin; based on the description of several other individual objects, this hole is present but too corroded to be obvious in the drawings. The pins range from 1.1 cm to 6.5 cm in length.[107]

The barb-spring padlock is the only actual padlock from Vindolanda (Figure 78). Birley employs Manning's system of categorizing these locks: dividing them into "looped hasp" and "straight hasp" groups.[108] Four locks are catalogued, equally of Manning Type 1 and 2. They are from Periods VI and VII (160 to 300 C.E.).

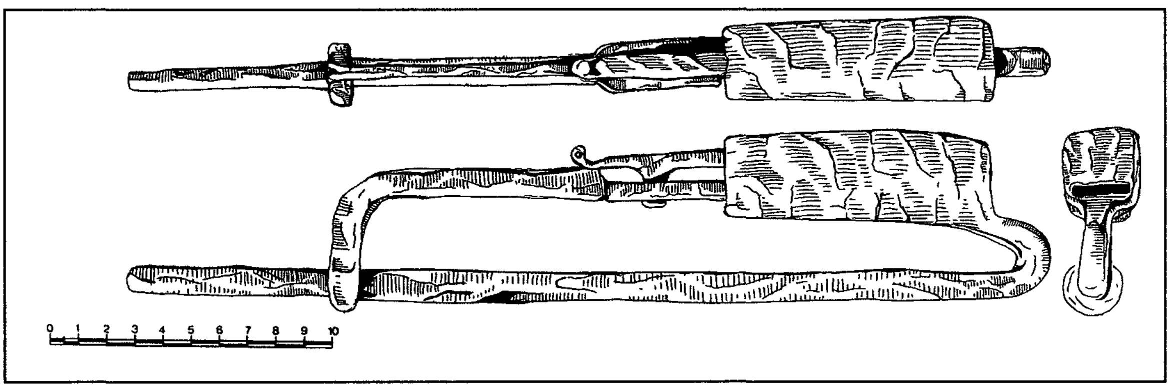

Figure 78 Barb-spring padlock from Vindolanda Birley 1997, fig 14

Finally, the lock plates from Vindolanda will be discussed (Figure 79). Although sometimes decorated, these plates must be differentiated from the decorative plates that

[107] Birley 1997, 30.
[108] Manning 1985, 95.

were described above since they served two important utilitarian purposes: to protect a locking mechanism fitted in a door from being tampered with, and to protect the door itself from the wear of the key's regular insertion. There are six examples in the catalogue from either Period V (120 to 140 C.E.) or VII (213 to 300 C.E.). The lock plates are either square or round and made of iron. All but two appear to have been affixed to the door by way of four nails; of the other two, one is too incomplete to tell, while the other shows signs of five attachment nails. Five of the plates are between 5.6 cm and 9.3 cm in length, with the odd round one being 19.4 cm across.

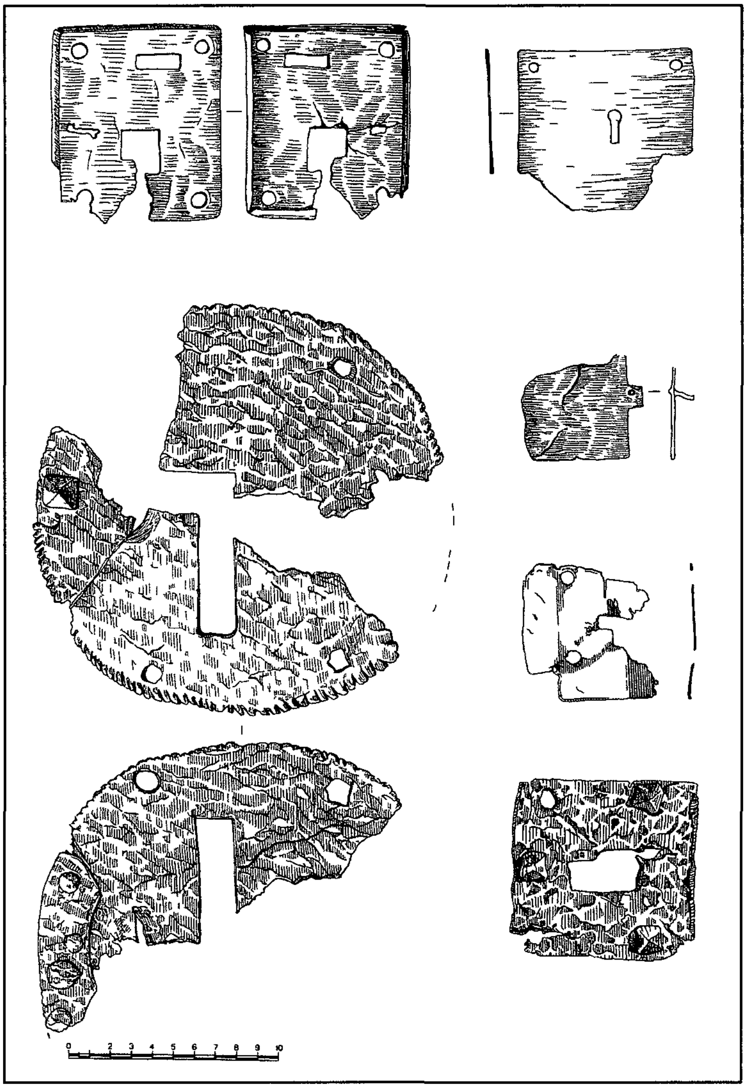

Figure 79 Lock plates from Vindolanda Birley 1997, fig 15

Conclusions

It is clear that ancient peoples were no less practical about security than with any other aspect of their structures. In fact it is with security objects that we are able to see most clearly the effort of craftsmen to build a better mousetrap. This inventive drive led builders and metal smiths of the Classical period to advance from slide-locks and latch-lifters to barb-springs and tumblers. By the Roman Imperial period, we can see complex rotary tumbler locks which could be encased to form unfixed padlocks; the progression is truly fascinating.

Just as important in this study as the progression itself is the regional synchronism of the technical advances. Though more material is required to confirm the pattern, the evidence compiled in this chapter points to a high degree of technology-sharing between cultures and regions. The slide-lock was in common use over a wide area as far back as the Classical period, and it was at roughly the same time that more advanced locking mechanisms appeared in Britain, Italy, and the Near East.

Interesting also are the different metals used in security applications. The relative hardness and strength of iron over bronze was known in Antiquity, yet we find that both keys and lock components were still made of bronze. Given that iron might have been less expensive and more readily available, the only other reasons to choose bronze are the ease with which it could be worked into intricate shapes and its aesthetic characteristics. This is worth noting since it suggests that even such a small thing as a lock or a key deserved aesthetic consideration.

Finally, the pervasiveness of security objects is important to note. The fact that evidence of securing fixtures was found at every site considered in this study speaks to the importance and the real need to protect property in the ancient world. Locking a door, a window, or a closet was as common an action as it is today, which is evidence of a profound social norm. It is making connections such as these, in addition to purely material ones, which validates the comparative study of material culture and provides the basis for conclusions about the wider context.

The Absence of Fixtures

One of the most telling aspects of ancient metal fixtures is their occasional conspicuous absence. Indeed, in some ways at the heart of the question being addressed is an attempt to understand why blatant inconsistencies exist in the material record. The investigation of instances when fixtures were not found where expected is carried out with the intention of understanding why they were not used in the first place, or why they may not have survived to be found. Both questions ultimately contribute to a better understanding of fixture use, and are just as worthwhile as exploring patterns in the finds themselves.

To this end, three sites where metal fixtures are conspicuously absent are discussed below. While more sites would have served to illustrate the pattern more clearly, constraints of time, scope and site selection limited this study to just these three. It is hoped that, notwithstanding their small number, by finding common ground between them, answers to the above-mentioned questions may be offered.

Dura-Europos

Dura-Europos is a good example of a site which, reasonably, should have produced many fixtures for study. Having been simultaneously a frontier city and hub of trade in the Selucid, Roman, and Parthian Empires, the scale and extent of construction from over a millennium of occupation make a strong case for fixtures having been employed at the site.

Every type of structural metal fitting, however, is entirely absent from the, admittedly incomplete, Yale University publication of the site.[109]

This is a particularly difficult dilemma to address since some of the most productive excavations for the study of fixtures, most notably that of Olynthus in Macedonia, took place at roughly the same time. The reason for there being no structural material in the publication then, should not be a matter of academic interest or archaeological technique. Rather, a combination of factors may be blamed for there being little or no evidence.

The first of these is actually a contradiction to the above; i.e. that fixtures were prevalent in the city. This is because the assumption that builders in Dura were as much in need of metal fixtures as other regions is questionable, since timber was used less in construction there on a whole. The city is situated in an arid desert zone, and although in many cases the ancient environment was drastically different from the modern one, mainland Greece being a perfect example, the central Syrian plain was no greater a producer of timber in antiquity than it is today. The snake-like oasis of the Euphrates could have been counted on to produce some vegetation, but not trees able to yield structural timber in quantities sufficient to make wood as common a material in a city the size of Dura as in Europe or Africa. Without wood as a common construction material, therefore, the use of fixtures begins to approximate more closely the speculated use at Karanis in Egypt, where a similarly arid environment made adobe and stone the primary building materials.

[109] The most recent excavators of Dura-Europos intended to produce an eight-part report of their findings. These were subdivided for publication into numerous fascicules. Although the volume by Rostovtzeff (1949) was consulted, the author recognizes that the greater publication is still far from complete, and any useful material is likely in an unpublished state.

A second factor, which combines readily enough with the first to support the point, is that Dura was not sacked in the usual destructive fashion. Though it was taken by force from Rome by the Sassanid Empire sometime between 256 and 258 C.E., the evidence from the siege indicates that the defenders sued for peace after a particularly catastrophic breach of the city wall. It is unclear as to the fate of the city's inhabitants, but the evidence points to there being no fighting within the walls.[110] The importance of this is that Dura may not have been sacked and left destroyed and empty. Instead, it may have been taken peacefully and deliberately abandoned, dismantled even. This would allow for the relatively few items of utility and value to have been carried off. Though it seems less probable that structures were stripped of all useful fixtures, as in the cases discussed below, this could be a contributing factor to their scarcity.

The House near Vari in Attica

The country house below the Cave of Pan in Attica is a perfect example of an ancient site conspicuously devoid of metal fixtures.[111] Located approximately 3 km north of the Athenian village of Vari, the house is a well-preserved example of an Attic country residence, either a temporary harvest-time dwelling or a full-time rural homestead; no specific agrarian equipment was uncovered to suggest any industry at all. Preserved in situ were up to a metre of foundations and walling, pavement and earthen floors, and several built-in furnishing features. The area was not greatly disturbed and the excavators note that greater degradation of the site was evidently caused by erosion than by later human

[110] Matheson 1982, 35; cf. MacDonald 1986, 63.
[111] Jones, Graham, *et al.* 1973.

activity. With regards to date, the excavators used ceramic and numismatic evidence to date the original occupation to the second half of the 4th century B.C.E. The lack of wear and renewal of the structure itself supports this short-term occupation. All together, the circumstances are promising for the discovery of all manner of domestic objects, including structural fittings.

Interestingly, however, the minor finds were unexpectedly few. Furthermore, "they included nothing of value or utility to the former inhabitants of the house or any ancient visitor to the site." In the context of structural fixtures, this is particularly interesting since Jones *et al.* point out that timber was certainly employed in the roof proper and was probably used in various parts of the colonnade which supported the house's covered porch.[112] Consequently, the excavators concluded that the house was deliberately abandoned, with sufficient time to take away with them anything which might have been of use or value. Beyond what they might have carried away, the site was no doubt scavenged for materials by subsequent visitors, right down to the roof tiles. The removal of mounted hooks, locks, and even latches is understandable, but the fact that this scavenging activity was so thorough as to include the nails used in the house's superstructure makes a clear statement to us that no fixture was considered too trivial to recover.

The Dema House in Attica

Highly similar to the house at Vari, is the so-called 'Dema House', also in Attica.[113] Situated just below the Dema Wall, which partially bars a pass between Mt. Aigaleos and

[112] Jones, Graham, *et al.* 1973, 427.
[113] Jones, Sackett, *et al.* 1962.

Mt. Parnes on the route from Athens to Eleusis, the house is similar to the Vari house in its preservation; namely, several courses of walling, some floors of earth, in situ features such as lintel blocks and door jambs. The front part of the house had been somewhat destroyed by agricultural activity, but enough is intact to allow for the reconstruction of the damaged walls. The site has two occupation periods, though the later is much shorter. The original and primary occupation of the site is thought to have begun with the peace of Nicias, about 420 B.C.E., and ends with the outbreak of the Decelean War in 413 B.C.E. The second occupation, characterized by a minor restoration of some walls, is a point of debate. A source discussing the Dema Wall places the reoccupation at the end of the 5th century, while Jones *et al.* propose a period in the middle of the 4th century.[114] Regardless, the two occupations were relatively soon after one another, and were not long-lived.

Of importance is the fact that the Dema house yielded similar finds as the Vari house, in quantity and character. Aside from a sparse ceramic catalogue, very little was recovered from the site, and no fixtures were found at all. Add to this the fact that the Dema house was likely abandoned in more haste than the Vari house due to the invasion of Decelea by Spartan troops, and it becomes even more interesting that the occupants so thoroughly scoured the structure for reusable materials. Certainly the possibility exists that several returns were made to the site by its owners to clean it out effectively, not to mention the salvage of materials by others, but the fact remains that the conspicuous absence of fixtures points to a deliberate effort to remove them.

[114] Munn (1993) discusses the poor tactical decision to allow a structure so close to the Wall. Vague dates for the construction of both the Wall and the house prevent a truly conclusive answer with regards to which came first.

Conclusions

The effort required to recover fixtures of all kinds so completely from the sites looked at speaks to the value that these objects held for their owners. Even today an object like an ornate door knocker is the subject of relocation upon leaving a residence, but that ancient peoples took the time to extract nails, reinforcing plates, and hinges indicates that these were viewed as movable objects within the house, and not necessarily part of it. Furthermore, we know from Thucydides that in Attica specifically, people were taking the very wooden framing of their houses with them when vacating a building, which forces us to re-evaluate the way we understand ancient ideas of movable property.[115]

In line with such a re-evaluation, we may well also consider the monetary value of the objects which this study has focused on. The sheer usefulness of raw metal in antiquity cannot be overstated. For re-use or for smelting into an ingot, all metalwork in a structure was likely extremely valuable – in many senses of the word. Accordingly, while we now might consider a whole and sound house to be a valuable thing, ancient people may have valued the metal holding their structure together even more.

As late as the 2nd century B.C.E., objects like nails and hinges may still have been produced by smiths in small scale operations in most, if not all, parts of the Mediterranean. The mass-production mentality of Roman industry does not seem to appear in earnest until the 1st century B.C.E., at which point the value of such objects may have decreased. The process devaluation in a produced building material has an analogy in the Roman brick and tile industries, which supplanted more ad *hoc* construction materials as they grew into

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[115] Thuc. 2.14; cf. Ath. 5.40 and Joseph. *AJ* 1.95 where *ξύλωσιν* is used in reference to the timber framing of ships.

imperial institutions.[116] On the other hand, in the case of Dura-Europos, the city was occupied for just over a century by the Romans during which time there is evidence of an earthquake and development of the city walls.[117] These events would both have resulted in substantial Roman construction utilizing Roman techniques and fixtures. Such a rationale for fixture finds coupled with the relative prevalence of finds at other later Roman sites makes the issue inconclusive for the time being. While there are reasons why Dura should and shouldn't have had many fixtures and reasons why those fixtures might not have survived, the anomaly regardless exists that none were found.

In light of these arguments, we perhaps ought to consider that instead of these sites being out of the ordinary for not having fixtures to be found, they should be considered quite commonplace for having been stripped of their metal at some point. Whether due to deliberate abandonment, as suggested at Dura-Europos, or later pillaging, as in Attica, the idea that metal fixtures are reasonably as ubiquitous a find as coarse ware seems less and less tenable. Such a change in how fixtures are viewed is a precursor for their study as an important and independent type of evidence.

[116] Darvill, McWhirr 1984, 242; Helen 1975, 16; Bloch 1941, 4.
[117] Hopkins 1979, 270.

CONCLUSIONS

The purpose of this study has been to discover, compare, and categorize wood-use metal structural fixtures in the Mediterranean from the Archaic through Byzantine periods. Evidence was compiled from 14 individual sites, from the British Isles to the Euphrates River, in an effort to find significant patterns of development in the type and use of structural fixtures among disparate cultural groups. Various assemblages were compiled by type and location, and then compared to similar objects. Conclusions were drawn from the form and style of these finds, and a standard typology for finds of this nature in the Mediterranean basin is proposed in Appendix B.

Overall, it was found that fixtures were both in common use, even from an early period, and that functional and stylistic differences between groups were minimal at any given time. Over time, some fixture types developed both functionally and stylistically while others fell out of use. These trends can also be observed among sites separated by great distances and from different cultures. Clearly the transmission or sharing of construction techniques was common. It is beyond the scope of this study to determine whether this was a result of travelling craftsmen or clear lines of communication, but it has been shown that as developments in style and function occurred, they were echoed elsewhere relatively quickly. This undermined one of the secondary objectives of this study, which was to see if construction techniques could be used to track specific contact among ancient cultures. It seems that technique sharing was too common a practice for such a test to be useful or even credible. One trend, the increased use of the strap hinge as a product of Roman influence, does indicate that a technology (or in this case singular type of fixture) could be characteristic of cultural influence, and so more consideration of the theory is worthwhile.

When examining the frequency and number of fixture finds, there arises the question of how they should be viewed by modern scholars. Should they be expected as a common feature of construction at any given excavation? Or should they be valued as rare survivors of a conscious effort to recycle them by generations of earlier people? Though a clear answer to this question is impossible, it may seem reasonable from the discussion of sites without fixtures to assume that fixtures are less common finds which ought to be ranked alongside more valuable objects, due to the improbability of their survival and the information they provide us. A more careful consideration of fixtures may well be warranted at this point.

Previous scholarly treatment of fixtures has been highly inconsistent. Clearly this needs to improve and become more consistent in order to extract better information from this important source. One of the foremost needs is a standard terminology and system of description and categorization.[118] Not only would this reduce the effort required to publish fixtures, by eliminating the need to develop new terms and typologies for each site, but it would help the academic community to discuss the material more accurately and effectively.

Ideally incorporating a comprehensive collection of examples, a study which standardized the terminology, classification, and most likely use of certain ancient fixtures could have benefits beyond the study of fixtures themselves. A common dating schema may

[118] See Appendix B for a proposed definition of terms and comprehensive typology for working with structural fixtures.

allow individual fixtures to be used in dating whole structures, while a use study may help in the identification of fully or partially revealed structures. Such a catalogue is clearly a next step in the analysis of fixtures as valuable ancient artefacts.

An integral part of standardizing publication of architectural small finds is the development of common methods by which the objects are processed during excavation and conservation. One of the greatest challenges of this study has been trying to compare objects that were processed and published in different ways.[119] In order to address this problem, the chart below provides information which would be most useful and which ought to be recorded and published as a best practice for the treatment of structural fixtures. The chart is organized by object type in the same order as those discussed in this study:

Nails and Bosses

- Find site relative to building remains
- Metal(s), including alloy composition if possible
- Head dimensions, shape, and profile
- Shaft dimensions and profile, including extra measurements if tapered
- Overall length if intact
- Measurements of straight shaft segments if obvious bends are present
- Evidence of manufacture/ other defining characteristics (i.e. obviously cast, unused, cut, etc.)
- Illustrations and photographs, with scale, of type examples

Decorative Pieces

- Find site relative to building remains
- Metal(s), including alloy composition if appropriate
- Dimensions

[119] Inconsistent descriptions, visual representations, and inclusion of dimensions meant that some collections of objects could not be understood from the publication. For example, the nails from Isthmia posed a particular problem, since very little about the character of the nail is provided by Raubitschek besides their length and metal.

- Full description of decoration
- Description of mounting
- Drawing/Photograph, with scale

Handles and Pulls

- Find site relative to building remains
- Metal(s), including alloy composition if appropriate
- Dimensions including 'height' from mounting surface, if determinable
- Description of mounting
- Evidence of manufacture/ other defining characteristics (i.e. obviously cast, bent, worn etc.)
- Drawing/Photograph, with scale

Hinges and Pivots

- Find site relative to building remains
- Metal(s), including alloy composition if appropriate
- Dimensions
- Description of mounting
- Evidence of manufacture/ other defining characteristics (i.e. obviously cast, unused/ worn, damaged/ repaired etc.)
- Illustrations or isometric reconstructions and photograph with scale

Security

- Find site relative to building remains
- Metal(s), including alloy composition if appropriate
- Dimensions
- Mechanism type if relevant
- Drawing/Photograph, with scale

While some of this data would be tedious to record for the great variety of objects sometimes uncovered, two factors justify this effort: 1) using the proposed classification system would speed up description and 2) having exact find locations relative to building remains, along with more accurate descriptions, would lead to better understanding of use on a site.

If the information recommended here were extracted from a wider sample of sites, we could begin to answer culturally diagnostic questions about fixture use beyond the context of construction. Experiments could be developed which would allow for more accurate real-world reconstructions of ancient structures and laboratory testing to identify metal sources and production methods could make the discovery of fixtures more influential to research in trade relationships, metal resource management/ exploitation, and ancient metalworking practices themselves. For example, the question of manufacturing objects as numerous and ubiquitous as nails in either small batches on a local scale, or in massive quantities on an industrial scale, could influence discussions about the trade of raw materials, the metalworking capabilities of different cultures, and the value of these goods as a whole. Many avenues for understanding the manufacture and use of fixtures can be explored by the combination of a standard Mediterranean fixture typology and more detailed information provided by excavators.

In conclusion, this study of structural fixtures has made apparent the great lack of attention that these objects have received and the potential they have for work done in many other areas of research. Though this study did not look extensively at the practical aspects of the material under consideration, it is obvious that much more information, highly useful in the interpretation of structural remains, is to be found through more careful analysis and comparison of structural fixtures. Questions about use, origin, and economic factors are raised by the conclusions of this study. It is hoped that this work demonstrates the potential of such a line of inquiry and provides a starting point for further work.

APPENDIX A: LOCK TYPES AND THEIR FUNCTION

Barb-spring Padlock

The function of the barb-spring padlock, while simple, is quite ingenious. One or more bolts, to which a chain is attached, are slid through a hole in the lock casing. Riveted to these bolts are one or more 'springs', appearing as barbs on the bolt. These are compressed as they enter the casing, but pop up once they clear the hole on the inside, thus preventing the removal of the bolts. To open the lock, an L-shaped key is slid through a slot in the opposite side of the casing. This key has holes in it which must correspond to the bolts. As the key slides over the bolts inside the casing, it compresses the springs/ barbs and allows for the removal of the bolt. Obviously the simplicity of the key means that this lock provides only a modicum of security, but against the casual thief it would be quite effective. A particularly good explanation of the function of this system can be found in Andrew Birley's publication on the locks from Vindolanda, while a large number of examples from Roman Britain have been published by Manning.[120]

Slide Lock / "Homeric Lock" / The Lakonian Lock

The slide lock mechanism was used for the securing of doors. It involved a wooden bar or bolt being set in a hole in the jamb/ wall to the inside of the door (Figure 81). This bolt (Figure 80), either one long one or two shorter ones on each side, was drawn across the doors, through a casing, to prevent them swinging inwards. A lip in the sill prevented the door being opened outward. This system was capable of being manipulated from the outside by way of a slot in the door just above the bolt case. The key was inserted at either

[120] Birley 1997; Manning 1985, 95.

end of this slot, its bit(s) fitting into corresponding slots on top of the bolt-casing, perhaps even into the bolt itself. This key was then drawn along the slot, across the door, to push or pull the bolt into place. Security was achieved by varying the spacing of the slots that the key and bit(s) would need to fit into. The key would accordingly be L-shaped.[121]

Figure 80 A wooden slidelock bolt from Karanis Husselman 1979, pl 49

Figure 81 Lock bolts protruding from their casing in a Karanis doorway Husselman 1979, pl 48

[121] A number of these keys in wood were found at Karanis and described by Husselman (1979, pl. 54a). For an iron example, see Figure 58 above; Thesmophoriazusae 421, Menander frag. 343, Souda '*lakonikai kleides*', Plautus *Most* 404.

Roman Tumbler Lock

The tumbler lock, in its simplest form, was employed by the Romans to provide slightly more security than the latch-lifter. It functioned by having a certain number and arrangement of pins ('tumblers') fall into corresponding holes in the hollow bolt as it was slid home. To open the mechanism, the key was inserted into the bolt, and the bits on it pushed the tumblers up and out, freeing it. The bolt could then be removed by a string or with the key itself. This mechanism could be installed in a door or enclosed into a padlock, thus making it very versatile.[122]

Lever-lock

The lever-lock was an advanced form of barb-spring lock employed by the Romans. Enclosed within a casing, the mechanism was used to secure a padlock. The key used to activate this lock did not require an arrangement of teeth. Only a single bit of the correct height and distance from the shaft's end was needed (Figure 82). This type of lock could have been 'picked' fairly easily if the culprit understood the mechanism. The bolt in a lever-

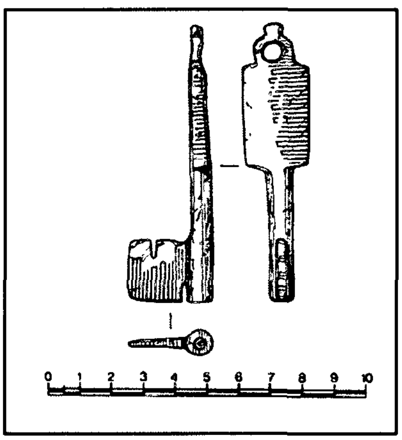

Figure 82 Lever lock key from Vindolanda
Birley 1997, fig 6

[122] Manning 1972, 181.

lock was held secure by a spring-loaded catch. Essentially, the key was simply inserted under the catch spring and rotated to use the single bit as a lever against it. Once the spring was sufficiently lifted, the bolt could be slid out of the case. One advantage of this mechanism is that, like the barb-spring padlock, the bolt could be secured without the use of the key; when reinserted, the spring-loaded catch would simply pop over the notched bolt and hold it fast.[123]

[123] Cunliffe (1971, 142) gives for an excellent illustrated explanation.

APPENDIX B: A STANDARD TYPOLOGY FOR ANCIENT MEDITERRANEAN FIXTURES

Among the many types of objects included in this study, five in particular would benefit from a standardized typology. Outlined below is a system for describing and categorizing these object types. It has been developed with comprehensiveness and utility in mind. It is hoped that if such a system is adopted widely among archaeologists, progress can be made in reaching the potential value held by these finds in their archaeological context.

Tacks, Nails, and Spikes

The most carefully categorized of all the objects studied here are the nail-fasteners. They are treated differently by almost every scholar to study them. The most notable attempt to produce a standard system of categorization is that of W. Manning, whose typology of the iron fixtures in Britain has real value.[124] Another excellent attempt is that of Schaus and Munaretto for the finds at Stymphalos, presented here in anticipation of that site's publication.

One of the most significant aspects of the typology presented here is an attempt to bring the three ambiguous terms used for these fasteners –"tack", "nail", and "spike"– into a clearly defined continuum. The critical point is that all these words refer to objects which have the same basic function, to secure two or more items to each other. They are differentiated by the fact that they are of different sizes.

Given the high number of variables/ attributes ascribed to these objects, a hierarchy of groupings proves to be impractical for any system attempting to be comprehensive.

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[124] Manning 1985.

Consequently, the system proposed here relies on constructing a label for a given object by filling in a number of fields of a formula from a list of possible descriptors, each of which correspond to an attribute of the object. The complete label provides a concise and accurate classification while standardizing the terms used for description. To create a full label, the following dimensions are needed: total length, length and thickness(es) of the shaft, and head dimensions (diameter or length/width).

The formula for nail-fastener labels is as follows:

Type : Metal . Head Size . Head Profile . Head Shape / Shaft Section . Shaft Taper

- The possible descriptors for each field are given in Table 5.
- Where any descriptor cannot be determined due to breakage, corrosion, etc., this should be indicated with an "x" in the series.
- Badly corroded objects should be indicated with a trailing "c".
- Objects with a deliberate bend should be indicated with a trailing "b".
- Broken or partial objects should be clearly indicated under the appropriate 'type' label. See examples below.

Type (overall length)	Metal	Head Size (diameter)	Head Profile	Head Shape	Shaft Cross-Section	Shaft Taper
Tack	Bronze	Small	Domed	Round	Square	Continuous
($<$ 3.0 cm)	Iron	($\leq$ 1.0 cm)	Flat	Square	Round	Abrupt
Nail	Lead	Medium	Bent-over		Triangular	
(3.0 $\leq$ 9.0 cm)	Other	(1.0 $\leq$ 2.0 cm)	Looped			
Spike		Large	T-Shaped			
($>$ 9.0 cm)		($>$ 2.0 cm)	Spherical			
Broken						

Table 5 Tack, nail, spike descriptors in order

Examples

Tack: B.Sm.D.R/R.C

I.e. a bronze tack (less than 3.0 cm in overall length) with a small (less than 1.0 cm in diameter) round, domed head attached to a round in section shaft which tapers continuously to its point. See Figure 1, 3rd object from the left; dimensions estimated without a scale.

Broken Nail: B.Med.F.R/R.C.c

I.e. a broken and badly corroded bronze nail (between 3.0 and 9.0 cm in overall length) with a medium (between 1.0 and 2.0 cm in diameter) round, flat head attached to a round in section shaft which tapers continuously to its break. See Figure 2, 2nd object from the right; dimensions estimated without a scale.

Spike: I.Med.B.Sq/x.C.c

I.e. a badly corroded iron spike (greater than 9.0 cm in overall length) with a medium (between 1.0 and 2.0 cm in length) square bent-over head attached to a continuously tapering shaft of unknown profile. See Figure 10, 2nd object from the right; dimensions estimated without a scale.

While individual objects may require more detailed descriptions including more precise measurements, this shorthand system conveys much information in a very concise manner. Moreover, once acquainted with the field values, simultaneously sorting and describing objects should make processing objects easier for excavators.

Rivets and Bolts

The system for rivets and bolts only differs from nails in that these objects are not 'driven' and so do not have a tapered shaft. The label formula for rivets and bolts is below:

Type : Metal . Head Size . Head Profile . Head Shape / Shaft Section

- The possible descriptors for each field are given in Table 6.
- Where any descriptor cannot be determined due to breakage, corrosion, etc., this should be indicated with an "x" in the series.
- Badly corroded objects should be indicated with a trailing "c".
- Objects with a deliberate bend should be indicated with a trailing "b".
- Broken or partial objects should be clearly indicated with the appropriate 'type' field.

Type (overall length)	Metal	Head Size (diameter)	Head Profile	Head Shape	Shaft Cross Section
Rivet (< 4.0 cm) Bolt (≥ 4.0 cm) Broken	Bronze Iron Lead Other	Small (≤ 1.0 cm) Medium (1.0 ≤ 2.0 cm) Large (> 2.0 cm)	Domed Flat Bent-over Looped T-Shaped Spherical	Round Square	Square Round Triangular

Table 6 Rivet and bolt descriptors in order

Examples

Broken Rivet: B.Med.D.R/R
I.e. a broken bronze rivet (less than 4.0 cm in length) with a medium (between 1.0 and 2.0 cm in diameter) round, domed head attached to a round in section shaft. See Figure 9, dimensions estimated without a scale.

Bolt: B.Lg.D.R/R
I.e. a bronze bolt (greater than 4.0 cm in length) with a large (larger than 2.0cm in diameter) round, domed head attached to a round in section shaft. See Robinson 1941a, pl. 43.2.

Just as with nails, individual objects may require more extensive descriptions.

Dogs

Categorizing timber dogs as completely as the nails and rivets would require a similar system. Its utility, however, makes it less justifiable. Metal and width variables are the only essential information for distribution research. Accordingly, a comparatively simple classification system has been outlined below.

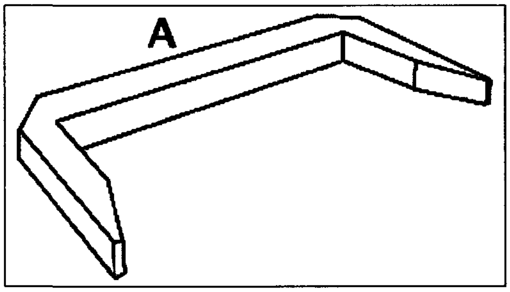

Figure 83 A timber dog

As with tacks, nails, and spikes, however, it is important to define several of the terms commonly applied to this fixture. Sometimes labelled "staples" or "clamps", the dog is a U-shaped piece of metal with triangular points so it can be driven into the edges of two pieces of wood at the same time. The 'arms' of the "U" bend inwards to draw the pieces of wood together (Figure 83).

Three groups are distinguished by metal, and three sizes are distinguished by the length of the dog (side 'A' in Figure 83). See Table 7 for the timber dog classification.

Size	Group 1: Bronze	Group 2: Iron	Group 3: Other
Small :	< 6.0 cm	< 6.0 cm	< 6.0 cm
Medium:	6.0 cm ≤ 15.0 cm	6.0 cm ≤ 15.0 cm	6.0 cm ≤ 15.0 cm
Large:	> 15.0 cm	> 15.0 cm	> 15.0 cm

Table 7 Timber dog classification

Door Bosses

These objects are common at Greek sites but less so elsewhere. A classification system would be helpful for archaeologists since there are certain distinctive types.

Before discussing the proposed system however, the term "door boss" or just "boss", as opposed to a nail with a large head for example, needs to be defined. The evolution and purpose of door bosses must be considered in arriving at this definition. Some objects may have served both as bosses decorating a door and nails holding it together. Bosses may have had a culturally utilitarian purpose as well; as proposed by Schaus.[125] The majority of Classical Greek bosses are made of two separate pieces,[126] while some earlier Greek and later Roman examples are one piece.[127] It is this kind of variable, not shape, which may provide the most important information about door bosses. When deciding if a given object is a boss or a nail, a general guideline is to consider the purpose of the object. If the primary purpose was not to fasten two pieces of wood together, the object is more likely a boss. A boss therefore can be defined as a tack or nail with an unusually large head that is often dome-shaped, or convex with a protruding knob/spike, for decorative purposes.

[125] See above on page 51.

[126] Despite corrosion, this can usually be determined in one of three ways: (1) the head may be obviously too delicate or may show no signs of having been hit to drive the shaft of the object into the wood, thus the head was mounted to the shaft after being driven; (2) the 'bowl' formed by the head may be filled with lead which was used as a solder; (3) the boss is bipartite or comprised of more than one metal since ancient welding techniques were generally not advanced enough to join bronze and iron .

[127] The early iron bosses from Isthmia are a perfect example of such exceptional objects. See Raubitschek 1999, 138.

Bosses are classified first by the metal of their head, then by head profile, as per Robinson's typology at Olynthus, and finally by head diameter.[128]

Group A: Bronze Head

A.1: Domed

A.1.sm: head less than 3.0 cm in diameter

A.1.med: head between 3.0 cm and 5.0 cm in diameter

A.1.lg: head greater than 5.0 cm in diameter

A.2: Domed with flat 'brim' around circumference

A.3: Convex which narrows to a point or knob with decorative mouldings

A.4: Flat, with or without engraved or embossed decoration

Group B: Iron Head

Group C: Bronze Head and Shaft, one piece

Group D: Iron Head and Shaft, one piece

Handles

Unlike the object types discussed so far, there is less to be gained from a more detailed classification of handles. The three main types of handles already discussed in this study should provide sufficient definition. (See the conclusions at the end of the chapter on handles on page 66.)

Hinges and Pivots

As with handles, there is little to be gained from more detailed classification of hinges. Even size groupings are of limited use, based on the sample found in this study. Moreover, important differences such as the means of mounting and specific uses cannot

[128] Robinson 1941a, 260.

be readily identified. For the time being, the following definitions are presented as a contribution to the study of hinges and pivots:

Shod Post Pivot – Any set of fittings designed to facilitate the rotation of a doorpost within the doorframe and threshold. Usually comprised by a large spike (which is driven into the bottom of the doorpost) and a socket (which is mounted in a cutting in the threshold), a shod post pivot may also include a crimped 'bowl' of metal (shodding for the doorpost), and a bushing (which sat in the socket around the base of the doorpost). Components may be iron, bronze, or lead. See Figure 41 and Figure 43.

Strap Hinge – The precursor of the modern mortise hinge, the strap hinge is defined by two leaves with interlocking barrels at one end which are fixed together as a pivot by a pin or dowel. Commonly affixed to a structure and door/ shutter by nails, these hinges create a strong and square rotation. See Figure 42.

Hook and Loop – Comprised of a hook and an eyelet, the one side is hung from the other. Also referred to as a drop hinge. See Figure 55 and Figure 50.

Loop-linked Hinge – Similar to the Hook and Loop type, the loop-linked hinge is formed by two straps with a single interlocking loop at one end. See Figure 54.

Locks and Keys

Appendix A constitutes an effort to define the lock types (and their associated keys) encountered in this study. Far from being comprehensive, the definitions used there need further consideration based on a wider sample of security objects.

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