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Tools of Different Trades? Merging Skill Sets in Metalworking at Viking Age Kaupang

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In Old Norse poetic literature, the smiðr *was a master of the arts, able to control and shape multiple materials into various kinds of objects. While the mythological* smiðr *has been regarded as separate from the real-world blacksmiths and metalworkers of gold, silver, and copper alloys, the archaeological evidence recovered in towns and workshops of the Viking Age, as well as medieval written sources, provide a different perspective. In 2015, a hitherto unknown, well-preserved workshop was excavated in the Viking town of Kaupang in Norway, containing evidence of complex metalworking requiring the skills of blacksmiths and workers of soft metals. In this article, the authors venture beyond the Old Norse myths, into the world of the proficient smiths as multi-crafters and their tools of the trade.*

Keywords: Viking town, Kaupang, metal workshop, metal technology, multi-crafting, Norse mythology

Introduction

Highly decorated weapons and jewellery from graves of the Viking world give us a glimpse into the metalsmiths' capabilities and the importance of fine metal workshops on which society relied, in life and in the afterlife. Many Viking Age metalworkers were professionalized and extremely knowledgeable in metalworking techniques and the use of various alloys (see e.g. Pedersen, 2016, with further references). Production waste found in early towns (Figure 1) as well as at high-status farmsteads, occasionally in large quantities, constitutes essential evidence for our understanding of the technology and labour required. During the last few decades, studies of alloys, crucibles, casting moulds, and other debris have contributed to a growing body of research into the technical aspects of non-ferrous metalworking (e.g. Ottaway, 1992; Jouttijärvi et al., 2005; Söderberg, 2008; Gustafsson, 2013; Ambrosiani, 2013, 2021; Pedersen, 2016; Croix, 2020; Croix et al., 2022). The status and labour of urban ironworking has, by contrast, received less attention (see Ottaway, 2019 for an overview), and few studies have addressed both iron and non-ferrous metalworking together.

Well-preserved workshop contexts are vital for understanding the processes and knowledge employed by the producers of Viking Age metal objects, but few intact workshops have been identified and most are poorly preserved, partly due to the 'elusiveness' of the smiths and their

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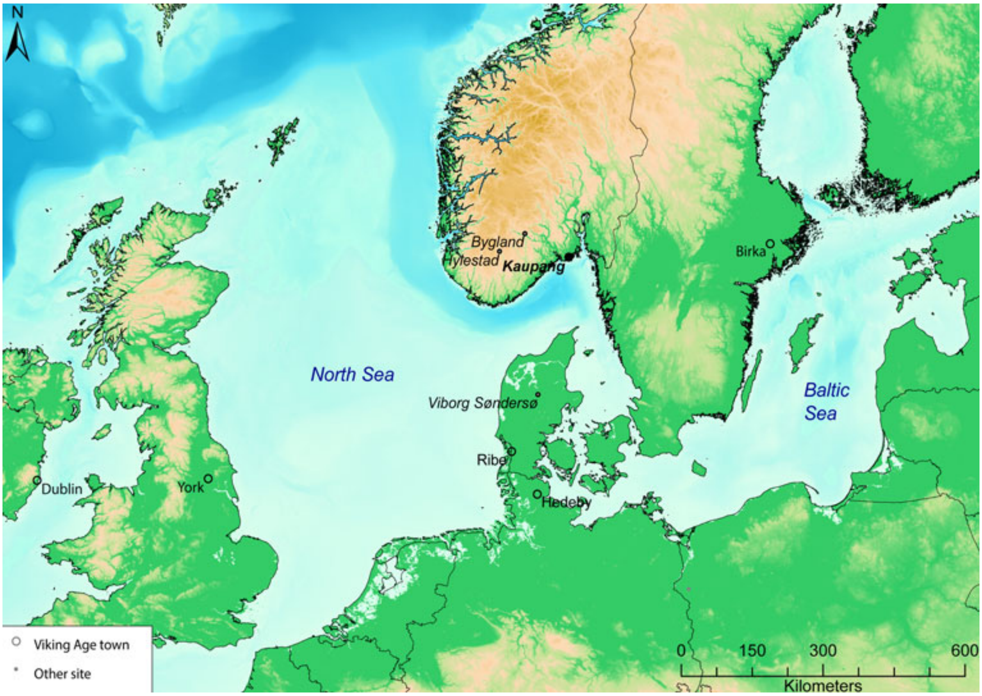

Figure 1. *Location map with sites mentioned.*

workshops (Pesch & Blankenfeldt, 2012; Wicker, 2012). Hence, aspects such as the organization of work and the metalworkers' expertise in handling a range of alloys and metals are only partly understood. New results and data from a workshop excavated at Kaupang in 2015, detailed below, where both iron and soft metals were handled, give us the opportunity to present and discuss the work of prolific metalworkers and the extent to which the combination of skill sets raised the profile of the Viking Age smith as a multi-crafter, that is, an artisan well skilled in techniques and materials, able to produce objects in different materials and composite artefacts.

Myths and Literary Sources

The Old Norse word *smiðr*, meaning 'smith' or 'crafter', refers to the making of objects regardless of material, be it wood, bone, glass, or metals (Capelle, 2012: 17–18). In the mythological text known as the 'Lay of Vǫlundr', the smith boasts about his range of skills (Pettit, 2023: 341–64). The mythical Vǫlundr is a skilful 'master of fine metals', but also a man able to sharpen and temper his own sword. Vǫlundr has his equal in the dwarf smith Regin in the Poetic Edda and the late thirteenth-century Volsunga Saga. He describes himself as a master *smiðr*: 'I knew how to work iron, as well as silver and gold, and from everything I could make something useful' (Byock, 1990: 57) (Figure 2); many such other artisans are mentioned in Old Norse texts dating from the ninth to the sixteenth century AD (Carstens, 2012; Marold, 2012). Vǫlundr and Regin have their origins in Germanic legends, where they perhaps embodied a more widespread idea of multi-crafters in early medieval northern Europe (Byock, 1990: 1–7;

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Figure 2. *The dwarf smith Regin and his apprentice depicted on the doorway of the Hylestad stave church, Norway, dated to c.* AD *1200.* © Museum of Cultural History, University of Oslo, photograph by Ove Holst (CC BY-SA 4.0).

Hedeager, 2011: 140–44, 177–81; Hardt, 2012). There are similar ideas in the Irish Mythological Cycle, e.g. in reference to the god Lugh as 'a master of all arts' (Old Irish *Samildánach*; Stokes, 1891: 77). In essence, a *smiðr*, in the original sense of the word, was a highly versatile artisan.

Several medieval written sources give descriptions of real-world metalworkers (for a discussion of ideal and real smiths of the Viking world, see Pedersen, 2009, 2016). One of the most detailed is by Theophilus Presbyter, who wrote *De diversis artibus* in the first half of the twelfth century (Hawthorne & Smith, 1979). He gives us an insight into the variety of techniques employed in the production of precious items in gold, silver, copper, and tin, as well as iron. Theophilus also included chapters referring to the making of iron tools, where he describes forging and the hardening of steel through water-quenching (Hendrie, 1847: 211–25). The level of detail and technical knowledge, as well as the designs of individual tools, suggest that Theophilus was himself a multi-crafter, even producing his own toolset. It also indicates that he was very much aware of the changing properties of iron through forging and of the techniques of iron soldering and brazing. Even decorative techniques, such as encrustation, that is used solely on iron objects and involves the application of precious metals, is discussed in Theophilus's treatise (Hendrie, 1847: 381). The way Theophilus also included both ironworking and technically advanced processes aligns him with the *smiðr* Vǫlundr.

Graves, Hoards, and the Idea of the Multi-Crafter

In 1951, Jan Petersen counted as many as 375 Viking Age graves with metalworking tools in Norway alone (Petersen, 1951: 108). Most contained only a few such tools and may represent the toolsets used by the deceased (Bøckman, 2007: 91) or symbolic attributes of high-ranking individuals (Ježek, 2015). There are also several Scandinavian examples of hoards containing toolsets and graves richly furnished with a large assemblage of both wood- and metalworking tools (Blindheim, 1963; Müller-Wille, 1977: 173–93; Arwidsson & Berg, 1999; Barndon & Olsen, 2018). Blacksmithing tools are commonly found in combination with lightweight hammers, small tongs, small chisels, and sheet-metal shears, as well as small anvils for working softer metal (e.g. Blindheim, 1963) (Figure 3). The combined toolsets have led to the suggestion that there was no clear distinction between the many types of metalworkers in the Nordic past (Petersen, 1951: 104; Müller-Wille, 1977: 193; Jørgensen, 2012: 4; Guldberg, 2014). Whether or not the burial was that of an actual (or 'professional') smith, the

Figure 3. *A metalworkers' assemblage from a grave at Bygland, Norway. It contained a wide range of tools, from heavy sledgehammers (top left), small chisels, and punches (bottom left and right), to a long-handled iron pan for melting lead and tin (centre right) resting on a soapstone mould for casting ingots, as well as tools for working both ferrous and non-ferrous metals.* © Museum of Cultural History, University of Oslo, photograph by Ove Holst. (CC BY-SA 4.0).

deposition reflects a status aligned with the mythological Vǫlundr. These graves and hoards may mirror the idea of the *smiðr* as a multi-crafter.

However, becoming a multi-crafter required the right conditions for the transfer of knowledge through social interaction. Undoubtedly, it must have involved long training. A skilled metalworker may well have begun training during childhood, and the understanding of materials and complex techniques must have taken years (Pesch, 2012: 41, with further references). While the multi-crafter was an ideal of the late first-millennium AD Scandinavia, probably only a limited number of people could have learnt to handle both iron and soft metals at a technologically advanced level. The development of skills must have been conditioned, requiring proper learning arenas and social mechanisms, such as those present in the royal courts mentioned in the sagas (Capelle, 2012: 17–18) and in Viking Age towns.

The Metalworkers in Towns, Marketplaces, and Farmsteads

From the 1930s onwards, an increased interest in Viking Age towns and early urbanism (see Hyenstrand, 1992: 39–40; Hilberg, 2022: 38) is reflected in excavations that yielded an enormous body of material relating to production techniques, processes, crafts, and trade in Viking Age Scandinavia. While fine metalworkers and their products have received much attention (e.g. Armbruster, 2004, 2012; Feveile,

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2006; Ambrosiani, 2013; Pedersen, 2016, 2017; Orfanou et. al., 2021), the working of iron (blacksmithing) and the way the blacksmiths' roles and skill sets were integrated in this milieu have attracted less notice (see, however, Ottaway, 2019). The extensive excavation campaigns of 1998–2003 at Kaupang did not reveal any *in situ* traces of ironworking or interrelations between different types of metalworking. It has nevertheless been suggested that non-ferrous and ferrous metalworking may have been carried out by different specialists at Kaupang (Pedersen, 2015: 55), in view of the finds recovered at Ribe and Birka. Recent excavations at Ribe have uncovered traces of both ferrous and non-ferrous metalworking in the same workshop floor, dating to *c.* AD 810–830. The key activity though seems to have been the casting of soft metals—at least in one part of the building (Croix et. al., 2022: 174–75, 179).

Non-ferrous metalworking activity is somewhat easier to date typologically than pieces of iron slag. Metalworking tools and casting waste from soft metals may also be less difficult to link directly to processes and products. Further, iron tools, ingots, and slag/smelts of precious metals are more often recovered in metal-detecting, whereas iron slag may be overlooked (Gustafsson, 2013: 23). These factors affect the balance, availability, and compilation of key data for research into the presence and mechanics of multi-crafters in Viking Age markets and towns.

The Urban Scene and Viking Age Kaupang

Essential for what is today regarded as the 'Viking world' was a network of proto-urban nodes in north-western Europe connected by trade across the North Sea and the Baltic during the ninth and tenth centuries AD (Sindbæk, 2007). These centres were commonly founded and protected by powerful nobles and served as hubs for local and regional crafts and exchange (Sindbæk, 2007: 127). The remains of buildings, a vast number of artefacts, cultural deposits, and associated graves attest to long-distance trade and contact across the known world.

Kaupang, on the south-eastern coastline of present-day Norway, was one such centrally located nodal point. It is mentioned, around AD 890, as *Skiringssal* by the tradesman Ottar in a report to King Alfred of England (Skre, 2007: 28–29). It was later named Kaupang, derived from the old Norwegian term *kaupangr*, meaning 'market' or 'trading place' (Brink, 2007: 63).

The central part of Kaupang, the so-called 'Black Earth', consists of cultural deposits encompassing a 650 m-long belt along the western bank of the inlet of Kaupang (Figure 4, top). The size of Kaupang during the Viking Age is estimated to cover approximately 20,000 m^2, surrounded by a 34,000 m^2 zone with areas of more temporary trade and craft activity. Since 1956, around ten per cent of these areas has been excavated, including a harbour area (Pilø, 2007a: 130–31; 2007b: 152–54). Kaupang is interpreted as a permanent settlement from *c.* AD 800 to 930. Thereafter, trading and crafting appears to have continued only to a limited extent for another forty years before the site lost its function as a place for artisans and traders (Pilø, 2007d: 177–78).

The main layout of Kaupang comprised small rectangular plots separated by ditches and fences, similar to most other urban Viking sites (Skre, 2008: 88–89, with references). It is estimated that some 90–100 plots existed within the central area along the bay, each plot large enough (approximately 40–80 m^2) for one building and a small outdoor area (Pilø, 2007c: 193; 2007d: 178; Skre, 2008: 89). The

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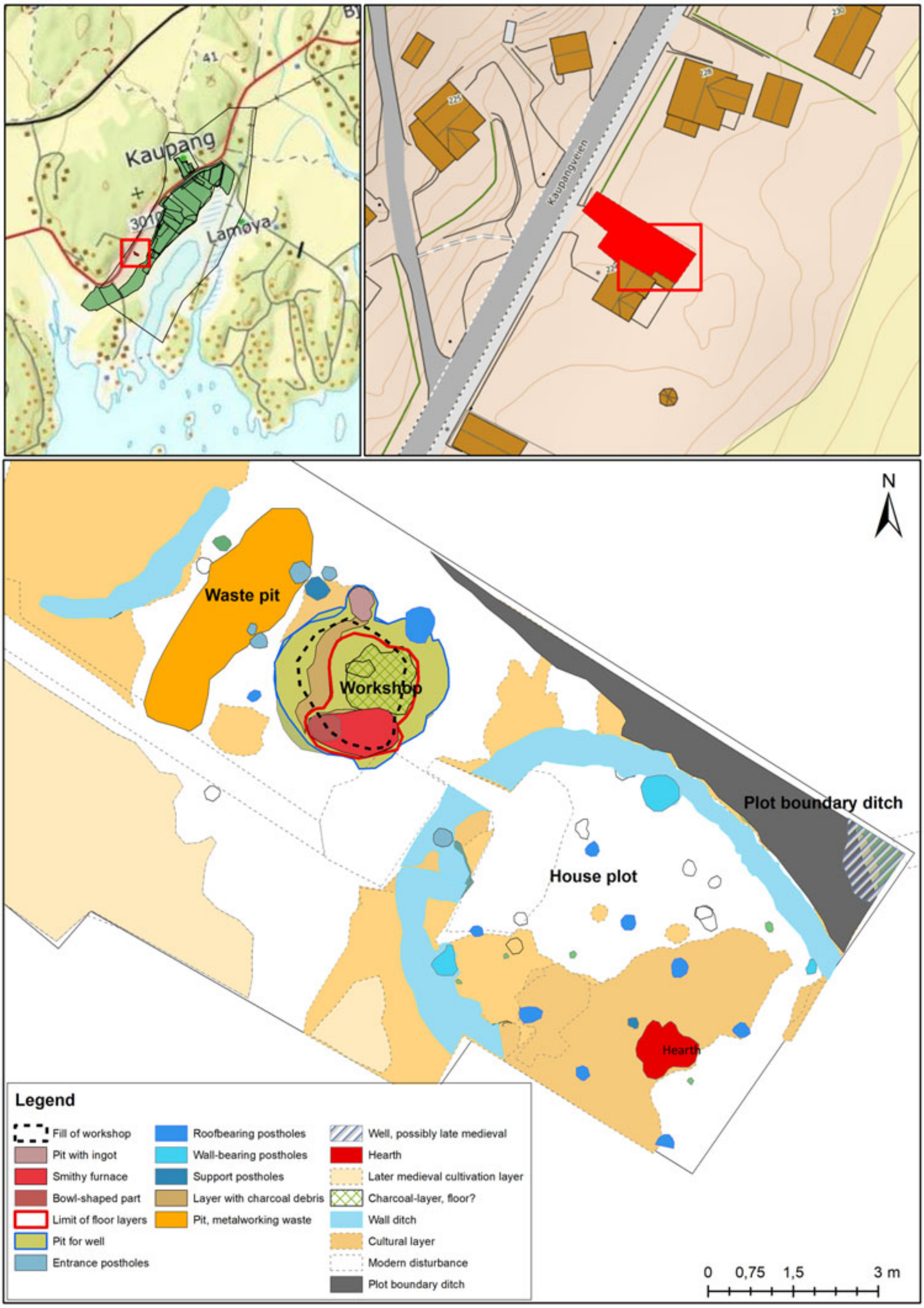

Figure 4. *Top: Kaupang and the site of Kaupangveien 224. Bottom: the site's main archaeological features, including a well-defined domestic building ('house plot'), associated with the workshop and waste pit.*

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excavation campaigns of 1998–2003 uncovered six plots, five of which contained house remains of a relatively uniform type (Pilø, 2007c).

Unn Pedersen has conducted extensive studies of the metalworking activity at Kaupang (Pedersen, 2009, 2015, 2016). While the excavations of 1998–2003 did not reveal any well-defined workshops with an intact furnace, evidence of fine metalworking was identified in two stratified contexts: a small part of a floor layer (plot 1B) and in house A302 (plot 3A). Because no iron slag was recovered in the floor layer of plot 1B, it was concluded that this may have been a specialized workshop for silver casting, as well as other soft metals. The finds and stratigraphy suggest a date to the second half of the ninth century for metalworking activity in plot 1B (post-AD 863) and pre-AD 840/850 for house A302 (Pedersen, 2016: 182–84).

The Kaupang complex may originally also have contained about 1000 graves (Stylegar, 2007: 75–78). Nearly 200 have been excavated, displaying diverse burial customs, as well as a close relationship to the town's trading and production activities. The assemblage of artefacts of iron and soft metals from these burials is rich and varied, some showing excellent craftsmanship. Numerous graves surrounding Kaupang contained tools related to different types of metalworking and have been linked to activities in the town (Blindheim, 1981: 44).

The Kaupang Workshop

During the summer of 2015, a small rescue excavation of *c.* 160 m^2 in the south-western part of Kaupang (Figure 4, bottom) revealed, among other finds, a domestic building with roof-bearing posts, a curved wall ditch, and a hearth; its plan suggests a possible link to the Dublin-style houses of the Viking Age (Wallace, 1992: 100). The building was radiocarbon-dated to 1211 ± 29 BP, cal AD 702–891 (at 95.4 per cent confidence; Ua-53944, charred barley from a posthole) and 1218 ± 29 BP, cal AD 692–888 (at 95.4 per cent confidence; Ua-53945, charred barley, central hearth). Directly to the north-west of this building and at the same discovered plot, a well-preserved metal workshop with a furnace and an associated waste pit with metalworking debris was uncovered.

The workshop area was quite small and sub-rectangular, measuring approximately 2.6 × 2 m. The activity layers were well defined, suggesting that the workshop was enclosed by walls. An earlier well, lined with wooden planks, was situated underneath the workshop; it had been plugged before the workshop was built and was slightly truncated in the process. This process created a depression—which made it possible to construct a sunken floor in an easy and opportunistic way. Postholes suggest that timber posts supported a makeshift roof, and two juxtaposed postholes in the workshop's north-western corner may have been related to a possible entrance. A shallow, elongated waste pit lay directly outside this entrance, an expeditious place to dump waste from metalworking when cleaning the floor.

Inside the workshop, features include a 1.6 × 0.8 m dual-pit forge. The forge itself consisted of a shallow pit connected to a deeper pit, both lined with clay and located at the far end, opposite the entrance. The forge was dug into the sandy backfill of the well beneath the workshop. A modern disturbance had cut the southern part, truncating a small part of the forge (Figure 5).

Next to, and around the forge, several charcoal-rich layers contained various amounts of metalworking debris. Analysis of soil sampled in a limited grid from these soot- and charcoal-rich floor layers

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Figure 5. *The metal workshop, view towards north-northeast. The clay-lined dual-pit forge at the bottom of the image is only partly excavated, and sandy soot- and charcoal-rich floor layers lie directly north of the forge. To the left is the circular cut of the underlying well.*

(A2612/R2612 and A2713/R2713) showed the presence of hammerscales and slag spheroids from ironworking, in combination with crucible fragments (n = 61) and other forms of debris from handling soft metals (Jouttijärvi, 2017: 18–32, 38–42, see also below). In contrast, two layers, interpreted as the fill of the workshop itself (A2425, A2426), contained fewer crucible fragments (n = 30), little slag, and much less charcoal. The largest assemblage of crucibles was collected from the forge itself, with 187 fragments. As for tools, only a small, well-used chisel was recovered.

The workshop has been dated by multiple methods. The well beneath the workshop, lined with vertical planks of oak of variable size and thickness, displayed signs of reuse and some had holes filled with wooden pegs. The planks were dated by dendrochronology, with felling dates in *c.* AD 800–805 and during the winter of AD 823/824 (Daly, 2016) (Figure 6), which provide a solid *terminus post quem* for the metalworking activity. A charred fragment of hazelnut from the larger dual-pit forge was radiocarbon-dated to 1046 ± 31 BP, cal AD 895–1038 (at 95.4 per cent confidence; Ua-53943) and an uncharred hazelnut fragment in a shallow pit at the entrance was dated to 1140 ± 30 BP, cal AD 774–992 (at 95.4 per cent confidence; Ua-53942). The uncharred hazelnut lay next to a large brass ingot (cf. Figure 4) and was preserved due to the antibacterial qualities of copper alloy. The ingot is similar in size and shape as examples from a hoard in Hedeby, a type dated to the eighth and early ninth century AD (Sindbæk, 2003: 57–58). The same pit also contained an oblate spheroid weight with simple dot decoration of a type more common after

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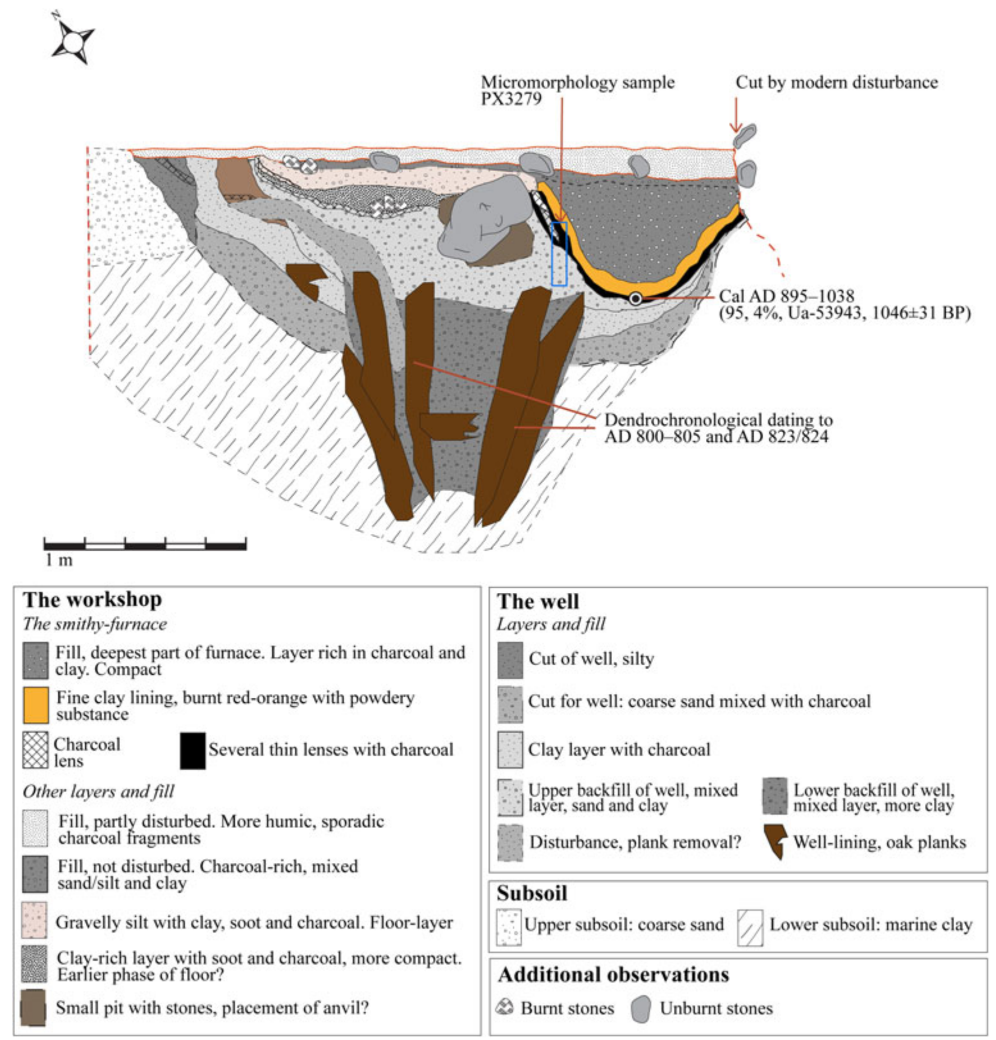

Figure 6. *Section through the workshop and underlying well.*

c. AD 860/870 (Gustin, 2004: 314). Fragments of five different beads, of which two belong to Johan Callmer's (1977) group Av, type A340T (AD 835/840–875/890), and one to group Bc, type B545 (AD 830/840–860/870), were found in the workshop; although only bead B545 was collected from an *in situ* layer. The rest were recovered from the backfill layers, and their typological dating and context suggest that they were redeposited.

The combination of these dates, together with stratigraphic data, suggests that the workshop was not established before AD 824. While the timeframe between the oak felling and the reuse of the timber in the well is difficult to estimate, the radiocarbon data support a dating to the latter part of the Viking Age: the latest ^{14}C date of cal AD 895–1038 on a fragment of hazelnut shell retrieved from a sealed context, with additional fragments found in the same micro-context, lends further reliable support.

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The recovery at Kaupang of typologically datable finds during the 1998–2003 investigations of non-stratified deposits suggests that occupation of the settlement ended in *c.* AD 960–980, although later cultivation has eradicated stratified deposits later than AD 840/850. The workshop thus seems to have been in use in the later period of occupation at Viking Kaupang, possibly during a period previously thought to have been destroyed by subsequent farming (cf. Pilø, 2007d: 177–78). Its sunken floor saved it from eradication by later agricultural activity.

Ironwork

Iron slag, weighing 3.5 kg, was retrieved from the workshop and associated waste pit (Figure 7.4). Approximately 2.6 kg was collected from the elongated waste pit and 0.7 kg from various layers within the workshop itself. The waste pit contained the largest pieces of slag, two of which resembled small blooms. No clear stratification was observed within the pit, and fragments of crucibles, in addition to a few pieces of copper alloy and a piece of gold, were uncovered in the same layer as the iron slag.

Figure 7. *A chisel (1), a possible bell-hammer (2), an iron spring fastener for oval brooches (3), and slag from working iron (4) and fine metal (5).* © Museum of Cultural History, University of Oslo, photograph by Vegard Vike (CC BY-SA 4.0).

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Six pieces of ferrous slag were metallurgically analysed using scanning electron microscopy with energy dispersive X-ray spectroscopy (SEM/EDX) to determine their composition, three from the workshop and three from the waste pit (Jouttijärvi, 2017: 42, 127–34). The workshop also contained items such as rivets, nails, cramp irons, a bolt, and a fishhook, all of iron and possibly made in the workshop.

Microscopic finds of hammerscales and slag spheroids suggest that both refining of raw iron (bloom) and working of refined iron took place in the workshop. Moreover, the analysis of selected pieces of iron slag from the waste pit and the workshop displayed similarities in composition and structure. With one exception, the analysis suggested that the refining/working of blooms probably came from the same iron extraction event or the same source of bog iron. One piece of slag contained a higher amount of manganese oxides, suggesting extraction from another bog source (Jouttijärvi, 2017: 42). The results indicate one or two episodes of refining iron and the similarities of slag composition provide insights into the relation between the debris in the pit to the activity inside the workshop. This gives us a rare glimpse into the upkeep and maintenance of the workshop during its lifespan.

Iron refinement indicates that the raw iron may have been brought here directly from an extraction site. More recent sources of traditional blacksmithing highlight the importance of refining as integral to the production of good quality iron (e.g. Evenstad, 1790: 437–40) and of the role of the blacksmith as a quality assessor of good workable iron.

Soft Metals and Technical Work

Soft metals were recovered in various amounts in the workshop and the adjoining waste pit, from the same contexts as the ironworking debris (Figure 8). The evidence for working soft metals consisted of nearly 500 fragments of crucibles (0.42 kg), approximately 300 fragments of burnt clay (1.2 kg), pieces of clay moulds, two offcuts of silver and one of gold, as well as melting debris from copper alloys and lead (Figure 9).

The metallurgical analysis of thirty-one crucible fragments, of which sixteen were from the workshop itself and fifteen from the adjoining waste pit, revealed that three different types of temper had been used in producing the crucibles. One group was exclusively tempered with quartz, one with feldspar, and the third group with a combination of both. Soft metals like gold and silver had been worked, but far less frequently than brass, bronze, and lead-bronze alloys (Jouttijärvi, 2017: 5). The use and work of such non-ferrous alloys are in line with previous analysis of metalworking waste recovered at Kaupang in 1998–2003 (Pedersen, 2016: 189–94, fig. 5.1).

Four fragments of crucibles used in cupellation were identified, supporting the case for small-scale refining in the workshop, perhaps of impure silver (see Bayley & Eckstein, 1995). The process of cupellation involves the removal of impurities by adding lead to liquefied metal. A spongious material (e.g. charcoal or bone) can be added. The oxidizing lead acts as a binding agent for impurities, thus encouraging the purification of silver for further recycling and/or quality assessment. The cupel fragments had a mixture of quartz and feldspar as a temper, with distinct layers of lead oxides clearly visible on X-ray. Crucibles densely tempered with quartz have previously been identified at tenth-century AD Fyrkat, where they had been used in silver refining (Lønborg, 1998: 14–15).

A small group of crucible fragments, made of a thicker material, stood out from

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Figure 8. *Selected metalworking finds from the workshop. (1) a 190 mm-long brass ingot; (2) offcut of gold with spirals in false filigree; (3) offcuts of brass; (4) a spheroid weight with simple dot decoration; (5) offcut of silver.* © Museum of Cultural History, University of Oslo, photograph by Vegard Vike. (CC BY-SA 4.0)

the assemblage. While also made of fired clay tempered with quartz and feldspar, their cross-section showed a layered encrustation, one dark grey and one with bright red/purplish oxidation. The metallurgical analysis of one piece indicated markedly higher levels of evenly dispersed silver in the dark grey layer, as well as silver sulphides. This combination indicates that niello was produced (Jouttijärvi, 2017: 10–11), and may suggest that technically advanced methods of decoration took place in the workshop.

Micromorphological studies of the charcoal-mixed layers in the forge found evidence of both ferrous and non-ferrous metalworking in the form of trace elements embedded in the same micro-contexts: siliceous glassy slag and trace amounts of zinc were found, possibly deriving from marine plant material, suggesting either the use of fluxes in soldering or a source of fuel in the workshop (Macphail & Linderholm, 2016: 2, 8–11).

Most of the clay casting moulds were poorly preserved, as were those from earlier

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Figure 9. *Poorly preserved clay moulds with imprints (top left), small crucible fragments (right), and fragments of charred hazelnut shells (bottom left), all from the workshop.* © Museum of Cultural History, University of Oslo, photograph by Vegard Vike (CC BY-SA 4.0).

excavations (Pedersen, 2016: 181–83), and very few reveal any indications as to what was cast in the workshop. The imprint of part of a pin in one of the mould fragments (Figure 9) hints at the production of simple stickpins—a common type of jewellery in the western Viking world (Graham-Campbell, 2007). An iron spring fastener (Figure 7.3), typical of oval brooches, suggests that the production or repair of such jewellery also took place.

Three fragments of metallurgical clay packages with faint traces of textile or organic imprints show that brazing of iron may also have been carried out. The imprints are from wrapping iron parts with strips of copper alloy, enclosing them in clay packages, and heating them in the forge in order to braze the iron parts together (see Söderberg, 2004). Such fragments have been identified in earlier excavations at Kaupang as possibly representing the production of padlocks (Pedersen, 2016: 135–40). Large-scale production of padlocks and small bells has been suggested for Birka (Gustafsson, 2005), and spherical weights were produced in similar clay packages (Söderberg, 1996), indicating that similar techniques for dissimilar objects were employed in the same milieu.

The 190 mm-long brass ingot mentioned earlier (Figure 8.1) is similar to ingots from Hedeby (parallels to ingot hoards from Myrvälde and Kamänget on Gotland in Sweden are also worth noting, though the Gotlandic types are much larger). Clay moulds from casting Hedeby-type ingots have been found at Ribe (Sindbæk, 2003). Recent lead isotope analysis of ingots from the Hedeby hoard indicate that they must have been produced at a high level of standardization, possibly from Balkan copper ores (Merkel,

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2018), suggesting that specific workshops had direct access to raw materials, through organized production, and that metalworkers contributed to a market-driven economy. The Kaupang workshop may have been part of this network.

The smithing debris in our Kaupang workshop attests to varied techniques, processes, metals, and alloys, reflecting shared customs and contacts, as well as *ways of doing* between different Viking workshops. In turn, this may mirror learning traditions and diversity, reflecting the metalworkers' individual environs.

Multi-Crafters or Interdisciplinary Collaborators

Initially we addressed the idea of the *smiðr*, the multi-crafter of the Viking world, and argued that Viking graves and hoards could reflect such an idea. The excavation of the Kaupang workshop indicates that highly technical and diverse metalworking processes took place within the same workshop, raising the question of multi-crafting.

Mixed contexts with traces of both ferrous and non-ferrous metalworking are not unique for Kaupang. Indications of similar combined workshops have been identified in major Viking trading centres such as Birka (Ambrosiani, 2013: 223), Dublin (Wallace, 2016: 311), Hedeby (Schietzel et al., 2014), Ribe (Brinch-Madsen, 1984: 79–90, cf. 2004: 206–10), and York (Ottaway, 1992: 719), and examples are known from outside urban towns (Gustafsson, 2011). A workshop in the late Viking Age settlement of Viborg Søndersø in Jutland (Denmark) offers the most detailed insight into the combination of such activities. Studies of its well-preserved microtopography showed evidence of varied use (Jouttijärvi et al., 2005; Jouttijärvi, 2014), including iron smithing, casting of silver, bronze, and lead, as well as comb-making, i.e. evidence of multiple crafts. Pieces of cupellation crucibles were also found, as at our Kaupang workshop, although in small amounts, suggesting that silver refining may also have taken place. The range of products made in the same workshop during the same season may suggest that the Viborg workshop was used by more than one craftsperson. It is, however, impossible to determine how many were present in any one working season, despite the excellent state of preservation and documentation.

The ability to exercise multiple crafts is a question of practice and schooling. It is, however, difficult to estimate the degree of practice and training the metalworkers needed (Pesch, 2012: 41), but it is unlikely that an average artisan could have mastered all specialized forms of metalworking in equal measure. Therefore, the production of certain complex artefacts may have taken place within a larger operational network of specialists, driven by the development of urbanism and/or market-based economies (Croix et al., 2019: 358; see also Pedersen, 2020). Furthermore, Viking Age metalworking has been considered a social and cooperative activity, with workshops potentially shared by several people (Callmer, 2002; Sindbæk, 2009; Pedersen, 2016: 34). Consequently, it can be argued that the mixed metalworking debris in the workshop at Kaupang reflects the work of multiple artisans, potentially with different skills and specialisms.

However, there are also strong arguments in favour of the concept of the multi-*smiðr* in the real world, and that the possession of multiple skills was seen as an ideal that allowed and encouraged multi-crafting. Traces of non-ferrous metalworking have been documented in rural smithies in Norway and Sweden, sometimes far away from urban contexts. The evidence for non-ferrous production

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at these sites is, however, often limited, suggesting an absence of separate traditions of metalworking (Narmo, 1997: 152; Rødsrud & Jouttijärvi, 2020; Sahlen, 2020). When required, rural smiths also handled soft metals as well as refined iron blooms. The Kaupang workshop, with its mixed metalcrafts, was therefore by no means unique in the Viking world.

The vast production of composite objects, i.e. products of combined metals and techniques, also suggests an absence of a strongly divided metalworking tradition during the Viking Age. Composite items are good indicators of collaborative work or products reflecting the presence of a multi-crafter. With an iron core, swords, spearheads, and prized tools of iron were often decorated with precious metals using various techniques. These objects would have required combined skill sets and multi-crafting knowledge. The same can be argued for copper-coated iron weights and the soldering/brazing of padlocks, which require complex processes combining ferrous and non-ferrous metalworking techniques (Söderberg, 2004; Gustafsson, 2005; Ambrosiani, 2013: 223; Pedersen, 2016: 135–40). Many artisans were even proficient in both technique and art, applying the animal and vegetal styles of 'the Viking way' to various materials, such as iron, soft metals, wood, and stone (e.g. Wilson, 2008), thereby integrating forms of craftsmanship into one common tradition.

The archaeological record suggests that the skilled artisans and other metalworkers at urban sites, such as Kaupang, had access to collective spaces, where they could share their trade, knowledge, and experience. Such arenas may have resulted in, possibly even enhanced, the social and artistic mobility of knowledge and experience needed to be a true multi-crafter, which, in its idealized form, is reflected in the myths and ideas of the *smiðr* graves. The evidence from the Kaupang workshop and elsewhere that attests to the multiple skills and experience needed to produce certain goods, make it highly likely that multi-crafters existed in a Viking world, in which there was no strict separation between those who worked with iron and those who worked with soft metals.

Concluding Remarks

The data collected from a metal workshop excavated at Kaupang in 2015 indicate that artisans worked with both ferrous and non-ferrous materials, handling advanced technical processes in addition to refining iron. The context suggests cross-crafting between technical and mechanical disciplines. The degree of material knowledge is significant, in terms of the economy (i.e. silver assaying and iron refinement) as well as in the recycling of metals for casting and blacksmithing. The multi-crafters identified at Kaupang and in other workshops display versatility, mirroring the body of ideas represented by the assemblages of tools in contemporary Viking graves. Traditionally, there has been a tendency to study specific crafting traditions in isolation, but more nuanced, interactive, and cross-disciplinary approaches to the study of crafts are needed (Pedersen, 2020: 401–02). In the Viking Age, market-based crafts emerge in an economically co-dependant society. The graves and hoards can be seen as social expressions of, and responses to, these markets and networks, expressing value, power, and materiality. These markets gave artisans a direct link to both materials and consumers, creating the basis for crafting mobility through 'learning by doing'.

Of course, not all artisans possessed the same degree of control, knowledge, and skill with metals and materials. Many Viking Age metalworkers in rural areas may not have had access to the knowledge or experience that would allow them to

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undertake complex metalworking. Others must have been professionalized, as well as highly specialized, producing the most valuable, high-status metalwork. These metalsmiths possessed a technological expertise in line with that conveyed by Theophilus in the twelfth century and may have had a status on a par with Vǫlundr, which could have originated at the same time as the increased demand for high-status objects at the onset of the Nordic Late Iron Age (*c.* AD 550–800). Finds from urban contexts, such as those from the Kaupang workshop, with advanced and mixed metalcrafts under the same roof, may reflect the work and presence of multi-crafting. These urban nodes were places that allowed multi-skilled artisans to develop and prosper, in essence places that enabled the *smiðr* to become something close to the ideal of the myths and idols of the Norse mythological world.

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Des outils pour divers métiers ? La fusion des compétences des artisans du métal à Kaupang à l'époque viking

Dans la littérature poétique en vieux norrois le smiðr *était un maître des arts, capable de contrôler de multiples matières et de réaliser des objets de toutes sortes. On a considéré le* smiðr *de la mythologie comme différent des forgerons et artisans réels qui façonnaient des objets en or, argent, alliage de cuivre et fer, mais les données archéologiques provenant des villes et ateliers de l'époque viking, ainsi que les sources écrites médiévales, présentent une autre perspective. En 2015, les fouilles de Kaupang en Norvège ont mis à jour un atelier bien conservé et jusqu'alors inconnu. Il était consacré au travail de divers métaux, requérant les compétences spécifiques des forgerons et des artisans du métal tendre. En conclusion, les auteurs de cet article cherchent à aller au-delà du mythe pour entrer dans le monde des maîtres-forgerons et autres artisans du métal, de leur savoir-faire et de leurs outils.* Translation by Madeleine Hummler

Mots-clés: villes viking, Kaupang, ateliers, technologie du métal, compétences artisanales multiples, mythologie norroise

Werkzeuge für verschiedene Gewerbe? Die Fusion der Fähigkeiten der Metallhandwerker im wikingerzeitlichen Kaupang

In der altnordischen Literatur war der smiðr *ein Meisterwerker, welcher unterschiedliche Materialien beherrschte und sie in allerlei Gegenstände verwandeln konnte. Während der mythologische* smiðr *als separat von den Schmieden und Edelmetallhandwerker der Realität angesehen wird, zeigen die archäologischen Angaben aus wikingerzeitlichen Städten und Werkstätten und die mittelalterlichen schriftlichen Quellen ein anderes Bild. Eine bis jetzt unbekannte und gut erhaltene Werkstatt, die im Jahre 2015 in der Wikingerstadt Kaupang in Norwegen ausgegraben wurde, hat Hinweise über eine vielfältige Metallproduktion geliefert, welche das Geschick und die Kenntnisse der Schmiede und Edelmetallhandwerker verlangte. Abschließend versuchen die Verfasser über den Mythos hinauszugehen, um die Welt der kompetenten, vielsietigen Kunsthandwerker und derer Arbeitsverfahren zu schildern.* Translation by Madeleine Hummler

Stichworte: Wikingerstadt, Kaupang, Metallwerkstatt, Metalltechnologie, vielfältiges Handwerk, altnordische Mythologie

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