

New Light on Tempered Clay

3D White Light Scanning as a Means of Analysis of Early Medieval Casting Moulds

BY NY BJÖRN GUSTAFSSON

Abstract

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During the excavation of the early medieval town plots in the Trädgårdsmästaren block in Sigtuna in 1988–90 a collection of Viking Age clay casting moulds was recovered from a mid-11th-century refuse pit. Most of these moulds derive from the production of a specific type of bridle mounts that are generally seen as Anglo-Danish. The article covers various aspects of the analysis of these moulds by means of 3D white light scanning, and in the following discussion several possible interpretive answers to why these moulds have been found in Sigtuna, far from the artefact type's presumed core area, are presented.

Ny Björn Gustafsson, Archaeological Research Laboratory, Department of Archaeology and Classical Studies, Stockholm University, SE-106 91 Stockholm, Sweden. bjorn.gustafsson.ny@arklab.su.se

Introduction

On the celestial sphere of Scandinavian archaeology Sigtuna must be regarded as one of the comets. Even though it sometimes settles below the horizon and its light appears to fade one can rest assured that it will return again to illuminate and inspire both scholars and their theories. Its historical significance has been known for centuries and each archaeological undertaking has brought new and intriguing clues to the town's former grandeur. Sigtuna's layout still partly follows the original early medieval outline, and by the main street – *Stora gatan* – the cultural deposits are several metres thick due to good preservation conditions. Many excavations have been carried out by *Stora gatan* over the years, but the hitherto largest took place between 1988 and 1990 in the block Trädgårdsmästaren (Tesch

(ed.) 1990). 1100 m² were excavated within the two plots Trädgårdsmästaren 9 and 10. A large collection of artefacts were recovered, of which most are still being processed for publication. The excavation showed that the area had held four town plots with similarly arranged buildings during the early medieval period (ca 1000-1100 AD). Some were living quarters and others seem to have had more functional uses as workshops for various crafts. During the middle of the 11th Century extensive metalworking took place in the area, indicated by quite large quantities of slag, burnt clay and technical ceramics (Nordin 1990; Söderberg & Gustafsson 2007). Among these metallurgical finds was a moderate yet noticeable quantity of broken clay casting moulds of which most are too weathered and broken to yield much information.

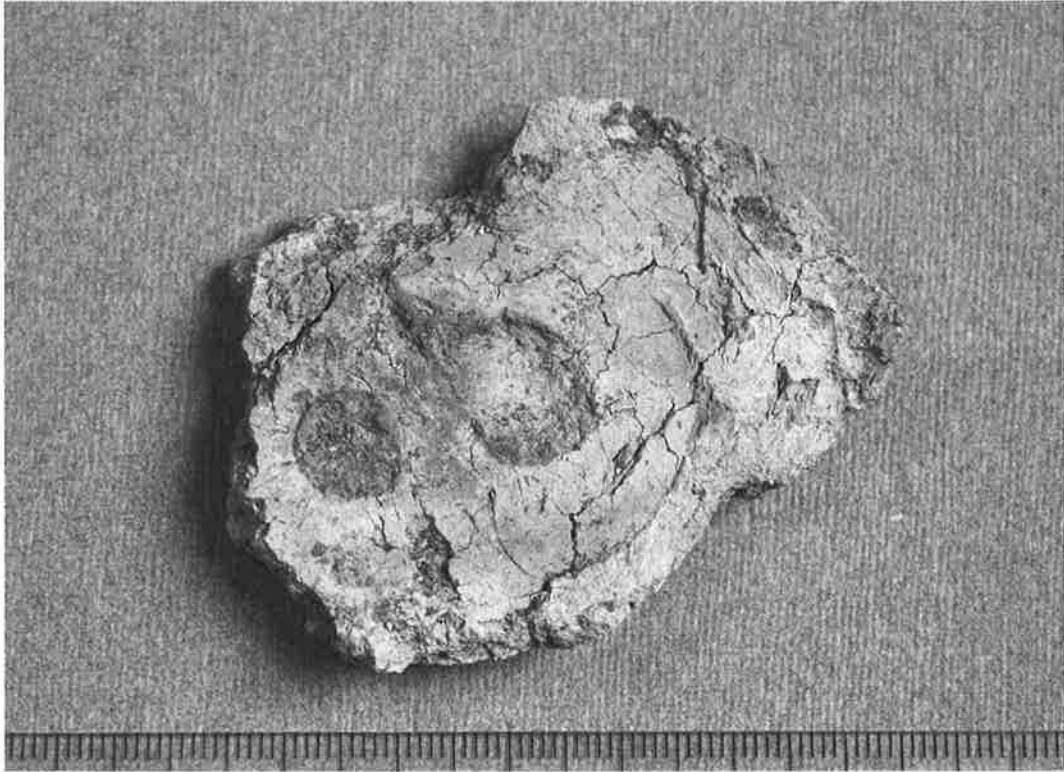


Fig. 1. Fragment of Viking period casting mould from Trädgårdsmästaren 9&10, F nr. 26097.

From negative to positive – interpretation of mould cavities

However, a small number of the fragments display excellent imprints. These are of course negatives of the cast objects and to get a good picture of these, the imprints have to be inverted. In previous research such inversions have been accomplished by various direct methods, for instance by means of Plasticine, wet clay or Wood's metal (cf. Arrhenius 1973, pp. 100 f), but they all have limitations and drawbacks. To a trained eye the imprinted fragments from the Trädgårdsmästaren block clearly show that most of them were used to cast rather flat mounts. Many of these featured ring-like extensions with three protruding knobs in each end. Such mounts are rather well-known by previous research – they for-

med parts of horse bridles. A relatively large number of such bridle mounts have been found, especially by metal detectorists in Denmark and the British Isles (Williams 2007), but they are also occasionally found within the boundaries of modern Sweden (e.g. Sundkvist 2001; Andersson 2000). These bridles have traditionally been interpreted as English or Anglo-Scandinavian (Paulsen 1933; Arbman 1937; Graham-Campbell 1992; Pedersen 1999). Regardless the origin, the Sigtuna-moulds are the first to be tied to this particular find group. By visual examination it is possible to divide the fragments into sub-groups. A larger portion belong to moulds for side- and rein links, and a smaller number can be connected to the cheek pieces which formed parts of the bit. These cheek pieces are often quite striking, with ornamental details in Scandinavian animal styles, mainly Ring-

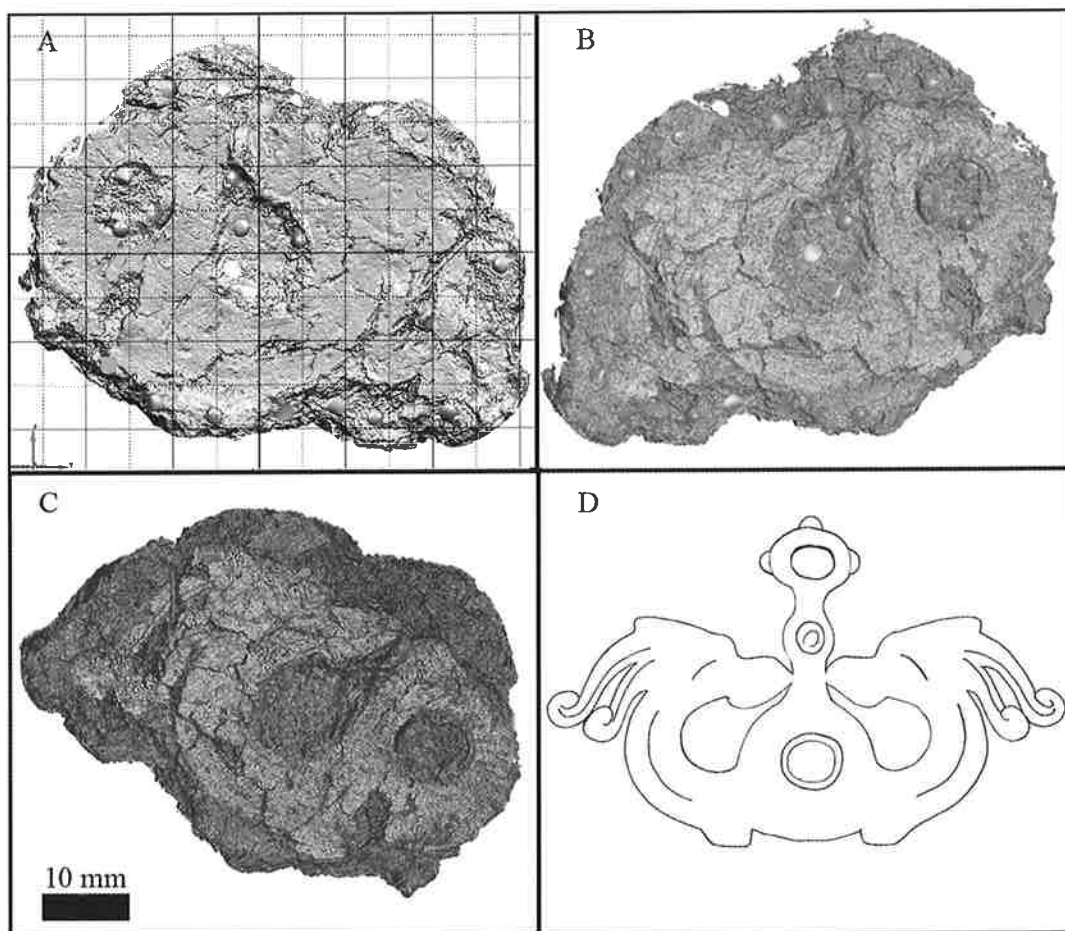


Fig. 2. The stages of analysis of one of the mould fragments. A. 3D-modell scanned by an Atos II scanner. B. Inversed 3D-modell. C. 3D-modell altered and digitally graded. D. Outlines of interpreted bridle mount.

erike and Urnes. It is possible to distinguish a group of three mould fragments with such characteristics. One of these is rather large (62 by 48 mm) and it clearly has been used to cast a Ringerike-styled cheek piece (Fig. 1). To enable a closer analysis of the rather shallow ornamental details it was decided to scan the fragment optically. This was carried out with a GOM optical 3D Atos II scanner with a measuring volume of 35x28x15 mm and a resolution of 0,027 mm. Prior to scanning the fragment was fitted with a suitable number of measuring points (\varnothing : 0,8 mm). The resulting computerized 3D-model (Fig 2A) was then

inverted to render a picture (Fig. 2B). By altering the 3D-model, several features not visible to the naked eye could be observed and after a final examination in a graphics editor (Fig. 2C) an approximate reconstructional drawing could be produced (Fig. 2D). The benefits of 3D-scanning are obvious – it is harmless for the object and the resulting renditions are easy to interpret and form an excellent basis for further work.

Anglo-Danish bridle mounts

As stated above, most bridle mounts of this type have been found in southern Scandinavia and on the British Isles. Two of the most complete extant sets found to date have however been recovered in Sweden. One was found over a period of several years during the early 20th Century in what is believed to be a ploughed-out burial in a garden in Eskilstuna, 112 Km west of Stockholm (SHM 13703, 14497 & 14634). It was probably made during the latter part of the 11th Century judging from the cheek pieces which are decorated in a crude Urnes-style with floral details. They correspond rather well with a pair of cheek pieces from Leck in Schleswig (Paulsen 1937) and a fragment from Sønderholm in Jutland (Pedersen 1999). Another set was excavated in 1924 by Årsunda church in the province of Gästrikland. They were found in and around a disturbed cremation burial (SHM 17408). This second set was decorated in a debased Ringerike-style and was probably made during the first or middle part of the 11th Century. Most known bridle mounts of this type have however been found as stray finds, often in fragments – the openwork ornaments of the cheek pieces apparently made them exposed to wear and breakage (cf. Pedersen 1999, Fig. 4; Williams 2007, Fig. 3). When looking at the geographical distribution of these mounts an apparent source of error has to be taken into consideration: metal detecting is heavily regulated in Sweden, whereas it is quite common in both Denmark and England. This fact has also been noted by Anne Pedersen (Pedersen 1999, p. 154) and it might of course act to demerit the empirical base of previous studies. Something which may speak in favour of the bridle-style being brought in or influenced from an Anglo-Scandinavian (or rather Anglo-Danish) cultural milieu is that such mounts, i.e. flat elements with shallow, almost crude ornaments, are sel-

dom seen in Scandinavia proper prior to the 11th Century (Arbman 1937). One recurrent and plausible explanation is that these bridles became highly fashionable among the Anglo-Danish nobility in the North Sea Empire of Cnut the Great (Paulsen 1937; Pedersen 1999). There Anglo-Saxon and Scandinavian styles fused – something which is evident in the bridle mounts. The fashion then spread to surrounding areas.

Why in Sigtuna?

So far, so good; but this does of course raise questions of how and why moulds for at least one set of mounts for an Anglo-Danish bridle occur in the cultural deposits of Sigtuna – far from both Denmark and England. The simplest answer is of course that a craftsman trained in the Anglo-Danish sphere was working in Sigtuna by the middle of the 11th Century. There are some other finds which might support Danish connections. One of these is a cast copper alloy patrice or press die in the Hiddensee style which was found in Sigtuna in 1928 (Arbman 1933, SHM 18720). Since the Hiddensee style is seen as predominantly Danish it might have formed part of a Danish, or Danish-trained goldsmith's toolset. Recent research dates these press dies and the jewellery which was made with them to the latter part of the 10th Century though – quite early in Sigtuna's history (Kleingärtner 2007). A later, possible time for another Danish-trained craftsman to enter Sigtuna might have been in the late 1020's as a result of an intricate chain of interactions between Swedes, Norwegians and Anglo-Danes. In 1025 or 26 the Norwegian King Olav Haraldsson and the Swedish King Anund Jakob Olofsson joined forces against Cnut the Great. As a result of this they met in the battle at Helge å in Scania. There are several versions of what happened (Moberg 1987, pp. 175 ff.), but

Cnut is said to have lost many men. Despite this the others withdrew and apparently let Cnut and his Anglo-Danish forces carry the day. Soon thereafter, in 1027 Cnut described himself as king of all England, Denmark, Norway and parts of Sweden (*ibid.*, p. 179). In older research a particular type/series of coins struck for Cnut has been seen as proof for him holding Sigtuna for a short period. This has however been refuted by more recent studies (Jonsson 2007, pp. 272 ff.). Which parts of Sweden Cnut claimed is thus unclear, as well as for how long he possessed them. If he indeed held Sigtuna around 1030 Anglo-Danish influences – in metalworking as well as in other fields – would have had unhindered access to the area.

Both the late 900's and the 1030's are too early for the Sigtuna moulds though – most of the fragments were recovered from a refuse pit in a cultural deposit which has been dated to approximately 1050 AD (Söderberg & Gustafsson 2007, p. 32). This is of course not an absolute date, but it might offer an interesting theory as to why these particular bridle mounts were cast in Sigtuna at that particular time. By the middle of the 11th Century Cnut was long dead and his empire had ground to a halt and crumbled. Internal fighting over its carcass led to many skirmishes and outright actions of war. One of the main protagonists in these troubles was Cnut's nephew Sweyn, son of his sister Estrid and his Jarl, Ulf Thorgilsson. He formed part of the uppermost elite of the Anglo-Danish society. Between 1042 and 1047 AD he tried to seize power in Denmark on several occasions but was defeated repeatedly by King Magnus Olavsson of Norway who had inherited the country in 1042 from Cnut's last surviving son Harthacnut. Sweyn is said to have spent twelve years in Svithjód (Sweden), during which he undoubtedly visited Sigtuna on numerous occasions (Adam of Bremen, chapter 73, p. 111). According to Snorri Sturlusson and his Haralds saga Si-

gurðarsonar it was there, in 1045, he met with Harald Sigurdsson Hardrada when the latter returned to Scandinavia after his Varangian years (Sturluson 1993, p.78). Sweyn's presence in Sigtuna could also explain the occurrence of the bridle-moulds. The excavated area is located just a few metres from where the royal estate is thought to have stood (Tesch 1990, p. 30). One needs not to be very imaginative to envision one of the Danes – not necessarily Sweyn, he hardly travelled alone – stepping over to the nearby foundry, commissioning a set of mounts for a stylish bridle. Another version might be that it was commissioned by a Swedish noble, who did not want to look any less stylish than the King's Danish protégé and his retinue. Regardless who ordered it, no cheek piece to match the mould has been found in Sweden to date, though a group of related, but cruder pieces (four in all) have been found in the provinces of Södermanland (SHM 14207), Uppland (UMF 4573) and Gästrikland (SHM 17408) (Paulsen 1937, p. 28; Graham-Campbell 1992, Fig. 6; Baudou 1964, pp. 26 f.).

Concluding remarks

In his previously mentioned paper from 1937 Holger Arbman suggested that a number of Swedish bridles with similar mounts made from iron were local attempts to mimic Anglo-Danish bridles (Arbman 1937, p. 270). That assumption must be taken lightly – It is important to keep in mind that neither Denmark nor the British Isles might be the place of origin for this style of bridles; the cast copper-alloy sets might just form the last link in a long chain whose full stretch is yet to be discovered by research. Anneli Sundkvist has pointed out that the tradition of bridles with animal-styled ornaments can be followed back to the Classical era, for instance to the Scythian bridles with wooden ornaments from Pazyryk in Sibi-

ria (Sundkvist 2001, p. 121 f.).

Like so many other archaeological finds the Sigtuna-moulds might evoke more questions than they answer, but regardless of this, 3D-scanning of casting moulds stands out as a good and non-destructive method of analysis well worth a larger appliance within finds research.

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