

Early medieval locks and keys in England and Scandinavia

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Abstract

This thesis consists of two studies examining early medieval locks and keys as socially active and agentive objects. The first presents evidence for the continued use of locks and keys through the early Middle Ages in England. Locks are among the most complex objects manufactured in this period, requiring specialised knowledge and skill. Their continued use suggests that there was a perceived need amongst communities for these objects and that there was also an available network of craft workers who could supply that need. This is particularly important for understanding the nature of that network during the periods of change and transition in early medieval England.

The second study looks at the social significance of locks and keys by focusing on the Viking Age site of Birka. It challenges the traditional interpretation of keys used as grave goods as primarily and simply signalling female status. Instead evidence is presented for these objects carrying multiple meanings and having multiple uses and intentions within grave assemblages. Recognising this complexity allows the opportunity to see the relationship between women and keys with greater nuance, and also to explore how these objects may have been used to help navigate and control the relationship between the living world and the world of the dead.

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Author's declaration

I declare that this thesis is a presentation of original work and I am the sole author. This work has not previously been presented for an award at this, or any other, University. All sources are acknowledged as References

Chapter 1 Introduction

The central purpose of this thesis is to establish a greater understanding of the social aspects of locks and keys in the early Middle Ages. The specific aims are to use these objects to provide insight into the cultures of technology and manufacture, and those of active use and belief. This is done through the central idea of the importance of *persistence*: the active and deliberate retention of recognisable forms and practices. To accomplish these aims, the study begins with the establishment of a general understanding of the pre-existing technologies, traditions, and beliefs seen in the Roman period. With this foundation, we next establish the parameters of the distribution of these objects in early medieval England through patterns of chance loss of keys in order to understand some of the extent, nature, and implications of craft knowledge during this period. Finally, the social significance of locks and keys as seen through evidence from the trade centre of Birka is investigated in order to understand why these objects continued in use throughout the early Middle Ages, and the roles they may have played in early medieval communities.

This study is based on the idea that the qualities of archaeological artefacts and their context, are the product of two broad factors: the *physical* and the *social* conditions in which they are made, used, and deposited. The *physical* includes not only the properties of the materials and settings of the objects themselves and the world they inhabit, but the additional circumstances that make those things more or less available. The *social* includes the set of mental ideas, beliefs, and intentions held by the extended community that motivate the choices involved throughout the active life of the object, from initial concept

through to deposition or destruction.

This idea has been explored in relation to the technology of object construction (Pfaffenberger 1992, Lemonnier 1993, Ashby 2013, 2014) and patterns of trade and other exchange (Callmer 2003, Sindbæk 2013), but has not yet been applied specifically to locks and keys. But these objects, because of both their technological complexity and their social significance, are particularly well suited to this sort of study. In particular, they have the potential to provide insight into the culture and conditions of the early Middle Ages.

This project is important because through the examination of locks and keys it allows us to understand attitudes about a number of culturally significant subjects including privacy, authority, identity, and the nature and use of space in a period that saw considerable social and economic change. By looking at the way in which lock use developed from the practice seen in the Roman period, it is possible to discover the ways in which craft practice adapted to changes in the availability of resources. But it is also possible to explore the social structures and practices that meant there was an ongoing need for locking technology.

The presence of a lock in a given space changes the perceptions, relationships, and identities of the surrounding objects, people, and landscape. Locks and keys create and participate in social hierarchies that are structured around concepts of responsibility, authority, trust, and wealth. These hierarchies are not rigid, but can be negotiated, reshaped, and even deconstructed as the location and state of the lock changes, and as the person who controls the key extends and retracts privileged access.

Locks and bars can be used to create a complex system of spaces with varying permeability, securing buildings, rooms, and even cupboards or boxes within those rooms. The essential characteristics of each of these layers of spaces is that they are nested within areas of a higher order of accessibility. In other words, locked spaces most often exist within more generally open areas: a locked house within an open landscape, a locked room within a building, a locked box within a room. This means that there is both a rhetorical and an inherently performative aspect to the existence and use of locks. Because they are visible to the wider community, they project messages about the nature of the enclosing space as well as the protected space. Further, the moments when the lock is used and the space is accessed are, at least potentially, equally public: an enactment of the role implied by the possession and display of a key.

The social and cultural weight given to these objects is found embedded in language. The concept is applied to human bodies poetically, as hearts and minds are locked or unlocked, an image that occurs in some of the earliest Old English writing (Christ III 1054-55, Cook 1900; Elene 1236-51a, Kent 1891). But it is also a fundamental theory in cellular biology. The key—lock theory as described by Emil Fischer in 1895 is a metaphor that illustrates the singular morphological link between enzyme and molecule (Kunz 2002). Computer science borrows the concept to provide a solution to a common error; the locks-

and-keys method maintains integrity between a data point and the reference to that data point by creating a “lock” value in one and a “key” value in the other. In common usage, ideas and information of central importance are consistently referred to as “key” without the definite article, moving the word from reference to an object to a role or even a state of being.

With the understanding of this cultural weight, locks and keys must be considered to have the potential to provide considerable information about past communities. However for the early medieval period these objects have until recently gone largely unexamined. The difficulty in constructing a definitive typology for these objects in this period is partly to blame. This difficulty is related not only to the lack of consistent and diagnostic change to morphological features, but also to problems presented by the nature of the objects themselves, something that is discussed in greater detail in Chapter Four. Without the organisational framework of a typology, traditional approaches to artefacts have been relatively unfruitful.

But by framing the questions asked about locks and keys in terms of the factors referenced above, it is possible to achieve a better understanding of both the physical and the conceptual conditions that surrounded them. To do so, this thesis is divided into two central studies. The first uses data from the PAS to examine the distribution of casual losses of locks and keys in order to understand what that distribution may imply about the nature and conditions of specialised craftwork in early medieval England. Because of the limitations of the data this is a deliberately interdisciplinary study that uses evidence from both the physical artefacts and their depiction in art work from the period to help establish a more complete understanding of these objects at this time. The second study builds on this understanding, using the early medieval trade centre of Birka to focus on locks and keys in a living community, focused in particular on cemetery assemblages. This allows the objects to be examined in relation both to practical considerations such as utility and morphology, and to the question of the conceptual model that the Birka communities had of locks and keys: their significance, their roles, and their meanings.

1.1 Organisation of the thesis

Chapter two provides the historical background of locks and keys. It begins by introducing the basic morphology of locks and keys, and the terminology that is used to describe them. The broad categories of key types that are discussed in this study are then introduced.

Next the chapter provides an overview of the earliest known approaches to security. After looking at some of the theories about the origins of mechanical locks, and the evidence for their use in Mesopotamia, Egypt, and Greece, the discussion then moves to

focus on the Roman period. It is from this culture of manufacture, use, and meaning that early medieval technology and use developed.

To establish this context, first the range of lock types that emerged during this period is discussed. There were a number of developments made to prior lock types, as well as innovations of new mechanisms. Among the most important of these were those that allowed locks to be used for a wider range of applications, particularly smaller furnishings and even portable boxes.

Evidence for these different applications is presented, using both the material record of in-situ locks, keys and structures found in Pompeii and some of the written sources from the time. This allows both a general view of the ways in which space was managed and manipulated through the use of locks, and some understanding of the cultural importance that was placed on the ownership and use of these objects. In particular, possible connections to social roles and identity is introduced, as well as the appearance of boxes and keys in some burial constructions, both of which will have significance in the early medieval period.

These new lock mechanisms meant there were also new forms of keys in use. The use of locks for a wider range of purposes is reflected in the evolution of key forms. These forms not only visually reflect the type of lock and imply the type of space they secured, but are used to signal other ideas both literal and symbolic. Some of the ways these messages were expressed are illustrated, and the social implications of the ownership and display of keys during this period are discussed.

Finally evidence for the appearance of locks, keys, and boxes in Roman Britain is presented. This includes evidence that the range of lock types and applications already seen in the material in Pompeii was also present in England. The cultural importance of boxes is discussed through the appearance of these objects in burial assemblages. Then the suggestion that locks and keys carried additional symbolic importance is made. At the beginning of the fifth century, this data shows, locks and keys were a well established part of everyday life, and the ways in which objects and people were distributed in space was, at least in part, regularly mediated by their use. This background provides important context for the developments of use seen in the early Middle Ages.

Chapter three focuses on previous literature about early medieval locks and keys. It begins with an examination of the 19th century context against which early interpretations of keys in the archaeological record were made. This includes a brief discussion of the historic use and nature of primary sources from this period before presenting and analysing the content of those texts. Particular attention is paid to evidence for a strong link between keys and women.

The chapter then turns to studies focused on the physical appearance and technological characteristics of locks and keys. The first section looks at several broad

studies on the history of lock and key technology and morphology that were influential in the formation of an early chronology of lock development. This is followed by a discussion of studies focused specifically on objects from the Middle Ages.

Next, studies that are concerned with the social significance and meaning of keys in the archaeological record are discussed. These sources are primarily interested in exploring the significance of keys to the identity of early medieval women in Scandinavia. Various interpretations of the social roles that might be signified by the use of keys in burial assemblage are discussed.

Chapter Four presents a study that makes use of the British Portable Antiquities Scheme (PAS), a large dataset of found objects, the majority of which were reported to Finds Liaison Officers by members of the public. After introducing the theoretical framework for this study, we then turn to the central data source, the PAS. The known limitations of these data are discussed followed by an examination of the difficulties specific to the study of early medieval locks and keys. This is followed by a brief explanation of how, given these considerations, I approached the collection of data. The additional data sources used in the study, from the collection of the Museum of London Archaeology (MOLA) and from a set of archaeological sites with keys from securely dated contexts are then introduced. Finally, a general discussion of the characteristics of the data in the PAS are presented, as well as a comparison with the MOLA collection.

The next section provides a description of the system used to organise the keys in the dataset into type groups. After discussing the rationale that informed the creation of the system, the eight groups used in the study, which were briefly presented in Chapter Two, are described and illustrated. Finally, the morphology of key handles is discussed, particularly in relation to the date classification of keys within the PAS.

Having established the type groups, the distribution of date classification of those types in both the PAS and MOLA is then presented. The observable bias, particularly in the PAS, is analysed. An argument is made for the effect this bias has on the perception of the range and number of key types in use in the early Middle Ages, and the limitations this places on developing a more accurate understanding of the extent and nature of their manufacture during that period.

This introduces the central concept used in the study, mentioned above, of the importance and value of persistent forms in artefacts. The theoretical justification for focusing on these forms is discussed. Then the data used to establish these forms is introduced. The first are keys and locks from archaeological sites that provide secure dates for specific forms and for the type groups to which they belong. Next, a methodological approach is introduced that attempts to identify potential persistent bit forms through the use of specific key types with known limited date ranges, as well as depiction of keys in contemporary art. Using this method, two key forms that are particularly informative

are presented. The first may demonstrate the continuity of craft knowledge through the transition from the Roman period, while the second may suggest the re-introduction of a form towards the end of the early Middle Ages. This section closes with a suggestion of the nature and limitations of lock use and lock crafting in England during the early medieval period.

The chapter concludes with a close analysis of the implications of continued lock and key use in England. The debate on the nature of iron production and smithing is discussed, and an argument is made that shifts in the availability of raw iron did not necessarily equate to a loss of craft knowledge related to the manufacture of iron objects.

Drawing on ideas developed by researchers in social anthropology such as Lemmonier (1986, 1993), and Pfeffenberger (1992), the study then turns to an analysis of the implications of the persistence of both general technological knowledge and the specific shared concepts about appropriate and desirable forms. The concept of resource communities and resource requirements in the making and trade of objects is introduced. Sociological research on how craft knowledge and skill are attained, maintained, transmitted, and lost is presented in order to better understand what persistence of a form may mean in terms of the nature of the community of craft workers. This is followed by an examination of the specific resource and craft knowledge requirements in the making of early medieval locks.

Finally, there is a discussion of how evidence for persistence in the manufacture of locks and keys may provide insight into the wider community that was acquiring and using them. The argument is made that both visibility and flexibility in the control of access to specific spaces and objects was important to early medieval households. This is based on the idea that early medieval spaces were nested in terms of their accessibility.

Chapter Five presents the second study, the appearance of locks and keys in early medieval grave assemblages in Scandinavia. Building on the idea of the cultural significance of locks and keys from the previous chapter, the chapter begins with a discussion of the evidence for layers of meanings given to locks and keys, meanings that were both direct and symbolic. Then the central themes that the study uses are discussed, specifically the question of gender identity expressed through objects in burials, and the broader question of the motivation for object inclusion in grave assemblages.

Next, the difficulties and challenges of studying the social aspects of locks and keys are outlined, followed by a brief explanation of the approach taken to data collection. Then the main site, Birka, is introduced, with a brief description of its location and archaeological features. The distribution of keys by group type in both the settlement (the Black Earth) and the cemetery areas is presented, and compared to data from England and other areas. Evidence for boxes and caskets is similarly discussed.

The study then turns to a closer examination of the separate cemetery areas of

Birka, their general characteristics, and the appearance of keys within them. Comparisons are made between the areas with particular attention to the appearance of objects that are considered to have gender association (specifically weapons, textile tools, and female jewellery). This is followed by a description of data from sites in the wider Scandinavian context.

These data are analysed in relation to several themes frequently discussed in the interpretation of mortuary constructions. The interpretation of keys as strictly female objects is examined by looking at the nature and limitations of the distribution of keys in assemblages with female-associated objects. The appearance of keys in assemblages with objects generally assumed to be associated with the burial of males is similarly treated. Then the possibility of a symbolic use of keys in graves with blacksmith tools is examined. Lastly, the possibility of enchainment between locks and keys as a factor in the choice to either include or avoid these objects is explored.

Finally two further possibilities for the meaning of keys in burials are introduced. The first is that as socially significant objects, locks and keys may have multiple potential meanings and uses, and there may be fluidity in which of those were salient in a given burial. The second is that locks and keys could be used in a more literal way, to manipulate access between the dead individual, the afterlife, and the living world.

Chapter Six summarises the central concepts developed in the two studies. A brief synthesis of the implications of their conclusion is presented. Finally, potential areas for further research are suggested. Six appendices are included:

1. A description of the development of the morphological grouping systems used to classify the keys in the dataset
2. Illustrations of the bit types in the dataset
3. Illustrations of the handle types in the dataset
4. Tables of the archaeological sites used, showing the number of keys of each type and the date ranges
5. Table of the art works used in the project
6. Table of casket keys described using the classification system introduced in Chapter Four with their frequency of appearance

1.2 Scope of the project, definitions and terminology

1.2.1 Geographical and temporal range

This thesis is limited to the appearance of locks and keys in two areas: England and Scandinavia. Additional material from Germany and France is used to provide a comparison for the morphology and appearance of specific forms and objects. This allows the study to

provide a more thorough understanding of the areas of focus which can then, ideally, be used in further research in other locations.

The temporal range for the research is the early Middle Ages. In this study the terms “early Middle Ages” and “early medieval” are used interchangeably and are defined as the period roughly between 400 - 1100 AD, approximating the date ranges used by Historic England and the PAS. Similarly the approximate date divisions of early period (400-700), middle period (701-850) and late period (851-1100) are adopted, with the recognition that these divisions are to some extent arbitrary. For consistency, the PAS and Historic England terminology for these periods has been retained.

1.2.2 Definition of “lock”

For the purpose of this study, a lock is defined as a multi-part mechanism that uses a moving element to control access to a space. The movement of that element is affected by the use of a key. A key is defined as a object that interacts with but is physically separate from a lock. Using this definition, there are mechanisms that, depending on how they are opened, may or may not be considered locks.

A modern metal gate latch, for example, with a latch string that can be left out for open access, or pulled in for greater security, is clearly similar in both principle and in essential physical form to basic wooden latches known from the last century, and almost certainly used throughout history. However there are important perceptual differences that not only are significant to the physicality and utility of locks, but are fundamental to understanding the communities that choose to use them.

While a latch string can be withdrawn, closing access off to the outside, anyone from the inside can still open the latch. Similarly, the ability to change the status of the latch is physically available to anyone in the community (although there may be invisible cultural restrictions). Finally, the latch and string are one contained unit, complete in themselves and essentially static in their relationship to each other.

In contrast, a key creates a tool set composed of two distinct objects, lock and key, changing the use and the perception of both objects, including allowing the presence of one to suggest the existence of the other. Limiting the ability to control access to the person or persons who hold the key reflects and reinforces a social hierarchy of trust and authority, as well as concern for the visible security of particular spaces and objects. A lock, as opposed to a latch, denies access to anyone but the key holder, and the key holder has the ability to control when and by whom a space may be opened. This social and cultural significance of locks and keys, and the implications of their types and constructions, is of central importance to this study.

1.2.3 Lock morphology

There were several broad types of locks in use in the early Middle Ages, and a number of minor but significant variations within those types. Unfortunately, there is currently no universally accepted typology for locks or keys. Those efforts that have been made are complicated by the relationship of lock types to key types. As will be explored in Chapter Four, there is not a simple one-to-one relationship between all lock and key types as, particularly in the early Middle Ages, some key types were used for a variety of mechanisms. As a result, typologies have tended to focus either on lock types (Pitt Rivers 1883, 6-7; Linlaud 2014, 38) or on keys (Ward Perkins 1954, Almgren 1955, Manning 1985), making it difficult to discuss how the two morphologies are related and what might have driven their development.

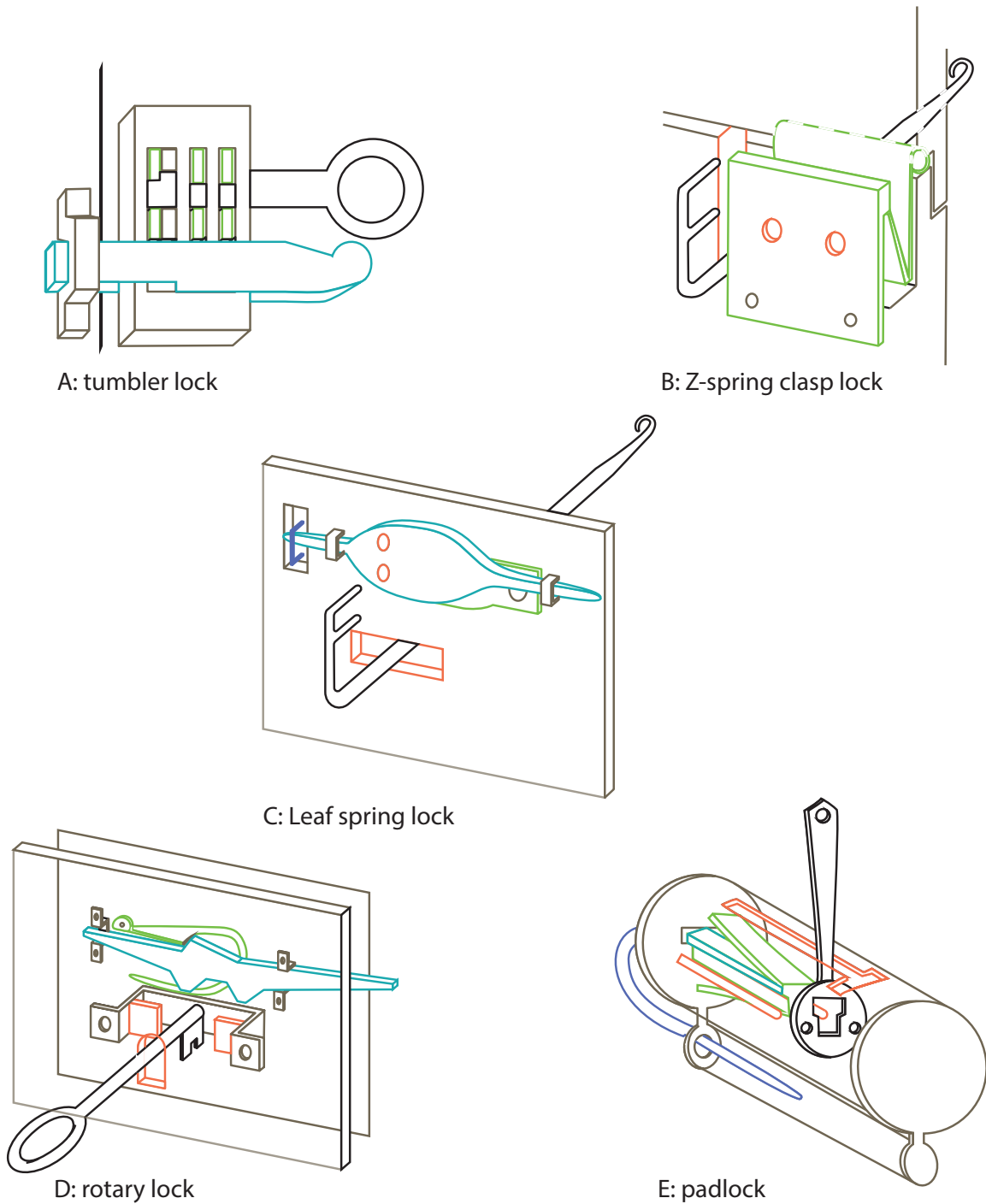
The establishment of a comprehensive and coherent typology that considers both locks and keys is beyond the scope of this project. A rough grouping of keys (primarily based on morphology) is used in Chapter Four, but this is not intended to be more than a very limited tool to clarify and facilitate discussion within the confines of this thesis (see Appendix One). Similarly, a description of the basic mechanisms and movements of Roman locks (from which all known early medieval locks likely derive) is presented in Chapter Two, but does not represent a complete typology (which would necessarily include a comprehensive catalogue and discussion of the relationship of variants). The limited goal of the material presented below is to show how mechanisms relate to and differ from one another, but not to attempt to do more than provide a broad logical grouping for discussion.

All locks consist of multiple separate elements. Because of the variation in morphology of locks, it is useful to discuss these elements in terms of purpose and function rather than shape. However it is important to recognise that some parts of a lock may perform more than one function.

Support and protection of the lock is provided by elements that are mostly or entirely structural. These include plates, cases, brackets, and staples. For some locks, the structure is primarily provided by the door, frame, or box into which they are built. For others, the lock is largely or entirely self-contained.

The central element of any lock is the piece that physically blocks the movement of the door, lid, lock (in the case of padlocks) etc. It is this element that the key engages with and moves, locking or unlocking the space. This piece is usually referred to as a bolt, depending on the lock type and the shape of the element. Some locks have no bolt, instead using a catch. In some variants, there is an additional element that engages with the bolt, such as a staple.

Most locks have an additional element, or elements, that physically impede



Structure/support
 Bolt
 Restrictor
 Ward
 Additional

A	case, staple	bolt	tumblers	(keyhole)	
B	box, chest		clasp, spring	keyhole, holes	staple
C	faceplate	bolt	spring	keyhole, holes	
D	faceplate, backplate	bolt	spring	keyhole, wards	
E	case	bolt	spring	keyhole, wards	hasp

Figure 1.1 Schematic of lock elements for five lock types

the movement of the primary blocking element, and must themselves be moved or manipulated. These secondary elements act, in fact, like a nested lock system. In Roman and early medieval locks, these elements are usually tumblers, springs, or a combination of both.

Finally there are elements or characteristics that limit access so that only the right type of key, or ideally the right key, can shift the bolt. The simplest way to limit access was through the shape of the lock structure itself - the placement, size, and morphology of holes, slots, or other voids. In the Egyptian example discussed in Chapter Two, the angle of the opening could be altered to block some key shapes. However, in more complex locks and lock types, a wide variety and configuration of barriers could be used, increasing the individuality and therefore the security of the lock. These elements are often unrelated to the practical function of the lock mechanism and were included solely out of concerns of security. This security was found not in the physical strength of the lock, but in the difficulty involved in forging a replica of the key. Figure 1.1 is a schematic of five of the lock types discussed in this study with the various elements highlighted.

1.2.4 Key morphology

Although keys are considerably simpler objects than locks, there is a great deal of variation in the shapes of the different types. There is also some inconsistency in the terminology used for some of the component parts. Further, most terminology is focused on rotary keys, familiar from modern locks, which means that there is less consistency in the vocabulary used in the discussion of less common, earlier types.

Figure 1.2 (below) is an illustration of seven different types of key forms that are found in this study, labelled with the terms that will be used to discuss their characteristic parts. These models are, obviously, simplified and reduced and do not reflect the range of variety seen within each group. As mentioned, Chapter Four will present and discuss the type group classification created for this study in greater detail.

Having established the aims of the study, its scope, and some of the basic terminology, we now turn to an examination of the origins of locks and keys. This begins with a brief discussion of early strategies for securing spaces and some of the motivations that drove them. Then the developing lock technologies of the Roman period, and the evidence for their use and meaning will be presented. This will provide the context necessary to understand the early medieval material that will be the focus of the two central studies.

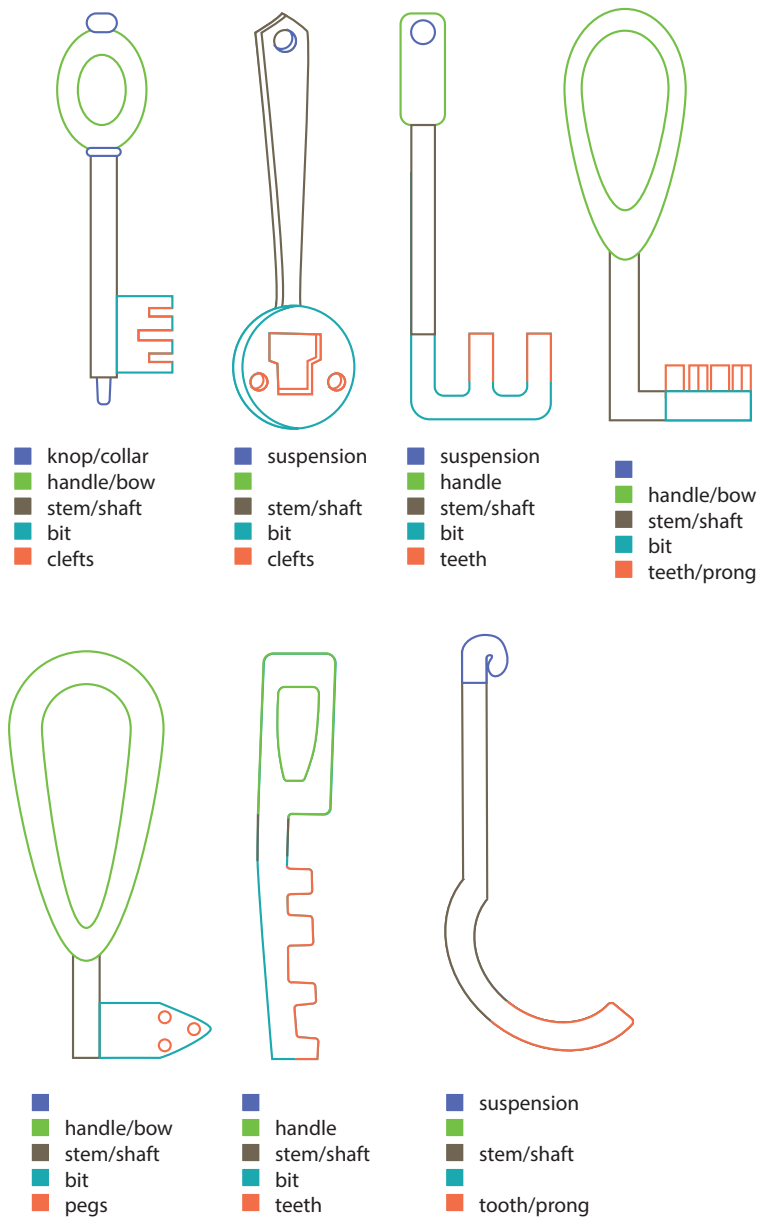


Figure 1.2 Keys from groups A-G coded to reflect morphological elements

Chapter 2 Origins of the technology and culture of locks and keys

2.1 Introduction

In order to better understand both the technological and social implications of locks and keys in the early Middle Ages, it is important to establish the nature of the traditions and beliefs that have developed around these objects. Cultural understanding of the significance, use, and meaning of objects builds on and reacts to what has come before. So spending the time to examine the practices of prior cultures will provide a more accurate understanding of the appearance and use of locks and keys in the early Middle Ages. The following is, necessarily, only a survey of the subject and is primarily focused on the development of locks and keys during the Roman period. This includes both the variety of mechanisms that were in use, and the evidence for symbolic significance. Establishing both of these aspects is essential to understanding the role and significance of locks and keys for early medieval communities..

We begin with a brief discussion of the history of security, and of the evidence for symbolic importance placed on both locks and keys from their earliest known use. We then turn to the Roman period, first describing lock mechanisms and then considering how those locks were used to organise and secure various spaces. In particular, attention is given to the use and importance of large chests, and of boxes, objects that this study will show were also significant in England and Scandinavia throughout the early Middle Ages. Evidence for who carried and displayed keys is then introduced. Finally, the appearance of locks and keys in Roman Britain is discussed.

2.2 Origins of security

The earliest solution to safeguarding valuable resources was caching. Initially this may

have been a means of increasing efficiency as groups moved through territory with varying proximity to source materials (Hurst, 2006), but it may also have been driven by a need for security within a competitive environment. Caching is object-centred, constrained and directed by the physical characteristics of the objects in the cache, such as size and perishability. This approach relies primarily on secrecy, although it also often involves the use of sites with limited or difficult access.

However when a community makes the shift from a primarily nomadic to a settled lifestyle, a new issue may appear: the need to secure not only objects, but also spaces. This can simply reflect a concern with physical security. But a number of other conditions may drive this concern: hierarchical social structures; a cultural emphasis on the purity of specific spaces, objects, or people; regular intermixing with out-group members; a concern with individual ownership; the existence of highly valued objects.

The resulting structure of the secured or restricted spaces is concentric in nature, separating increasingly finely defined in-group members who are trusted to access town, building, room and finally container, from out-group individuals and groups who are restricted from those various levels. Each secured space is contained within the insecure environment of the defined out-group. This produces very specific security needs, needs that must be balanced against the practical requirement of accessibility. Very simply put, the more accessible a space is the less secure it is. It requires technological solutions to resolve the problem. Examining how this technology develops, therefore, may provide information about the existence and importance of the various cultural drivers behind the desire for security, as well as the emphasis placed on the importance and value of the objects involved in satisfying that need.

2.2.1 Seals and sealing

A level of protection can be achieved by physically restricting access through the design of buildings, limiting the number and location of doors and windows and embedding particular spaces within others (cf Zettler 1987, 204). Spaces that are more widely used and accessible can be temporarily closed off from inside using physical bars and bolts. However, these solutions have limitations. If the concern is not only for physical security, but for the visible preservation of that security, for example if a space is seen as sacred, it is necessary to visibly and physically restrict spaces from the outside. The first solution was to seal such spaces, producing a barrier that was relatively ephemeral physically, but powerful rhetorically.

These seals were used on buildings, rooms, and containers of various sorts. Lumps of clay, often impressed or inscribed, provided a visual statement of ownership and authority. The use of these seals is cited as evidence for the development of administrative centres. The

assumption is that seal markings would be useless without the existence of both a system of punishment for violating the seal, and a political power that could enforce that punishment (Alizadeh 2006, 17). Importantly, it also indicates a development in the idea of security that was intended not only to provide protection from simple theft, but also from tampering. Such interference might diminish the physical qualities of the contents of the space, but could also constitute a contamination of perceived purity.

Among the earliest known sealing technology that begins to combine aspects of both lock and seal is that used in rooms or buildings in Mesopotamia which could be secured by looping a cord or a hook over a knob set into a plaque (Zettler 1987, 212-13), or by using a similar arrangement with a plaque, cord, and peg. A lump of clay was then pressed over the whole and allowed to dry. Each element of the system had the potential for layered meanings. Knots and cords had powerful apotropaic properties (Wendrich 2006), providing spiritual as well as physical protection. The plaque could be decorated with narrative scenes (figure 2.1), and the seal itself could be impressed with inscriptions or images appropriate to the setting (figure 2.2). The importance of this sealing and unsealing is evidenced by a series of reliefs at Karnak, on the east wall of the Hypostyle Hall (figure 2.3), which depict Seti I performing three actions to access a shrine: breaking the seal, removing the pin that the seal secured, and finally opening the doors (Nelson 1949, 205). Breaking the seal on the shrine doors was known as ‘disclosing the face of the god’ and was the first important moment in the ritual.

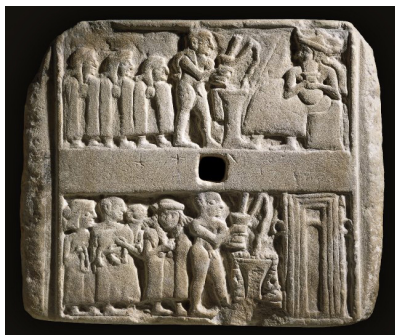


Figure 2.1 Left: Early Dynastic III wall plaque, Ur 2500 BC
British Museum 118561

Figure 2.2 Right: Impression of cylinder seal of Sin-ishmeanni Old Babylonian, about 19th century BC
British Museum 118561

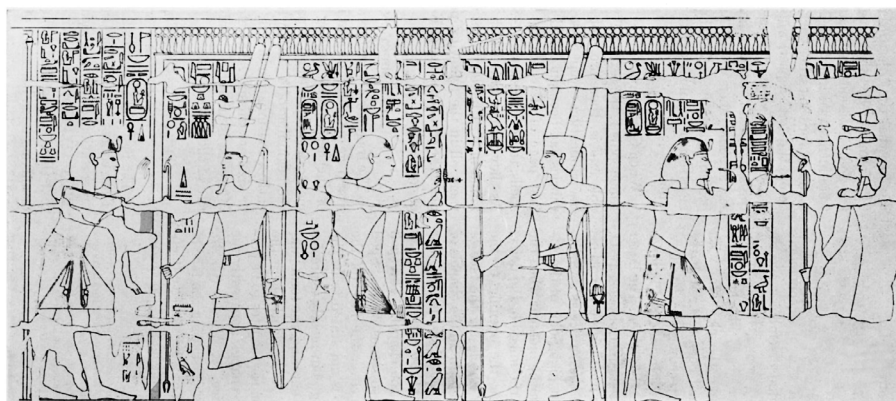


Figure 2.3 Karnak Hypostyle Hall, east wall Episodes B-D Seti I Breaking the seal on the shrine doors.
Nelson 1949, 206, fig 3

From the earliest known evidence, therefore, the acts of securing and opening restricted spaces appear to have often had considerable symbolic importance. They were associated with and representative of authority and power, and the visual representation

of that power through the objects involved was part of the system of security itself. Visual rhetoric is an aspect of security from the earliest known practice.

2.2.2 Early locks

The first known mechanical lock, was a gravity-based system (figure 2.4) in which a number of tumblers (a) drop into holes in the bolt (b) securing it in place. A key with corresponding pegs (c) is introduced beneath the bolt, and lifts the tumblers free, allowing the bolt to be withdrawn. Because the locks and keys were likely primarily made of wood, very little evidence has survived in the archaeological record. There may also have been some use of copper alloy for some or all of the components, particularly because wooden tumblers would have been liable to swell and stick in high humidity, although that could be mitigated by the use of wax or other lubricants.

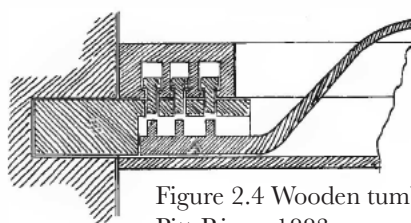
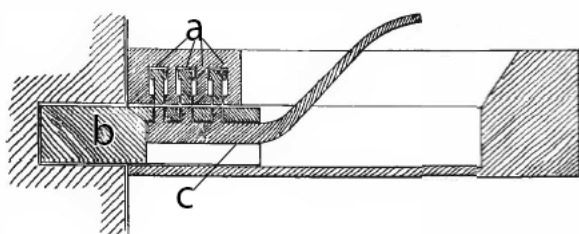


Figure 2.4 Wooden tumbler lock
Pitt-Rivers 1883
Plate III figures 13b and 14b

It is not entirely clear where or when these locks were invented, although provenance is commonly assigned to Egypt. In 1799, Vivant Denon, part of Napoleon's corps de savants, noted in his description of Karnak that the gates to the temple were secured with wooden locks (Denon 1803; figure 2.5 below). More importantly, he directly related these locks to ancient depictions he found in the temple reliefs. Unfortunately Denon did not sketch the reliefs he was referencing and no such scene is known to have survived, so the Egyptian origin is difficult to support (this is particularly true of his own, likely exaggerated, claim that the technology was 4,000 years old). However the idea of Egyptian priority in the invention was widely accepted and the lock style is commonly called 'Egyptian'.

An earlier origin in Mesopotamia, has been suggested (Pitt-Rivers 1883; Potts 1990; Oates and Oates, 2001; Radner 2010), but the evidence is extremely limited. The arguments are based primarily on suggested translations of terminology in fragmentary texts (Zettler 1987; Potts 1990, Fuchs 1998), and on a single artefact from Kalḫu that has been interpreted as part of a tumbler lock (Oates and Oates 2001; Radner 2010). On such slim evidence it is difficult to support Radner's contention (2010, 276) that tumbler locks had replaced door seals by the Neo-Assyrian period. It seems far more likely that when tumbler locks came into use they did not replace sealing methods, but were coeval with them. At best it seems reasonable to say that

the developments of locks in this period is plausible, but that seals maintained their significance, particularly as they continued to be used through the Roman Period and beyond.

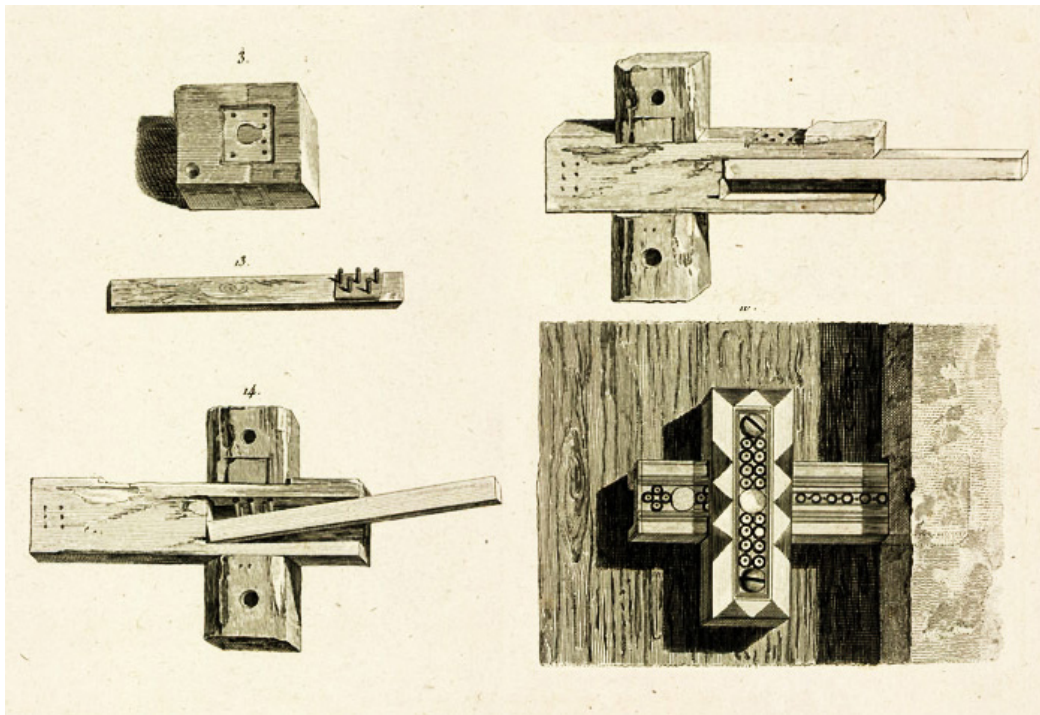


Figure 2.5 Illustration of wooden Egyptian locks
Vivant Denon 1807 Pl 50

2.2.3 Greece

The lack of archaeological evidence also makes it difficult to understand to what extent early “Egyptian” locks continued in use, although because related systems were used in the Roman and early medieval periods it seems unlikely it they were completely abandoned prior to that time (contra Monk, 2010, 8). A passage in Aristophanes’s *Women at the Festival* (Rogers 1930, lines 421-428) may be read to refer to these locks, and suggests that they were brought to Athens from Sparta. The key is described specifically as having three teeth (*γομφίος*, literally molars; line 423) which fits with the Egyptian key, but as it is also said to be worn around the neck it must refer to a smaller object, possibly the wooden tumbler lock described below.

This passage certainly cannot refer to a lock variant that seems to have had significance in Greece but does not appear to have continued in common use into the Roman Period. Unlike the “Egyptian” lock, which appears to have been mounted on the exterior of the door, these locks were probably placed on the inside, making them less vulnerable. However, the specifics of the mechanism involved are not known, and a number of explanations have been given. Neuberger (1919) imagined an extremely simple system with a bolt with a series of notches that allowed the key to inch the bolt free (figure 2.6) while Pitt-Rivers (1883) suggested a variant of the tumbler system, possibly using a single metal tumbler. Monk (2010, 8) described a simple mechanism where the key engaged with

the bolt and shifted it through a rotary movement (unfortunately not illustrated). A surviving key (figure 2.7) has a metal tooth at one end, a feature not shown in depictions on pottery (figures 2.8, 2.9 below), which makes all of these suggested mechanisms unlikely. Probably the tooth of the key engaged with a corresponding single hole in the bolt and slid it free.

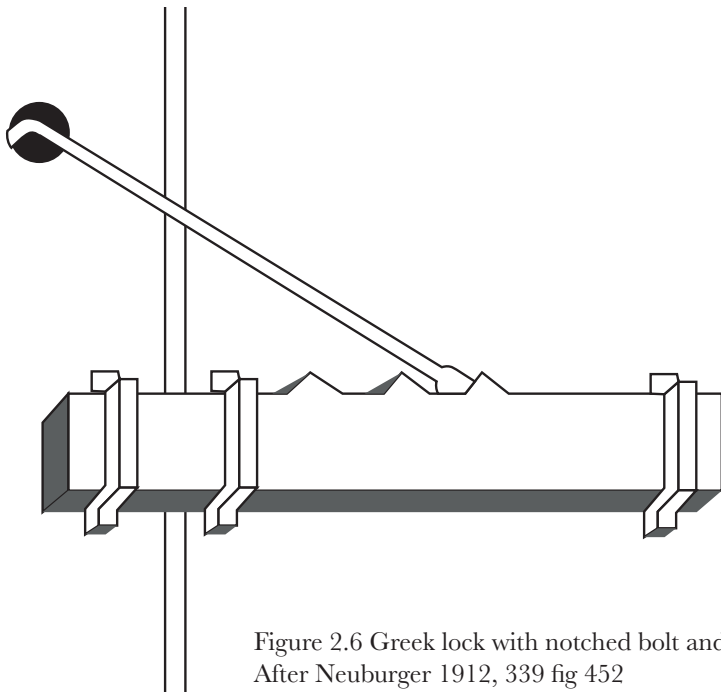


Figure 2.6 Greek lock with notched bolt and engaged key
After Neuburger 1912, 339 fig 452



Figure 2.7 Copper alloy key, 5th c BC inscribed: TAS ARTAMITOS TAS EN LOUSOIS
Boston Museum of Fine Arts, 01.7515

This mechanism is a step backward in terms of security in comparison with the multi-tumbler lock as it loses both the additional physical barrier provided by the tumblers and the ability to create a level of individuality through varying their placements. The concept of uniqueness being important in security measures is referred to in the same passage from Arisophanes mentioned above, where the woman speaking complains that husbands have stopped using common and easily replicated seals in favour of those made of worm-eaten wood, which will have unique characteristics. This suggests that the consistent and repetitious form of the key was intentional and significant.

There is also evidence that these locks were used on particularly important buildings. In images on surviving high-status painted ceramics (figures 2.8-2.9) the key is used as

an identifier, marking out a figure (frequently female) as a temple functionary. The size of the key and the consistency in form, suggest that visibility and recognisability were more important than practical security. This emphasis on repeated forms continues to be a factor in the development of lock technology into the early Middle Ages.



Figure 2.8 Volute crater: priestess with suspended key
Napoli, Museo Archeologico Nazionale, 82270



Figure 2.9 Pelike: fleeing priestess, key over shoulder
Napoli, Museo Archeologico Nazionale, 81392

Although the key could be worn suspended, it was frequently shown carried over one shoulder, an attitude that may have had cultural significance. Isaiah 22:22 describes the accoutrements of the high office of steward, which consist of a robe, a belt, and a key which is specifically stated to be carried over the shoulder. From a very early point, therefore, the design of lock mechanisms was driven by cultural ideas about the significance and symbolism of lock use. And the special role of the key holder developed in tandem, affecting both the morphology of the key itself and the way in which the key was worn or carried.

2.3 Lock mechanisms in the Roman Period

There is considerably more evidence about the use and importance of locks and keys, both written and physical, from the Roman period. However, as will be discussed in the following chapter, there is still little recent, in-depth research specifically on the topic. Most interpretations rely on work by Pitt-Rivers (1883) and other 19th century scholars, and the handful of researchers who followed them. This is particularly unfortunate as although it was in the Roman period that innovations were made upon which lock technology would rely for the next 1500 years, it is not entirely clear when some of the advancements were

made. However it is still worthwhile to examine these lock types more closely in order to understand the technology that carried forward into the later period, to establish something of how locks were used and viewed, and therefore to provide a context to better understand how the manufacture, use, and significance of these objects carried forward or changed in the early medieval period.



Figure 2.10 Iron window bars, Herculaneum.
Author's photograph (2015)



Figure 2.11 Shop threshold in Pompeii, grooved to lock shutters in place. Author's photograph (2015)



Figure 2.12 left, Chalcedony, gold, Head of the Doryphoros, 50 - 40 B.C. 75.AM.61



Figure 2.13 centre, Carnelian, gold, 250-400 A.D. Roman seal 83.AM.228.3 Both J. Paul Getty Museum



Figure 2.14 right Copper alloy and enamel seal box British Museum 1814,0704.256

Both the physical and the written evidence seems to confirm that by the height of the Roman empire, ideas about security had become nuanced and complex, adding layers of significance to the different methods used. Rather than discarding earlier modes, they were added to, and they acquired new symbolic interpretations. Spaces could be and were, of course, still protected by simple physical barriers (figure 2.10 and 2.11), and caching

continued to be a practical method of keeping valuable items available but secret (cf the cache of intaglios found in Eastcheap, London, Henig 1984, 11-15). Seals were also still important, but were significant primarily for their implication of a guarantee of purity or authenticity (figures 2.12, 2.13). Seal boxes, although theoretically useful in protecting a wax or clay seal from accidental damage, were larger and more ornate than necessary for the task, and clearly serve as a visual reinforcement of the seal's authority (figure 2.14).

The separate role of seal and lock is made clear in a surviving letter fragment from Vindolanda where the writer instructs that an already locked box be then sealed with a ring (Birley 2002, 109). These two actions are brought together in a single object in the British Museum: a seal ring with a miniature key suspended from the band (figure 2.15 a, b). The seal on the ring has possible Christian symbolism - a fisherman pulling a fish from the sea - so it could be that the key also carried religious meaning. This object suggests that the concepts of sealing and locking were connected, and once again reinforces the idea that there was additional cultural significance to the objects involved.



Figure 2.15 a and b Late Roman silver seal ring key
British Museum AF.196

The use of a lock not only adds extra complexity to the protection of a sealed space, it also creates a psychological link between the security of the space and the person who carries the keys. 'Key holder' is a cultural role with associated status, authority, and responsibility (cf Orphic Hymn to Hecate). Tacitus reports on the alleged treachery of Publius Vitellius who had offered the keys to the treasury, which he held in his role as prefect, to insurgents (Tacitus VI 5.8), a charge so serious that Vitellius committed suicide. And according to Plutarch, Romulus declared that the three betrayals that justified a husband divorcing his wife without penalty or payment were poisoning his children, committing adultery, and copying or counterfeiting his keys (Plutarch 61, Treggiari 1991). It is these layered ideas about roles and significance, as well as the technology of locks and keys that are carried through to the cultures that followed the Roman empire.

The development of lock technology, the way that new approaches were added to older ones rather than supplanting them, indicates that these objects carried greater social weight than their basic practical use. Although security was clearly an important

driver in the evolution of the technology, there were also strong rhetorical forces directing the continuity of established methods and forms. Their use and appearance in a culture, therefore, provides an opportunity to explore a variety of different aspects of community life, craft, and practice. In what follows, we examine in greater detail the different forms of lock in use in the classical world.

2.3.1 Wooden tumbler locks

Although Pitt-Rivers (1883, 10) suggested a Roman origin for the “Egyptian” lock discussed above, there is little evidence that the form continued in widespread use in the Roman west. There are a few surviving variants of an L shaped key (discussed below) that have an oblique curve as the stem leads into the pronged bit (cf Birley 1997, fig 5: 33), and although this could be due to damage, it’s possible that these were used for Egyptian type locks, or with a mechanism using a Z-bend spring with a clasp, a type found in Scandinavia and discussed in Chapter Five. The Egyptian type lock was relatively straightforward and easy to make, but it did have some disadvantages. The downward sloping access hole suggested by the curved key form may have accumulated water, speeding up rot and causing problems with the movements of tumblers and bolt. The key was also bulky, which may have been a consideration in situations involving multiple keys. Some of these issues could have been resolved by changing the morphology of the lock and using metal for some components, but I have not found compelling evidence for this form.

It does seem that a development of the Egyptian lock type was preferred during and after the Roman period. Only wooden examples of this variant are known to have survived, although other materials may have been used. This variation of the mechanism shifted the location where the key interacts with the tumblers, from beneath the bolt to above it. This change may have been to lessen the issues to do with environmental exposure. The keys to this lock are also smaller and more streamlined, and therefore easier to carry.

Further, the lock mechanism, including the bolt, was entirely contained in its own case which meant that it could be easily removed or replaced. Mounted to the exterior of the door, it could also be accessed for repairs in case a tumbler became jammed. This form of lock was so practical it continued in active use into the modern era; a number of these locks remain in situ in San Benedetto, Italy (Haddad 2016, 59) (figure 2.16, 2.17).

A well-known example of this lock type was found at Vindolanda. Like the modern objects from San Bernadetto, the Vindolanda lock is composed of an outer case, three wooden tumblers, and a bolt (not preserved). The tumblers freely move in their individual shafts; their resting position is in the corresponding holes in the bolt, locking it in place. The tumblers have a notch carved partway along the length, to allow the key to be introduced (figure 2.18).



Figures 2.16, 2.17 Wooden lock from San Bernadetto, Italy showing lock housing (left) and keyhole (right)
Soldati, 2012



Figure 2.18 Wooden tumbler lock
Vindolanda Museum.
Author's photograph 2016.

Excavations at Vindolanda have also produced a number of keys made of wood or bone, indicating that the lock type was relatively popular. As they could not be opened from the inside, they would have been used in settings where it was not necessary to unlock the door from the interior, such as storage buildings, or to secure an empty room or building. Because of the limitations of the material, these wooden locks were probably not made in significantly smaller scales, and so were only used on buildings and possibly large cupboards.

Although the keys found at Vindolanda are simple, there is enough variation between them to suggest that there was a deliberate effort to ensure a reasonable amount of individuality and security. The most common form had three teeth, seen in eight out of ten complete examples (Birley 1997, 24-25). One key had four teeth, and one had two. But in the three-tooth objects there is sufficient difference in the size and spacing of the teeth to suggest that the keys may not have been readily interchanged (figure 2.19 A-D below). Obviously, objects this simple could be copied. By reducing the width of the teeth on a forged key, an approximate fit could be made, and there are other ways the lock could either

be picked or forced. Further, the form itself restricts the amount of variation that could be achieved. However the individuality seen in this small group suggests that even with fairly simple locks made of inexpensive materials, care was taken to provide as much security as possible.

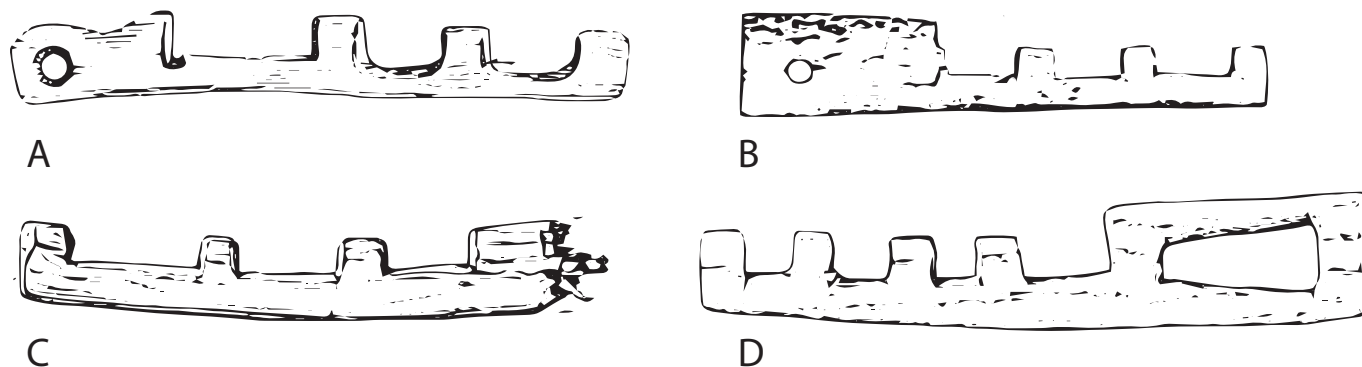


Figure 2.19 Keys from Vindolanda A-B, bone; C-D wood
 A 6091; B W485; C W59; D W582
 after Birley 1997 25, fig 10

Another suggested wooden tumbler lock type is something of a hybrid between the “Egyptian” version and the case lock of the Vindolanda type. In this lock the bolt and tumblers are mounted on the interior of the door. The key, assumed to be the T-form (and possibly L-form) key (figures 2.20, 2.21 below) mentioned above in relation to the slide lock and also used with two of the leaf spring locks discussed below, is fitted through a slot in the door. It then engages with notches in two tumblers, and lifts them free so the bolt can be slid aside using a handle (figure 2.22). Without surviving examples, this must be considered a possible, but not proven form.



Figures 2.20 and 2.21 Roman “latch lifters” T form (top) and L form (right)
 2.20 MOLA 19336; 2.21 MOLA 1966

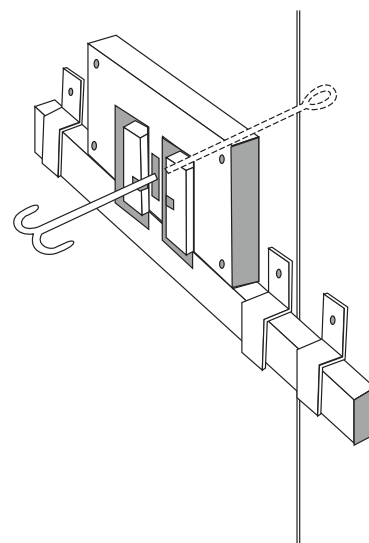


Figure 2.22 Proposed tumbler lock

2.3.2 Spring-actuated tumbler locks

The Roman period saw two important innovations in tumbler lock mechanisms (figure 2.23). The first was the use of metal rather than wood for the principle lock components. The second was the addition of a leaf spring to provide positive pressure on the tumblers. These two changes made the tumbler locks considerably more reliable and robust, and allowed the mechanism to be scalable, specifically to be made far smaller than any known earlier lock. It also meant that because they no longer relied on gravity for security, they could now be used on smaller, portable boxes and caskets.

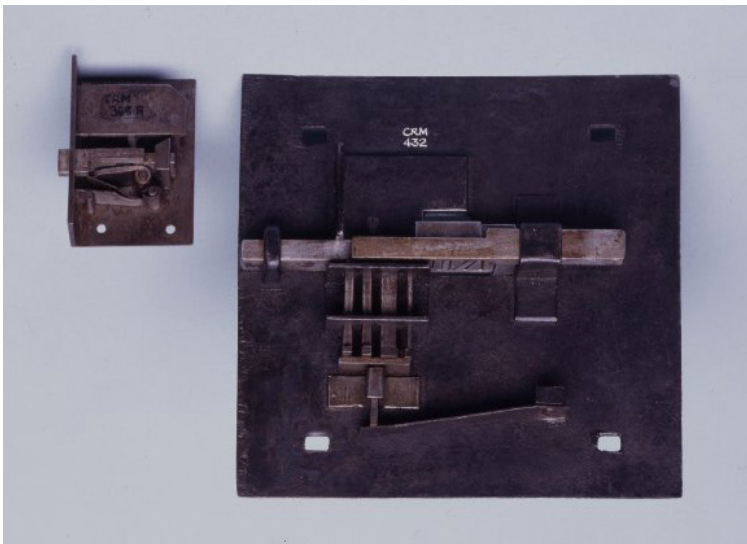


Figure 2.23 (above) Recreation of a Roman spring-actuated tumbler lock. BM CRM.432

Figure 2.24 (right) Z-shape tumbler key. MOLA 19751

Figure 2.25 (below) Roman lock bolt
PAS BERK-D5E561



In addition, these locks showed an increased concern for security. One variation did this by adding complexity to the distribution and spacing of the tumblers, bending the line of teeth on the key in an L or Z shape (figure 2.24). Another adapted the bolt to add wards - shaped perforations that would allow only the correct corresponding shaped teeth on a key to pass through and release the tumblers (figure 2.25). An important characteristic of this lock type is that because of the shape of the keyhole, the key to this lock could only be withdrawn when the lock was engaged.

The smallest of these locks required a significant amount of precision to ensure that the mechanism moved smoothly. Although some latitude could be built in by increasing the size of the ward perforations and other elements, at the scale of small box and casket locks, limitations imposed by the nature of the metal being used meant that these tolerances were still relatively narrow. The manufacture of these mechanisms required specialised, practiced skill.

2.3.3 Leaf spring locks

The development of new types of locks, those using leaf springs as the primary element that blocks the bolt or lock movement, shows that there was considerable importance placed on security solutions in this period. Attention was not only directed at improving existing mechanisms but also on innovating entirely new approaches. There are roughly three variants of leaf-spring mechanisms: fixed plate leaf springs, springs that act with or as a sliding bolt, and flared springs used in padlocks. Variants of these locks were extensively used in early medieval England and Scandinavia so they will be more completely described and illustrated in the following chapters.

2.3.4 Rotary spring locks

The last lock mechanism developed in the Roman period is the rotary spring lock. The morphology of the key to this lock type is the one that is the most recognisable today, although the mechanism behind it is no longer in use. In this lock a spring, which may have a variety of shapes, holds a bolt in place. Because the key has three edges, there are three planes in which wards can be introduced, allowing for a large amount of individuality and therefore security (figure 2.26). The flat bit also makes the implied complexity of the lock easy to read in comparison with the keys to the spring actuated tumbler locks.



Figure 2.26 Roman rotary key with complex bit
Getty Museum 96.AC.197

This ability to visually transmit information also provided the opportunity to embed rhetorical messages in the design of the key. This is most noticeable in later keys, such as church keys that deliberately included crosses (figure 2.27), but the appearance of repeated complex shapes, as will be discussed more thoroughly in Chapter Four, suggests that a symbolic “language” of specific forms may have developed.

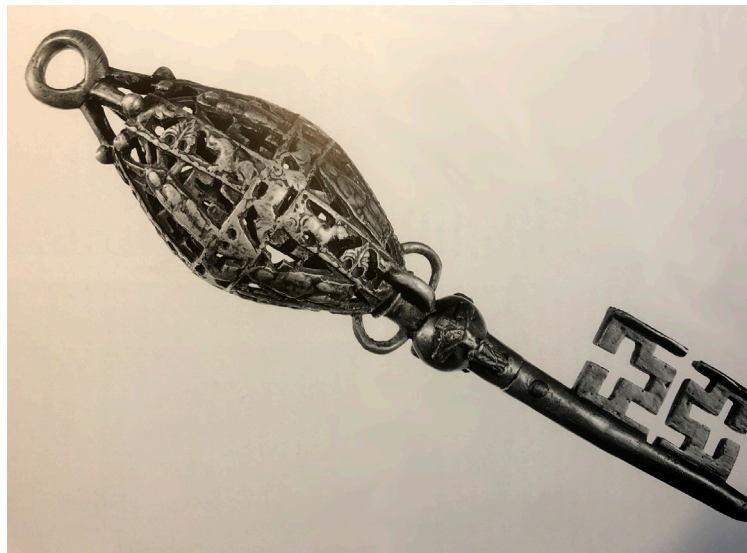


Figure 2.27 Key of St-Hubert containing a relic of St Peter in the handle, with crosses in the bit. Église Sainte Croix, Liège. Brunner 2006, 141.

A version of the rotary lock is the puzzle padlock, a striking example of combined symbolic and practical elements. This is an extremely rare form, one that appears to drop out of the archaeological record at the end of the Roman period. These locks are the most complex known from the time. The lock is secured in two ways - with the puzzle (hidden movement or movements that have to be manipulated in the correct order), and with a small key. The cover of the lock is a stylised head or mask, doubled in some forms, possibly to create a reference to the two-faced god Janus. It also could be that the open eyes of the mask were meant to provide a third layer of protection (figures 2.28 and 2.29). Slocum and Sonneveld (2017) suggest that these locks were used to secure leather money pouches. But the layers of meaning built in to the form of the lock may mean that they had a cultic significance. Certainly the complexity of construction, the aesthetic nature of the form itself, and the fact that the objects were small enough to be worn in some form variations, indicate that these objects were valuable, and were meant to be displayed.



Figure 2.28 (left)
Square shackle padlock
Slocum and Sonneveld
2017 fig 4



Figure 2.29 (right)
Janiform padlock
Slocum and Sonneveld
2017 p 95

2.4 Locked spaces and places in the Roman period

The number of types of locks in use in the Roman period reflects the number of different types of settings in which they were used. Locked spaces in the Roman period can be roughly divided into three categories: structural spaces such as houses or other buildings, apartments, and rooms; large and inbuilt furniture such as cupboards and chests; and small, portable objects such as boxes and caskets. Studies at Pompeii (Allison 2004, 2006), Herculaneum (Mols 1999), and some military sites (Burley 1997; Allison 2013) give some impression of how these different spaces were used in daily living, and how locks and keys may have played a role in the use and perception of these spaces. The expansion of the use of locks to smaller structures and objects is particularly important for the early Middle Ages.

2.4.1 Structural locks

Locks were, of course, used on warehouses (Ulpian 16.3.1) and on exterior doors, like those found on the three entrance doors of the Casa del Obellius Firmus, in Pompeii (figure 2.30 below) (Allison 2006; Della Corte 1911, 267-272). Warehouses may sometimes have been secured with chains and padlocks, but two recorded opinions of Ulpian in the law codes of Justinian (book 19.1.17; book 21.17.15) relating to domestic structures emphasise that locks and keys are considered to be part of the building even though they are technically not attached to the soil (an important legal definition). The fine distinction seems to be that the locks are part of the door or door frame and must therefore have been permanently fixed in place. That the keys were included in the legal definition in spite of being entirely independent of any structure indicates how closely locks and keys were associated with each other; although not physically attached, lock and key together were a coherent object.

In addition to external doors, locks were also used on interior doors to secure store rooms, to direct and control traffic patterns, and to create separate quarters or apartments. The surviving door locks in Casa Julius Polybius (figure 2.31 2-4 below) provide control points, regulating the divisions between formal, public facing spaces and those that were more private. How these divisions were created had legal, and therefore probably cultural, significance. A ruling by Ulpian makes a significant distinction between an apartment separated from the rest of the building by a single locked door, vs one that had open access (Book 21.17.15). The ability of a tenant to control movement into and out of the apartment changed the nature of the space both in practical use and in its view under the law.

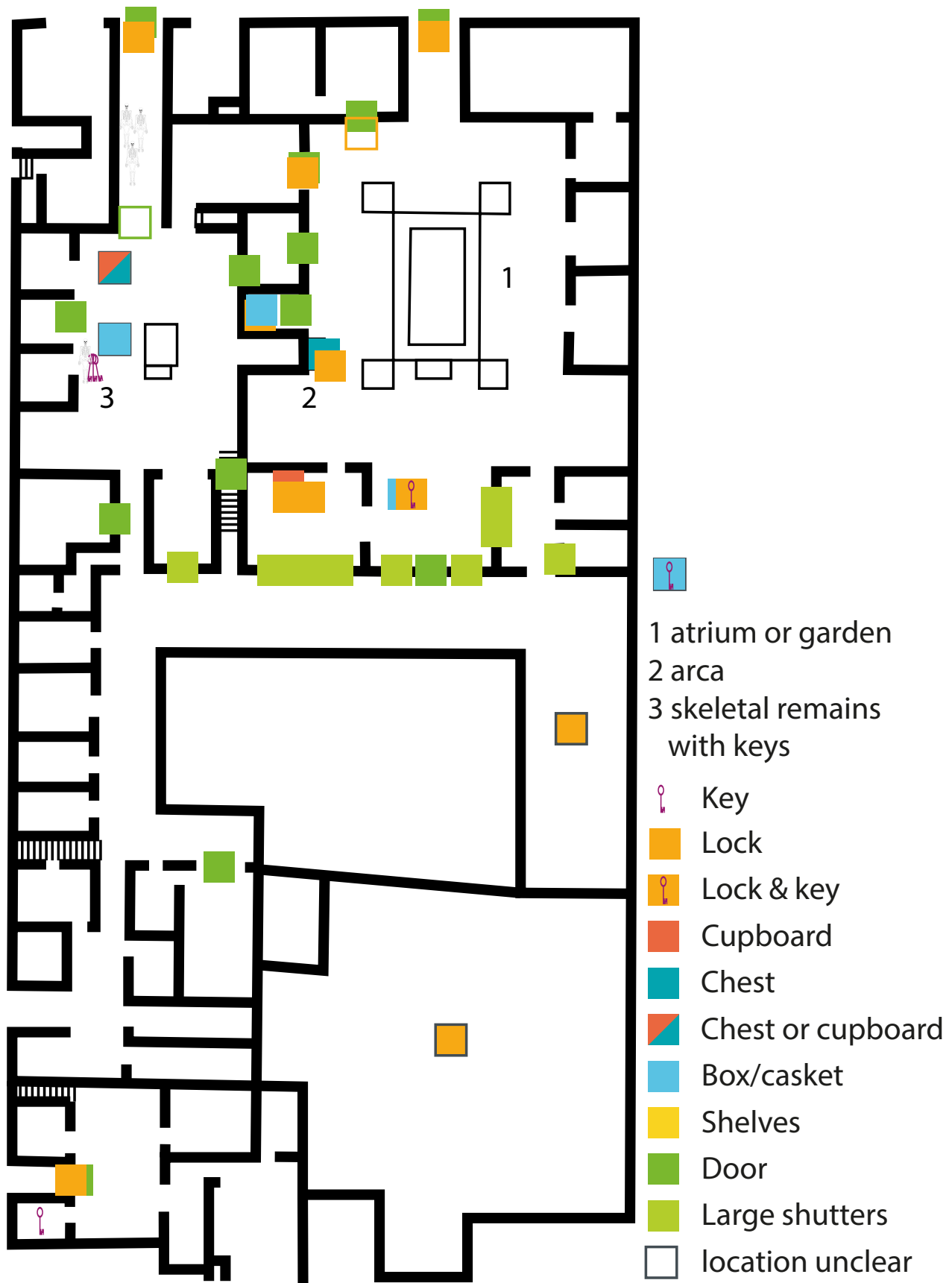


Figure 2.30 Floorplan of Casa Obellius Firmus with locations of locks, keys and other fittings and structures. After Allison 2013 and Della Corte 1911 267-272

2.4.2 Furniture locks

The second type of locked space, large cupboards and chests, introduces the importance of visibility. Allison's study of Pompeian houses in the Isla Meander in Pompeii (2004, 2006) showed that it was common to have a number of cupboards and chests located in the atria and/or in the peristyle of the garden. Plotting the location of recorded finds of locks on the floorplans of these buildings (figures 2.30, 2.31), makes it clear that in many houses these pieces of furniture could be locked. However, because of the amount of disturbance in many of these areas it is difficult to know how these spaces were used.

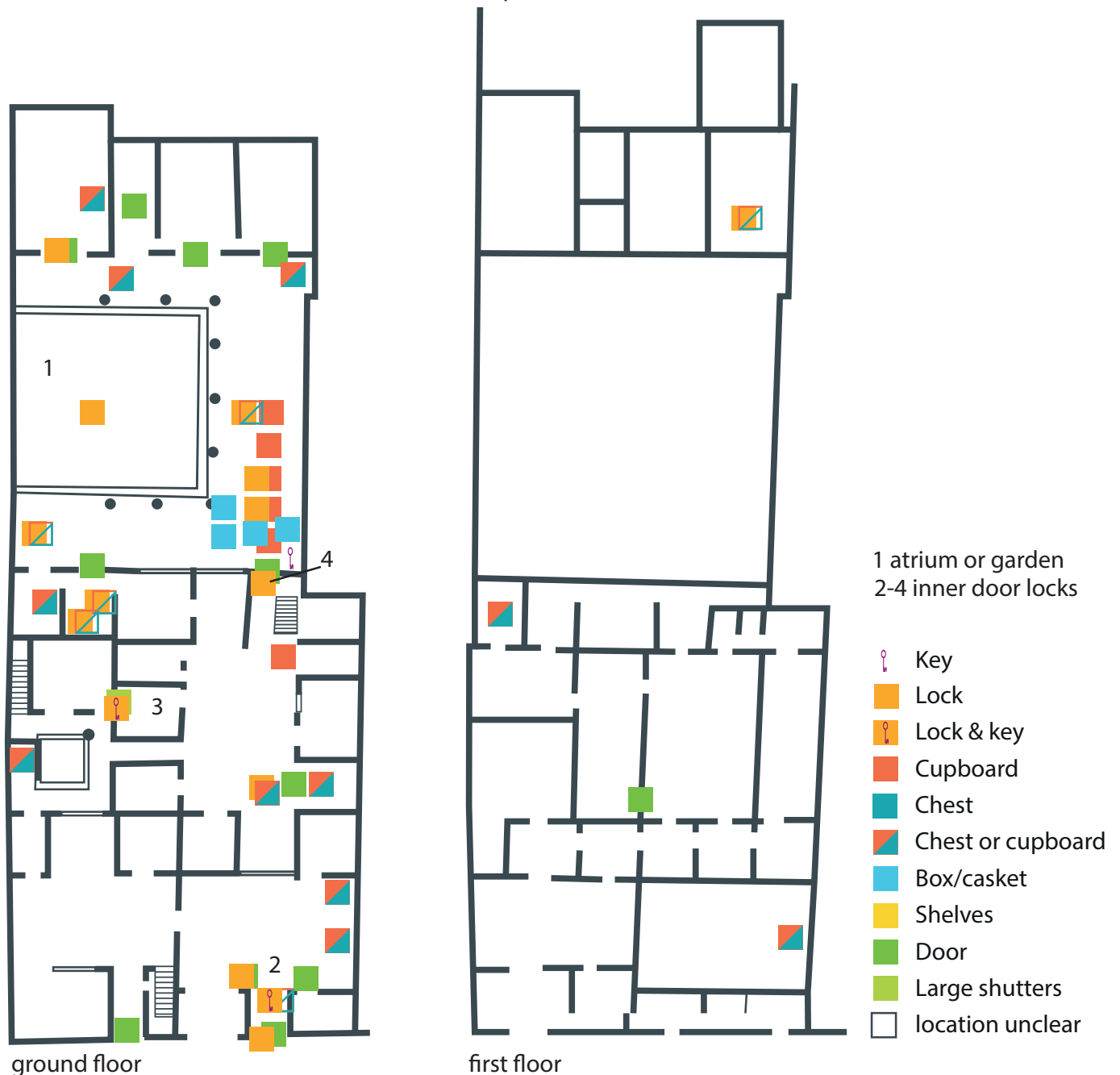


Figure 2.31 Floorplan of Casa Julius Polybius with locations of locks, keys and other fittings and structures
Note interior door locks.
After Allison 2004

These are open areas, probably accessible to most members of the household and even visitors. The use of locks on much of the storage indicates that security was still a concern, and access to those objects was often restricted. A locked storeroom on the south end of the smaller garden of the Casa di Julius Polybius (figure 2.31: 2, above) that contained at least one cupboard or chest, shows that deeply placed, nested storage was also used. So the decision to keep these objects in an open and relatively public area was deliberate, and a difference was made between objects that were stored behind a locked door and those that were secured in communal spaces.

Arguably, the visibility of interaction with the cupboards, and with the items in them was itself important. This could be in part because that public visibility was another layer of security; theft was less likely to take place in the open. Highly visible spaces recruit the viewing community to participate in the security of the objects.

The visibility of atria and garden storage also means that although not all household members had physical access to the objects, most or all of them would have knowledge of the contents. A difference was being made, in other words, between controlling the availability of resources and controlling the availability of knowledge of those resources, their condition and their use. This idea is supported in part by texts in the Digest. Slaves are liable to be questioned in the case of theft from a building under the assumption that they have knowledge of the layout and contents of that space (Paul 1.15.3, 19.2.55).

An important example of this balance between security and visibility is the *arca* or strongbox that, in some large houses, was placed in the atria (what Allison, 2006, prefers to refer to as the entrance hall). As many as 30 possible *arca* have been identified in Herculaneum and Pompeii (Pernice 1938, 71-99 and Taf. 43-58, from Mols 1999, 104) although only eight have survived. These chests were substantially built and appear to have often been semi-permanently installed on masonry plinths which would have both protected the vulnerable underside of the chest and made removing it more difficult. The *arca* from the Casa di M Obellius Firmus (figure 2.32; 2.30: 2) was covered in bands of iron and heavily studded with rivets, a construction that is seen in several early medieval Scandinavian chests which will be discussed in Chapter Five. Rather than having a lid, the contents of this *arca* were accessed through a flap in the top of the chest which was secured with two locks.

The reinforcement of this object, arguably excessive to needs, is as much about conveying the message of strength and security as it is about actual protection. The chest needed to be seen, and it needed to be seen as impregnable. Because the strongbox both held deposits for others and was used to disperse loans and gifts to clients, the highly visible security was essential. It inspired confidence in the safety of deposited money, and suggested substantial wealth and through it social and political power. The importance of such an object carries through the early Middle Ages, and it is possible that there is

intentional reference to this particular, reinforced form the chests and boxes found in burials in Scandinavia, just mentioned.



Figure 2.32 Arca from Casa del Obellius Firmus, Pompeii
Pompeii Archaeological Park, nd

2.4.3 Locked boxes and caskets

Whilst *arca*, cupboards and chests were intentionally large and sturdy, not only to hold bulky items but also to prevent easy theft (Paul 47.2.21), they were less useful in organising small objects, particularly those that were valuable and/or fragile. For these objects smaller caskets were used. These allowed small objects to be safely contained or stored, made them easily portable, and gave additional security by providing the opportunity for nesting the small locked box within larger locked spaces. The vulnerability introduced by the second characteristic could to some extent be mitigated by the latter.

All three of these characteristics are evident in surviving boxes and caskets from Pompeii and Herculaneum. Where it has been possible to identify the contents of these smaller containers, they held both high value (jewellery, coins, silver etc) and more mundane objects (needles, game pieces, toiletry items etc). At least 20 caskets, many with evidence of locks, were found inside cupboards or larger chests. Four small caskets, one of them with a silver lock and containing jewellery, were found in a cupboard in an open room to the south of the atrium in the Casa del Sacello Iliaco (figure 2.33: 1). A lock plate found with the

cupboard fittings suggests that it too was lockable - another example of layers of security in an open area accessible to the majority of the household (Allison 2004).

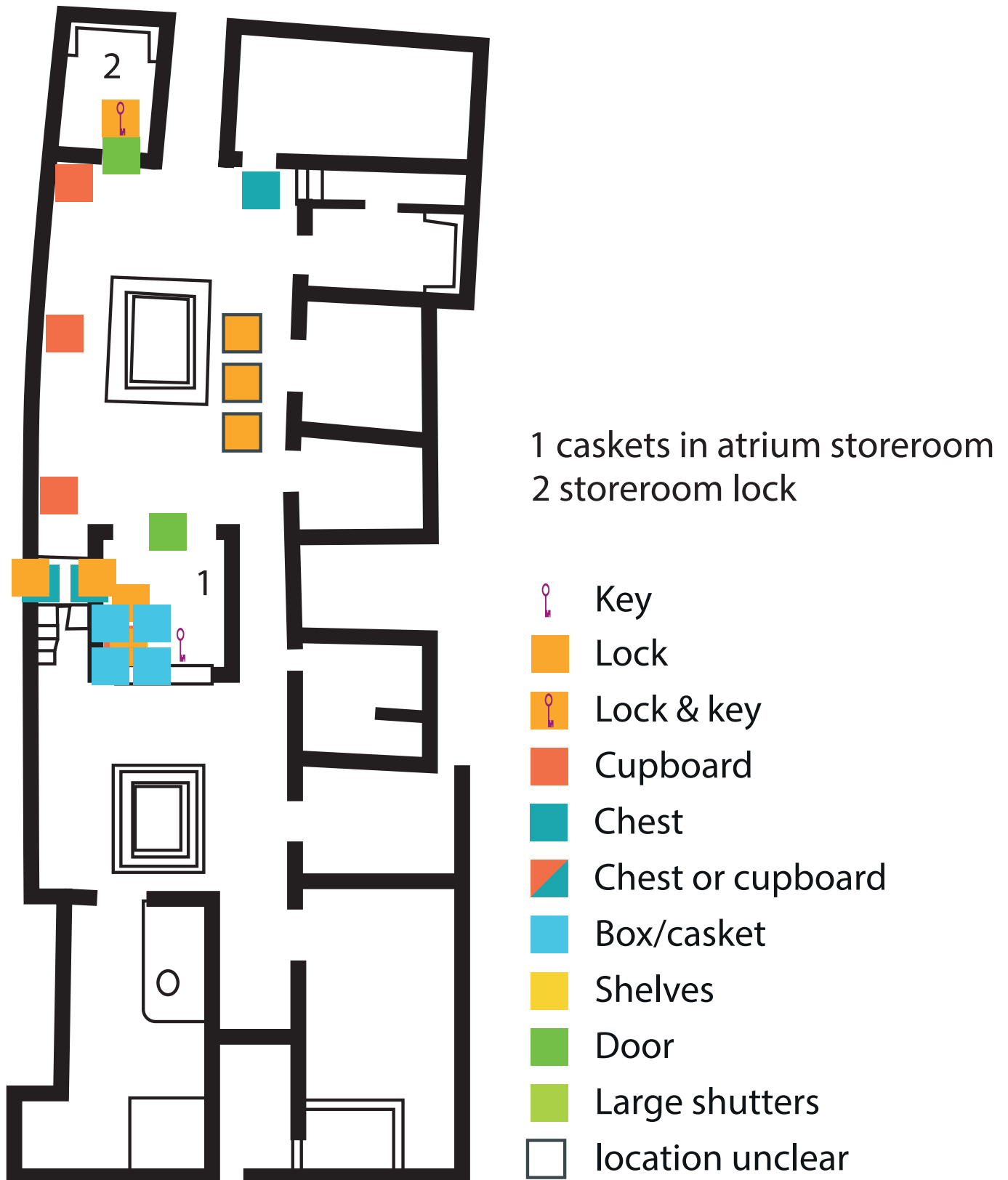


Figure 2.33 Floorplan of Casa del Sacello Illiaco
After Allison 2004

Small boxes could be used as a sort of portable safe as well, allowing easy transport of valuable objects, coins, or personal belongings. Many of these objects had chains that would have facilitated this. Two such chests were found in room 12 on the beach at Herculaneum (Scatozza Horicht 1989, 27-68), close to two skeletons. The chests contained valuable jewellery and may have been brought as convenient portable wealth to make the journey easier, or to keep them safe from looters. In the Casa di Fabio, Pompeii a skeleton was found on a bed, with a small box containing a ring and a large number of coins. Another skeleton was discovered well above street level outside the Casa della Venere with a bag filled with assorted copper-alloy objects, including a compartmentalised casket containing what was only reported as “substances” which may have been perfumes or medicine. The other objects in the bag seem to have little value so may have been personal belongings or objects taken as loot (Allison 2004).



Figure 2.34 (above) Detail of mosaic in baths of the Villa Romana del Casale, Sicily

Figure 2.35 (right) Mosaic in situ author's photographs



These portable boxes were not only used for emergencies or for longer-distance travel. The mosaic at the entrance to the baths of the Villa Romana del Casale shows the woman of the house on her way to the baths. She is accompanied by four people, two of them carrying boxes (figures 2.34, 2.35). One box is large and may have held clothing. The other, its lock clearly visible, may have been a toiletries casket, holding oils, combs,

cosmetics, and perfume. Such a box, carried in public, would have signalled messages of status, wealth, and femininity.

The evidence seems to show that portable caskets, chests, or boxes were used in a number of contexts and in a variety of ways. It is reasonable to assume that many small boxes had no lock, but for others the lock was central to their usefulness and their purpose. The ability to easily and readily change the level of access of the boxes or the objects in them as well as their visibility within and even outside of the household would have given flexibility both in ordinary use and in more weighted moments such as gift exchanges.

This idea of cultural weight is also seen in the inclusion of small boxes that contain jewellery and other small personal objects in burials (Kiernan 2009). This practice of including lockable boxes in burial assemblages was widespread in the Roman world. Examples have been found in Germany (Friedhoff 1991; Müller 1971, 213), Hungary (Fülep 1977, 56), Spain (Künzl 1994, 625) and Britain (Crummy 1983, 85-88). There are a number of possible interpretations for the inclusion of boxes, including convenience in carrying small items, a shared biography between the container and the objects it held that made them difficult to divide, or even an instinct for organisation and tidiness in the construction of the grave. But the fact that many of the boxes could be locked may also have significance, indicating a desire to keep the objects secure even in burial, a need to seal or anchor them more firmly. As with the *arca*, the significance placed on the ownership of small boxes and on their use in mortuary assemblages will also be seen in practices in both England and Scandinavia in the early Middle Ages.

Another possibility, that of the intentional creation of a link between the living and the dead, which is also discussed in Chapter Five, is supported by assemblages found in rock-cut tombs in Knossos (Wardle and Wardle 2004). Evidence of at least four lockable boxes in three tombs have been found (Wardle and Wardle 2004 474-75). Surviving bolts and lock plates make it possible to identify that the locks were of the spring tumbler type. No keys were found in the tombs, including the well-preserved tomb at Monastiriako Kefali (473), implying that the keys were purposefully retained and that the boxes were deposited locked.

As with the locks in Pompeii, these three categories of lock application produce the ability for space to be more or less nested. Locked spaces can contain smaller locked spaces, creating a concentric system (figure 2.36). The characteristics of that system can be informative, not only in terms of the depth and complexity of the nesting, but the degree to which the use of the locks can shape it. This introduces concepts that will also have significance for the understanding of early medieval lock use: the depth or shallowness a concentric system may exhibit; the amount and extent of control a lock is able to exert over elements of that system; and as a result of these two, the amount of flexibility in terms of

the use, access, and depth of space that a particular system has, and finally the visibility of the lock and key within the enclosing space. Because these characteristics are shaped by practice and social structure, they contain information about those forces.

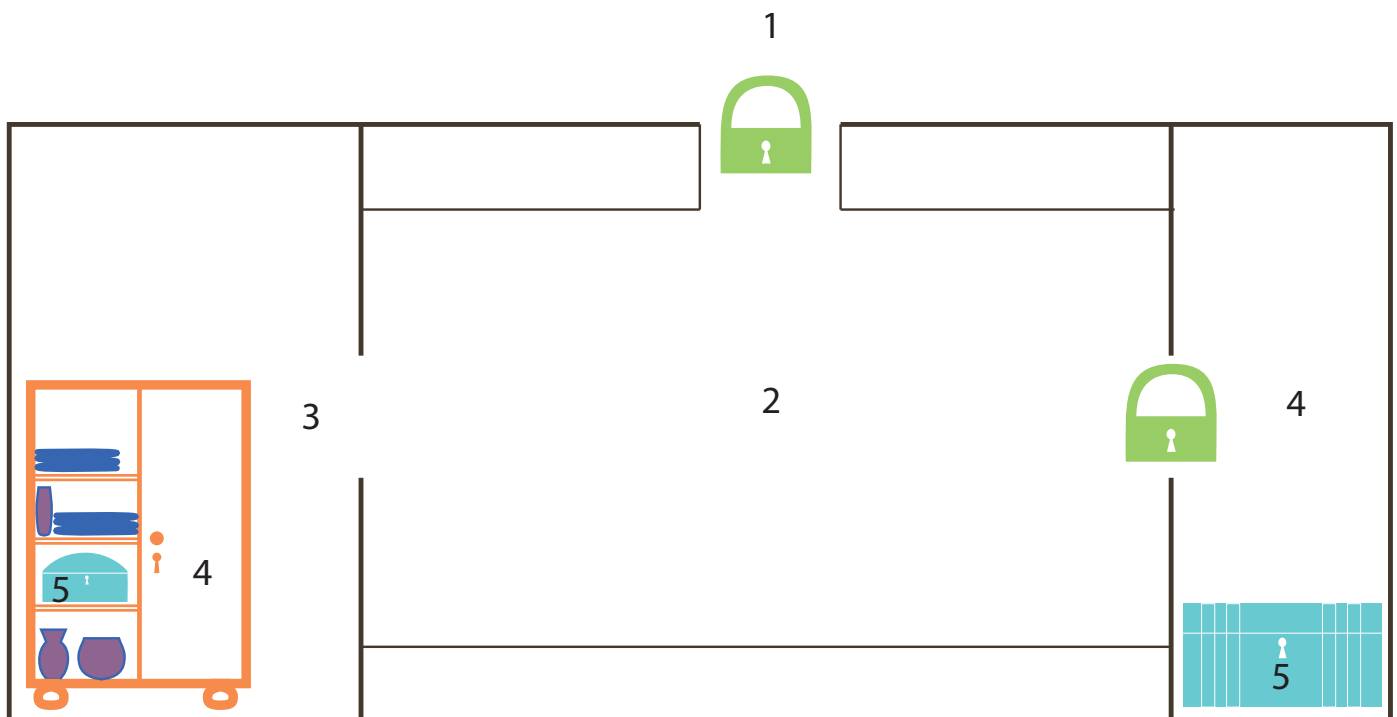


Figure 2.36 Nested spaces with levels of access 1-5 from publicly accessible (1) to highly controlled (5)

Essential to these concepts is the idea that it is not only physical access, but visual access that is actively important. This is both in terms of how a lock may change the experience of the visibility of a space, and also in how visibility may have been important in where and why a lock was used. This is particularly true when considering locked furniture and smaller containers.

These ideas are, of course, related to Space Syntax (Hillier and Hanson 1984), a theoretical framework based on the premises that space is an essential aspect of social activities, and that the configuration of space is a result of and an agent in those activities. Ideally, the methodologies of Space Syntax, such as Access Analysis, axial analysis, and Isovist analysis, could provide insight into the significance of the use and placement of locks. Unfortunately, although there have been a number of important Space Syntax analyses on Roman buildings including those at Pompeii (Grahame 2000, Laurence 1994, Landeschi et al 2016) and Ostia (Stöger 2011), they have not discussed the effect of locks. In all of the studies mentioned, doors are assumed to be unlocked, and in the case of Landeschi et al's visibility analysis, wide open. Given the centrality of doorways to core concepts of Space Syntax, a reevaluation of some of these studies, particularly in Pompeii where, as mentioned, there is surviving evidence for locks in situ, would be useful.

2.5 Key use

Moving from a focus on lock use to an examination of how and by whom keys were used, there is less available evidence. The find of a single skeleton, assumed by Della Corte (1914, 214-222) to be male, in the western atrium of the Casa del Obellius Firmus (figure 2.30: 3) may provide some information about how keys were associated with individuals. This person had apparently been left in charge of the house as they were found with a large bundle of keys, possibly as many as twelve. The skeleton was also found with one gold and 101 silver coins, thought to have been in a cloth or leather bag. Although this is a significant collection, it does not seem sufficient to be the contents of the atrium *arca*, which was found empty. It seems more likely that the coins were the personal savings of the individual, or represent money entrusted to them by the owner of the house to pay for any necessary expenses. The only jewellery found on the skeleton was an iron seal ring which had to be held in place by a simple copper alloy loop, suggesting that the seal ring was not made specifically for the individual, indicating someone without resources to buy a more expensive, bespoke item.

The keys were all iron and were found corroded together. The description of the keys and the fact that the body was found near a door, suggest that some if not all of them were to structural locks although as there is no mention of a lock found with the door fittings, this can only be a suggestion. There is certainly no mention of smaller, finer keys, often made of copper alloy, that would have opened caskets or boxes. The only other human remains in this structure were of four or possibly five individuals, but they seem to have broken into the entrance way from the adjoining shop (Spano 1914 372-373). The key holder, then, was likely left alone in charge of the building whilst the rest of the household evacuated.

This suggests that the keys to a substantial household could be distributed amongst a number of different people according to their position and responsibilities. Although it is possible that they were normally held centrally, by the household head or the steward, and only handed out as tasks were assigned, it seems reasonable to assume that in order to assure the smooth running of daily activities, at least some of the keys were more or less constantly kept by the person who managed that space. Wearing the keys would, of course, openly signal the role and authority of the person involved, both within the household and to the wider public in the town.

Because that authority is delegated, the display of the keys is also a display of the power, wealth, and authority of the household head; there is no real transfer of ownership of the space and objects secured by the key. Similarly, Papinian (Book 31.1.77) describes a situation where a man had a number of heirs and gave his keys and seal ring to his eldest daughter. In this case the daughter was seen to stand in place of all of the heirs, to accept

the keys on their mutual behalf rather than solely her own. It was important both that the keys should be handed into the possession of a single person, and that the legal limitations of that possession were clarified. In contrast, in the simpler situation of a sale of goods stored in a warehouse, a number of opinions in the Digest make it clear that the transfer of keys is held to represent the transfer of ownership of the contents of that warehouse (Papinian book 18.1.74; Gaius book 41.1.9.6; Paul book 41.2.1.21).

Some keys, however, may have been reserved solely for the owner. The most obvious are ring keys, wearable keys with rotary, spring tumbler, and leaf-spring bits (figures 2.37-2.39). Their size suggests that they were used for locks to small boxes. This combination of tool and jewellery is particularly interesting. It allowed absolute control over the key and also provided an opportunity to signal wealth, status, and social or political importance.



Figures 2.37-2.39 clockwise from above left
Roman ring keys including leaf-spring slide keys (above left and centre)
and rotary warded keys (above right)
2.37 British Museum 1814,0704.1045;
2.38 Museum of London A7999 ;
2.39 Museum of London 1940a;

The size of surviving examples suggests that they were worn by both men and women, but there is reason to believe that some ring keys were specifically used by women. A sarcophagus with the name Crepereia Tryphaena inscribed on the side and containing the remains of a sub adult female was discovered in Rome in 1889 (Lanciani 1889, 173-80). The objects inside included a carved wooden doll and its accessories: a miniature box containing two combs and a mirror, and a gold ring key (Sommella 1983, 31) (figure 2.40-2.43 below). These objects together seem to represent an idealised set of feminine belongings of which the ring key is an essential part.

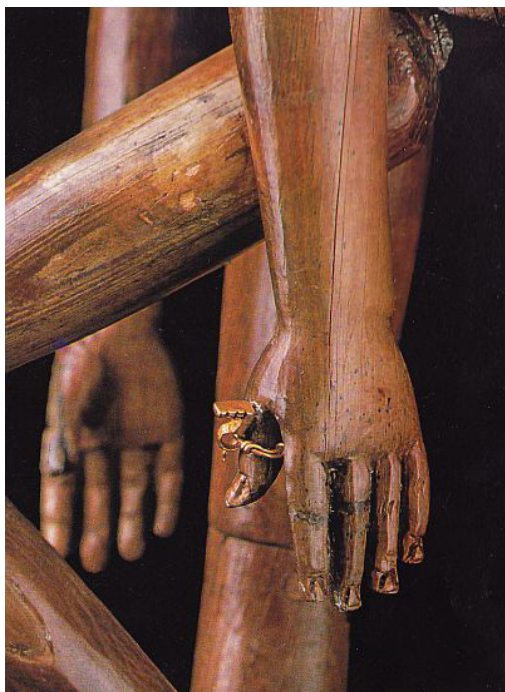
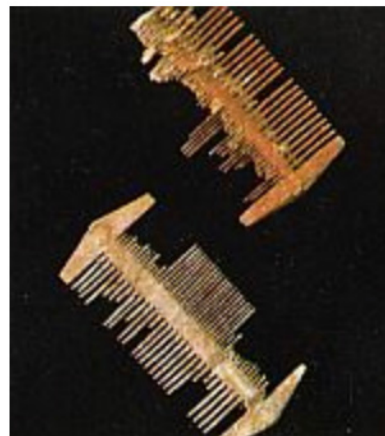
2.6 Locks and keys in Roman Britain

There is ample evidence for the use of locks and keys in Roman Britain in a variety of sites and settings. Keys to locks for buildings and rooms, large chests or cupboards, and

small caskets are all well represented and are relatively common finds (Manning 1985, 88). The wide range of key types and sizes suggests that there were comparable use practices in ordinary daily life involving storage and organisation, and probably the public dispersal of loans and gifts.



Figure 2.40 - 2.43
Miniature box (left), ivory
combs (right), wooden doll and
her ring (below) from the tomb
of Creperia Tryphaena
Museo di Milano 1982



The level of craftsmanship available is evidenced by the surviving fragments of two boxes from the Hoxne hoard. This substantial hoard, found in Hoxne, Suffolk in 1992, was deposited in a large chest, and contained two smaller, finer boxes (Johns and Bland 1994). The first of these was made of cherry wood and lined in leather (probably kid) with hinges and fittings of silver. There was no surviving wood from the second box, but the fittings and lock case were silver gilt. Although the conditions of the excavation meant that the box fittings and locks were displaced and scattered, Johns (2010) has argued for relating the silver gilt fixings to the smaller, similarly gilded lock (figures 2.44, 2.45).

Both Hoxne locks are spring based, but use a rotational motion to compress the spring rather than the more common slide. Both locks are made entirely of silver, and it's reasonable to assume that the keys would also have been silver. Silver, even in alloy,

has limited tensile strength and has a tendency towards metal fatigue with repetitive use (McCreight 1991). This means that the locks are by necessity quite small, and the mechanisms very simple, reducing the amount of torque necessary for use. Far stronger and more effective locks were certainly available (cf examples from Baldock, Stead and Rigby 1986 73-75; Lullingston, Anstee 2001), and as Johns points out even the rivets holding the locks on could have been pried out with very little effort (2010, 142). And of course with boxes as small as the Hoxne examples likely were, the easiest thing of all for a thief would be simply to steal the entire thing.



Figure 2.44 (above) and 2.45 (right)
Hoxne hoard box locks
2.44 British Museum 1994,0408.154
2.45 British Museum 1994,0408.155

In spite of the relative fragility of the locks, the level of craftsmanship involved in their manufacture is high. As will be discussed in chapter four, the practice of a particular craft at a high level implies the existence of a larger population of craft workers with a less advanced, but competent ability. The evidence suggests, then, that locksmithing was a craft that was well established in Roman Britain, and was practiced by a large number of metal workers at a variety of experience levels.

In addition to this evidence of the importance of locks and keys in the living community, there is also some support for the idea that, at least in some areas, there was

also a symbolic importance placed specifically on lockable boxes or caskets. Lockable boxes appear as grave goods, for example in grave 69 in the Butt road, Colchester late Roman cemetery (Crummy 1983, 85-88). Unfortunately the box had been crushed prior to excavation, and because the dig had experienced a number of thefts, the decision was made to lift the box en bloc in a single day. As a result, the fittings were dislodged from their original positions, and some of them were damaged during the excavation.

It has not been possible to confidently recreate the box completely, but enough survives to understand most of the original structure (figure 2.46 above). The fittings were mostly copper alloy and secured with iron nails, but although the materials were relatively inexpensive, the design was intended to give an exaggerated impression both of security and of value. The front of the box most likely had eight brace fittings, far more than necessary, and of the wrong shape to provide real structural support. The lock plate was also large, giving the impression that the lock it covered was more substantial than it really was. Further, both the lock plate and the key had been gilded.

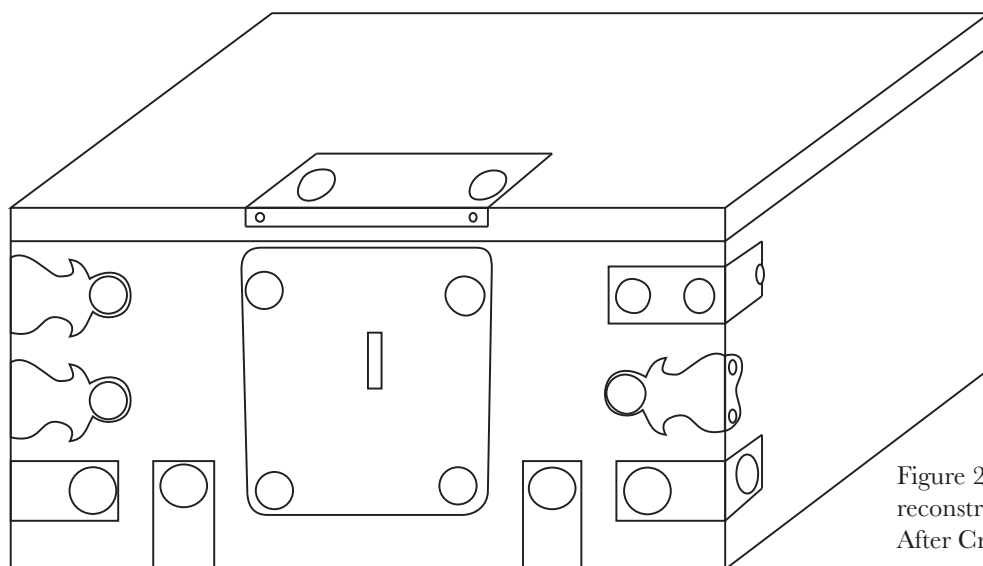


Figure 2.46 Butt Road box theoretical reconstruction.
After Crummy 1983 fig 91

In addition to the inclusion of boxes as grave goods, there is limited but important evidence for their use as cinerary containers, which may have significance for the later early medieval practice of using chests with locks as coffins, discussed in Chapter Four. Hugh Borrill's 1981 survey (304-318) of the practice in Southern Britain and East Anglia differentiated between box burials and casket burials, identifying the former as involving simpler, less elaborate boxes and tending to be found in less richly furnished burials (317). In both types of grave the box or casket holds the cremated remains whilst other grave goods, primarily pots or glass vessels, were arranged outside the container. In some cases, small, possibly ritually significant or personally linked items were placed with the remains.

One of the largest collection of casket burials is from Skeleton Green, Hertfordshire. Of the six surviving caskets, two were decorated with lion-headed studs (figures 2.47, 2.48), a decoration also found on two caskets from burials uncovered during an excavation for a

nearby by-pass (Borrill 1981, 304). Borrill, citing Toynbee (1971, 331-32), suggests that these studs may be similar to lion head motifs seen on funerary monuments (Borrill 1981, 315-16) and that either decorations were added to existing caskets, or that the boxes were specially made for the purpose. While it is entirely possible the latter is true, a lion head motif also features on an *arca* from Villa B, Oplontis, Torre Annunziata (figure 2.49 a-d below), which has a number of other highly decorative features (Biasiotti 2003 172-173) so the Skeleton Green studs may simply be ornamental.

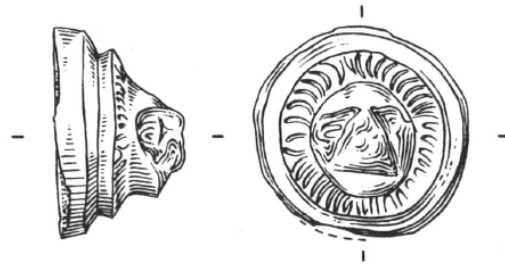
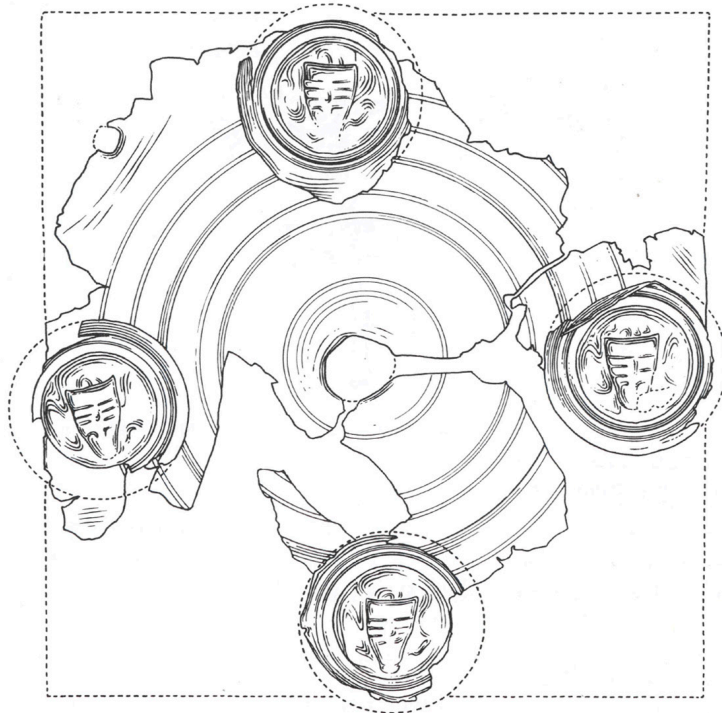


Figure 2.47 Lion head stud from Gr 4, Skeleton Green, after Partridge 1981, 314 fig 119

Figure 2.48 Lock plate with lion head studs from Gr 3, Skeleton Green, after Partridge 1981, 312, fig 117

Three of the caskets have surviving evidence for a lock, and it appears that these locks had special significance. In one burial, BXXXV, the key was included in the grave, possibly placed inside the casket (307-08). Another, BXXX, clearly had a functional lock (307), but the decorative lock plate had no keyhole (figure 2.50). Once the lid was shut, it was effectively sealed. This suggests that the lock - possibly made without a key - had an important and symbolic role in the funeral rite and, although this particular practice appears to be extremely rare (Partridge 1981, 318-321), it may reflect an importance that locks and keys held more widely, possibly controlling access to, or by, the dead.

This symbolic significance of keys is further suggested by an intriguing artefact in the collection of the British Museum: a set of eight miniature copper alloy keys suspended from two rings (figure 2.51). It is possible that this is an item of jewellery and is simply decorative, which is one reasonable interpretation of non-functional, single miniature keys (figure 2.54). It could also be the symbol of a role or office, representing the authority or trust placed in the person. Or possibly it is a talisman or amulet, perhaps meant to attract wealth or keep the owner safe, or for use in graves (White 1988). Whatever the meaning, the fact that keys had become icons on their own is significant.

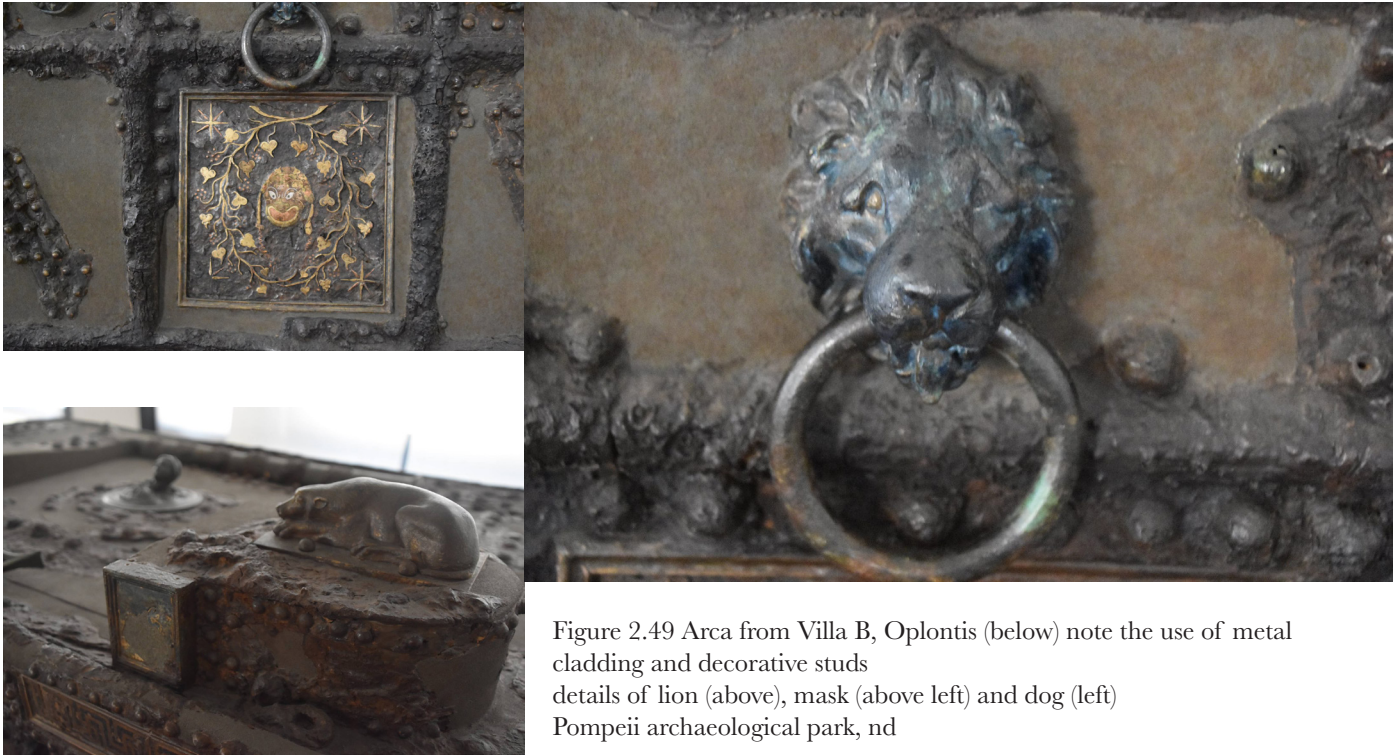


Figure 2.49 Arca from Villa B, Oplontis (below) note the use of metal cladding and decorative studs
 details of lion (above), mask (above left) and dog (left)
 Pompeii archaeological park, nd



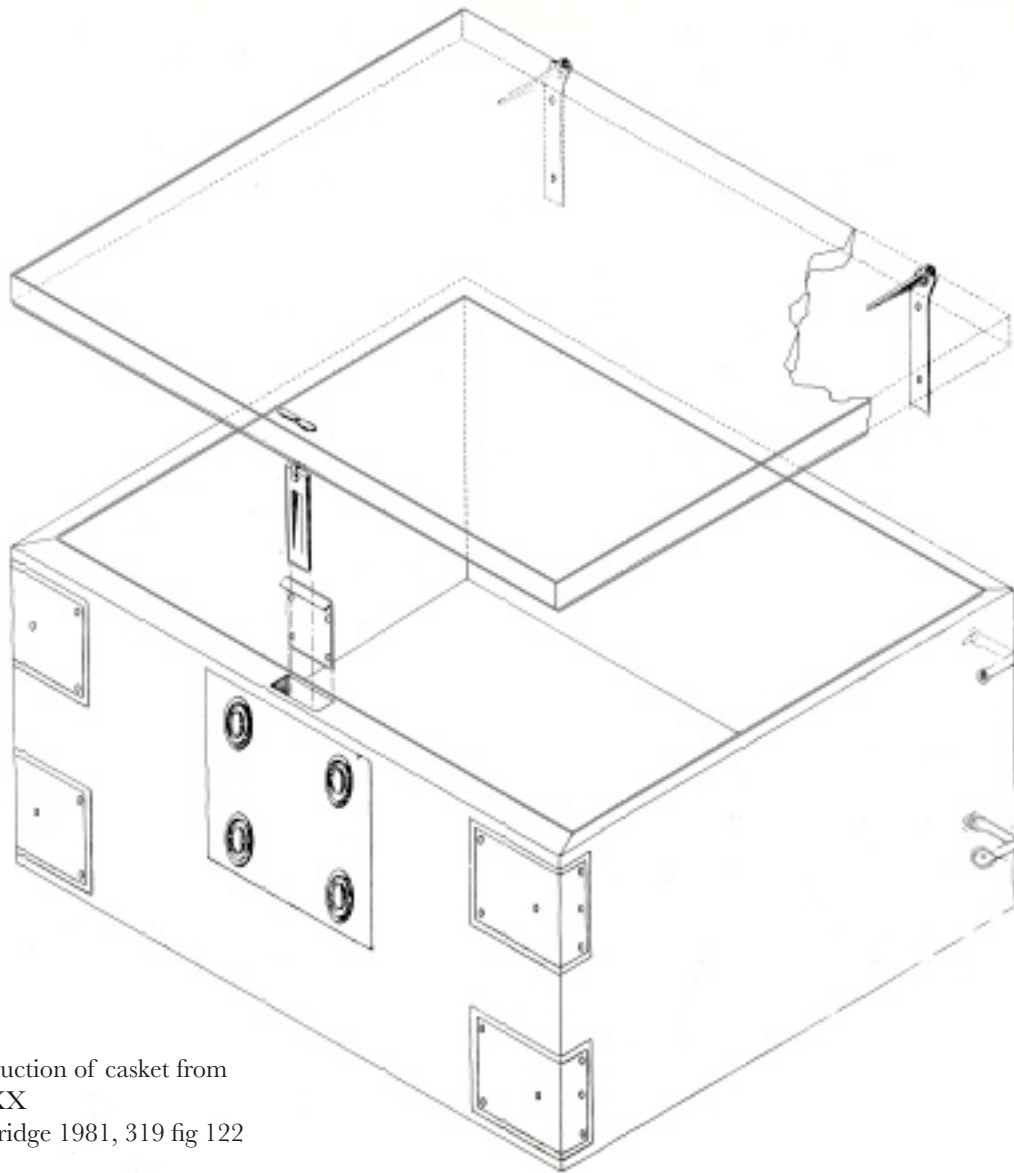


Figure 2.50 Reconstruction of casket from Skeleton Green BXXX after Garfi from Partridge 1981, 319 fig 122



Figure 2.51 (left) Copper alloy miniature keys. British Museum 1814,0704.1035



Figure 2.52 (right) Miniature key, private collection



2.7 Conclusion

The development and expansion of lock technology and locking solutions in the Roman period represents a cultural emphasis on the ability to secure spaces of a variety of sizes and under a variety of conditions. In particular, locks for large, semi-permanent furniture as well as smaller, portable boxes and caskets allowed for a significant amount of flexibility in the way spaces, objects, and people were used and perceived. The importance of managing visual access as well as physical access seems to be particularly relevant, something that allowed the community to participate in the security of resources, and to observe when those resources were used or distributed. This social importance was reflected in a symbolic importance, seen in the iconography of various gods (figs 2.53-2.54), and also found in the use of locks and keys in various ways in funeral rites.



Figure 2.53 Janus
Alexander S. Murray 1898, p 147



Figure 2.54 Leontocephaline
of the Mithraic mysteries, after
Cumont (1896) Fig 68, p 238

It is from these technologies and cultural practices that lock usage in the early Middle Ages developed. Although necessarily shaped by changing availability of materials and possibly of access to a wider craft-network for knowledge exchange, the desirability of lock use would have persisted. This would include the need to protect vulnerable objects and to maintain boundaries and borders, but also the social importance of having visible oversight of those security measures. Therefore, there was likely to be, at least for some households and communities, an emphasis on the retention of lock technology, even when the expression of that technology may have changed.

This examination of Roman lock use highlights a number of points that will be important in understanding early medieval use. The development of the technology indicates the usefulness of these objects and the demand for greater flexibility in security. The innovations of this period led to an expansion of the range of spaces that could be secured, and allowed the opportunity to display that security openly, signalling both the ownership of resources and control over access to them and visually claiming the social roles that this implied. Innovation in the size of locks also made it possible for these secured spaces to be portable, allowing the technology to spread, literally being carried around the empire.

Building on this understanding of the significance of locks and keys, It is now possible to contextualise the evidence of early medieval use of these objects. This knowledge of the extent and range of the lock technology, the use of locks in various spaces, and the possible symbolic importance they carried in the Roman period allows a more complete understanding of the ways in which these things were retained and adapted in the early Middle Ages.

Chapter 3 Literature review

3.1 Introduction

This chapter will survey past literature and research on locks and keys. The survey begins with the history of the traditional interpretation of keys, its foundation in 19th century nationalism and the creation of cultural identity. We then look at the primary, or near primary sources that have been used both in these constructions and in later scholarship directed at locks and keys. The most frequently cited texts are from Scandinavia, but there are also early English sources that need to be examined. The chapter then turns to the early typological approaches to keys in both Britain and Europe. The final section looks at more recent studies, first works focused on the Scandinavian record that have focused on the social aspects of locks and keys, both building on and challenging traditional views, then discussions of locks and keys in British archaeological studies.

3.2 Keys, literature, and national identity

Keys as an academic topic have been largely overlooked, particularly in Britain. There is a long history of popular interest in the mechanical aspects of the locks, and the aesthetic appeal of many examples has inspired collectors and enthusiasts. They also feature

prominently in literature, art, and mythology, from classical depictions of gods, to film makers like Alfred Hitchcock, who repeatedly used keys as plot devices (Walker 2005 270-74). However this evidence for the importance and social weight of these objects has not been echoed in a significant amount of academic literature focused directly on the subject.

Although the earliest academic writings on the early Middle Ages do not contribute directly to the study of keys today, it is worthwhile discussing the ideas they contain because those ideas informed later scholars and, arguably, at least in some part remain unchallenged. Early studies of social structure and cultural roles which reference keys were grounded in 18th and early 19th century antiquarianism and relied heavily on the newly rediscovered Old Norse canon for information and interpretation, using archaeological digs primarily to verify or support the historical record. The texts provided the framework of understanding; the artefacts were often used to illustrate and reinforce it.

Directly influencing Scandinavian scholars of the time was the volatile political and economic situation in Europe in the 18th and 19 centuries (Arwill-Nordbladh 1991, 53, 55). Gerd Weber (1986, 415-417) points out that, with the rise of industrialisation, the increased power and influence of the middle class created a desire to discover the cultural past beyond the myths of kings and lords. Shifting political boundaries meant that there was also a drive to establish cultural identities on national scales. Here too, the past was the obvious place to look for inspiration and support.

This search for identity was not a simple exploration of history, but a dynamic reinterpretation that combined scholarly writings, literature, and art (Wawn 2000). The search for an heroic Germanic past, in both Britain and in Scandinavia, was therefore powerfully visual and textual, both inspired by the objects being excavated, and inspiring their interpretation in the context of a larger, imagined culture. Archaeology provided physical talismans that grounded national origin stories (Andrén 1998, 26).

The ways in which the fascination with the early Middle Ages led to the creation of not only national and cultural identities, but racist theories and ideologies has been well documented (cf McDougall 1982; Cantor 1991; Frantzen and Niles 1997) Less well studied, although that is changing, is how Anglo-Saxonism and the cultural context for the origins of early medieval archaeology have effected theories and interpretations of the physical evidence. With some notable exceptions (Lucy 1998; 2002), when attention has been paid to how assumptions of the past may be biasing current understanding about the early Middle Ages, it tends to be on an *ad hoc* basis and directed at specific subjects, sites or objects.

For understudied object types, such as locks and keys, this means that traditional ideas about meanings, and even distributions, tend to be repeated relatively uncritically. Even approaches using more recent theoretical models, such as gender archaeology, often do so by re-interpreting the implications of the accepted model rather than questioning its accuracy or looking for new ways in which the objects can be approached. This means both

that ideas about the social and cultural significance of these objects have stagnated, and that their potential to contribute more widely to the study of the period has not been fully realised.

Fortunately this is changing in Scandinavia, with a number of new studies building on foundations laid in the 1990's. However in Britain there has been less work, in spite of the opportunities presented by the dramatic increase in available information thanks to recent excavations and the data sets such as that found in the Portable Antiquities Scheme. Therefore, in order to better understand current approaches to the study it is important first to look at the textual sources that have influenced past interpretations, before examining the development of research.

3.1.1 Primary sources

Although limited, there is a fairly large corpus of European early medieval texts. This includes narrative and poetic works, of which the Scandinavian sagas and the Beowulf poem are perhaps the best known, but also sacred poems, riddles, charms, and other writings such as laws codes, chronicles, and translations of scripture. There are also external but contemporary (or near contemporary) writings, including accounts by traders, travellers, and missionaries, such as the 9th century narrative of Ibn Fadlan (2012).

Historical study has always given precedence to primary sources, particularly with identifiable authors, even while recognising that written evidence has significant limitations. Written works are produced with biases that are both conscious on the part of the author and unconscious. While the conscious bias may be obvious, reasonably easy to recognise, and often even overtly stated, the unconscious bias deriving from cultural understandings and personal history can be subtle.

Written documents are also necessarily mono-vision, providing only the carefully selected, narrow viewpoint of the author. The experiences and opinions of those peripheral to that viewpoint are unexpressed. In surviving early medieval literature, written almost entirely by men, about men and for men, this is particularly true when it comes to depictions of women and of lower status individuals. In particular, slaves and servants are rarely portrayed, even more rarely named, and particularly in the older sources, almost never used as the voiced focus of narrative.

There are additional, considerable difficulties specific to using the Old Norse canon as a source text for understanding cultural practices. The suggested date ranges are often extremely large, in part because of the significant issue of disentangling date the piece was composed vs. the date it was codified in written form (Meulengracht Sørensen 1983, 76-77). Most of the works follow a traditional pattern which produces a stylised archaism, and debates have yet to resolve whether archaic appearing passages can be considered

reliable evidence of antiquity, or must be approached with more caution (1983, 82-83). Although there have been efforts to determine a set of reliable rules by which the genuinely ancient can be distinguished from pastiche (Mundal 2013), there is still no consensus among historians or philologists. This means that a narrative about Viking Age events, which is likely removed from those events by several centuries, cannot always be securely compositionally dated, and contemporary cultural practices that are anachronistic to the purported setting of the narrative may go unrecognised as such.

In looking for social and cultural norms there is the additional problem that, although the subject and narrative arc of a story might be retained, the language in which it is transmitted and particularly the descriptive details are likely to shift (Meulengracht Sørensen 1993, 75). Scandinavian culture shared a rich heritage of mythological and epic-historic knowledge which formed the basis of the oral stories, but in their performance they would be adjusted to be pertinent to the context in which they were told (Schneider 2002, 127). This can be particularly true of details that discuss mundane aspects of daily life, including descriptions of living spaces, or objects that are not directly essential to the story. Such descriptions make ancient stories vivid and living to the audience and illustrate their continued applicability. If such elements have no narrative function they are likely to be re-invented to suit the performance context. This can also be an unconscious effect when describing objects or practices that are so ubiquitous they become atemporal, losing a sense of having ever not been in use (Kellogg 2000, xxxix).

Because the literature tends to be concentrated on the epic and dramatic, rich descriptions of more ordinary details are mostly sketched. Scenes are set with only a few words, relating action to the setting. In this sort of sparse storytelling, ordinary objects tend to be mentioned only when they serve a specific narrative purpose. This implies that the descriptions of individuals that include the objects they interact with were narratively significant. The difficulty is teasing out whether that narrative significance was driven by a link to the transmitted past, or a reference to a shared and familiar cultural present. This is particularly complex when the reference is to objects that carried cultural meanings which survived, even though the use or form of the object had significantly shifted.

Keys, given the potential social importance discussed above, may have been just such objects, carrying through an older tradition of use and meaning. The question, therefore is whether their mention in the text refers to such a meaning, or if it uses contemporary understanding as a sort of descriptive short-hand. It is also possible, of course that both scenarios occur.

3.2.2 Locks and keys in early medieval Scandinavian texts

Keys, specifically named within the text as objects, are extremely rare occurrences. There are only three of any real significance in the older sagas, and only the first two are commonly used by historians and archaeologists. The first is a description of the arrival of a bride to a farmstead, found in *Rígsþula*, *The lay of Rig*:

*Then home they conveyed a lass with pendant keys,
and goatskin kirtle; married her to Karl. Snør was her name;
under a veil she sat. The couple dwelt together, rings exchanged,
spread couches, and a household formed.
(Sturluson 2006, loc 1276)*

The lay of Rig is one of the twenty-nine pieces of the Elder Edda and is considered by some scholars to be one of the earliest of the Eddic poems (Meulengracht Sørensen 1983, 85-86). The Eddic manuscript in which it survived has been palaeographically dated to the thirteenth century (Meletinsky 1998, 11). Assuming these dates are correct, that places any cultural influence contemporary to the compilation near or just prior to this date - possibly centuries after the early Middle Ages.

Elizabeth Arwill-Nordblah (1991, 51-64) has discussed how the search for a description of early medieval woman was inevitably driven by a desire to support the contemporary politically and religiously driven concept of women as having a strictly limited authority within the home. Given the imperatives that drove this search, it is not surprising that this passage was selected. Not only did it have the claim to Germanic antiquity, but the women depicted were entirely and comfortably domestic. They were the literary wives and mothers of the modern Scandinavian and Germanic races.

In the Lay, the god Rig makes three visits and fathers the male progenitors of three status groups (or classes, as they are often anachronistically described): thrall, ceorl, and jarl. The encounters have an in-built temporal hierarchy. Not only does Rig father the three groups in an ascending order, but the couples who offer hospitality, and who eventually act as parents to the offspring, are named in order: great-grand parents, grandparents, and finally Mother and Father. The temporal setting, the age of the narrative, and the description of strict physical and genealogical divisions between statuses, make the lay particularly valuable for constructing identities in newly class-conscious cultures.

Because the lay contains the myth of the origin of the three social divisions: thralls, karls and kings, physical descriptions are an essential part of the narrative, driving home the differences in status through distinctions in body and in dress. For the three mother figures this is demonstrated narratively by describing their clothing in close detail, but those descriptions appear to be of status related costumes. The three brides, Thy, Snør and Enna, are much more loosely sketched. Only Snør, the bride who will mother the ceorls, has her

clothing described, which may suggest that the audience for the lay would most closely identify with this particular status group.

In the passage in question, Snør arrives to her wedding in a goat-skin skirt wearing hanging-keys (*hanginluklu*). With the above mentioned drive to find visual icons to symbolise rhetorical concepts, this short description became extremely important, assigning keys a powerful but extremely narrow meaning, and through that meaning defining an entire gender role. Providing supportive evidence using contemporary analogues in older traditional cultures, a description of the role of the Viking housewife was constructed (Arwill-Nordbladh 1991, 58). Housewifely responsibility, which created both authority within and restriction to her domestic sphere, was given an expressive icon in the key, seen in Oscar Montelius's (1888, 152) careful phrase, 'the keys were worn by the mistress of the house as a symbol of her authority *indoors*' (my emphasis). Hans Hildebrand (1883, 128-129) repeats the idea, referencing ancient law (without attribution) that enchains women to keys even more strongly, as they are "married to lock and keys".

The power of the iconic connection between keys and housewives carried through the nineteenth and into the twentieth century. Very few, if any, references to early medieval Germanic women seem to leave out a mention of keys, and they usually assume that the keys were prominently worn on display. Johannes Brøndsted gives a particularly imaginative description of a Nordic woman with scissors, needlecase, knife and keys all dangling by chains from her brooches (1965, 131). As keys were being discovered in excavations, often in graves that also contained brooches and beads, the archaeology appeared to be simply confirming what the literature had already made clear.

The connection between brides and keys is further reinforced in *The lay of Thrym*, in a description that is repeated within the lay for added emphasis:

*'Let by his side keys jingle, and women's weeds fall round his knees,
put on his breast place precious stones, and a neat coif set on his head.'
Then said Thor, the mighty As: 'Me the Æsir will call womanish,
if I let myself be clad in bridal raiment'
(Sturluson 2006, loc 947)*

The compositional date of *The lay of Thrym* is a matter of debate, with some scholars believing it is a genuinely early, pagan work and others suggesting it is a post-Christian parody (Meletinsky 1998, 97-98). Certainly the depiction of Thor in full bridal costume, a literary emasculation of the god, makes it likely to be a satirical work, a reading supported by the exaggerated, broad nature of the entire poem. Throughout the lay there is a theme of masculinity and femininity contrasting and overlapping. Loki borrows Frejya's bird-shape, effectively dressing as her in his search for Thor's hammer (Sturluson 2006, loc 926); Thrym,

the hopeful bridegroom, is described as plaiting gold bands and combing his horses's manes (2005, loc 926-27), the sort of attentions a woman might give her lover.

The two passages quoted above are the most commonly cited in discussions about the role of keys. As discussed above, they are used to justify the assumption that keys were feminine tools and were closely linked to marriage. What's more, their emphasis within the text in both cases is used as evidence that keys had a specific symbolism related to brides and were therefore, at least in a certain context, iconic objects that graphically represent an otherwise complex social role.

The importance of the Thrym passage is taken further by scholars who have used it to suggest that keys were an iconic object for Freya (Steuer 1982, 225), an idea that has been repeated without criticism in some archaeological reports (cf Hirst and Clark 2009, 546). This interpretation, however does not examine whether the iconography of keys was directed at Freya in her intended role of bride (which is supported by the passage in *Rígsþula*), or whether the description accurately reported beliefs about a pagan goddess. Outside of *Rígsþula* there is no contemporary depiction or description of Freya being associated with keys, while other objects - her necklace birsinganen, her feather coat, the cats that draw her chariot, and the red-gold tears she weeps - are found in multiple stories and sometimes in kennings.

These two passages also differ in the narrative function of the use of keys. Snør is truly an iconic bride, and is associated with the social group that served as the primary subject of and audience for Norse literature. In this view, her costume could be purposefully archaic, emphasising the antiquity of her ancestral role. Alternatively it is her role as honoured bride that is most important and what is described could be a more contemporary idea about iconic bridal wear.

In contrast, Thor is anything but an iconic bride. Everything about him contradicts the bridal image. He is literally wearing a costume. Arguably, the comical contrast between the raging, masculine god and his feminine aspect will be far more effective for the audience if it is described in terms that are familiar and visually evocative. A modern version of the same scene could easily dress him in white lace and high heels. In this passage then, the association of keys with a 'feminine' character is not necessarily reflective of the practice of Viking Age culture, but may be more strongly connected to the much later audience for whom it was compiled. It is interesting to note that neither description includes a mention of paired oval brooches, objects which are among the most iconic in association with early medieval Scandinavian women, but which had long since fallen out of fashion by the time the Edda was compiled.

There is a third passage in the Eddic lays that calls into question the idea that in older poetry keys were iconically and solely associated with women. *The lay of Volund*, which is generally considered to be among the oldest of the Eddas (Meletinsky 1998, 28), tells of

the capture of Volund by Niðuðr. To prevent Volund from escaping or taking revenge, he is hamstrung and placed on an island where he is forced to use his skill as a blacksmith to forge treasures. The two young sons of the king visit Volund in his smithy:

*To the chest they came, for the keys they asked;
manifest was their grudge, when therein they looked.
(Sturluson 2006, loc 1847, 1852)*

As in *The lay of Thrym*, the passage above is repeated twice for emphasis. It is clear from the setting of the events that Volund is alone with the boys, certainly for the second repetition which occurs after he has instructed them to come alone and tell no one of their plans (2005, loc 1847, 1852). Therefore only he could have kept and used the keys to the treasure chests.

Volund is depicted in the poem as entirely masculine. He is described as a warrior and a hunter (2005, loc 1827). Although imprisoned, he retains his agency and power, taking gruesome revenge by murdering the two boys, and making their skulls and eyes into jewels. Even after he is physically disabled he is able to both rape the king's daughter and impregnate her, leaving his virility in no doubt.

If there were a cultural bias that associated owning keys with femininity it seems unlikely the poet would have mentioned them in reference to Volund. However the fact that not only are they mentioned, but that the passage is repeated seems to imply that there was cultural significance in the locked treasure box that necessitated its mention. It further shows that Volund's ownership of the keys was not inconsistent with the image of powerful masculinity that the poem creates. It could even be suggested that the young boys's irritation with the sight of the treasure implies that Volund was keeping the objects from the king in secret, and therefore that the locked chest and the keys were symbols of his retention of power in spite of injury and captivity.

There are other, less dramatic instances where male characters are shown using keys. In Thor's journey to Geirrod's court, for example, the giant Geirrod locks Loki in a chest for three months. Once again the action is not presented as an anomaly or something to be remarked on. It attracts no commentary from the author, but it is another instance where locks and keys are used to demonstrate power and authority in a masculine figure (Sturluson 2006, loc 1729).

Jenny Jochens points out that in all of the Old Norse canon men are more often shown locking or unlocking doors or chests (Jochens 1995, 132). While she ascribes this to the male-driven action of the stories, it is still clear that keys, while perhaps iconically attached to brides coming to marriage in the context of that action, are not limited to that setting. Nor is there any apparent concern with the control and use of keys by men.

In practice it is clear that they were used by both sexes, without any attachment of

gender bias. The shame feared by Thor was apparently not in wearing keys in general, but in taking on the complete apparel of a bride, of which keys were only a single element. But the weight given to the interpretation of these passages has been considerable. Even early on it led to inaccuracies in reporting, as when Hildebrand (1883, 128-29) stated that Stolpe's then-active excavations at Birka were producing female graves with two keys, as expected from the texts. In fact, only 10 of Birka's 75 key graves have two keys, and at least one of those burials is likely of a male. This bias continues to be felt in archaeological interpretations, and must be challenged in order to attain a more accurate idea of the objects themselves and the roles they may represent.

Rather than assuming that the literary evidence provides both accurate and exclusive evidence for key use and association, it should instead be examined more holistically to better understand the narrative settings for locks and keys. More importantly, focus should be directed at understanding how they may inform on the methods and the reasons for the division and protection of space in the communities in which they were used. Certainly these passages should be used with caution when interpreting archaeological evidence. They do not support an exclusive association with women, but instead suggest that they had broader and more complex social uses.

3.2.3 Locks and keys in early medieval British texts

Locks and keys are very rarely mentioned in the Old English canon, and unlike the Old Norse literature are never overtly connected with women. The exception may be in the laws of Æthelbirht, the c 7th century Kentish laws preserved only in the 12th century *Textus Roffensis*. Christine Fell (1984) argues for a reinterpretation of a particular phrase from chapter 73: the line *Gif friwif locbore leswæs hwæt gedeth, xxx scill' gebete*, which is traditionally read as a fine to be paid by (or on behalf of) a free woman (*friwif*) with long hair (*locbore*). Fell instead suggests that the element 'loc' should be translated not as lock of hair, but as a mechanical lock (160), literally translating to "lock-bearer". Fell pushes the translation further, arguing that a reasonable modern approximation would be "in charge of the keys" (160), citing a phrase found in the Old English poem *Christ* (Christ 15, *se þe locan healdeð*).

Although her argument for a reference to locks rather than hair is reasonable, the extension to refer specifically to keys is less convincing. *Locbore* is a nonce-occurrence so there are no other texts against which this reading can be compared. There is another nonce-occurrence term, *cægþora*, that translates as "key-bearer" (Ælfc. Gr. 8; Som. 7, 19), but it is from a later source. Even if the two terms were contemporary, it is arguable that the use of "lock" rather than "key" was deliberate and meaningful and the two should not be conflated.

An even later law code, Cnut's Winchester code (c 1020/21) does specifically link women to both locks and keys, and specifies the types of spaces they secured: *Búton hit*

under ðæs wifes cæglocan [cæglocum MS. A.] gebroht wære, sý heó clæne, ac ðæra cægean heó scéal weardian; ðæt is, hire hordern, and hire cyste, and hire tege. Cæglocan is translated in Bosworth-Toller as both the action of locking, and the space that was locked (the literal translation is key-lock), clarifying that a mechanism using a key is being specified. The passage, which outlines the woman's areas of legal responsibility, reinforces that any locked space to which she holds the key is included: storeroom, chest, or casket.

These texts support the idea that some women controlled access to stores and valuables in a household, at least in the 11th century if not earlier. But the simplistic interpretation of keys signifying a single role or identity meant that emerging evidence of locks and keys appearing in early medieval graves was interpreted solely in that light. Further, there is a conflation of the narrative Scandinavian textual evidence, which is more easily read in relation to identity with early medieval archaeological evidence from outside of that area. In spite of a lack of written evidence, the social significance of keys in England was considered settled very early on, and for decades research on the objects instead concentrated almost entirely on their physical attributes.

3.3 Typological works

3.3.1 General studies of locks and keys

One of the most important of the typologically based studies is a monograph written by Augustus Pitt Rivers (1883). Pitt Rivers approaches the subject as an historian, particularly in the development and spread of the technology. He lays a foundation for his arguments by providing an extensive etymology, tracing a number of related words through all the major European languages. Although this methodology is no longer used with such enthusiasm, it does demonstrate the academic rigour that Pitt-Rivers was using towards the subject, although the history that he constructs is often erroneous. He is careful to point out areas where he is consciously making conjectures or assumptions, or is basing his statements on the unverified work of another person, but beyond the citation of earlier work or of known physical evidence there is very little either in the social or in the technological history that is entirely useful.

In spite of this, the work is valuable. Pitt-Rivers was an enthusiastic collector and his large personal collection, which was the foundation of the Pitt-Rivers museum in Oxford, included a significant number of locks and keys. Pitt-Rivers largely drew upon these objects for his book, and provided a great deal of detail on the provenance of some artefacts. This provenance not only gives information about the objects themselves, but also about the

process involved in collecting them, information that can be informative when evaluating these collections for use in research.

He established an early typology for locks, dividing them into three classes and focusing on two desirable qualities: security and rapidity, the latter being the term he used to describe ease of use. The first two lock types are tumbler based, and are morphologically very similar. Class A requires two hands to operate, one to work the key and the other to shift the bolt. Class B uses the key itself to slide the bolt - a more efficient action. Class C, spring locks including both mounted locks and padlocks, are grouped together on the premise that they are more secure than the tumbler locks.

This approach to classification, which ignores significant aspects of the morphology of both locks and keys, places the focus on the social pressures that produced the different types, and the physical experience of interacting with the objects themselves, anticipating modern debates on issues of material, materiality, and the appropriate locus of research attention between person and object (Ingold 2007a, 2007b, Tilley 2007, Knappet 2007, Miller 2007, Nilsson 2007). He also attempted to construct probable stages of development of specific type forms, focusing on padlocks, and he recognised the importance of trade networks in knowledge exchange.

Pitt-Rivers's ideas have been sometimes been filtered through another book, which is the most extensive general work on the subject available in English. Vincent Eras's 1957 *Locks and keys throughout the ages*. Eras worked for a single locksmith company, Lips' Safe and Lock Manufacturing, for fifty years. The book was produced under their copyright and is dedicated to the founder. It is not, and does not pretend to be, the work of an academic, but because Eras himself was a highly experienced technician, his understanding of the mechanisms of locks throughout their development is deep, and provides significant authority to the sections on lock technologies. He also had a large personal collection of objects, and had access to the Lips company collection, an asset he took full advantage of by providing a large number of excellent photographs and illustrations.

The book is a broader study than Pitt-Rivers's, and although it also surveys the origins, types and development of mechanical locks from their first appearance in Egypt, Eras devoted a significant amount of the work to then-modern technologies which is where his own expertise lay. For the majority of the pre-modern information, Eras relied heavily on Pitt-Rivers, and although he mentions his debt to the source openly in his introduction, because he does not cite in the text, the extent to which Pitt-Rivers provides not only the primary but often the only authority for a number of points is obscured.

Eras's interests are less tightly focused than Pitt-Rivers's, so his historical section does include a wider range of topics. Unfortunately this results in a lack of structure that can be confusing. He mentions the Gordian Knot (1957, 18) as an example of earliest approaches

to locking (an example taken from Pitt-Rivers 1883, 5), and then discusses wooden tumbler based Egyptian locks that pre-date the writing of the Gordian myth by centuries (Eras 1957, 21). In his history he mentions that padlocks in ancient Egypt were made from bronze or iron (1957, 43) and discusses how the Romans brought their advanced lock-making technology to England (1957, 33), but later claims that the first metal locks were made in England in 870-900 AD (1957, 59). Eras also moves somewhat unsystematically through time, using a loose topical narrative instead of a chronological one which makes it difficult to understand how he views the development of locks in general. Having said that, as a narrative approach it provides insight into the way a technician viewed the history of the objects and where his particular focus lay.

The significant gaps in the history and chronology of the technology, however, are still problematic. The early through high middle ages are not covered at all. The discussion goes from examples from the classical world to the artistic and technological developments of the fifteenth century with only the briefest mention of the intervening time. This gap is understandable given Eras's own interests, but it is also significant because of the book's standing in the literature of the technology.

Notwithstanding its problems, Eras's book remains an important work in the study of locks and keys. This is in part due to its excellent illustrations, which provide a rich resource of various forms of both object types. Additionally, Eras read extensively on his subject, and although the book lacks a formal bibliography, he not only cites a large list of literary sources through the ages, but refers to a number of archaeological and historical works in the text. But it is clear that its continued importance relates mostly to the fact that no similarly comprehensive work has been produced since its publication.

The closest example in English is Eric Monk's 2010 *Keys: their history and collection*. Monk's book also takes a broad, multi-period approach to the subject, so it is disappointing that, although nicely illustrated, it is hardly more than an expanded pamphlet. The text is brief, with the focus of the publication on the many black and white drawings and photographs.

Like Eras's work, Monk focuses on punctuated moments where significant changes in form, technology or construction occur. This means that after an examination of the ancient roots of the mechanisms, he concentrates primarily on the late- and post-medieval eras. The beautiful craftsmanship and design of the Elizabethan locksmiths are understandably featured, as are the technological innovations that occurred in the eighteenth century. However the considerable span of time from the fourth to the fifteenth centuries is hardly mentioned simply because of the lack of large, technologically significant changes.

The other obvious omission in both Eras's and Monk's works, and this is a function of the focus and purpose of the books, is any sort of reliable typology. Although there

are illustrations of key forms through time, these examples are not sufficiently extensive or consistent to form the basis for an understanding of common forms in any particular era. Further, because the examples naturally focus most often on the exceptional or the beautiful, more ordinary or common key types are either passed over or not mentioned at all.

3.3.2 Roman locks and keys

As discussed in the previous chapter, a number of technological developments in lock mechanisms occurred during the Roman Period. However, the understanding of when and how those developments took place is not complete. Most of the available literature on Roman Period locks and keys is focused on specific sites, and although valuable in understanding the distribution of lock and key types around the Roman world, there has not yet been a synthesis that attempts to produce a timeline.

In spite of this, the site reports are valuable for their ability to demonstrate the variety of locks used at various locations. Catalogues and discussions of locks and keys at diverse sites both close to Rome (Proffitt 2018) and around the Empire (Birley 1997; Allen 1997; Weeber 2000) demonstrate that not only was lock use common in the Roman world, but that access to a range of lock and key types was widely spread. In addition to this diversity in mechanism, unlike some later Post-Roman keys that show considerable similarity in their bit type (Chapter Four), Weeber's 2000 catalogue of keys from Saalburg (302) showed that Roman keys reflect a strong emphasis on individuality.

This focus on security is explored by Max Conzémus (2013) In his study of the Roman concern for physical (and spiritual) protection. He shows how locks and keys were used to ensure a visible security, one that was in addition to other, often less ostentatious methods such as the multiple bars and bolts found on the interiors of Roman doors (59-68). Although he does not discuss the significance, Conzémus provides evidence of locks used on the doors of tombs (71-74), a practice that may have been to prevent looting, but may also have been to allow and control access to the dead. The latter possibility could be reflected in the use of locks or keys in the early Middle Ages, an idea discussed in Chapter Five.

3.3.3 Early medieval and medieval studies

One of the earliest works specifically focused on early medieval keys was Bertil Almgren's *Bronsnnycklar och djuronamentik* (1950). In this study, Almgren begins by tracing the lineage of Viking Age keys, looking to Roman and post Roman examples. In particular, he is interested in whether keys can, through observed stylistic and technological changes, be used to trace cultural exchange between Scandinavia, wider Europe, and Britain.

This ambition is, as he points out, necessarily limited by the fact that many keys are either chance finds, or for some other reason do not come from datable contexts. For this reason he relies heavily on stylistic elements found in the decorated handles of the keys, particularly animal ornamentation, comparing them to other objects with similar characteristics which can be reasonably reliably dated (1950, 24-25). This also means that although he does reference iron keys, his main concern is with moulded bronze examples.

Within this limitation, Almgren's study is thorough and systematic. He provides an extensive catalogue of keys, divided into those found outside and those inside Scandinavia. Some of the artefacts he lists are only known from this study, having since been lost (Svanberg 2003, 276). He also surveys, and clearly illustrates with line drawings, examples of keys of various forms and types from around western Europe. The illustrations are detailed, and extensive enough that they are often used as reference types for site report identifications (Ottaway 1992, 673; Portable Antiquities Scheme, nd).

Finally, and most importantly, Almgren lays the framework for a typology, although it is limited to the focus of his study and was not expanded past the suggestion of how it might be structured. However, the principles on which it constructed have made it flexible enough to allow typing of non-ornamental keys, including iron keys, and sometimes even keys which date from outside of the Viking Age. It provides an excellent foundation on which a more extensive system could easily be constructed.

Unfortunately Almgren's work has never been translated into English and is not as widely known as it deserves, although within the specialised area of key identification it is a central reference text. Perhaps it is partly for this reason that no similar work was taken up in Britain. Even when David Wilson (1959) drew attention to the value of the work it was for its chronological approach and not for the object study, spending only a paragraph to describe that aspect of the work.

Arguably the most important recent work is Mathieu Linlaud's (2014) study of locks and keys from the 8th to the 13th centuries. Linlaud focused on the modern continental French territory (45-6), but used evidence from Ireland, England, Switzerland, Germany, Sweden, Spain, Italy, Poland, and the Netherlands for comparison (50-55), a total of 25 central and 61 comparative sites, with 800 objects in the catalogue. As he admits, this still leaves large geographical and cultural gaps, but given the constraints of the project (which was originally a PhD thesis) and of the available evidence the study is reasonably inclusive. Areas that were not studied provide opportunity for expansion and additional comparison.

Linlaud provides a series of very useful models of various lock technologies showing not only the structure, but the functional movement. He also sketches out a provisional typology, although because he acknowledges the wide variation in locks and keys as well as the difficulty with choosing a particular, consistent characteristic on which to base a system,

he deliberately keeps his organisation abstract and flexible which means that it is primarily useful within the study itself.

The most valuable contribution of the work is the identification of specific characteristics of elements of medieval locks and keys that he feels represent distinct developments that occur within this period. The dates that he suggests for these developments inform the parameters of the study: the appearance of a particular form of spring bolt (*resort á gorge*, 45, 228) which he dates to the late eight or early ninth century, and the development of a bolt with two symmetrical projections (*a serrure bénarde* 45, 224) that, he argues, show the bolt could be opened from either side of the lock. The latter characteristic he traces through a series of different bolt morphologies (160) and connects with a change in the manufacture of keys and the appearance of a terminal pin (171-175).

Although, as he recognises, the dating of these changes is necessarily fluid and can only be discussed in general terms, the identification of these characteristics provides an important framework on which a better understanding of the development of lock technology during the early and later Middle Ages can be built. By examining evidence from other areas, a more complete understanding can be achieved of whether and how these characteristics appear elsewhere. Doing so may provide some insight to the nature and possibly the direction of knowledge exchange among metal craftworkers in the early Middle Ages.

3.4 Research on the production of locks and keys

There is a lack of broad and comprehensive research on the manufacture of early medieval lock mechanisms, but there are two useful studies that have specifically focused on the construction of padlocks. The first of these is J-E Tomtlund's 1978 examination of the locks from Helgö. Tomtlund identifies three types of padlock and compares their construction methods, providing a brief but useful list of some of the steps involved (8). He also gives a more detailed description of the manufacture of the cases, which are made of both copper alloy and iron. Tomtlund provides schematics showing eight techniques for soldering different styles of lock case (7, fig 6), a variety which suggests that they had been made in different workshops with different craft traditions.

A more in-depth study on one aspect of padlock manufacture was carried out by Ny Björn Gustaffson (2003, 2005) on the material from the Birka garrison. Gustaffson used impressions found on vitrified clay shards to create a hypothetical series of steps involved in the last stages of padlock construction - the soldering and brazing of the padlock case (2005, 21-22). This stage is possibly the most complex, difficult, and specialised and Gustaffson's work provides a better understanding of some of the skills involved. Anders Söderberg

(2014) has built on this research, suggesting additional refinements to Gustaffson's suggested steps of manufacture (25). He also explores how the soldering and brazing techniques used for padlocks are related to the production of weights and bells, helping to set these skills within the context of specialised metal craftwork more generally.

In addition to these studies, a number of works on early medieval iron objects have included a discussion on lock mechanisms. One of the more extensive is Patrick Ottaway's unpublished paper on mid-late Anglo Saxon iron objects (1995, 12-16). Ottaway divides lock mechanisms into two groups: mounted locks and padlocks. He describes a total of five different mechanisms, three mounted lock forms and two padlocks. His discussion is, of course, limited to locks found in Britain, but the mechanisms he discusses are also found in Scandinavia. Unfortunately, although he states that early medieval locks are complex and technically advanced, he does not discuss the processes involved in their manufacture, nor does he examine how the skills and knowledge used may compare with those necessary in the making of other objects.

Other discussions of lock mechanisms, such as those in Almgren (1954) or Linlaud (2014) are similarly focused primarily on description. They do, however, provide useful diagrams of the lock structures; in Linlaud's case this includes 3-D modelling of the rotary locks on which his work is focused. Through these diagrams and models, it is possible to appreciate the complexity of these objects. But discussion on the extent the knowledge and skills of the makers may have been shared with other craft workers is, by and large, not addressed.

Unlike the works on locks just discussed, there has been little concentrated research directed towards the production of early medieval keys. This is most likely because these objects are relatively simple, requiring no specialised skills or equipment (other than knowledge of the morphology of the objects themselves) outside of that used for other objects made of similar materials. Although a thorough examination of the literature surrounding early medieval metal work is beyond the scope of this discussion, it is worth discussing some of the literature that looks at the social and cultural world of this work.

The first is Unn Pedersen's 2009 study of the evidence for non-ferrous metalworking in Kaupang. Pedersen takes a holistic approach to her discussion of the craft work, examining both the technical and the social aspects, a decision she explains and gives context to with an extensive review of previous literature.

Because this study is focused specifically on Kaupang, it is necessarily limited in both geographic and temporal scope. This large, well connected community is also clearly exceptional both in terms of the number of craftworkers and the access to material resources that they would have had. But the insights Pedersen presents into the processes involved in the making of cast copper alloy objects, the types of evidence that these processes leave, and the ways in which the finished objects may show characteristics specific

to a particular workshop or community of craft workers are of great value in understanding early medieval metal work.

Pedersen deliberately places non-ferrous craft work into the broader category of metalworking (21-27), arguing against what she terms the “ideal smith”, an abstract construct based primarily on specific literary and ethnographic sources. In particular, she challenges the idea that metal workers were not only socially but physically removed from communities, practicing their craft on the fringes or in the *utland*. Instead, her close examination of identified workshops shows that non-ferrous metalwork was not carried out in isolation but took place in general craftwork areas within the main settlement.

The artisans worked with a variety of materials and demonstrated a range of skills and abilities. They would have been closely associated with people working with glass, bone, antler, and other materials and may have either collaborated with them or even practiced some of these crafts themselves, although the evidence for this is unclear (202).

Of particular interest, her work shows evidence for a deliberate and efficient transference of craft knowledge (202). Not only do the metalworkers appear to have been competent and highly skilled, the objects they made and the processes they used showed a considerable amount of fidelity. But there is also evidence for variation between workshops or craft workers, which indicates that there was a shared pool of general knowledge but also different traditions within that knowledge that were maintained and that survived contact with other methods.

Early medieval blacksmithing in northern Europe has also been the focus of a number of studies that look at the techniques and practice or at social and cultural role of smiths. Among the former, the work of Blakelock and McDonnell (2007) on early medieval knives is of particular interest. As the authors point out, the production of knives involves a number of smithing techniques that are also used in manufacturing other objects, including the components of locks.

In this study, Blakelock and McDonnell present the analysis of 79 knives from nine early medieval sites. Their work was able to demonstrate that while there was a range of quality in the objects examined, some early medieval smiths were highly skilled, able to effectively produce and work with different alloys in their manufacture process. They also found evidence that these skills developed following the Romano-British period and that there may have also been an improvement in the quality of the raw materials (54).

Samantha Rubinson also used metallurgical analysis in her 2010 PhD thesis. Rubinson concentrates on evidence from settlements, using a range of object types including tools, building materials, and dress accessories. Among these objects was a single padlock and a key. Rubinson divides the objects in her study into three classes, based on their use and the complexity of their construction (53-54), criteria that she feels were related to the probable quality of materials used in manufacture.

She suggests that craft workers were skilled in the identification of different alloy

types, and of evaluating metal quality even in stock material that contained a mix of alloys. She also finds evidence that even though less concerned with specific alloys, workers deliberately selected higher quality metal even in the manufacture of simpler, less valuable objects (Rubinson's class 2) such as building nails (185).

In addition, Rubinson details the skills involved in early medieval metalwork, including the identification, manipulation, and manufacture of different alloys as well as hot and cold working, and welding. She provides an analysis of each of these techniques, and although this analysis is again specifically directed towards the question of the appearance of iron alloys, it still provides a useful insight into the range and complexity of craft knowledge.

In his 2012 PhD thesis examining iron production in early medieval Ireland, Brian Dolan takes a broader approach, looking at both smelting and smithing and examining not only the processes involved but the social setting in which they were carried out. He finds evidence that smithing was practiced at different levels of production and at a variety of site types, contradicting earlier ideas that the craft was tightly controlled and centralised (163).

This includes some evidence for ferrous and non-ferrous metalwork being carried out in close proximity to each other (165), which he suggests may be the result of an itinerant craftsman doing occasional work on other craft sites, but could also represent a single workshop producing objects in a range of materials, including possibly making their own tools. In addition to these workshops, he describes sites that could be the property of specialist smiths where metal work for trade was the primary occupation of the household (Lowpark, Co May for example), and elite ecclesiastical sites with large scale production, some of which may have been also intended for trade.

However, Dolan states that large-scale production is not characteristic of the majority of Irish smithing sites from the early medieval period. Instead most sites appear to have had very small slag assemblages which he interprets as evidence for *ad hoc* manufacture and repair of iron objects (171). While acknowledging that this evidence of episodic smithing may support the idea of itinerant specialists, Dolan feels that it is reasonable to assume that in addition to some itinerant specialists, routine repairs and related activities were carried out by farmers and other householders who had acquired basic skills through observation or imitation.

Together these three studies help to provide a sense of the range of iron working ability in early medieval communities. They show that although there had been a change in how raw material was sourced and an increase in the use of recycled materials, craft knowledge was not only maintained but may have increased following the end of the Roman Period, possibly as a response to the challenge of working with a range of alloys and metal qualities. Although not all smithing activities were carried out by dedicated craft workers, there was a network of smiths who had both the knowledge and the

resources necessary to craft objects like multi-alloy knives, bells, and the more complex lock mechanisms.

3.5 Research on the social aspect of locks and keys

Although there was little significant academic interest in locks and keys as objects in the second half of the 20th century, following the emergence of gender archaeology a number of researchers recognised the possible importance of their social function. The implications of controlling, displaying, and using keys could provide insight into aspects of some roles that had been previously overlooked. Because of the previously discussed strong traditional association of keys with women, the objects became a valuable lens through which women could be recognised and examined. This may have contributed to the tendency to discuss keys solely in terms of the connection with female identity, even when the researchers themselves acknowledged that the archaeological record did not demonstrate a strict and exclusive gendered appearance of keys in graves. Most researchers, after acknowledging the issue, essentially dismissed it without discussion in order to focus on the implications of the female roles signified by the keys. Unsurprisingly, the ways in which these roles and their expressions are interpreted varies.

Gender archaeology is often expressed as a reaction to and a correction of established, biased views of the roles of women, derived from 19th century ideas and interpretations. But most researchers analysing the social aspects of locks and keys did not challenge the Victorian association of keys with housewives. Instead they attempted to broaden understanding of the significance that role may have had within the community, both functionally and symbolically. At the same time, the recognition that the archaeological record did not always support this traditional idea produced an element of tension in some studies of the time.

The majority of research was carried out by Scandinavian archaeologists. Perhaps the most extensive exploration and expansion of the standard housewife identity model is found in the work of Siv Kristoffersen, which looks at the significance of bronze key bundles found mostly in mound burials in south and west Norway (Kristoffersen 1999; 2004a; 2004b). Although Kristoffersen's work is in Migration period graves, the examination of these early practices and traditions is important in understanding the longer span of the early Middle Ages. Further, in order to interpret the physical evidence, Kristoffersen relies heavily on the same literary canon used by Viking Age scholars, making the work analogous in practice to those directed towards later cultures.

Kristoffersen focuses on three artefact types: bronze key bundles, iron weaving

swords, and relief brooches. Using texts from the old Norse canon, she extrapolates from their co-occurrence in specific graves the existence of a social role which she terms the Lady of the House. This role, she acknowledges, is a construct, but she believes it is not only a construct of her own interpretation of the literature and the physical evidence, but also a reflection of a construct created by the community who designed the grave assemblage (1999, 91; 2004b, 31).

This construct, an idealisation of social roles that were found in the community but weren't necessarily embodied by the individual in the grave whilst alive (2004a, 292), relies on layers of meaning. Through the objects, practical, ritualistic, and symbolic roles of the farmstead housewife are physicalised and made visually accessible by the artefacts. Kristoffersen goes further and suggests that these roles are all associated with marriage, and that their presence in the burial assemblage could symbolise the woman's new marriage with death.

The evidence she applies to the keys she studies is essential to this interpretation as it is most closely tied to bridal ceremonies and marriage. Using both Old Norse literary sources, specifically the passages from *The Lay of Rig* and the *Lay of Thrym* referenced above, Kristoffersen proposes an analogous importance of keys in Migration Age marriage ceremonies. This ceremonial association, Kristoffersen asserts, is strengthened by the nature of the keys she studies.

These keys, or more properly, key bundles, were made of bronze and were not single, but ringed together in sets. Through the period they became more elaborate, changing in construction from simple straps that were hammered and bent into shape, to moulded keys with various shapes, indicating that the symbolic importance of the keys increased over time (2004a, 292-293). While Kristoffersen points out that there is a lack of wear on the functional edges, suggesting that they were symbolic or ritualistic rather than practical, she does not mention whether there was a corresponding lack of wear on the suspending rings (2004a, 293). This is an essential omission as a lack of suspension wear could indicate that the key bundles were created specifically for inclusion in the grave, shifting the focus of symbolism from the living individual to the grave assemblage construct.

Kristoffersen's conclusions about the significance of keys in relation to her posited role of Lady of the House are, by her own admission, highly subject to interpretation (1999, 91). The three artefacts she chooses for focus are found in a number of diverse grave assemblages, and not always in association with each other. Further, her selection of object types is biased to some extent, ignoring other common grave goods such as spindle whorls and beads. She also neglected to mention other types of keys: those that are found singly, and those made of other materials. Further, her interpretation relies heavily on texts that are (as discussed above) not only removed chronologically, but geographically and to some extent culturally from the community that created the graves.

However, her work does establish that keys played a significant role in some burial constructions, and that this role, in the time frame prior to the Viking Age, was likely symbolic as well as practical. Further, the fact that the key bundles include several keys of different types could show that there was a difference in function between various sorts of locks, a difference that was significant enough to justify their inclusion as individualised ritualistic objects.

But it is also possible that not all of the objects referenced in the key bundles were keys, and that the bundles themselves were an assemblage, referencing a range of object types and meaning, which Kristoffersen does not address. Nor does she challenge the idea that keys are linked strongly enough to women in Iron Age Scandinavia to justify treating the entire object type group, extended from the symbolic bundles to the practical objects, as exclusively female gendered.

The problem with the number of keys in graves had already been discussed by Elisabeth Arwill-Nordbladh (1990), who pointed out that the historical documents on which the housewife link relies refer to keys in plural, while graves in Birka almost always have single keys included. These keys, she contended, could not represent the keys to the household. She further argued that if keys were strongly linked to the position of housewife, then rather than being interred at the woman's death, they would have been passed to the next woman to take on the role. In her view therefore, mortuary keys should not be seen as linked to a broadly shared and largely impersonal concept of a role, but instead should be understood as directly related to the woman as an individual.

In contrast, Anna-Sofie Gräslund (2001) accepted the traditional interpretation of keys in graves but viewed the role they represented as one of significant power and influence. Oddly, although recognising the importance that management of household resources had to the wellbeing and status of the community, she created a strict dividing line between these female responsibilities and what she terms "official life" (99). The physical and social location of this official life, in her reading, is not clearly defined but is instead referenced through what women do and do not do. Official life is public and broad; women are relegated to the private and specific, and their place is indoors. Official power is direct; female power is tangential and expressed through influence. In maintaining this distinction Gräslund contradicts herself, recognising that feasts and feasting are political events (van der Veen 2003) and would have largely been the responsibility of women, but simultaneously insisting that there was no official political role for women.

This ignores the evidence in sagas and in texts such as *Beowulf*, where women have both an inferred role prior to the events, and an active role during them (Schulman 2007). The selection and preparation of food and drink is, of course, part of this, but women also manipulate the perception of allegiances and hierarchy by the positioning of guests at the table. They actively suppress or incite violence, often through controlling conversational

content and aspect, but sometimes also physically (Laxdæda saga, Magnusson 1969; Völsunga saga, Sparling et al 1935).

Hanne Aannestad (2004) asserts that it is specifically bronze keys that are associated with women, whilst iron keys are found in graves of both genders (72-73). But rather than examining the complexity of the record, she concentrates entirely on the female connection with keys, citing the saga passages already discussed. She does reference later medieval laws and cultural traditions that strongly link the possession of keys with a woman's status and rights (80-81), practices that may derive from earlier social conventions but that need to be related more strongly to the archaeological record to be meaningful. Her article, therefore, although it hopes to explore the symbolic meanings conveyed by keys, is hampered by an incomplete view of the material evidence, as well as the limited available research on key forms and designs.

Earlier work by Else Roesdahl had already highlighted the problems created by this lack in her article, 'On keys' (1993, 218), pointing out that without a good typology the potential information contribution of keys remains unexploited. Her work is one of the very few at this time that looks beyond questions of identity and asks how key forms may be used to understand exchange networks. She focused on a particular type of iron padlock key which has been found in a wide distribution, including York, Greenland, and Novgorod. She suggested that these broadly dispersed finds could be used to indicate a continuity in cultural identity (1993, 222), or that they may indicate patterns of culture contact. This is particularly interesting in the case of the York key, which has been dated to the 11th-12th century and may therefore be evidence for the continued connection and exchange between Scandinavia and England after the Norman conquest (1993, 221). However this suggestion depends on the assumption that this particular key is a Scandinavian type, an assumption that she admits is unsupported (1993, 222).

With the exception of Roesdahl's work, studies of this time remained tied to the idea of the key as symbol. They appear to struggle with how and where to acknowledge the agency and power of early medieval women, using keys to provide a tangible focus for the various interpretations they present. There seems to be a need to balance traditional view points with modern gender sensibilities, to accommodate historical texts while recognising the contradictions found in the archaeological record. The result is an image of women at the time that presents a superficial consistency, but, on closer examination reveals incompatible concepts and contradictory interpretations of evidence that have not been effectively reconciled.

There are more recent studies that look critically at the historical record and give greater weight to the physical evidence. These studies challenge the traditional interpretation, and call for a broader examination of keys. However because there is no foundational understanding of the distribution and characteristics of appearance of keys

and locks, most publications can do little more than emphasise the potential inherent in the objects and the need for further study.

Pernille Pantmann (2011) looked at keys in graves in Zealand and challenged traditional interpretations in two ways. First, she pointed out that keys are far from ubiquitous in female graves, but are found in only 9% of those in Zealand. Second, she uses evidence such as the position of keys in graves and the inclusion of non-functioning keys to argue that these objects were not intended to be symbolic of the traditionally defined role of housewife, or as practical equipment for the afterlife. Instead she suggests a connection with cult and cultic practice (80) or perhaps a role as a wise woman or community leader. However she does not discuss whether this role was exclusively female, or examine what the existence of keys in non-gendered or in male graves may imply about the way that keys were used in burials.

In contrast, In work for her master's dissertation, Heidi Lund Berg (2013, 2015) analysed keys in assemblages from five counties in Norway, and was able to demonstrate that a statistically significant number of keys are found in male graves or in graves that cannot confidently be assigned a gender. These graves, she argues, do not support the idea that keys had one meaning for women and meant something entirely different when associated with men (2015 130). Although she addresses and dismisses the suggestion that keys may have had some association with cultic or religious activities, she does not discuss the possibility that keys or locks may have had other symbolic associations, perhaps as charms. Instead, she suggests that these objects should be viewed as representations of authority and wealth.

She also provides an insightful analysis into the assumptions and practices within archaeology that have resulted in the persistent ideological connection between keys and housewives. Using the stereotype as a focus, she explores more broadly the way in which the legacy of emphasis on written over physical evidence continues to distort interpretations. This discussion, together with her challenge of the assumed divide between masculine and feminine identities in relation to objects, are valuable contributions, not only to research on these object types but also on early medieval archaeology more broadly.

One of the most interesting recent studies is Marianne Eriksen's work on Viking Age doors and thresholds (2019). Drawing on a variety of theories and methods, including Access Analysis, Actor Network Theory, and ideas drawn from critical sociology, she has examined the question of the lived experience of space and how it defines and shapes daily activity and the perception and enactment of identity. In doing so she uses both the physical and the symbolic nature of doorways to explore the relationships between Viking Age people, their landscape, their community, and their spiritual beliefs.

Eriksen specifically addresses keys in her discussion of doors and sexualised ritual (146-163). Although she cites the work of Pantmann (2011) and Berg (2013, 2015) discussed

above, she returns to the traditional interpretation of keys being strongly associated with women both practically and symbolically. She argues that this association interlinks ideas of feminine gender and sexuality with complex cultural knowledge of acts of locking or unlocking, and of liminal spaces such as those defined by doorways (159). She supports these arguments both with the literature discussed above, and with ethnographic comparisons. The door, in her view, is a material metaphor for female genitalia (161). In this view the doorway is linked to the vital life events of marriage, sex, and birth.

Although the argument is intriguing, the link with keys is not clearly supported. After acknowledging that it is more generally understood that keys found in the graves of Viking Age women are associated with chests or boxes, she references Berg (2011, 12) and Pantmann (2011) to suggest that these keys could also have opened doors. However, neither of these sources make this argument; each of them make a single reference to structural doors as one of the things that keys may have been used for. That does not mean that this door was the entrance to the house. Instead, because known forms of early medieval lock were only able to be locked or unlocked from one side, it is equally likely that they were, instead, to outbuildings used primarily for storage or for housing animals, a use she does not discuss.

Eriksen also references Arwill-Nordbladh's (1990) suggestion that keys were such powerful symbols of female status and authority that they were handed down from generation to generation. But this idea of keys being valued heirlooms raises difficulties with their appearance as grave goods, a difficulty that, as mentioned above, is raised by Arwill-Nordbladh but is not addressed by Eriksen.

She also does not discuss the fact that keys, both in shape and in use, are distinctly phallic. If, as she suggests, the door is metaphorically linked with female genitalia, then the key, which penetrates the lock and without which the doorway cannot be opened, means that the masculine is also essential. Although this point does not, of course, refute Eriksen's argument about the symbolic meaning of the doorway, it does need to at least be considered given the fact that Eriksen is using the traditional connection of keys with women to support her argument.

Although the role of keys in the connection between doorways and the female body and female life events has not been securely proven, Eriksen also develops an important argument for doorways being seen and ritually used as links with other worlds, particularly the world of the dead (189-210). In support of this idea she cites both literary evidence, including Ibn Fadlan's description of what may be a Viking funeral and later narratives including *Eyrbyggja* saga and the *Völsapáttir* episode from *Flateyjarbók*, and archaeological evidence. The latter includes structures from burials, such as the mortuary house in Gulli, Vestfold, and in Sannagård, Halland, Sweden, and from the spatial relationship between houses and the dead.

Unfortunately, although Eriksen had already argued for a symbolic link between keys and doorways, she does not explore whether the appearance of locks and keys in burials may have been linked to this relationship between doors and the world of the dead. This is particularly odd given that she has previously argued for the strong association of women and keys using grave goods as evidence and has also explored the how some women may have used doorways in the practice of *seiðr* (148). Arguably this connection between locks, keys, doorways, and the dead is equally if not more strongly supported by the evidence of burial assemblages.

In spite of these minor issues with the use made of keys, Eriksen's work is a significant and useful study. Her work establishes that thresholds and doorways were important spaces in Viking Age culture, shaping and linking the communities relationships with others, with their environment, and with other worlds. Of particular value is the way that her varying approaches illustrate how complex ideas about and use of thresholds may have been, with their significance shifting depending on the context and the needs of the community.

3.6 Scholarship on keys in early medieval Britain

One obvious feature of the above mentioned studies is that they focus almost exclusively on Scandinavian, or in the case of Linlaud, French locks and keys. In contrast, since Pitt-Rivers Britain has produced almost no scholarship dedicated solely to the subject. One tangentially related study is the work of Kathrin Felder (2014, 2015) on the subject of girdle hangers.

These objects are found in female graves in the 5th and 6th centuries and are somewhat analogous to the Scandinavian key bundles referenced above. One of the most important contributions of her work to research on locks and keys of this era is that it provides a clear definition of girdle hangers, a term that is often used loosely in object identification. She establishes a description of girdle hangers and their forms that makes the distinction between these objects and functional keys clear. Additionally, her work shows the rhetorical and symbolic importance of keys in early medieval Britain as expressed in the non-functional girdle hangers.

However there has yet to be a definitive study of early medieval locks and keys in Britain. Instead, object identification and research relies primarily on a number of well known site and collection catalogues. Naturally, as these publications often identify and interpret locks and keys from the point of view of the site, the assemblage, or the collection rather than the object, the focus is not directed towards contributing to the broader understanding of the type.

Perhaps the most frequently cited is the 1940 catalogue of the Museum of London's extensive medieval collection (Ward Perkins 1993, 135-150). Ward Perkins organises the collection into broad types, progressing roughly chronologically, although there is, of

course, a great deal of overlap. These types are defined by the physical characteristics of the bow, shank and bit, by the construction method, and by the material. However his categories are only useful for a very general classification, and are problematic when applied to individual keys. For example, his Type I, which covers pre-conquest keys, is subdivided into two bow-types, loop shaped and circular (1993, 134), while Almgren recognises five basic bow shapes found in England alone, many of which also have variants (1950, Karta 1). Ward Perkins illustrates the bits of Type Ia and Ib as identical in mechanism, in-line with the shaft with 90° teeth at the nose, ignoring several other common variants found in keys of this type.

A further complication is that he treats very small keys separately, referring to them as casket keys, and placing them in a single group, Type IX, in spite of their wide variety and their morphological similarities to previously established types (Ward Perkins 1993, 143-145). He also makes a very distinct difference in padlock slide keys, creating an entirely different typology, A-C (1993, 146-150), but including only barrel padlocks and not the box types used in the early Middle Ages. Finally, although he briefly describes latch lifters, one of the most common types of keys throughout the medieval period, he does not illustrate them at all.

There are also difficulties with the chronology he suggests. It is extremely loose, often spanning several centuries, particularly in the early types. He makes a few categorical claims about order of appearance without providing sufficient justification, stating for example that Types VIIA and VIIB were certainly contemporaries while also admitting that VIIB is not found in early contexts (1993,141).

In spite of its limitations, the catalogue does serve as a useful reference. He provides a number of cultural references, such as depictions of keys in manuscripts or on gravestones. Although many of these are from continental sites (137) and most are post conquest in date, they are, as he points out (136) valuable for establishing a *terminus ante quem* for particular forms. Although this collection of type designations is not secure and has not been universally adopted, in the absence of an authoritative typology it does provide a reference framework.

Another catalogue worth mentioning is Geoff Egan's (1998) work on medieval domestic objects from excavations in London. Although, as with Ward Perkins, he primarily deals with material from the later medieval period, Egan includes an extensive discussion of padlocks and padlock technology, including both schematic drawing of the mechanisms, and x-rays of surviving artefacts showing the internal structures (1998, 92-105). This information, which gives insight into the relative cost in terms of labour, training and materials, for early medieval padlocks, is of particular interest as it can be used to explore the level of technical expertise found in medieval metal workers and could indicate both the contemporary value placed on these objects and, through association, the messages of

status and wealth that display of the keys that opened them would convey.

Arguably the most important of the site-based catalogues is Patrick Ottoway's (1992) report on iron objects found in Coppergate, York. The value in the work lies in both the number of objects described and the care Ottoway takes with the identification and the illustration of significant examples. Coppergate represents one of the largest single-site collections of early medieval keys, particularly of keys from a context other than burial. Even more importantly, a number of locks and lock mechanisms were uncovered, an extremely rare survival for the period (657-667). Further, the collection represents a fairly wide range of forms both of locks and of keys, allowing a better understanding of the variety of options and applications of security in a community the size of Jorvik.

Ottoway divides his material logically into locks and keys, allowing him to provide a background for discussing the forms seen in the key assemblage by giving a brief but comprehensive explanation of the mechanisms involved in the locks found on site. This explanation is made even more valuable thanks to the clear illustrations of those mechanisms in action. His illustrations of the keys themselves are of equally high quality, although by necessity only a selection of the finds could be shown (1992, 670-671, 674, 676). He also provides an extensive body of references to comparative materials from other contemporary sites, although he draws no conclusions about distribution or exchange.

There are a number of other catalogues that among them add to the corpus of securely dated forms. A useful addition to them, particularly for Anglo-Scandinavian studies, is the study of small finds in Winchester (Rees et al 2008) which provides not only a considerable catalogue of Anglo Saxon keys found in the 1971-1986 excavation, but a useful analysis of their pattern of deposition. The keys have been organised into types that are roughly based on Ward Perkins, but that deviate from his illustrations. Unfortunately no justification is given for the classifications or the deviations, so it is difficult to determine whether bit type, bow shape or methods of construction were given more or less weight when forming the system. This limits its potential to be extended into a more broadly applicable system.

Notwithstanding the above studies, there is a clear lack of focused attention on the cultural meaning of locks and keys in Britain in the early Middle Ages, nor has there been a recognition of their potential in illuminating either characteristics of social structure or the state of craft knowledge and skill throughout the period. This is particularly surprising given the potential these objects have for contributing to the ongoing debate about how craft and culture may have changed or persisted through the transition from the Roman to the post-Roman period, the nature and effect of the Germanic immigrations or invasions, and how trade and exchange networks with the rest of Europe may have developed. The newer studies cited above, however, provide an opportunity to establish the study of British locks and keys and begin to place them into their wider context.

Chapter 4 Locks and keys in early medieval England

4.1 Introduction

The first area of focus of this thesis is on the distribution of keys and locks in early medieval England primarily using data from the Portable Antiquities Scheme (PAS), as well as the collection at the Museum of London (MOLA), and a number of archaeological sites. These data are used to understand how the practice of lock making was maintained and adapted during the transition from the Roman to the early medieval period. The study first identifies the various key forms in the dataset and uses the available evidence to infer the probable distribution of those forms through time. It then identifies persistent forms, keys with specific bit morphologies that appear over time, using both traditional archaeological data and evidence from early medieval art. It then examines the implications of the persistence of lock use through the early Middle Ages both in terms of the craft workers, and of the wider community.

Studying locks and keys in early medieval England brings particular challenges. The conversion to Christianity and the accompanying shift away from furnished burials means that one of the most important types of archaeological evidence for early object distributions is not available after the 8th century. However the data resources available in Britain create the opportunity for a different, broader approach that, although not allowing the close-grained study of specific communities, may shed light on more wide-spread patterns of the use and social significance of locks and keys in the early Middle Ages.

The theoretical framework used in this study is based on concepts from social construction of technology theory (Pfaffenberger 1992; Lemonnier 1993; Ingold 1993) and related ideas found in object biography theory (Appadurai 1986; Ashby 2014), and actor

network theory (Latour 2005; Sindbæk 2007, 2008). The central concept underpinning my approach is that the making and use of objects are social activities and that the context in which they take place (both physical and conceptual) constrain the choices made by the craftworker. Evidence of these constraints is found in the materiality of the object, and through that evidence information about the wider community that made, traded, and used the object can be discovered.

Lemonnier (1993, 2) made a distinction between forces affecting craftworker choices that were technical, and those that were social. In the first category are factors such as resource availability and the physical properties of those resources. In the second category are the beliefs and knowledge acquired from and shared with the wider community of craftworkers. Together these factors influence the *chaîne opératoire*, the series of choices and actions taken in the making of an object. While many researchers focus on evidence of change, which can provide important chronological evidence or suggest patterns of knowledge exchange and culture contact, for this study the importance of stability over time is used to better understand the nature and extent of the craft practice and knowledge of lockmaking during periods of transition in England throughout the early Middle Ages.

4.2 Characteristics, collection, and initial analysis of the data

The PAS is an excellent example of the problems and potential of crowd-sourced big data. It not only suffers the difficulties endemic to many heritage projects, of insufficient funding and under-staffing, but also the major technical difficulties faced by any large, long-term data-based undertaking: changing software platforms, storage, obsolete file formats, and data quality. There are also concerns raised continually about the ethical issues of whether or not amateur metal detectorists should be given tacit approval or authorisation. But of primary concern to researchers is the issue of whether or not raw information about isolated artefact finds, without a documented context, can be used in a robust, substantive way in academic research.

The decision to use data from the PAS in this study naturally maintained these concerns very much in mind. However, these data represent not a possible (and inevitably insufficient) parallel to traditional archaeological information, but a valuable supplement to it. Certainly there are limitations to the data, but there is also enormous potential. Specifically, because the PAS has no research or project limitations on geography or time, it provides a broad picture of the general distributions for particular artefacts against which specific collections or sites may be compared. That comparison, of course, allows a clearer understanding of the discrete, contexted collection within its wider framework, and better

informed, more correct content within the PAS itself. Ideally the relationship should be reciprocal.

Launched in 1997, the PAS is a primarily publicly sourced database of archaeological artefacts. The database holds records of well over a million objects from England and Wales, the majority of which have been voluntarily submitted by metal detectorists and other members of the public. The considerable size of the database, and its geographic spread, make it an invaluable research resource.

There have been a number of object-centred studies that have exploited this resource, such as Sam Moorhead's 2013 work on Roman coins, Sophie Adam's 2013 thesis on iron age brooches, Kathrin Felder's 2014 thesis on early medieval girdle hangers, and Adam Daubney's 2010 use of finger rings to examine the extent of tribal identity in Roman Britain. In addition there have been as large scale, more general studies such as the 2006 Viking and Anglo Saxon Landscape and Economy (VASLE) project led by Julian Richards (Richards and Naylor 2009). These and other projects have shown the enormous potential of the PAS, and discuss some of the biases that inevitably result from the collection method. The PAS itself recognises these biases, and has produced a guide for researchers that describes approaches to mitigating their effects (Robbins 2013). These methodologies are still being developed and refined as more projects look at ways to effectively exploit these data.

There is, however, a significant problem that is specific to research focused on artefacts like keys, the forms of which are dictated largely by concerns of function rather than aesthetics. Most object related projects have concentrated on objects that have relatively secure typologies and that are recognised by and desirable to metal detectorists. This is not simply a question of presumed value. Hobby detectorists are very often as interested in the history of an object as in its inherent worth, and the community frequently emphasises the importance of that history in their official publications (UKDN nd).

However recognising the possible historic value of a particular artefact is easier when that object can be readily and reliably identified, most particularly if it has a known date range. Metal detectorist resources for object identification tend to be limited in scope, and are somewhat out of date when discussing locks and keys (cf Hammond and Murawski 2014, Egan 2010). They are particularly unreliable on the most common forms from the early Middle Ages, forms that lack distinctive characteristics. Therefore the PAS records present additional challenges that must be recognised and understood in order to make the most of the data.

In order to mitigate these biases and challenges it is necessary to use additional data. One possibility considered is the UK Detector Finds Database (UKDFD) which is created and maintained by a community of metal detectorists. Unlike the PAS, this dataset is directly entered by members themselves, with additional identification being provided by volunteers (UKDFD 2005a). The emphasis for this community is on the process of the

discovery of the artefacts, and the recording guidelines stress the value of providing information on detector models and field conditions in order to improve understanding on the effective detection and recognition of different artefact types (UKDFD 2005b).

Although there is a relatively large collection of keys in this dataset, 192 keys on the UKDFD at the time of access (June 2017), and the records do include photographs of sufficient detail and quality to classify the key types, there are significant concerns about using the data. Some of these concerns are practical, involving the question of data quality, but far more important are the ethical issues of working with data that cannot be shown to have been legally discovered and recovered. Further, within weeks of recording the UKDFD dataset, the site imposed a required registration in order to access the catalogue (previously openly available) a move that makes assessing the discovery and collection of these objects considerably more difficult.

It also means that, without registration, other researchers cannot verify analyses presented. Therefore, although this dataset provides a potentially useful comparison to the PAS collection in terms of the composition of the set itself, and allows some understanding of the collecting and reporting practices of an active metal detecting community that does not directly participate in the PAS, its use in the project has been limited to providing a comparative distribution of a single specific key form, a use which also provides a very general idea of distribution of collection practices.

To complement the publicly sourced data, I turned to the large collection at the Museum of London Archaeology (MOLA). This catalogue provides a useful source for calibration as it is comparable to the PAS in the size of the collection, containing over 700 keys with images, and covers approximately the same time frame. The identified dates in the museum recording system range from the Roman era through the 19th century. However the source of the material in the MOLA dataset and the purpose for which it was collected is markedly different.

The Museum of London was originally formed from two collections that were amalgamated in 1964: the London Museum, founded in 1912, and the Guildhall Museum, founded in 1826. The earliest objects in the catalogue reflect the concerns and interests of those institutions and would have been selected for their visual or historic interest. More recently acquired material includes donations from collectors, mudlarks, and detectorists as well as finds from formally excavated sites. This dataset, therefore, has characteristics that are distinctive from those of the PAS. However, although it does not constitute an unbiased representation of the distribution of key types in London and its surrounding area, the difference in the type of data represented and the geographic limitation of its scope mean it provides a useful comparison to the PAS.

Finally, in order to provide a temporal framework for these data, I used artefacts from archaeological sites that have fairly secure and tight dates: this includes the relatively large

collections from Flixborough (Evans et al 2009), York (York Archaeological Trust; Ottaway 1992), and Winchester (Rees et al 2008), as well as examples from a further 41 settlements and cemeteries. A table of these sites is found in Appendix Four.

4.2.1 Limitations and biases

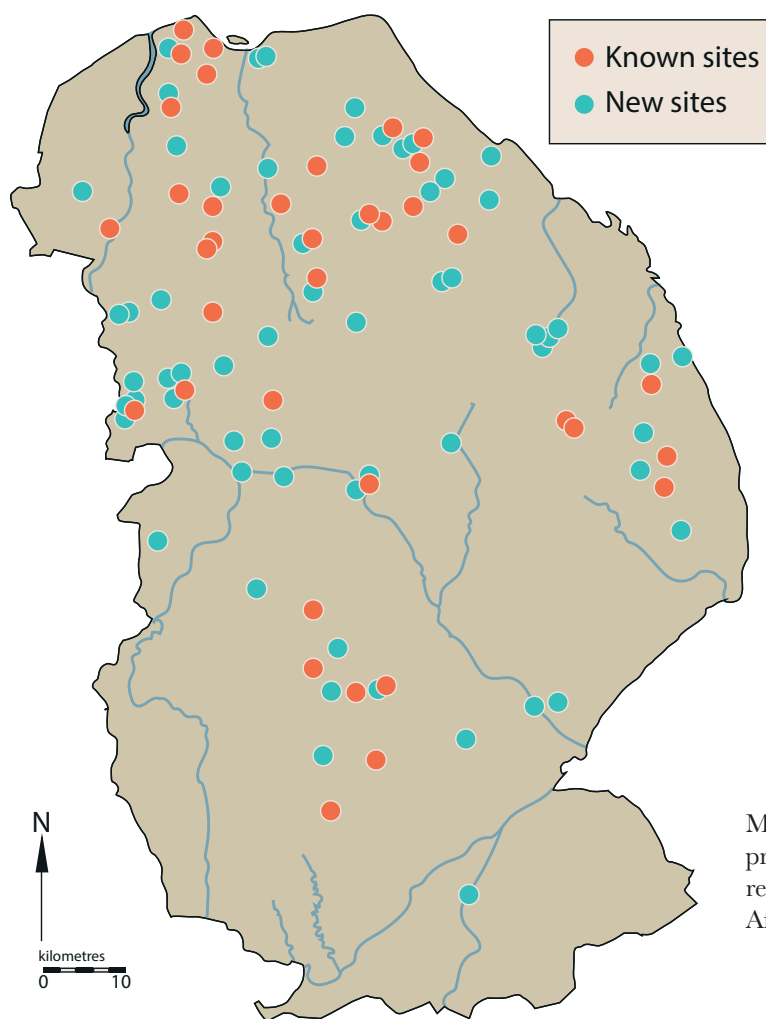
One of the primary biases in the PAS database is geographic. Although objects are recorded from throughout England and Wales, land use, topography, and limitations on access influence where and to what extent collecting is carried out. The majority of metal detecting takes place on easily walked arable land where ploughing regularly brings small finds to the surface. Forests, mountains, and built up areas will be under-represented in the database, something that may or may not reflect past land uses and activity levels (map 4.1). In addition, protected and scheduled lands are unavailable for metal detecting, as are areas of restricted access such as military bases.



Map 4.1 Constraints map of areas with limited accessibility to metal detecting
After Richards et al 2008-09, fig 2

Previous studies have developed methods of mitigating the effects of these biases. Richards et al's 2008-09 Viking and Anglo Saxon Landscape of England (VASLE) project produced a constraints map of areas with restricted availability which can then be compared with the distribution of finds in the database (map 4.1 above). Tom Brindle (2013, 2014) then compared these areas of restriction with the Historic Environment Records (HER) and was able to show that, for Romano British artefacts, there is a reasonable correlation between PAS distributions and the HER, although that correlation is variable by region.

Large-scale projects, such as the Anglo Saxon Kent electronic database (Harrington and Brookes 2012) and Silchester Iron Age Environs Project (Fulford and Barnett, ongoing) give a sense of distributions for specific time frames and, as these projects develop, meta-analysis of the patterns they show can imply information that will help shed light on time frames with less recognisable physical evidence. Regionally focused research such as Katharina Ulmschneider's 2000 work on productive sites in Lincolnshire (map 4.2) or Mary Chester-Kadwell's 2009 study on the Anglo-Saxon landscape in Norfolk has provided a more fine-grained picture of how PAS data both add to knowledge about known archaeological sites and provide information about activity in areas that have not previously been recognised as archaeologically significant. This process is, of course, fluid and as more objects are recorded and more studies take place the overall understanding will only improve.



Map 4.2 Known and new early medieval production sites in Lincolnshire identified through recorded metal detector finds
After Ulmschneider 2000, fig 5

4.2.3 Challenges for the study of locks and keys

There are two major additional biases in the PAS that provide challenges to using these data to understand locks and keys in the early Middle Ages. These biases are not unique to these artefacts, but highlight difficulties facing a number of artefact types, particularly for the time frame in question. One is related to collecting practices, and the other to recording.

Most metal detectorists prefer to set their machines to filter out ferrous responses (Brindle, 2013). This is partly because of the large amount of iron debris - much of it modern - that can be found in the topsoil. However it also reflects the tendency to prefer high-status or valuable objects. As a result, the PAS database shows a very strong material bias (Robbins 2013). 93% of keys in the PAS are copper alloy, a number that is comparable to both brooches and buckles (table 4.1). This clearly leads to a skewed perspective of real object use, emphasising the decorative over the practical, and losing the important, common iron forms of objects that were also made of other materials.

Material	Buckle	% of total	Brooch	Key
Copper alloy	41,066	99%	37,218	93%
Silver	198	0%	893	0%
Iron	180	0%	50	6%
	41,444		38,161	1643

Table 4.1 Distribution of the material of buckles, brooches and keys recorded in the PAS

A good comparison of the effect of material bias is the data set of knives. Although extremely common in archaeological settings, there are only 3,366 examples in the PAS compared to over 40,000 buckles and over 38,000 brooches. Of these knives only 11% were identified because of surviving iron (table 4.2) Because keys, throughout their use, have been made of both ferrous and non-ferrous materials, there is still useful information to be gained from the database, but the skew introduced by the ferrous filter is significant.

KNIFE	Number	% of total
Copper alloy	2036	60%
Flint	835	25%
Iron	364	11%
Bone	78	2%
Lead Alloy	18	1%
Silver	14	0%
Lead	10	0%
Copper	4	0%
Wood	4	0%
Stone	3	0%

Table 4.2 Distribution of materials of knives recorded in the PAS

Discrimination in collection extends beyond the material. Decorative objects are more likely to be saved and reported than those that are less visually interesting. This compounds the problem introduced by antiquarian tendencies to study the exceptional, the beautiful, and the valuable. It has led to a large amount of literature on a sub-set of objects, giving an incomplete idea of past lives and communities. Within the PAS it leads to a reinforcement of activity; metal detectorists who use the PAS for research will be more likely to recognise and report object types that are strongly represented in the database. In the case of keys, which have a wide range of physical forms, this results in an exaggeration of familiar forms and of forms that are assigned to particular time frames. It also means that object research that uses the PAS tends to focus on higher status object types and forms, not only because there is a greater depth of existing scholarship on which to draw, but because there are more objects available for study.

The second problem is with the classification of keys in the PAS. The difficulty arises because, as already addressed, there is both a lack of focused studies on the object type, and a relative stability of many of the key forms over significant periods of time. Together, these factors make the accurate dating of keys problematic.

However there is an additional issue with early medieval material in general, which is the persistent idea that there is a dearth of material evidence from this period. It has been recognised that this lack is, at least to some extent due to loss (Hamerow and Brennan 2015, 343), but is also one of perception and interpretation. Issues with identifying and dating material culture, and even with the type of excavation most often carried out in the UK (Hamerow 2002, 7-10) have historically made recognising early medieval settlements difficult. But even though important new work is continually improving our understanding of the period, the perception of a lack of evidence, and further of a loss of technology at the end of the Roman period can still influence decisions about classification and recording.

It is reasonable to assume that a number of object types continued to be made well past the Roman period and, rather than being residual as is often assumed, were actively used into the early Middle Ages. Equally, some forms could have had their origin in the early Middle Ages but have traditionally been given a post-conquest date. Further, many of the objects that are known from contexts within archaeological sites are not themselves easily and reliably datable. There are forms that have a great deal of morphological stability, particularly for functional and practical objects such as rings, hooks, and tools (figure 4.1, 4.2) and in reports these objects are often considered undatable, or at least only given a very large possible date range based on the information available. All of this means that, although there are a number of object types in use during the early Middle Ages, they do not fit easily into traditional date classifications.



Figure 4.1 (left) William Marples & Son 19th century jack plane. MOLA 68.29/153

Figure 4.2 (right) Planes from the 16th c. Mary Rose. Mary Rose Trust 2009



The PAS database structure requires a broad period assignment (table 4.3) for every object, even those with a morphological stability that spans centuries. In order to provide that information, there is a clear tendency to classify such objects as Roman or medieval in preference to early medieval in the dataset as a whole. The suggested dates “from” and “to” for keys assigned to the early medieval period show how problematic dating can be, and how much date ranges can influence a search. Keys assigned to the Roman period have 75 different date ranges; early medieval keys have 45. Although some of the date ranges for “Roman” keys are appropriately broad (1 - 1700 ad for example) others are extremely narrow, even for objects that can clearly not be so tightly dated (figure 4.3). This is even more true for keys classified as early medieval. It is notable that only three dates prior to the 7th century are given for “early medieval” keys.

Broad period	Date begins	Date ends
IRON AGE	800 BC	42 AD
early	800 BC	401 BC
middle	400 BC	101 BC
late	100 BC	42 AD
ROMAN	43 AD	410 AD
early	43 AD	200 AD
late	201 AD	410 AD
EARLY MEDIEVAL	410 AD	1066 AD
early	410 AD	700 AD
middle	701 AD	850 AD
late	851 AD	1066 AD
MEDIEVAL	1066 AD	1539 AD

Table 4.3 PAS date ranges

The tendency for bias in dates and in date assignments can be seen more clearly when looking at brooches, which have an established typology. Dates for these objects are predominantly Roman (which may be an indication of preference on the part of detectorists), but 14% of brooches are classified as early medieval in comparison with only 3% both of buckles and of non-flint knives, a pattern of date assignment that is comparable to that of keys (table 4.4).

Knife			Buckle			Brooch		
Mesolithic	61	3%	Mesolithic			Mesolithic		
Neolithic	631	30%	Neolithic			Neolithic		
Bronze Age	269	13%	Bronze Age			Bronze Age	1	0%
Iron Age	13	1%	Iron Age			Iron Age	2,981	8%
Roman	357	17%	Roman	593	2%	Roman	26,471	69%
early medieval	82	4%	early medieval	1,137	4%	early medieval	5,634	15%
Medieval	663	32%	Medieval	25,314	94%	Medieval	3,174	8%

Table 4.4 Distribution of broad date assignments in the PAS for knives, buckles, and brooches

Evidence from early medieval sites indicates that knives and buckles were more common than brooches (Geake 1997, 103-105), but the PAS date assignments for these objects clearly does not reflect that. It seems likely that because brooches often have diagnostic characteristics, they can be more confidently placed into established typologies, so the classification distribution for these objects is somewhat less obviously skewed. Buckles, however, tend to be simpler and less easily dated. The PAS distribution of these objects would seem to reflect a bias towards assigning a broad medieval date preferentially.

Because keys, although sometimes highly decorative, are more often simple and repetitive in form, with a high degree of morphological stability, this tendency to classify undiagnostic forms as medieval can have a significant effect on the apparent variety, number, and distribution of keys. This can not only give a false impression of the range and number of forms in the early Middle Ages, but, as discussed below, places artificial limits on the use life of common forms, masking evidence of continuity in the craft and culture of these objects

4.2.4 PAS Data collection and broad characteristics

With these concerns in mind, the approach to data collection was designed to be as inclusive as possible. Although the PAS site has an advanced search function that can filter for date, material, object type and more, the issues with date classification just discussed, and with object classification meant that filtering by the assigned category: KEY (LOCKING) eliminated some keys from the results (see Richards et al 2008 for a discussion on issues with search terms in the PAS). The most significant of these are Roman ring keys, classified as finger rings in the database. In order to produce as complete a dataset as possible therefore, a simple search of all records using the free text term “key” was done with no date restrictions, but with a filter to return only records with images, to allow identification. This resulted in 2,445 objects. After the raw data were cleaned, removing unrelated objects such as tap or winding keys, and those that could not be clearly identified, there were 1,643 records. The categories of data from the PAS download were retained in the resulting dataset. The PAS is a constantly growing dataset; these statistics refer to the data as it was at the time of download (August 2015).

Next, every distinctive form of handle and bit was sketched and given a classification (see Appendices 3 and 4). This process was deliberately generous with the definition of “distinctive” in order to create as complete a record as possible. Although keys can be divided into broad morphological groupings, discussed below, within those groupings there is a considerable amount of diversity. In bits, this diversity is not incidental but often relates to physical characteristics in the corresponding lock that may increase or decrease the individuality, the security, and the construction complexity. By retaining this diversity one can evaluate the amount of innovation that was both feasible given the knowledge and skill of the craft working community, and more generally culturally acceptable, as well as tracking the possible development of specific forms. This process resulted in 128 identified handle forms and variations and 183 bits.

In order to understand patterns in the co-occurrence of handle and bit types, the subset of complete, or near-complete keys was examined, a total of 1087 keys. There are 326

combinations in the dataset, 239 of which occur only once. 61% of bits and 66% of bows do not occur in repeated combinations which is evidence of the amount of variety in form and in technique. However one bow, a basic round handle, accounts for 61% of all combinations, and one of those combinations accounts for 35% of the entire dataset. This form, with a simple 2 cleft rotary bit, will be discussed in greater depth below.

It is not surprising that there is proportionately greater diversity in bits than in bows, but the difference is significant. It suggests that in spite of the acceptability, and perhaps desirability, of unusual and decorative handles, there was a greater demand for ingenuity in bit design. To what extent this diversity was reflected in the associated lock mechanisms is unknown, however it is interesting that the appearance of complexity was so highly desirable.

The geographic distribution of key finds in the PAS, a distribution which reflects the distribution of access to locks and lock makers, is roughly comparable to that of the dataset as a whole (maps 4.3, 4.4 below). The most notable exceptions are Lincolnshire, which represents almost 15% of all key finds, but only 7% of all objects found, and Wales in which only a third of the principle areas contained any keys. This is particularly striking for Monmouthshire which has a similar number of total reported finds as Cambridgeshire or Gloucestershire.

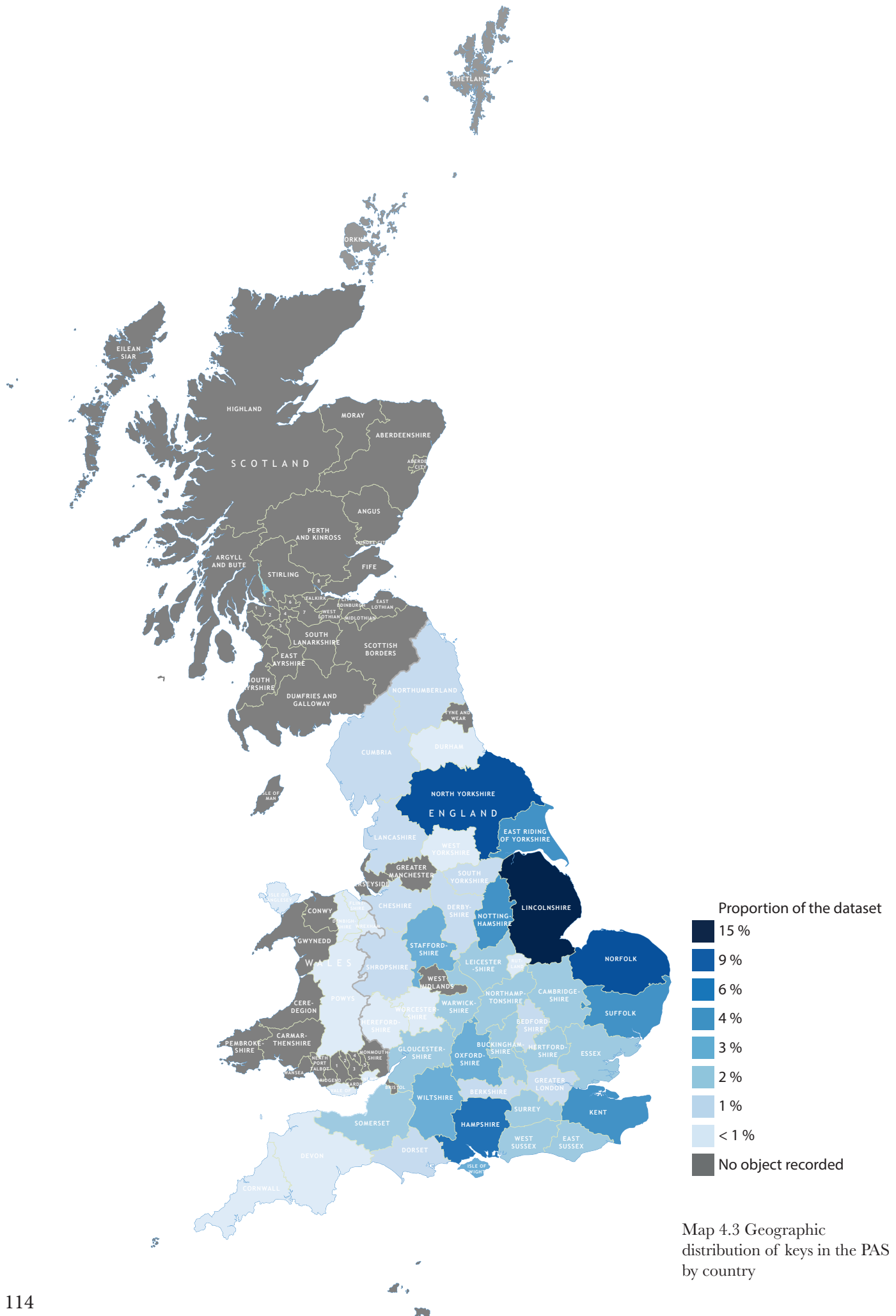
An assessment of the broad date assignments given to keys in the dataset demonstrates that there is a significant bias (table 4.5), similar to that seen above in brooches. There is a higher percentage of keys given a broad Roman period date, in part because of particular forms that are diagnostic to that period. The extremely low number of keys assigned an early medieval date is comparable to both buckles and knives.

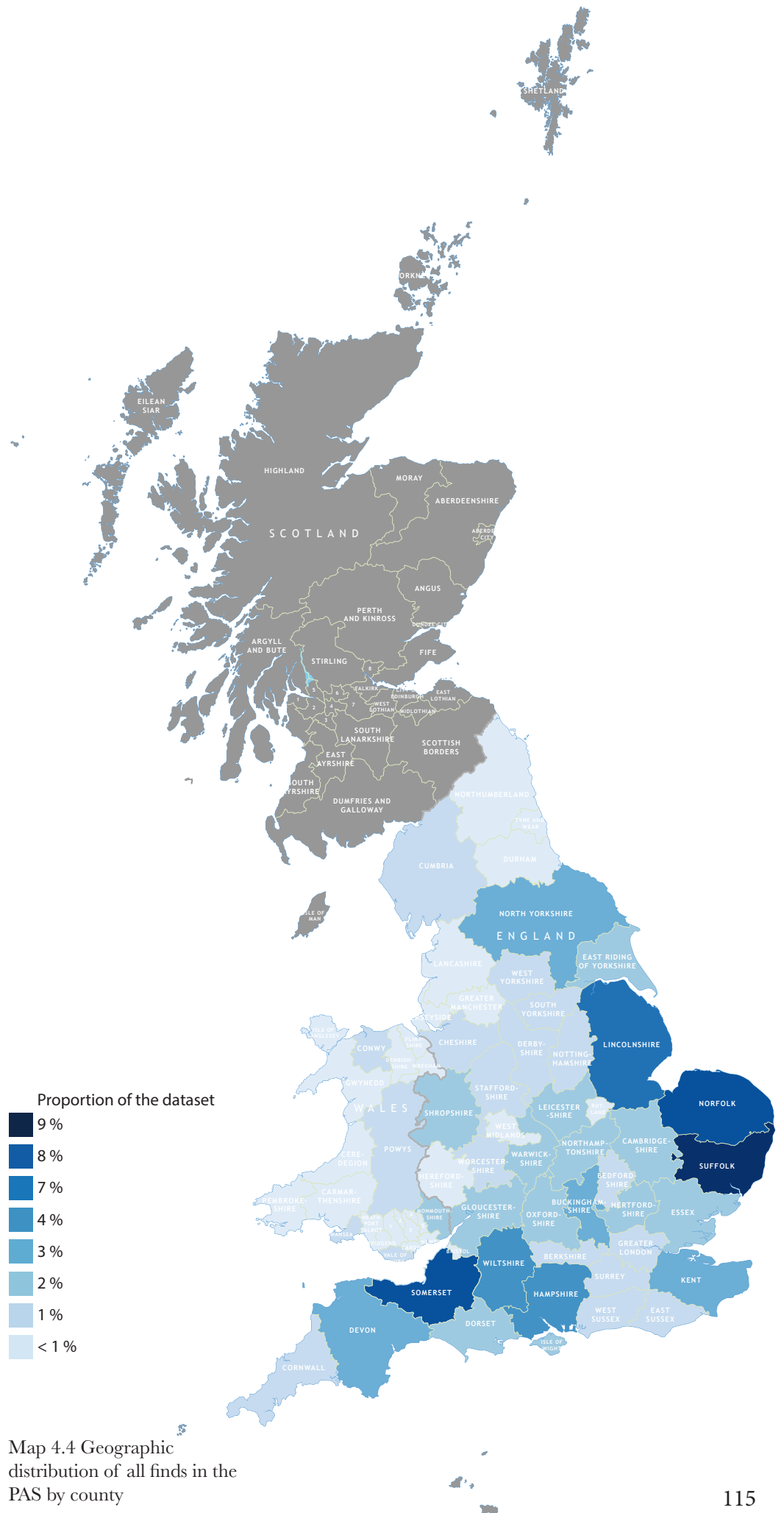
Period	No of keys	Percent of total
ROMAN	243	15%
EARLY MEDIEVAL	64	4%
MEDIEVAL	1140	69%
POST MEDIEVAL	178	11%
MODERN	7	0%
UNKNOWN	11	1%

Table 4.5 Distribution of broad date assignments of keys in the PAS

4.2.5 Data from MOLA (Museum of London Archaeology)

Knowing the biases identified above, a second collection of locks and keys was necessary to provide a comparison and allow a better understanding of how these biases may be skewing the data. The Museum of London Archaeology (MOLA) holds, at time of writing,





Map 4.4 Geographic distribution of all finds in the PAS by county

713 identifiable keys with images, the majority of them collected from in or around London. This allows the opportunity to explore how key use developed and changed in a relatively limited location. Although the characteristics of this distribution will not parallel that in other early medieval sites, it does provide a glimpse of the types of keys that were in circulation and that may have been known, even if they were not available more widely.

Keys from MOLA were given handle and bit classifications using the same method as for the PAS material, resulting in 75 distinct handle shapes and 150 bit varieties. Because of the differences in data structure between the two sources, a separate database was constructed for the MOLA material, with comparable data categories to allow comparative analysis. Although there is significant overlap in terms of handle and bit types between the PAS and the collection at MOLA, there are also a large number of forms unique to each. Similarly, although date assignments broadly agree, almost half of the bit types that occur in both collections are given different date classifications.

A comparison of the material distribution of the MOLA collection to the PAS dataset helps to make the extent of the bias in the PAS clear (figure 4.3). Iron keys are strongly represented in MOLA, at 76% of the total collection. Usefully, several forms found only in copper alloy in the PAS occur in iron in MOLA. Although this was expected in simpler types, such as casket keys which will be discussed in more detail later, it was also true of quite complex forms, demonstrating a high standard of workmanship and investment of skill resource in objects that, because of their material and their mundane nature, might not otherwise be considered as possibly indicative of a higher status or importance (figures 4.4, 4.5).

A visual comparison of the distribution of assigned dates in the two datasets (figure

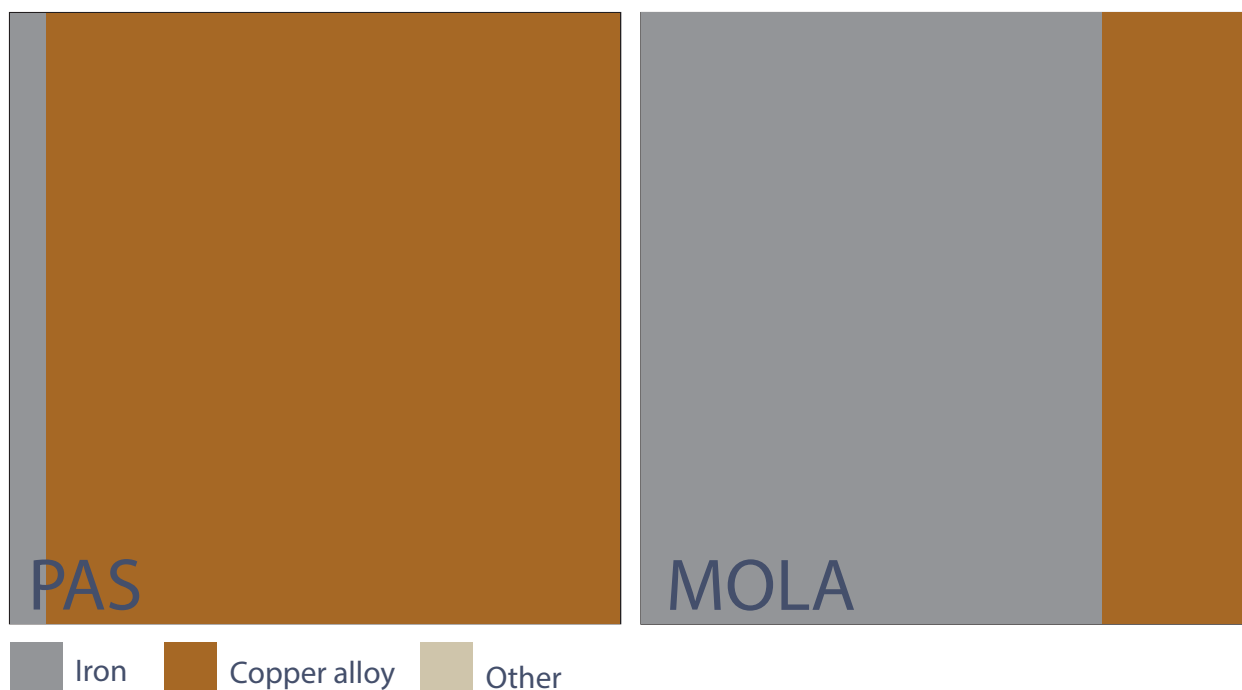


Figure 4.3 Mekko chart comparison of the distributions of object materials in the PAS and MOLA showing the proportion of iron to copper alloy and other materials in the PAS and MOLA



Figure 4.4, 4.5 Comparable bit forms in copper alloy (left) and iron (right)
 4.4 PAS LVPL-DF5884
 4.5 MOLA 80.82/28

4.6) shows that in MOLA there is still a tendency to preferentially assign medieval dates to keys, but the skew is less extreme, particularly for Roman keys. This may in part be due to the greater granularity allowed by MOLA's date classification system (which follows Historic England's period assignments), although there is some inconsistency with the early medieval classification, and some overlap that leads to confusion. But it is also likely that because this is a museum collection there is an introduced bias towards objects that are not only diagnostic, but are suitable for display. As the collection practices of the museum have shifted through time that bias will also shift.

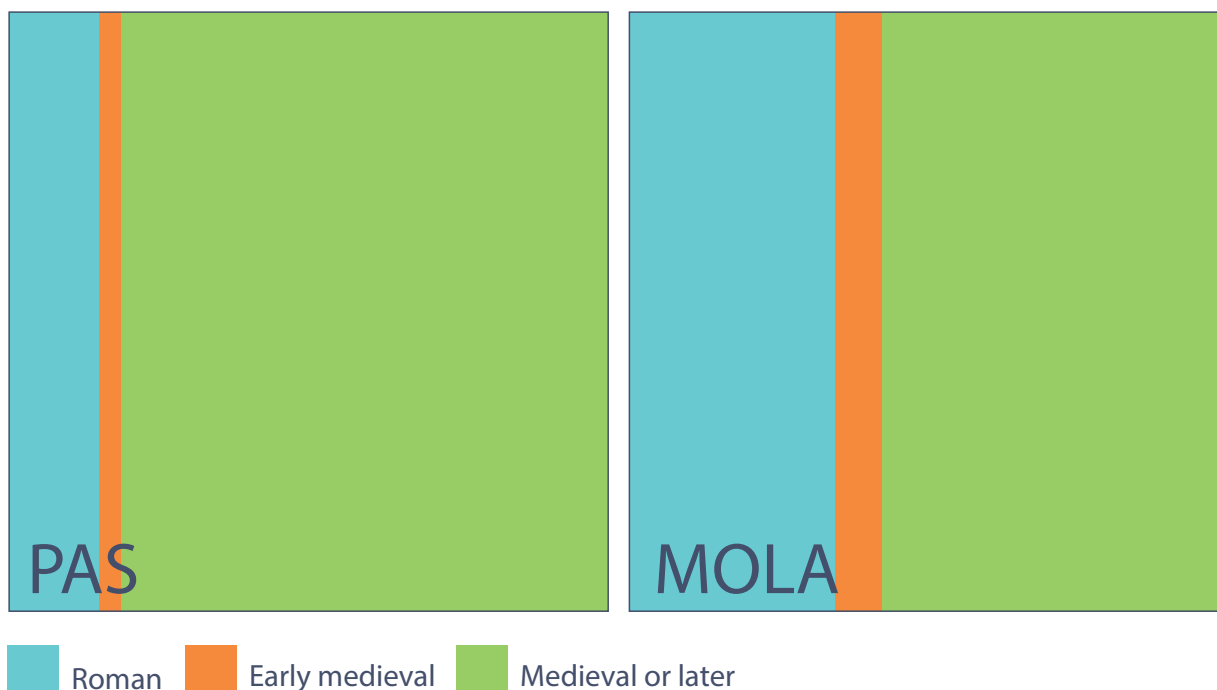


Figure 4.6 Mekko chart comparison of the distributions of broad date assignments in the PAS and MOLA showing the proportion of keys assigned dates in the Roman, early medieval, and medieval and later periods.

Particular key forms, once given a date classification, are generally not assigned a different date range even though they may occur over several centuries, a practice that is also seen in the PAS as will be discussed below. Certain forms of padlock key bit types (figure 4.7 a-d) which have been found in a number of early medieval and even later medieval

contexts are, without exception, dated as Roman. Another very common large iron key form and its variants (figure 4.8), classified as form VIIB in Ward-Perkins (1993, 142) are almost always listed as 15th century, although Ward-Perkins himself provides evidence for an earlier date of origin (141). In fact, 64% of the material was classified as medieval or later (44% were late medieval), and a further 30% was dated Roman (table 4.6).

Broad period	Number of keys	Percent of total
Roman	159	30%
Early medieval	32	6%
Medieval and later	337	64%

Table 4.6 Distribution of broad date assignments of MOLA keys

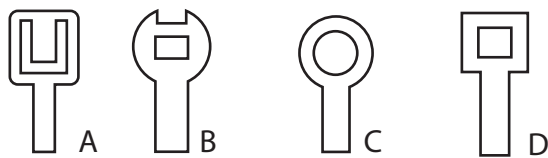


Figure 4.7 a-d Padlock bit types with known early medieval and later medieval dates, identified as Roman in MOLA

Figure 4.8 Ward-Perkins type VIIB
MOLA 93.98/1



4.2.6 Data from archaeological sites

The final data set is a collection of keys from archaeological sites that have secure early medieval dates. These sites were chosen with particular criteria in mind. First, it was useful to represent as wide a variety of site types as possible: larger communities, elite sites, smaller villages, cemeteries etc., although it was difficult to find evidence from smaller communities. Second, several sites were chosen that had reasonably large numbers of keys, allowing a comparison between assemblages at different locations. Finally, sites were selected to represent evidence from the periods before and after the early Middle Ages in order to better understand how the technology may have changed during periods of transition. Although a number of early medieval sites contain at least one key, relatively few of those keys come from securely dated contexts (they are often found in the fill of ditches or in pits) so unfortunately the geographic distribution is not as wide as would ideally be preferred, nor is it possible to do statistical analysis by site type.

In addition to securely dated keys, a few of the chosen sites also have surviving evidence for lock furniture. Although there are a few padlocks large enough to have been used on built structures, the majority of locks come from chests and caskets. These sites give a better understanding of the types of lock commonly used for movable storage. Examining the dimensions of fittings and fastenings also gives an idea of the range of proportions these objects had.

4.3 Key types

Creating logical divisions of key types is not entirely straightforward, and some previous classifications tend to add to the confusion. Classifications that do not focus largely on the morphology of the handle (cf Ward Perkins 1993) often focus on motion, defining keys as lift, rotary/lever, or slide. However that system has led to confusion. For example, certain padlocks were unlocked with a sliding motion, but the keys are entirely distinct morphologically from those usually defined as “slide”. Making an exception to the motion system and defining these as padlock keys is unsatisfying in terms of a coherent and logical system. It also makes it difficult to know where to place padlock keys, found both in Roman times, in early medieval Scandinavia, and later in the Middle Ages, that used rotary systems.

Further, there is often more than one motion involved in the movement of a lock. While the primary motion is the action that shifts the bolt, in warded locks there is usually a secondary motion that clears obstacles such as springs or tumblers, and sometimes even a tertiary motion that moves the key into position. Keys may be involved in only the secondary motion, while the bolt is shifted by another mechanism, usually by hand. Or they may perform all necessary motions. Because it is not always clear whether the descriptive motion term (slide, lift, lever etc) is directed towards the action of the key or the action of the bolt, the same term may be applied to very different key types. For example, two hybrid keys from Flixborough are identified as slide keys although morphologically they are similar to rotary keys, and do use a rotary motion (Rogers 2009, 194).

Finally, as discussed above in chapter 2, there is an important group of morphologically similar keys that have a number of prongs set either asymmetrically (L type) or symmetrically (T type). Both variations are classified by Manning (1985) as “lift keys” while Ottaway (1992) classifies them, along with several other morphologically distinct types, as “slide keys”, although somewhat confusingly, he also includes in that group a third lock mechanism which does not use a slide movement. Difficulties with classifying these keys by lock type are discussed below.

It is not in the scope of this project to create a definitive typology. In spite of the foundations for a typological approach developed by Linlaud (2014, 60-67), discussed

above, there are, as of this writing, no entirely satisfactory classification systems that allow fine-grained analysis of forms. For the purposes of this study, therefore, a set of groups were developed based largely on the morphology of the bits. The groupings used here are intended only to facilitate discussion and should not be assumed to reflect structures or understandings of the past.

The use of bit shapes as the primary characteristic is problematic. The fluid nature of the relationship between bit morphology and lock mechanisms means that any division on this basis will have the potential to mask the relationship between lock and key. However because, as the study will show, there is evidence for the importance of the appearance of keys during the early Middle Ages, this approach seems reasonable. A more complete discussion about the development of these type groups can be found in Appendix One.

This morphological approach produced 8 broad classifications, labelled A-H (table 4.7). There are, in addition, a number of rarely seen bit types that do not comfortably conform to any of these classifications. It should be noted that most group types occur in a wide range of sizes, and could have opened structural doors, large furniture, or small boxes. The exception is Group F which, because of the nature of the locks and the limitation of the materials involved, were probably used only for doors, and possibly large furnishings.

Group classification	Description	Alternate names
A	Rectangular bit, set to one side of and in-line with stem	rotary key, lever key
B	Round or rectangular bit, centred with stem, in-line or angled	padlock key, slide key
C	Multi-prong bit set symmetrically (T form) or to one side (L form) of stem	lift key, slide key, latch lifter
D	Heavy bit, set to one side of stem, with multiple teeth	tumbler key, slide key
E	rectangular or triangular bit set to one side of and in-line with stem with one or more projecting teeth or pegs	lever key
F	multi-toothed key made of wood, bone, or antler	latch lifter
G	single prong hook with stem of varying profiles	latch lifter
H	single narrow foot at terminus of stem	unmentioned

Table 4.7 Key classification system used in this study
120

4.3.1 Group A

Group A are rotary keys (sometimes called lever keys), usually with a single bit in-line with the stem. After the Roman period, this bit is almost always oriented in the same plane as the handle. Variations in this group are primarily related to the shape, number, and distribution of clefts (figures 4.9-4.11), although there are rare examples with double bits. These keys usually have either a hollow stem or a terminal peg which would keep the key centred as it rotated in the lock. Although it is possible, by doubling the lock mechanism and having an identical, double-sided structure, to use this lock from either direction it is likely that in the early Middle Ages they were primarily used only from one side. The simplest shape of bit is a solid rectangle, but most have at least one cleft, which allows the key to bypass physical barriers (wards) as it turns, engage with the bolt, and slide it free. The more wards used in a lock the higher the security, although that also depends on how unusual the position and shape of those wards are.



Figure 4.9-4.11 Group A rotary keys. 4.9 (left) MOLA 84.252/2; 4.10 (centre) MOLA 9137a; 4.11 (right) MOLA A 1869

4.3.2 Group B

Group B are keys with bits at the end of the stem. Those found in the PAS dataset are padlock keys and have two main sub-groups. The first key would have unlocked a barrel padlock with a slit down the length of the case (figure 4.12). The second, with the bit in line with the stem, related to a box padlock with a t-shaped keyhole (figure 4.13). The third has a bit set at an angle to the stem and would be used with a barrel padlock with a keyhole at the end of the lock (figure 4.14). Both box and barrel padlocks used one or more sets of leaf springs to hold the bolt in place. The perforations in the key bits relate to the size and position of those springs, and to any wards such as rods that were used for additional security. A morphologically similar key would have opened both a mounted lock type found

in Fyrkat, Denmark, and a variant of the box padlock that will be discussed in the following chapter.

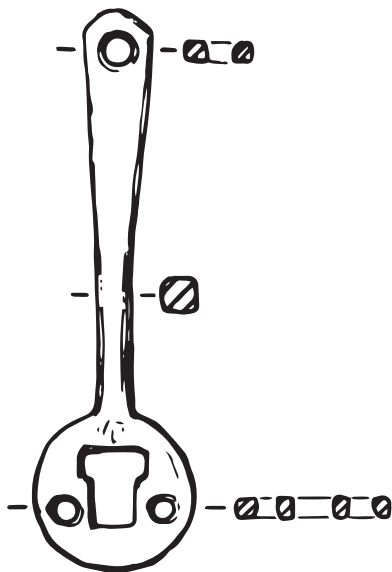


Figure 4.12 In-line barrel padlock key after Ottaway 1992, fig 290 YAT 3666



Figure 4.13 In-line box padlock key MOLA 80.65/13



Figure 4.14 End plate barrel padlock key MOLA 1956

4.3.3 Group C

Group C are the above-mentioned T and L variant prong keys (figures 4.15, 4.16 below) and although they are very simple, they are associated with three different mechanisms, described more fully below. Usually found with a simple suspension loop, these keys may have only one prong, or as many as six. Although fairly basic in form, varying the spacing of the prongs could make the key more difficult to copy. There is a variant of the L-form key, with a dogleg stem, common in Scandinavia that is found in a few sites in England (figure 4.17 below). This variant is discussed in Chapter Five.

4.3.4 Group D

Group D are warded tumbler keys (figures 4.18, 4.19 below), the only Roman key type that was apparently not carried through to the Middle Ages in England. This lock, an innovation in scaling security, was described in chapter 2. Both locks and keys involve a high degree of craftsmanship and skill, and provided considerable security. The keys have a higher mass than most other keys, and a measurably different construction method. Roman examples are often composite, with an ornate cast copper alloy handle and an iron shaft and bit. The bit

required more cold shaping with chisels and files than other key types, and because of the tolerances of the lock ward plate would need great care to produce a functional object.

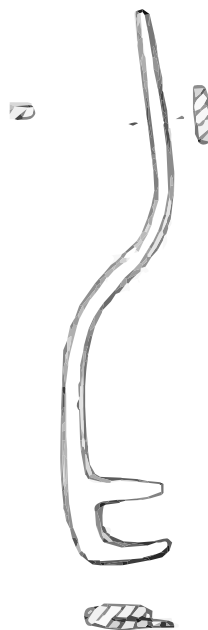


Figure 4.15 (left) Group C, J form prong key MOLA 2054

Figure 4.16 (centre) Group C, T form prong key MOLA 7471

Figure 4.17 (right) Group C, dogleg J form prong key after Ottaway 1992, fig 289 YAT 3661



Figure 4.18, 4.19 Group D Roman warded tumbler keys
4.18 (left) MOLA 1982
4.19 (right) MOLA 19551

4.3.5 Group E

Group E are hybrid keys (figures 4.20, 4.21), a type that uses a rotary motion but with pegs or other perpendicular extensions of the bit that work with a ward and leaf spring.

Some bits also have perforations which could mean that additional wards were in place to block the rotary movement, although they could also be decorative. If they were functional, the mechanism of the lock would have been measurably more complex and would have required a correspondingly high skill level of the craftworker. This group is relatively uncommon in the English record, but appears fairly frequently in Scandinavia, so it is possible that they were primarily used by Norse communities or those with whom they regularly traded. There are three variants of these keys which will be described more fully in the next chapter.



Figure 4.20, 4.21 Group E hybrid rotary keys
4.20 (left) MOLA 15811
4.21 (right) MOLA 2015

4.3.6 Group F

Group F is a the simple wooden tumbler key discussed in chapter 2 and used for the same type of lock as the third mechanism described for group C below. This group is most distinctive for its material rather than its bit morphology, which superficially resembles group A, although the lock mechanism is entirely different. This reflection in morphology may indicate that there were broad ideas of what shape keys should be, and those ideas transcended questions of function (figure 4.22 below). Carved of wood or bone, they are known in Roman Britain from eleven examples found at Vindolanda (Birley 1997), as well as an exceptionally rare complete lock (figure 4.23 below). Unsurprisingly, they are not found at all in the PAS and there is only one example in MOLA (31.97/1). However two examples securely dated to the Viking Age have been found in Orkney (figure 4.24 below), demonstrating that the technology survived, and could easily have continued in use in mainland Britain.

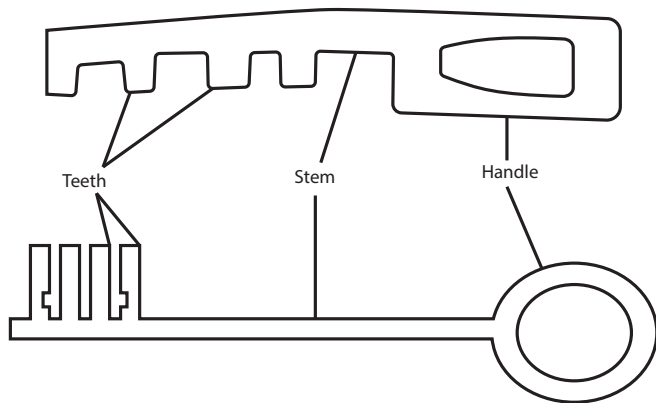


Figure 4.22 Diagram comparison of the anatomy of group F and group A keys



Figure 4.23 Wooden lock and key with reproduction. Vindolanda Museum. Author's photograph 2016.



Figure 4.24 Bone key of a tumbler lock from Stenabreck, North Ronaldsay
National Museum of Scotland 000-100-040-701-C

4.3.7 Group G

Group G are keys commonly called latch lifters (although this is a term that is also sometimes applied to keys from Group C and other, later keys). The simplest in form of all key types, they consist of a curved shaft and various shapes of hook or prong (figure 4.25). The question of how this key interacts with the bolt is unclear, and reconstructions of possible locks are conjectural. Because of this simplicity, latch lifters share morphological characteristics with many other iron work objects, such as pothooks. Issues with identification of these objects will be discussed below.

4.3.8 Group H

Group H is designated as a classification for a number of key types that appear to rely on a lever action to engage either a spring or a tumbler (figure 4.26). These key types have not been widely discussed, and it is unclear how much their related locks may have in common in terms of mechanism. They all have a projecting step or projecting teeth, similar to

those found in group E, but do not seem to have used a rotary motion. Although there are relatively few examples from this group in the dataset, only 1% of the total, they do seem to have been used in both the Roman and early medieval eras. It is possible that they were used for a small version of a leaf-spring lock discussed below, but this is purely conjecture.



Figure 4.25 Group G simple hook key
MOLA 93.40/6



Figure 4.26 Group H lever key
MOLA 84.268/1

4.3.9 Eccentric forms

There are also a number of keys that cannot be classified into any of the identified groups. The morphology of these keys varies considerably, and there are not enough of any given form to provide any statistically significant information in analysis. In the database these keys are all designated as group X (figures 4.27, 4.28).



Figure 4.27, 4.28 Examples of “eccentric”
bit, classified as Group X
MOLA A11586
PAS LON-66DCD1

4.3.10 Bows, suspension loops, and handles

As mentioned, the above group system is based on bit morphology. Although there is some relationship between handle or bow shape and bit type, groups A, D, and E have a significant amount of variation. This is contrary to type systems such as that developed by Almgren (1950) that emphasise decorative examples that have stylistic elements that allow them to be placed into known timelines. However because the majority of keys have very simple bows these systems are ineffective in classifying a large number of objects, and

arguably the reliance on the few distinctive forms has a tendency to skew the perception of what an early medieval key “looks like”. For the purposes of this study, therefore, bows and handles were not considered in the creation of type groups. However the range and distribution of forms is still informative and important to examine.

Like bits, handles can have both practical and aesthetic characteristics. The majority of them provide some means for suspension (one important exception is Roman ring keys, discussed below), with the simplest type of keys having only a loop at the termination of the stem (figure 4.29, 4.30). Variations on this type include modification of the stem through twisting, or flattening and shaping into rectangular or leaf profiles. Additionally, there are a few figurative handles, although these are, so far as is known, primarily Roman and were only revived in the later Middle Ages (figure 4.31, 4.32).



Figure 4.29, 4.30 (above) Loop termination of stem
 4.29 (left) MOLA 32.177/3
 4.30 (right) 22056

Figure 4.31, 4.32 (right) Roman figurative handles
 4.31 (top) PAS SF-6038E8
 4.32 (bottom) PAS NMGW-0A2DDD



Rotary keys generally require a larger handle with a flattened profile to provide the necessary leverage when turning the key. The simplest and most common form is a basic round or near-round shape. Variations are simply distortions of this form, some of which were codified into repeated, recognisable forms of their own (figure 4.33), or other geometric forms with or without elaboration (figure 4.34). Other, more decorative or distinctive forms have the potential to be more closely dated, but these are relatively rare (figure 4.35) (see Appendix Three for a catalogue of handle forms found in the dataset).



Figure 4.33 (left) Round handle. MOLA 1979

Figure 4.34 (centre) Geometric design. MOLA A14921

Figure 4.35 (right) Decorative handle. PAS NMS-A22BC3

There are a few distinctive handle forms that can be securely dated to the early medieval period. As mentioned, it is these forms that tend to be relied on in typologies. In the study dataset these handles correspond to bit types from groups A and E. They are mostly variations on a pear or tear drop shaped form. Examples range from the very basic to considerably more elaborate (figure 4.36-4.38).



Figure 4.36-4.38 Simple and elaborated early medieval tear drop handles

4.36 (top) MOLA A13482

4.37 (right) MOLA 1976

4.38 MOLA A3086

It is possible that the scarcity of these distinctive forms combined with the difficulty of securely dating the more common varieties has contributed to the impression that there were relatively few early medieval keys. Because there are comparatively few of the distinctive early medieval handles found, there are correspondingly few bit types. Further, decorative handle types as a whole tend to occur with unusual or complex bit types - hardly

surprising given the higher skill level involved in making these objects. The ratio of handle types to bit types for all complete keys in the PAS is 4:1; for those defined as early medieval it drops to 3.54:1. Therefore the more common, simpler bit types are less likely to occur with an identifiable early medieval handle. Without that datable association, the default assumption has been that the bit type did not occur in the early Middle Ages.

4.4 Date distributions

4.4.1 Broad distribution of type groups in the PAS

As will be discussed in more detail below, the locks related to the identified groups vary considerably in complexity, in material requirements, and in the number and variety of skills necessary for their construction, a variation that exists both between and within the groups. There is also some, although less, variation in the skill needed to make the keys, some of which involves aesthetic considerations of decoration, quality, and finish. But for complex locks with multiple security components, wards, the creation of a functional key requires knowledge of the dimensions of the finished lock and the relationship of the various parts within it as well as a concept of the complete motion of the key as it interacts with those parts..



Figure 4.39 Girdle hanger
PAS LIN-8AF3B7

The PAS dataset contains examples of all groups except F and G and similarly, MOLA has examples of all group types except group F. Although group C is extremely common in archaeological settings, there are only 9 examples in the PAS database, one of which is likely to be half of a non-functional girdle-hanger rather than a key (figure 4.39). The material bias

discussed above, the tendency to overlook or not report less distinctive objects, as well as the difficulty in identifying these keys when they are broken or heavily corroded, makes it unsurprising that this group is so poorly represented. Table 4.8 shows the distribution of the different groups, and the number of bit variations within those groups. Table 4.9 shows the group proportions by county.

	% of keys	% of bit types	Number of types
A	91%	84%	122
B	3%	5%	7
C	1%	3%	4
D	3%	3%	5
E	2%	3%	4
F	0.08%	1%	1
G	0.15%	1%	1
H	1%	1%	1

Table 4.8 Distribution of type groups and bit variations in the PAS

County	A	B	C	D	E	F	G	H	Total
Bedfordshire	17	1							18
Berkshire	2								2
Buckinghamshire	21	1		1					23
Cambridgeshire	31								31
Cheshire	15								15
Cornwall	4	2							6
Cumbria	4	4	1						9
Denbighshire	1								1
Derbyshire	6			1					7
Devon	4								4
Dorset	10	1							11
Durham	4								4
East Riding of Yorkshire	57	2			1				60
East Sussex	23								23
Essex	22				1				23
Flintshire								1	1
Gloucestershire	17			1				1	19
Greater London Authority	17								17
Hampshire	70		3	2		1			76
Herefordshire	3								3
Hertfordshire	17	1		3	1			3	25
Isle of Wight	44	3			2				49
Kent	47	1			1			2	51
Lancashire	7	2							9
Leicestershire	24	1							25

County	A	B	C	D	E	F	G	H	Total
Lincolnshire	177	3	2	7	6		1	2	198
Monmouthshire				1					1
Norfolk	90	4	1	4	2				101
North Yorkshire	106		2	4	1		1		114
Northamptonshire	26			2					28
Northumberland	10	1							11
Nottinghamshire	42			1					43
Oxfordshire	39			1					40
Powys	6								6
Rutland	3								3
Shropshire	9								9
Somerset	24	1							25
South Yorkshire	11	1							12
Staffordshire	36			1					37
Suffolk	33	2		3	4			1	43
Surrey	22							1	23
the Vale of Glamorgan	2								2
Warwickshire	30			1					31
West Berkshire	9			1					10
West Sussex	27	2							29
West Yorkshire	6								6
Wiltshire	41	1		1	2				45
Worcestershire	7								7
Wrexham	1								1

Table 4.9 Distribution of type groups by county (continued from above)

4.4.2 Distribution of dates of type groups in the PAS and MOLA

The dating discrepancies related to handle forms described above demonstrate the difficulty with using these collections in object research. The problem can be illustrated more clearly by looking at how the date assignments in the PAS and MOLA affect the apparent time line of specific key forms (figure 4.40). The larger proportion of keys given a Roman date in the MOLA dataset is largely due to the number of objects that can be stylistically identified as from that period, particularly the 95 keys from group D. However two other type groups that are given Roman period dates are more problematic. Of the 28 group B padlock keys, half have a very simple handle form that is also found in early medieval sites and cannot, therefore, be tightly dated to only one period (figures 4.41, 4.42). The group C assignments have a similar problem as this is a form in common use in the early medieval period.

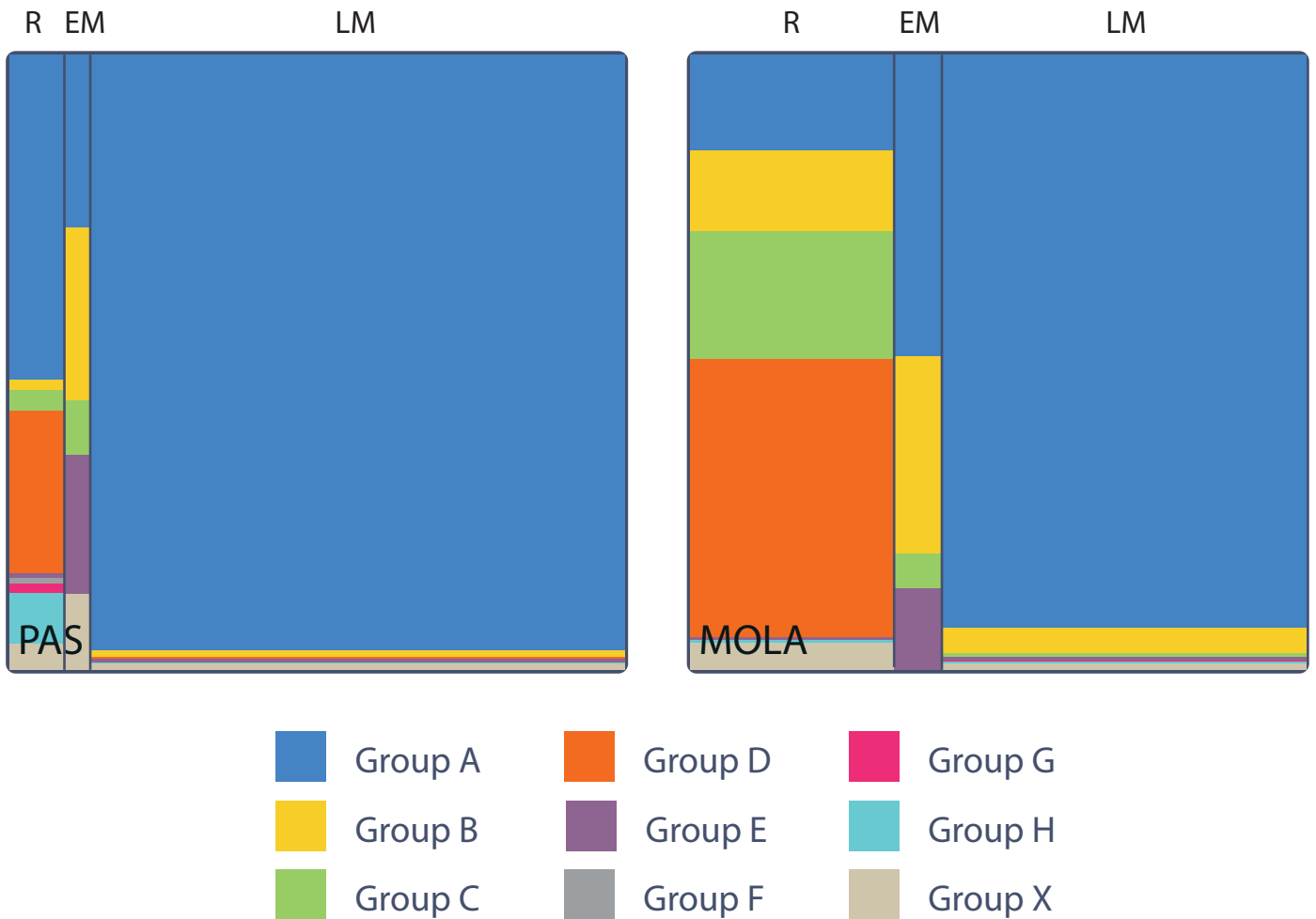


Figure 4.40 Distribution of type groups by date assignment, from left to right Roman, early medieval, and medieval or later. This Mekko chart acts as a visual representation of a pivot chart, allowing distribution comparisons for two related aspects of a data set. In this case, the chart displays the proportion of keys assigned to each period (Roman, early medieval, and later) and the percentage of the various type groups that are represented within those date groupings.

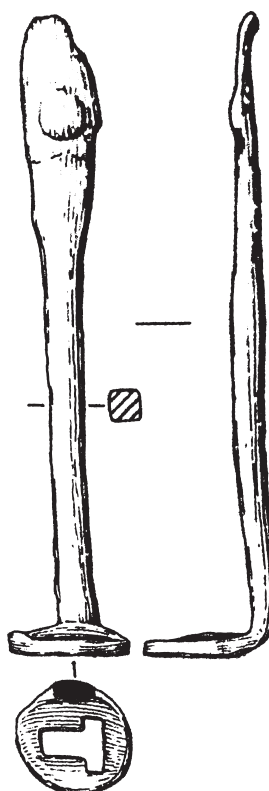


Fig 4.41 (left) Group B barrel padlock key given Roman date MOLA A2379

Fig 4.42 (right) Group B barrel padlock key from Coppergate, York. After Ottaway 1992 fig 290, 3665

However the most striking pattern is that of the date assignments of group A keys seen in the PAS. This skew can at least be partly explained by the tendency to rely on and repeat date classifications from already existing records, which means that date assignments made in earlier database records for commonly seen forms have a considerable effect on the overall date distributions. Figure (4.43) is a comparison of date assignments for the five most frequently found bit forms in the PAS to the dates given in MOLA. It highlights in particular how drastic the date bias is for the most common bit type, A in the figure, a type that will be discussed in greater detail below.

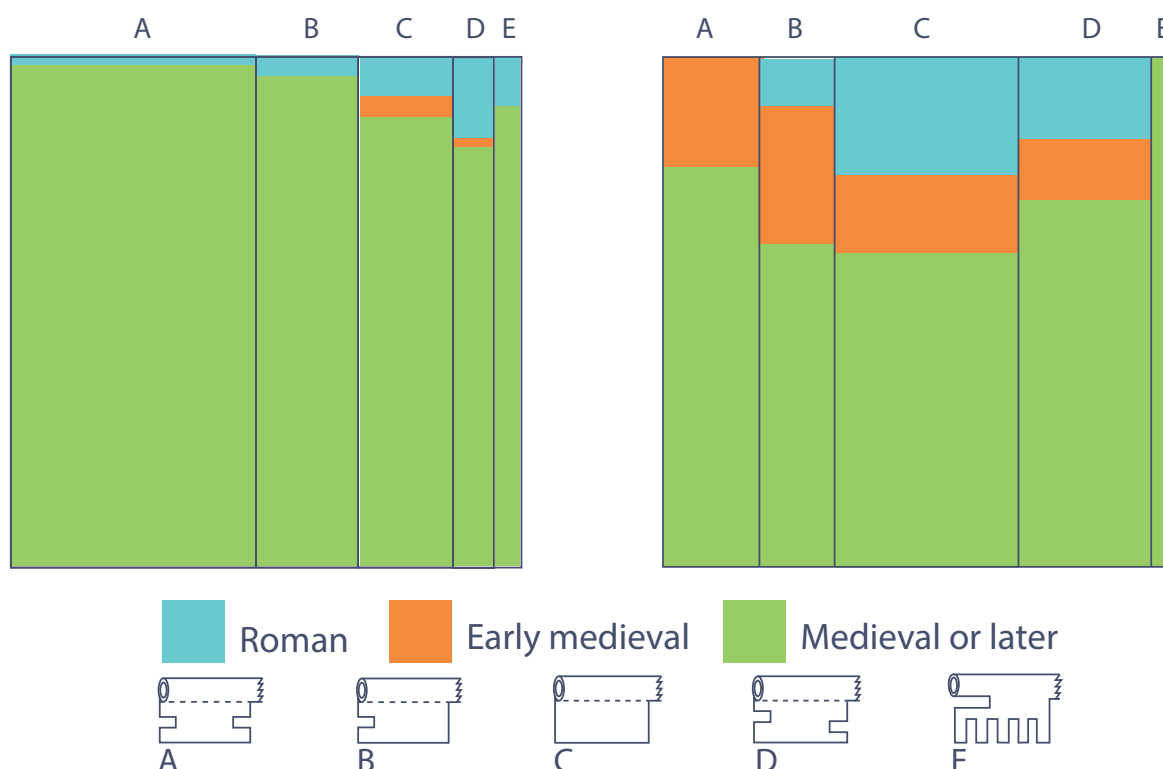


Figure 4.43 Comparison of the distributions of broad date assignments for the five most common bit types in the PAS with the assignments given in MOLA

Early entries for these keys in the PAS often provide no reference or reason for the assigned dates. Both PAS LIN-5A79BE or PAS LIN-EB8520, which are referenced by later entries (for example PAS HAMP-61F54D), give a very narrow range (1200-1400), and although later entries broaden that range somewhat (primarily 1100-1450), the majority fall between 1150-1400. Even those entries that do not directly reference the earliest records appear to rely on the broad date assignment established by them as a basis for finding archaeological examples and providing a more refined date. By far the most common references used are specific to the medieval period (Egan 1998, 2010; Margeson 1993)

This introduced bias has two effects on the perception of the distribution of keys. First the tendency to only assign easily recognisable diagnostic forms to the early Middle Ages leads impression that these forms accurately represent the range of types in use during that period. Second, the restrictive date ranges given to common forms, such as the

bit type just discussed, masks the actual length of use of these objects, making it difficult to recognise continuity in craft and cultural practice over time.

4.5 Persistent forms

The importance of evidence of such continuity in understanding periods of significant change, has not been sufficiently recognised in archaeological research. But the practical and cultural forces that have been recognised in studies on technological development and change (cf Pfaffenberger 1992; Lemonnier 1993; Ashby 2014; Ashby forthcoming) also influence the resistance to that change. The continuity of technology requires consistent investment, an investment that is driven by demand. But the continuity of specific forms within that technology suggests additional conditions necessary for their maintenance within the craft community.

Because the manufacture of locks is complex and involves specialised knowledge and skill, persistence in the morphology of the surviving keys can be used to infer information about the nature of the community of craftworkers who created them. A high fidelity in type morphology through time, what I am terming persistence, shows that there was a consistent and effective transmission both of the technical skill and knowledge involved in construction, and of the cultural ideation of what was seen as appropriate forms. This requires a community of craftworkers sufficiently large to counter both the natural degradation of skill and of form concept, and the episodic attrition of population and disruption of exchange networks through catastrophic events such as plague or war. It also means that there was a consistent demand for these objects within the community, a demand that was also based in those shared ideas about form, and that this community had access to the craftworkers, evidenced by the distribution of keys.

4.5.1 Securely dated bit types from archaeological sites

The keys from 44 archaeological sites, a total of 414, represent 76 bit types from dates ranging from the 5th to the 12th centuries. Figure 4.44 illustrates the group distribution of the dataset as a whole by date range. Map 4.6 shows the geographic location of those sites. In the timeline, 39 bit types appear in either or both the Roman and the medieval eras and it is these types that represent potential persistent forms. Bit types from the sites that are also found in the PAS and MOLA total 837 objects, 36% of the combined datasets. There are also 27 types which are not found in either dataset. Of those bit types that do co-occur, 28 (56%) have not been classified as possibly early medieval. Figure 4.45 shows a comparison of the distribution of date assignments of bit types found in securely dated contexts to the date assignments of those same bit types in the PAS and MOLA.

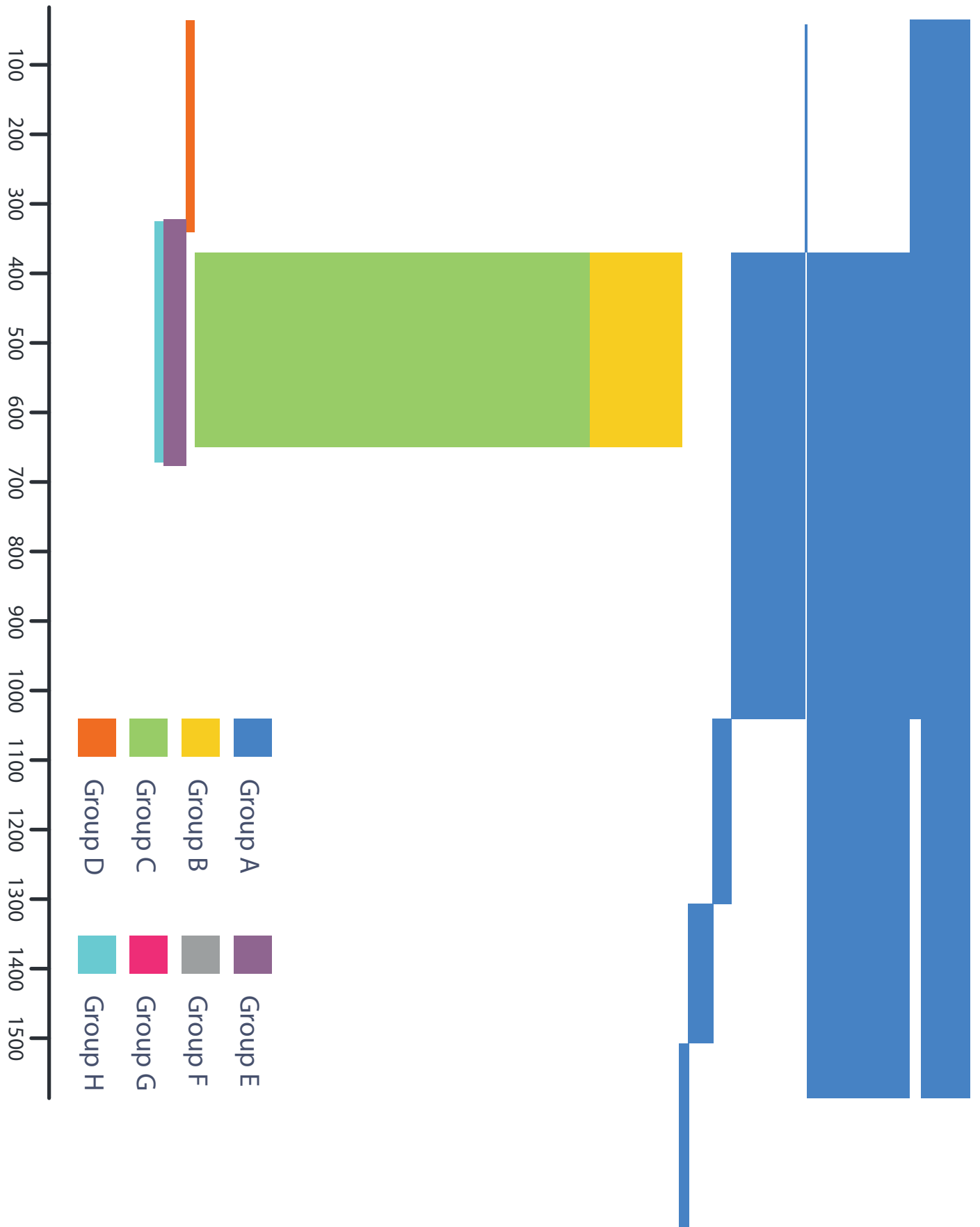
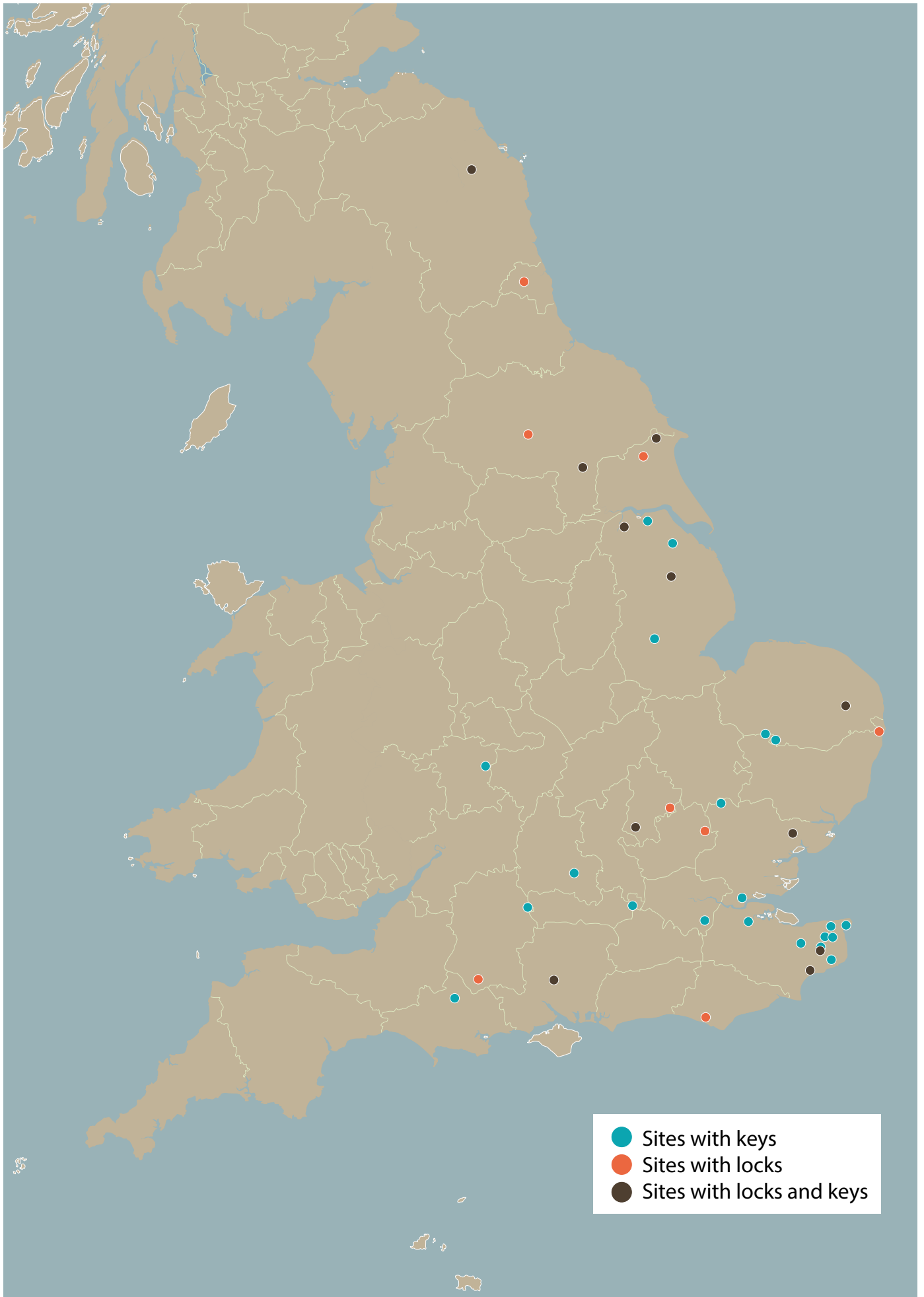
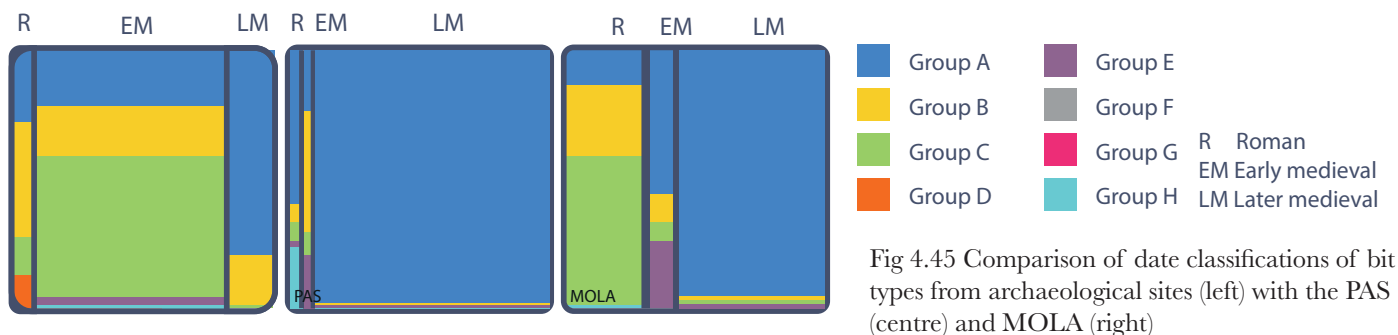


Fig 4.44 Timeline of bit types from archaeological sites by group



Map 4.5 Location of archaeological sites used in the study
136



4.5.2 Securely dating Roman period and medieval bit types

In order to evaluate persistence, it is necessary to demonstrate that particular forms can be confidently said to be to have been used in both the Roman and medieval periods. As the date classifications of both databases have been shown to have some inaccuracy, and as the degree of that inaccuracy for Roman and for medieval examples is unknown, it is necessary to use additional data to more confidently identify bit types that were used in each period.

For Roman keys this was primarily done using a distinctive form that fell out of use in Britain very soon after the end of the Roman period - ring keys. As discussed in chapter 2, ring keys were used to open small locks most likely on or built into boxes, such as the two fifth century examples from the Hoxne hoard mentioned above (Chapter 2, pp 43-44). The bits on these keys represent groups A, B, and D (figures 4.46-4.49). There are 50 ring keys in the combined datasets with 22 bit types, three of them found in both collections. Additional examples of the form from other museums and private collections provide secure Roman dates for 28 bit types total. Ten of these bit types are also known from the catalogue from archaeological sites, seven of which can now be identified as persistent forms.



Figure 4.46 Roman ring key, group A
British Museum a
OA.11078



Figure 4.47 Roman ring key, group A
PAS 403799



Figure 4.48 Roman ring key, group B
British Museum 1855,0912.1



Figure 4.49 Roman ring key, group D
British Museum 1870,0402.163

Medieval keys are more problematic. Particularly in the 11th and 12th century, there are very few if any handle forms that can be securely stylistically dated. Most handles are some variation of the basic round bow. Therefore, known archaeological examples from selected sites were used, in addition to representations of keys in manuscripts and other art, a method also used by Linlaud (2014).

The latter category is of particular interest. Artistic representations are often stylised, especially when that stylisation serves a narrative purpose, for example the use of letters as bits in the 1300-1350 illustration of Peter in Egerton 3753 (figure 4.50 a, b). However, cultural concepts of what is necessary for an object to be a key will still carry through. In this case, handle, stem, and bit are clearly identifiable even though their existence as real-world, practical objects is deliberately contradicted through the use of the letters and the exaggerated fragility of the form.



Figure 4.50 a and b The Prayer book of Archbishop Arnulph II of Milan c 998-1018 BL MS Egerton 3763

In contrast, in many depictions there is a clear reference to real forms, and the narrative urgency comes not from challenging expectations but from referencing the cultural implications of those forms. Using familiar objects in illustrations of heightened narrative import, such as scripture or historically weighted scenes, can add verisimilitude. This grounds the illustration in a shared cultural reality and allows the viewer to engage more intimately with the scene (see Nagel and Wood 2005 for a more complete discussion).

Subtle messaging in the specific form of those objects could also provide further information about status and identity. The use of high status contemporary textiles and finishes has been well examined (cf Stein 2016), but it is equally applicable to objects. This sort of signalling obviously depends on the accurate depiction of recognisable forms. This means that, for the intended audience, these particular forms were familiar either from direct experience or through other references. It is reasonable to argue that they were, therefore, relatively common.

4.5.3 The keys of St Peter in medieval art

One of the best sources for early key references in art is depictions of St Peter. His iconic association with keys is based on Matthew 16:19 with Christ giving Peter “the keys of the

kingdom of the heavens". Keys do not appear in Petrine icons in the west until the 6th century (figure 4.51), which is perhaps evidence of the slow increase in the centralised power of Rome. Certainly there later was a lively debate about the extent and exclusivity of the powers implied by the keys (Thomas Aquinas, 1947-48). This could also be why, when keys do appear, they are often exaggerated in size (figure 4.52). If so, then there is additional reason to believe that these depictions are more likely to reference known and familiar key forms in order to ensure that the message is read easily and appropriately.



Figure 4.51 An archaeologist gestures towards a watercolour [sic] of St. Paul at the 'Cubicle of Apostles' Photo: AFP/GETTY Squires 2010



Figure 4.52 Croatia, Istria, Porec, Basilica of Euphrasius, Byzantine apse mosaic on triumphal arch depicting Christ and the Apostles Mosaic. 543-554 AD Alamy Stock Photos BG8N6C

One of the earliest depictions of St Peter in England is a 10th c bas relief in the Church of the Holy Rood, Daglingworth (figure 4.53 a, b below). The bit form here is slightly problematic as it either represents a single, symmetrical double bit key or two identical keys. The Greek text refers to keys in the plural (τὰς κλεῖδας), and later depictions make the distinction between the keys clear, most obviously in the crossed keys used heraldically. It seems likely, therefore, that the visible cleft at the terminus of the stem is intended to indicate two keys. It is possible that they were shown as strongly joined in order to emphasise that St Peter's binding powers made the separate realms of heaven and earth into a single kingdom under Christ.



Figure 4.53 a, b
Saxon carving of St Peter
10th c bas relief
Church of the Holy Rood
Daglingworth, Gloucestershire
David Ross and Britain Express nd

This idea is supported by the early 11th century illustration of St Peter in the New Minster Liber Vitae (figure 4.54 a, b). Here the keys are tightly connected, but are clearly separate objects, with a strong dividing line, while the bits are similar but distinctive. This could be an evolution in the way the intended messages were projected.

The Liber Vitae keys, as with the Daglingworth example, are group A types and are clearly intended to show a complex warded version. Very similar keys are shown in one of the illustrations of St Peter in the Benedictional of St. Æthelwold, produced in Winchester between 963-984 (figure 4.55 a, b). A second illumination features a highly stylised object that places a cross at the end of the bit, clearly making it an object that is symbolic rather than practical. But the form of the key itself visually references both the bit type seen in Daglingworth sculpture and the conjoined keys (figure 4.56 a, b).



Figure 4.54 a, b New Minster Liber Vitae
BL Stowe 944 f. 6



Figure 4.55 a, b (right)
St Peter
Benedictional of St.
Æthelwold
BL Add MS 49598, f. 4r

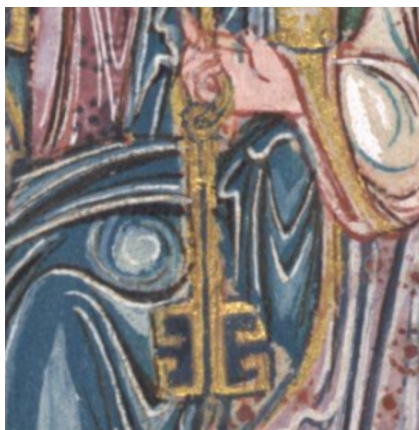


Figure 4.56 a, b St Peter and Christ
Benedictional of St. Æthelwold
BL Add MS 49598, f. 56v

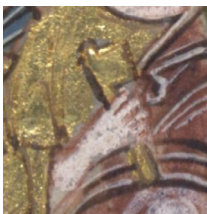


Figure 4.57 a, b St Peter and the disciples
Benedictional of St. Æthelwold
BL Add MS 49598, f. 102 v

Figure 4.58 a, b St Peter and the disciples
Benedictional of St. Æthelwold
BL Add MS 49598, f. 67 v





Figure 4.59 a, b Three Magi
Benedictional of St. Æthelwold
BL Add MS 49598, f 24v

There are also two illustrations of Peter with far more basic keys, one of them entirely unwarded and one with a single cleft (figures 4.57 a,b and 4.58 a, b), showing that in the 11th century there was not a single, iconic key type associated with St Peter. This supports the idea that the artists were drawing from known contemporary objects. It also helps to justify the argument that all three of these bit types were in use in Britain prior to their depiction in these art works, possibly pushing the practical use at least into the early 10th or late 9th centuries. It is clear that there were also a number of bit types in common use, allowing for these multiple references. Further, the consistent use of group A keys shows that this type of mechanism was in use for doors as well as chests and caskets, and that although that use may have been limited to high status buildings, it was common enough to be recognisable in that application.

This last point is interesting because in the same manuscript there is a rare depiction of keys without a direct narrative or icon-related purpose (figure 4.59 a, b). This illustration of the three Magi shows one with two bunches of keys, apparently suspended from rod chains. He is bearing his gift of gold, and the keys may be intended to reference his wealth; they are the only visual differentiation between him and the other two kings. The size of the keys, and the narrative setting involving gift exchange, makes it likely that they were meant

to reference locked caskets or chests, demonstrating that both uses of this key type were known.

There are several closely comparable examples to the Daglingworth keys in the combined datasets (figures 4.60, 4.61). Although no group A bits in the datasets are identical to either of the Liber Vitae bits, there are several fairly close analogues (figures 4.62, 4.63). None of the dataset examples for either type is classified as early medieval, however 24% of unwarded bits in the Museum of London collection and 3% of those in the PAS dataset are identified as such, which may show that in both databases, more complicated forms are less likely to be given an early medieval classification.

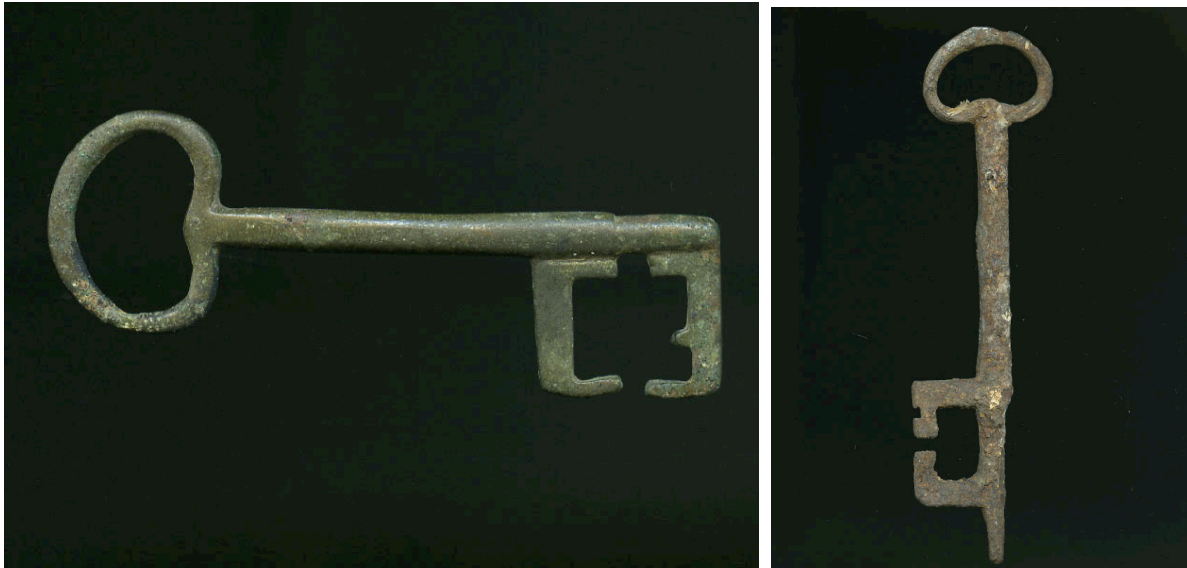


Figure 4.60, 4.61 Daglingworth St Peter bit type comparisons. 4.60 (left) MOLA A1486; 4.61 (right) MOLA 10924



Figure 4.62, 4.63 Liber Vita St Peter bit type comparisons. 4.62 (left) MOLA A2885; 4.63 (right) MOLA 51.4/17

In total, thirty-four English depictions of keys from sculptures, manuscripts, and stained glass were collected and analysed (see Appendix Five for the list of sources used). Although these keys do not significantly change the distribution of known persistent

forms, they provide a more reliable early date for many medieval types, and strengthen the argument that some bit types from group A were in use throughout the early Middle Ages.

Because of the restricted number of forms available for inclusion using this approach, it seems reasonable to argue that there are additional bit types found in the dataset whose use could also have spanned these transitional periods or that may have led to or developed out of these forms, showing a continuity of practice and cultural conceptions.

4.5.4 Casket keys



Figure 4.64 Franks Casket 700-750 AD
British Museum 1867,0120.1

A particularly important group of transitional key forms are small keys, usually less than 55mm in length, that would have opened in-built locks on small boxes or caskets. Small boxes have been found in some burials, suggesting they had some cultural importance (Geake 1995, 185-187). Surviving examples show they could also be highly decorated. The best known example is probably the 8th century Franks Casket, with its heavy relief figurative carvings and inscriptions (figure 4.64). But simpler decorated boxes were also known, such as the nearly complete box lid from a mid 11th c context at Coppergate, York (Addyman 1999, 1954-59) (figure 4.65 below). Remnants of a wooden box from grave 15 at Bloodmoor Hill (Lucy et al 2009, 406-408) have traces of what has been identified as gesso, probably used to provide a smooth base coat for painting. All indications are that these were

often deliberately ostentatious or eye-catching objects, intended for display. They were also very portable, and as markets and trade sites increased, may have allowed lock and key types previously only found in elite sites with highly skilled craft workers to be spread more widely.

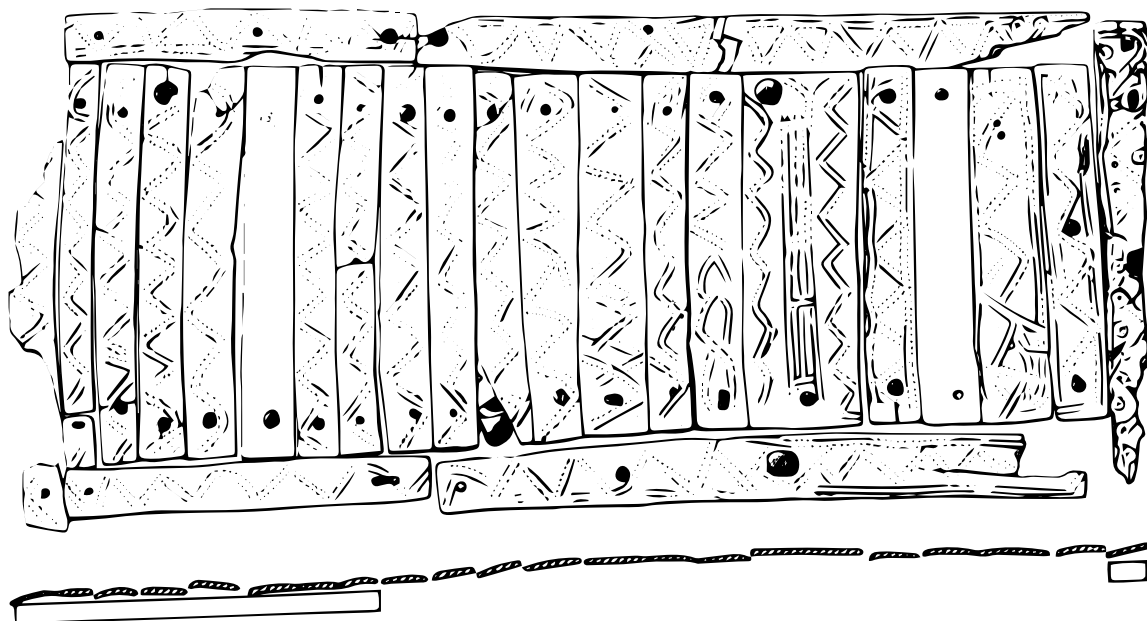


Figure 4.65 Bone casket lid, Coppergate, York
MacGregor et al 1999 1955, fig 913 YAT 6964

Evidence from boxes, chests, and caskets from several archaeological sites indicate that they were built with a range of lock types, with keys from groups A-C, while several keys from group E are of a suitable size to suggest they were also made for boxes. The most common lock type was the leaf spring lock opened with group C keys. These are known both from smaller boxes, for example from grave F, Buckland, Kent (Evison 1987, 275), and large chests used as coffins in sites like York (Kyølbye-Biddle 1995) and Winchester (Biddle et al 1990).



Figure 4.66 Unwarded group A
MOLA A11882



Figure 4.67 Roman unwarded
group A MOLA 2012



Figure 4.68 Bi-clefted group A
MOLA A11331

However the most numerous small keys in the datasets are from group A. The locks may have been cased in metal and externally mounted, as in the Hoxne hoard locks, but it is likely that many of them would have been set on the interior of the box, the key passing through the front panel. The simplest form of bit is completely unwarded, with no clefts (figure 4.66), a form that is known from Roman examples (figure 4.67). However the most common form has symmetrical clefts on the fore and aft edges of the bit (figure 4.68).

The large number of these keys in the PAS (table 4.10) implies that they were extremely common, and had a fairly wide distribution (recorded in 39 counties in the PAS), but they are not often found in early medieval burials. This may indicate that they were a more expensive variant than leaf spring locks worked by prong keys, that rotary key making was a less widely practised skill, or that they were more difficult to replace and were therefore less likely to be deliberately deposited in graves. It is also possible, of course, that this type was not in use in England during the period of furnished burials. However there is a group A type lock in a chest burial from grave 1045, Ailcy Hill, Ripon (Hall and Whyman 1996, 107). Radio carbon dates from this burial (80) place it in the 8th century (c 660-810), indicating that group A locks were in use by that time.

Data set	Number of bit types	% of keys in dataset
MOLA	14	2%
PAS	226	14%
UKDFD	72	37%

Table 4.10 Number of bi-clefted bit types by data set

There is considerable variation in how the term “casket key” is applied within this sub-group, with some studies including small rotary keys of any bit variation (Ward-Perkins 1993) and others specifically referencing only a very narrow range of bit types (Ottaway 1992). Rather than examining the complete range, I chose to focus on a clustering of morphologies that are particularly informative in relation to the question of knowledge transfer and form persistence.

To better examine these clusters, the basic full rotary key form was divided into discrete sections, starting with extensions of the bow, such as suspension loops or decorative knops and ending with the stem terminus. Six sections were identified: head, bow, collar, stem, bit, and terminus (figure 4.69). A table of the frequency of complete designations found in the dataset can be found in Appendix Six.

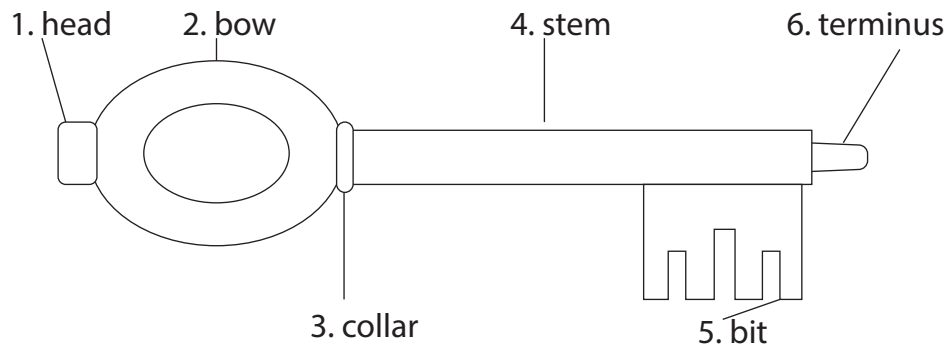


Figure 4.69 Schematic of rotary key sections

Each of the sections can vary, reflecting choices by the craftworker (Lemonnier 1993). These variations may show individual preference, but also may carry information about knowledge exchange both in the distribution of frequently seen variation and in the ways in which more unusual or exceptional designs may have spread. By coding the keys by section, it is possible to more closely examine the amount of variety the entire data set contains, and describe how much or little individual keys vary from each other. Keys that share more characteristics are more likely to have been made by craftworkers with a common knowledge set and to have been made for communities with a shared idea of appropriate and desirable forms. The wider the distribution of these keys, the larger the network of craftworkers with these shared ideas and skills.

Observed variants of each section are designated by letter, with sub-variants given an additional number. Although somewhat ungainly, the result is a six part designation that describes the morphology of the majority of rotary keys to a reasonable degree of thoroughness. Sections 1-4 are largely aesthetic, but may require different skills or changes in manufacture methods. Sections 5 and 6 reflect differences in the construction of the related lock.

Rotary keys from the combined dataset with a total length less than 60mm were then classified under this system, resulting in 782 keys and 211 forms - nearly 65% of which are unique appearances. Over 30% of these keys fall into a single form category, with the classification aaaabb (figure 4.70). There are also a number of closely related variants, with five of the six sections in common. An extension of this system may be able to be used to begin to trace morphological associations that could indicate the amount of shared craft practices or cultural preferences more widely.

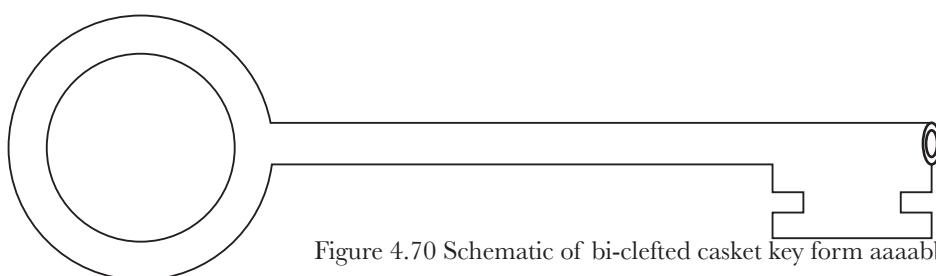


Figure 4.70 Schematic of bi-clefted casket key form aaaabb

For three of the observed combined forms, including the bi-clefted form aaaabb, there are datable examples from both Roman (PAS 2002, 24) and post-conquest Britain (Biddle et al 1990, 1010). There are also two additional forms from Roman contexts, and two from post-conquest contexts. However, the most striking is for the bi-clefted key which is not only persistent, but shows remarkable fidelity over time. Mapping the occurrence of this form by county shows that it was widespread in use (map 4.6). Clear clusters occur in Lincolnshire (for the PAS) and in Kent and Essex (for the UKDFD) although this may be in some part due to detecting and reporting practices on the part of the local groups.

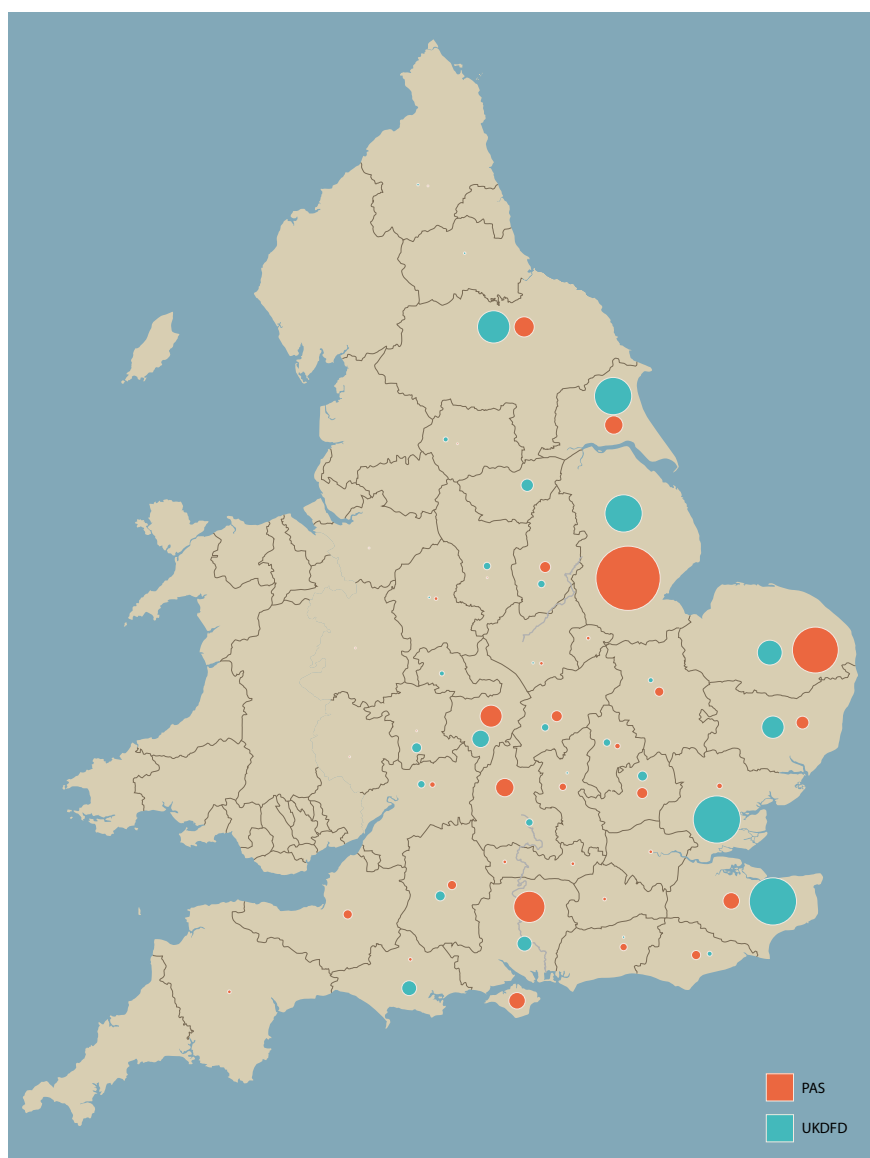


Figure 4.71, 4.72 Examples of aaaabb type bit with non-functional clefts.
4.71 (left) MOLA 43272,
4.72 (right) MOLA 432161

Map 4.6 Distribution of casket key form aaaabb in the PAS and UKDFD databases.

There is also evidence that it wasn't simply the craft of this particular key form (and its associated lock) that was widespread, but that there was a broader, cultural sense of the appropriateness of this shape. Several keys that clearly follow the basic morphology have only rudimentary clefts that would almost certainly not have had any functional value (figures 4.71, 4.72). They are included, in other words, because that is what a key of this type should look like, and that was important enough to require a gesture towards the form to satisfy that cultural expectation.

4.5.5 Complex transitional forms

The fidelity of transmission in the form of the casket keys does provide evidence for a continuity of practice and culture. But the bits are relatively simple and the level of familiarity necessary to effectively reproduce them is quite low. However another group of Roman bit types is more interesting not only because of its greater complexity, but because some of that complexity is, arguably, not due to practical considerations. Instead it represents choices made in response to cultural ideas, possibly referencing a known form that had a particular history and meaning, or that suggested value, status, and security.

This provides important information about possible shared cultural ideas about object status, and specific ideas about how status is expressed. In doing so it supports the argument made by Steve Ashby (2013) in his study on early medieval comb making, that practical considerations of efficiency are not always the most significant influences on choices made in the manufacture of objects. Shared knowledge about the meaning and importance of what Lemonnier called the stylistic aspects of technology choice making (1993) also has a significant effect.

These bits represent a much higher barrier to accurate reproduction which means both that their continued use required a greater amount of effective transmission of cultural and technical knowledge, and that observed variations may indicate something about the structure of the knowledge transmission network in space, time, or both.

This idea of varying degrees of difficulty in effective transmission can be quantified in a very broad way by assigning values to different aspects of bit morphology. It's important to note that this system is specifically looking at the design of the bit and not how or even whether those design elements translate to practical utility in a lock.

The type group in question is related to the bi-clefted casket keys just discussed, but is elaborated with a series of clefts along the bottom edge of the bit, parallel to the shaft (figure 4.73). The number of clefts varies considerably, between four and ten. As the number of clefts increases, the relative strength of the remaining metal decreases. Unlike the fore



Figure 4.73 Diagram of complex transitional bit

and aft edges, the bottom edge is actively involved in the unlocking action, raising a spring and shifting a bolt which means it is subject both to friction and to torque stress. Keys with more clefts will be more likely to break. The fact that in spite of this, such elaborate keys

continued to be made indicates a significant emphasis on the value of the visual rhetoric of the highly complex form, even when that form involved a significant risk of breakage. The clefts also can decrease the tolerance for error in lock construction as the bolt must be precisely placed for the bit to effectively engage with it.

There are two variants of this group found in the PAS, with a total of five objects. However the MOLA database contains three variants and a total of 36 keys. Among these are ring keys (figure 4.74) that establish this variant as being used in Britain in the Roman Era. It is notable, however, that it is rare as a form in British art, and seems to only appear after the 11th century (figure 4.75). This fact, and the higher concentration of this key type in London, may indicate that, unlike the simple casket key, this more complicated variant, although popular or important enough to be maintained in areas with a more gradual transition from the Roman Era, dropped out of common use in England and was brought back after the Conquest.



Figure 4.74 Roman example of the complex persistent bit form
MOLA 81.282/14



Figure 4.75 Life of St Edward the Confessor. 13th c.
Cambridge MS Ee.3.59 7v.

This comparison shows a clear difference in both the artefactual and the artistic evidence between the two types and supports the idea that there was also a difference in the production and use pattern of the keys through the post Roman and early medieval periods. Rather than a complete loss of lock use and lock-making ability, there was instead a reduction of types used, particularly in areas outside of elite or productive centres. In fact, it would appear that most lock types continued in use, and it was the relative complexity of their internal structures and therefore the complexity of the key bits that was reduced.

This could be because, as keys are vulnerable to loss, keys required replacing more frequently than locks. Local craftworkers who did not have the necessary specialised knowledge to make locks could still produce reasonably functioning keys by replicating known forms. Naturally this would result in a tendency to prefer the simpler types that had a higher tolerance for error, but it is worth emphasising that there was apparently still

sufficient interest in relatively complex locks to keep their production at a fairly high level in some areas. For example, although prong keys could be and were frequently used for boxes and chests, the rotary key system was also apparently kept in use.

4.5.6 Atypical key construction

This idea is supported by key examples that appear to have been made by non-specialist craft workers. A small group of eleven keys in the dataset shows a range of technical ability and a concern with conforming to established forms (figure 4.76-4.78). What they all have in common, however, is a non-traditional construction method. All eleven keys are made of copper alloy, but where objects made by a practiced craftworker would be cast in a mould and then finished with a file, these eleven are made out of sheet metal. They would appear, in other words, to have been made by someone who was used to working in iron rather than copper alloy, and who had adapted the techniques they were comfortable using to apply to the available material.



Figure 4.76-4.78 Examples of atypical key constructions. (left) CORN-8F8940; 5.71 (centre) PAS IOW2018168; (right) PAS 4_2002_key

The eccentricity of form and technique are only part of what suggests these keys are made by non-specialists. There is also the fact that the form itself often appears to be non functional. Although these copies are all keys from group A, many of them have flattened stems that would make that rotation difficult, if not impossible, depending on the size and shape of the lock interior. For example, a key found in the East Riding of Yorkshire, (figure 4.79), scarcely looks finished and appears to have been made rapidly and with no regard for aesthetics - possibly an emergency replacement meant only as a temporary measure as the thin, roughly shaped bit would quickly bend or break with use. It



Figure 4.79 Possible forgery or toy PAS NCL-EED377

seems likely that this key, and others like it, was intended to be used symbolically (possibly as a charm or in a grave), was made as a toy, or was a crude attempt at a forgery.

Together this group of keys appear to support the idea that, at least in some households, there was no reliable, regular access to a skilled lock maker so non-specialist local metal workers would be expected to provide necessary replacements if a key were lost or broken. This idea may explain why there was such fidelity in replication of common forms; the market demand for familiar keys that could be replicated when needed may have given a strong impetus for close conformity.

It also may provide insight into why the common Roman lock type associated with group D keys appears to have fallen out of use within a few decades of the end of the Roman period. Spring-assisted tumbler locks, even when conforming to a relatively simple type, require a fairly close replication of the shape and spacing of teeth. The basic rotary keys, in contrast, could easily be adjusted if necessary and often appear to have been effective without any clefts at all (figure 4.80, 4.81, for example). Tumbler keys also require more material than a rotary key for a comparably sized lock and, for the simpler types that were produced in quantity, were cast of copper alloy rather than forged out of iron. The restricted availability of copper alloy following the Roman period (Swift 2012) would have made such keys considerably more expensive to make. Even the iron examples require a somewhat specialised technique to form, file, and finish, skills that, although related to those used in crafting common household tools, are different enough that they might not have been as widely known and used.



Figure 4.80, 4.81 Examples of keys with non-functional clefts
4.79 (left) PAS Ashton 0111key,
4.80 (right) PAS LON-01FBC1-Key-Jan13

4.5.7 Keys in Groups C and G

Two very important and common persistent key types are those in groups C and G. The simplest of all key types, their construction requires no specialised skill outside of the most basic metal working. As mentioned, this group is entirely unrepresented in the PAS, and

MOLA has only a single example. However in the early medieval sites studied these objects represent 15% of all keys. They are, however, a problematic set of objects to study.

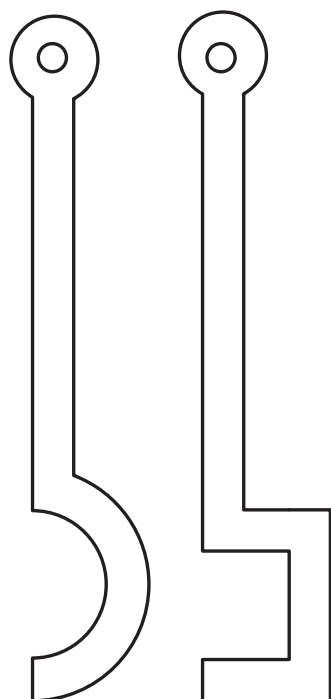


Figure 4.82 Diagram of hook shaped “keys”

Although group G, with a single tined hook, is extremely simple, there are variations in the length of stem, whether or not it is curved, and the angle or aspect of the hook. The latter in particular needs examination. A common variant has a C shaped hook or curve with the free end of the hook in line with the main stem (figure 4.82). These objects are often found in early medieval English graves, frequently in bundles of three or more (for example Dover Buckland 30/8, 132/4c). However the peculiar alignment of the hook means that these objects could not operate as keys given the most common illustrations of latch-lifter type locks. The straight stem means that if the hook is passing through an opening of any width, it could not be tilted down to engage with a hole or tumbler, and, because it is in line with the stem, the hook can only slip into a hole that is on the top or the bottom surface of the bolt.

This is, of course, a possible form of lock. Such a hook could push up a single wooden tumbler and allow the bolt to be slid free. However, the measurements of most hooks make this an unlikely mechanism for something as substantial as a structural door. Further, even for smaller boxes or cupboards there would not be a need for multiples of the same tool; a single, deeper throated hook could accommodate varying depths of tumblers.

The bundles found as grave goods, therefore, may need additional consideration. It is possible that they are not, in fact, keys but are some sort of tool (it is worth noting that Faussett (1856) conservatively identified these bundles as “unknown implements”). It could be that they were used for ritual or spiritual activities; there are ethnographic examples of locks and keys being used to facilitate childbirth for example (Belousova 2002; Wise 2007, p 84). Or there might have been an aesthetic reason for the bundles. For example, Siv Kristoffersen (2004a, 36) remarks on the noise made by migration era key bundles from Scandinavia.

Whether or not these specific objects can or should be included as keys, there is still the broader question of the importance of the group in the general population of early medieval keys. Within the dataset of English sites, these types are quite rare at 3% of the total, and the majority of those occur in contexts dated to the Roman period. It must be assumed that both corrosion and problems with identification have a significant

impact on this small number. Differentiating between a hook-like latch lifter and a hook is obviously problematic, and if the hook portion has corroded or been lost then identification is impossible. However, the total is still notably low, particularly given the emphasis in archaeological literature on latch lifters as relatively common feminine objects in funerary assemblages.

4.5.8 Discussion: Persistent forms, knowledge exchange, and craft networks

This study of the importance of persistent forms builds on concepts discussed in the work of Lemonnier (1993) and Ingold (1993). These studies recognise that the technology of making and using objects is the result of a series of choices that are directed both by limitations of material and resource and by the beliefs and practices developed through the participation of the craftworker in wider communities of making, trading, and using. However where Lemonnier (1993) was focused particularly on the agents and products of change, the study of persistence recognises the equally informative choice to resist change. In this view the persistence of form is seen not as the result of a disinclination for innovation, a sort of passive conservatism, but as the result of active choices made by individual craftworkers and also by the wider community in which they worked. These persistent forms are the result of an equally persistent tradition that gave a significance to these particular shapes.

Unlike persistence seen in common tools, such as those for metal, wood, or stone working, which is the result of considerations of efficiency or other pressures related to what Lemonnier termed the “function” aspect of the practice of technology (1993, 8), the continuity of form in keys is in large part related to Lemonnier’s “style” aspect. Steve Ashby’s work on the manufacture of early medieval combs (2006, 2011, 2013) has shown the importance of these shared concepts in choices made during the crafting of objects that carry considerable social significance, particularly in relation to identity. His work uses evidence of belief-based choice, seen in the composition and decoration of the combs, to suggest features of the structure of the craft communities themselves. I argue that the persistence of particular key forms is similarly informative.

Where the craft and form of tools may show remarkable stability with small fluctuations or gradual declines, other objects that are subject to changes in aesthetic preferences, very specific cultural meanings and uses, or technological knowledge may have a more or less abrupt appearance and/or disappearance from the record. While forms certainly can be and are revived or revisited, the ability to do so with fidelity depends on a continued presence of technological knowledge in the craft community that can analyse,

understand, and replicate a form without having been directly taught that specific task.

Recognisable form persistence can take place on a spectrum of fidelity, from highly accurate models that closely replicate nearly all characteristics of a given object, to examples that reference one or two core characteristics but incorporate variations on other elements that clearly diverge. The increasingly abstract faces seen on button brooches, for example (Suzuki 2008) show how replication of line and gesture was given higher priority than



Figure 4.83-4.85 Shift towards abstraction visible in Anglo Saxon button brooches over time
4.82 (left) PAS PUBLIC-61770D; 4.83 (centre) PAS KENT-AC16E8; 4.84 (right) PAS KENT-405833

producing a recognisable, exact reproduction of an original (figures 4.83-4.85).

Because key morphology relates not just to aesthetic preferences but to a practical system of moving parts in the related lock, the persistence of forms in keys over time requires a considerable amount of technological knowledge transference, as the engineering of the lock form and the relationship of that form to the key must both be effectively taught. The distinctive shape of the date distribution patterns in the PAS and MOLA are inconsistent with a smooth knowledge transfer, but the appearance in both sets of keys from groups as well as specific types on either side of the early medieval period indicates that there is a dating bias that does not entirely accurately reflect the actual date distributions of these objects.

Identifying forms that can be securely dated both to the Roman era and to the post-conquest Middle Ages does not, of course, mean that those forms were consistently used throughout the intervening centuries. However it does show that there may have been a degree of continuity in the knowledge involved in making similar objects and in the idea of the form itself. This knowledge may have survived the end of the Roman occupation and the transition to the Early Medieval period. Or it could be that a very closely related set of cultural and technological knowledge was successfully reintroduced into England.

The former would indicate that there was a certain amount of stability both in the population of craftworkers and in their ability to exchange knowledge. Such stability relies, of course, on a continued demand for the product. It is possible, therefore, to suggest that (if this model is correct) there continued to be inter-networked communities with sufficient social complexity to prioritise security. Those communities would also have had either direct access to craftworkers or indirect access to the objects through trade and exchange.

If, however, complex lock technology was lost in Britain during the fifth century and

was only reintroduced by invading or immigrating Anglo-Saxons, then it must be assumed that these incursions included or were quickly followed by enough skilled craftworkers to successfully build a networked community that could effectively establish and disseminate the practice of constructing that particular key form and its corresponding lock. This would indicate either the prioritisation of including such craftworkers in the immigrant groups, or a sufficiently high distribution of this specialised knowledge within the population in general. Either model depends on considerable cultural importance being placed on not only the idea of locks and locking, but on the particular characteristics of these specific forms.

There is, of course, also a compromise between these two models. Lock use may have continued after the Roman era, although in a diminished and reduced form. There could have been fewer variants of locks being regularly and widely produced, particularly of the more complex, technically demanding types. Dispersed settlements may have tended to use only locks that could be locally produced and serviced, such as the simple tumbler types, while elite centres that maintained some of their wider network could support specialised crafts. This scenario would suggest that there were enough of these elite-centred craftworkers to sustain the form with good verisimilitude so that, as networks grew and were strengthened and demand increased, it could be spread more widely without degradation.

It is my contention that it is this third model that is the most likely, with enough cultural weight given to the importance of locks and keys to sustain the technology at a basic level fairly widely during the early decades of the Post-Roman era. The incoming Anglo-Saxons, sharing that culturally held value, likely supported the craft knowledge networks and may have strengthened links with craftworkers outside of Britain. However, as will be discussed below, it is not entirely clear whether there was a continual improvement in technical skill and in lock complexity within indigenous craft workers, or whether innovations were imported at punctuated times either by immigrants or through trade and knowledge exchange.

4.5.9 Summary

Together, the reliably datable bit types present a strong case to support the idea that lock technology in Britain survived the upheaval following the end of the Roman period, and that it survived in multiple forms. But the extent to which that technology was spread geographically and the likely distributions of the population of the objects themselves is more problematic. Obviously there is no way to produce an entirely accurate number. The skews in the dataset produced by the biases mentioned above make even the known examples difficult to assess. However it may be possible to give conservative estimates of probable ranges, estimates that could be further refined if, in later work, additional sites and comparable collections were added to the dataset.

Those estimates are based on the assumption that, given the material bias mentioned above, it is reasonable to assume that for every copper alloy key present in the PAS there would have been a number of iron keys. For example, given the consistency of form in casket keys, and with the strong bias towards iron rather than copper alloy keys in the site database, it must be assumed that there were as many, if not more, iron versions in use in the early Middle Ages.

There are useful implications of this assumption in terms of the access to locks and keys available to the wider population, the network of craftworkers and of knowledge exchange, and the cultural weight placed on locks and keys that perpetuated the technology even when copper alloy became more difficult to obtain. Certainly the possibilities would justify further research.

4.6 Implications of the persistence of lock and key use

4.6.1 Iron production in the early medieval period

The suggestion that there was a continuity of lock and key production contradicts some long-held beliefs about iron work following the collapse of the Roman Empire. The clear shift in the amount and type of physical evidence for the production and working of iron following the Romano British period has, naturally, led to the perception that this correlates to a catastrophic loss of craftworkers and craft knowledge. This perception is based on both the decline in evidence for iron smelting (McDonnell 1989, 374) and the apparent reduction in the variety of iron objects produced (Ottaway 1992). However, there are several reasons why a simplistic interpretation of the evidence is problematic.

Fleming (2012, 10-15) argues that the lack of securely identified early medieval smelting locations indicates there was a loss of the technological ability to produce new metal and that ironworkers instead turned to recycling Roman Period iron as their primary source of material. While the large-scale smelting production seen in the Romano-British period, for example in the Weald, Sussex, and the Forest of Dean, Gloucestershire (McDonnell 1989, 374), drops out of the archaeological record, a complete loss of the ability to smelt metal is unlikely. As Hall (2018, 344) points out, the time frame Fleming suggests for this loss is improbably short, covering only a scant century. This is particularly problematic as it is possible that smelting continued at some Romano-British sites into the fifth century. Radiocarbon dating from Rockingham Forest, Northamptonshire indicates continual use of the site from the 5th to the 9th centuries (Hamerow 2002, 190). As there was clearly a continued demand for iron objects, it seems likely that the skill was retained, even if it were on a reduced level.

Fleming seems to conflate the difficulty with sustaining iron production on the scale seen in the Roman period with that of maintaining the skill in the population at a less intensive level (2012 7-8). But although the evidence for smelting is scarce, it is not completely absent, and an ongoing, likely ad-hoc production of iron seems more likely than a complete loss of the practice entirely. Unlike the complex knowledge involved in smithing finished iron objects (secondary smithing), the skills involved in the smelting process are more easily learned and have a greater tolerance for failure. Experimental studies have shown that these skills can be fairly quickly mastered (Sim 1998, 18), so the learning process would not necessarily need to be long or extensive. It is, however, something likely carried out as a somewhat specialised activity; Schrüfer-Kolb (2004, 48) argues that in the Roman period smaller households would be unlikely to smelt their own iron (although see Condrón 1997, 4-5). More likely it was a cyclical activity undertaken by specialists within communities (Bray 2006, 278)

An alternative explanation for the lack of smelting evidence has been suggested by Thomas Birch (2011) and Neil Hall (2018). Drawing on the inmark/utmark model developed in Scandinavian archaeology (Holm et al 2005), they suggest that the apparent lack of evidence is because smelting was an activity carried out on the periphery of settlements and is therefore less likely to be identified archaeologically. The few sites that have been identified as dating from the Post-Roman Period are mostly rural and often appear to have been removed from nearby settlements.

It is likely that, as Fleming (2012) suggests, Roman Period iron was also exploited where available, although this resource would have introduced difficulties Fleming does not discuss. Collections of previously worked iron would have unknown alloys with differing characteristics and therefore unpredictable levels of workability and hardness. Ferritic iron is the most pure form of iron and is highly workable, flexible, but relatively soft. Phosphorous iron is produced in the smelting process, as phosphorous is a fairly common component of English iron ore. Phosphorous increases the hardness of iron (Godfrey 2007, 47), but can also increase brittleness, although the degree to which this is true depends on the composition of the alloy (see Godfrey 2007, 47-55 for a complete discussion). Finally, iron with a high enough carbon content becomes steel. The amount of carbon present determines the hardness of the steel (and therefore its ability to hold a cutting edge), and its tensile strength. The characteristics of these alloys make them more or less suitable for different applications, and for some objects, including some locks, the use of the wrong alloy can result in premature failure of the object.

The difficulties of working with this kind of varied pre-worked metal are considerable. Sorting scavenged objects by their characteristics would have to be done by heating and working the metal, a process that takes skill and experience, indicating a higher level of general craft knowledge among smiths rather than a lower. And because the management of alloy types was important in crafting knives (Tylecote and Gilmour 1986; Blakelock and

McDonnell 2007; Blakelock 2013), this knowledge must have been widely spread.

But while alloy qualities are essential to understand when making edged objects or objects that would need to withstand stresses, for other, simpler things such as nails, hooks, clenches, or some chains, it is less important. It is possible that for ordinary household needs such as these, scavenged and recycled Roman material was both sufficient and convenient. A small community with generalised skills could be mostly self-sufficient in terms of these basic needs, relying on trade for more specialised objects such as knives or locks and keys. Hjärthner-Holdar et al (2002, 176) argue that the difference between elite and ordinary household smithies is the type of materials available for use, and while this may be, as they argue, evidence for hierarchical control of high-quality material, it could also be related to a more simple question of ease of access and relative cost.

There is also the possibility that a certain amount of raw iron was imported into England. Areas in Scandinavia were producing iron in sufficient quantities for export (Hamerow 2002, 173), either as raw metal or in a worked or semi-worked form. Birch (2011, 12) suggests that the pattern of deposition of pattern-welded blades, concentrated in the south of England and particularly in Kent may be evidence of trade in iron or in finished blades.

Whatever the source of workable iron, the problem of a scarcity of evidence of smelting has, arguably, somewhat obscured the equally important evidence that iron appears to have been plentiful (McDonnell 1989). Iron knives are the most commonly found grave good (Härke 1989), and occur in considerable numbers. Had either the raw iron or the knives themselves been scarce or difficult to acquire, it is unlikely that they would feature so strongly in mortuary depositions. Instead it seems reasonable to assume that there was little difficulty in accessing both the materials and the craft knowledge involved in their manufacture.

It is possible that knives were considered so intimately personal that they were what Heinriche Härke (2014, 45-46) has termed “inalienable property” and that their cultural importance in deposition was greater than concerns about resource scarcity. Although some objects were clearly handed down, possibly for generations, prior to being deposited in a grave (Kars 2011; 2012), that does not mean that other objects, including knives, may have been seen as unsuitable for curation. But the argument could be made that a belief in inalienable property would be less likely to survive in a culture where material resources were scarce, particularly on the scale of deposition seen with knives. Further, the inclusion in graves of “key bundles”, sets of the crooked type G keys discussed above also suggests a lack of concern with the availability of iron. These bundles, as discussed elsewhere in this thesis, contain multiples of very similar objects and, as in grave 134 (figure 4.86 from the Bucklands, Dover cemetery (Evison 1987, 246, 326), usually include additional iron pieces such as chains and rings.

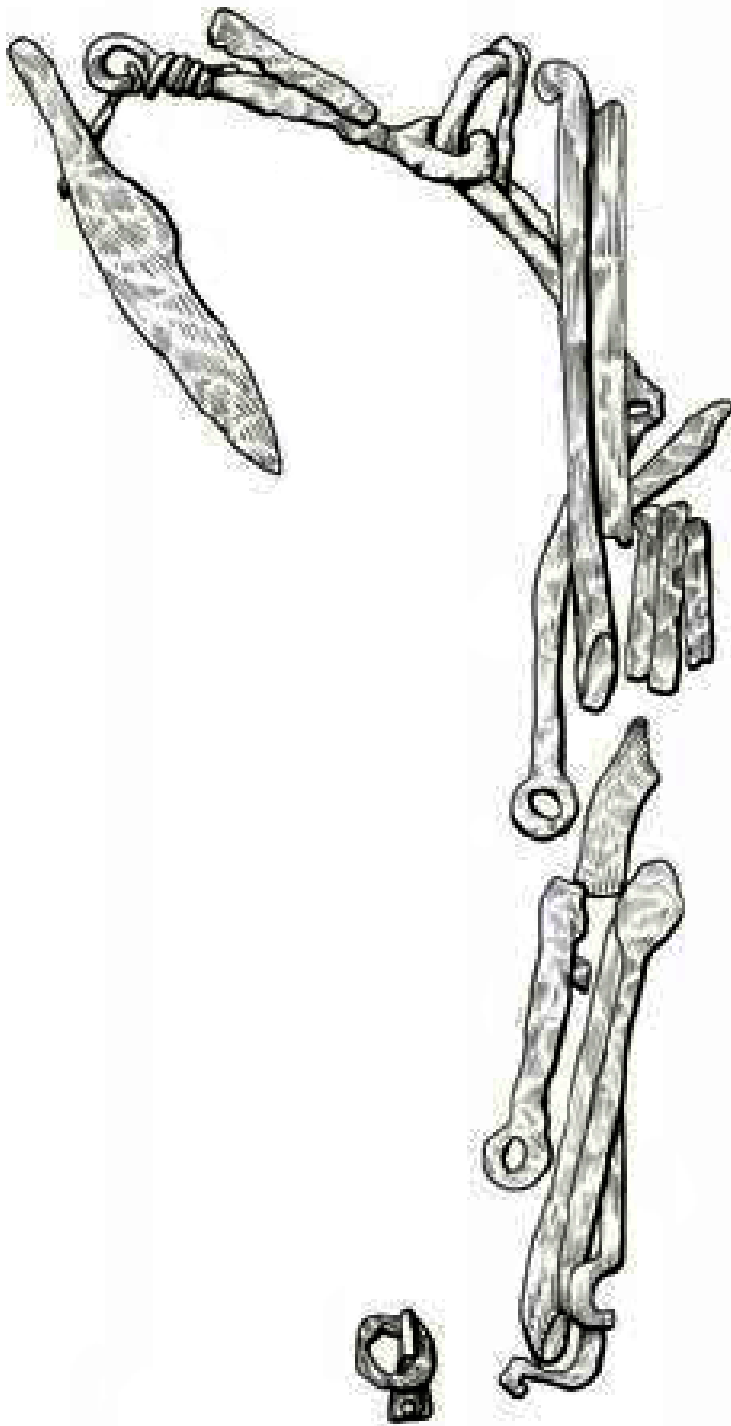


Figure 4.86 “Key” bundle from Gr 134,
Buckland, Dover
After Evison 1987 fig 48

This evidence suggests that iron and iron objects remained relatively easy to access in Post-Roman Britain. The final point, then, is that although there was a change in the distribution mechanisms and some of the production stages, and although there may have been a shift in the demand for object types, that does not equal a reduction in technological skill and craft knowledge. As discussed, effectively using recycled, pre-worked iron required a significant understanding of the working characteristics of the material, an understanding that goes beyond the ability to produce object types through basic repetition.

But in addition to this evidence for a persistence in material knowledge, there is also

skill demonstrated in the forging of the range of iron objects used during this period.

Although every day objects such as knives, rings, or tools may be morphologically simple, their construction can be quite sophisticated. Examining evidence from the Buckland cemetery, blacksmith Piers Edsall (personal communication, 7 June, 2019) noted that iron suspension rings in grave 134 had been made with scarf joints. This method involves thinning both ends of an iron strip, applying flux, then simultaneously heating the ends until they can be hammer-welded together. This process requires more time, resources, and skill than a simple butt joint, or a cold join involving pins (figure 4.87), but is stronger, more functional, and more visually elegant.

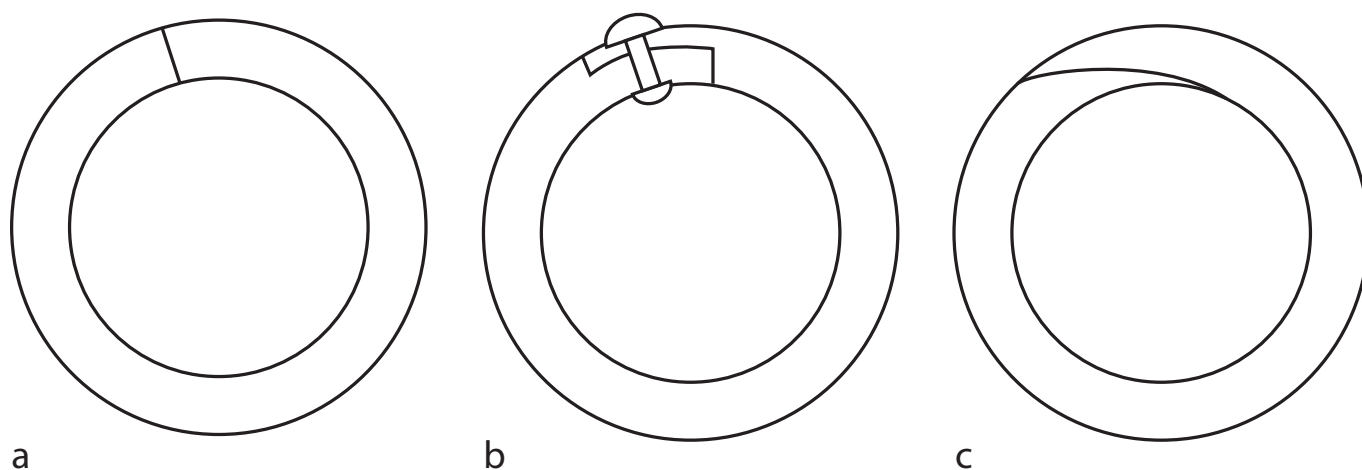


Figure 4.87 Ring closure methods

a. butt joint: ring is simply forged or bent into shape

b. pin joint: ends of stock are thinned, pierced, and then pinned to secure joint

c. scarf joint: ends of stock are thinned, flux is applied, piece is carefully heated and forged to weld in place

Construction of even the simple, group C type keys also requires more craft knowledge than is apparent, and their finish can signal a greater amount of effort and skill. Although the steps in their construction are straightforward (figure 4.87), it is more difficult to achieve a squared or straight finish than to leave the corners and edges rounded (Edsall, 7 June, 2019). Examples of both level of finish (figure 4.88-4.91) indicates that there was a range of skill and attention to detail and suggests a certain amount of interest in the display of a higher ability. This is even clearer in studies of early medieval knives (Blakelock and McDonnell 2007; Blakelock 2013) which show that there was a range of competence in knife production but that complex construction methods, requiring a variety of skills, were common and that the skills of blacksmiths throughout the early medieval period were considerable (McDonnell 1989, 380; Blakelock and McDonnell 2007, 40).

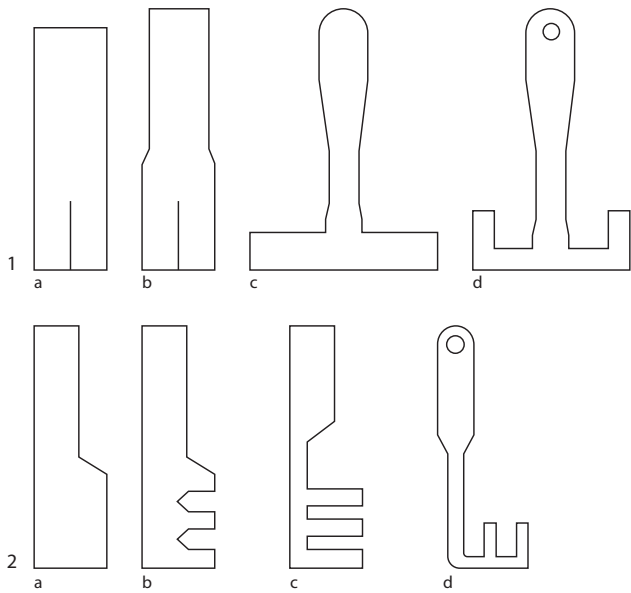


Figure 4.88 Steps in forging group C keys

- 1a. stock is flattened and split at one end
- 1b. handle is flattened, thinned, and extended
- 1c. split is spread to either side of stem
- 1d. ends of bit are turned up to form teeth; handle is finished

- 2a. stock is thinned to begin forming stem
- 2b. handle is flattened, clefts cut to remove stock
- 2c. teeth are filed and forged, stem refined
- 2d. bit is bent into position; teeth, handle and stem are finished



Figure 4.89-4.92 Variations in finish in group C keys

- 4.89 (far left) MOLA 1922
- 4.90 (centre) left MOLA 3537
- 4.91 (centre right) MOLA 19318
- 4.92 (far right) MOLA 19222

The apparent continuity of key forms through the early medieval period in England implies a continuity of demand, and of craft conception of appropriate morphology. This could be through a relatively intact chain of craft knowledge that survived the changes of the fifth century. Or it could indicate that immigrant craft workers were able to integrate with the local community seamlessly enough to produce the sense of continuity. Either explanation suggests rather less disruption to the knowledge exchange of early medieval iron workers than has previously been understood.

4.6.2 Objects and resource communities

Understanding that most, although not all, lock types continued to be known and used provides the opportunity to explore the implications of that continuity in terms of both craft knowledge and social conditions (see Ashby 2014, forthcoming). These implications are closely tied to the resource requirements of each lock type and the technical knowledge associated with them, particularly specialised knowledge. They are also related to ideas about access control and spatial permeability.

Any artefact can be thought of as the product of three types of resource investment: materials, knowledge, and labour. The physical survival of a given artefact, or even of evidence that it once existed, allows the inference of the contemporary existence of the minimum immediate resource community necessary in order for it to exist. This community is the smallest possible resource input that can reasonably be assumed absolutely necessary in order to produce, use, and deposit a given artefact.

This concept is based on the understanding that, for any given craft community, there must be in existence the material resources to make a given object, the technical knowledge about the production process, the necessary skilled time investment to create the object, and the sufficient demand for the object to justify its creation. In addition, for each resource type, further inferences can be made about the wider resource network - the minimum extended resource community - that must have been available to support and maintain the local one including associated objects and crafts, transportation infrastructure, information exchange and wider market conditions (figure 4.93 a, b).

Examining the information investment represented by any given object type provides access to a considerable amount of information about the community. This includes the *chaîne opératoire* (Lemonnier 1986), the series of intentional actions that physically transform material to object, and also the cultural and conceptual knowledge that underpin those actions. Understanding the material properties, atmospheric conditions, and heat management among many others is essential. But in addition there are the cultural 'whys' that steer choices of style, size, and material, producing an object that is not only functional, but appropriate to its context (Lemonnier 1986, 154; van der Leeuw 164

1993). Because of this, many quite common objects including locks and keys, although made of low-cost materials, represent considerable knowledge investment. Further, objects that require unusual or exceptional skill and expertise indicate not only the availability of specialised craftspeople, but a network of information exchange at a sufficient level to maintain the necessary knowledge pool.

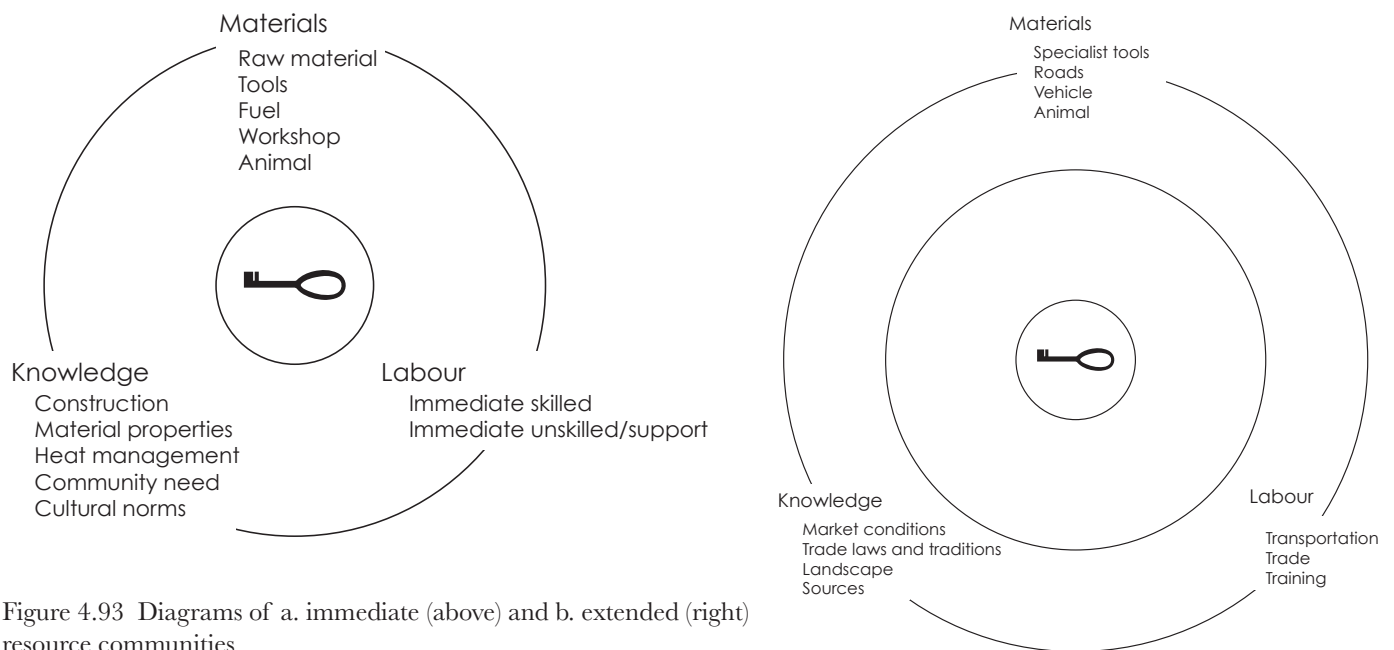


Figure 4.93 Diagrams of a. immediate (above) and b. extended (right) resource communities

Because these resource communities are inferred, it seems preferable to take the conservative approach and establish a reasonable foundation of the fewest possible resources. The intention is not to produce an exact image of the resource community that created a given lock type, but to develop an understanding of the necessary conditions that must have existed in order to account for the condition and context of that object. Obviously it cannot be assumed that a particular settlement in which an object was found also contained all of the necessary resources to produce it; they may have traded for these objects. What can be said is that the settlement had access to or was networked into the relevant minimum immediate resource community.

For example, evidence for a loaf of bread allows one to infer the accessibility of flour, water, leaven, fuel, and an oven (material) as well as the awareness of the process of making the dough, raising, and then baking it (knowledge), and the necessary time to mix, knead, raise, and bake the loaf (labour) (figure 4.94 a), but that loaf of bread might be found in a setting that did not contain any of those things, such as the site of a grave.

The presence of that loaf of bread links the grave site to the entire minimum immediate resource community by inference. Even from this simple example it is clear that a secondary level of resources can be inferred: the ploughs, land, seed, and stock, as well as knowledge about agriculture, soil and weather conditions (figure 4.94 b). It is likely that a cooperative community existed in order to provide the necessary labour to prepare the field,

sow, harvest, and process the grain. Obviously the more directly that information can be inferred, the more secure the information is, while indirect information is less positive, but usually provides a broader view of the community.

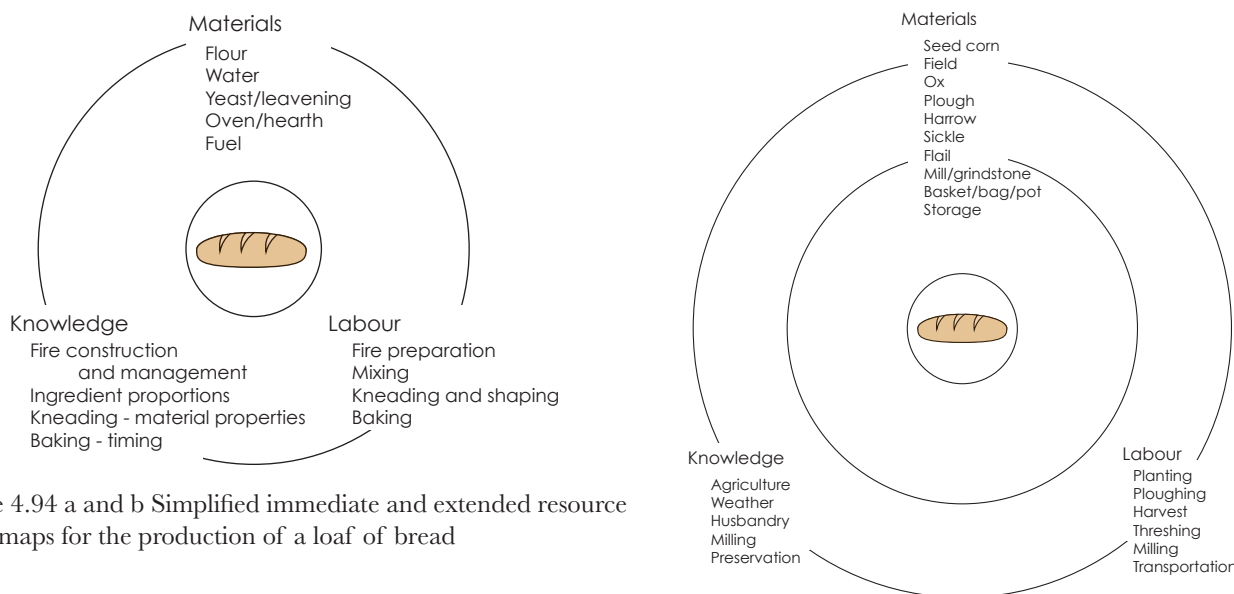


Figure 4.94 a and b Simplified immediate and extended resource input maps for the production of a loaf of bread

It should also be noted that the idea of the minimum immediate resource community is object centric, referring to the community of resources linked to the specific object. Although each of these resource input categories clearly relates to the efforts, skills, and needs of people, the minimum immediate resource community is not expressed in terms of individuals. This is simply because although it is possible to define roles that were involved, such as miner, weaver, trader, carter and so forth, it is not always possible to know how many people filled those various roles. Producing a loaf of bread can involve tasks assigned to the roles of baker, farmer, and forester, but it's possible that a single person performed all of those tasks.

In spite of this focus on objects, this approach is still essentially anthropocentric, using objects as a means to illuminate and understand the human community - looking at the materiality of the objects rather than focusing solely on the material (Knappett 2007, Tilley 2007, Ingold 2007a, 2007b). By using the inferred information available in an object it is possible to approach an understanding of the social aspects that were attached to that object, while still recognising that the understanding must always be expressed as possibilities and probabilities far more than certainties. Although a clear and direct picture of the *habitus* underlying the production, use, and deposition of an object is not available, by using induction based on both the material evidence and the social and psychological foundations that shape that *habitus*, a reasonable approximation of the cultural conditions of the object may be produced.

Mapping the inferred resource communities and networks for a given object graphically does not, therefore, produce a realistic image of the composition of the social community, but instead is intended to help understand not only the complexity of a

particular artefact, but the level of investment an individual, household, or community would need to sustain in order to create or access that artefact, and to some extent the level of interconnectivity that existed. Comparing and synthesising the maps of a discrete collection of different objects can extend that picture, and although beyond the scope of this project it could be a useful approach for further research.

4.6.3 Requirements for sustaining and transferring craft knowledge

Archaeology has a long history of studying objects that are very desirable, with a high resource investment demand, and that are also extremely rare or difficult to obtain. These high-status objects, often weapons or jewellery, usually use extremely expensive materials, which is a major contributing factor to their resource cost, and to their rarity. However they also frequently exhibit a very high level of craftsmanship, one that is achieved by only a small percentage of the craft-working population. Because only a subset of any given population will have specialised craft knowledge, and because (by definition) only a small percentage of those craftworkers will be capable of performing at an above-average level, the presence of craftsmen of this standard depends on the existence of a large pool of knowledgeable workers from which the elite workers are drawn.

High-status patrons have direct access to a large number of individuals, and the ability to support a dedicated group of practitioners as well as a system of developing new skilled workers from within the community. They are also directly or indirectly connected to an extremely large, extended network, through which new knowledge or craft workers can be exchanged. Their available pool of resources is, therefore, extensive and diverse. The resource investment in this case is sustained by a very small group of people leveraging their access to large amounts of resources.

Because only a small percentage of individuals within a population has advanced skill knowledge (Costin 2005), the chance of having access to that resource for those outside of elite sites is directly related to the level of connectivity an individual or community has. However if the desirability of an object is high enough for a large section of a given population, then there will be pressure to reduce the resource cost and increase availability. In terms of material this can be done through the adulteration or substitution of expensive materials, such as gilding base metals or using glass in place of gems. Knowledge investment is more difficult. Although object construction may not demand the highest level of skill, there is still a base level of ability and knowledge that is necessary, and for some objects even that base level may be quite high. In this case the resource investment can be diffused and the necessary resource access derived not from a small power group, but through crowd sourcing. Although no single community in the network has an exceptionally high level of connectivity, access to specialised knowledge is relatively well diffused through

the population.

Knives again provide an excellent example. There are several classifications for early medieval knives that specify between six (Evison 1987) and four types (Blakelock and McDonnell 2007) based roughly on blade shape. Tylecote and Gilmour (1986) concentrated instead on the technology of edge manufacture which produced six broad types (figure 4.95). As mentioned above, knives are among the most common objects found in early medieval graves both in Britain (Härke 1989) and in Scandinavia, and it is likely that most people had at least one. This means that there was a market with a consistent, high demand for this object type, resulting in a relatively large number of craftworkers capable of producing them. Additionally, because there would obviously be a large amount of variety in the social identities of the owners and of the craftworkers, it is to be expected that there would be a range of available variations to satisfy that demand.

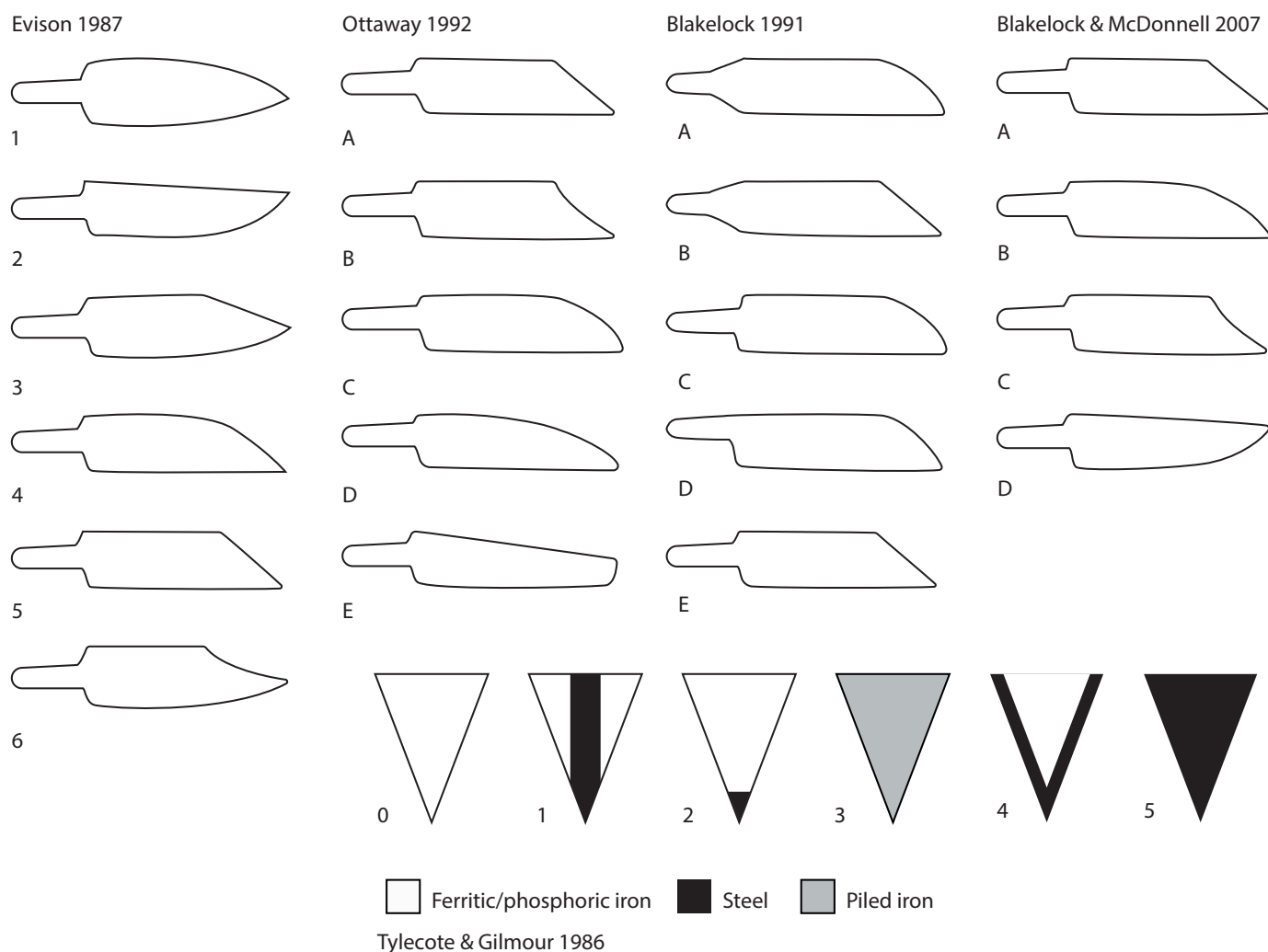


Figure 4.95 Knife blade type classification systems by blade shape and manufacture method. After Blakelock and McDonnell 2007 figs 2, 3 pp 41-42

Blakelock and McDonnell's 2007 study found that knives from cemeteries tended to have a broader range of both construction types and of quality while those from recognised

production centres were far less morphologically diverse and tended to be of a more consistently high quality (figure 4.96). Over time, and within a diverse community, knife choices would be dictated by fashion, availability, and economic status and would naturally tend to vary. But a group of closely associated, more specialised craftworkers who would both directly and indirectly share knowledge, and would tend to produce similar forms, many of which would be to a higher overall standard. The variety of forms and standard of work in the cemetery assemblages suggest that rather than drawing from a single production centre, over its lifetime a community had access to a number of object sources. This would include both possible local production of utilitarian versions as well as more distantly sourced, better made examples.

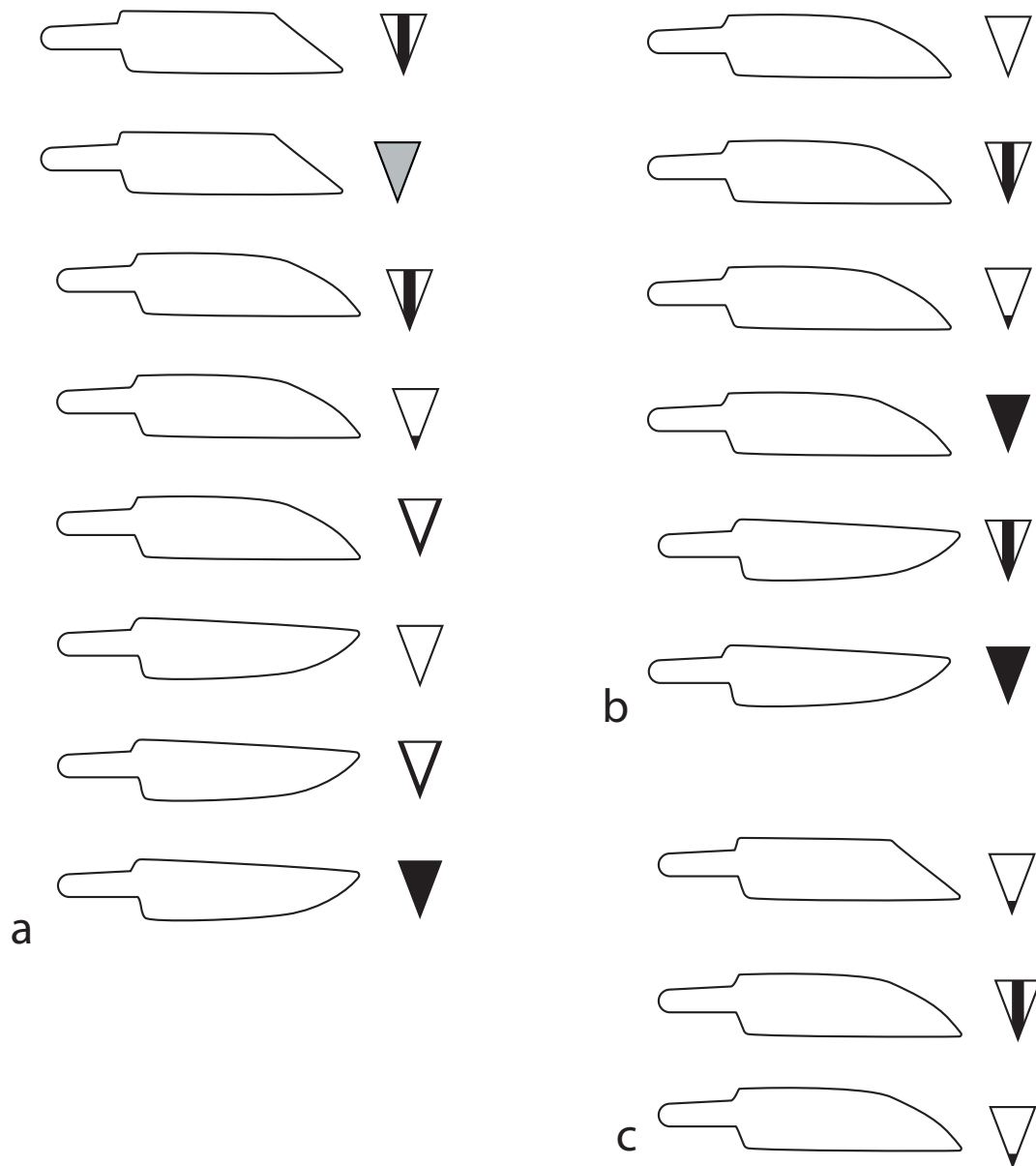


Figure 4.96 a-c Knife type distributions from Blakelock and McDonnell 2007, p 29 table 13

a Edix Hill cemetery

b Cannington cemetery

c Coppergate settlement

Just as with knives, the fact that there is a relatively large variety of both lock mechanism types, and of construction quality indicates that there were social and cultural conditions in place that produced an equally varied demand for locks and keys. That variety may derive from variance in one or any combination of: economic conditions, cultural concepts of appropriateness in form, technological knowledge and ability in craftworkers, and of context-specific requirements such as the type of space and type of access required.

Locks come in a much wider range of morphologies and complexities of construction than knives, and their fabrication can involve a wider range of materials and individual skills. Although many of those skills are generalist and would be applicable in the production of a variety of objects, the most complex locks also include specialised abilities - skills beyond those that can be reasonably assumed to be common within a given community.

The 'common' set of skills could be defined as the knowledge and abilities involved in the performance of tasks necessary for ordinary daily life. In the broadest sense this would include purely social skills such as conversation and negotiation, but this discussion will focus on skills involving the creation and use of material culture. Obviously the full set of common skills are context dependent, affected by the characteristics of the community, including its size, level of technical complexity, and the degree to which it is more or less self-sufficient. The last of these will affect the variety of both materials and tools available (See Costin 1991 for a discussion of specialisation in craft).

For the purposes of this discussion, I have classified 'ability' levels into four general groups: unskilled, novice, specialist, and expert (table 4.10). This range of technical ability is context dependent, relating to the observed range of the community of craft workers. The definition and description of the final category, expert, is drawn largely from social-psychological research on the acquisition and maintenance of expert-level performance (cf Simon and Chase 1973; Ericsson 2003, 2004; Repovs and Baddley 2006).

Craft ability level	
Unskilled	Capable of performing most or all common skills. Can attempt more specialised activities that draw on the skill set, but does not exhibit competency or fluency
Novice	Demonstrates basic competency in lower level specialised actions in a given craft but does not exhibit fluency.
Specialist	Demonstrates competency in most specialised actions of a craft, and exhibits fluency in a range of those actions. Most activity is efficient and highly automated. May also demonstrate some creative problem solving or innovation
Expert	Is fluent in all shared specialised actions of a craft. May have additional skills that are not generally shared, or are shared only by a minority of craft practitioners. Regularly exhibits innovation and creative problem solving.

Table 4.11 Classification and description of craft ability levels

This research indicates that the conditions and characteristics of skill development are broadly applicable, observed in gross and fine motor dependent fields as well as those that are more analytically based. K Anders Ericsson (2003) claims that contrary to commonly held wisdom, expertise is not dependent primarily upon genetic or physical capabilities, but is achieved instead through focused, structured practice over time. Further, his research indicates that there are distinctive differences in skill performance between the expert and the specialist. This concept, when applied to archaeological studies, may prove informative about social structure both in the wider society and the specific community of craft practitioners.

Learning takes place in recognisable stages (figure 4.97). In the first stage, the student is strongly focused, acquiring basic understanding of the principles of the skill and concerned largely with mistake avoidance. In the middle stage, concentration drops as mistakes become less common, and performance becomes more consistent. This middle stage is the point at which the learning of most practitioners stops, and it correlates to the amateur and specialist ability levels. Depending on the complexity of the task, this stage may be achieved with as little as 50 hours of dedicated training (Ericsson 2004, 110).

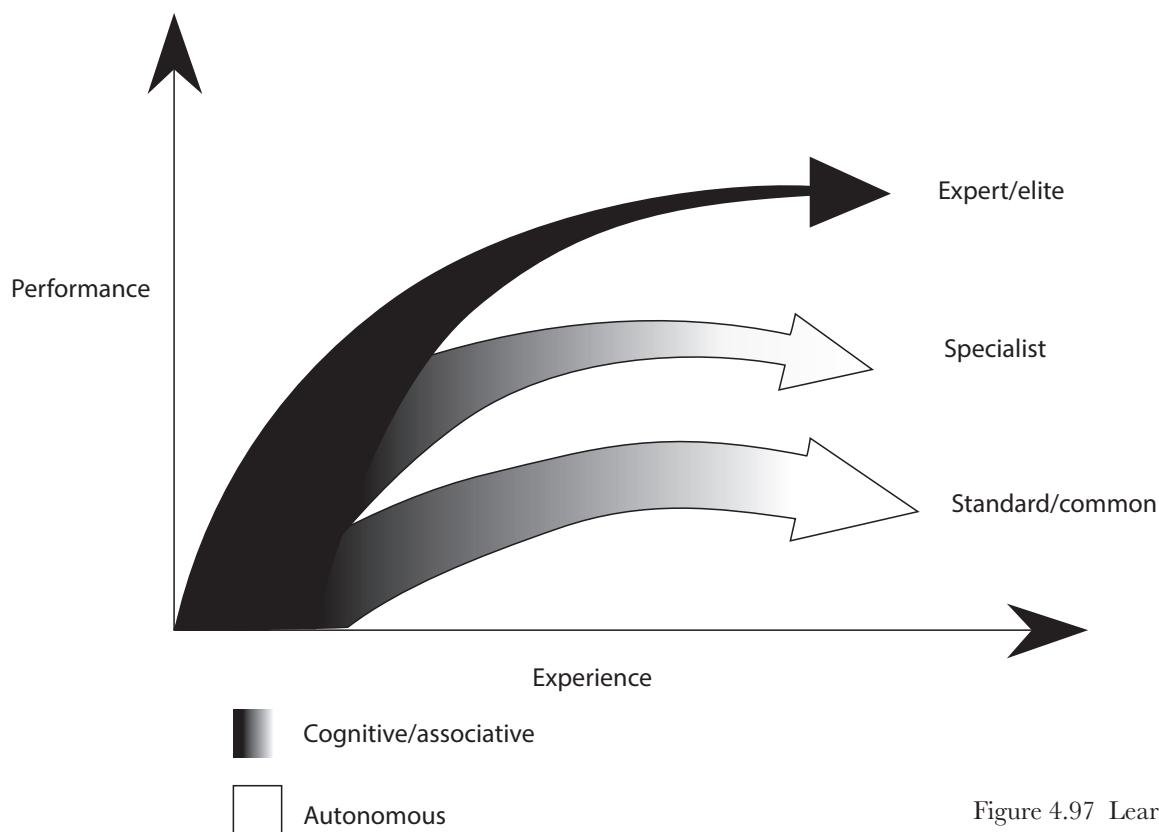


Figure 4.97 Learning patterns over time after Ericsson (2004) fig

Contrary to popular belief, practitioner performance stabilises at this point, and even considerable further experience with the activity will not result in a measurable increase in ability. Ericsson ascribes this performance plateau to the shift from largely deliberate to largely automatic action (2003). The self-reflection that characterised the first stage is replaced by a system of habitual processes and gestures. This system is extremely efficient

and also produces generally reliable, uniform results - both highly advantageous outcomes.

The third stage of learning, therefore, is not necessarily desirable to all practitioners. Further, as it does not automatically follow from the earlier stage, it requires conscious and motivated choice. This third stage is achieved through what Ericsson et al (1993) have termed deliberate practice, a form of attentive practice that involves a high degree of concentration, focus, and attention. It also frequently involves a mentor or instructor.

A comparison could be made to riding a bicycle. Initially the rider is uncertain, erratic and likely to fall. With practice, however, muscle memories are established that allow the rider to effectively make the constant small adjustments necessary to maintain balance, navigate turns, and react to the changing environment, much of which will happen without conscious decision or thought. This is the ability range of the average rider, with things like stamina or reflexes occurring in a spectrum dependent on experience. However even riders on the upper range of that spectrum would not be able to ride competitively without doing formal training.

The fundamental difference between ordinary and deliberate practice is *automaticity*. Deliberate practice is active and goal oriented, focused on the improvement of discrete skills beyond current abilities. This requires continual challenge, which for some areas of performance can be provided independently by the performer, such as the cyclist who tackles more and more technically challenging hills. However most skills to some extent require access to an instructor who can provide both specific instruction on tasks intended to target a particular skill, and detailed feedback on the performance of that task, allowing immediate adjustment. Finally, there must be the opportunity for repetition which will allow this new, elevated ability to become relatively automatic.

Clearly, not all areas of craft work will be practiced at all four levels of ability in any given community. In order for expert level workmanship to be achieved, the community must be able to provide the necessary conditions of dedicated, supported time, and expert instruction. But as these conditions obviously represent a considerable investment on the part of the community, demand, whether for internal consumption or for trade, must be high enough to justify that investment.

Extrapolated from this, it seems reasonable to assert that in order for a community to demonstrate a development in skills over time, within the community as a whole there must be a conceptualisation of a continuum of craft ability beyond that ordinarily found within any single settlement. Where the development is one in the quality of already existing and known technologies or skills, the concepts can be abstract in nature, related to ideals of workmanship that can be projected from known examples. This sort of abstraction can be seen at work in folktales like Puddocky, where cloth can be so fine that a hundred ells could be drawn through a finger ring (Lang 1892, 222).

As in the cycling example above, a single craft worker, once competent in a particular

set of skills, could theoretically develop exceptional competence independently by actively working to improve an aspect of those skills. A spinner, for example, might work on the fineness or the consistent evenness of the thread. As not all craft workers will have the motivation or the time for the necessary dedicated practice, the observed level of overall craft competence within a community for an established craft will likely remain relatively stable.

However, advances that involves new skill sets, even when building on or related to already familiar ones, will often require informed instruction. Obviously the more familiar a craft worker is with the principles underlying their discipline the more likely it is that they can independently develop methods to replicate unfamiliar forms, but there are some techniques that are so specific in their requirements that, to all intents and purposes, they require tutoring from an expert.

The easiest example with which to illustrate this, relates to craft skills sometimes referred to as 'lost'. The methods used to produce the exceptionally fine, decorative granulation seen in Etruscan gold jewellery, for example (figure 4.98, 4.99) were not explained until well into the 20th century although generations of craft workers had attempted to understand them (Wolters 1981). In this case, the extremely high degree of difficulty involved, with a very small window between success and total failure, is why this technique required expert tutelage.



Figure 4.98 (above) Etruscan fibula,
700-600 BCE
Gold
Museum Appropriation Fund 30.051
RISD museum



Figure 4.99 (right) Etruscan earring decorated with fine granulation
Jastrow 2006, Public Domain

Another limitation to auto-didacticism is when a skill uses familiar materials in a unique way, where knowledge is the necessary skill (Childs 1998 112), such as in the early

medieval art of fire- or mercury-gilding (Oddy 1981). For this technique, gold is first either ground into fine grains or pounded into a leaf. The gold is then gently heated and added to hot mercury. The resulting mixture must be slowly cooled and stirred until it forms an amalgam. An object is coated in the amalgam paste, then carefully heated to sublime the mercury, leaving behind a thin gold coating which can then be burnished (figure 4.100 a-f below). The process, including the precise management of heat at various stages and the knowledge of material properties, is particular to gilding and cannot be directly inferred from other metalworking techniques. Excavations at Coppergate in York produced several fire-gilded objects, evidence that although the method was specialised, knowledge of the practice was not limited to elite craftsmen (figure 4.101).

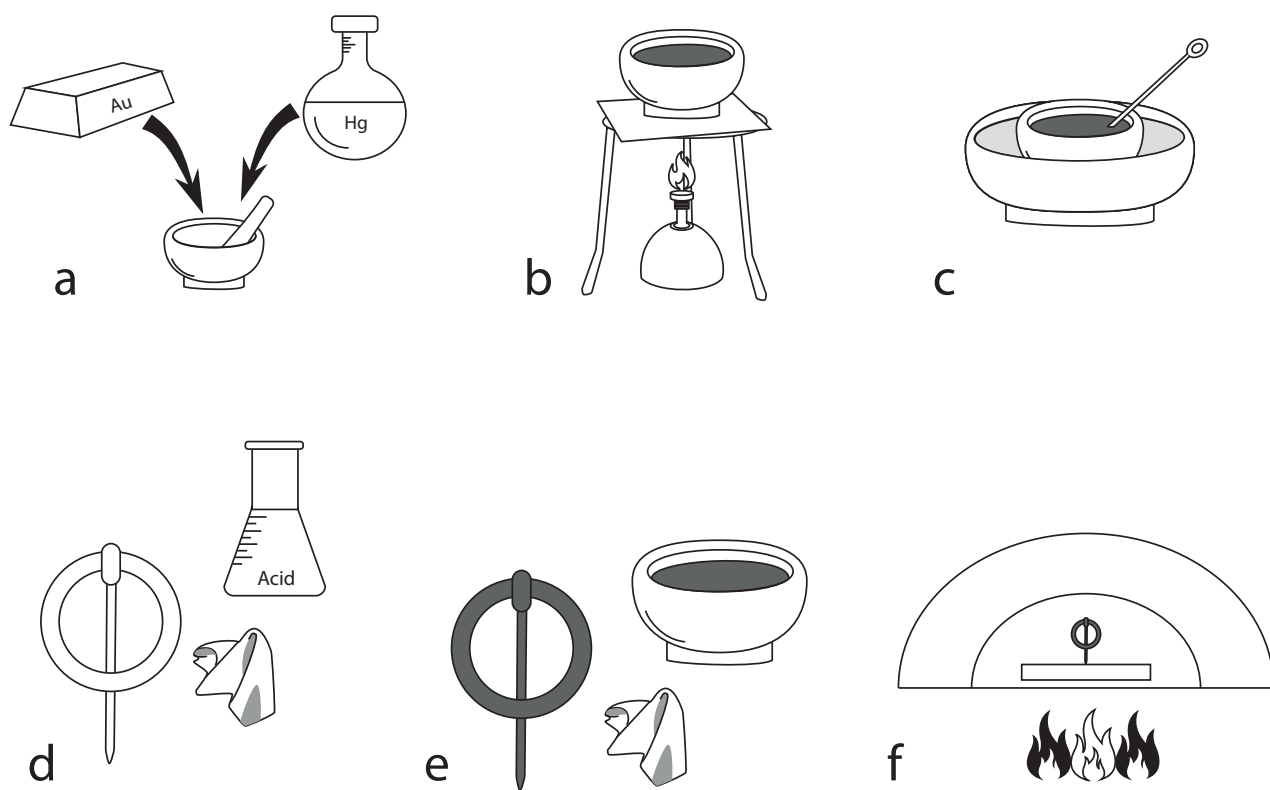


Figure 4.100 a-f Process of mercury gilding a) adding heated fine gold to warm mercury; b) heating to combine; c) cooling and stirring to form an amalgam; d) preparing the object's surface; e) coating the cleaned object; f) firing at controlled heat to sublime the mercury



Figure 4.101 Traces of mercury gilding on the decorated padlock from York, Coppergate

For the development of this sort of complex skill, craftworkers would need consistent access to example objects, or conditions in which they could compare their own performance with the desired standard, as well as access to experienced, capable craftworkers who can demonstrate the circumstances and actions necessary to produce that result. This is not to say that some advanced or complex technologies could not be achieved through emulation. However this sort of skill transfer is less efficient and far more prone to error or failure than the socially more complex method of imitation (Whiten et al 2004). It is also important to point out that this learning through imitation can take place without intentional instruction on the part of the expert (Lycett 2015), it is simply the effective transfer of what Krause (1985) has termed the 'behavioural recipe' of actions and processes that result in a desired outcome.

Complex crafts, such as metal working, that involve the acquisition of a number of different individual skills and the knowledge of how to make not one, but multiple object types, require the worker to go through a number of learning cycles. Some of them will be concurrent with each other, but others must build on a previously mastered ability. Therefore, even if the craftworker does not go on to achieve an expert ability level, becoming a competent specialist will involve a considerable amount of time spent in the company of a skilled instructor or demonstrator. It is estimated that for most skills it takes at least 50 hours of experience to move out of the first learning stage while expertise in a craft can take 10,000 hours total (Ericsson et al 1993).

Having acquired a skill, there is still the problem of maintenance. Ericsson et al have demonstrated that there is a degradation of technical knowledge and skill over time, and the more complex a particular set of actions is, the more susceptible it is to degradation (figure 4.102 below). A craftworker who is spending several hours per week pursuing their particular craft will probably be able to maintain their fluency with those particular craft actions. Knowledge that is only occasionally or even rarely accessed is liable to degrade in accuracy and in completeness.

For some skills this degradation can be avoided through the use of mnemonics or external props. Agricultural knowledge passed along through rhymes, proverbs, and stories give cues to timing and managing planting, predicting weather, recognising soil conditions, and managing livestock (Evans, 1956; Dorst 1983), maintaining the information over gaps of time. But technologies requiring fine motor skills, the memorisation of complex sequences, knowledge of required measurements, and the ability to recognise material and fuel conditions with precision, require consistent use and practice in order to be maintained.

The degradation of skill knowledge is not only an issue for an individual, but within a community. For any given small community with limited resources of time as well as materials, only those crafts that are consistently in demand, allowing the necessary ongoing

maintenance of knowledge, will be practiced. The more complex a task is, the more liable it is to information loss and the more practicing members a community must contain in order to maintain it (Henrich 2004). In order for a society to be able to support the maintenance of a craft community therefore they must be able and willing to provide both the material resources required for the current practice of that activity, and the support for the necessary training of new craft workers. A loss of demand for a particular object can quickly result in the loss of the knowledge of the related skills.

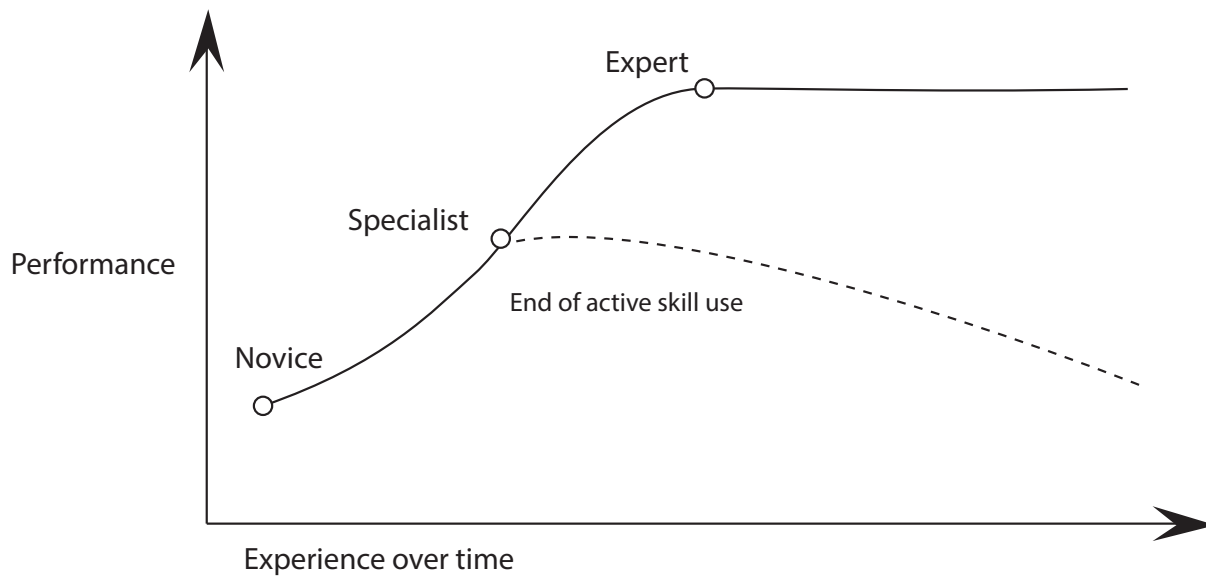


Figure 4.102 Degradation of skill knowledge over time after Ericsson et al 1993 fig 4 p S75

But knowledge is vulnerable to other disruptions. Research into the conditions of technology development supports the idea that the size of the available craft community is directly related to the ability of that community to effectively transfer complex 'behavioural recipes' (Derex et al 2013). Although there have been mixed results from ethnographic studies in this area (Read 2008; Collared et al 2005) more recent studies (cf Kline and Boyd 2010) and experiments (cf Muthukrishna et al 2014; Derex and Boyd 2016) have shown a strong link between population, networking, and skill transferral.

There are two important factors involved in this connection. First, skill knowledge is subject to chance loss when there is a failure in knowledge transmission. This can take place through a lack of interest by learners, which is directly related to the amount of demand in the community. It also can be caused by the direct loss of the knowledgeable craft worker, as when an Inuit community lost the ability to make kayaks, bows, and fishing spears after their craftworkers all died in a plague (Kline and Boyd 2010, 2560).

The second factor is that social learning is imperfect; imitation is never completely accurate. Although this inaccuracy can result in improvement on the model, the majority of differences will produce a reduction in quality. This results in what Kline and Boyd term a 'treadmill of cultural loss' (p 2559) which requires active and continual effort to counteract.

This effort is facilitated by the ability of students to selectively imitate, choosing the more skilled craftworkers as models (Henrich 2004).

For both factors, the larger the population of craftworkers with skill knowledge (including networked populations) the greater the likelihood that both the skill level and the technology level of that population will be maintained (Bamforth and Finlay 2008). Disruption of the pool of potential learners, of the population of skilled workers, or of the demand for that skill threatens skill maintenance, with the likelihood of complete loss increasing with both the scale and the length of the disruption (Muthukrishna et al 2014, Henrich 2004).

Therefore if a craft survives a time of social upheaval that results in a drop in population or in a loss of network connection between groups, it indicates that there must have been a relatively large number of community members with craft knowledge in the original group, and that there is an ongoing interest in the maintenance of that craft. It seems reasonable to conclude that any particular object with a high skill knowledge requirement that is carried through such times of upheaval must be both highly desirable in order to justify the ongoing investment in its knowledge maintenance, and have had a reasonably large community of skilled practitioners prior to the disruption .

4.7 Knowledge requirements of early medieval locks

Aside from the very simplest versions, locks are quite complex objects. They are built from multiple parts and they involve moving components that must function in three dimensional space. Their construction requires access to tools, to a variety of materials, and to specialised workspace, all of which would have been required for the manufacture of other iron objects. However, because locks involve moving parts that will be subject to stress, the craft worker needs to be able to judge the quality of the raw materials and their properties.

Further, during the early Middle Ages surviving keys show there was a degree of individual adaptation, adding complexity to the ward systems or adjusting the number, distribution, and alignment of tumblers or springs. This requires a fundamental understanding of the principle behind the mechanism, which is knowledge of a different order than that required to simply recreate an existing pattern. For these reasons, it seems reasonable to assert that locks indicate a high degree of both skill and of specialised technical knowledge and understanding among early medieval metalworkers.

The fact that a range of lock types continued to be made in both Britain and Scandinavia through the post-Roman and Migration era and into the early Middle Ages is indicative both of their importance within those cultures and of the dispersal of lock-making

knowledge throughout the communities. Because these types have a range of complexity, understanding the distribution and population characteristics of locks and keys is essential to understanding the corresponding resource pool and the economic implications involved. This is also true for the social and cultural significance as will be discussed below.

Another factor that must have been considered in the choice of lock type (alluded to above) was the ability to have that lock serviced or the key replaced when necessary. Obviously keys are small portable objects and are therefore liable to loss. In addition, because a lock consists of at least one and upwards of five moving parts, and because those movements entail a certain amount of repetitive force on both the lock components and the key, it must be assumed that repair or replacement of both locks and keys was a known necessity. A complex turn lock or padlock may have been considered more secure, but the ability to repair the lock would likely require access to a skilled craftsman, while a more basic lock could possibly be repaired at home and, as mentioned above, a crude replacement key might be fashioned. This fact of the ongoing need for access to a skill base must be considered when evaluating the resource network implications of more complex locks and keys. The following section examines the lock mechanisms corresponding to the key groups in this study, presented in order of increasing resource requirements.

4.7.1 Lock mechanisms

The lock mechanisms discussed in this section have already been introduced in chapter 2 as they are all inherited from Roman technologies. Here these mechanisms will be examined in terms of their complexity and therefore their resource requirements according to the concept of the minimum immediate resource community discussed above.

A. Sliding bolt

The most basic lock mechanism is usually illustrated as a bolt that can be either lifted clear or slid aside using a hook-shaped key, group G. The hook would engage with a corresponding hole or notch in the bolt (figure 4.103). Manning (1985, 88) has rightly

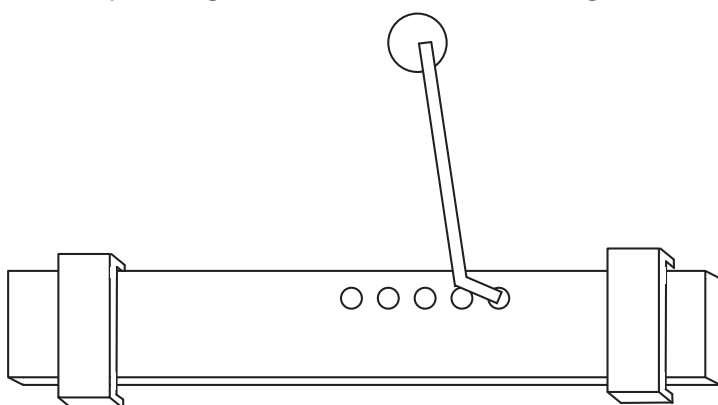


Figure 4.103 Group G key with simple sliding bolt mechanism

described them as the simplest key type. However their simplicity does not mean they were not important. The majority of non-girdle hanger keys found in Anglo-Saxon graves are variation on the basic hook latch lifter, although as mentioned above the small number of non-mortuary examples of this key type could be significant.

As mentioned in Chapter 2, Pitt Rivers (1883, 9) presents evidence that this lock was slightly more complicated than is now believed. In his model, rather than manipulating the bolt from above, the key was introduced from below and pushed a tumbler free so the bolt could slide (figure 4.104). It seems that this interpretation is reasonable given the morphology of the keys and the limitations that the stem would place on movement. A simple experiment using replica objects should resolve the question.

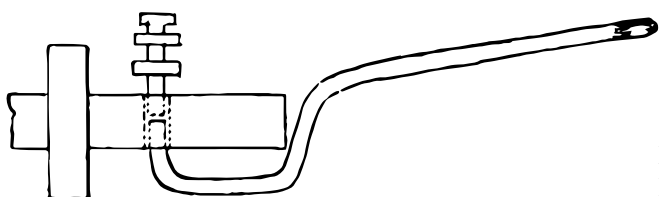


Figure 4.104 Suggested mechanism for group G keys
Pitt Rivers 1883, Plate II Fig 9b

The working parts of this lock consist of the bolt and the supporting cleats in which the bolt slides, both made of wood, and the key, usually iron. If Pitt River's interpretation is correct then a wooden or metal tumbler would also be needed. Figure (4.105) illustrates a suggested set of the skills required to make the lock and key, and the corresponding materials. Of all of the lock types, this is the one that could most easily be made without requiring either uncommon resources or complex, specialised skills. The mechanism itself is exposed and visible and could be replicated without instruction, which means that knowledge maintenance is not dependent on direct transmission and is therefore relatively robust. It is interesting, therefore, that Patrick Ottaway (1992, 675; 1995, 12) suggests that this lock type, along with keys from group C, fell out of active use relatively early. It is possible that this is true in England, but as will be discussed in the next chapter, there is evidence that at least the group C keys continued in use in Scandinavia throughout the early medieval period.

Components

Cleats (2)
Bolt
Key

Materials

Wood
Knife
Axe
Drill bit/auger
Chisel (optional?)

Skills

Iron
Hammer
Anvil
Hearth
Fuel
Flat forming
Finishing
Carpentry
Installation

Figure 4.105 Group G lock and key requirements

B. Wooden tumbler lock

A more complex lock type, but one that still represents a very low material investment, is the wooden tumbler lock, with keys from Group F. As discussed above, these locks are known from Roman contexts, most notably at Vindolanda where not only have six wooden and five bone keys survived, but also the very rare example of a complete lock shown above (figure 4.23). The fact that these locks appear to have most often been mounted on doors, combined with the fragile nature of the material, means that it is not surprising there are no known surviving early medieval examples in England. However, Linlaud (2014, 285-289) has recorded a number of wooden lock components and keys that were preserved at the 11th century site of Colletière à Charavines (figures 4.106, 4.107) and as mentioned above, there are examples elsewhere dating well into the modern age (Borg 2005). It is reasonable to assume that these locks would have also been used during and possibly after the early medieval period in England. As mentioned, there are two examples of a bone keys found at Stenabreak on North Ronaldsay in Orkney, dating between 850 and 1100 (figure 4.24 above); the form is nearly identical to the Vindolanda artefacts.



Figure 4.106 left 11th c wooden tumbler lock from Colletière à Charavines (Isère) from Linlaud 2013 Pl XXIX

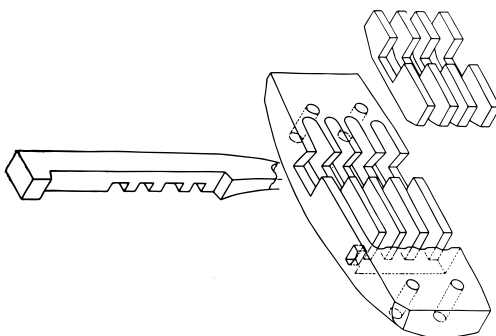


Figure 4.107 right schematic of the Colletière à Charavines (Isère) lock after Linlaud 2013 Pl XXX

Because the Vindolanda lock mechanism is relatively simple (figure 4.108), the material investment is minimal, but there is a certain amount of woodworking skill and technical knowledge necessary to produce a working object (figure 4.109). It is possible that a simple lock and key could be shaped using a knife, but the Vindolanda example appears to have been made using at least a chisel and quite possibly a saw. Although the mechanism is enclosed, and therefore not visible during use, it is self-contained in a removable case and could be easily disassembled. Because it relies entirely on gravity to function it could still be replicated without specific instruction. The similar, tumbler based lock suggested for use

with type C keys would have nearly identical material requirements, although the possible configurations differ (figure 4.110, figure 4.111). Keys for the second suggested mechanism are under more force and would need to be slightly more robust.

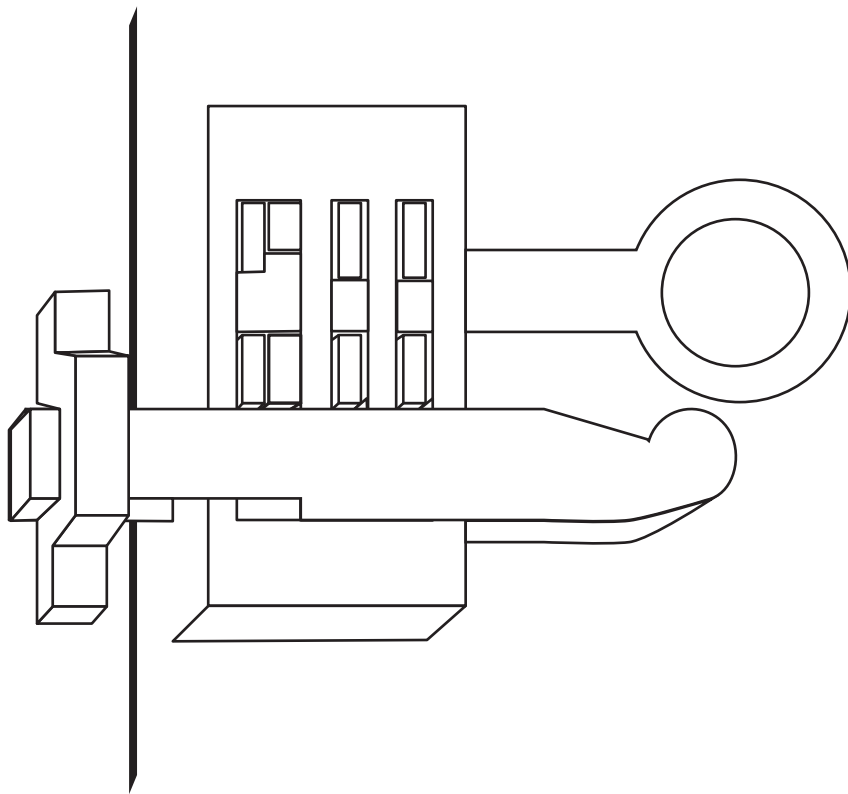


Figure 4.108 Wooden tumbler lock mechanism

Components

- Tumbler case
- Tumblers (2-3+)
- Bolt
- Key

Materials

- Wood
- Knife
- Axe
- Chisel (optional?)

Skills

- Carpentry
- Installation

Figure 4.109 Wooden tumbler lock requirements

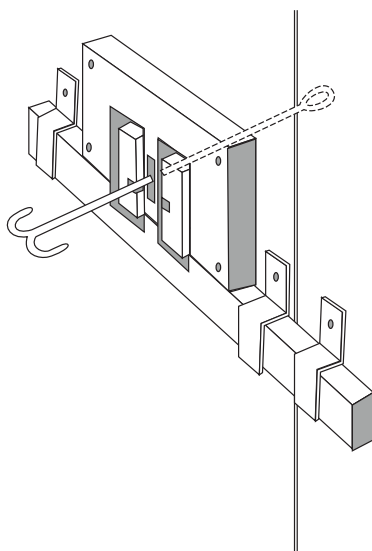
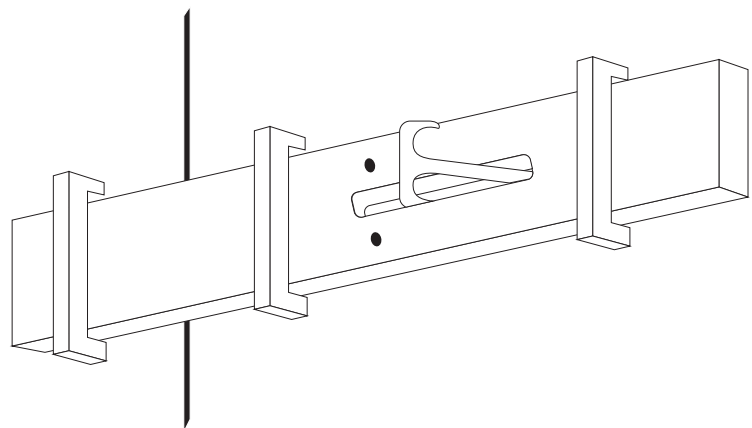


Figure 4.110 T-form group C keys with a tumbler lock (left)

Figure 4.111 T-form group C keys simple slide mechanism (below)



C. Leaf spring locks

Leaf spring locks are slightly more complex and occur in three main forms. All three locks have been found with boxes and chests, and it is possible the first two were also used on some cupboards or structural doors. In the first form, a bolt, pierced with corresponding

holes and held in place with a leaf spring, engages with a hasp (in the case of boxes), or with a staple on a door frame. The prongs of the key pass through the holes in the bolt, depressing the leaf spring behind and freeing the bolt which can then be slid aside. Both L shaped and T shaped keys from group G were used for these locks. For the first, the key would be inserted from above or below the bolt; for the second the bolt was pierced with a slot to allow entry to the key (figures 4.112, 4.113).

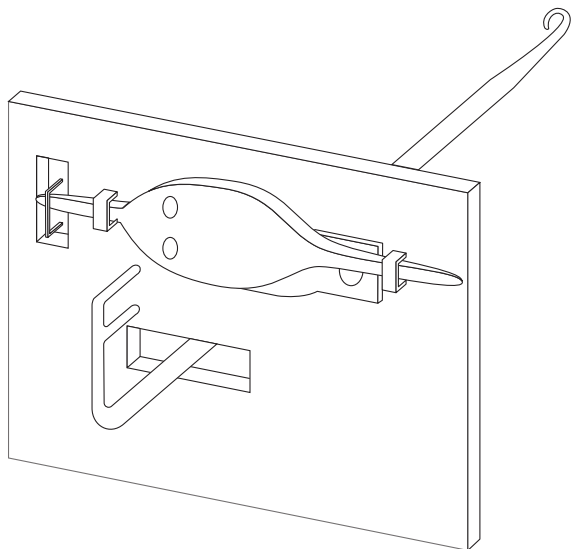


Figure 4.112 L form group C keys with leaf spring mechanisms

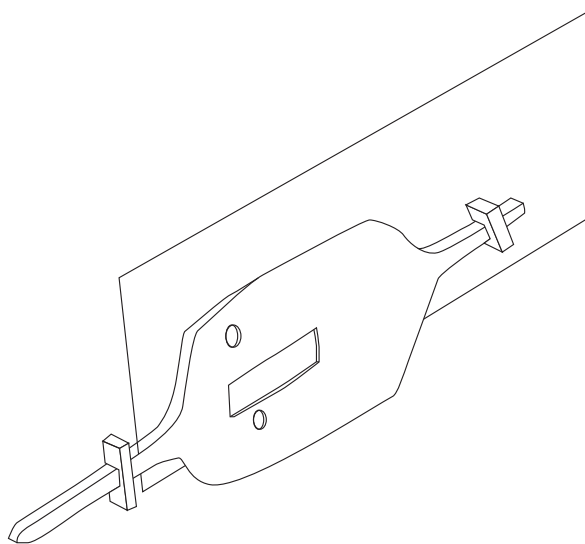


Figure 4.113 Lock form for T-variant group C keys

The second mechanism is also spring based and was unlocked with L shaped group C keys or with a variant with a bent shaft and perpendicular prongs. This lock consists of a metal plate that serves as both ward and catch, fixed to the interior of a box or cupboard. The top of the ward has a lip that keeps a leaf spring in place. The prongs of the key pass through holes in the plate and compress the spring which can then be moved free of the lip (figure 4.114). Unlike the first example, this simple but effective system automatically locks when the lid or door is closed, however it can only be used for chests or boxes.

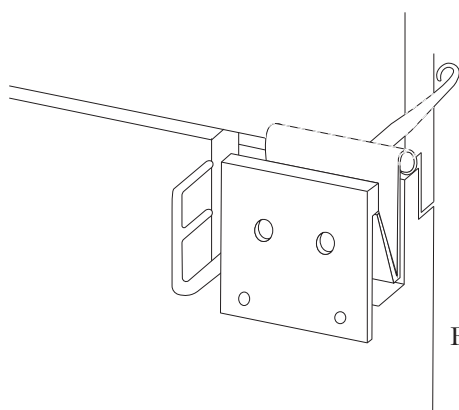


Figure 4.114 Z-spring catch lock

The last variant relates to keys from group E. The bolt and spring configuration is similar to the first variant, but its aspect to the box or casket is different. The key would fit through a key hole where it engaged with a hole or pin for stability. It was then rotated,

sometimes past wards, until the protruding pegs or teeth on the key compress the spring and free the bolt (figure 4.115).

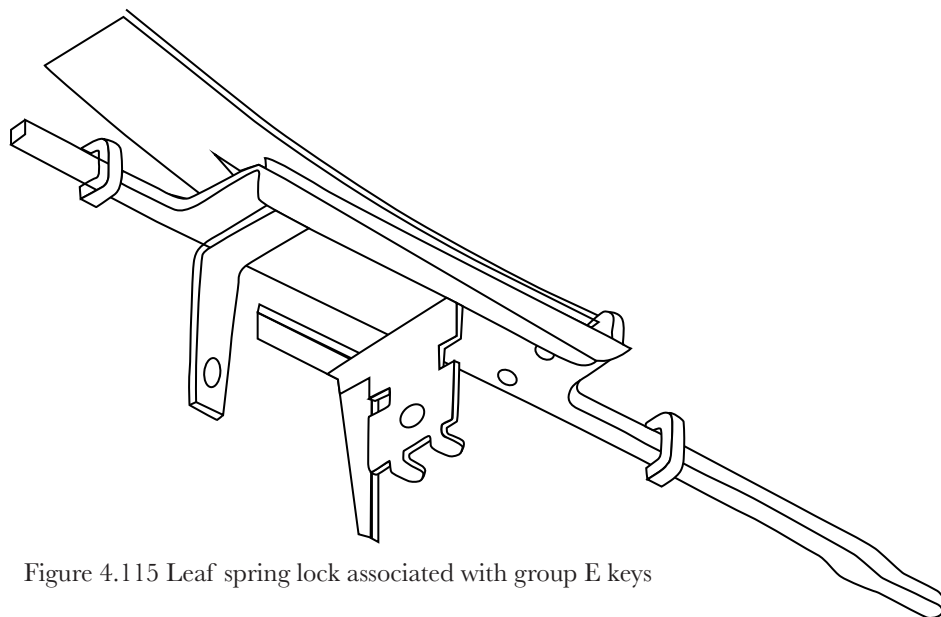


Figure 4.115 Leaf spring lock associated with group E keys

Although most of the keys are quite simple, and do not show a high degree of morphological diversity, the lock itself requires the knowledge and ability to temper iron to produce the correct amount of tension (figure 4.116). These leaf spring locks, because of the size of the surviving lock components, are usually assumed to be attached to furniture or movable boxes rather than to fixed doors. In some cases it may be that they were either produced in cooperation with a carpenter, or that a single craftsman had both sets of skills, however as will be discussed below, it is also possible that these locks and others were made independently of chest or cupboard construction. Keys in group C from the site database range in length from 24cm to 165cm and although the larger examples may relate to tumbler-type locks, it cannot be ruled out that larger spring-leaf locks were also in use on doors. Experimental research into material tolerances may be able to resolve this question. Group E keys appear to have been used only on chests and boxes.

Components

- Catch / bolt
- Spring
- Hasps (slide bolt)
- Box/cupboard
- Nails
- Key

Materials

- Wood - structure
- Tempered iron - spring
- Iron - key, nails
- Carpentry tools
- Blacksmithing tools
- Anvil
- Bellows
- Hearth
- Fuel

Skills

- Flat forming
- 3-d forming
- Annealing
- Tempering
- Finishing
- Carpentry
- Construction

Figure 4.116 Leaf spring lock requirements

D. Rotary lock

The simplest version of the rotary lock, corresponding to keys from Group A, has a back plate with either a pin or a hole, a bolt with three ridges that engages a hasp or a staple, and some form of mechanism to hold the bolt in place (figure 4.117). Patrick Ottaway (1992) describes this as a shaped tumbler, but a better term would be “spring” as the fittings appear to have worked under tension, which would have been necessary for their use in small boxes or caskets.

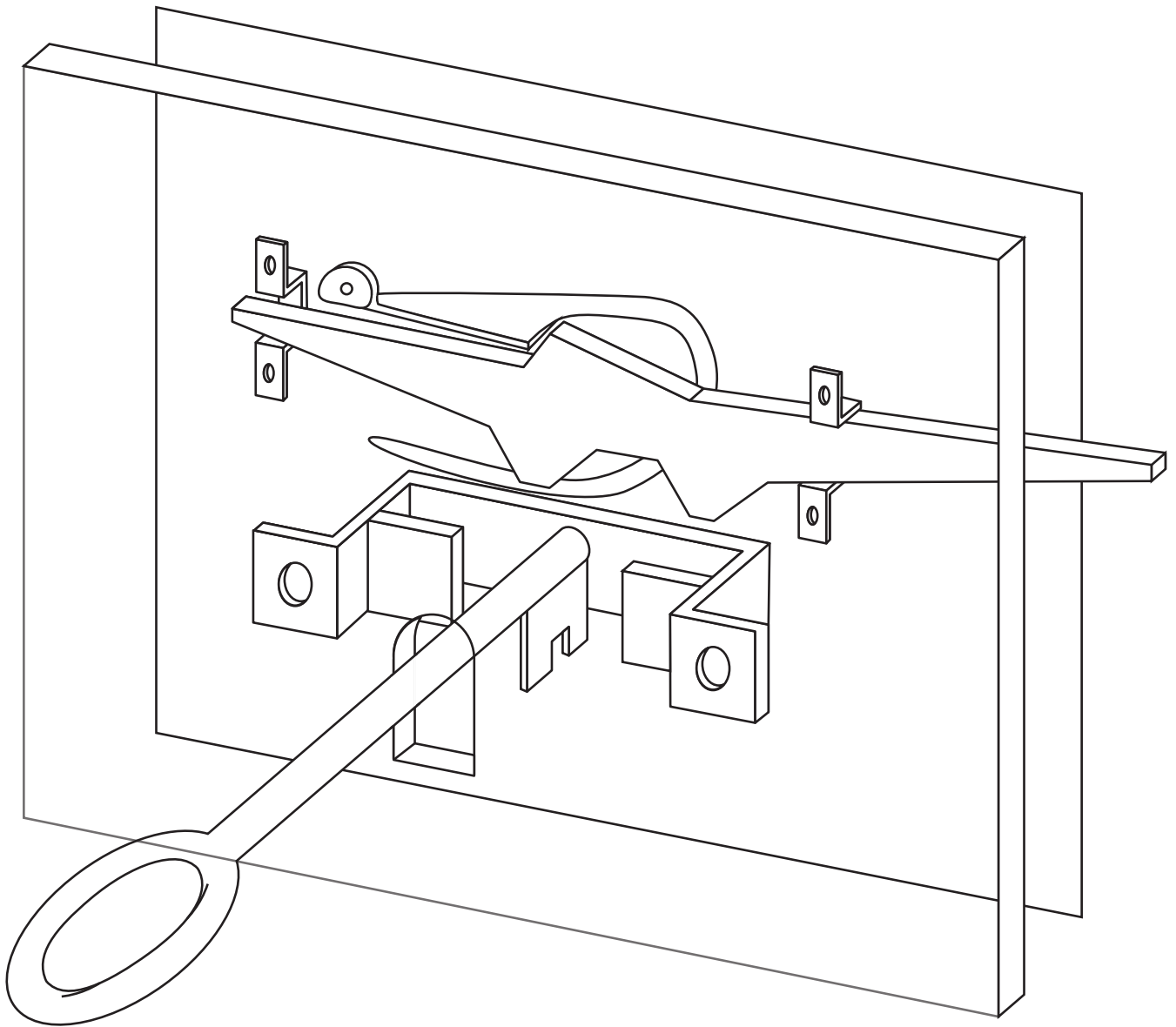


Figure 4.117 Group A rotary lock

Security for this lock is increased by the introduction of a variety of wards that serve as physical barriers. These wards can interact with the key bit on any of three edges, and can range in number, size, and profile. There are a large number of component parts, a correspondingly large number of individual steps in construction, and because of the moving bolt and the wards there is a limited tolerance range for error. Although a craftsman

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capable of doing basic repair work could reproduce the component parts, successfully assembling them into a functioning unit would be challenging, and producing an original piece most likely required a skilled and experienced specialist (figure 4.118).

Components

Front plate Ward plate (1-2)
 Back plate Mortice
 Cleats (2) Nails/pins (6+)
 Spring Key
 Bolt

Materials

Blacksmithing tools
 Swage & block
 Axe
 Anvil
 Bellows
 Forge/hearth
 Fuel
 Iron
 Timber

Skills

Flat forming
 Punching
 3-d forming
 Tempering
 Welding
 Filing
 Carpentry
 Construction

Figure 4.118 Rotary lock resource requirements

E. Spring padlocks

The most complex lock types are spring-based padlocks, opened by Group B keys. In the early Middle Ages there were two basic shapes, barrel locks (figure 4.119, 4.120 below) which have two keyhole configurations, and box locks, which have two minor variations in fixing the inner spring (figure 4.121). The first is known from Roman contexts and carries through to the later Middle Ages. The latter is far less common and is limited to 9th and 10th c contexts (Ottaway 1992, 677). Roman padlocks also sometimes used a rotary key with spring, but that form does not seem to have survived in either Britain or Scandinavia after the end of the Roman period. There is a Scandinavian variation of the box padlock that used keys from Group E which will be discussed in the following chapter.

Although the lock mechanisms involved can be relatively simple, relying on one or more pairs of leaf springs to secure a hasp, the entire construction is arguably the most complicated compound object made by early medieval metalworkers (figure 4.122). Even the simplest lock has a sheet metal case consisting of at least three main elements with additional reinforcing and connective structures, and some variation of a hasp with leaf springs. Many surviving keys show that additional wards and sets of springs were common, increasing both the security of the lock and the complexity of construction. Finally, because the lock case is often made of finely beaten thin iron sheet which is vulnerable to rust, the entire lock was often brazed or tin-plated, producing a finish that was both decorative and protective. The elaboration and intricacy of construction of such objects can be seen in the remarkably complete example from the Coppergate, York excavation (figure 4.101 above).

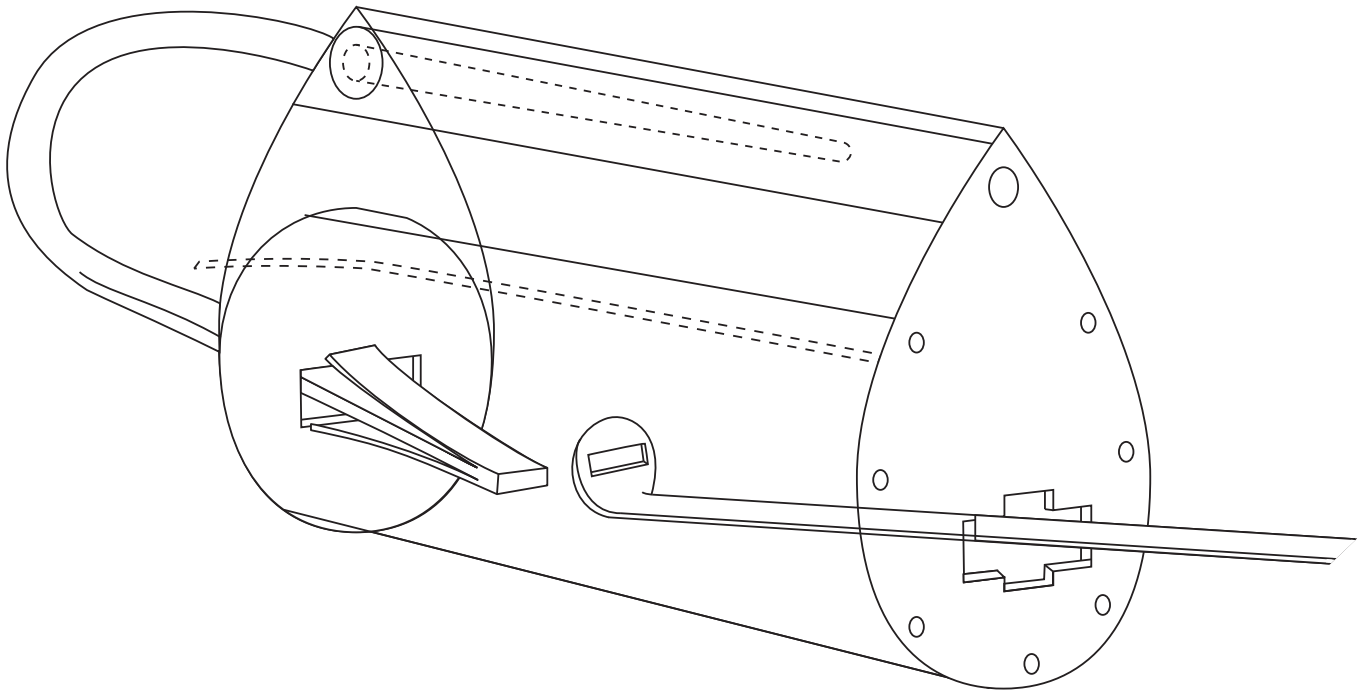
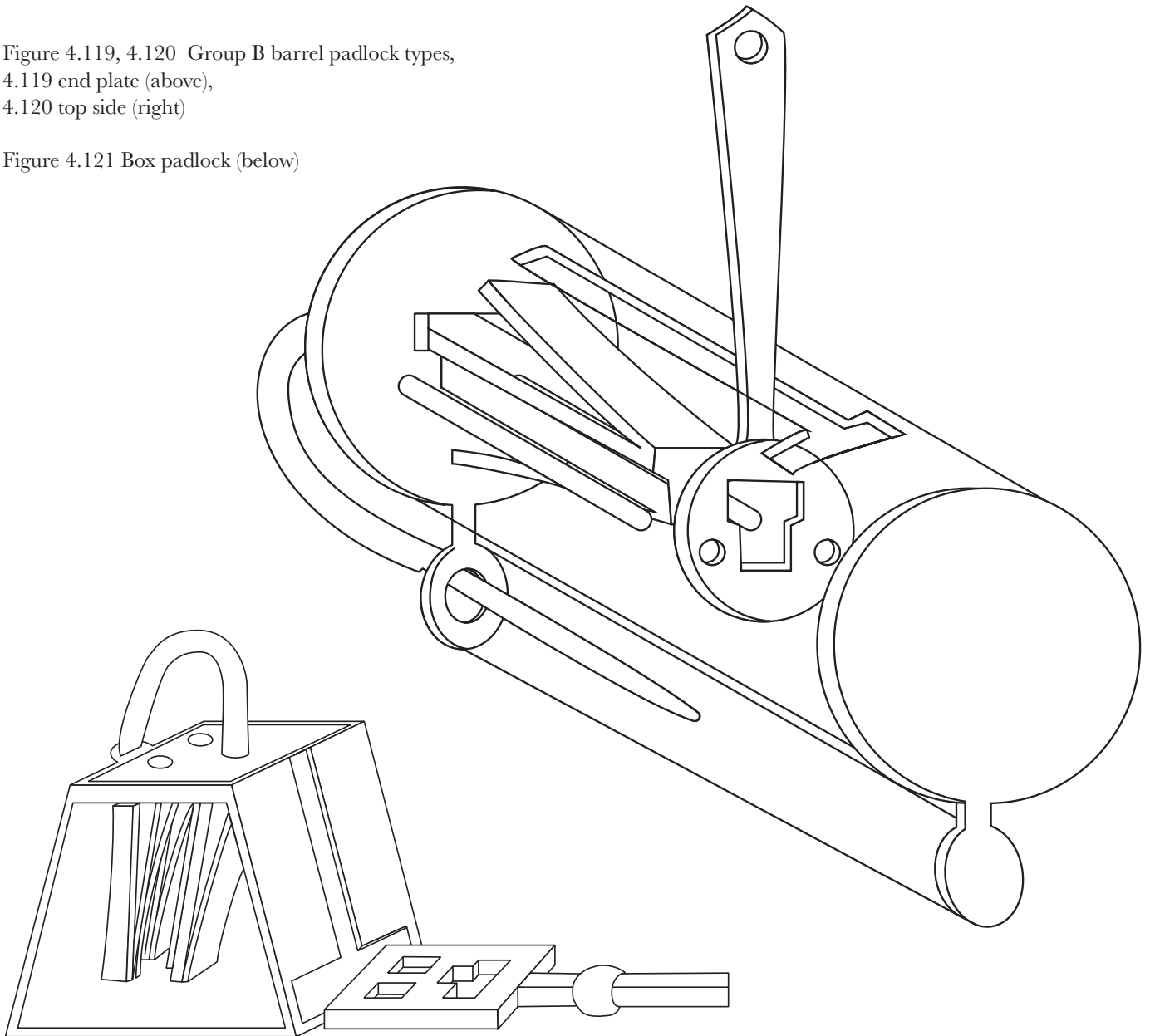


Figure 4.119, 4.120 Group B barrel padlock types,
4.119 end plate (above),
4.120 top side (right)

Figure 4.121 Box padlock (below)



Components	Materials		Skills
Plates	Hammer	Iron	Flat forming
Body cases	Tongs	Mercury	Punching
Bolt case	Shears	Copper alloy/tin/gold	3-d forming
Leaf spring bolt	Chisel	Clay	Annealing
Rivets	Punch	Leather	Tempering
Reinforcing structures	File	Forge	Welding
Key	Swage and block	Fuel	Filing
			Brazing/Tinning
			Box carboursisation

Figure 4.122 Padlock resource requirements

Productive sites in Scandinavia help provide an understanding of how many specialised skills and practices are involved in making padlocks, as well as the required tools and workspace. Workshops in Birka, Fröjel, Haithabu, and Sigtuna (Gustafsson and Söderberg 2007; Söderberg 2014; Drescher 1983; Gustafsson 2005) show that there were multiple complex stages, many of which would not be necessary for every day crafts practiced in most households. Ny Gustafsson (2005 21-22) suggests that the construction of the lock case alone involved six stages, and a range of materials including copper alloy solder, iron, leather, clay, and wax. His ideas are supported in part by the identification of fired clay in a number of craft working sites that shows signs of having been used to braze and weld objects such as locks and bells (see Söderberg 2008).

4.7.2 Implications of lock and key resource requirements

It seems reasonable to assume that the most basic level of locking mechanism, with wooden components, worked with group C or F keys, could be produced or acquired by most if not all settlements. The raw materials are widely available, and the construction of the lock itself does not require craft skills beyond those necessary for other common tasks, such as building fences or repairing structures or tools. The keys are simple in form, and the iron versions have a fairly large tolerance for variation errors. There is, in fact, no resource input necessary beyond the resources required by other basic household objects. This lock, therefore, represents the minimum possible investment choice available.

The evidence that there were, at the same time, an entire range of more complex locks and keys indicates that the demand for locks was both broad and diverse, a demand that was sufficient to sustain and support a network of trained, specialised craftworkers. Although surviving lock examples do not often seem to be of an exceptionally high standard of workmanship, some of those objects should still be considered the product of highly skilled specialised craftworkers. While some other object types, such as knives or spears,

primarily demonstrate the difference between skilled amateur and specialist craftworkers in terms of the quality of the work, with locks it is also the structural complexity of some of the objects that can define the work of a specialist. The distributions sketched above indicate that these specialised locks, particularly those for boxes or caskets, were reasonably widely available, although that availability may have been through networks of trade rather than direct access.

More broadly, those same distributions show that the perceived need for locks, and the importance of locks in England was sufficient to keep at least some of that technology intact through the periods of disruption following the Roman period and the transitions that followed it. It also shows that there was enough knowledge about lock technology and the culture of locking to allow craft work at various levels, making locks and the privacy and security they afforded accessible to more than just the elite.

This evidence demonstrates that, following the end of the Roman period, the drop in the amount of metalwork surviving in the archaeological record does not reflect a loss of technical knowledge and craft ability. Instead it is related to the disruption of trade networks and large-scale manufacture that changed the ways in which raw material was made and acquired.

Pollard et al's 2015 study on the quality and characteristics of copper alloy metals in Britain supports this contention. Tracking shifts in the component metals in these alloys through time, the study shows that there is significant evidence for recycling metals, but that this act of recycling is an indication of a continuity of technical knowledge (710). The material availability changed, but the craft workers adapted to that change, indicating a high understanding of material properties and an ability to effectively adjust practices.

That knowledge depth was not limited to copper alloy. Andrew Welton's 2016 assessment of early Anglo-Saxon spearheads shows that craft workers were capable of both creating a range of iron alloys from ferrite to steel, and of effectively recycling older material, the latter supported by an analysis of iron objects found in Scraftoft, Leicestershire (Leahy 2013). As mentioned above, this included an ability to accurately assess the type and quality of the pre-worked metal in order to suit the material to the intended use (p 231). Welton (2016) points out that the skill level involved in the making, as evidenced in the objects, was not always high. However, the continuity of practice demonstrates that the understanding of the properties of the material and the ability to exploit them was sustained in the population as a whole.

However in the early period, the lack of some material availability would have had a significant effect on the craft-working community outside of high status sites. Scarcity of copper alloy would have shaped choices about key construction and lock types, and those choices would carry forward. A shift to using iron to make keys rather than relying on copper alloy is likely partly responsible for the Roman spring tumbler lock dropping quickly out

of the record. Many of these keys in the Roman period were partly or entirely cast out of copper alloy. Although many bits were iron, the cast versions were more efficient to produce and allowed a greater fidelity in creating replicas. Creating iron bits for this form required a great deal of skilled, precise work in multiple stages of forging, cold forming, and filing. If, as suggested above, replacement and duplicate keys were sometimes made by non-specialist craft workers then resource heavy, complex keys like this would be selected against in preference for other types.

The evidence presented above for the resource requirements of lock production supports my earlier suggestion that the trajectory of lock technology appears to be a contraction in lock variation after the end of the Roman period, followed by a steady increase in variety and complexity. As mentioned above, it appears that fairly early in the period this simplest of all lock forms dropped out of use, an indication that forms with greater security were both available and affordable. This implies an overall increase in the number of locks being made and a strong, consistent network of contact and exchange among tradespeople and craftworkers. Of course it is could be that the loss of these simple locks is only apparent and not actual. It is entirely possible that in more isolated rural areas they continued in use but have not survived or been discovered, but in larger settlements and villages it appears that through the early Middle Ages there was an increase in the desire for and the availability of complicated keys and locks.

This increase may not have been one of steady growth, but could have been punctuated. Pollard et al (2015, 710) show evidence for a marked shift in the distribution of different alloys around the middle-Saxon period. This implies that while there was a continuity of metal craft practiced from late Roman to early Saxon period, a change in the ways in which materials, and possibly craft knowledge were distributed occurred in the 7th-9th centuries. If this is accurate, then the use and the technology of locks and keys would be expected to also be affected.

Because the number of locks and keys with known dates from this period are relatively few, statistical analysis on their distribution is not, at this point, possible. Keys from group C are the best represented, but because they come primarily from grave assemblages, it is difficult to be sure that their numbers accurately represent wider distribution patterns. There may have been cultural or economic reasons that these keys and not other types were more likely to be deposited.

Objects from Flixborough and Winchester are also problematic. Phase dates for the keys are often broad, spanning a century or more, and many of the phases overlap, making it difficult to evaluate any apparent patterns. Further, any perceived increase or decrease in key and lock appearance may not reflect the availability or use of the objects, but instead be related to the dynamics of the site as a whole, or the way in which the area in which the key or lock was found was being used.

There is evidence that all three of the more complex lock types - leaf spring variants, rotary locks, and padlocks - were in use by the 7th century. The first two are both found in chest burials from Winchester (Biddle 1990), York (Kyølbye-Biddle 1995), Ailcy Hill (Hall and Whyman 1996), and Thwing (Ottaway nd). Padlock barbs and keys are known from a number of 7th century sites, but a burial at Bloodmoor Hill shows how sophisticated available lock technology was at this time.

Grave 15 (Lucy et al 2009, 394-397, 406-408) was the well furnished burial of a young adult, mentioned briefly above. Unfortunately the remains were too damaged to allow sex identification. There was evidence the grave had once contained a coffin, and inside it, at the foot of the body, was a wooden casket with copper alloy fittings (figure 4.123). The casket was locked with an iron barrel padlock, about 4cm long and just over 2cm wide (figure 4.124). In comparison, the Coppergate padlock case (Ottaway 1992, 659) is 8.6cm long and 8cm wide. Like many other objects, reducing the size of the mechanism can actually increase the difficulty of manufacture (Foxhall 2015, 1) as tolerances of material and movement are reduced. Although the lock is too corroded to evaluate the quality of the finish, the surviving barrel is symmetrical and straight and appears extremely well made.

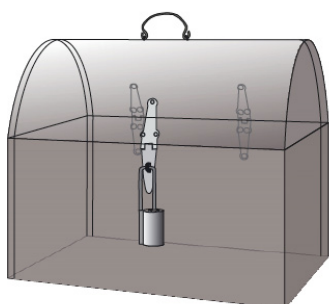


Figure 4.123 Reconstruction of the casket from Gr 15, Bloodmoor Hill.

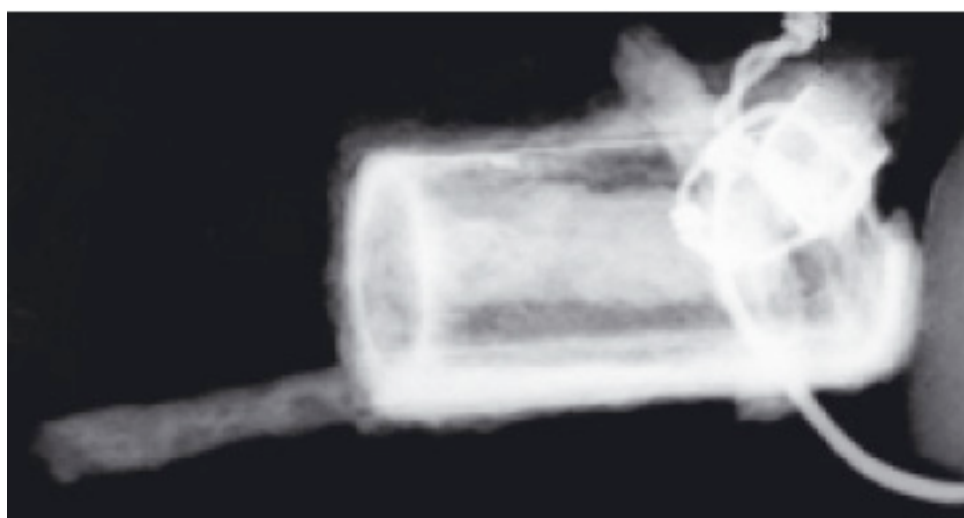


Figure 4.124 X-ray of the Gr 15 padlock

From Lucy 2008 fig 7.16, 4, 5

The fact that lockable chests and boxes appear in 7th century and later graves does more than give a firm date for the use of the lock types in England. As will be discussed in the next chapter, objects are used in mortuary assemblages with intention and purpose, and the purpose derives in part from the meaning the object carries. For objects that are unique within a cemetery, that meaning may be focused on the object itself - its individual biography. For repeated objects, however, there must also be a shared community meaning for the object type. It is reasonable to say that it takes time for such a meaning to develop to the point where the object type becomes a regular part of burial rituals. It must have, in

other words, a period of active use within the living community in order to acquire sufficient importance to be desirable in the commemoration and furnishing of the dead.

It is reasonable to suggest that lockable chests, boxes, and caskets were in use and had some social importance in early medieval communities prior to the seventh century. Although the simplest wooden tumbler locks may have been able to be miniaturised sufficiently to work on smaller objects, for the movable caskets and boxes they were not a reasonable solution, as discussed above. Therefore some form of metal lock, whether leaf spring, rotary, or padlock, was most likely widely used.

As padlocks are less common in 7th century graves than other lock forms it is possible that this form was only introduced more widely later, and that they were adopted as a new, possibly higher status method of locking boxes. But there are enough examples to suggest that their use was reasonably widespread. It is not possible to say whether there were skilled craft workers making these objects near these locations, or whether the objects were brought there through trade or gift exchange. But it is apparent that both desire for and access to complex locks was not tightly limited geographically.

This suggests that the observed changes in material and craft knowledge availability affected locksmithing in the earliest part of the suggested time frame, allowing the adoption and spread of more complex lock forms by the mid 7th century. Both craft ability and demand from the wider community were sufficient to drive the spread of the technology. However it is not clear whether the knowledge of even padlock construction was retained after the end of the Roman period or the technology was re-introduced in the late 6th or early 7th centuries and then rapidly spread.

The morphology of some locks for caskets and chests shows that they could have been easily transported, facilitating the distribution of both the objects and the technology. Evidence from casket burials at York (Kjølbye-Biddle 1995, 508 fig 178), Winchester (Biddle et al 1990, 1016 fig 317), and Ailcy Hill (Hall and Whyman 1996, 91 fig 20) demonstrates that rather than being built into the structure of the box, the lock is essentially self-contained. The bolt, spring, and other elements are fixed onto a large metal faceplate (figure 4.125 below). This was then nailed to the side of the box.

This construction method provided a great deal of flexibility. Not only were the locks portable, but they could be attached to an already existing chest (changing its use) and also removed and reused as needed. This did, however, mean a compromise in security as evidenced by a chest found in an excavation of Haithabu harbour. The rectangular lock plate and the two hasps been roughly pried off in what appears to have been a robbery (Kalmring 2010a, 282-83), and the chest itself was discarded (figure 4.126). The fact that these locks continued to be made, in a variety of forms, implies that their portability was a desirable feature that had developed in response to the conditions and needs of the market.

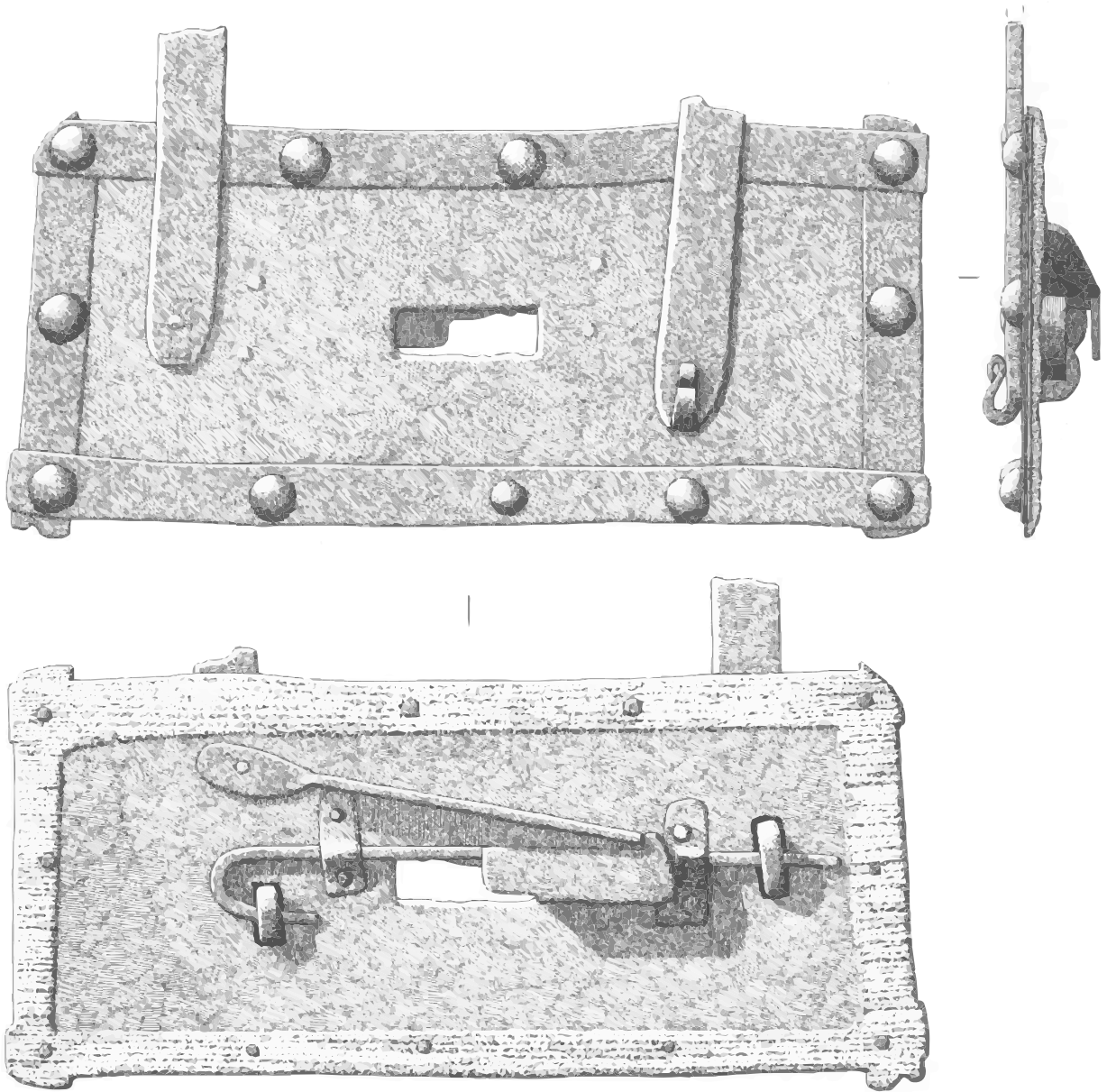


Figure 4.125 Faceplate and mechanism
of a self-contained lock for a chest.
Winchester 3686
After Biddle 1990, 1016, fig 317



Figure 4.126
Vandalised lock plate
of a chest found in the
Haithabu harbour
Kalmring 2010, 433,
fig 3.14

Those needs or ideas were maintained well past the early Middle Ages. Locks continued to be made as self-contained, movable structures even though the craft of lockmaking became increasingly more sophisticated. Henry VIII travelled with his own locks and a locksmith who could install them on the doors to the chambers the king would use (Gairdner 1880) (figure 4.127). Mobility and flexibility in locks was, arguably, seen as an essential characteristic.

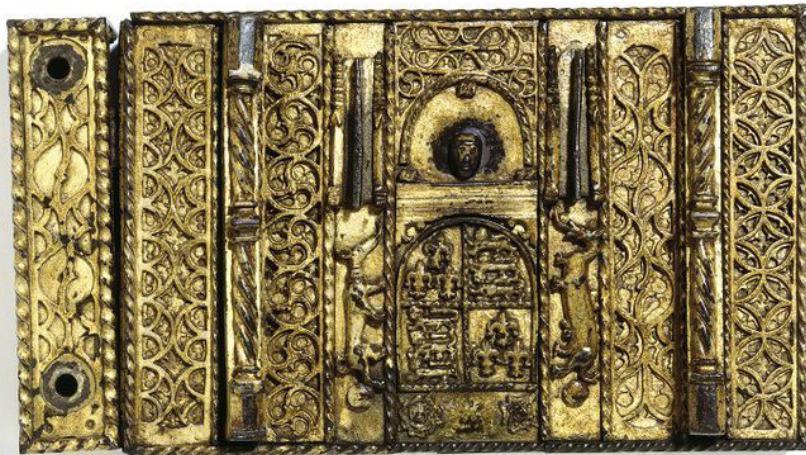


Figure 4.127 Beddington Lock
Victoria and Albert Museum
M.397&:1 to 6-1921

This mobility may help to explain the fairly wide distribution of keys. More rural communities would be able to acquire locks through extended trade networks without needing to have direct access to craftworkers with this specialised knowledge. It also may support the idea that key manufacture was not necessarily exclusive to locksmiths, and that the need to readily replace lost or broken keys was in part responsible for the persistence of simpler key forms like those from group C as argued above.

4.7.3 Social implications of persistent lock use

In addition to containing information about the characteristics of early medieval craft knowledge and skill, there are the implications of the social investment involved in the perpetuation or the spread of the craft (Flad and Hruby 2007). The community will necessary to ensure these objects continued to be available suggests their social importance. Because of the particular characteristics of locks and keys, that implied social importance is itself a source of information about the structure and nature of past cultures.

Specifically, as already discussed above, locks are socially active objects whose use creates noticeable change in the structure of their surrounding landscape and of the community in which they are used. Even the presence of a lock, but certainly its use, creates categories of spaces, objects and people. The fact that there were a number of lock types and applications in the early Middle Ages, therefore, is extremely important both because

it is essential to understand the possible implications of the types of spaces being locked, but also because there were choices available for solutions for those particular applications. Those choices are themselves informative.

There is evidence for what was called above an 'onionisation' of space in the early Middle Ages, a concentric set of psychological and physical divisions. The broadest social or mental boundaries between the 'outside other' and the 'inside known' may have been made up of landscape elements, ancient built features, markers, etc (cf Lund 2005). These divisions are, essentially, soft in nature, easily crossed and relying on a shared cultural understanding rather than built barriers. However built boundaries, markers, and locks make spaces that are utland distinct and absolute as opposed to shiftable and conceptual. It provides a single, shared location for the transition instead of a diffuse, individualised conception of it.

The outermost of these, a fence or a ditch or possibly both, protected the settlement or farmstead and simultaneously announced the extent of land that settlement claimed. Æthelberht's law codes set fines for entering fenced enclosures (Richardson and Sayles 1966), indicating the importance of these structures; the legal division between the outside 'other' and the household began here rather than with the doors and walls of buildings. This same emphasis on the bounded homestead is repeated in other contemporary Germanic law codes (Hamerow 2002, 85-86) suggesting there were broadly shared ideas about the implications of these boundaries even when the physical expression of them varied. Even in more urban areas such as York or Kaupang where households were closely butted against each other, there is evidence that wattle fencing and other indicators were used to define the limits of one allotment from another, maintaining the practice of an outer, breachable boundary (Hall et al 2014; Skre 2007a).

Within that boundary there may have been a single building, but often, particularly outside of more urban areas, there was a larger complex with groupings of multiple buildings and the spaces that connected them, perceived as a single unit with many cells. Instead of complexity introduced simply by walls and doorways in a single structure, the rural farmstead taken as a whole expresses complexity through this multi-cellular nature. And these cells themselves, aside from the central living space, were not necessarily experienced as fixed but were to a certain extent fluid, temporary both in construction (with some smaller structures being replaced after a few years, Lucy et al 2009) and in purpose.

The number of descriptive nouns for buildings in Old English preserves some of the variety of function these structures could take. The basic term 'ærne' could mean not only house but also closet or secret place, supporting the idea of nested layers of increasing privacy and security within a settlement. But it also occurs with a variety of prefixes such as breáw-ærne (brew house), bere-ærne (barley house or barn), hédd-ærne (storehouse) and even mold-ærn (earth house, or grave). Using locks to vary the permeability of these

structures would not only signal something of the intended use, it would also vary the perception of the complex as a whole, as well as the people and objects it contained, allowing the continual manipulation of these perceptions as circumstances changed.

The living space of the main house was yet another layer, firmly defined with walls and with a door or doors that provided additional control over movement and access. But this was also a shared space; mentions of common benches used for both eating and sleeping in texts such as *Beowulf* show that community members likely had free and ready access. So although the doors could and almost certainly did have internal bolts for security, if there were locks requiring keys to those doors it may be that this was not a usual practice.

In contrast, outbuildings such as barns, storage sheds, and craft buildings were very often lockable. Germanic law codes make a significant difference between damage to locked structures and those that were unlocked (Hamerow 2002, 39), or the abduction of a woman from a locked *screona*, identified by some translators as referring to sunken feature buildings (45). It seems reasonable that England had similar practices. Certainly the early law codes show significant concern about theft (Attenborough 1963).

Further nested within the living space would be boxes, cupboards, and chests. Some larger houses may have had sleeping compartments or cupboards for the heads of the household, and like the house itself, these could have had bolts on the inside, as seen in a reference in *Íslendinga saga*. Although the story focuses on the idea of security, with the paranoid owner also rigging a warning system of chains and a secret escape hatch, the arrangement allowed for the privilege of personal privacy, something the ordinary inhabitant would not have enjoyed. These cupboards physically represented the exceptional role of the people who were protected by them. But sharing that equally deep level of security were objects. Arguably, for the most part it was bodies and actions in early medieval culture that were, and perhaps needed to be, publicly visible and accessible while specific objects required access control - protection, security, and perhaps privacy.

In these communities it was necessary to see what people were doing both in terms of their productivity and consumption, and their interactions. This oversight allowed everyone to understand subtle group dynamics, to know who was closely associated with whom and where conflict may arise. It also allowed everyone to know who was contributing to the group well-being through labour and production. Continual visibility of people was, therefore, a means of ensuring group cohesion and morale. In contrast, by controlling access to important assets of goods and objects, the group as a whole could be assured that those assets were secure. It also gave visible assurance of the stability of the group by implying there were resources valuable enough to require security.

This central concept of social organisation is embodied in the essential characteristics of each of these layers of space: that they are nested within areas of a higher order of

accessibility. In other words, as mentioned above, the secured spaces most often exist within more generally open areas, a locked house within an open landscape, a locked room within a building, a locked box within a room. This means that there is both a rhetorical aspect and an inherently performative aspect to the existence and use of locks. Because they are visible to the wider community, they project messages about the nature of the enclosing space as well as the protected space. Further, the times when the lock is used and the space is accessed are, at least potentially, equally public, an enactment of the role implied by the possession and display of a key.

4.8 Conclusion

The extent of metal scarcity during the post-Roman transition has been debated but there is consistent evidence for both recycling of metals and the discontinuation of some metal-heavy type of objects, such as hobnailed shoes (Fleming 2012). However there is also evidence for adaptation in the production of iron and of a continued high level of skill in its working. The persistent appearance of keys demonstrates that locks, requiring special knowledge and skill, likely continued to be used through this period. Because keys and locks are portable, their distribution does not necessarily directly show the distribution of the craftworkers making them, but it does provide evidence of the extent of the network in which they were made and traded. Their appearance in both the archaeological record and in contemporary art work including sculpture and manuscripts, shows that they were not only considered necessary utilitarian objects, but that they also had connotations of status, and may have had additional, symbolic importance which could have contributed to the maintenance of the craft.

It is significant that through periods of considerable change, networked craft communities were able to transmit not only general knowledge of the necessary skills involved in lock making, but specific knowledge of the culturally appropriate morphology of the keys involved. It reinforces the idea that although trade networks were disrupted, and access to raw materials was restricted, the craftworkers were able to adapt to new circumstances. They had both the flexibility of knowledge and skill, and sufficient motivation from market demand, to maintain a technology with a high resource demand even in a time of relative scarcity. It also supports the idea that objects can be used to infer information about population disruption and stability during the transition between Roman Britain and the Anglo-Saxon periods (Härke 2011). Locks and keys, with other objects approached in a similar way, may be able to contribute considerably to the ongoing debate over whether the transition was one of migration or invasion, stability or mass colonisation (Arnold 1984; Burmeister 2000; Montgomery et al 2005).

This study has shown that uncontexted evidence like that found in the PAS can provide significant insight into the characteristics of the production, dispersal, and use of objects like keys. Although there are significant limitations on the extent and the granularity of those insights, the information available provides an important context for evidence from traditionally excavated sites allowing a better understanding of those sites individually and collectively.

The morphological stability of keys, which has been a barrier to effective research on the object type in the past, has been shown to be evidence of considerable continuity in the culture and the practice of both the communities that use them and that produce them. This continuity may help to better understand the nature of the transitions that took place in this period.

This portion of the thesis has established that there was an ongoing demand for locks and keys and also a population of craftworkers with the specialised skill necessary to supply that demand. The focus for this portion of the study has been on establishing an understanding of the range of physical characteristics of early medieval locks and keys and through them looking at the nature of contemporary craft knowledge and practice. But in order to better understand why lock use persisted and in particular the cultural symbolic importance locks and keys may have had in an early medieval community it is necessary to use a different type of data.

Because of the nature of the data in the PAS the understanding of lock and key making and use in England in the early Middle Ages is necessarily general in scope and primarily of rural environments. We now turn to an examination of evidence that is more specific and is related to settlement. The next chapter builds on the basic ideas developed here: the importance of persistence both in the use of locks and keys and in their morphological characteristics, and the cultural significance placed on these objects that is implied by this persistence. Using objects from archaeological contexts, the diverse mortuary constructions at Birka and the wider community in which they are found, the following study examines the nature of that significance. This data allows the exploration of the ways locks and keys were used within a living community with a particular interest in their role in the creation and expression of identity, and in their possible symbolic meanings.