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A cross-craft approach to ceramic, glass and iron in the Early Middle Ages. The resources of workshops from southern Belgium

Line Van Wersch, Martine van Haperen and Gaspard Pagès

1. Introduction

The Early Middle Ages are a period of strong political and social mobility. This period truly marks the end of the Roman as well as the beginning of medieval society and economy (Wickham 2000). With the fall of the Western Roman Empire, in its northwestern part, the power goes first to the Merovingian kings and at the end of the 7th century CE, they are replaced by the Carolingians. Under their rule, the aristocracy becomes more powerful and changes the rural world by organizing manorial complexes[1] (Verhulst 2002; Devroey 2003). This period also sees the growing supremacy of the Christian faith that goes along with the intensifying foundations of churches and abbeys who possesses large estates and hosts craft activities (Lebecq 2000; Henning 2007). Next to them, emporia emerge on the coasts of the North Sea. These ports have a clear commercial orientation and appear as economically dynamic agglomerations (Tys and Loveluck 2006; McCormick 2007). Some historians view the transition from the Merovingian to the Carolingian period as a time of demographic and productive growth due to the rural reorganization in which the North Sea is a zone of active exchanges (Wickham 2000; Verhulst 2002; Devroye 2003). Others however believe the new organisation of the rural world can just as well lead to the ruin of productivity and to the inhibition of efficiency and innovation due to the strong paralyzing domination of the elites (Henning 2007). Nonetheless the early medieval elites are regarded as leading the economy and as responsible for cultural change (Wickham 2008).

With the ERC Advanced project 'Rural Riches' (2017-2022) Theuws questioned that point of view and considered the role of the rural population in the economic development in northern Gaul after the collapse of the Roman Empire. In his opinion the mass of objects found in the graves, especially those of the 6th century CE, show that rural dwellers had access to local, regional, and global exchange networks and that they could have triggered economic growth. In order to substantiate this hypothesis, a large amount of data has been collected from sites, their material culture, and burial rites in northern Gaul, allowing the analysis of the distribution patterns by means of GIS and the contextual analysis of finds. The 'Rural Riches' project also employs instrumental

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1 The lords possessed and ruled rural estates exploited by labourers supporting themselves and their lords who had to protect them in return.

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analyses on various categories of objects as well as the study of ancient DNA and isotopes. Thanks to these new data, Theuws and his team aim at formulating new models on structural and dynamic aspects of the early medieval economy. In these, they will consider the links between ritual, production, and exchange, as well as the nature of demand, material culture, and the relations between production and the imaginary world.

In a Marie Skłodowska-Curie project, called EMPyr (2021-2025), the artisans are considered as the starting point of technical changes that precipitated into wider changes and transitions in the Early Middle Ages, more specifically at the 8th century CE, the fringe between the Merovingian and Carolingian periods. Indeed, for this period, the scholars have traditionally favoured demand, while disregarding the realm of production (Moreland 2000; Wickham 2000; Theuws 2007) and, up until now, the studied production lines were mainly of the agrarian type (e.g., Dierkens et al. 2017). Craft production has long been neglected as it left almost no written traces. Until Henning's work published in 2007, there was no global inventory of the archaeological traces of craft activities in the Frankish territory. Henning (2007) presents an overview of Merovingian, Carolingian, and Ottonian archaeological sites (6th – 11th centuries CE) between the Loire and eastern border of Bavaria, with evidence for non-alimentary production surpassing the household level. This includes glass working, ferrous and non-ferrous metal processing and pottery production.

From the Roman to the Merovingian period, there is a significant shift in the location of production from ancient agglomerations to single workshops in small rural settlements and rural craft centres with multiple workshops. There is still some artisanal activity in the old Roman towns, but this is dwarfed by the evidence from the countryside. Production took place on a smaller scale, but nevertheless still had substantial yields, as evidenced by the lavish funerary record from this period. The predominance of rural production in single workshops and craft centres persists into Carolingian times. Production in old Roman towns seems to decline somewhat further in this period. Monastic sites however, which show almost no artisanal activity in the Merovingian period (476-751 CE), take on a noticeable role during the Carolingian period (751-987 CE). Finally, there is an increase of production in the so-called proto-urban trading sites or emporia. These modifications in the location of craft production must have reflected, and also introduced substantial changes in the social structure of early medieval society.

At the same time, the pyrotechnologies, especially ceramic, glass, and iron underwent profound technical changes. The most emblematic is certainly that of glass production, changing the fluxing agent from soda to potash glass, at the end of the 8th century CE (Wedepohl et al. 1997; Van Wersch et al. 2016). By using material available in northwestern Europe, glassmakers first put an end to the dependency on oriental primary productions with natron, only available in the eastern Mediterranean (Foy et al. 2003). Secondly, in the 8th century CE, between the Loire and the Rhine, the Merovingian ceramic characterised by biconical dark pots or red bowls (Siegmund 1998; Châtelet 2002; Van Wersch 2011) was replaced by white products with a more limited morphological repertory (Gross 1991; Châtelet 2002). If the first had a regional diffusion, the second were spread from centralised production centres over greater distances (Verhaeghe 2003). Finally, Carolingian documents reflect a new start in iron production at that time (Sprandel 1969) with the existence of large rural iron workshops and villages of blacksmiths (Verhulst 2002). This period also witnessed significant modifications in forging. Damascene blades obtained by pattern welding, the most common during the 6th and 7th centuries CE (Rogalla von Bieberstien and Dillmann 2011: 196), seem to decrease during the 8th century CE (Coupland 1990), almost certainly as a direct consequence of the development of improved forging techniques that produced blades of higher quality steel. All these modifications imply changes in the material resources used that might explain or be due to the relocation of the workshops.

In order to tackle this phenomenon, the present paper examines the locations of production activities and tries to evaluate how the geological resources may have influenced the settlement process. Our approach starts from the raw material used by craftspeople, especially because its procurement is essential for the production. We therefore focus on a limited area holding the resources used to make glass, ceramic and iron: the south of current Belgium, Wallonia. The region is crossed by the Meuse river which was a major communication axis along which several settlements are attested (Plumiers and Regnard 2005). Both recent and older excavations delivered a reasonable amount of archaeological data regarding artisans' productions in both rural contexts and agglomerations (Van Wersch et al. in press). In addition, this region is at the heart of the Loire-Rhine area that had both unusually rich landowners and widely available artisanal productions during the Early Middle Ages (Wickham 2000). The Carolingian family has its roots in this specific territory (Close et al. 2017) and some of the places under their influence developed to become wealthy monasteries or bishopric seats.

In order to fully understand these productions and their changes, we consider, in addition to the natural factors, cross-craft interactions because one production process could have triggered innovation in others. This approach provides a framework to study one craft at a time as well as considering several crafts comparatively

Site	Production	Start date	End date	Remarks
Macquenoise (?)	Glass (?)	540	610	uncertain identification
Stavelot	Glass	650	900	
Huy – aux-Ruelles	Glass	475	525	
Huy – Sous-le-Château	Glass, Iron	575	700	general date 400-700, glass production dated end 6th-end 7th century CE
Huy – place Saint-Séverin	Glass, Iron	550	700	glass production dated second half of the 6th-beginning of the 7th century CE
Namur – Grognon	Iron, Pottery	450	700	iron working debris deposited in the final phase
Huy – quartier de l'hôpital	Iron			no specific date
Huy – Saint-Hilaire	Iron			no specific date
Huy – Avenue des Ardennes	Pottery	500	700	
Huy – rue du vieux-pont	Pottery	500	700	
Huy – Saint-Jacques	Pottery	550	650	
Huy – Batta	Pottery	600	700	kilns dated to 700
Huy – Parc Struvay/rue Godelet	Pottery	675	800	dated from the end of the 7th-8th century CE by Willems (?) – uncertain dates
Marilles – Mossembais	Pottery	650	750	
Quévy-le-Grand – Rue des Soeurs	Pottery	650	800	

Table 1. early medieval workshops for production of glass, pottery and iron excavated on the current territory of Wallonia.

(McGovern 1989; Costin 2005; Miller 2007; Brysbaert 2007; Brysbaert and Vetters 2010). The concept of cross-craft interaction has never been applied to the Early Middle Ages so far. The actual division of the work and specialisation lead researchers to consider glass, ceramic, and iron as separate, and these pyrotechnologies have usually been studied independently. However, as for other periods (Brysbaert 2007: 333), in the Middle Ages, the same person may have mastered several skills and practiced different arts, such as the monk Theophilus who wrote about recipes and techniques of paintings, glass and metals (Bontemps 1876). The juxtaposition of the different pyrotechnologies in artisanal quarters may also have facilitated sharing and exchange of goods, materials, tools, technical knowledge, and ideas (Van Wersch et al. in press). For example, the supply in raw material might be shared by more than one craft (Brysbaert 2007: 330, 347). The co-location of these craftspeople could also promote reciprocal emulation and acquisition of skills that could lead to innovation, especially when they worked in the same building, for the same people or in the same network.

2. The location of the workshops, a new assessment

Within the ERC Rural Riches project, we are creating an updated inventory of all archaeological data from pyrotechnological activities from the Merovingian period in the area between the Seine and the Rhine. For this purpose, we have meticulously sifted through numerous regional overview publications and excavation reports, and we have also consulted Henning, who kindly allowed us access to the data he gathered for his 2007 article. This has resulted in a comprehensive overview of workshop sites in the research area. Unfortunately, many finds from production sites have still not been studied or published in detail. It is often unclear for how long workshops were in use and at what scale production took place. Add to that the problems of taphonomy and preservation that archaeologists always struggle with, and it is clear that we are working with an imperfect and limited sample. Nevertheless, some very interesting details have come to light in this study, offering useful insights into the early medieval economy and the modus operandi of early medieval artisans.

For the period running from the 6th to the 8th century CE, 45 ceramic workshops, 20 glass working sites and 76 places with traces of iron metallurgy are recorded between the Loire and the Rhine. Of these, eight pottery production sites, four glass workshops and five iron smelting and smithing sites were located in Wallonia (Table 1 and Figure 1).

Most of the workshops were found in two Merovingian agglomerations: Namur and Huy. The site 'le Grognon' in Namur, delivered iron slags from the 7th century CE, together with crucibles fragments for copper alloy working (Plumier et al. 2005: 223). Two other kilns for ceramic production were also discovered more recently on neighbouring sites in the same city (Van Mechelen et al. pers. comm.). In Huy, Willems and Witvrouw (2005) recorded that nine Merovingian pottery kilns were uncovered, and that production wasters were attested in two additional locations. Glass production took place in at

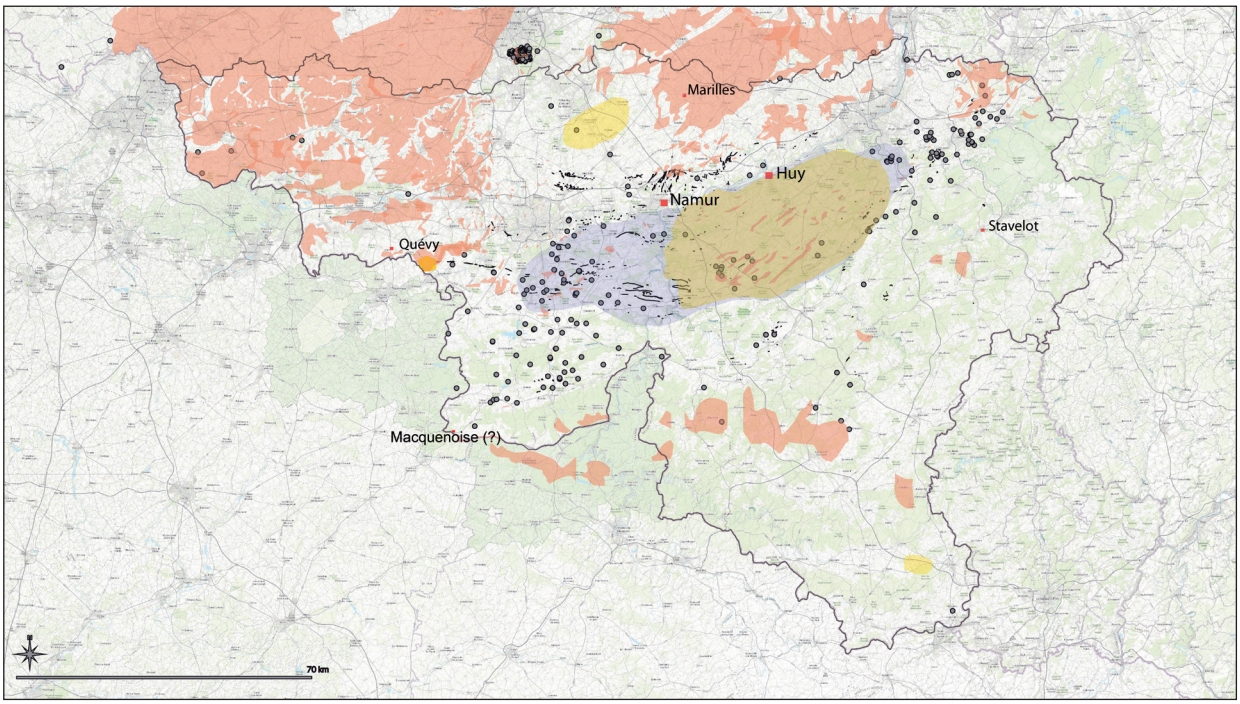

Figure 1. Map with the location of the workshops mentioned in the paper and the raw resources. Clay resources in orange (from Rekk 2104); zones with white sands in yellow; location of iron ores in black and smelting sites corresponding to grey dots. The blueish area corresponds to the Condroz region.

least three sites from the 5th to the 7th century CE. Still in Huy, wasters and two kilns were found on the site called 'aux Ruelles' (Péters and de Bernardy 2016) and iron slags are attested at different places (Péters and de Bernardy 2016). Next to the remains of ceramic, glass and iron, related traces of bronze production also exist in the same places as well as the remains of antler working (Péters and de Bernardy 2016).

Ceramic productions could be located in rural areas outside these Merovingians centres. One pottery kiln was discovered in Marilles (Mercenier 1962) and another in Quévy (Danesse et al. 2016: 127). While the latter can be dated between the end of the 7th and the end of the 8th century CE, the production of the former is typical for the Merovingian period and should be situated in the 6-7th centuries CE. From this period, there is also indirect evidence for ceramic production at several other locations. One can be situated in the Condroz region, a karst (limestone) plateau located between the Meuse river and the Ardennes massif (Figure 1), stretching 130 km from east to west, because the potters used a clay characteristic of that region (Van Wersch et al. 2020). Next to this, the numerous wares found in the cemeteries show technical and material peculiarities indicating that several productions existed and that settlements had access to multiple suppliers, but the exact locations of their workshops remain unknown (Van Wersch 2011).

Regarding glass craft in Wallonia, only secondary production occurs. It relied both on recycling and on imports of raw glass transported over long distances. In addition to the workshops from Huy and certainly Namur, an additional one has been reported in Macquenoise (Chambon and Arbman 1952). Even though, it was proved that an important number of glass objects were made by Chambon (Fontaine-Hodiamont and Wouters 2012). A recent study of the remains leads us now to doubt the identification of this site as a glassworkshop. One more glass production site was found at the abbey of Stavelot, in contexts dating between the end of the 7th and the end of the 9th century CE (Figure 1). The fragments of crucibles, glass wasters and pieces of kilns at this site could be related to the manufacture of architectural glass, most certainly tesserae, that was meant to decorate the church(es) and buildings of the monastery founded by saint Remacle at the end of the 7th century CE (Neuray et al. 2019).

Traces of iron metallurgy dating to the Early Middle Ages are only reported in Huy and Namur (Table 1 and Figure 1). These sites, from which the artefacts still have to be studied, are most certainly related to forges and not to ore treatment. In addition to these places and thanks to the discovery of slags, 172 smelting sites (direct iron process) have been inventoried, by Serneels (in the 1970s), Houbrechts and Petit (2003) and Pagès (Pagès et al. forthcoming). So far, the reported locations could

date from Protohistory to the middle of the Middle Ages, including the Early Middle Ages. Only some of the smelting sites can be identified as clearly Roman, especially in the Entre-Sambre-et-Meuse region, but the others cannot be accurately dated. Still, this inventory allows us to identify clear concentrations of these traces in certain zones and the total lack of them in others (Figure 1).

Considering these data from a limited territory, the Merovingian artisans practising pyrotechnologies seem to have settled preferentially in the agglomerations, although they were present in rural contexts as well, specifically pottery and iron. Parallels can be drawn with the rural settlements discovered in the north of France where, if iron metallurgy is rather common, ceramic production is rare and glass craft is not attested at all (Peytremann 1995: 12-14). After the 7th century CE, there is a clear lack of archaeological evidence for craft production in the agglomerations. This already lead Theuws (2007: 162) to wonder where the artisans of the 8th century CE were located. In the considered territory, the potters' workshop of Quévy for ceramic production and the glassmakers of Stavelot are the only ones dating after the Merovingian period. This matches with the conclusions of Henning who noticed a continuous decline of production in old Roman centres and an increase at monastic sites during the Carolingian period (Henning 2007). Still, more traces should be sought out, especially in areas where potential sources of raw materials were located.

3. The sources of raw materials

Based on the work of geologists, especially that of Rekk (2014), clay is a quite common material in the south of current Belgium. Large deposits are available in the area (Figure 1). To these deposits, the river clays can be added. Still, the clays that will give white pottery are more limited to the Condroz region. White clay is also attested south of the Meuse river and to the east of the territory, close to the German border (Goemaere 2010; Rekk 2014). From the map, it appears that some areas, especially in the Ardennes, seemed quite poor in clay material.

Before the end of the 8th century CE, the material necessary for glass production was imported from other regions. Then with the change of fluxes to wood ash glass, the glassmakers would have had to find the right sand for glass production. Wedepohl et al. (2011: 89) assume that the glass workshops were established in the woods. The glassmakers avoided the rivers sands and preferred to use tertiary sands available in a nearby area. In Wallonia, sands are numerous and varied, but geologists paid them limited attention (Macar et al. 1947: 125). At the moment, there is no general inventory of sands, and the only mapped deposits are limited to potential places for current sand extraction (Poty and Chevalier 2002). The tertiary sands are a discontinuous cover lying on older deposits. At the northern reaches of the Meuse river, they are distributed without connection with the substratum. They become more continuous and deeper to the north of Belgium, in Flanders under the loess deposits (Macar et al. 1947: 125). Quite substantial deposits were exploited at the southern end of the Meuse river in the karstic depressions lying in the Condroz region. In the karstic traps, these sands were associated with gravel, clay (sometimes white clay) and lignite (Goemaere 2010: 409). Among these deposits, some were used in 19th century CE glass production such the famous crystal of the Val Saint-Lambert (Macar et al. 1947: 139). In the Walloon Brabant, white quartz sands are also attested and could be very deep. These are also present in the northwestern part of the present province of Namur and in the northeastern part of the Hainaut. Around Mont-Saint-Guibert et Chaumont-Gistoux, they were exploited for the glass industry, such as the sands at the eastern border of Wallonia (Macar et al. 1947: 140). Finally, white fine sands were used for the glass industry west of Arlon, in the south of Wallonia (Macar et al. 1947: 146). Even if these deposits cannot be mapped properly, at least some zones that could have been more interesting to find materials for craft activities are pointed out (Figure 1). In that regard, the Condroz is of particular interest.

This region also contained large quantities of iron ore, in the form of limonite, extracted from clay-sand karst filling as well as seams of ore derived from sulphide oxidation. All deposits date to the Dinantian (-358,9 ± 0,4 to -330,9 ± 0,2 millions of years) or the Famennian (-372,2 to -358,9 millions of years) Paleozoic Ages (Denayer et al. 2011). The iron ores from Wallonia were listed and geolocalised by Denayer et al. (2011). In addition to the Condroz resources, this work points out additional concentrations of smelting sites which illustrates the existence of iron ores nearby, along the Meuse river (Figure 1). The Entre-Sambre-et-Meuse area can be distinguished by the number and the concentration of iron smelting sites and of the iron ore deposits (92 smelting sites, including 36 from the Roman period). The Soignes Forest, close to Brussels, the current capital of Belgium, also yields abundant evidence of smelting practices.

Next to the raw materials that will be transformed (clay, sand and ores), the crafts of ceramic, glass and iron also required water and wood. The quantities of wood vary depending on the craft, but this material is found more or less everywhere in the territory, and it was probably not a constraining element for the location of workshops. Finally, clay was needed by the three crafts in order to build the kilns and the furnaces. As this was a common material as well, it probably did not constitute a limiting factor for the placement of a workshop.

4. Discussion: a first crossing of the data

It appears that the Merovingian artisans settled at first in the agglomerations, along the river Meuse. Natural resources are also attested in and around these places. Clay was easily accessible and proven to be used by the potters. The petrography and the chemical studies of their productions showed that they worked with local resources even if those were not the most suitable (Van Wersch et al. 2015). Outside the settlements, iron ores are at hand around Namur. In smaller amounts, some are also located near Huy (Figure 1). The glass production of that period rested on imported and recycled materials. Those were probably more easily accessible in the agglomerations, especially close to a communication axis like the Meuse. The river and its affluents joining it in Namur and Huy also provided water. Wood was abundant in the vicinity. All the materials required were therefore present. Moreover, in these places, the existence of living quarters as well as churches (Péters and Fontaine-Hodiamont 2005; Plumiers et al. 2005) reflected the presence of a community of potential customers for artisanal products. In addition to the demand from the agglomerations' regular inhabitants and travelling people, these places may have seen additional seasonal activity, for instance at the time of religious festivals or administrative assemblies when inhabitants from the surrounding rural area would have gathered here (Theuws 2001: 203-204), taking advantage of the opportunity to acquire goods from the local artisans. This might have constituted an added motivation for the artisans to set up their workshops here.

Along with the access to the materials and consumers, the presence of other artisans could have influenced the choice of some craftspeople to settle in these places. Indeed, in a recent paper, Croix et al. (2019) defined 'operating networks' at early medieval emporia of Ribe (Denmark) where specialist bronzers set up alongside other craftspeople working with copper alloys. They suggest that the interdependence of crafts and the resulting self-organization of craft workers may have been a catalyst in the emergence of an urban community at Ribe. This offers an interesting alternative to the established thought that organization of crafts and the development of an urban community requires elite involvement. Within the framework of the Merovingian pyrotechnologies, we have evidence of the existence of similar networks of artisans, which may also have played a role in the organisation and development of the local communities. The sharing of certain materials, resources, tools and techniques could have formed the basis for cooperative relations between artisans. In that regard, some crafts were probably more dependent on these relations than others.

Glassmakers were especially reliant on other crafts. Even if not discovered in their workshops, their iron tools – canes, pincers, scissors – were certainly made by smiths. They also needed the potters for the production of their crucibles. During the Merovingian period, the known crucibles were wheel-thrown pots, quite similar in shape to common cooking pots (Péters and Fontaine-Hodiamont 2005). Those found in Huy were made with a particular type of inclusions that were not attested in common pottery, but the clay matrix is very similar, indicating that they were probably made for this specific purpose by the potters. Moreover, the colouring materials of glass are often metallic elements such as particles of copper or iron (Peake and Freestone 2012). It can be concluded that glassmakers had to have at least sporadic exchanges with the potters and blacksmiths. These exchanges could also have been a determining element in the location of their workshops.

Regarding the other crafts, their dependence upon material coming from other productions is weaker. Blacksmiths could use additions of clay or sand as refining elements during forging, but these do not need to come directly from other artisans. For this particular craft, the metallurgy of iron, we have to keep in mind that its *chaîne opératoire* is divided in two main steps: the first to obtain a raw material, the second to shape it. The extraction, the preparation of the ore, and its reduction usually take place close to the deposits while refining and forging took place elsewhere (Pagès and L'Héritier 2021). In this case, as reported in table 1 and figure 1, forging was practiced in the agglomerations and, even if they cannot be dated, the remains of extractive metallurgy are found outside the centres, close to the ores' deposits.

Potters also used clay and sand but, in the same way, they did not require specific collaboration with other artisans in order to practice their craft. Nevertheless, a common supply of wood, perhaps even clay, could be considered for several pyrotechnologies. This would suppose an organization of craftspeople, and this would also imply access to these materials. Access to raw clay is attested at the location of the Merovingian potters' workshops outside Huy and Namur, in Marilles (Figure 1). At the end of the Merovingian period, workshops disappear from the agglomerations. In the same period, a specific white clay was also selected but this particular material cannot be found everywhere. Such white kaolinitic clay from the Condroz, called 'derle', was already sporadically used before the 8th century CE and had a growing success later. The workshop from Haillot, dated to the 10th century CE, was situated in the region of these specific deposits (Van Wersch et al. 2019). Around the 8th century, the need of a white clay might explain the relocation of pottery production, most certainly close to kaolinitic beds and maybe in the Condroz.

Still in the Condroz, white sands are also attested (Macar et al. 1947: 139). Those were suitable for the glass industry and could have been used by medieval glassmakers. As for

iron metallurgy, the *chaîne opératoire* of glass was divided in two steps: the production of the raw material and the shaping of objects. With the introduction of woodash glass these could have occurred at the same place but, up until now, there is no evidence for that. The only workshop dating after the 7th century CE is the one of Stavelot, where architectural glass was produced. All production-related evidence from this site points to natron glass (Neuray et al. 2019). On this same site, fragments of windows made of woodash glass were found in a context dated from before the end of the 9th century (Van Wersch et al. 2014), but no indications for woodash glass production were found on the site and this material might originate from another location. In a near futures, strontium (Sr) isotopes analyses could answer some of the questions about glass production on this site (Van Ham-Meert et al. 2021). Next to the sand sources from the Condroz, suitable sands for glass productions are also attested in the south of the territory as well as in Walloon Brabant, in the northwestern part of the province of Namur, and in the northeastern part of the Hainaut region. Close to Walloon Brabant, a high concentration of remains of metallurgical activity is noticed in the Soignes forest. These certainly date to the Early Middle Ages, contrary to those in the Entre-Sambre-et-Meuse region that date mostly to the Roman period. In the Soignes forest, another type of ores is exploited than in the Entre-Sambre-et-Meuse. Therefore, during the Early Middle Ages, the ores as well as the exploited areas were much more diversified.

In the three pyrotechnologies of ceramic, glass and iron, the innovations of techniques all demonstrate a better comprehension of the materials used in the manufacture, and led to the production of artefacts with new, sometimes better, qualities. Artisans increased their knowledge of their environment and made more efficient use of the raw materials available in their region. The more advanced mastering of local resources led to a higher or more efficient production. If one was looking for places of production linked to pyrotechnologies at the fringe of Merovingian and Carolingian periods, areas surrounding the deposits of raw materials should be targeted specifically.

The areas containing simultaneously clay, sand and ores, such as the Condroz, could be particularly interesting regarding the cross-craft interactions because the exploitations of these resources could be mutualized. If workshops are not found, the petrographic and chemical analyses of the tools, such as crucibles and kilns, as well as the one of the productions could identify the materials and their origins. This could also give insight into the sharing of innovations. For example, the white kaolinitic clays shaped by the potters could have been used for the production of crucibles and benefited to the glassmakers. It could also be added as refining agent in forging. Still, this remains to prove by further studies.

Finally, the access to raw material might also shed light on the implication of the elite in craft organisation and innovation, especially when these activities are concentrated in one place. Being at the origin of the technical changes or not, if the elites controlled the land and its resources, they had to guarantee, or at least allow their exploitation by the artisans. This aspect also must be searched and we will build models for the social organization of the crafts and their interactions with varying levels of elite involvement. Those could be related to an historical study of the aristocratic domains placed on these territories since the use of these resources could have become a determining factor for the development of these domains. The stranglehold on some supplies may have favoured certain owners or guardians of the land whose access to specific resources allowed them to develop specific artisanal activities that other could not.

5. Conclusion

The elites are generally considered as the main actors of changes during the Early Middle Ages, but scholars have decided to take a closer look at the role of the rural population as well as the artisans considering them and their potential interactions as trigger for innovation linked to social and economic changes. In that frame, this paper specifically questions the relocation of the production activities and the contemporary innovations in pyrotechnologies between the Merovingian and the Carolingian period. Therefore, it considers the location of the workshops and the raw resources on the current territory of Wallonia.

For the Merovingian period, the inventory of these activities underlines the geographical proximity of the artisans linked to glass, ceramic and iron production inside the agglomerations along the Meuse river. Established close by one another, they certainly had contacts and exchanged goods and ideas. For some artisans such as the glassmakers that needed tools from other craftspeople, their presence could have influenced the choice to settle in one place. In these agglomerations, they also had access to material and customers. After the end of the 7th century CE, the clues of these activities became scarce and they disappear from these centres. Still, they are sporadically testified in the rural area and in one monastery, as already observed previously by Henning (2007). This change in the settlement choices also corresponds to technical modifications in the three pyrotechnologies, especially ones in the raw material used by these craft.

Looking at the raw materials available in the considered territory (Figure 1), if some places are totally lacking them others have rich resources such as the Condroz and the Brabant regions where it is attested that clay, sand and ores where gathered. These geographical areas containing several raw materials would undoubtedly have been of

interest to the artisans, even more so if they were crossed by major communication routes such as waterways. Moreover, from the 8th century, as the artisans were using specific clay, sands and ores, their location in the environment could have influenced their relocation. These areas also offer opportunities for the sharing of resources and for the organisation of a common supply. In the near future, a detailed examination of the materials used and made by the artisans might highlights these cross-craft interactions.

Finally, a link could be drawn to other crafts and production activities such as architecture that also demonstrated a renewal at the beginning of the Carolingian period. In this domain, the shared exploitation of a common material with multiple crafts is already proven on one site where kaolinite such as iron was identified in some mortars (Demelenne et al. 2016: 18-19). These domains that have barely been studied could give us a better idea on the craft organization that certainly contributed to the so-called 'Carolingian Renaissance ', the roots of which might be found in the creativity of craftspeople.

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