Chronology and spatial distribution of terra sigillata potters' stamps and coins within the Nijmegen *castra* and *canabae*

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Introduction

This paper discusses the chronology of the legionary fortress *(castra)* and surrounding civil settlement *(canabae legionis)* of Nijmegen, the Netherlands *(Fig. 1)*, by examining distribution patterns of terra sigillata potters' stamps and coins. It partially draws on previously published data but supplements this with a large amount of hitherto unavailable data from various sources to provide a new chronological framework for this military assemblage[1]. While previous research has usually focussed on either the *castra* or the *canabae*, this is the first attempt at a comprehensive comparative study of both sites, providing new insights into their development and interaction.

There is little doubt that the *castra* were built around AD 70. The end date, however, is far less certain and has been the subject of quite some debate, which is summarised below. Little has been written on the chronology of the *canabae*, but it is generally assumed that it is in line with that of the *castra*. This paper aims to provide a chronological framework focusing on dating arguments for the end date of the Nijmegen *castra* and *canabae* by examining two find categories that can be dated with a high degree of accuracy, namely coins and stamped terra sigillata.

Before addressing the chronology of the Nijmegen *castra* and *canabae* first an overview will be given of how the dataset was compiled and how its composition has been influenced by deposition patterns, post-depositional processes, and excavation methods. Attention is then turned to the chronology of six subareas, before some smaller chronological patterns within the research area are visualised. The main research questions addressed are:

[1] As part of the author's PhD research project at the Radboud University Nijmegen under supervision of Prof. Dr Eric Moormann and Dr Marinus Polak. The project is entitled *Mapping the Flavian castra and canabae at Nijmegen. A big data approach to the analysis of a military community and its activities*.

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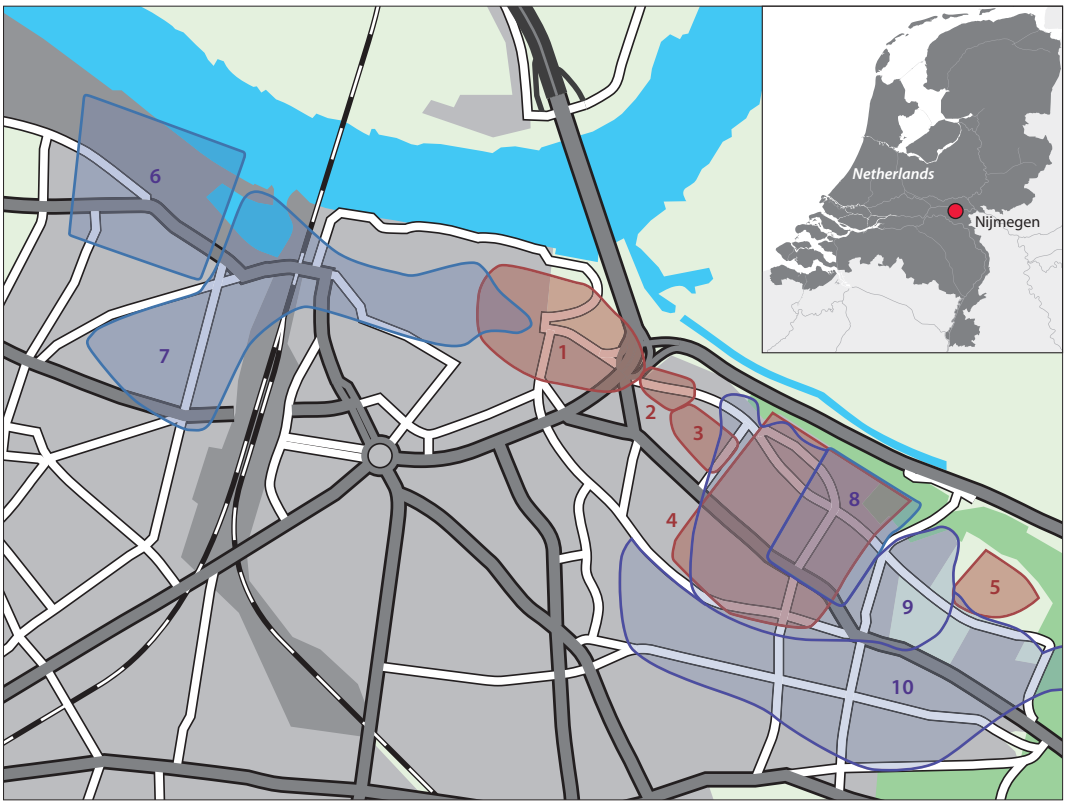

Fig. 1. The main archaeological complexes in Nijmegen from the early and middle Roman periods. 1–5 pre-Flavian: 1 *Oppidum Batavorum*; 2 Trajanusplein fort; 3 cemetery; 4 Augustan military camp; 5 Kops Plateau fort. – 6–10 Flavian and later: 6 *Ulpia Noviomagus*; 7 cemetery; 8 *castra*; 9 *canabae legionis*; 10 cemetery (adapted from Van Enckevort / Heirbaut 2010, fig. 29; 151).

1. How are the finds distributed across the research area and what does this tell us about the impact of depositional patterns, post-depositional processes, and differing excavation techniques?
2. What are the start and end dates of the *castra* and *canabae* and are these the same?
3. Can any chronological patterns be discerned and how should these be explained?

Research area

The research area is situated in Nijmegen, in the district of Nijmegen-Oost. This paper is primarily concerned with the mid-Roman period, but Roman activity in this area goes back as far as the Augustan period, when a large operational base of 42 ha was situated here *(Fig. 1,4)*. Coin finds indicate that this early camp was in use between c. 19 and 16 or 12 BC[2]. Other largely pre-Flavian complexes in the vicinity, further to the west, include the Museum Kamstraat cemetery *(Fig. 1,3)*[3] and the Trajanusplein area *(Fig. 1,2)*. The

[2] Kemmers 2006, 61–62.

[3] The Museum Kamstraat cemetery was in use during the entirety of the 1st century AD with a floruit from Claudius until the Flavian dynasty (c. 40–100 AD); Stuart 1977b, 73.

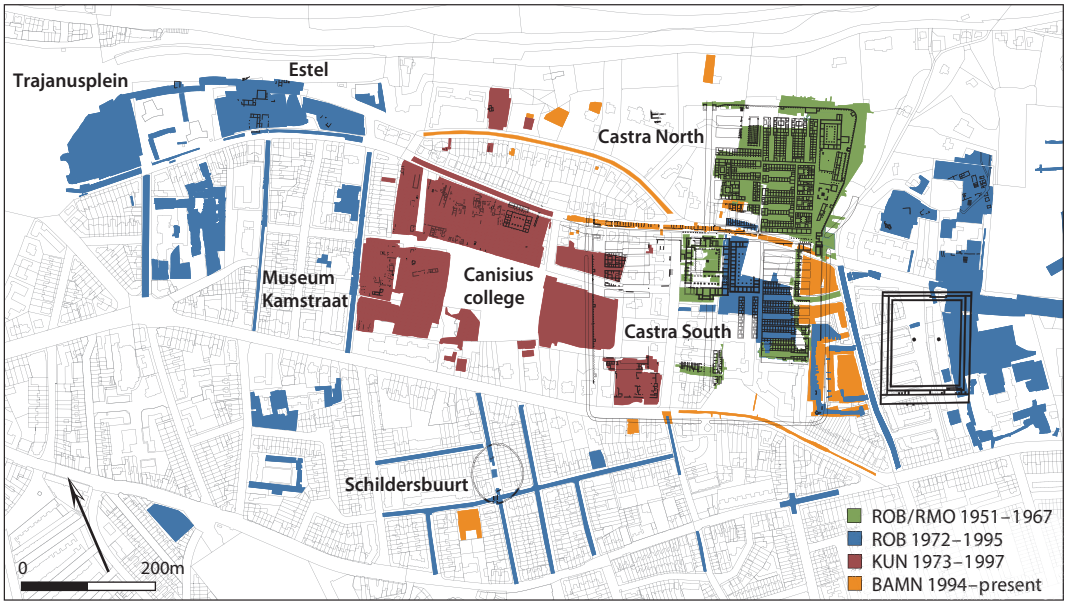

Fig. 2. Excavations within Nijmegen-Oost per excavating party, along with the main toponyms used in the excavation reports.

latter was the site of a small fort dating to c. AD 10–20[4] and also includes parts of the likewise pre-Flavian civil settlement of *Oppidum Batavorum (Fig. 1,1)*[5]. In the Flavian period, however, both the Museum Kamstraat cemetery and the Trajanusplein area were overbuilt by the *canabae legionis (Fig. 1,9)*, which surrounded the legionary fortress *(Fig. 1,8)*. To the east of the research area the Kops Plateau is located, the site of a fort dating between c. 10 BC and AD 70 *(Fig. 1,5)*[6].

Research history *(Fig. 2)*

The earliest finds considered in this paper are coins and pottery collected by the retired industrialist G. M. Kam during the early decades of the 20th century and those collected before c. 1940 by M. P. M. Daniëls, municipal archivist at Nijmegen. Apart from these finds, and those acquired thereafter by the former Rijksmuseum G. M. Kam[7], all other finds come from excavations.

The first large-scale excavations in the area were carried out in 1951 and 1957–1967 by the former State Service for Archaeological Investigations (ROB)[8], led by H. Brunsting, curator of the National Museum of Antiquities (RMO)[9]. These excavations covered most of the northeast and part of the southeast corner of the *castra*. During the 1970s and 1990s, large parts of the southeast corner of the *castra* were investigated by the State Service, supervised by J. H. F. Bloemers, and by the Municipality of Nijmegen (BAMN)[10].

[4] Willems / Van Enckevort 2005, 70–71.
[5] Haalebos / Willems 2005, 44.
[6] Van Enckevort 2014, 122.
[7] Now absorbed in Museum Het Valkhof.
[8] Rijksdienst voor het Oudheidkundig Bodemonderzoek, now: Rijksdienst voor het Cultureel Erfgoed (RCE).
[9] Rijksmuseum van Oudheden.
[10] Bureau Archeologie en Monumenten Nijmegen, now: Bureau Leefomgevingskwaliteit, Archeologie, Nijmegen (BLAN).

Between 1973 and 1983, the former Catholic University of Nijmegen (KUN)[11] excavated much of the southwest quarter of the *castra*, under the supervision of J. E. Bogaers and J. K. Haalebos.

Large parts of the western and eastern *canabae* were excavated during the 1970s and 1990s by the State Service and the University. More recently, BAMN has also carried out some smaller excavations and held a number of watching briefs. Less is known of the southern *canabae*, where only relatively few and small-scale excavations have taken place.

Dataset and corpora

In total 1840 terra sigillata potters' stamps and 4231 coins were gathered from both published and unpublished sources.

The terra sigillata data set comprises both Arretine and Gaulish potters' stamps from a variety of excavations. Most of the Gaulish sigillata collected by G. M. Kam and Daniëls and from the ROB excavations had previously been recorded by B. M. Dickinson and can be found in NoTS[12]. The Arretine stamps have been studied by S. L. Wynia and were included in OCK[13]. Sigillata stamps from the RMO and ROB excavations not included in NoTS were identified by K. Testers as part of a master's thesis and by the author. Gaulish potters' stamps from the Canisiuscollege excavations have been studied by E. van der Linden[14]. The Arretine stamps from these excavations were identified by D. I. J. L. Visser[15].

Illegible stamps or writing imitations cannot always be accurately dated and are not listed in NoTS. It was therefore decided to exclude these from the newly studied datasets in order to minimise artificial differences across the research area.

The coins collected by Kam and Daniëls have in part been studied by A. V. M. Hubrecht. Coins not yet studied were kindly identified for me by R. W. Reijnen. All coins from the RMO and ROB excavations within Nijmegen up until 1986 were recorded by J. S. Boersma. The Canisiuscollege coins were identified by F. Kemmers for her PhD thesis[16]. Finally, coins were included from four BAMN excavations[17], identified by Reijnen and Kemmers.

Republican coins were dated using RRC[18], Imperial coins using RIC[19]. Most excavations took place after the revision of RIC I. but prior to the revised edition of RIC II. For the new sample identified by Reijnen the revised edition of RIC I and original versions of RIC II were used to ensure consistency between datasets.

Stamped terra sigillata

When discussing the date of terra sigillata, this normally concerns the moment when it was lost or discarded[20]. This is because sigillata is usually dated by comparing specific forms and stamps with their occurrence on sites which are dated independently from ceramic evi-

[11] Katholieke Universiteit Nijmegen, now Radboud Universiteit Nijmegen.

[12] Names on terra sigillata = Hartley / Dickinson 2008–2012.

[13] Oxé et al. 2000.

[14] Van der Linden 2011; Van der Linden in prep.

[15] For Visser's research see Niemeijer 2014.

[16] Kemmers 2006.

[17] Heirbaut / Van Enckevort 2009; Polak / Van Diepen 2011; Heirbaut 2011; Van Enckevort 2011.

[18] Roman Republican Coinage = Crawford 1974.

[19] Roman Imperial Coinage. Vol. I revised edition = Sutherland / Carson 1984; Vol. II = Mattingly / Sydenham 1926.

[20] Polak 2000, 43.

dence[21]. NoTS stresses, however, that it has been attempted to date the range within which a potter was operative rather than when his pots were discarded[22]. This is usually expressed as a period of twenty to forty years. As some time will have passed between the moment of production of a vessel and its deposition – the latter being relevant for our purposes – a stamped vessel may therefore have been discarded later than its stamp's date. Due to its fragile nature, however, sigillata probably had a relatively short lifespan[23]. This makes terra sigillata potters' stamps ideally suited for assessing the dates of activities in the research area. However, there are also a few limitations. For one, not all sigillata vessels were stamped and the percentage that was stamped was not a constant over time[24]. This will certainly have an effect on both the absolute and relative numbers of stamps for certain periods. When these factors are taken into account, the potter's stamps dating curves should be ideally suited to date the *castra*'s and *canabae*'s occupation, especially when compared to those of other nearby sites.

Coins

Coins can often be dated much more accurately than terra sigillata. However, these dates refer to the moment a coin was issued, not the moment it was lost or discarded. While pottery has a relatively short lifespan, coins could remain in circulation for long periods of time. Precious metal coins, Republican denarii in particular, are known to have remained in circulation for decades and longer. Republican and Augustan coins can therefore easily have belonged to the Flavian circulation pool[25]. The same applies to bronze coinage, although to a lesser extent. Long interruptions in the minting of bronze coins in the Republican period, irregular minting in the first decades of Augustus' reign, and a neglect of bronze coinage by some Julio-Claudian emperors meant that early bronze coins could also remain in use well into the 1st century[26]. It is also likely that Celtic coins, particularly those of the AVAVCIA type, formed part of the early Roman coin circulation[27].

The fact that coins tended to circulate for extended periods of time means that they are more suited to determine the start of a site's occupation than its end[28]. A steep drop in new issues need not mean a drop in activity if the older coins still remained in use. This is why the coin dating curve is compared to that of the sigillata potter's stamps, for which long

[21] Mees / Polak 2013, 40. Polak, however, points out that many dated sites are in fact dated by the sigillata found there and that only few settlements can be dated by other sources of information such as coins, inscriptions, or historic events (Polak 2000, 43).

[22] Hartley / Dickinson 2008, 4; 28.

[23] Little evidence on the lifespan of sigillata vessels is available, although a clue is given by Drag. 37. This bowl is almost exclusively found in contexts dating after the year AD 70. Polak argues that a few sherds of Drag. 37 at Colchester, London, and *Verulanium* must have ended up in the ground during the Boudiccan Revolt of AD 61 and at Baden and Valkenburg during the Batavian Revolt of AD 69/70. As Drag. 37 bowls were generally not discarded until after AD 70, this means that Drag. 37 may have had a lifespan of at least 10 years (Polak 2000, 43).

[24] Most pre-Flavian forms (e. g. Drag. 24/25 and 29) were stamped, while new forms introduced in the late Neronian or early Flavian period were not (Drag. 22 and 23), almost never (Drag. 35, Drag. 36, and Curle 11), or only sometimes stamped (Drag. 42) (Hartley / Dickinson 2008, 8). From the late 2nd century onwards, vessels were stamped progressively less often (Brulet et al. 2010, 124; Marsh 1981, 190).

[25] Kemmers 2006, 24.

[26] Kemmers 2006, 24.

[27] Aarts 2000, 54–56.

[28] As stated above, in the case of the Nijmegen *castra*, the starting date is already well-established through the historical sources. Even so, the dating curves do seem to agree with Kortüm's *Anfangsmaximum* model (see *Figs 6–8*; Kortüm 1998).

circulation life is much less of an issue. As will become clear in the paragraph "Abandonment of the *castra* and *canabae*", however, the coin dating curves do closely follow that of the sigillata stamps when it comes to the site's end date. Further evidence regarding the end date is provided by comparing our curves to those of the town of *Ulpia Noviomagus*. I argue that when combining all these strains of evidence it is possible in this case to determine the site's abandonment.

As there is no clear overview of how to date imitations of different coin types, for the purposes of this study these have all been given the same date as the official coins they are copying. Countermarks, especially those that can be attributed to an individual such as an emperor or general, can be dated with a fair degree of precision. However, details on countermarks were not always available in the coin lists used. These have therefore been disregarded here. In Nijmegen, countermarking is most frequent on coins of Augustus and especially Claudius, with hardly any countermarks appearing on coins from Nero onwards[29]. Many of the coins countermarked during these periods will only have been lost or discarded during the Flavian period[30].

Spatial distribution

As is clear from the above, the finds have been gathered during many different excavations carried out by different parties over a time span of several decades and across a fairly large area. Differing excavation methods and post-depositional processes will surely have influenced the composition of the datasets.

To address this issue, the find-spots of the stamped sigillata[31] and coins were plotted in a geographical information system (GIS). Subsequently, the number of finds per 1,000 m^2 of excavated surface area[32] was calculated *(Tab. 1)*. The result demonstrates that the area outside the *castra* has yielded over three times as many stamped sherds and almost six times as many coins per 1,000 m^2 as the *castra*.

To illustrate the differences in density more precisely, a grid of interlocking hexagons was superimposed over the research area[33]. The number of sigillata stamps and coins per hexagon was calculated, and the hexagons were then colour-coded according to the numbers of stamps and coins within them *(Figs 3–4)*[34]. Clearly, the large difference in density between *castra* and *canabae* is primarily the result of very high numbers of both stamped terra sigillata and coins from the northern part of the so-called Canisiuscollege area excavated by the

[29] Kemmers 2006, 78–79 and 95; MacDowall et al.1992, 47–52.

[30] When comparing the degree of wear on Julio-Claudian and Vespasianic coins from the Canisiuscollege excavations, Kemmers showed that the former were significantly more worn. This led her to conclude that the majority of the Julio-Claudian coins must have been lost or deposited in the Flavian period or later (Kemmers 2006, 121).

[31] For this calculation the Arretine wares were excluded, as these certainly were no longer in use during the Flavian occupation.

[32] The cumulative surface area of ROB, KUN, and BAMN excavation trenches was calculated in a GIS. Some parts of the *castra* have been excavated up to three times, first by Brunsting, then by Bloemers, and finally by BAMN. It was not always standard practice to section or analyse all features, so excavating a second or third time still yielded some finds. As finds from the topsoil and a selection of the features will have been recovered already, following excavations will yield significantly fewer finds. In these cases, the surface area has only been counted once.

[33] Using the QGIS plug-in MMQGIS > create grid layer > hexagons. An x-axis spacing of 10 was chosen, which led to a grid of interlocking hexagons with areas of approximately 115 m^2.

[34] Using the QGIS in-built function vector > analysis tools > points in polygon.

	castra	outside *castra*
stamps	216	1578
excavated m²	67,000	150,000
stamps per 1,000 m²	3.2	10.5
coins[35]	294	3937
coins per 1,000 m²	4.4	26.3

Tab. 1. Number of Gaulish sigillata stamps and coins found inside and outside the *castra*. Coins within the *castra* are probably underrepresented, as Brunsting's excavations were carried out prior to the introduction of the metal detector.

University between 1987 and 1997. In the following, the main processes will be outlined that may have caused this very uneven distribution pattern.

Primary deposition

For hygienic reasons, if not space constraints, rubbish must have been removed from the *castra* on a regular basis and discarded elsewhere. Bloemers argues that the rubbish pits inside the *castra* should be mainly associated with rebuilding or demolition activities and that only a small percentage of the associated finds represents everyday use[36]. For pottery this could indeed be the case. Coins, however, were probably mainly lost accidentally and therefore may represent everyday use rather than a single event such as a rebuilding phase.

Directly outside of the camp's east gate lies a natural depression that was filled up over the years with soil mixed with pottery and other artefacts. It has been interpreted as a rubbish dump for the *castra* and possibly the eastern *canabae* as well[37]. However, neither the density of the stamped sigillata nor that of the coins comes close to the densities of the Canisiuscollege area *(Figs 3–4)*.

The Canisiuscollege complex is situated directly south of a road leaving the *castra*'s western gate. No less than two thirds of the Canisiuscollege finds come from pits[38], which often cannot be associated to buildings or structures. A comparative study of the pottery assemblages from the Canisiuscollege excavations and the excavations in the southwest quarter of the *castra*[39], both carried out by the University, shows that the Canisiuscollege area yielded much more amphorae, while the *castra* yielded more flagons and *mortaria*. Van der Linden's very plausible explanation for this contrast is that in the *canabae*, with their commercial character, one would expect more amphorae. In the *castra*, one would expect more flagons and *mortaria* associated with the

[35] Coins within the *castra* are probably underrepresented, as Brunsting's excavations were carried out prior to the introduction of the metal detector.

[36] Based on the connection between pits and built-on areas and the stratigraphical position of a large number of pits between the wooden and the stone building phases (Bloemers / Van Dierendonck 2016, 165).

[37] For an overview of the features and a very limited selection of the finds see Heirbaut 2011.

[38] Polak / Kloosterman 2014, 40.

[39] Van der Linden 2011, 92–93 fig. 6.

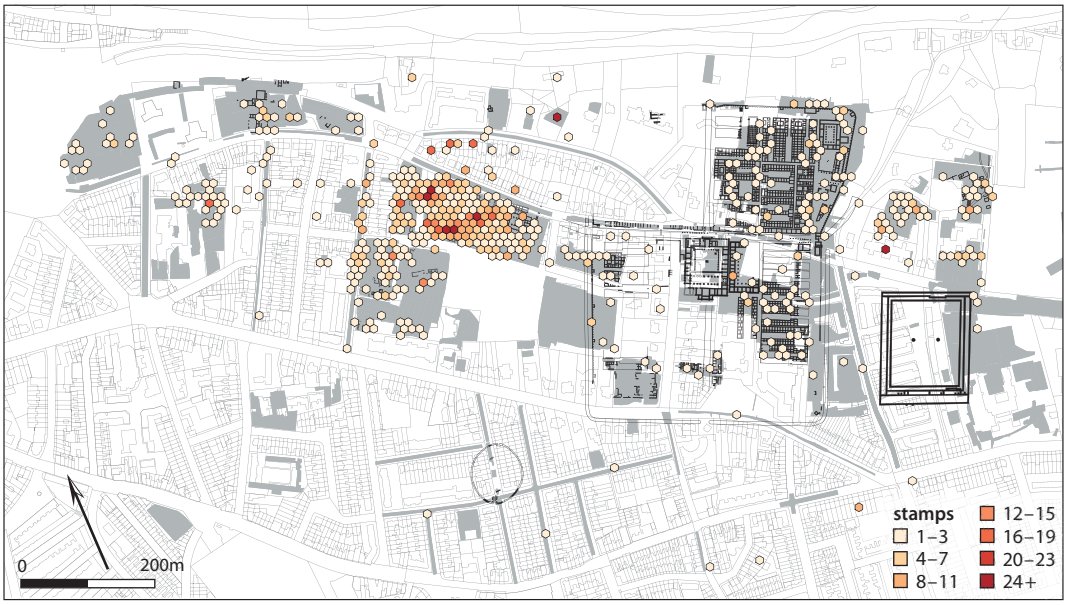

Fig. 3. Density map of all potters' stamps on Gaulish terra sigillata.

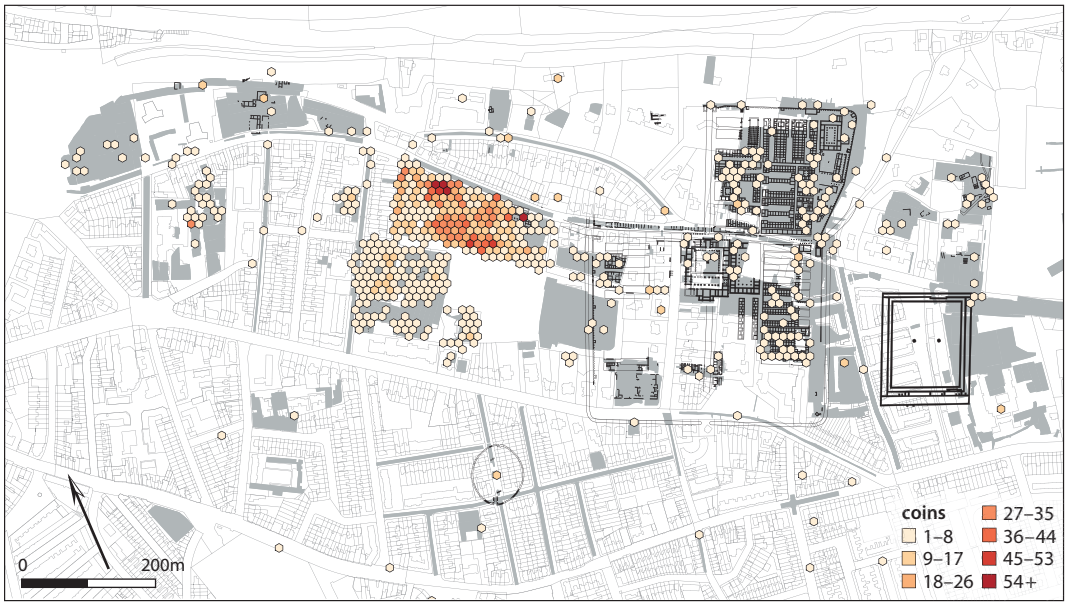

Fig. 4. Density map of all coins.

preparation and consumption of food by the legionaries[40]. There is, however, another possibility for the higher percentage of amphorae outside the *castra*. As amphorae sherds are particularly large and heavy in comparison to most other types of pottery, these must have taken up relatively much room inside the *castra*, where space was

[40] Van der Linden 2011, 92.

limited. Due to their size, amphorae sherds were also easily gathered and their disposal outside the *castra* was therefore probably prioritised.

Excavation methods and post-depositional processes

Original deposition patterns will certainly have attributed to the large difference in density between the *castra* and *canabae*, although excavation methods and post-depositional processes will arguably have had a bigger impact. During the Canisiuscollege excavation, an emphasis was laid on the systematic collection of ceramic finds, including those from the top soil, as well as on the use of metal detectors at all stages of the excavation[41]. In comparison, the *castra* were excavated mainly in the 1950s and 1960s, prior to the widespread use of metal detectors[42]. It is also clear that the topsoil was not searched for finds as thoroughly as would be desirable[43].

However, both density maps show that the area around the western ditch and gate of the *castra*, also excavated by the University of Nijmegen, yielded far fewer finds. That fewer coins were uncovered here can perhaps be explained by a less intensive use of metal detectors during these excavations, although no information regarding the excavation procedures has been recorded. This obviously cannot explain the also significantly smaller numbers of sigillata potters' stamps.

Post-depositional processes are probably another important factor here. The northwestern part of the *castra* was badly damaged in the early 19th century during the construction of Fort Sterreschans[44], although there are indications that the remains of the Roman fortress were not entirely destroyed[45]. Around 1912, parts of the 1st century cemetery and western *canabae* were disturbed by treasure hunters hoping to sell off the

[41] Polak 2014, 32–33. A complicating factor is the rumour that not all volunteers using the metal detectors were reliable and that some only reported their bronze coins, not their silver ones. This was discovered after a few months, upon which they were discharged (Kemmers 2006, 24 note 33). The damage caused should therefore not be too large and should be limited to the earlier trenches in the northeast part of the excavation area. Further evidence of the limited effect of these activities is that the density of all other (including non-metal) finds in these trenches is also considerably lower (Polak / Kloosterman 2014, 40 fig. 2,1) and was to all probability caused by lower numbers of buildings, pits, and other features.

[42] The campaigns of 1974 and 1977 were the first instances when metal detection was used somewhat systematically (Bloemers / Van Dierendonck 2016, 107; 120).

[43] At least from 1959 to 1965 emphasis was placed on the features; unless they could be used to date the features, finds were only of secondary importance. Many wall sherds and perhaps also base fragments of pottery, roof tile fragments, and stone material were not kept during the excavation. Many finds were thrown away after being examined for graffiti, stamping or manufacturing traces (Bloemers / Van Dierendonck 2016, 112). There is even mention that roof tiles and pottery sometimes were thrown away without having been checked or recorded at all (Bloemers / Van Dierendonck 2016, 117). Brunsting indicates that his 1951 campaign was carried out alongside civil engineering works, which harmed the accuracy of the investigations (Brunsting 1960, 15). His 1959 and 1960 campaigns on the grounds of the Klokkenberg were not to interfere with planned construction works, which again suggests that work was somewhat rushed and that the topsoil may not have been inspected very thoroughly (Brunsting 1960, 16–17).

[44] Starting out in 1817 as simple earthworks, it was rebuilt from 1820 to 1821 as an eight-point star fort with a c. 19 metre wide dry ditch, brick-lined counterscarp and scarp, eight casemates, and a cruciform brick redoubt. During the construction, a great deal of Roman coins were discovered (Raeven 1988, 43–44; 46). Demolishing of fort Sterreschans began at 1876 and was completed in 1878 (Raeven 1988, 63).

[45] Polak / Van Diepen 2011, 92.

antiquities they uncovered[46]. Large parts of the western *canabae* and the *castra* were levelled by removing the top 1.5–2 metres of soil to elevate the surrounding area[47], and a number of sand and gravel quarries probably caused damage to the southeast part of the *castra* and parts of the eastern *canabae*[48]. Agricultural use of the area will have caused comparatively little damage[49].

Conclusion

In short, the dataset and thus the chronology of the subareas are affected by three main factors: original deposition patterns, post-depositional processes, such as site disturbance, and differing excavation methods, such as an emphasis on the collection of topsoil finds and the use of metal detectors. It is important to note, however, that in many cases these circumstances mainly affect representation between areas, not within one area. There is no clear way to avoid interference from any of these factors. Nevertheless, as long as we keep in mind that these limitations exist, it is possible to observe some chronological trends.

Chronology per subarea

Turning from the distribution of the coins and stamps to the start and end dates of the *castra* and *canabae*, first an overview will be presented of what has previously been written on this subject before turning to an analysis of the sigillata and coins to see how they relate to these hypotheses.

Previous research

We know that the *castra* were built shortly after the Batavian Revolt of AD 69/70. Perhaps they were briefly manned by *legio II Adiutrix*, which had helped quell the uprising[50]. *Legio II* was moved to *Britannia* in AD 71 and it is assumed that *legio X Gemina* took its place that same year[51]. This legion would remain at Nijmegen until c. AD 104, when it was moved to *Aquincum* (Budapest, HU) and thereafter to *Vindobona* (Vienna, AT)[52]. It is generally thought that after the legion's departure around 104 the *castra* were occupied

[46] Daniëls 1955, 116. The area is described there as the western *intervallum* of the Flavian *castra*. Based on subsequent excavations by Brunsting and Bloemers, the Flavian *castra* are known to have been considerably smaller than previously expected. The area referred to instead forms part of the 1st century cemetery and western *canabae*.

[47] Canisiuscollege: Daniëls 1955, 120–121; 126–127; Bogaers / Haalebos 1988, 28. – Southwest half of *castra*: Bogaers / Haalebos 1980, 39.

[48] Brunsting 1969, 7; Ulpia Noviomagus 10 (flyer BAMN, Sept. 2004).

[49] Bloemers / Van Dierendonck 2016, 106.

[50] According to Tac. hist. 5.20, the *legio II* was present at *Batavodurum*. Whether it was stationed in the *castra* is uncertain. Van Enckevort / Heirbaut (2010, 251–252) are of the opinion that this legion was housed in a temporary camp farther west.

[51] Bogaers 1967, 56. Tacitus mentions that the Tenth Legion was at *Arenacum* (Cleves, DE) in AD 70 (Tac. hist. 5.19). No classical sources mention it being stationed at Nijmegen, but epigraphic evidence is abundant in the form of inscriptions, graffiti, and stamps on bricks and pottery.

[52] The exact year the legion left is unknown. A series of votive altars from the Brohltal in the Eifel region (DE) mention soldiers of *legio X* that worked in the quarries there. The altars are generally dated to AD 101/102, indicating that *legio X* was still at Nijmegen at that time (CIL XIII, 7694; 7697–7699; 7715–7718). The year of the legion's departure is generally given as AD 103 or 104, or occasionally 105.

by a *vexillatio Britannica*[53] and a detachment of *legio VIIII Hispana*[54]. These in turn were succeeded by a detachment of *legio XXX Ulpia Victrix*[55], stationed at *Vetera* II (Xanten, DE) from around AD 120.

When the *castra* were finally abandoned is less certain, and this question has been the subject of some debate. In 1965, Bogaers argued that the production of bricks and tiles stamped by the *Exercitus Germanicus Inferior* at De Holdeurn (NL) was part of a larger building program to reinforce the *limes* of *Germania Inferior*. He placed this program around AD 175, when Iunius Macer (or Macrinus) and Didius Iulianus were successively governor of *Germania Inferior*. As no brick stamps of the *Exercitus Germanicus Inferior*, Iunius Macer (or Macrinus), Didius Iulianus, or any other stamp dated after AD 175 were known from the *castra*, Bogaers tentatively considered AD 175 as the *terminus ante quem* of the *castra*[56].

In the German version of his article, Bogaers inserted a longer postscript dedicated to the discovery of a stamp of the *Exercitus Germanicus Inferior* within the *castra*, which thus contradicted the *terminus ante quem* of AD 175. Bogaers noted that new insights had shown that the moment the *Exercitus Germanicus Inferior* started producing bricks at De Holdeurn was far from certain[57]. More recently, it has also been shown that Didius Iulianus probably was governor of *Germania Inferior* slightly later, from 180/181 to 184/185[58]. Nonetheless, in following publications AD 175 was repeatedly considered to be the end date of the *castra*[59].

In 1995, an alternative view was put forward in a study of brick stamps from Nijmegen, including those recovered from the *castra* between 1950 and 1967. It was argued that the latest building activities must have been carried out c. AD 121 since only one type of brick stamp of *legio XXX Ulpia Victrix* was found[60]. At De Holdeurn, by contrast, no less than 32 different types of stamps belonging to this legion were uncovered. The brick stamps of *legio XXX* from the *castra* would therefore constitute only a single batch meant for small-scale repairs, as prolonged occupation of the fortress and accompanying large-scale repairs would have resulted in a larger variety of stamp types. Stamps of *legio XXX* at Nijmegen have a *terminus post quem* of c. AD 121, as this legion had been transferred from *Dacia* to *Vetera* II (Xanten) around that year. The last small-scale repairs would therefore have been carried out around AD 121.

In 2000, however, Haalebos again suggested that the *castra* may have remained in use into the second half of the 2nd century[61]. In a slightly later overview of the history of Nijmegen, it is stated that brick stamps, pottery, and coin finds indicate that the *castra* remained in use until at least the reign of Hadrian and possibly even somewhat longer[62]. However, the number of published finds on which this statement is based seems to be

[53] Based on brick stamps. Additionally, at the nearby military brick works of De Holdeurn a graffito was found reading […] COH II […][…] NICA […], which has been completed very tentatively as *[… mil(itis)] coh(ortis) II […ex vex(illatione) Britan]nica* (Haalebos 2000d, 475; 489 fig. 13).

[54] Based on brick stamps and on a *mortarium*, found at De Holdeurn, with a stamp reading *l(e)g(io) VIIII His(pana)* (Bogaers 1967, 63–64).

[55] Based on brick stamps and an altar with an inscription belonging to a *frumentarius* of *legio XXX* (Haalebos 2000a, 50; Haalebos 2000c, 25–26 fig. 12; Haalebos 2000d, 474; 488 fig. 12).

[56] Bogaers 1965, 14; Bogaers 1967, 62.

[57] Bogaers 1967, 76.

[58] Eck 1985, 184–186.

[59] E. g. Noviomagus 1979, 41; Willems 1990, 51.

[60] Brunsting / Steures 1995, 107–108.

[61] Haalebos 2000a, 50; Haalebos 2000d, 465; 477.

[62] Haalebos / Willems 2005a, 86. Based on a few coins from the reign of Antoninus Pius up until Commodus.

very small indeed[63]. Yet, some more recent publications still consider the *castra* to have remained in use until c. AD 175[64].

Compared to the history of the *castra*, fairly little has been written on the start and end dates of the Nijmegen *canabae*, which tend to be equated to those of the *castra*. Kemmers argues convincingly that the *canabae* were not inhabited before the construction of the *castra* and that all pre-Flavian coins found there should be attributed to the Flavian circulation pool[65]. It is generally noted that activity in the *canabae* waned in the first quarter of the 2nd century[66] or after 120 at the latest [67]. Van der Linden, on the other hand, equates the abandonment of the *canabae* to the departure of *legio X*, as her study of the terra sigillata potters' stamps from the western *canabae* showed that only 1 % of these were dated after c. AD 105[68]. Based on these results, it has been suggested that the *castra* were also virtually empty after AD 105[69].

Mid-2nd century or later finds are indeed scarce in the *canabae*[70]. One notable exception is the amphitheatre. In the centre of the arena, many pottery sherds were found that can be dated from the middle of the 2nd to the middle of the 3rd century AD, suggesting that the amphitheatre may have remained in use into the 3rd century AD[71].

Six subareas

Turning to the analysis of the sigillata and coins, we can examine how these find categories relate to the hypotheses summarised above. To do so, six subareas were distinguished based on existing knowledge of the archaeological complexes and associated research history *(Fig. 5)*. These subareas are: 1 *castra*; 2 Canisiuscollege area (large Augustan military camp and western *canabae*); 3 western *canabae* (other excavations); 4 eastern *canabae*; 5 Museum

[63] A coin of Marcus Aurelius (163/164) (Brunsting 1960, 19; 25 fig. 15). – A coin of Lucius Verus (161–169) and one of Julia Domna (193–211) (Daniëls 1950, 7). – Stuart 1977, 113–114 also mentions 30 sherds from the *castra* dated to the mid-2nd century and seven dated to the second half of the 2nd century (stray finds from areas Terrein U.99, Gracht 1952, Sterreschansweg, West *intervallum*, and Legerplaats passim).

[64] Heirbaut / Van Enckevort 2009, 10. Based on brick stamps from *vexillatio Britannica* and *legio XXX*.

[65] Based on the degree of wear on Julio-Claudian and Vespasianic coins and on the steady increase of coins per emperor with a climax under Vespasian, explained by the fact that coins minted at the time of the foundation of a settlement have the highest chance to be deposited before the settlement is abandoned. A final supporting argument is the absence of clearly pre-Flavian pottery (Kemmers 2006, 120–121).

[66] Haalebos 2000b, 53.

[67] Noviomagus 1979, 56.

[68] Van der Linden 2011, 86.

[69] Swan 2009, 83.

[70] In the western *canabae*, a cellar was found with several mid-2nd century sherds of bowls St 201B, St 203, and St 211 and a jug Nb 98 (Haalebos 1998, 42–43 fig. 34). Also in the western *canabae*, a large palisade was excavated, the function of which remains unclear. Small fragments of roof tiles, a sherd of Holdeurn ware, and a sherd of mid- or east Gaulish terra sigillata indicate that the structure was not demolished before AD 70 (Bogaers / Haalebos 1980, 62; Polak 2014, 30). Haalebos also mentions a sherd from this context of a dish St. 10, dated to the 2nd or 3rd century. This leads him to conclude that the palisade may have remained in use into the 3rd century (Haalebos 1995, 88). This sherd, however, was not recovered from a post hole associated with the palisade (Polak 2014, 30 note 32). Elsewhere in the *canabae*, a few sherds were found of a colour-coated beaker Nb 32 dated to the second half of the 2nd century or slightly later (Haalebos 1995, 86 fig. 59).

[71] See Bloemers 1979, 46 for a preliminary report. A more detailed analysis of the features and the finds is published in Bloemers et al. 2020.

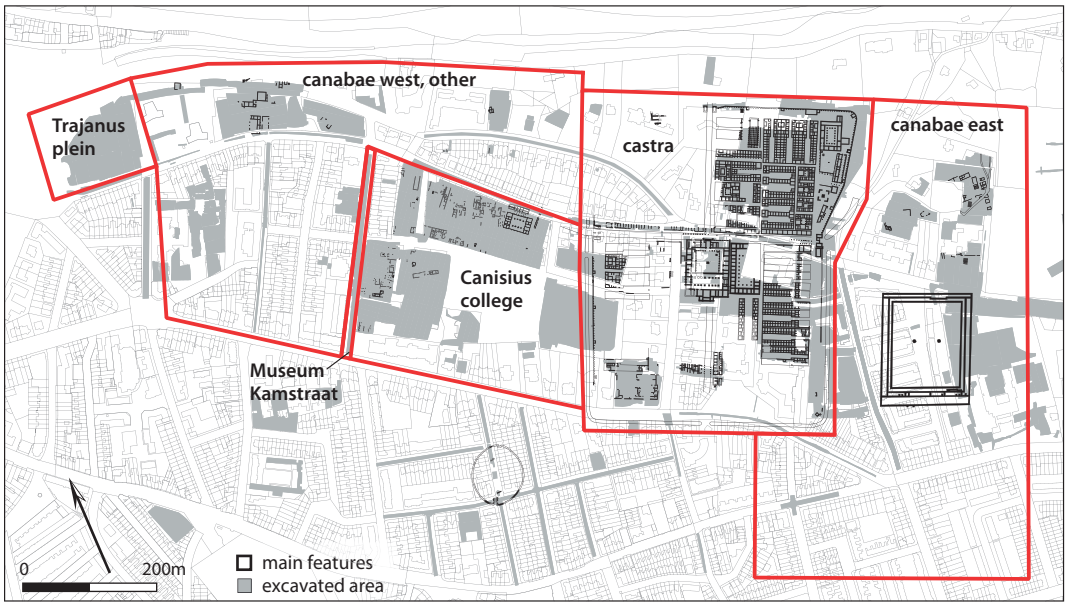

Fig. 5. The six distinguished subareas.

	stamps	%	coins	%	coins < 250	%
castra	233	13	294	7	286	7
Canisiuscollege	988	57	3518	85	3352	86
canabae west	264	15	210	5	130	3
canabae east	174	10	90	2	83	2
Museum Kamstraat	58	3	24	1	24	1
Trajanusplein	30	2	12	0	12	0
Total	**1747**	**100**	**4148**	**100**	**3887**	**100**

Tab. 2. The numbers of stamped sigillata sherds and coins for the six subareas.

Kamstraat (mainly pre-Flavian cemetery); 6 Trajanusplein (pre-Flavian fort and *Oppidum Batavorum*). Very little of the southern *canabae* has been excavated. The few stamps and coins uncovered there were disregarded for the analysis. For each of the six subareas lists were compiled of all associated stamped sherds and coins. These lists are used below to set up separate chronologies for the six subareas.

When plotting the coins of the western *canabae*, it was found that almost a third (76 out of 210) date from the 4th century AD, leading to a distorted view of the preceding centuries. As 4th-century coins are irrelevant for the Flavian occupation, the analysis was limited to the coins up to AD 250. Museum Kamstraat and Trajanusplein yielded too few coins[72] to produce meaningful results.

The numbers of finds per subarea are summarised in *Table 2*. The distribution over the subareas of all coins including those dating to the 4th century is nearly identical to that of

[72] 24 and 12 respectively.

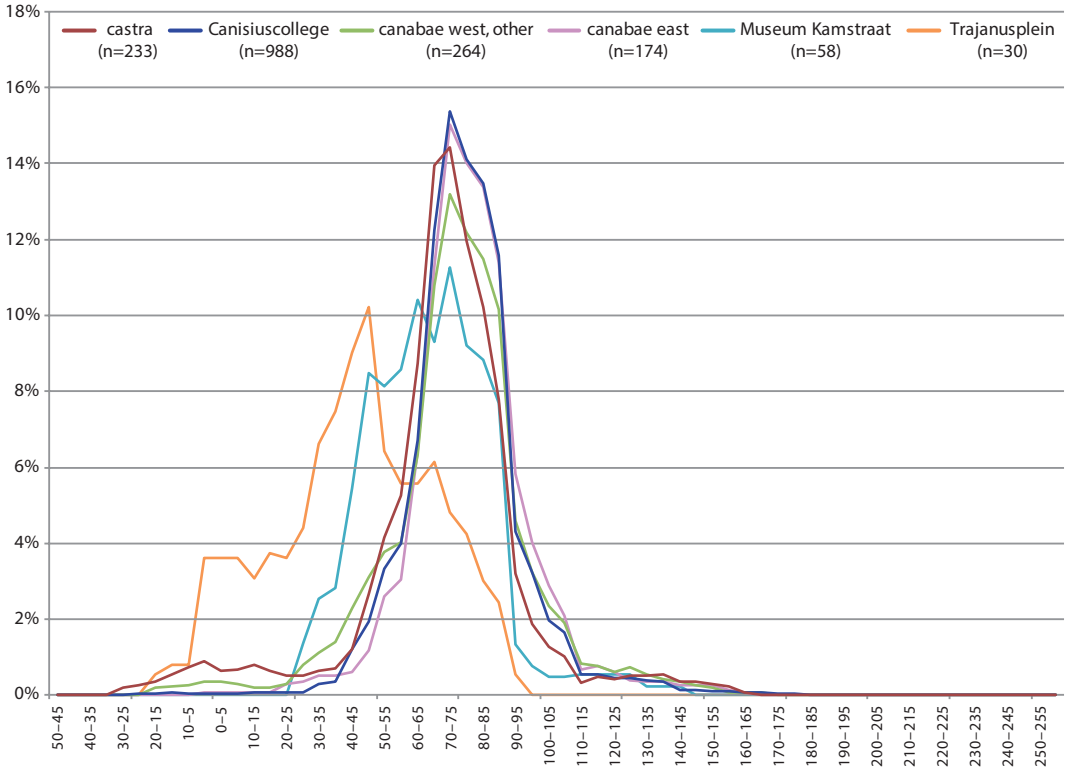

Fig. 6. Chronological distribution per subarea of the stamped sigillata. The stamps are plotted in 5-year intervals, expressed as percentages of the assemblage of their associated subarea.

the coins dating up to AD 250. Differences between the distribution of the coins and the stamped sigillata, however, are more substantial. The main contributor to this difference is the Canisiuscollege area. This subarea is responsible for 57 % of all stamped sherds but for as much as 85 % of all coins *(Tab. 2)*. As mentioned before, this is probably largely due to a very consistent use of metal detectors and a systematic collection of finds from the topsoil.

Chronology of the six subareas

In order to produce comparable chronological distributions, the dates assigned to the sigillata stamps and coins were divided over 5-year periods. E. g. a stamp dating from AD 45 to 70 consists of five 5-year periods (45–50, 50–55, 55–60, 60–65, and 65–70). For this stamp each of the 5-year periods is allotted a value of 1/5 = 0.2. After this, the cumulative numbers of stamps or coins per 5-year period were expressed for each subarea as a percentage of the entire assemblages *(Figs 6–8)*. I have chosen this method, rather than dividing the coins into the 21 periods commonly used by numismatists, for three main reasons. Firstly, I prefer all periods to be of equal length for clarity and comparability. I also feel this benefits ease of understanding for non-numismatists including myself. Finally and most importantly for the aim of this paper, using 5-year periods makes the coin dating curves directly comparable to those of the sigillata potter's stamps.

A dating curve is not solely the result of the activities on a particular site but also of the supply of coins and terra sigillata to the region as a whole. For coins, some emissions

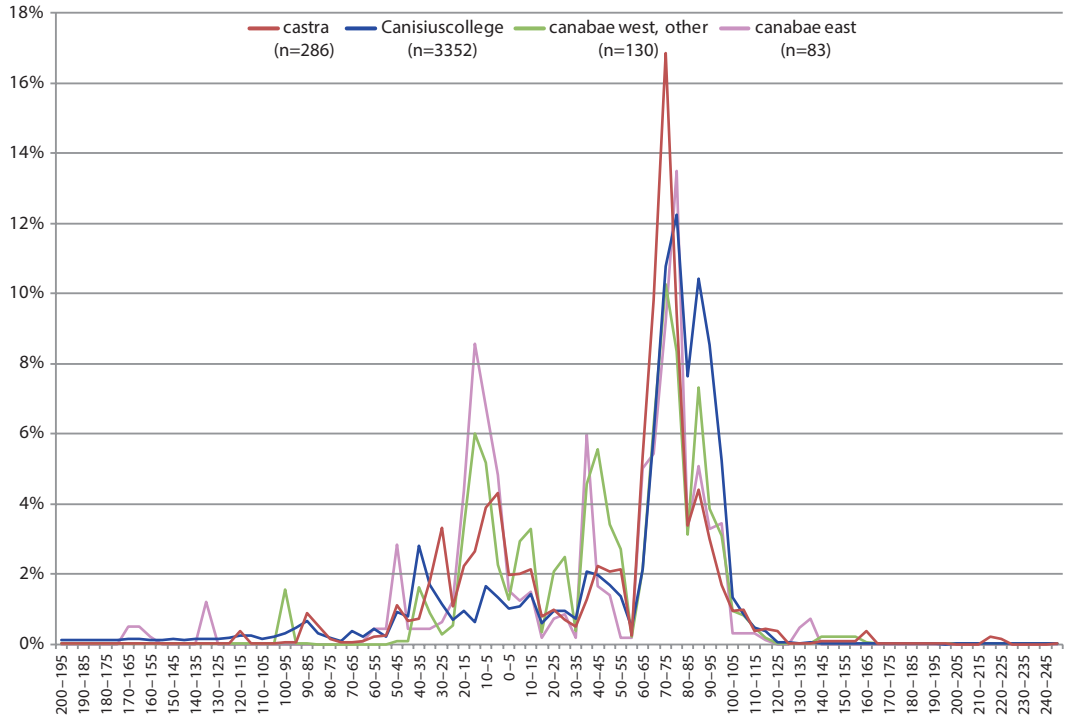

Fig. 7. Chronological distribution per subarea of the coins issued up to AD 250. The coins are plotted in 5-year intervals, expressed as percentages of the assemblage of their associated subarea.

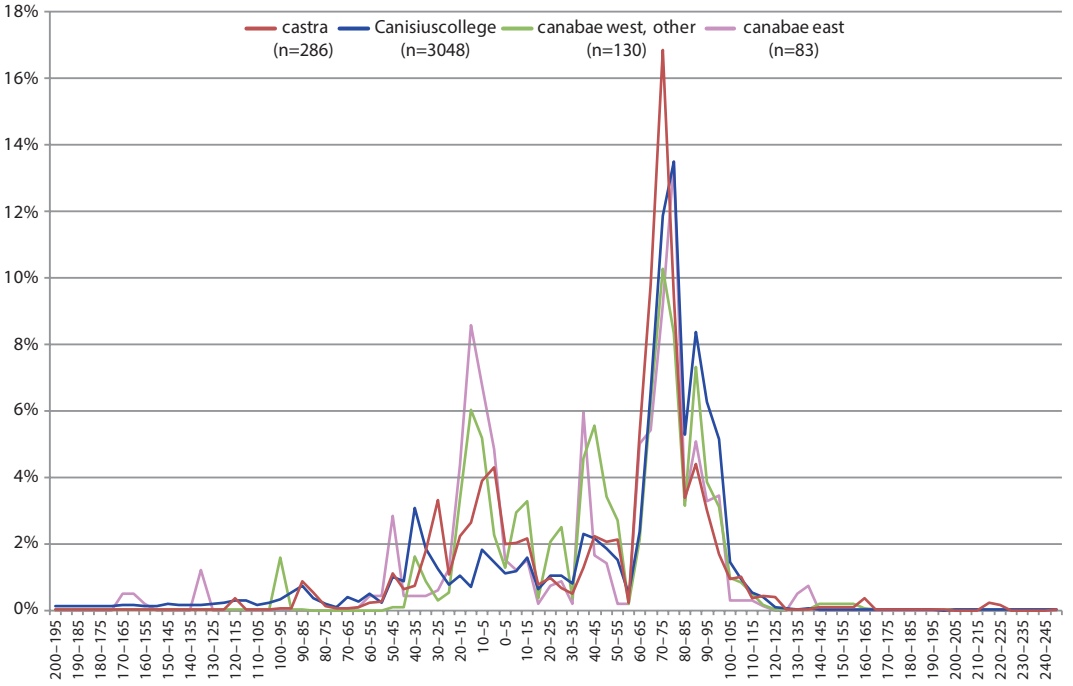

Fig. 8. Chronological distribution per subarea of the coins dating up to AD 250, plotted in 5-year intervals as for *Fig. 7* but with the Domitianic quadrantes of Canisiuscollege removed.

may be very common in a particular region, while others may have only reached the area in small numbers. To combat this problem, Reece developed a method by which he subtracted the mean values of the coin dating curve of the region, in this case Roman Britain, from the dating curves of each site[73]. This results in a graph that shows, for each period, whether the number of coins is higher or lower than the mean value for the region. Kortüm later expanded on this for the forts along the Upper Germanic-Rhaetian Limes[74].

A coin list is available for the Dutch river area[75] and with some effort this could be made into a mean dating curve for the larger region Nijmegen is part of. I have, however, chosen not to do so here. The main reason is that I am not comparing several sites within a larger region but rather small subareas within a single site complex. Subtracting the mean value of the Dutch river area as a whole will likely hide any subtle differences between the subareas. Another solution would be to lump the subareas together and to use this as a mean value with which to compare the individual subareas. However, the size of the assemblages per subarea varies greatly with the Canisiuscollege dataset being by far the largest *(Tab. 2)*. Comparing each subarea's dating curve to the dating curve of all subareas lumped together would be very similar to comparing the Canisiuscollege subarea with the others.

Instead, continuous comparison is made between the coin dating curve and that of the sigillata potters' stamps, which had a different supply chain and for which long circulation periods are also much less of a problem. Additionally, when relevant, such as when discussing the end dates of the *castra* and *canabae*, comparison is drawn between the dating curves of the subareas *(Figs 6–8)* and excavation data from *Ulpia Noviomagus* (see paragraph "Abandonment of the *castra* and *canabae*" and *Figs 9–11*).

Pre-Flavian period

This paper is primarily concerned with the Flavian and later periods. Even so, it is necessary to include the pre-Flavian coinage because, as explained earlier, a substantial part still circulated in the Flavian period. It is less likely that terra sigillata also remained in use for such extended periods of time. It will, however, serve as a good comparison for the coin assemblage and can provide a starting point for future research.

About 44 % of all the coins issued up to AD 250 are pre-Flavian in date. Similarly, 35 % of the stamped sigillata date before AD 70. For the stamped sigillata, two subareas stand out as having particularly high percentages for the pre-Flavian period: Trajanusplein and Museum Kamstraat *(Fig. 6)*.

The Trajanusplein dating curve starts at 20 BC and temporarily levels out between c. 5 BC and AD 30. Considering that the Trajanusplein fort has been dated to AD 10–20, one would expect a peak in this period, rather than a plateau. This can be explained by the fact that in general stamped sigillata in Nijmegen is particularly scarce in AD 10–30. This is the case for all other subareas in Nijmegen-Oost *(Fig. 6)* as well as for the stamped sigillata from Nijmegen as a whole *(Fig. 9)*. The plateau in the Trajanusplein sigillata graph therefore does reflect intensified activities associated with the fort.

After the abandonment of the fort c. AD 20, the number of stamps does not dwindle but increases significantly instead. A distinct peak can be seen between AD 35 and 50. This can probably be linked to the development of the civil settlement of *Oppidum Batavorum*. After AD 50, the numbers steadily decline. Only 15 % of the stamps of Trajanusplein can

[73] See e. g. Reece 1995.
[74] Kortüm 1998.
[75] Aarts 2000, appendix 10.

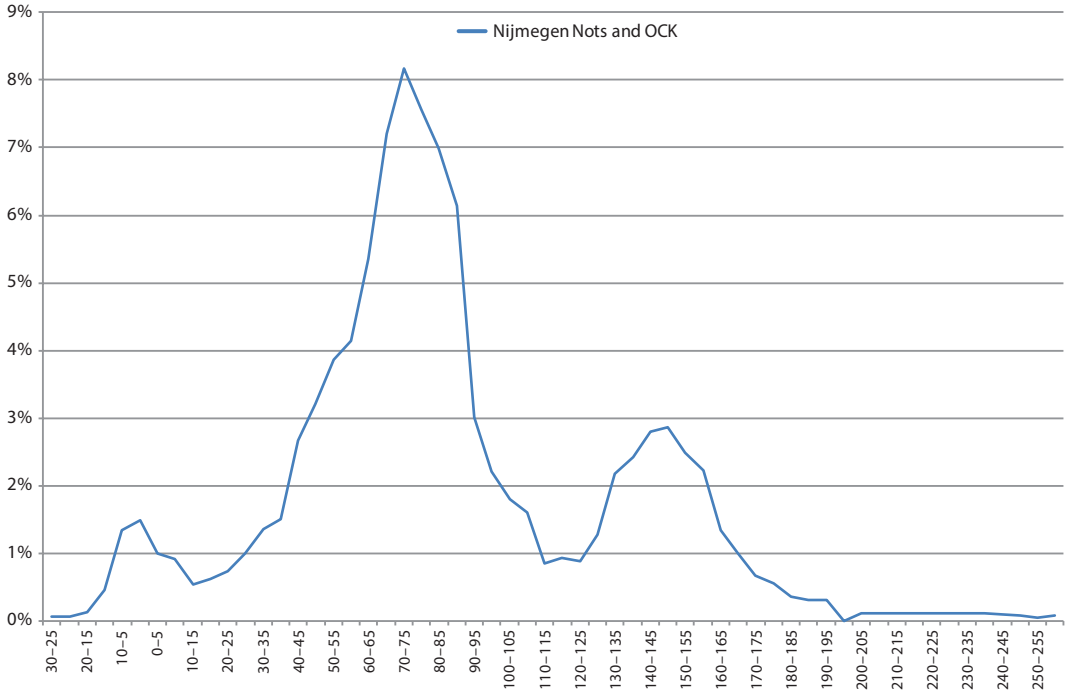

Fig. 9. Chronological distribution of all stamped sigillata from Nijmegen published in NoTS and OCK (n = 1643).

be dated after AD 70 and none date after AD 95, indicating little activity in the Flavian period compared to elsewhere.

The dating curve of Museum Kamstraat, with its predominantly pre-Flavian cemetery, starts somewhat later than that of Trajanusplein and has a first peak at AD 45. That the western *canabae* in this area overlap the pre-Flavian cemetery is evidenced by a second peak between AD 60–75. The dating curve drops rapidly after AD 85. Although the pre-Flavian component of Museum Kamstraat is smaller than that of Trajanusplein, well over half (57 %) of all stamped sigillata can still be dated before AD 70. Apart from these, the western *canabae* have slightly higher percentages between c. AD 25 and 50. This is likely due to interference from the cemetery, as the cemetery is not confined to the Museum Kamstraat but to some extent branches out to the north and west.

For the coins the first major peak can be seen in the last two decades BC *(Fig. 7)*. This peak is for a substantial part made up of the Altar I series, followed by Moneyer's asses. This peak should not be associated with the Augustan legionary camp, as the Altar I series postdates the camp's end date of 16 or 12 BC[76]. In the dating curves of the sigillata stamps a contemporary peak is almost absent *(Fig. 6)*. This is not solely the result of the stamps being spread out over a longer period because they cannot be dated as accurately as coins, as the graph of the stamped sigillata from Nijmegen as a whole does show such a peak *(Fig. 9)*. The difference between the coins and the sigillata stamps may, at least in part, be caused by the composition of both datasets. These datasets are very similar in that both

[76] Kemmers 2006, 61–62.

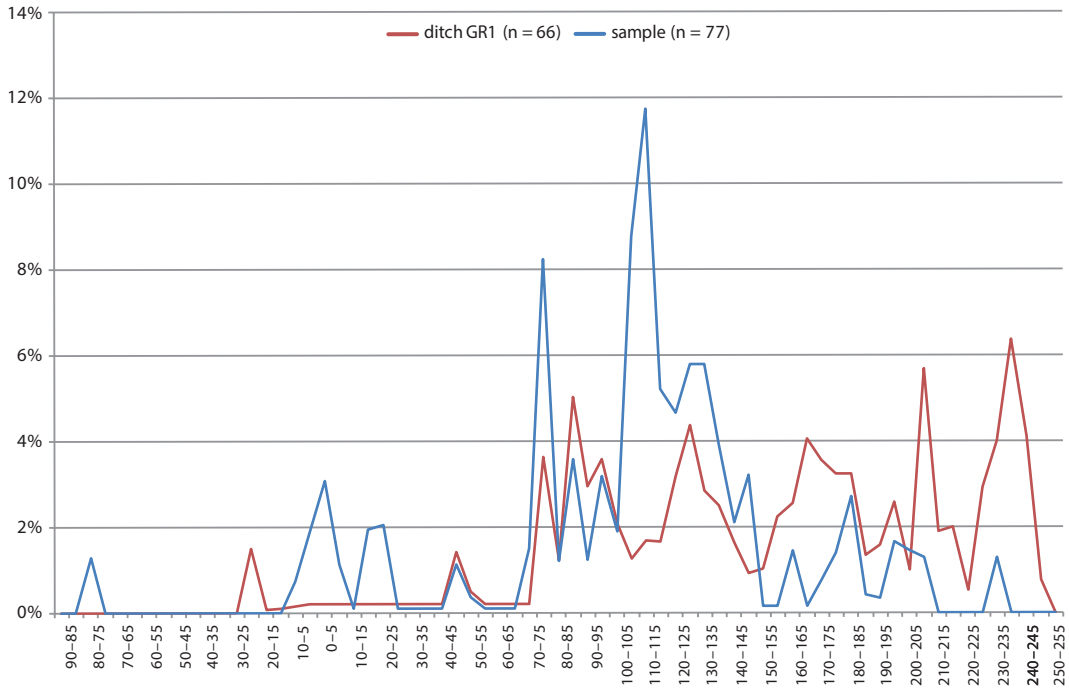

Fig. 10. Chronological distribution of the coins issued up to AD 250 of the Rijnstraat-Lekstraat excavations in Nijmegen-West *(Ulpia Noviomagus)*, plotted in 5-year intervals.

include finds from the same excavations and stray finds collected by Daniëls, but the coin dataset also incorporates the private collection of G. M. Kam. For metal there is also the matter of preservation. Until the early 20th century, much of Nijmegen-Oost was in use as arable land. Perhaps the earlier coins in deeper stratigraphic layers were less affected by ploughing and corrosion from acidic manure. The larger the sample, the smaller these effects will be. And indeed the smallest two datasets, the eastern and western *canabae*, have the highest percentages for these early coins. However, the abundance of 4th-century coins shows that the effects of ploughing and corrosion are limited, as these coins, being the youngest, would have been most affected. For the eastern *canabae*, there is an additional element at play. This subarea also incorporates an excavation carried out by Holwerda which yielded 17 coins of which eleven are dated to the last two decades BC[77]. As the eastern *canabae* as a whole yielded only 83 coins in total, this has a large effect on its dating curve.

Between c. AD 35 and 50 there is again a divergence between the *castra* and Canisiuscollege on the one hand and the western and eastern *canabae* on the other, with the percentages of the latter two being higher. This again may be caused by a better preservation of the earlier coins in the deeper strata, the effects of which are more pronounced in the smaller datasets. For the western *canabae*, interference from the pre-Flavian cemetery of Museum Kamstraat can also be a factor. As said above, this is also noticeable in the dating curve of the sigillata stamps, where the western *canabae* have slightly higher percentages between c. AD 25 and 50.

[77] Holwerda 1943.

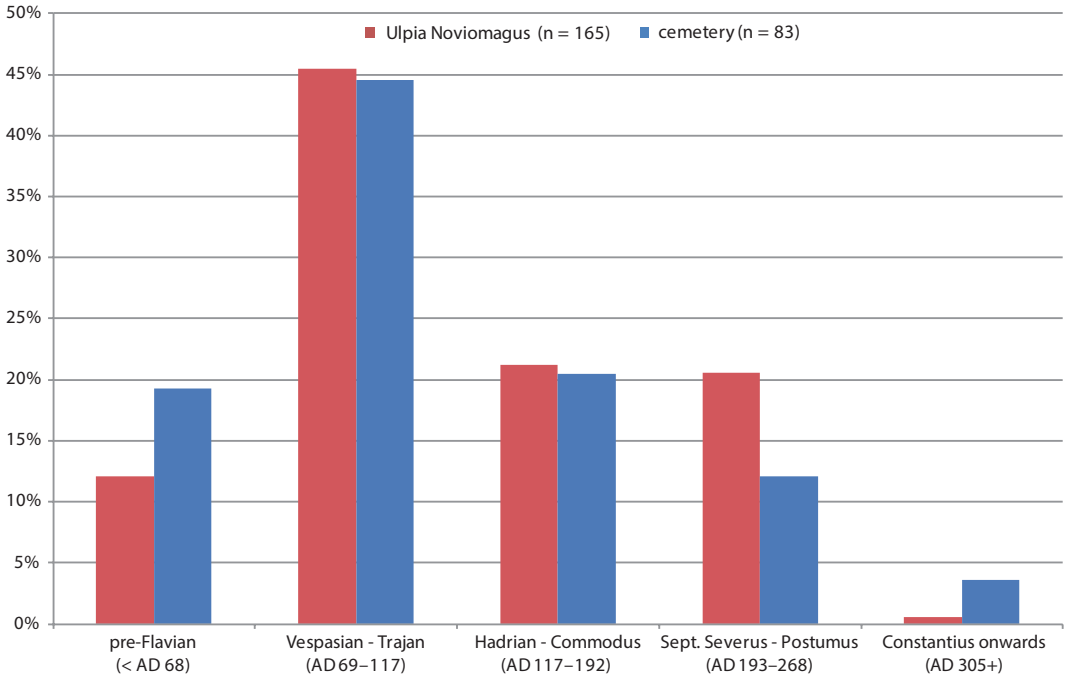

Fig. 11. Chronological distribution of the coins from Nijmegen-West in the G. M. Kam collection.

Flavio-Trajanic period

For both the stamped sigillata and the coins, the highest peaks are found in the Flavio-Trajanic period, particularly AD 65/70–90 *(Figs 6–7)*. The sudden increase of coins from AD 65 to a large extent is the result of the suspension of bronze issues under Claudius and the resumption by Nero. It is therefore not purely related to the site's occupational history. The increase in terra sigillata is significant, although less dramatic. For the sigillata, the years just prior to the arrival of *legio X* around AD 70 may also be somewhat inflated due to the way that stamps are dated in NoTS. Stamps are generally dated in periods of between twenty and forty years, many starting in AD 50, 60, and particularly 65 and dating into the Flavian period.

For the *castra*, the dating curves of both the sigillata stamps and the coins rise slightly quicker in the years preceding AD 70 than for the other subareas. After this initial peak, the *castra*'s sigillata curve drops quickly after AD 60–75, while the curves of the other subareas do not drop for another 5 to 10 years. After AD 85–90, the percentages of these subareas also quickly drop.

Furthermore, the *castra*'s coin dating curve has an exceptionally high peak directly at the start of the Flavian period, with 17 % dating between AD 70 and 75. The early Flavian peak for the *castra* is mainly caused by a large number of coins struck in AD 71[78]. These tend to be very common on all Flavian sites in *Germania Inferior*, *Germania Superior*, and

[78] Vespasian COS III. Of the 48 coins from the *castra* dating between AD 70 and 75, 26 are of this type. In AD 71, a large number of aes coins were struck, especially in comparison to the two fairly meagre preceding years (Mattingly / Sydenham 1926, 7–8).

Britannia[79]. The curve of the western *canabae* also has a peak between AD 70 and 75, although at a more modest 10 %. For the Canisiuscollege area and the eastern *canabae*, this initial peak is found five years later, between AD 75 and 80.

The above might be an indication that there was a small delay between the foundation of the *castra* and the *canabae*. The legionaries were not isolated in the *castra* and will have spent and / or lost much of their money in the *canabae*. If the *castra* and *canabae* were built simultaneously, one would expect the peaks to overlap. For the sigillata, however, this could also be a reflection of the prioritisation of the *castra* over the *canabae* in the supply of pottery.

For all subareas the dating curves of the coins show a secondary Flavian peak around AD 90–95, which is largely made up of coins dated to AD 90–91. Like the peak around AD 71, this peak at AD 90–91 is a common characteristic for Flavian sites in the German provinces[80]. There is therefore no need to associate this peak with the rebuilding of the *castra* in stone (phase 5), particularly considering that the peak for the *castra* is the lowest of all subareas.

For the Canisiuscollege area, this secondary peak is particularly high, with 10 % of its coins dated to AD 85–90 and 9 % to AD 90–95. Here, however, another factor is at play. While Canisiuscollege includes a total of 190 coins dating from AD 90–91, an even higher number of 304 coins are quadrantes of Domitian dated to his entire reign (AD 81–96)[81]. Due to the systematic use of metal detectors[82], small coins such as quadrantes will be overrepresented in the Canisiuscollege dataset. After removing the quadrantes for Canisiuscollege, the Domitianic peak becomes significantly lower and is similar to that of the western *canabae (Fig. 8)*. Removing the quadrantes does not significantly alter the remainder of the dating curve.

Nor does removing the quadrantes change the fact that the dating curve of the *castra* has the highest AD 70–75 peak by far and the lowest AD 90–95 peak of all four subareas. Even after removing the Domitianic quadrantes, the AD 90–95 peak for the Canisiuscollege area is almost twice as high as that of the *castra*. The dating curve for the stamped sigillata, although less clearly, seems to reflect this. Between AD 95 and 105, Canisiuscollege and the western and eastern *canabae* all have slightly higher percentages than the *castra*.

It is tempting to suggest on the basis of this that the *canabae* may have remained in use for a short period of time after the abandonment of the *castra*. However, it may also be a result of post-depositional processes. As argued before, earlier coins may have been better preserved in the deeper strata. The effect of this will be more pronounced for the *castra* dataset, as it is much smaller than that of Canisiuscollege. And again, most excavations in the *castra* were carried out in the 50s and 60s of the previous century, so it is likely that the topsoil was not thoroughly searched for finds.

Abandonment of the *castra* and *canabae*

It is striking that of all stamped sigillata and coins from the research area only a very small percentage can be dated to the 2nd century. Of the stamped sigillata only 8 % date after

[79] Kemmers 2006, 211–212.

[80] They are less common in *Britannia*, where numbers dwindle from 85–87 onwards, almost certainly due to the reduction of the British army for Domitian's Dacian war (Kemmers 2006, 212).

[81] RIC II 436. It has been argued that these may be dated more precisely to 82 or 83 (Carradice 1983, 124).

[82] Polak 2014, 32–33.

From \ To	AD 99	AD 100	AD 101	AD 102	AD 103	AD 111	AD 114	AD 117	Total
AD 98	39			42				18	**99**
AD 99		34		1				1	**36**
AD 100		1							**1**
AD 101			1	9					**10**
AD 103					1	48		3	**52**
AD 104						1		3	**4**
AD 112							2	1	**3**
AD 114								6	**6**
Total	**39**	**35**	**1**	**52**	**1**	**49**	**2**	**32**	**211**

Tab. 3. Overview of the Trajanic coinage from the research area. The rows show the coins' start dates, the columns show their end dates.

AD 100 and less than 1 % after AD 150. Similarly, of all coins issued up to AD 250 only 2 % are struck after AD 100 and less than 1 % after AD 150.

It is beyond doubt that stamped sigillata and coins still reached this part of the Empire in great quantities after AD 100, as both categories are abundant in *Ulpia Noviomagus (Figs 9–11)*[83], only 3 km to the west. The absence of sigillata and coins from the mid-2nd century therefore needs to be explained as a lack of activity in the area rather than as a reduced supply to the region.

It is clear from the dataset that activity in the area dropped rapidly and significantly after the departure of *legio X* around AD 104. As this year falls within the reign of Trajan (AD 98–117), it may be useful to briefly examine the Trajanic coinage. It is of note that only 211 of the 4231 coins in the dataset are dated to the reign of Trajan *(Tab. 3)*. 35 % of these date between AD 98 and 100; 60 % date between AD 98 and 103. 31 % date after AD 103, while the remaining coins could not be dated with enough precision. The fact that 60 % of the Trajanic coinage can be dated before AD 103 can partly be explained by the observation that the later coins had less time to be lost while the *castra* were still in use. More important, however, is the inevitable reduction in the supply of coins after the departure of *legio X* in 104.

The impact of a garrison's departure on coin supply to the region is also seen in other sites. At *Vindonissa* (Windisch, CH), the departure of *legio XI Claudia* in AD 101 is reflected by the fact that of the Trajanic aes coinage up to AD 103 almost 97.7 % can be dated to AD 98–100 and only 2.3 % to AD 101–103[84]. The same pattern again is visible at *Argentoratum* (Strasbourg, FR), where the supply of new coinage virtually stopped after

[83] *Figure 9* is a dating curve of all terra sigillata potters' stamps from Nijmegen recorded in NoTS and OCK. The data was obtained via http://www.rgzm.de/samian/home/frames.htm, by selecting Corpus Vasorum Arretinorum / Names on Terra Sigillata > Chart sites > Sites and Provinces > % Graph. *Figure 10* is a dating curve of the coins issued up to AD 250 of the Rijnstraat-Lekstraat excavations in Nijmegen-West *(Ulpia Noviomagus)*. The data was derived from Reijnen 2013, 183–184 tab. 13,1 (test sample); 192–193 tab. 13,3 (ditch GR-1). *Figure 11* shows the chronological distribution of the coins from Nijmegen-West in the G. M. Kam collection (after Daniëls 1950, 9–10).

[84] Peter 1996, 317.

legio II Augusta left around AD 43, before picking up again with the arrival of *legio VIII Augusta* during the reign of Domitian[85]. This clearly shows how directly the supply of new, mainly bronze, coins is linked to the military presence. An exception would be *Mogontiacum* (Mainz, DE), where the coin series does not show a stronger drop under Domitian than at other forts along the Rhine, even though the fort's garrison was reduced from two legions to one. David Wigg-Wolf points out, however, that as Mainz was the capital of the province, there was still a large concentration of troops even after the reduction of the garrison[86].

As mentioned above, the exact end date for the *castra* has been the subject of some debate. Suggestions range from AD 105[87] or 125[88] to AD 175[89]. However, both the coins and the stamped sigillata point more towards the second date. The sigillata dating curves for all six subareas and for Nijmegen as a whole drop below 1 % between AD 110 and 115 *(Figs 6–9)*. However, while the dating curve of Nijmegen rises again in AD 125–130, those of the six subareas do not. In fact, these drop even further to approach zero around AD 160. This strongly suggests that the *castra* were abandoned not much later than AD 125–130.

If the *castra* still housed a detachment of any significant size after this date, one would expect the sigillata curve at least to rise slightly. This is corroborated by the coins. The dating curves for all four subareas drop below 1 % between AD 105–110 and do not rise significantly until after AD 250 *(Figs 7–8)*, while at *Ulpia Noviomagus* there seems to be no shortage of 2nd century coins *(Figs 10–11)*. As suggested above, the *canabae* may have remained in use for a while after the *castra* were finally abandoned. If this delay existed at all, it is unlikely to have been longer than a couple of years.

Late Roman period

Although it is not the main focus of this paper, the number of Late Roman finds is too great to be left entirely unmentioned. Furthermore, a brief description of this material may serve as a starting point for future research into this period. After about a century and a half of hardly any new issues appearing in the area, a substantial number of 247 coins can be dated to the 4th century AD. Of these, 155 were found during the Canisiuscollege excavations.

As 4th-century coins are generally found in the top soil in Nijmegen-Oost, it has been argued that they originate from the present-day city centre of Nijmegen, where 4th-century occupation is well attested. The argument goes that the medieval and later inhabitants of Nijmegen dug their cesspits through the Roman layers; the contents of the cesspits were then spread on the arable land outside the city walls[90].

Heeren, who studied the fibulae from the Canisiuscollege excavations, is of a different opinion. Among the 440 identifiable fibulae, he found four examples dating to the late 3rd or early 4th century[91]. As two of these Late Roman fibulae are almost entirely intact, he argues that these cannot have undergone centuries of ploughing after having been dug up and deposited on the arable land outside the city walls. Heeren suggests a short-term

[85] Martin 2011, 820.
[86] Wigg-Wolf 2014, 168.
[87] Swan 2009, 83.
[88] Brunsting / Steures 1995, 108.
[89] Bogaers 1965, 14; Bogaers 1967, 62.
[90] Kemmers 2006, 124; Polak / Van Diepen 2011, 94.
[91] Heeren in prep. Two crossbow brooches, one of which is of the Keller / Pröttel / Swift type 1 var. Richborough (published previously in Haalebos 1995, 86–87 as a late 3rd century *Fibel mit langen Scharnierarmen*). One ring fibula type Jobst 36A / Fowler C and one *Germaanse kniefibula met trapeziumvormige voet.*

military presence in the area, perhaps associated with the construction of the Late Roman fortification on the Valkhof further west[92]. Along similar lines, it has been suggested that the 4th-century coins from Nijmegen-Oost ended up in the soil when the stone walls and buildings of the *castra* were used as a quarry for the construction of this fortification on the Valkhof[93].

The number of 4th-century coins in the research area seems too large to be explained away by secondary deposition in the medieval or modern period. This view seems to be substantiated by the Late Roman fibulae. There appears to have been some activity in the area in the Late Roman period, although it remains unclear whether this was of a military nature and should be associated with the construction of the Late Roman fortification on the Valkhof at the end of the 3rd century. It is clear, however, that there was little to no activity in the area between the abandonment of the *castra* and *canabae* around AD 125–130 and the late 3rd century. Coins and stamps dated between AD 150 and 300 make up less than 1 % of their respective assemblages and, as said earlier, pottery from this period is also almost completely absent.

Visualising chronological patterns

Having established the chronology of the six subareas, we can now turn to some smaller chronological patterns within the research area. These will be highlighted by means of three so-called heat maps, graphical representations of data showing values as colours. These heat maps were made by calculating the average date of each stamped sherd and coin (i. e. starting date plus end date divided by two) and then mapping them in a GIS. Using these point values, intermediate values were interpolated. These values were then divided into five periods of equal length and colour-coded accordingly *(Figs 12–14)*[94].

The technique provides a clear visual representation of the distribution of early and late finds. An important shortcoming, however, is that it can only attribute one value to any given coordinate. If a particular coordinate contains more than one value, the average of these values is taken, i. e. the average of the average dates of all coins or stamps for that coordinate. For example, in a worst case scenario a coordinate might contain two coins, one dated AD 0–50 and one AD 150–200. The average date for that coordinate would thus be calculated as AD 100, falling well outside the date range of either coin. Luckily, this only becomes problematic in areas with few finds. In areas with many finds, such a 'faulty' point value will be evened out by the surrounding values. Interpolation is thus most reliable when the points are fairly close together and evenly spread across the area. This means that the images below are fairly accurate for the western *canabae* and *castra*, where the density of finds is relatively high, but less so for the southern *canabae*, which have yielded only few coins and stamped sherds.

The first thing to note is that the map of the stamped sigillata *(Fig. 12)* is much more informative than the first map of the coins *(Fig. 13)*. This is due to the relatively long date range of the coins, which required the five periods to be much broader. Therefore a third map was made to include only the coins from AD 50 to AD 150 *(Fig. 14)*. This does mean, however, that some earlier coins have been disregarded that could still have belonged to the Flavian circulation pool.

[92] Heeren in prep.

[93] Reijnen 2009, 82; Enckevort / Thijssen 2014, 31.

[94] Using the QGIS Interpolation plugin > IDW (Inverse Distance Weighting).

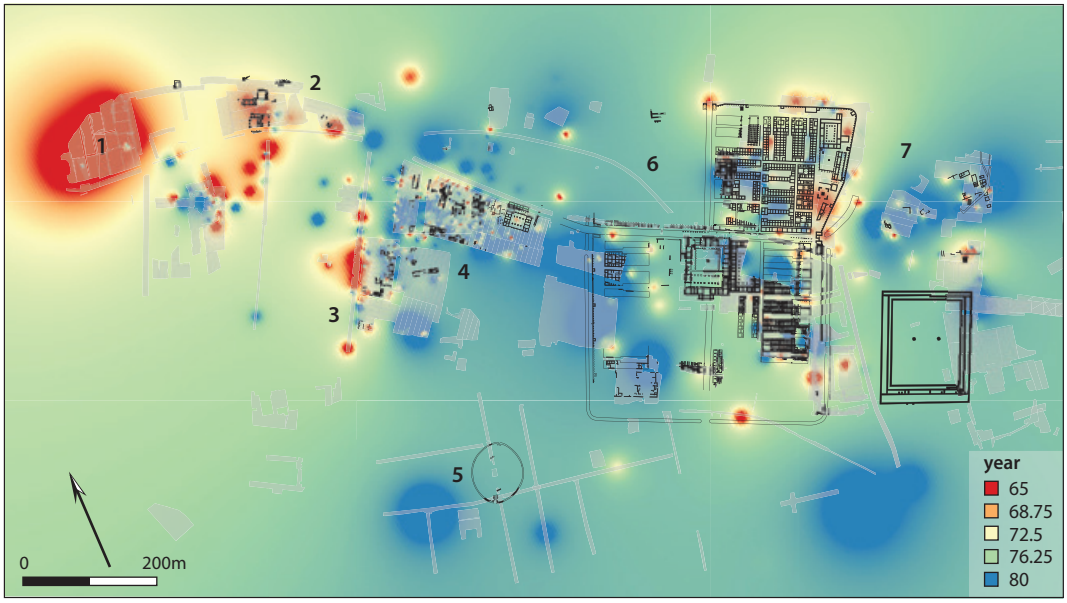

Fig. 12. Heat map of the average date per coordinate of the stamped terra sigillata (excluding Arretine wares). 1 Trajanusplein; 2 Estel; 3 Museum Kamstraat; 4 Canisiuscollege excavations; 5 amphitheatre; 6 *castra*; 7 eastern *canabae*.

To the west of the *canabae*, the Trajanusplein fort stands out in all three maps. That activity did not end here after the abandonment of the fort around AD 20 becomes clear from the third map, which only includes coins from AD 50 onwards. As previously remarked, this activity can probably be linked to the civil settlement of *Oppidum Batavorum*. The mostly pre-Flavian cemetery of the Museum Kamstraat is also clearly visible on all maps as a number of smaller red concentrations.

The first two maps also show a noticeable pre-Flavian component near the westernmost stone buildings of the *canabae* (2. Estel site). This concentration does not occur in the third map, indicating that most coins here date before AD 50[95]. For the coins it could be argued that these belonged to the Flavian circulation pool, but this is unlikely for the sigillata. The Estel site has produced few pre-Flavian features, with the noticeable exception of a large ditch considered as the defensive ditch belonging to the earliest phase of *Oppidum Batavorum* dated before AD 10–20[96]. A study of the terra sigillata from the Estel site has shown that 52 % of the stamped and 56 % of the decorated sigillata can be dated before AD 70. However, at least 60 % of the pre-Flavian sigillata was found in Flavio-Trajanic contexts. This seems to indicate that most of the finds were deposited during (re)building or demolition activities[97].

Within the *castra*, the earlier finds seem to cluster predominantly in the eastern half. However, as previously indicated, the western half of the *castra* has suffered from much site disturbance and has yielded comparatively few coins. This east-west opposition could thus be caused by post-depositional processes.

[95] One Republican, five coins of Augustus, one of Tiberius, and one of Claudius.

[96] Van der Veen 2017, 36 (greppel S1).

[97] Van der Veen 2017, 102; 108.

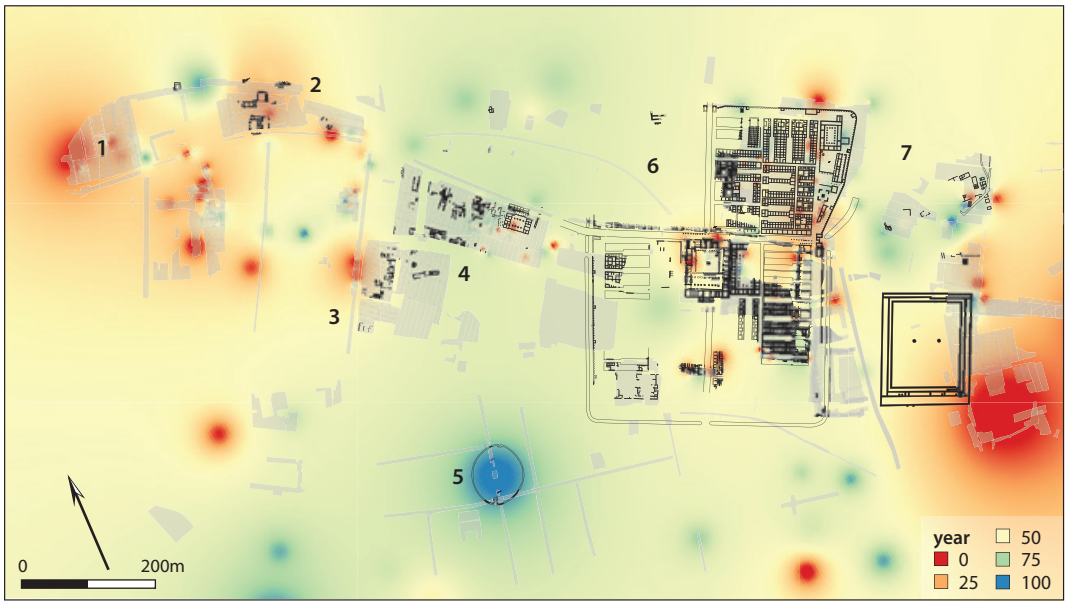

Fig. 13. Heat map of the average date per coordinate of the coins up to AD 250. 1 Trajanusplein; 2 Estel; 3 Museum Kamstraat; 4 Canisiuscollege excavations; 5 amphitheatre; 6 *castra*; 7 eastern *canabae*.

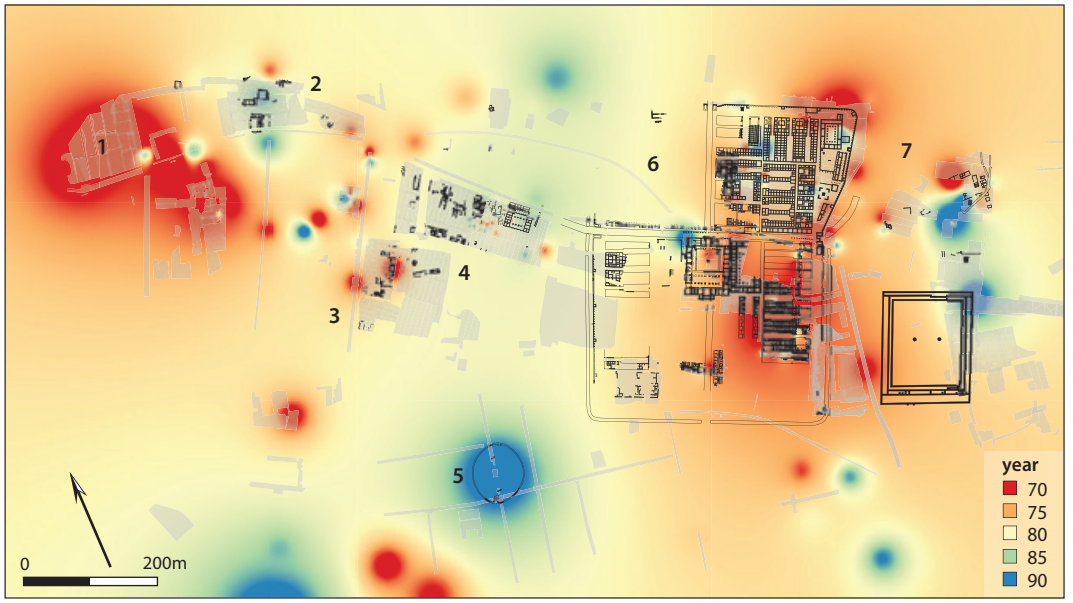

Fig. 14. Heat map of the average date per coordinate of the coins from AD 50–150. 1 Trajanusplein; 2 Estel; 3 Museum Kamstraat; 4 Canisiuscollege excavations; 5 amphitheatre; 6 *castra*; 7 eastern *canabae*.

Flavio-Trajanic finds are particularly well represented in the parts of the *canabae* directly outside the west and east gates of the *castra*. For the stamped sigillata these areas are clearly visible as two large blue concentrations *(Fig. 12)*. For the coins these concentrations show up as green *(Figs 13–14)*. *Figure 14* further shows that early Flavian coins cluster around

the east gate, while mid to late Flavian coins cluster around the west gate. This pattern is in line with existing knowledge of these areas. The Canisiuscollege excavations to the west of the *castra* have produced a great number of features associated with the Flavio-Trajanic *canabae*, while to the east of the fortress gate a large natural depression was used as a rubbish dump for the *castra* and likely the *canabae* as well.

Figures 13 and *14* further show that most of the coins struck after the departure of *legio X* in AD 104 were found outside the *castra*. Both coin maps also show a very noticeable blue concentration within the amphitheatre south of the *castra*, which starkly contrasts with the surrounding area. Eleven coins were found in the amphitheatre, four of which date after Trajan. None date later than Marcus Aurelius (AD 161–180)[98]. As stated above in the paragraph "Previous research", pottery finds indicate that the amphitheatre may have remained in use into the 3rd century AD.

South of the *castra* only limited research has taken place and very few coins are known from the area. The contrast to the surrounding area is thus mainly the result of a lack of data. However, it is striking that almost all coins dating between AD 150 and 250, ten in total, were found here.

Conclusion

The aim of this paper was to provide a new chronological framework for the Nijmegen *castra* and *canabae* by examining two find categories that can be dated with a high degree of accuracy, namely coins and stamped terra sigillata. For this purpose, previously published and hitherto unavailable data were bundled and presented to the reader in a series of dating curves and maps.

As this paper incorporates data from many excavations across a large area, there is the important matter of comparability. It was found that the dataset was affected by three main factors: original deposition patterns, post-depositional processes, such as site disturbance, and differing excavation methods, such as an emphasis on the collection of topsoil finds and the use of metal detectors. It is important to note, however, that in many cases these circumstances mainly affect representation between areas, not within one area. There is no clear way to avoid interference from any of these factors. Nevertheless, when it is remembered that these limitations exist, it is possible to observe some chronological trends.

Regarding the starting dates of the *castra* and *canabae*, there is little doubt that the *castra* were built around AD 70. Literary and epigraphic sources clearly point in this direction and the analysis of stamped sigillata and coins confirms this. Although the dating curves of the coins and the sigillata stamps show that there was plenty of activity in the wider area prior to the construction of the *castra*, the highest peaks by far are found around AD 70. This can be explained by a dramatic increase in supply of both coins and pottery with the arrival of *legio X* as well as by the fact that pottery and coinage from the period of the foundation of the *castra* had the highest chance to be discarded or lost while the site was still in use. Earlier types may have gone out of use and may therefore have never reached the area, while later types had less time to be deposited.

The sigillata and coin dating curves of the *castra* peak slightly earlier than those of most other subareas. This might be an indication that there was a small delay between the foun-

[98] Of Augustus, Titus, Domitian, and Nerva one coin each was found. One coin belongs to either Nerva or Trajan, two to Trajan, one each to Hadrian and Antoninus Pius, and two to Marcus Aurelius.

dation of the *castra* and the *canabae*. The legionaries were not isolated in the *castra* and will have spent and / or lost much of their money in the *canabae*. If the *castra* and *canabae* were built simultaneously, one would expect the peaks to overlap. For the sigillata, however, this could also be a reflection of the prioritisation of the *castra* over the *canabae* in the supply of pottery. In any case, if there was a delay between the construction of the *castra* and *canabae*, this delay will not have been longer than a few years.

There are many differing opinions on the end date of the *castra*, ranging from AD 105 to 175. While mid-2nd century finds are abundant in *Ulpia Noviomagus* further west, they are almost entirely absent from the *castra* and *canabae*. When looking at the sigillata curve of Nijmegen as a whole, there is a sharp increase from around AD 125–130 leading to a peak around AD 150, while none of the subareas in the research area display such a peak. Instead, all dating curves drop even further to approach zero around AD 160. This strongly suggests that the *castra* were abandoned not much later than AD 125–130. If the *castra* still housed a detachment of any significant size after this date, one would expect the sigillata curve to at least rise slightly. This hypothesis is corroborated by the coins. The dating curves for all four subareas drop below 1 % between AD 105–110 and do not rise significantly until after AD 250, while at *Ulpia Noviomagus* there seems to be no shortage of 2nd century coins.

A similar end date can be suggested for the *canabae*, although the data may indicate that the *canabae* were abandoned a few years after the *castra*. During the later 2nd and 3rd century, only one area of the *canabae*, the amphitheatre, seems to have remained in use. Coins and fibulae point towards renewed activity in the research area in the 4th century. It remains unclear whether this activity was of a military nature and if it should be associated with the construction of the Late Roman fortification on the Valkhof. It is clear, however, that there is no continuity in occupation between the abandonment of the *castra* and *canabae* around AD 125–130 and the 4th century.

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Abbreviations

BAMN	Bureau Archeologie en Monumenten Nijmegen = Municipality of Nijmegen, Department of Archaeology and Monuments
Drag.	Dragendorff 1895
KUN	Katholieke Universiteit Nijmegen, from Sept. 2004 known as Radboud Universiteit Nijmegen
NB	Niederbieber = Oelmann 1914
NoTS	Names on Terra Sigillata = Hartley / Dickinson 2008–2012
OCK	Oxé et al. 2000
RCE	Rijksdienst voor het Cultureel Erfgoed = Cultural Heritage Agency of the Netherlands
RIC	Roman Imperial Coinage. This work encompasses 10 volumes, but mainly two have been used: Vol. I revised edition = Sutherland / Carson 1984 and Vol. II = Mattingly / Sydenham 1926
RMO	Rijksmuseum van Oudheden = National Museum of Antiquities
ROB	Rijksdienst voor het Oudheidkundig Bodemonderzoek = State Service for Archaeological Investigations, now RCE.
RRC	Roman Republican Coinage = Crawford 1974

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Summary: Chronology and spatial distribution of terra sigillata potters' stamps and coins within the Nijmegen *castra* and *canabae*

This paper discusses the chronology of the legionary fortress *(castra)* and surrounding civil settlement *(canabae legionis)* of Nijmegen, the Netherlands, by examining distribution patterns of terra sigillata potters' stamps and coins. It partially draws on previously published data, but supplements this with a large amount of hitherto unavailable data from various sources to provide a new chronological framework for these military and semi-military assemblages. While previous research has usually focussed on either the *castra* or the *canabae*, this is the first attempt at a comprehensive comparative study of both sites, providing new insights into their development and interaction. The main research questions addressed are: How are the finds distributed across the research area and what does this tell us about the impact of depositional patterns, post-depositional processes, and differing excavation techniques? What are the start and end dates of the *castra* and *canabae* and are these the same? And finally, can any chronological patterns be discerned and how should these be explained?

Zusammenfassung: Chronologie und räumliche Verteilung der Töpfermarken auf Terra Sigillata und der Münzen innerhalb der Nijmegener *castra* und *canabae*

Die vorliegende Arbeit diskutiert die Chronologie des Legionslagers *(castra)* und der umgebenden zivilen Siedlung *(canabae legionis)* von Nijmegen, Niederlande, anhand der Untersuchung von Verteilungsmustern der Töpfermarken auf Terra Sigillata und der Münzen. Sie bedient sich teilweise bei bereits publizierten Daten, aber ergänzt diese mit einer großen Menge bislang nicht verfügbarer Daten aus diversen Quellen, um einen neuen chronologischen Rahmen für dieses militärische und halbmilitärische Fundgut zu liefern. Während sich bisherige Forschungen in der Regel entweder auf die *castra* oder auf die *canabae* konzentrierten, ist dies der erste Versuch einer umfassenden vergleichenden Studie beider Stätten, die neue Einblicke in ihre Entwicklung und Interaktion liefert. Die wichtigsten, hier behandelten Forschungsfragen lauten: Wie sind die Funde über das Untersuchungsgebiet verteilt und was sagt uns dies über den Einfluss von Ablagerungsmustern, Postdepositionsprozessen und unterschiedlichen Grabungstechniken? Was sind die Anfangs- und Enddaten der *castra* und *canabae* und sind diese identisch? Und schließlich: Lassen sich chronologische Muster erkennen und wie sind diese zu erklären?

Resumé : Chronologie et répartition géographique des marques de potiers de la sigillée et des monnaies dans les *castra* et les *canabae* de Nimègue

Ce travail se penche sur la chronologie du camp légionnaire *(castra)* de Nimègue (NL), et de l'habitat civil à proximité *(canabae legionis)*, en se basant sur l'étude des schémas de répartition des marques de potiers de la sigillée et des monnaies. Il utilise en partie des données déjà publiées et les complète par une grande quantité de nouvelles données provenant de différentes sources, afin d'établir un nouveau cadre chronologique à ce matériel militaire et semi-militaire. Alors que la recherche se concentrait généralement jusqu'ici soit sur les *castra*, soit sur les *canabae*, on tente ici pour la première fois une étude comparative des deux sites qui nous livre de nouveaux éléments sur leur évolution et leur interaction. Les questions les plus importantes abordées ici sont : Comment les artefacts sont-ils distribués dans l'espace étudié et dans quelle mesure est-ce lié aux modes de sédimentation, à des processus postérieurs et à différentes techniques de fouille ? Quelles sont les dates initiales et finales des *castra* et *canabae* et sont-elles identiques ? Et finalement : Peut-on déceler des structures chronologiques et comment faut-il les interpréter ?

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Fig. 1: author, adapted from Van Enckevort / Heirbaut 2010, fig. 29; 151. – *Figs 2–14:* author. – *Tabs 1–3:* author, graphics K. Ruppel (RGK).