Fold it

Recent finds of figural handles from Roman folding knives in Denmark

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ABSTRACT

A few years ago, an article on Roman folding knives in Denmark would have been unfeasible, as this small and distinct group of artifacts had not yet been identified. However, the increasing use of metal detectors in Denmark has led to the discovery of numerous new artifact types, some readily identifiable and others less so. The identification process of this new type began with the discovery of a complete folding knife in Gl. Rye cast in copper alloy. While initially proposed to be of Roman origin, this attribution was met with skepticism due to the early dating it implied, resulting in a lack of consensus among both detectorists and archaeologists.

Subsequent discoveries of similar folding knife fragments have since emerged, beginning with a find from Oslo, Norway, followed by two fragments from different regions in Jutland, Denmark, as well as a fragment from a distinct handle type uncovered in Zealand, Denmark. To date, these represent the entirety of identified fragments from southern Scandinavia. This article presents and contextualizes this material.

Moreover, the article argues for a Roman provincial origin of these artifacts. It examines their iconographic features and archaeological context, complemented by metallurgical analyses. These analyses reveal a metal composition closely resembling that of Roman sestertii minted in the 1st century AD. It also narrows the origin of the copper ore to two different areas within the Roman Empire, supporting the proposed Roman provenance.

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Introduction

Finds from the Roman Provinces are increasing as detectorists search the fields for stray-finds in present day Denmark. It should be noted that the use of metal detectors is legal in Denmark, and this hobby saw a significant rise in popularity during the COVID-19 pandemic. Coins, fittings, brooches and other metal objects with an origin on the continent south of Limes are being entrusted to the local museums in ever growing numbers. These finds indicate that the barbarians had a keen interest in silver and other valuable objects from the continent. Some of these items were deposited in graves, others offered to the gods, yet others circulated the realms of the living.

Figure 1. Complete folding knife from Gl. Rye, Jutland (Photo: Museum Skanderborg).

Among this latter group of artifacts, a new type emerged in 2020, discovered within the plough layer of a field in East Jutland, Denmark (Figure 1). Metal detectorist Henrik Manse Dupont

Figure 2. The fragmented side plates of similar type as figure 1, left from Oslo right from Hjørring (Photo: Vivian Wangen / Michael Ejstrup Nielsen).

Figure 3. The side plate fragment from Melby (Photo: Museum Nordsjælland).

unearthed a small object that was identified as a Roman folding knife with a figural handle through a British online detectorist forum. Reactions in the Danish counterpart to this forum were divided, with some participants being optimistic about its Roman origin, while others speculated it could date to the Renaissance or even later. Some suggested it might be a sailor's knife, given its resemblance to a figurehead. Museum experts shared the same uncertainty, unable to provide a definitive judgment regarding its date.

During this debate, a fragment of an identical object was identified in northern Jutland, Denmark. Around the same time, a similar fragment was reported from a location near Oslo, Norway (Figure 2).[1] Subsequently, another fragment was identified on the Danish island of Zealand (Figure 3). As this article was in preparation, yet another well-preserved fragment came to light, discovered 25 km south-east of the first find in East Jutland (Figure 4).

Figural knife handles are rare in Scandinavia at any point in history. Although examples of bone handles with standing figure motifs exist from the Medieval period (Bencard 1975; Reinholdt 2009, 14-17, 112-115) and the Renaissance (Hobberstad et al. 2020, 29; Papin and Soulat 2017, 1-8), these belong to fixed knives rather than folding knives, representing a distinct category.

Given that the folding knives discussed in this article are all stray finds without archaeological context, a metallurgical analysis was conducted on one of the pieces. The article begins with an overview of Roman folding knives, followed by a presentation of the Scandinavian finds, with an emphasis on the finds from Gl. Rye and Melby, and a discussion of their iconography and archaeological context. The results of the metallurgical analysis will then be presented and evaluated, concluding with an assessment of how and why Roman folding knives may have found their way into Barbaricum.

Roman folding knives – an overview

The folding knife is a simple yet ingenious tool which dates back at least to the 6th century BC in Europe. From the second half of the 1st century AD, folding knives with figural handles gained popularity in the Roman provinces, a trend that persisted into the 4th century (Mercklin 1940, 351). These handles were typically crafted from bone, antler, ivory or cast in copper alloy. Other materials such as amber, jet and possibly wood, were also used.

Most knife handles from the Roman Empire appear to have been cut or cast as a single piece, though the quality of illustrations in publications

Figure 4. The well-preserved side plate fragment from Odder (Photo: Museum Skanderborg).

Figure 5. Typical motif of the figural handles found in Roman Britannia; hound chases hare (Photo: Wikimedia commons).

often makes it difficult to confirm construction details when they are not explicitly described. However, in a general description of Roman knife handles, Riha notes that many were assembled from two identical side plates (Riha 1986, 30), akin to the examples discussed in this article.

The craftsmanship of these knives varied widely, ranging from rudimentary to highly elaborate pieces of art (Bartus 2007). The blades, typically made of iron, are rarely preserved due to corrosion. Functionally, Roman folding knives resemble modern Swiss Army knives, with blades riveted to the handle at one end, enabling them to fold. These knives were relatively small, usually measuring 7-9 cm in length, and were possibly designed to be carried in a leather drawstring pouch or suspended from a chain (Ridgeway 2019, 15).

The folding knives occur in relatively high numbers across the northern frontiers of the Roman empire, especially in Gaul, Germania and Britannia (distribution maps in Bertrand 2021, fig. 4; Bartus 2010, fig. 3). The provinces of Germania and Britannia have yielded an extensive variety of finds. Notably, the regions around the German cities of Trier and Köln appear to have been epicenters for the production and popularity of folding knives with figural handles (Faust 2000, 2004, 2008; Fries 2008; Mercklin 1940, 252).

The difficulty in determining the distribution of Roman knife handles arises from several factors. Firstly, many older finds are labeled fundort unbekannt ("findspot unknown"). These artifacts often originate from undocumented excavations, donations of private collections, or stray finds near known sites (Kovač 2019). Secondly, the use of metal detectors, which has led to an abundance of finds in the British Isles, is prohibited in many countries, including Italy. This restriction creates a skewed image of the knives' distribution. Auction catalogues displaying folding knives suggest that metal detectorists find them in other regions as well, but due to strict legislation, these artifacts often end up in private collections rather than museums.

Despite these challenges, it is possible to gain an impression of the knives' distribution by examining examples with known contexts. The distribution appears to follow a broad west/northwest-east/southeast belt, stretching from Britain to the southern coast of Turkey. Very few handles derive from the Italian peninsula. Bartus has a few examples found near Ostia, but otherwise none have been published (Bartus 2007, 205). Numerous examples have been documented in the region corresponding to modern Hungary (Bartus 2007), plus a handful from the Roman city of Mursa in Pannonia, present-day Croatia (Kovač 2019). Three additional examples have been identified in the Roman province of Dacia, now Romania (Vass 2009, 298), and the easternmost known piece is a handle depicting an

eagle, discovered in Cilicia on the southern coast of modern Turkey (Canli 2020).

The northernmost example documented until recently was an asparagus-shaped handle found at the Roman castellum Laurium in the Netherlands (Hoss 2009), but Bartus mentions a gladiatorial example from a necropolis in present day Poland and proposes this as exported to the babarians outside of the Limes (Bartus 2010, 30). However, the examples discussed in this article now extend the known distribution further north, representing the first finds of such knives beyond the Limes in the northern direction (Søndergaard 2021; Søndergaard and Aarsleff 2021).

The variety of motifs on Roman knife handles is both broad and colorful, catering to diverse tastes. Among the most common are handles featuring various types of gladiators (Bartus and Grimm 2008; Bartus 2010; Jackson and Friendship-Taylor 2003; Kovač 2019). Handles depicting Roman gods and copies of popular statues were also highly favored (Bertrand 2021; Fries 2008, 32–36; Kovač 2020; Rüsch 1981). Additional motifs include erotic scenes (Faust 2004, 190-192), animals and hunting scenes (Figure 5) (Dufrasnes 2007; Fries 2008, 26-28). Asparagus was another recurring motif (Hoss 2009), as were the more peculiar handles shaped like table legs (Bartus 2007, 220-224; Fries 2008, 24-27; Mercklin 1940, 345-346).

Although clear patterns of preference are evident, isolated examples of motifs are also encountered. While Mercklin's classic work provides a comprehensive catalog of handle types, the best visual documentation can be found in Bertrand (2021, plates III-V).

The distribution of these handles aligns closely with the movement of Roman troops, with most examples originating from areas near Roman towns. Beyond stray finds and discoveries made with metal detectors, the documented contexts of these handles generally fall into two categories: grave goods or items that were accidentally lost. The latter category includes handles from Britain, the Netherlands, Germany, and Romania, often associated with military camps or forts (Allason-Jones and Miket 1984, 300; Hoss 2009; Ronke 2003). Notably, only the Dacian example mentioned by Vass is proposed to have originated from a weapons deposit or workshop (Vass 2009, 295).

A few examples have been recovered from Roman villas (Jackson and Friendship-Taylor 2003), baths and roads within towns (Faust 2000, 294; Fries 2008, 27; Rüsch 1981), suggesting that these knives were part of daily necessities, carried and sometimes lost at various urban locations. Only a very limited number have been found in sanctuaries, including one from a temple site in Trier, though no further contextual details are available (Fries 2008, 27). Another example, discovered in Turkey, was recovered from a possible votive deposit in a necropolis (Canli 2020). A striking example depicting a gladiator was recovered by divers from the River Tyne at Corbridge, near Hadrian's Wall. This particular find could be interpreted as both a loss and a possible deliberate deposit (Ravikumar 2024).

Due to their appealing motifs and recognizable features, Roman folding knives are more commonly found in auction catalogs or private collections (Faust 2004) than in archaeological excavations. However, a significant number have been unearthed in graves dating from the 2nd century to the mid-4th century AD. A handle depicting a lion was recovered from a richly equipped inhumation grave at the necropolis of St. Severin near Köln (Höpken and Liesen 2013, 458). Bertrand describes an example featuring a panther from a female inhumation grave at a necropolis near Bordeaux (Bertrand 2021, 90), which closely resembles a panther-shaped ivory handle with a chain from the Londinium cemetery of Newark (Ridgeway 2019, 15). The latter was associated with the remains of a young female, and stable isotope analysis on the bones indicates she spent most of her childhood in the Mediterranean region. Another example, depicting Hercules, originates from the Roman town of Mursa and was recovered from an inhumation grave that was not professionally excavated (Kovač 2020, 215). A particularly striking bone handle, also representing Hercules, was recently discovered in a richly furnished female grave near Bonn (Figure 6) (LVR-Amt für Bodendenkmalpflege im Rheinland 2019). Mercklin has several examples from older graves, both inhumation and cremation graves containing folding knives (Mercklin 1940). These contextual indicators suggest that both men and women owned folding knives, which is not surprising given their utility and cultural appeal.

Efforts have been made to determine the precise use of these knives (Riha 1986, 40; Vass 2009, 298), but the varied contexts of their findspots indicate that they served a range of purposes – similar to modern folding knives. They may have been used to slice fruit, clean nails or cut threads, among other functions. Their presence in graves strongly suggests they were items of personal use and joy. Bartus proposes that knives with gladiatorial motifs might have been souvenirs from gladiator shows (Bartus 2010, 44), akin to contemporary memorabilia like band T-shirts or football scarves. Other types of handles may also represent souvenirs or personal gifts. The variety of themes mirrors those found in hairpins from the same period. Like the knife handles, the quality of hairpins ranges from masterfully crafted pieces of art to poorly executed examples (Bartus 2007). These small, portable items, adorned with popular and recognizable motifs from Roman culture, likely appealed to the new inhabitants of the expanding empire, offering an affordable yet fashionable accessory.

Figure 6. From a well-furnished sarcophagus of a young woman, derives the artistically handsome Hercules shaped handle, excavated in Bonn (Photo: J. Vogel, LVR-Landes-Museum Bonn).

Material

A complete folding knife from Gl. Rye, Jutland

In 2020 a folding knife was entrusted to Museum Skanderborg (Søndergaard 2021). The iron blade, partly rusted, was sitting inside the shaft clearly revealing the identification of the object (Figure 1). The figural handle is constructed from two mirrored side plates and a back piece, riveted together at the top and secured with a larger pin at the bottom, which originally allowed the blade to fold in and out of the handle. The knife handle measures 8.8 cm in length, 1.7 cm in width, the back piece 1 cm.

The handle depicts a person in profile – presumably male – apparently standing with one leg in front of the other on a rectangular base. The arms are held at an angle, hands resting on the chest. Something – maybe cloth – encircles the neck of the figure and extends around the back of the head. From here on it gets more diffuse as some sort of decoration extends from the front of the head to the elbow of the figure. At the back this decoration is divided by a furrow.

The knife was found in the plough-soil of a cultivated field. No archaeological surveys have been conducted in the area, but an old parish description mentions settlement evidence from the Roman Iron Age (AD 1-375 in Denmark), including "stone paving and several pottery shards."[2] In 2009, Museum Skanderborg excavated a burial site 1 km to the east, dating to the Early Roman Iron Age (AD 1-174). This site included eleven richly furnished inhumation graves containing glass beads, copper-alloy brooches and buckles, ceramic vessels, and iron knife blades (Christensen 2009).[3]

The immediate vicinity exhibits a high density of Roman Iron Age artifacts, indicating substantial settlement activity in the area. Within 300 meters of the knife's findspot, three Roman denarii were recovered using metal detectors. One

Figure 7. Knife handle with Attis wearing a phrygian cap (Photo: Ross Thomas, British Museum).

coin, depicting Faustina Senior, was struck around AD 140; the other two are heavily worn and indiscernible, though Roman coins in Denmark are typically dated from the Flavian Dynasty onward (Horsnæs 2010, 27).

A folding knife from Melby, Zealand

The find from Melby represents a different type than those previously mentioned.[4] It consists solely of a side plate from a folding knife, appearing to have been torn or wrenched from the rest of the knife (Figure 3). The fragment measures 6.8 × 1.8 cm, is 0.5 cm thick and contains three rivet holes. Two of these are incorporated into the figure itself, while the third and largest hole is located at the base of the figure. This base rivet likely served as the pivot for the folding mechanism, like the example from Gl. Rye.

Despite wear, the handle retains a discernible level of detail, suggesting that the figure represents a griffin, characterized by the head of an eagle and the body of a lion. The figure may be depicted holding a staff, though it is also possible that this feature is a structural element of the side plate, intended to provide additional stabilization.

Iconographic analysis

The griffin on the example from Melby is a well-known motif from the Roman period, frequently appearing in mosaics, statues, sarcophagi, and as furniture fittings. It also appears in other contexts, such as the weapon sacrifice at Vimose (Funen, Denmark), excavated in the mid-19th century. Among the finds from Vimose was a bronze griffin head believed to have been part of a gladiator helmet, with a comparable example from Pompeii (Pauli Jensen 2003, 237).

Although no direct parallel to the Melby find has been identified, lions are known to appear on other knife handles, such as an example from Trier (Faust 2000, 294) and a handle in the shape of an eagles observed by Deschler-Erb (1998, 358 as well as in Canli 2020). This raises the question of whether the choice of a griffin or lion carried specific symbolic meaning or whether such motifs were used purely decoratively. The diverse range of motifs found on knife handles suggests that the figures could serve various purposes, from conveying deep symbolic meaning to being mere ornamental features on everyday objects.

Identifying direct parallels to the finds from Gl. Rye (Figure 1), Hjørring, Oslo (Figure 2), and Odder (Figure 4) within the boundaries of the Roman Empire has proven impossible. At first glance, the type resembles a ship's figurehead; however, such motifs were not in use until the 17th century.

The iconography of this type remains enigmatic. Even with the advantage of four fragments, the motif continues to elude definitive interpretation. The cloth extending from the figure's head could be likened to a Phrygian cap, most famously associated with figures such as Orpheus and Mithras. However, Orpheus is rarely depicted without his lyre and does not appear to have been a favored subject in small-scale representations. Mithras, a Roman deity of Persian origin and the central figure of the mystery cult bearing his name, offers another possibility.

The Mithraic cult was particularly popular in the northwestern provinces of the Empire, where numerous Mithraea have been unearthed (David 2021; Hensen 2014). The cult's height of popularity coincides with the peak of folding knife production, though no Mithraeum earlier than the second half of the second century has yet been found (David 2021, 426). A further potential identification is Aion, a deity linked to the Mithraic cult as the personification of cyclical eternity – an essential concept in a cult emphasizing rebirth and eternal life (Cohen 2014, 14-18). Roman representations of Aion often depict him as a youthful figure with a lion's head, wings, and coiling serpents around his body (Levi 1944, 275-277). Some sculptural depictions even show a snake protruding from the head, resembling a Phrygian cap. The coiling feature around the legs of the knife handle figure may evoke serpents, while the modeled and divided upper back could represent Aion's wings (Levi 1944, 283). However, membership in the Mithraic cult was secretive, making it unlikely that adherents would openly display their affiliation through portable objects.

A unique folding knife in the British Museum[5] features a motif of Attis, another Phrygian cap wearer (Figure 7). While this example does not directly parallel the types from Jutland and Norway, it demonstrates the existence of other, singular motifs.

Alternatively, the cloth around the head and neck of the knife from Gl. Rye (Figure 1) might suggest the figure represents Hercules wearing the skin of the Nemean Lion. However, this interpretation seems improbable, as knife handles depicting Hercules consistently portray him differently (Figure 7). He is typically shown with his club, either resting on his shoulder or nearby, and always depicted as a powerful, muscular figure. It seems highly unlikely that a worshipper of Hercules would present him with a blissful, almost foolish smile.

An intriguing archaeological discovery in a cemetery in 2023 may introduce a new perspective. A 70 cm-high statue of the sea god Triton was found near Thaynham in Kent. This unique statue depicts Triton with a lower body consisting of two coiling, elongated fish tails and fins protruding from both shoulders (Canterbury Trust 2023). Although the headgear of the knife handles is not mirrored in this find, the discovery opens up the possibility of a maritime interpretation for the lower body. However, Triton is also rarely depicted without his attribute, the trident. While male mermaids occasionally appear in Roman sculpture and mosaics, they were never a popular motif in small-scale representations. The overall composition of the standing profiled person is similar to that of the table leg type (Bartus 2007, 220-224; Fries 2008, 24-27; Mercklin 1940, 345-346), though these usually depict animals, especially lions.

The complete folding knife (Figure 1) from Gl. Rye was discovered during the COVID-19 pandemic, a period that brought unique challenges but also plenty of uneventful evenings. Many such were spent emailing photographs of the knife to museums, collections, curators, and researchers specializing in Roman small finds and Roman sculpture. Despite widespread interest and consensus that the piece appeared to be Roman, no one had encountered anything quite like it.[6]

More recent finds

At the initial stage of writing the present article, two side plates of the same type were identified (Figure 2). Both were discovered by metal detectorists – one near Hjørring in northern Denmark and the other near Halmstad, south of Oslo, Norway.[7] These fragments were examined only through photographs, but they match the complete example from Gl. Rye in form and detail. Initially, these fragments were misidentified as furniture fittings.

The Hjørring fragment was found alongside artifacts dated to the Roman Iron Age, including a gold ring, brooches and a denarius struck under Hadrian.[8] Although the immediate area remains unexcavated, three nearby grave urns of the same date suggest the presence of a cemetery within a 500-meter radius.[9] The Norwegian fragment was recovered from a field rich in Bronze Age grave mounds (Askebingen, Gravfelt). The detector finds from the area spans a date from Iron Age to late Medieval. [10]

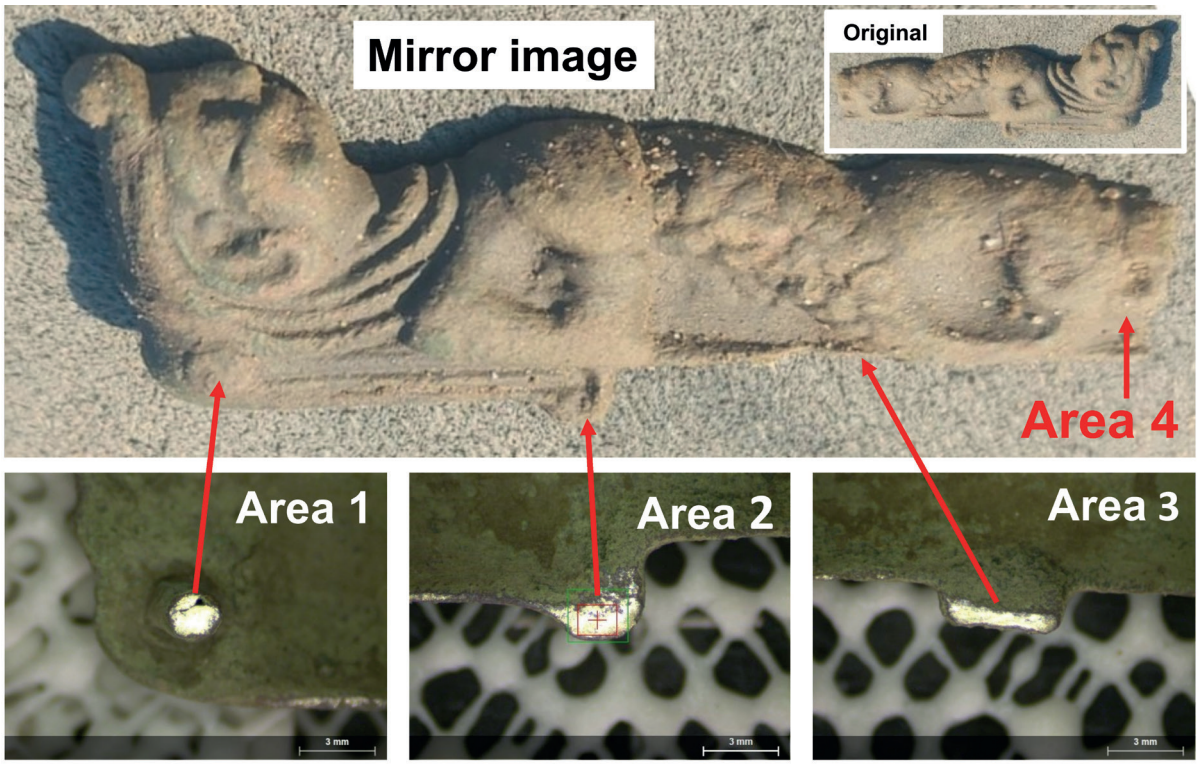
During the preparation of this article, a new side plate fragment was unearthed near Odder, approximately 25 km southeast of Gl. Rye (Figure 4).[11]

It was the only Iron Age artifact recovered during the detector survey, and no other evidence in the vicinity links the area to this era.

This fragment, measuring 5.2 cm in length (with the base and feet missing) and 1.7 cm in width, belongs to the same typological category as the previous examples. The preservation of this piece allows for sharper observation of its iconographic details. Notably, one leg exhibits the appearance of a scaly fish tail, coiling from the abdomen towards the backside. However, the absence of the feet precludes a definitive understanding of the features below the scaly area. While this fragment aligns with the typology of the complete knife, the additional details introduce complexities to its interpretation, that gave rise to doubts about the date of the knives due to the enigmatic and inexplicable nature of the iconography. A quite undesirable situation to encounter while we were in the midst of writing the article about the first discovery.

Archaeometallurgical analysis

The remarkably well-preserved and almost modern-looking handle fragment from Odder (Figure 4) was discovered during the preparation of this article. The exceptional condition of this piece had us on the brink of disbelief in our own conviction of a Roman date, thus prompting us to conduct analyses to better understand its composition and the potential provenance of the metal. This approach would also allow us to assess whether the Odder fragment aligns metallurgically with other Roman artifacts or deviates in a manner that might challenge its proposed antiquity.



Area	Cu	Zn	Pb	Sn	Ni	Cr	Fe	Si	P	K	Ca	Al	Ti
1	72.61	24.97	1.29	0.00	0.01	0.06	0.14	0.61	0.01	0.17	0.00	0.14	
2	75.06	21.60	1.63	0.00	0.18	0.07	0.47	0.83	0.00	0.15	0.02		
3	75.57	21.54	1.64	0.00	0.18	0.08	0.48	0.37	0.01	0.11	0.01		
4 (corr.)	56.35	2.55	3.71	0.17	0.02	0.01	3.50	19.60	2.85	1.07	3.64	6.33	0.20

Figure 8. Composite image showing the three areas cleaned for analysis (Areas 1-3) on the backside of the Odder sideplate (bottom images, scales = 3mm; in relation to the frontside of the object (note the top main image is mirrored horizontally to correspond with the sampling images; original orientation inserted top-right). The μ-XRF results are embedded in the image; note that Area 4 is the corroded metal surface, hence corr.).

Full methodological details and results are provided in the analysis report published elsewhere (Birch and Andreasen 2023). However, an overview of the methodology and key findings will be provided here.

Three areas were surface polished to expose fresh metal for micro-X-ray fluorescence (μ-XRF) analyses, two small areas on the side plate and one on the rivet (sampling locations and μ-XRF results shown in Figure 8). The composition was determined to be that of a high-zinc brass (alloy of copper and zinc), also referred to as a 'pure-brass' or 'alpha brass' (Scott 1992, 19-20), containing around 75 wt% copper (Cu), 23 wt% zinc (Zn) and around 1.5 wt% lead (Pb), with minor/trace amounts of nickel (Ni), chromium (Cr) and iron (Fe). A single analysis performed on the corroded surface yielded very low Zn contents, with elevated concentrations of elements commonly associated with corrosion (i.e. iron at 3.7 wt%), revealing a markedly different composition, showing the importance of analysing clean metal. Chemical mapping of the fresh metal surfaces yielded elemental maps consistent with a cast microstructure, with no signs of any further working or annealing (Figure 9). The rivet (area 1, Figure 8) on the backside directly corresponds to the cloth-like feature that continues towards the frontside of the object; this neat alignment visually disguises the rivet pin manufactured, making it impossible to discern it at all.

Zinc contents of Roman brass-alloys can be used as a crude method for distinguishing early Roman brasses from later brasses, owing to the decreasing trend in Zn content. Each time brass is re-molten, it loses approximately 1/10th of its Zn contents (Caley 1964, 83; Dungworth 1997, sec. 8.2); a 25 wt% Zn brass can reach around/below 15 wt% Zn within five or six generations of re-melting. This loss of Zn, due to its volatility is observed over time in Roman brass coinage, decreasing from ≈25 wt% Zn to ≈10 wt% over the course of 150 years (1-150 CE), as well as in other Roman style brass objects and fittings (Dungworth 1995, 1997; Jouttijärvi 2009, 2017).

These ancient brasses (Cu-Zn alloys) are mentioned by Pliny the Elder as the aurichalcum used to mint Roman coinage (Caley 1964; Healy 1978). Whilst low-Zn brasses (≈ 15 wt% Zn) have a typically golden colour or gold-like appearance, high-Zn brasses (≥ 20 wt% Zn) have a characteristic greenish-yellow colour (Craddock 1978).

The high Zn content of the brass side-plate here indicates that it is likely to fit chronologically with early Roman brasses from the 1st century AD (Craddock 1998; Dungworth 1997, sec. 6.3.1 and 7.5). The Zn concentration of the Odder side-plate sits neatly in the main (normally distributed) peak of high zinc brasses in the histogram of Zn contents from the 2100+ analyses of Roman copper-alloys (brooches and military fittings) from the 1st century AD in Denmark (Jouttijärvi 2009). No Sn was detected in the fresh metal exposed from the Odder side-plate (beneath detection limits), only in the surface corrosion (<0.1 wt% Sn), which corresponds well with the low (or absent) Sn levels analysed in Augustan (27 BC-AD 14) brasses,

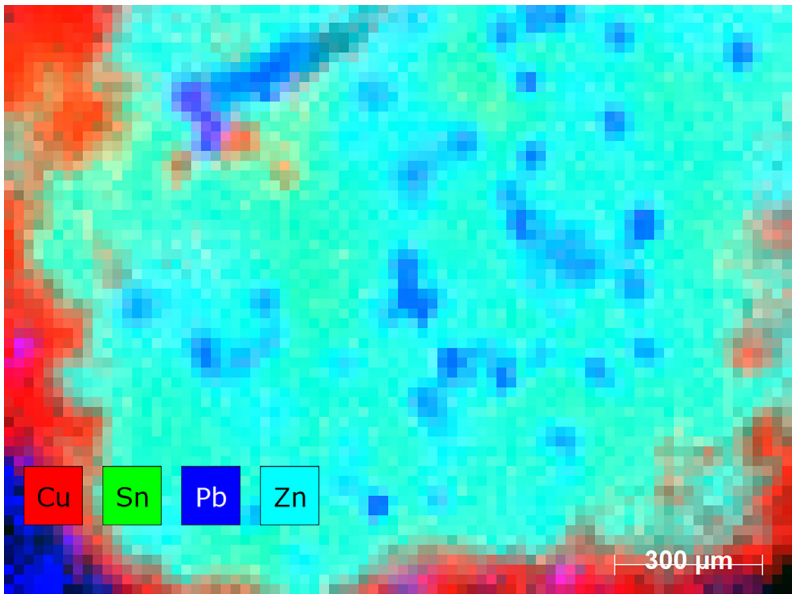


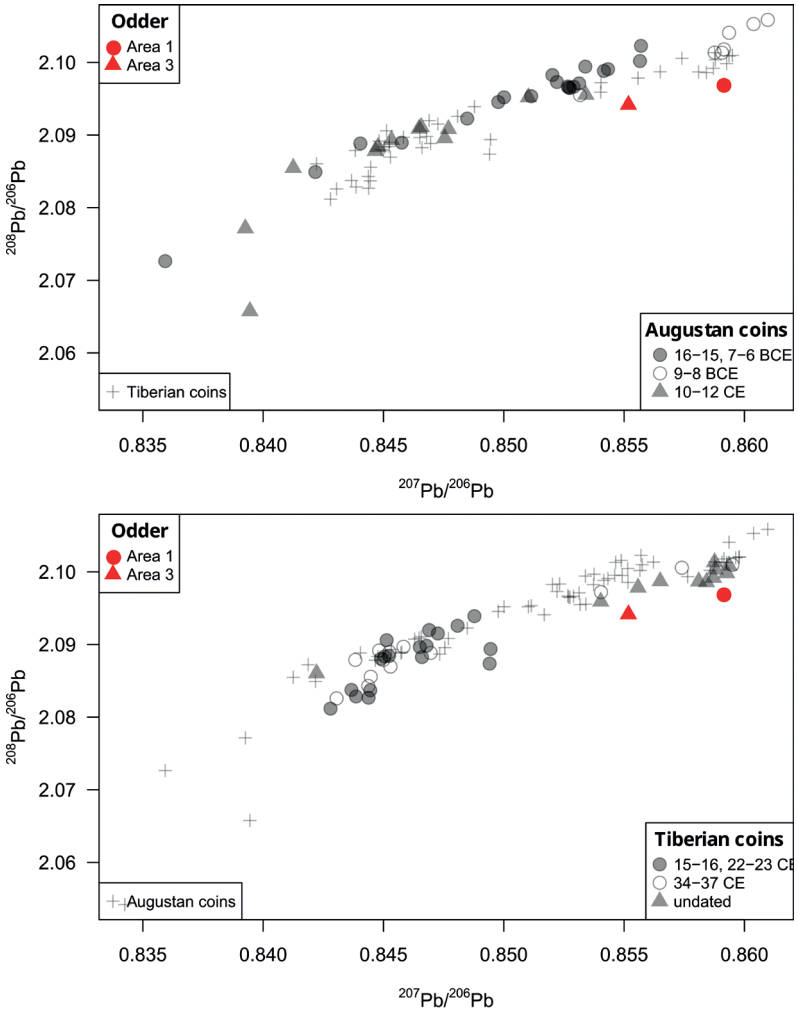
Figure 9. Composite chemical map of area 1 showing the distribution of the main elements (labelled and corresponding to colours, inset), showing the different metallic phases in the alloy; insoluble Pb globules (blue) in the primary phase (Cu-Zn) with the corroded surface (red) showing Cu depleted in Zn.

where it has been highlighted that more than half of them (56%) have very low to undetectable (<0.25 wt%) Sn contents (Merkel 2021, 253). Roman Imperial brass coinage such as sestertii and dupondii were minted from high Zn brasses, while Roman brass metalwork in general is characterised by low Zn brass alloys (Caley 1955, 1964; Craddock 1978; Di Fazio et al. 2019).

Due to the identification of the Odder sideplate as being a high Zn 'pure' brass, likely Roman, it was decided to further investigate the provenance of the metal of the artefact using lead (Pb) isotope analysis. Two micro-scrapings were taken from the exposed clean metal, one from the sideplate itself (area 1 Figure 8) and one from the rivet (area 3 Figure 8). The Pb-Pb model age was calculated from the Pb-isotope composition (Albarède et al. 2012), resulting in model ages of 387 and 383 million years ago (mya).

The lead isotope ratios compare favourably with those published for Roman brasses (see Merkel 2021), especially those used to mint Early Roman Imperial coinage as shown in Figure 10 (see Klein et al. 2004), and in particular those minted under Augustus (27 BC-AD 14) and Tiberius (AD 14-37). The fact that the two isotopic compositions from the same object are slightly different indicates that the rivet may be manufactured from a different brass, however the similarity in composition would likely preclude this. Instead, it seems likely that the slight difference in Pb-isotope results reflects a degree of inhomogeneity in the brass used to manufacture the object, however this variability falls within the range of values displayed by Augustan and Tiberian brass coinage.

Both the metal composition and the Pb-isotope values are highly similar to high Zn brasses published from Early Imperial Roman coinage,



Area	$^{208}Pb/^{206}Pb$	$^{207}Pb/^{206}Pb$	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$	Pb/Pb model age (mya)
1	2.097	0.859	18.163	15.604	38.089	388
3	2.094	0.855	18.263	15.618	38.245	333

Figure 10. Comparison of the Pb-isotope ratios of the two Odder samples (area 1 and 3) with Early Imperial Roman copper-alloy (namely brasses) coinage (reference data from Klein et al. 2004).

making this a likely anthropogenic source for the metal used to cast the Odder side-plate. When the potential dating of the source metal (coinage) is considered, the Odder artefact may be amongst the earliest Roman imports in Denmark (see Hansen 1987).

The same result is indicated by the lead isotope analysis that was performed on two samples: one from the rivet and one from the side plate. The high amount of zinc indicates that the material has not been re-melted several times as zinc is volatile when heated, meaning that zinc is lost during re-melting/-cycling of brass. This is evident in ex Roman brass coinage, where the zinc contents decline over a 150-year re-melting cycle from 25 wt% to around 10 wt% (Birch and Andreasen 2023, 10).

The lead (Pb) content is too low to discern whether it has been added or is part of the original copper ore. For either option the composition is consistent with Roman brass objects of the 1st century AD (Birch and Andreasen 2023, 15). The lead isotope composition points towards Roman mines and Roman metals as a source. Analysis of Roman military fittings and brass coinage of the Augustan and Tiberian era are comparable to the results from the side plate, and it is even possible to narrow the origin of the copper ore to two different areas within the Roman Empire (Birch and Andreasen 2023, 17).

When compared to published lead isotope reference data of ores, the nearest Euclidean neighbours are ores from the Rhine/Rhenish Massif (Eifel region, Germany) as well as the Iberian Pyrite Belt (IPB) in the Iberian Peninsula, which are both consistent with the Variscan orogeny (380-280 Ma). Both these regions show evidence of Roman mining for lead that are at least contemporaneous with Augustan copper and brass (Eifel region), if not mined earlier since the Roman Republic (Iberian Peninsula) (Bode, Hauptmann and Mezger 2009).

Discussion

Key Findings and Context

The scattered finds of folding knife fragments in Southern Scandinavia (Figure 11) suggest they were not a dominant import object from the Roman Empire. However, it is plausible that many more unidentified fragments remain unidentified in drawers and museum archives.

The absence of folding knives in burial contexts in South Scandinavia suggests that they were considered objects to be used and thus showed off as often as possible, rather than luxury items. As the contextual overview of finds in the Empire indicates, this type of artifact belongs in several different contexts, and the path from practical to very personal was probably short.

Trade and Distribution

The distribution of folding knives in South Scandinavia appears to mirror the trade routes of Roman coins (Horsnæs 2010, 33, fig. 8) and other Roman imports (Lund-Hansen 1987). This distribution was not in a direct line from the Roman provinces to the findspots. Rather, it is proposed that Roman coins circulated within Barbaricum for extended periods before reaching their final destinations (Horsnæs 2010, 187), and folding knives likely followed a similar trajectory.

Roman coins in Norway are scarce and they seem to have reached Norway via Jutland (Horsnæs 2010, 176). The fact that the Norwegian type corresponds to the fragments from Jutland raise the possibility of their production as part of a single batch. Maybe the fish-like appearance of the handle motif did not find customers within the Empire, and instead it was allocated to the North where the design would be sufficient to impress the receiver. Detailed metallurgical analyses of additional fragments could help verify the batch-hypothesis.

Provincial Origins and Iconography

The folding knives were in use from the 1st century but reached their peak popularity between the mid-2nd and mid-4th centuries AD, functioning both as practical tools and as markers of personal identity and taste. Interestingly, folding knives are rarely found in Rome or Italy, which may be reflected in differences in preservation, publication practices,

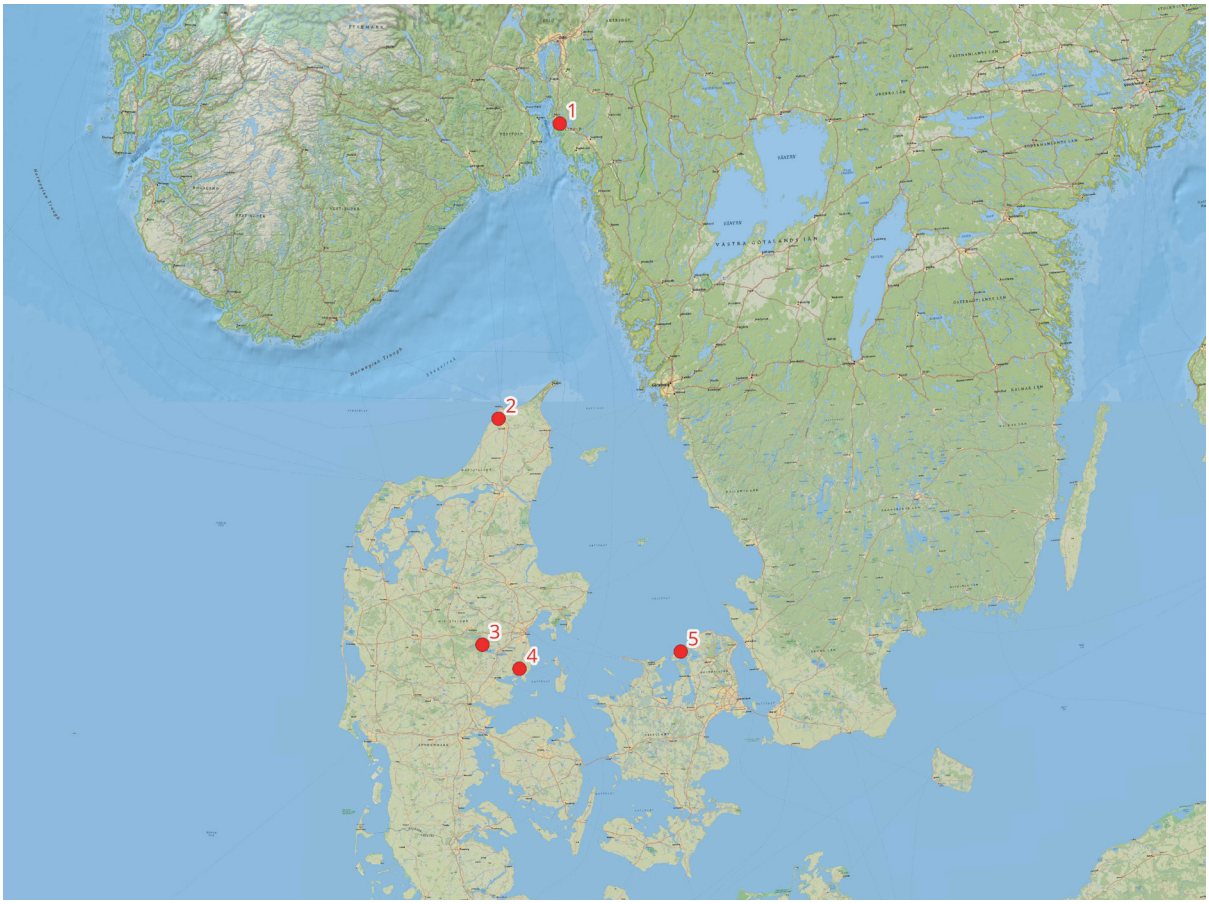


Figure 11. Distribution of folding knives in Scandinavia. 1: Askebingen (C57552), 2: Kærsgård (100615-97), 3: Gl. Rye (160405-140), 4: Odder (DIME 156143) 5: Bakkekammen, Melby (010505-164).

or perhaps cultural preferences of the past. Rather than originating in Rome itself, these knives seem to have been crafted in provincial workshops that catered to local tastes.

The iconography of these knives – including motifs such as gladiatorial scenes, eagles, and lions and even asparagus – demonstrates a strong connection to Roman cultural symbols. However, their appeal lay not in their direct association with the city of Rome but in their embodiment of Roman provincial identity. The Melby knife exhibits iconographical elements widely recognized within the Empire. The Odder fragment and its companions are less recognizable in terms here off, but material, size, design and construction mirror the overall group of folding knives.

Metallurgical analysis of the Odder side plate revealed a copper alloy composition similar to Roman sestertii of the 1st century AD, likely sourced in mines in the Eifel Mountains near Trier – proposed as one of the main hubs for production of folding knives (Mercklin 1940, 352) even though the varied quality indicates a somewhat liberal market of production within local workshops (Kovač 2019, 116). A thorough investigation of style combined with metallurgical analysis of several knives of the continent might clarify if the copper alloy pieces are a specialty of the Limes area, whereas the bone carved might be manufactured anywhere. The result of the analysis reinforces the interpretation of Scandinavian folding knives as provincial products influenced by Roman culture.

Conclusion

The archeometallurgical analysis provides valuable insight into the folding knives' composition, closely resembling that of 1st-century brass fittings and coins. While it does not yield an exact date, the absence of signs of re-melting – common in post-medieval copper alloys – makes a medieval or Renaissance origin highly unlikely. This, combined

with the manufacturing style and folding mechanism, which align with knives found in several Roman provinces, particularly Britannia and Germania, strongly supports a Roman provenance. Only one fragment was analyzed but as this fragment was identical to the three other fragments, it seems fair to conclude that they derive from the same region as well.

Although no exact iconographic parallels have been identified for the fragments from Jutland, Norway, and Melby, the diversity of motifs in Roman material culture suggests that these knives fit within the broad artistic repertoire of the Empire. Similar unique types have appeared in catalogues, reinforcing the interpretation of these knives as Roman provincial products. As such, they should be considered imported objects, akin to other Roman goods such as glass and silver coins.

The smoking gun (or knife, really!) would be the discovery of an example in a grave of Roman Iron Age date in Southern Scandinavia or an exact parallel to one of the presented types in a Roman context. Until such evidence emerges, the findings presented here provide a strong basis for further study and may help bring new examples to light – either through fresh discoveries or the reassessment of previously overlooked finds in museum collections. Continued metallurgical and stylistic analyses will further refine our understanding of these objects and their role in the complex networks of trade and cultural exchange between the Roman world and Southern Scandinavia.

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Notes

1 Oslo: Unimusportalen C57557 (wrongly described as a fragment of furniture fitting, but dated to Roman Iron Age and of possible continental origin) and VHM 00566 Kærsgård (100615-97).
2 Authors' own translation: Boplads fra Romersk Jernalder med Stenlægninger og mange Lerkarskaar. 160405-140 Gl. Rye.
3 160405-205 Katrinesminde I.
4 010505-164 Bakkekammen, Melby.
5 Inv. 1772,0312.87, British Museum.
6 The number of people the images were sent to is too comprehensive to list here, but many thanks to each and every one for their time and eagerness to reply, suggest and discuss.
7 Oslo: Unimusportalen C57557 (wrongly described as a fragment of furniture fitting, but dated to Roman Iron Age and of possible continental origin) and VHM 00566 Kærsgård 100615-97.
8 VHM 00566 Kærsgård 100615-97.
9 100615-64, 100615-45, 100615-58.
10 www.kulturminnesok.no 22299.
11 DIME 156143.

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