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PROCEEDINGS
OF THE WORKSHOP
OF NAMUR (BELGIUM)
ACTES DE LA TABLE RONDE
DE NAMUR (BELGIQUE)
29 et 30 mai 2015
29 and 30 may 2015

Textes publiés sous la direction de
Laurence Burnez-Lanotte

MATIÈRES À PENSER

RAW MATERIALS ACQUISITION AND PROCESSING IN EARLY NEOLITHIC POTTERY PRODUCTIONS

MATIÈRES À PENSER

SÉLECTION ET TRAITEMENT DES MATIÈRES PREMIÈRES DANS LES PRODUCTIONS POTIÈRES DU NÉOLITHIQUE ANCIEN

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Ceramic production and village communities during the Early Neolithic in north-eastern France and Belgium.

Issues regarding tempers and pot-forming processes

Louise Gomart, Claude Constantin, Laurence Burnez-Lanotte

Abstract: This article examines the links between tempers and forming processes within Linear Pottery (LBK) and Limburg ceramic production in north-eastern France and Belgium. Its aim is to analyse, by means of two case studies, variation patterns within these two key steps in the *chaîne opératoire*, for which several ethnographic studies have shown different variation patterns over space and time, and according to several social processes.
The questions asked involve the issue of archaeological recognition of ceramic traditions and their interpretation in terms of social and cultural identity: does the morpho-dimensional unity of LBK ceramics go hand in hand with a uniformity in technical behaviours spanning the various stages of the operational sequence? How is ceramic production organised within settlements? How are the different distribution networks organised? Do Linear Pottery vessels and Limburg vessels involve shared know-how? The identification of clay recipes and their correlation with various forming methods offers a complex vision of the ceramic production contexts. In fact, this approach allows us to understand the dynamics of persistence *versus* transformation of technical practices and also sheds light on knowledge exchanges between groups of producers.
The analyses carried out on both sites have not revealed a clear-cut relationship between clay recipes and pot-forming methods. The spatial and temporal variations identified suggest that within the same apprenticeship network, producers maintain their habitual practices in terms of the forming of vessels, but may change or adjust their clay recipes depending on the production site or the type of vessel that they intend to produce. While actions associated with pot-building are stable over time, the stages of clay preparation appear to vary depending on the interactions between producers.
This investigation also offers new elements for understanding the social structure of the LBK communities. For the site of Cuiry-lès-Chaudardes (Picardy, France), analysis of the spatial distribution of LBK technical traditions, defined on the basis of forming processes relative to the distribution of temper types, suggests a domestic production carried out by several groups of producers with complex settlement dynamics throughout the occupational sequence. For the site of Rosmeer (Limburg, Belgium), data regarding the LBK and Limburg vessels do not allow analysis at a house scale. Nonetheless, cross-analysis of clay-mixes and forming processes has allowed us to identify mechanisms of stylistic imitation and technical transfer between a group of producers, whose production is spread out among the various houses in the village, and who were engaged in the manufacture of Linear Pottery-style ware, and a group of producers who where essentially making Limburg vessels distributed within a particular sector of the village.

Keywords: Linear Pottery (LBK), Limburg, clay, temper, forming techniques, *chaîne opératoire*, know-how, household, apprenticeship networks.

Résumé : Cet article traite des liens entre recettes de pâtes et façonnage au sein des productions céramiques rubanées et Limbourg dans le quart nord-est de la France et en Belgique au début du Néolithique. L'objectif est d'analyser, au travers de deux cas d'étude, les structures de variation de ces deux étapes clés de la chaîne opératoire, pour lesquelles plusieurs études ethnographiques ont montré qu'elles pouvaient varier différemment dans l'espace et dans le temps et selon divers processus sociaux.
Les questions posées engagent la problématique de la reconnaissance archéologique des traditions céramiques et de leur interprétation en termes d'identités sociales et culturelles : l'unité morpho-dimensionnelle de la céramique rubanée se double-t-elle d'une uniformité des comportements techniques au cours des différentes étapes de la chaîne opératoire ? Comment s'organise la production céramique au sein des villages ? Comment se structurent les différents réseaux de transmission ? Les vases rubanés d'une part et les vases Limbourg d'autre part intègrent-ils des savoir-faire communs ? La caractérisation des recettes de pâtes et leur confrontation aux méthodes de façonnage offre une vision complexe des contextes de production céramiques. Elle permet en effet d'appréhender les dynamiques de

« persistance versus transformation » des pratiques techniques, ainsi que les transferts de connaissance entre groupes de producteurs. Les analyses menées sur ces deux sites ne permettent pas de conclure à une relation univoque entre recettes de pâtes et façonnage en contexte rubané. Les variations spatiales et temporelles identifiées suggèrent qu'au sein d'un même réseau d'apprentissage, les producteurs maintiennent leurs habitudes en ce qui concerne le façonnage, mais peuvent changer ou ajuster leurs recettes de pâte selon le lieu de production ou le type de récipient qu'ils souhaitent réaliser. Tandis que les gestes liés au façonnage paraissent stables dans le temps, les étapes de préparation des pâtes semblent varier au gré d'interactions entre producteurs.
Ces investigations offrent aussi de nouveaux éléments de compréhension de la structure sociale des communautés rubanées. Sur le site de Cuiry-lès-Chaudardes (Picardie, France), l'analyse de la distribution spatiale des traditions techniques rubanées définies sur la base des méthodes de façonnage par rapport à la répartition des types de dégraissants suggère une production domestique prise en charge par plusieurs groupes de producteurs, dont les dynamiques d'implantation au court de la séquence semblent particulièrement complexes. Sur le site de Rosmeer (Limbourg, Belgique), les données récoltées sur les vases rubanés et Limbourg n'autorisent pas une analyse à l'échelle de la maisonnée. L'analyse croisée des recettes de pâte et des méthodes de façonnage permet néanmoins d'identifier des mécanismes d'imitation stylistique et de transferts techniques entre un groupe de producteurs en charge de la production de style rubané répartie dans les différentes maisons du village et un groupe de producteurs fabriquant essentiellement des vases Limbourg concentrés dans un secteur du village.

Mots-clés : Rubané, Limbourg, poterie, matériau argileux, dégraissant, façonnage, chaîne opératoire, savoir-faire, maisonnée, réseaux d'apprentissage.

INTRODUCTION

As part of this workshop, we were invited to discuss the variation structures of clay recipes according to the forming processes in the context of the western Linear Pottery Culture (LBK). Several ethnographic studies showed that these two steps of the '*chaîne opératoire*' can vary differently over space and time and according to different types of socio-economical processes: they constitute in that sense key elements to assess producer trajectories and interactions (Gosselain, 2002; Gelbert, 2003; Gosselain and Livingstone Smith, 2005). Thus, while offering a refined understanding of the pottery production structure, this integrated analysis provides new insights into the sociology of the LBK villagers communities. In this paper we present, by means of two case studies, the variation patterns of these two steps of the operational sequence at the village level in order to understand who was in charge of the ceramic production, and also how the producers interacted through time (e.g. transmission of know-how) and space (e.g. borrowings, collaborations and exchanges).

Within LBK ceramic production, the morpho-dimensional homogeneity of which has often been highlighted, the decorative system appears at first sight to be the most variable element. A large number of ceramic studies have focused on this parameter: such works have given rise to extremely fine periodisation, which today constitutes the most precise sequence for the European Neolithic, with an analysis scale of 50 years (Soudský, 1962; Meier-Arendt, 1966; Modderman, 1970; Constantin, 1985; Pavuk, 2004; Lefranc, 2007; Marton, 2008; Ilett and Constantin, 2010; Meunier, 2012; Blouet et al., 2013). However, when it came to reconstructing the *chaînes opératoires* for the making of these vessels, there were very few elements available for understanding the social and technical contexts of production (Constantin, 1994; Bosquet et al., 2005; Gomart, 2014). While the formal characteristics of western LBK ceramics are particularly stable, two categories of vessels, distinguishable by their often open shape, their large size and their all-over ornament, occur in small quantities in certain assemblages: La Hoguette ware (mainly found in the Rhine basin in Germany and in eastern France), and Limburg ware (mainly found in Dutch Limburg, Belgium and north-eastern France; fig.1). The interpretation of the presence of these vessels in LBK sites has been the subject of intense debate for the past thirty years (for a detailed account of this research and a complete bibliography see: Manen and Mazurié de Keroualin, 2003; van de Velde, 2007; Crombé, 2009; Pétrequin et al., 2009; Constantin, Ilett et al., 2010). However, very little research was conducted with the aim of understanding the gestures implemented in their fabrication and in assessing their production context.

The current questions on LBK and Limburg/Hoguette wares raise the issue of archaeological recognition of the ceramic traditions and their interpretation in terms of social and cultural entities: does the morpho-dimensional unity of LBK ceramics go hand-in-hand with homogeneity of techniques? Can we highlight the coexistence of several apprenticeship networks in the LBK settlements? Was the ceramic production organised at the level of the household? Are LBK vessels, and Limburg/La Hoguette vessels, part of a shared know-how or do they instead reflect distinct technical milieus?

MATERIAL AND METHODS

In order to shed light on these questions, several LBK ceramic assemblages from north-eastern France and Belgium, occasionally including groups of Limburg ware[(1)], were studied from the point of view of clay recipes (Constantin and Courtois, 1985; Constantin, 1985 and 1994; Ilett and Constantin, 2010; Constantin, Allard et al., 2010; Gomart and Burnez-Lanotte, 2012; Constantin,

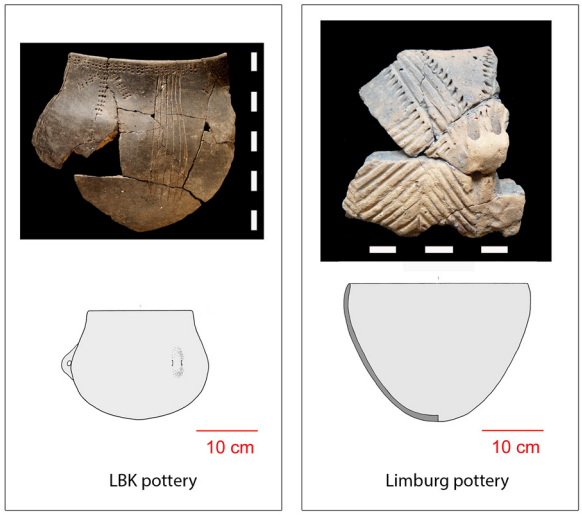


Fig. 1 – Characteristic decoration and morphology of LBK vessels (left) and of Limburg vessels (right).
***Fig. 1** – Décors et morphologie caractéristiques des vases rubanés (à gauche) et des vases Limbourg (à droite).*

forthcoming) and forming processes (Gomart, 2010; Gomart and Burnez-Lanotte, 2012; Gomart, 2014). All of these studies highlight the diversity in the technical behaviours of Early Neolithic pottery producers, a diversity that is evident in various steps of the *chaîne opératoire*. Here, we build on these studies in order to carry out the integrated analysis of the different ways of treating clay through the addition of temper and the 'ways of doing' (Roux, 2010) used for the forming of vessels.

Each step in the *chaîne opératoire*, defined as 'a series of operations which transform a raw material into a finished product' (Cresswell, 1976), may vary according to constraints related to the material and to cultural factors (Roux, 2010, p. 6). This double dynamic is a constituent of particular ways of doing things, the transmission of which leads to the creation of traditions. It is precisely the transmission mechanism that leads to the continuation of traditions. The traditional techniques employed by an individual are the result of a process of learning 'actions observed within a social group' (Roux, 2010, p. 6). At the end of this apprenticeship process, the skills necessary for creating a vessel are 'incorporated', so that the individual will have difficulty modifying his concepts and techniques before in turn passing them on (Bril, 2002; Roux, 2010). As a consequence, it is possible to establish a link between a technical tradition and a social group. These groups, or 'communities of practice' (Roux 2010, p. 6), correspond to dissemination networks or learning pathways. The sociological nature of these groups varies considerably because it is the result of different learning rules: it may, for example, involve distinct gender groups, a family, a caste, a faction, a class, a lineage, a clan, an ethnic group, a tribe, an ethno-linguistic group, etc. (Roux 2010, p. 4). The limits or 'frontiers' that can be observed between different technical traditions ultimately delineate the dissemination networks (Stark, 1998; Gosselain, 2008; Roux, 2010).

Technical traditions should not be seen as being frozen in time and space. In particular, studies of present-day situations describe instances of innovation (Shennan, 2002) and borrowing (Gelbert, 2003) which occur as a result of various processes such as direct or indirect contact, migration or wandering (Gosselain, 2010; Roux, 2010). Such changes do not necessarily affect all steps of the *chaîne opératoire*: producers may change their way of carrying out a single step as a result of innovations or borrowings from producers from different learning pathways, but may, at the same time, maintain their own methods for the other steps of the production process (Gelbert, 2003). More than any other formal or technical parameters, it seems that roughing out techniques are relatively resistant to change (Mayor, 2011). This stability may be linked to the process of 'incorporation' of skills at the conclusion of the apprenticeship period, resulting in 'automatisms that are difficult to alter' (Gosselain, 2002, p. 26), but may also be due to the fact that actions carried out in this step are invisible, or little visible, in the finished product (Gosselain, 2002). Other steps in the *chaîne opératoire*, which do not require specific technical competence or which are visible in the finished vessels (for example preparation of clay), may be more likely to undergo changes (Gosselain, 2002; Roux, 2010).

Taking these assumptions as a starting point, a cross-analysis was undertaken on the site of Cuiry-lès-Chaudardes 'Les Fontinettes' (Aisne, France). Featuring many houses, as well as a large corpus of ceramic finds, this site was ideal for a spatial and diachronic study of LBK pottery production. A second analysis was conducted for the site of Rosmeer (Limburg, Belgium). With a considerable amount of Limburg ware, the ceramic assemblage of this site lent itself particularly well to an evaluation of the technical know-how employed in the production of both LBK ware and Limburg ware.

For both assemblages, temper analysis (C. Constantin) was carried out on each individual vessel using a binocular microscope. This analysis focused on coarse-ware vessels, characterised by inclusions which were clearly visible to the naked eye (Constantin, 1985), as well as Limburg vessels, also characterised by the presence of clearly visible, non-plastic elements (Constantin, 1985). Fine-ware vessels characterised by the absence of inclusions which are clearly visible to the naked eye and the absence of intentionally added temper, were not included in this analysis. In the case of the pottery from Cuiry-lès-Chaudardes, thin sections were examined in order to validate the groups that were identified macroscopically. For the assemblage from Rosmeer, the observations made using a binocular microscope were compared to already existing reference material for Hesbaye and Hainaut in Belgium (Constantin, 1985; Constantin, Allard et al., 2010).

Secondly, the fine and coarse wares were examined in terms of the techniques and methods used in their forming (L. Gomart). In this regard, the characteristics of the surface topography (variations in texture and thickness, orientation of fracture networks), as well as the orientation of the non-plastic inclusions and the porosity in cross-section, were described for each vessel. The interpretation of macro-traces identified in terms of techniques and forming methods was based on several ethnographic and experimental reference studies (Shepard, 1956; Rye, 1981; Livingstone Smith, 2001; Gelbert, 2003).

It is important to note that the petrographic characterization of clay materials was exclusively conducted on fine-ware vessels from Cuiry-lès-Chaudardes (Ilett and Constantin, 2010; Gomart, 2014, p. 59). It is therefore too early to establish a petrographic classification of all vessels (fine- and coarse-ware vessels as well as Limburg ceramics in Rosmeer).

TEMPERS, FORMING AND LBK CERAMICS: THE EXAMPLE OF CUIRY-LÈS-CHAUDARDES (AISNE, FRANCE)

The site of Cuiry-lès-Chaudardes 'Les Fontinettes', which is the reference site for the LBK in the Aisne Valley, was the ideal site to address the issue of organisation of pottery production within LBK settlements. It has been extensively excavated and thirty-three, east-west oriented buildings of varying size have been discovered. No overlapping pits or buildings have been noted, which was optimal for spatial studies. In addition, the periodisation of the pottery decoration revealed three chronological phases (Ilett and Constantin, 2010; Ilett, 2012; Blouet et al., 2013) thus facilitating fine diachronic studies. Occupation of the settlement is estimated to have spanned about 150 years, covering the entire

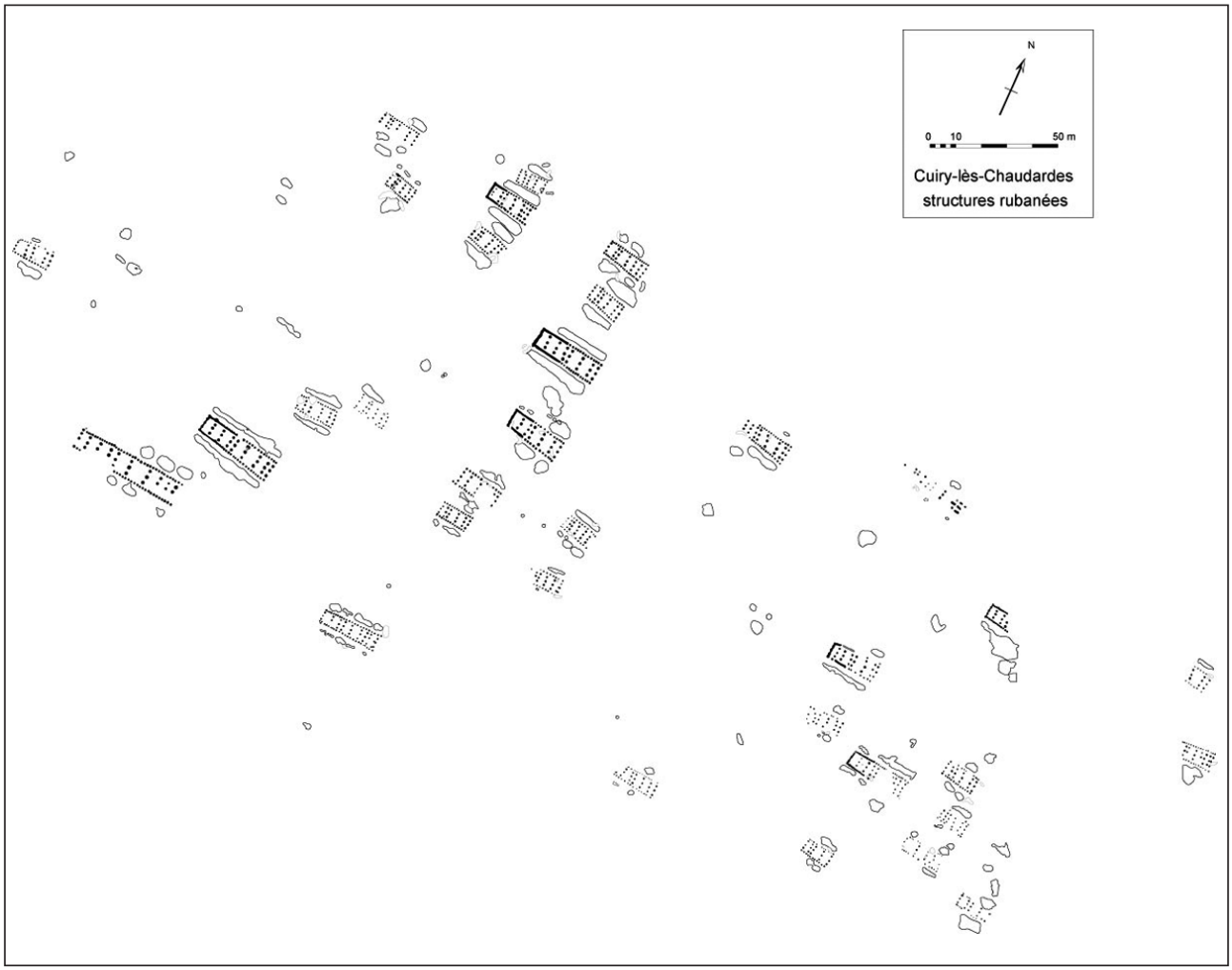


Fig. 2 – Plan of the LBK settlement of Cuiry-lès-Chaudardes (Aisne valley, France). The excavation limits are not shown.
***Fig. 2** – Plan du site rubané de Cuiry-lès-Chaudardes (Vallée de l'Aisne, France). Les limites de fouille ne sont pas indiquées.*

LBK sequence for the Aisne Valley i.e. 5,100-4,950 cal. BC (Dubouloz, 2003). The settlement was concentrated in the eastern part of the site during the first occupation phase, and then it spread westward during the second and third phases (fig. 2). Lateral pits flanking the buildings have yielded abundant and well-preserved archaeological assemblages for the entire chronological sequence, allowing us to investigate the daily activities of the village community.

The fact that no overlapping was observed between pits and that there are many instances where we can reassemble sherds from different pits associated with the same house leads us to suggest that the lateral pits are closely linked to each house. This theory is reinforced by the fact that all of the domestic units have yielded ceramic assemblages that are comparable in terms of morphology and dimensions, with equal proportions of decorated fine ware, undecorated fine ware, and coarse ware present, suggesting a complete set of vessels (Ilett and Constantin, 2010). Furthermore, the faunal assemblage from each house is systematically comprised of the same three domestic species (cattle, sheep/goat, and pig) and two wild species (deer and aurochs; Hachem, 2011). This regularity in the composition of the refuse assemblages of the site does not suggest random discard of waste within the village and leads to the assumption that remains in the lateral pits are generally a reflection of activities carried out within the household (Ilett and Hachem, 2001; Allard et al., 2013).

In terms of the study of the ceramic assemblage from Cuiry-lès-Chaudardes, 1,767 individual vessels displaying clearly visible technical macro-traces of building techniques and methods were included in the analysis. The vessels examined came from pits adjacent to the houses. After data processing, 1,145 individual vessels could be associated with a particular forming method: these included 537 fine-ware vessels and 555 coarse-ware vessels. Temper analysis focused on the coarse ware component of the assemblage: in the case of 497 vessels, it was possible to identify the inclusions added to the clay (Gomart, 2014, p. 59, table 4).

RAW MATERIALS AND TEMPERS

Locally-made pottery?

At Cuiry-lès-Chaudardes, the only direct evidence for ceramic production in the village takes the form of six bone tools, made from cattle ribs or fractured long bones, which use-wear analysis has revealed to have been used as potter's ribs (modelling tools) on soft clay (Maigrot, 1997).

Clay analysis (C. Constantin) carried out on the vessel assemblage (1,154 fine-ware vessels), using a binocular microscope and thin-sections, supports the hypothesis of on-site ceramic production. Over the entire period of occupation, two clay raw-materials were used: a clay material characterised by the presence of frequent limestone inclusions (Clay material 1: fig. 3a), as well as a clay material characterised by the presence of frequent quartz inclusions of sub-rounded to sub-angular form. (Clay material 2: fig. 3b; Ilett and Constantin, 2010; Constantin, forthcoming). Preliminary petrographic analysis carried out on six coarse-ware vessels suggests that the fine-ware and the coarse-ware were built using the same raw material.

By comparing the characteristics of these two ceramic materials with twelve clay deposits recorded in the surrounding area, it was apparent that Clay 1 originated from the Aisne floodplain silts, while Clay 2 originated from the remnants of an eolian deposit which survives on the limestone alluvial terrace and in shallow hollows within in the site itself.

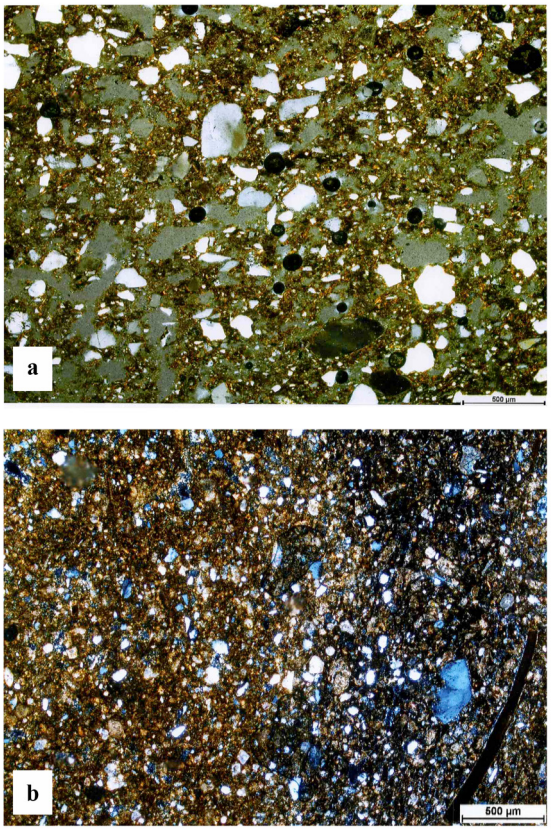


Fig. 3 – The two types of clay materials identified at Cuiry-lès-Chaudardes. a: clay material 1 characterised by the presence of frequent limestone inclusions; b: clay material 2 characterised by the presence of frequent quartz inclusions.

***Fig. 3** – Les deux types de matériaux argileux identifiées à Cuiry-lès-Chaudardes. a : matériau argileux 1 caractérisé par la présence de nombreux débris calcaires ; b : matériau argileux 2 caractérisé par de nombreux quartz.*

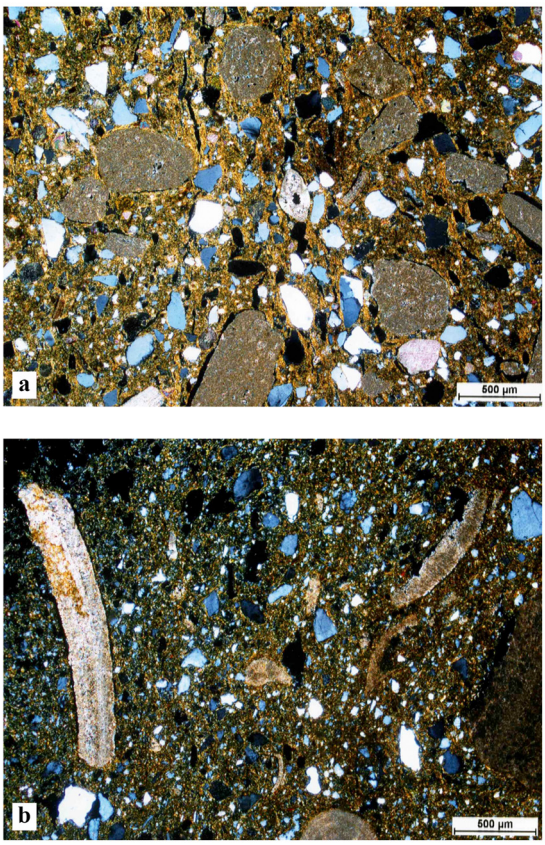


Fig. 4 – The two types of tempers identified at Cuiry-lès-Chaudardes. a: sand and limestone gravel; b: shell fragments.
***Fig. 4** – Les deux types de dégraissants identifiées à Cuiry-lès-Chaudardes. a : sable et gravier calcaire ; b : fragments de coquille.*

Two categories of temper

Analysis of the Cuiry-lès-Chaudardes pottery indicates the use of two types of temper, which were deliberately added to the clay and were very rarely mixed in the same pot.

First, sand and gravel (limestone) have been observed. They have a granulometry of between 1 mm and 5 mm (most commonly around 2 mm) and their relative quantities vary: they generally represent more than 10% of the volume and frequently represent up to 20-30% (fig. 4a).

Second, we find shell fragments and other calcareous debris, 1 to 5 mm in length and 0.2 to 0.5 mm in thickness, which occur in quantities of about 10 to 15% of the volume (fig. 4b). Some of these inclusions could be identified: they include bivalves (*Cyrena* cunéiformes), gastropods (*Turritella*), urchins (*Scutellina*) and miliolid limestone (identification by Christian Montenat, Institut Géologique Albert de Lapparent de l'Institut Catholique de Paris).

The pottery producers of Cuiry-lès-Chaudardes appear to have had ready access to these two types of temper. The sand and gravel temper was sourced on the alluvial terrace on which the site is situated and could be obtained during the digging of post holes and construction pits. The shell fragments could have been sourced in geological strata close to the site. The geological survey (Laurentiaux et al., 1972) indicates a limited zone of fractured Bartonian deposits, featuring decimetric *Coquina*, located on the south bank of the Aisne, less than 4km from the settlement site: this material includes diverse faunal remains including *Cyrena* which has been identified in temper. In addition, the lower Lutetian layers adjacent to and underlying the aforementioned area, and accessible within 2 km of the settlement site, contain abundant and diverse shell facies which include gastropods.

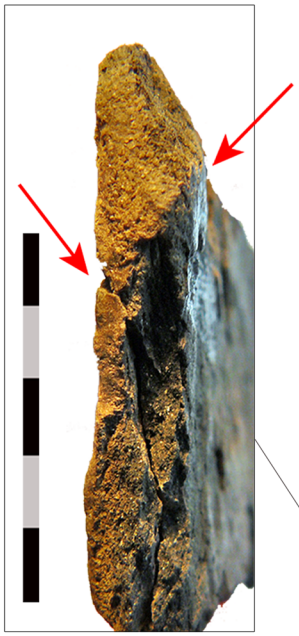
Finally, Thanetian and Ypresian layers, also accessible within 2 km of the site, contain macro-fauna including Turitella which has also been found among the temper fragments.

Diversity in pot-forming

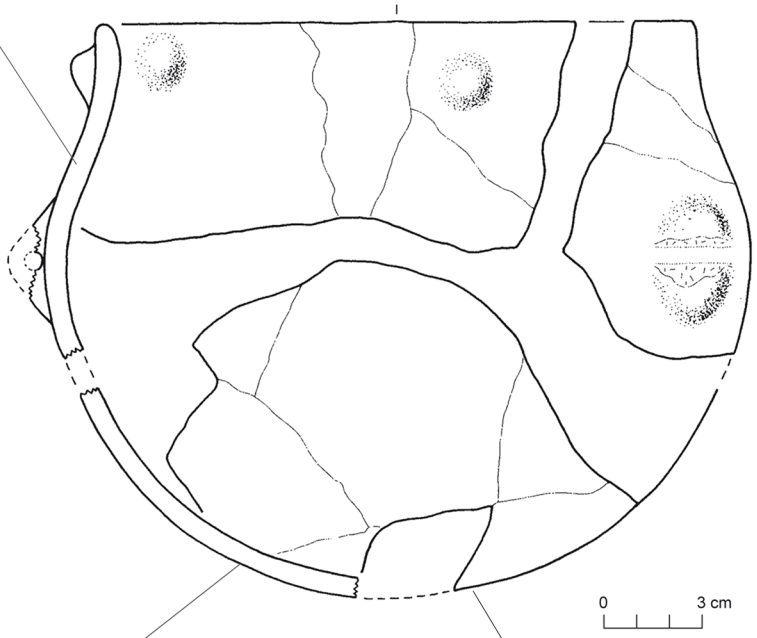
The processing of data relating to methods for building pots has revealed significant technical variability. Twelve distinct 'ways of doing' have been identified (CCF1 to CCF12), four of which dominate the assemblage: CCF1, CCF2, CCF7 and CCF12. These different ways of forming are essentially distinguished on the basis of shaping techniques (use of a support to shape the base, use of the beating technique) and assembling procedures (differences in coils overlapping).

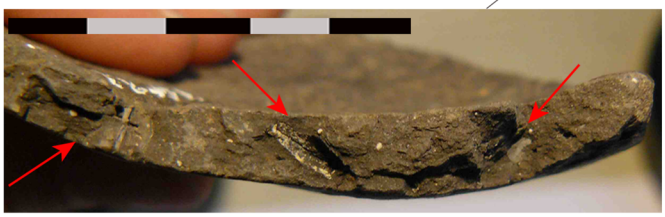
The first most commonly used way of doing, CCF1 (148 fine vessels and 204 coarse vessels), is characterised by the roughing-out of the base by arranging thin coils of clay in a spiral, and then pressing the base into shape in a concave mould. The body, neck and rim of the pot are then roughed-out using thick elongated coils, with alternate overlapping, which are then shaped with discontinuous finger pressure (see fig. 5 for a description of the diagnostic macro-traces). The second way of doing, CCF2 (239 fine vessels and 207 coarse vessels), comprises vessels that are entirely built using thin coils, which may or may not be slightly deformed when being laid down (see fig. 6 for a description of the diagnostic macro-traces). The bases of vessels associated with the third way of doing, CCF7 (42 fine vessels and 73 coarse vessels), have not survived. However, the bodies and rims of these vessels display very diagnostic macro-traces: the body is built of thin, non-deformed coils, while the rim is formed using a large folded band of clay (see fig. 7 for a description of the diagnostic macro-traces). The fourth common way of doing, CCF12 (20 fine vessels and 22 coarse vessels), also includes pots without preserved bases (see fig. 8 for a description of the diagnostic macro-traces). These vessels present macro-traces indicating that the body and rim were formed by superposition of thin coils which were then shaped using the beating technique.

Body and rim (external surface): *sub-circular concavities* visible on coarse vessels associated with CCF1, suggesting a shaping by discontinuous hand pressure.

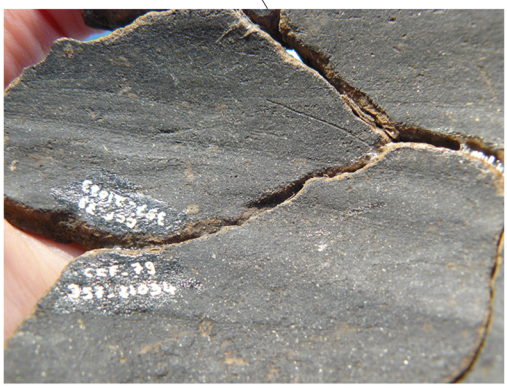


Body and rim (edge of vertical fracture): *S* or *Z-shaped configuration*. The orientation of the porosity is oblique/vertical. This suggests the use of elongated coils with an oblique alternate overlapping





Base (edge of vertical fracture): *series of voids* suggesting initial forming of the base with thin coils in spiral. Between these voids, the orientation of the porosity is sub-circular.

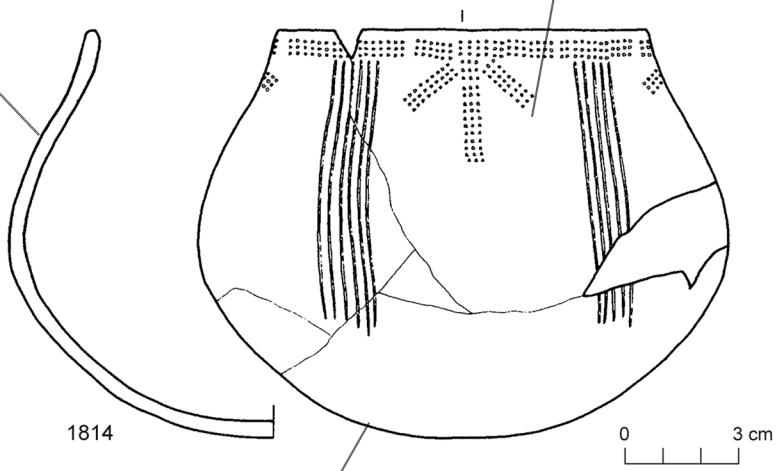


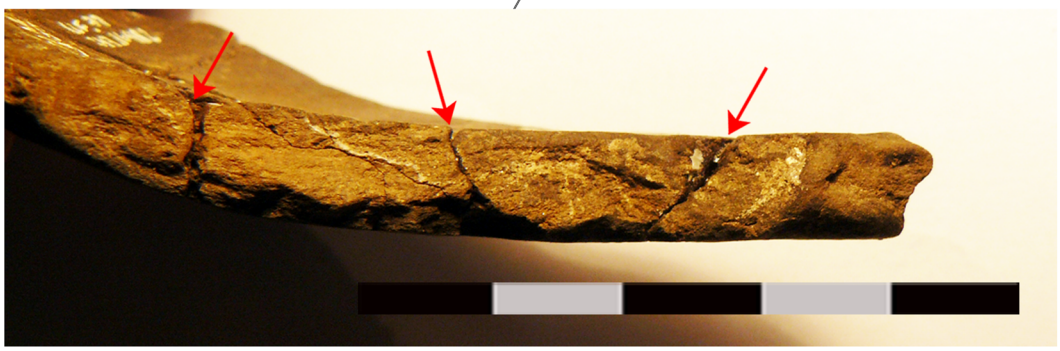
Base (inner surface): *Longitudinal depressions* evoking the application of hand pressure during shaping. This observation suggests that the base was shaped by compression against a support.

Fig. 5 – Characteristic macrotraces of the ceramic forming method CCF1 identified at Cuiry-lès-Chaudardes.
Fig. 5 *– Macrotraces caractéristiques de la méthode de façonnage CCF1 identifiée à Cuiry-lès-Chaudardes.*

Body and rim (inner surface) : *parallel hems* suggesting the use of thin coils, which were deformed slightly or not during shaping.

Body and rim (edge of vertical fracture): *sub-circular orientation of the porosity* (O or C-shaped configuration) suggesting the use of thin coils which were deformed slightly or not during during their placement.





Base (edge of vertical fracture): *series of voids* suggesting initial forming of the base with thin coils in spiral. Between these voids, the orientation of the porosity is sub-circular.

Fig. 6 – Characteristic macrotraces of the ceramic forming method CCF2 identified at Cuiry-lès-Chaudardes.
Fig. 6 *– Macrotraces caractéristiques de la méthode de façonnage céramique CCF2 identifiée à Cuiry-lès-Chaudardes.*

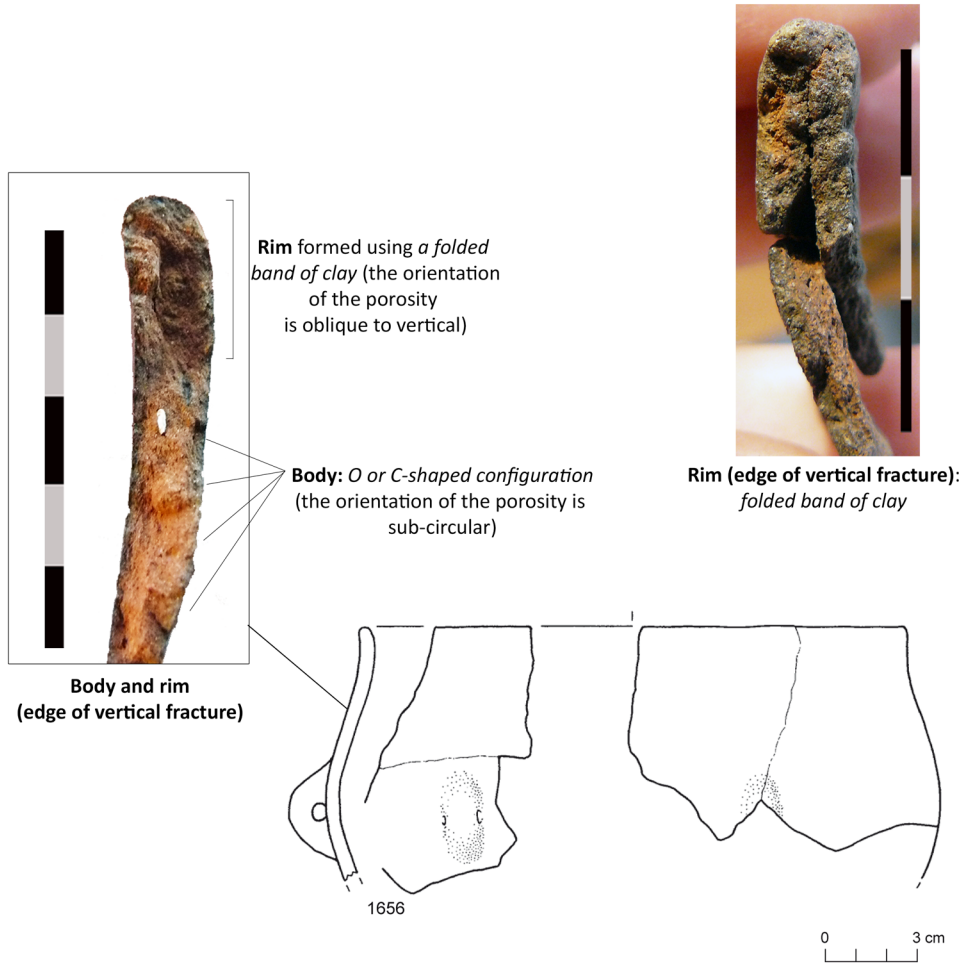


Fig. 7 – Characteristic macrotraces of the ceramic forming method CCF7 identified at Cuiry-lès-Chaudardes.
***Fig. 7** – Macrotraces caractéristiques de la méthode de façonnage céramique CCF7 identifiée à Cuiry-lès-Chaudardes.*

Tempers and pot-forming over time

The combined analysis of the two types of temper identified in the coarse-ware vessels and the four most common ways of forming shows some preferential associations during certain chronological phases (fig. 9 and 10; for detailed data, see: Gomart, 2014). CCF1, CCF 7 and CCF12 are thus predominantly associated with shell temper (70%, 86% and 70% respectively), while within CCF2 the limestone temper dominates (60%). Considering the variations of these associations throughout the three chronological phases, CCF1 is the only way of doing to present a gradual inversion in terms of temper use: the use of shell temper decreases from 91% during the first phase, to 55.8% during the second phase and finally to only 45.5% during the third phase. Thus, over the entire occupational sequence, there is no exclusive relationship between one forming method and one type of temper.

Tempers and pot-forming over space

On the basis of these observations, we have analysed the spatial distribution of the different temper types relative to ways of forming, for each occupation phase of the site. The results obtained were plotted on a plan of the village (fig. 11, 12 and 13): the way of forming that dominates the ceramic assemblage of each domestic unit is indicated by a specific colour on the plan. The tempers used for each predominant way of forming are represented in the form of pie charts. Only the four most common ways of doing (CCF1, CCF2, CCF7 and CCF12) are taken into account because the number of vessels representing the eight other ways of doing is too small to permit cross-analysis. These observations enable the following spatial and temporal schema to be proposed:

- during the earliest phase of occupation, there is remarkable homogeneity in the technical behaviour observed (fig. 11). CCF1 dominates in five out of the six houses present (houses 45, 390, 640 and 112, 126). House 90 situated at the centre of the settlement cluster, is the only house with a majority of vessels produced using CCF2. Houses 126 and 112, situated to the south of the centre of the settlement, are characterised by the use of CCF1 but have also yielded a significant proportion of vessels produced using CCF2. In terms of the tempers used,

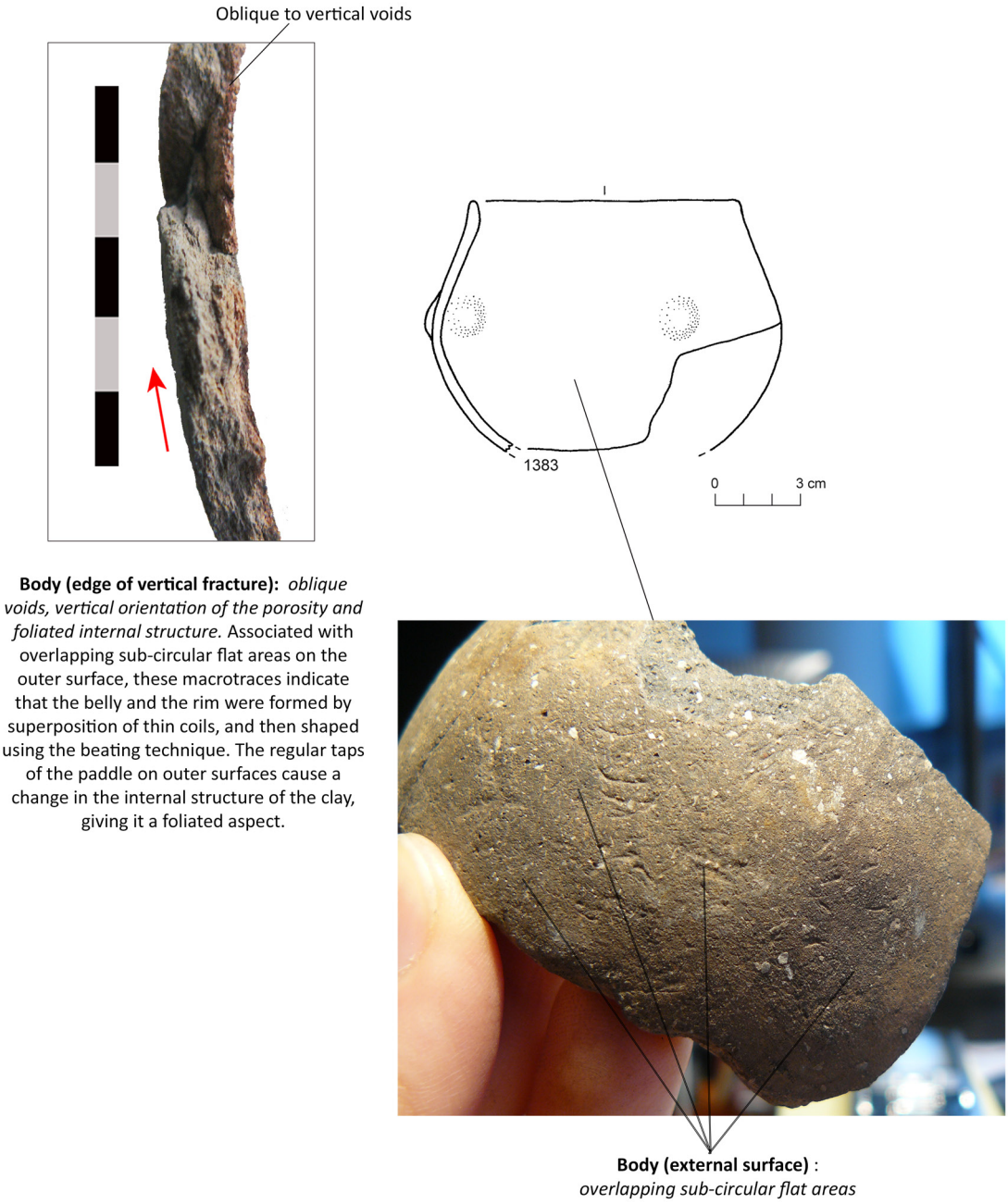


Fig. 8 – Characteristic macrotraces of the ceramic forming method CCF12 identified at Cuiry-lès-Chaudardes.
***Fig. 8** – Macrotraces caractéristiques de la méthode de façonnage céramique CCF12 identifiée à Cuiry-lès-Chaudardes.*

shell is clearly the predominant temper used in all of the houses characterised by CCF1. In house 90, the vessels associated with CCF2 are preferentially tempered using limestone, while those produced using CCF1 contain shell temper;

- during the middle phase, a diversification in the ways of pot-forming is observed (fig. 12). Certain houses are dominated by CCF1 (houses 330 and 400) while others are dominated by CCF2 (houses 570, 580 and 425; the last two also yielded a significant proportion of vessels produced using CCF1). A number of houses are characterised by two or three ways of forming in almost equal proportions: this is the case for house 440, which features a mixed assemblage of vessels produced using CCF1 and CCF2; house 89, characterised by a CCF7/CCF2 assemblage; and house 380 characterised by the presence of CCF1, CCF2 and CCF7. It was possible to identify the tempers used in all of the houses except from house 425. The distribution of tempers as a function of the pot-building methods used is not as homogenous as it was in the early phase. The two houses characterised by CCF1 (houses 330 and 400) do not present the same types of inclusion: shell temper prevails in house 330, while limestone temper is dominant in house 400. In houses 570 and

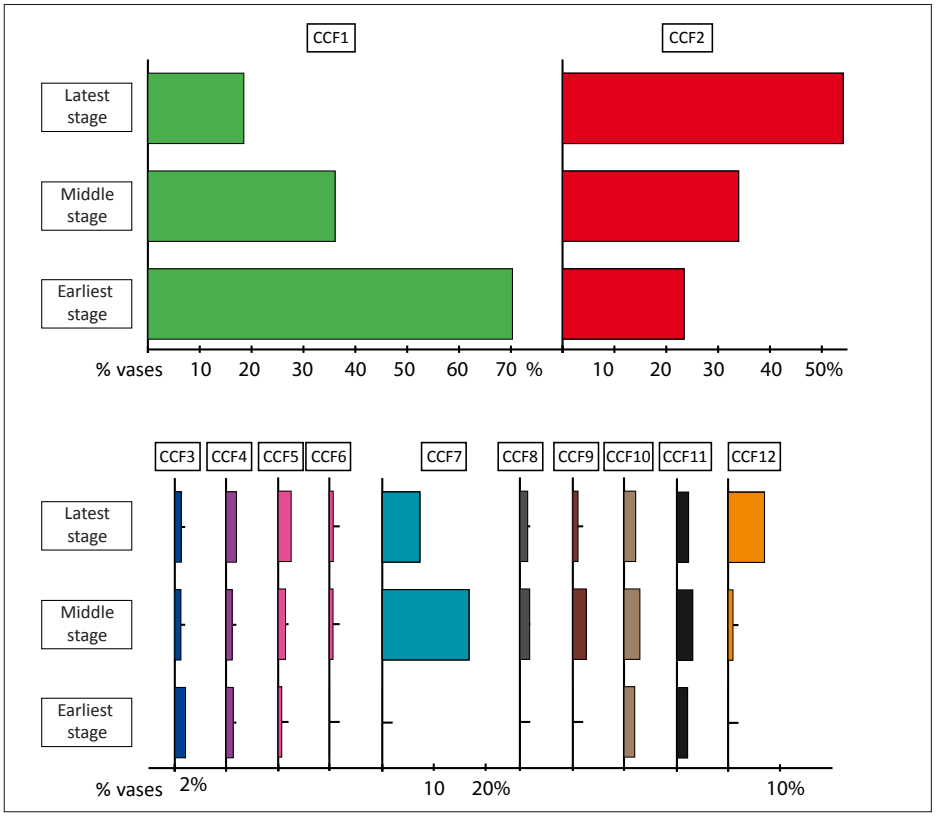


Fig. 9 – Percentage of vessels attributed to each of the twelve forming methods identified at Cuiry-lès-Chaudardes, for each occupation phase (diagram based on 968 vases).
***Fig. 9** – Pourcentage de vases attribué à chacune des douze méthodes de façonnage identifiées à Cuiry-lès-Chaudardes, par étape d'occupation (diagramme fondé sur 968 vases).*

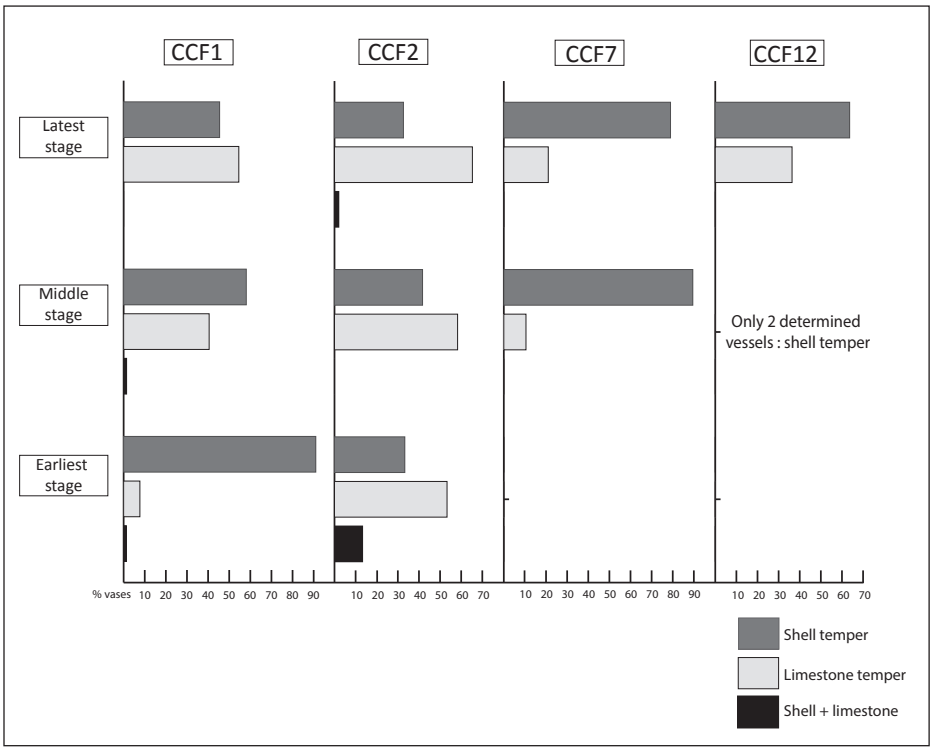


Fig. 10 – Use of the two types of tempers within the four prevailing forming methods in Cuiry-lès-Chaudardes, for each occupation phase (diagram based on 497 vases).
***Fig. 10** – Utilisation des deux types de dégraissants dans le cadre des quatre méthodes de façonnage prédominantes à Cuiry-lès-Chaudardes, par étape d'occupation (diagramme fondé sur 497 vases).*

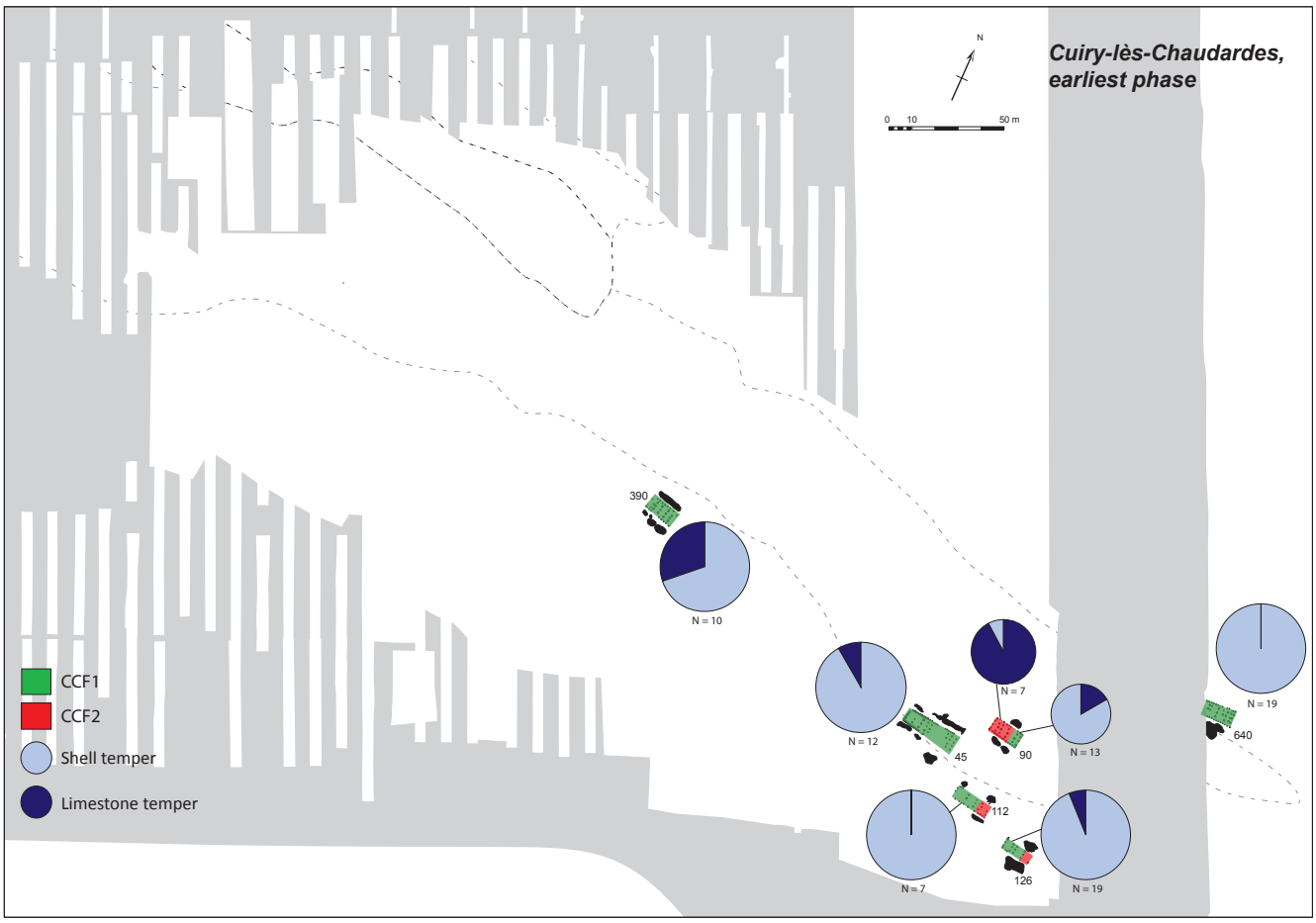


Fig. 11 – Distribution of the two types of tempers according to the forming method(s) prevailing in each housing unit at Cuiry-lès-Chaudardes, during the earliest occupation phase (step 1).
***Fig. 11** – Distribution des deux types de dégraissants en fonction de la ou les méthode(s) de façonnage majoritaire(s) dans les unités d'habitation de Cuiry-lès-Chaudardes, au cours de l'étape ancienne.*

580, characterised by CCF2, limestone temper predominates. In house 89, all of the vessels produced using CCF7 are tempered with shell. In house 440, shell dominates in vessels made using CCF1, but limestone dominates in vessels made using CCF2. In house 380, the nature of the temper varies from one way of forming to another: in terms of CCF1, the proportions of shell and limestone temper are almost equal; vessels produced using CCF2 are preferentially tempered with shell; finally, most of the vessels associated with CCF7 contain shell temper;

- the latest phase of occupation is characterised by a renewed homogenisation of pot-forming (fig. 13). Here, CCF2 dominates in five out of seven houses (225, 245, 280, 360 and 530), with CCF1 also present in the house 225 assemblage. These houses (225, 245, 280 and 360) are all situated in the southern part of the settlement core. The other two houses (690 and 420), which have yielded a mixed CCF1/CCF2/CCF12 assemblage, are located in the northern part of the village. As regards the tempers used, only the five houses characterised by the use of CCF2 can be used to draw conclusions regarding the nature of the materials used. Houses 225, 245 and 280 are all characterised by the use of limestone temper, while in houses 360 and 530 shell temper is predominant.

The distribution of pot-forming methods and tempers varies greatly over the entire occupation sequence for the site. All of the houses, without exception, are dominated by one to three ways of pot-forming and the tempers used are not correlated to the forming process used, except during the initial phase of the village when the majority of houses are dominated by the same clay recipe/pot-forming process.

When we correlate our observations with house size, it appears that homogeneity of manufacturing processes, namely the predominance of only one dominant way of pot-forming associated to one prevailing type of temper, mostly occurs in the largest houses, defined by 2 or 3 back units (CCF1: houses 45 and 360; CCF2: houses 225, 245, 280, 500 and 570). On the contrary, diversity of manufacturing processes, namely the presence of two to three prevailing ways of pot-forming that are not dominated by the same type of temper, mostly occurs in the smallest houses defined by a single back bay (houses 440, 580, 89, 690, 90, 126, 112 and 425). Differences

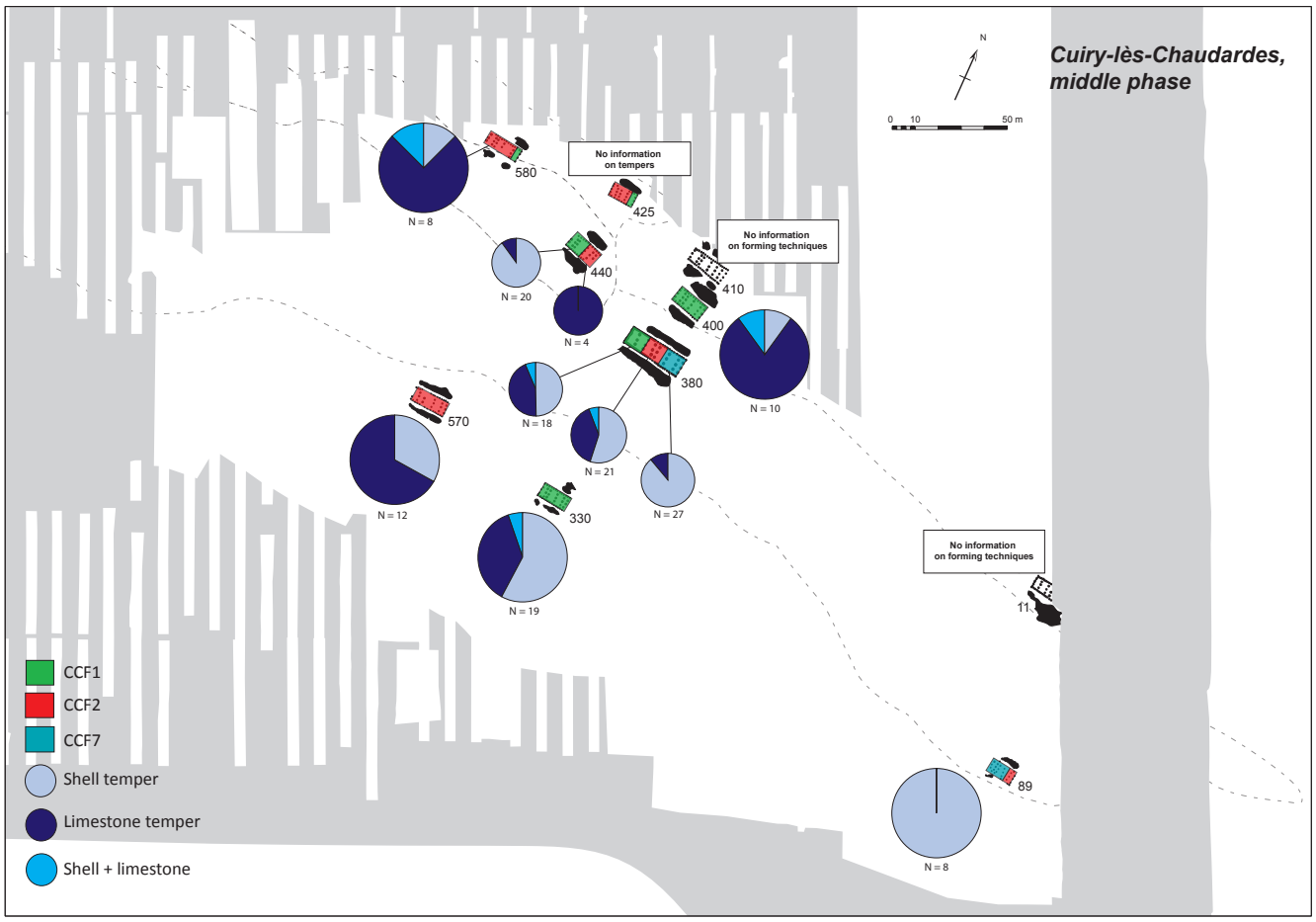


Fig. 12 – Distribution of the two types of tempers according to the forming method(s) prevailing in each housing unit at Cuiry-lès-Chaudardes, during the middle occupation phase.
***Fig. 12** – Distribution des types de dégraissants en fonction de la ou les méthode(s) de façonnage majoritaire(s) dans les unités d'habitation de Cuiry-lès-Chaudardes, au cours de l'étape moyenne.*

between the largest and the smallest houses can also be observed in terms of *continuity vs. novelty* of the forming processes (Gomart et al., 2015). The largest houses attributed to the second and third chronological stages are indeed all characterized by forming processes that were identified in the earlier phase (houses 330, 225, 245, 280, 500 and 360). In contrast, the emergence of new ways of forming throughout the sequence (CCF7 during the second phase and CCF12 during the third phase) occurs preferentially in the smallest houses (houses 89 and 690), which are located outside of the main settlement core (houses 89, 690 and 420).

Based on these results, several questions can now be asked in order to improve our understanding of the context of pottery production and the settlement dynamics of its makers.

Discussion

Structure of the pottery production and distribution within the settlement

None of the ways of doing identified is confined to a particular morpho-dimensional type and all of the vessels analysed were built using local raw materials: the technical diversity revealed cannot, therefore, be explained either in terms of function or non-local contributions. It appears, instead, to reflect diversity in the apprenticeship affiliations within the village (Gomart, 2010 and 2014).

The fact that the prevailing ways of pot-forming have been identified for several chronological phases of the site (fig. 9) and/or on other Western LBK settlements (Gomart 2014) implies that they were transmitted over time and suggests that each represents a technical tradition (Bonte and Izard, 2010; Roux, 2010). Inferring from ethnographic evidence, each of these technical traditions, reflecting a particular learning pathway, would have been unique to a particular group of producers (Latour and Lemonnier, 1994; Roux, 2010). At Cuiry-lès-Chaudardes, the ceramic assemblage thus suggests that there were four distinct groups of producers. In the current state of research, the eight other pot-forming methods identified, which occur in small quantities or within a single chronological phase, cannot currently be regarded as traditions but, rather, may reflect variability in terms of an individual producer or groups of producers.

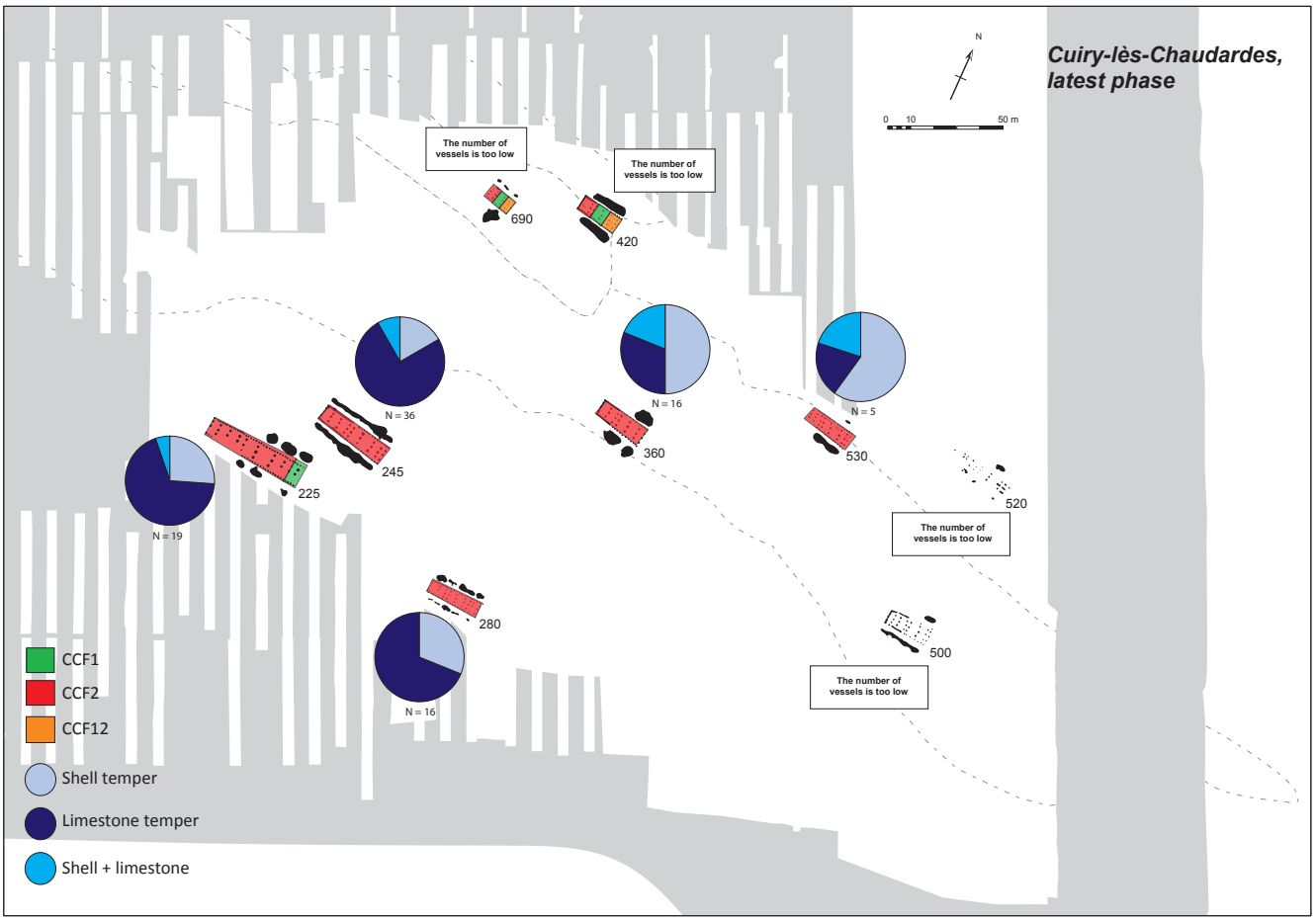


Fig. 13 – Distribution of the two types of tempers according to the forming method(s) prevailing in each housing unit at Cuiry-lès-Chaudardes, during the latest occupation phase.
***Fig. 13** – Distribution des types de dégraissants en fonction de la ou les méthode(s) de façonnage majoritaire(s) dans les unités d'habitation de Cuiry-lès-Chaudardes, au cours de l'étape récente.*

One of the issues to be tackled before we can attempt to assess the history of the village concerns the context of the pottery production. By examining the parallels between the four predominant traditions and the two types of temper used, we can make a number of important observations.

Thus, two houses attributed to the same chronological phase are not necessarily dominated by the same way or ways of building pots. Moreover, two domestic units dominated by the same way of building pots do not necessarily use the same temper when preparing their clay. This is for example the case in the third phase at Cuiry-lès-Chaudardes, where the houses in the south of the settlement are all dominated by CCF2, but do not appear to share the same temper (fig. 13). This observation suggests that the making of pots was not centralised. It seems that the producers shared the same way of doing to build their pots, but made different choices regarding the acquisition and use of tempers. If pottery production had been in the hands of a small group of producers and the vessels redistributed among the various houses, the production would undoubtedly be more homogenous at site level (Constantin, 1994). In fact, at Cuiry-lès-Chaudardes, all the evidence suggests that production was carried out at a domestic scale, in other words 'carried out by, and for, the household' (Jamard, 2010, p. 603). It appears therefore that most of the houses in the village were self-sufficient in terms of producing most of the vessels they required, just as they were self-sufficient in regards to their food supply (Hachem, 2011), grinding and abrading activities (Hamon, 2006) and activities related to the lithic industry (Allard et al., 2004).

Based on the assumption that ceramic production was local and domestic, a number of hypotheses can be proposed to explain the technical diversity of the assemblages from the smallest houses:

(1) The lateral pits associated with these houses may have been left open longer than those associated with other domestic units: the mixed assemblages would, therefore, reflect the production of a succession of different producers over time. However, recent data on material from LBK sites in the Aisne valley tend to suggest that the lateral pits associated with houses were left open for a relatively short period of time, perhaps 3 to 5 years (Allard et al., 2013). It seems unlikely, therefore, that the diverse nature of certain assemblages from Cuiry-lès-Chaudardes reflects the activity of successive producers.

(2) Pottery production in these houses may have been undertaken simultaneously by several producers coming from different apprenticeship affiliations. However, we have seen that the majority of the houses associated with mixed pottery assemblages were small-sized (houses 112, 126, 440, 580, 425 and 690), and were, therefore, probably inhabited by a small number of individuals (Dubouloz, 2008 and 2012). In these cases it seems unlikely that there would have been multiple producers living under one roof.

(3) Since mixed assemblages are composed of at least one pot-forming tradition present (or predominant) in several contemporary houses, it is possible that exchanges took place between houses. From our point of view, this hypothesis is the most plausible. In fact, in all of the houses with a mixed assemblage, at least one of the forming traditions identified is also predominant in one or more other contemporary houses, which are often larger in size. Moreover, in the houses characterised by heterogeneity of pot-forming methods, we observed associations between forming processes and tempers that also occur in some of the larger houses dating to the same phase. This is, for example, the case for house 90 belonging to the first phase, which may have received some pots from the other contemporary houses characterized by CCF1 and the use of shell temper. It may also be the case for house 440 during the second phase, which might have received some vessels from houses 330 or 570. This observation enables us to suggest that small houses with mixed assemblages were dependent on larger houses for some of their range of pottery.

Thus the inhabitants of the largest houses may have produced and provided a certain number of vessels for the inhabitants of smaller houses. Consequently, the inhabitants of the small houses with mixed assemblages may have been producers of one part of their range of ware, and mere users of the other. Ultimately, we cannot exclude the possibility that forms of co-operation existed between houses.

Sociological variation of pottery traditions Arrival of new population in the village

It appears, therefore, that small houses were engaged in a system of exchange or complementarity with larger houses (Hachem and Hamon, 2014; Gomart et al., 2015). We have seen that in three houses (89, 420 and 690), a pot-forming tradition which is very rare or absent in earlier phases was identified in significant quantities in addition to one or two traditions associated with a category of temper which predominates in contemporary larger houses.

In other words, in addition to vessels that probably originated in contemporary larger houses, the range of pottery produced in the houses 80, 690 and 420 may be linked to non-local technical practices in terms of their forming. Since the forms and decoration of the vessels made according to non-local methods are typical of the LBK style, it is possible that we are seeing the arrival in these three houses of producers from other LBK villages.

Hence, during the third phase of occupation, the appearance in houses 420 and 690 of the CCF12 tradition, which is rare in the Paris Basin, Alsace and Belgium, but which seems predominant in Lorraine (Gomart, 2014), may indicate that individuals from this latter area had established themselves in these particular houses. One can recall here that the results of bio-archaeological studies suggest that LBK communities were patrilocal with a high level of female mobility (Price et al., 2001; Bentley et al., 2012; Rasteiro et al., 2012; Rasteiro and Chikhi, 2013). It is, therefore, tempting to suggest that women from other LBK villages came to live in these small houses as part of marriage alliances (Gomart et al., 2015). Movements of women from one village to another through marriage networks have been observed for example by O. P. Gosselain in Cameroon (Gosselain, 2002): the women move into their husbands' communities but continue to make pottery using techniques and methods acquired in their home villages.

In the case of houses 420 and 690, the temper used as part of the CCF12 tradition is shell or limestone, which are typical for the Aisne Valley. These types of temper have not been identified in Lorraine (Gomart, 2014). Therefore, if we accept the hypothesis of an arrival of pottery producers, we can assume that the newcomers maintained their own forming methods while changing or adapting their clay recipes. It is particularly interesting to note that present-day potters sometimes modify their way of preparing clay through contact with other potters but continue to maintain their own tradition of pot-forming (Gosselain, 2002; Gelbert, 2003; Gosselain and Livingstone Smith, 2005). Such rapid and frequent changes might be explained by the fact that the procedures for preparing clays, particularly the use of a particular type of temper, do not require specific skills, unlike the steps involved in actually building the pot (Gosselain, 2002). In the case of the later Neolithic site of Chalain (Jura), a comparative study of the different parameters of the ceramic technical system (i.e. clay recipe, forming methods and decorative style) yielded a result similar to the situation observed at Cuiry-lès-Chaudardes: in fact, it appeared that the three parameters evolved independently of each other, according to different rhythms (Giligny, 1993; Pétrequin et al., 1994).

From ceramic cross-analysis to producer dynamics within the settlement

The production of LBK pottery at Cuiry-lès-Chaudardes seems to have been undertaken by different groups of producers whose dynamics appear to vary over time.

At the initial establishment of the village, we see uniformity in technical know-how. The producers in seven out of eight houses share the same technical practices in terms of tempers and pot-forming. These individuals, who appear to have belonged to the same social group, had a preference for using shell temper. This homogeneity suggests that the village was established by a group who shared the same technical traditions, at least in regards to clay recipes and the building of pots. When the village was founded, or very shortly before or after, a producer (or group of producers) following a different tradition (CCF2) came to occupy house 90. This producer (or group of producers), perhaps coming from a different social group, shows a preference for using limestone temper.

A diversification in technical know-how can be observed over the course of the second phase of occupation. Three dominant pot-forming traditions, perhaps reflecting three distinct social groups, co-existed within the village. The first group, maintaining the CCF1 tradition, remained present in the village and occupied houses 330 and 400. The producers in these two houses appear to have made different choices regarding their clay recipes: limestone is preferred in house 400 while shell is predominant in house 330. The CCF1 tradition is also well represented in houses 440 and 380, which are characterised by mixed assemblages. In house 440, vessels made using CCF1 are, for the most part, tempered using shell, as is also the case in house 330. This similarity may indicate that vessels were transferred from house 330 to house 440. The second group, following the CCF2 tradition, is more important than it was in the earlier phase. Producers belonging to this group apparently occupied three houses (570, 580 and 425), all of which are located at the west of the village. We know that the producer (or producers) in house 570 had a preference for using limestone temper. The same temper characterises the majority of vessels made using the CCF2 tradition in house 440. A third producer, or group of producers, following the CCF7 tradition of pot-forming, appears to have arrived in the village in the course of this phase and to have occupied a house outside the main core of the village: house 89. The producer(s) in this house had a preference for shell temper. The assemblage from house 380, located at the centre of the village, is exceptionally rich and unique in terms of its ceramic traditions: it is the only assemblage to contain, in almost equal proportions, the three technical traditions (CCF1, CCF2 and CCF7) which dominate the other houses within the phase. From this observation, we can suggest an intermittent or regular input of vessels from various houses to house 380, which might indicate a specific function, perhaps as a communal building (Gomart et al., 2015).

At the end of the period of occupation, we see village-scale standardisation in technical know-how. The group using the CCF2 forming process appears to grow in importance compared to the earlier phases. Producers belonging to this group occupied the five largest houses located in the south of the village (houses 225, 245, 280, 360 and 530). Even though they share the same pot-forming tradition, these producers make distinct choices regarding their clay recipes. In houses 225, 245 and 280, limestone temper is preferred, while in houses 360 and 530, shell temper is dominant. Houses 420 and 690, which are smaller in size and located in the north of the village, have mixed assemblages characterised by three forming traditions: CCF1, CCF2 and CCF12. The presence of significant quantities of vessels built in the CCF12 tradition in these assemblages suggests the appearance of a new social group in the village. The presence of CCF1 and CCF2 traditions in these houses may indicate an input of pots from other houses within the village. Therefore, the end of the period of occupation of Cuiry-lès-Chaudardes is characterised by the firm establishment of the group bearing the CCF2 pot-building tradition, as well as the probable arrival of a new group of producers in the village, bearers of the CCF12 tradition (which is characteristic of some ceramic assemblages from Lorraine: Gomart, 2014). The groups who followed the CCF1 and CCF7 traditions appear not to have maintained a presence in the village.

TEMPERS, FORMING AND LIMBURG WARE: THE EXAMPLE OF ROSMEER (LIMBURG, BELGIUM)

The site of Rosmeer is located in the province of Limburg, Belgium. An area of 1.6 ha was excavated by H. Roosens in the 1950s and 1960s, but the total area of the settlement is estimated to have been about 4 ha (Roosens, 1962). The excavation uncovered eighteen typical LBK buildings (fig. 14): the fourteen best-preserved buildings were subsequently published (Roosens, 1962). The site is one of the earliest LBK settlements in Belgium, as there are houses with Y- settings of posts (houses 10 and 13) which are typical of the Flomborn stage, corresponding to Period 1 Phase B in the Dutch chronology (Modderman, 1970). The ceramic decoration confirms this early date and suggests a long period of occupation, spanning periods Ib, IIa and IId (Janssens, 1974). Examination of a sample of decorated LBK sherds from Rosmeer has enabled us to make a number of typo-chronological observations and to associate certain houses to a chronological period. Houses 9 (north-eastern pits), 10 and 12 can thus be attributed to Period Id. House 14, features ceramic decoration characteristic of Periods Id and IIa (Gomart and Burnez-Lanotte, 2012).

One of the particularities of the ceramic series is that it has yielded a significant number of sherds of Limburg pottery. These have been published many times (De Laet, 1967; Modderman, 1981; Constantin, 1985). More recently, the decorative diversity of the vessels has

Fig. 14 – Plan of the LBK site of the 'Staberg' in Rosmeer (Limburg, Belgium). The excavation limits are not shown (CAD Y. Maigrot).
***Fig. 14** – Plan du site rubané du « Staberg » à Rosmeer (Limbourg, Belgique). Les limites de fouille ne sont pas indiquées (DAO Y. Maigrot).*

triggered a debate on their attribution to the Limburg ceramic tradition. P. -L. van Berg has suggested that two of the vessels should be reattributed to the Blicquy/Villeneuve-Saint-Germain and five others to the La Hoguette (van Berg, 1990). Other authors view the Limburg vessels discovered at Rosmeer as transitional variants in a continuous development between La Hoguette pottery, regarded as being earlier, and Limburg pottery, which is later (Constantin et al., 2010).

It is difficult to evaluate the exact number of individual ceramic vessels uncovered at Rosmeer. While we had access to all of the Limburg pottery discovered on the site (34 individual vessels; 110 sherds), we had access to only a limited number of the LBK style vessels (146 individual vessels; 870 sherds). Within this series, the representativeness of which cannot be estimated, 121 vessels can be classified as fine ware and 25 as coarse ware. Within our study, a total of 174 vessels were recorded because they displayed diagnostic technical traces.

Of the 34 Limburg vessels analysed, 32 could be associated with specific structures: they came from 12 pits, 8 of which were lateral pits associated with houses. Of the 121 LBK style vessels examined, 92 came from 45 pits spread out over the whole site. Of these, the majority (77 vessels) were from isolated pits. Only a small number of them (15 individuals) came from the lateral pits associated with houses. A large portion of the ceramic series cannot be linked either to a structure or a chronological period. As a consequence we decided to start by treating the corpus as a whole. Specific remarks regarding chronological and spatial issues will then be proposed for the vessels with an established provenance.

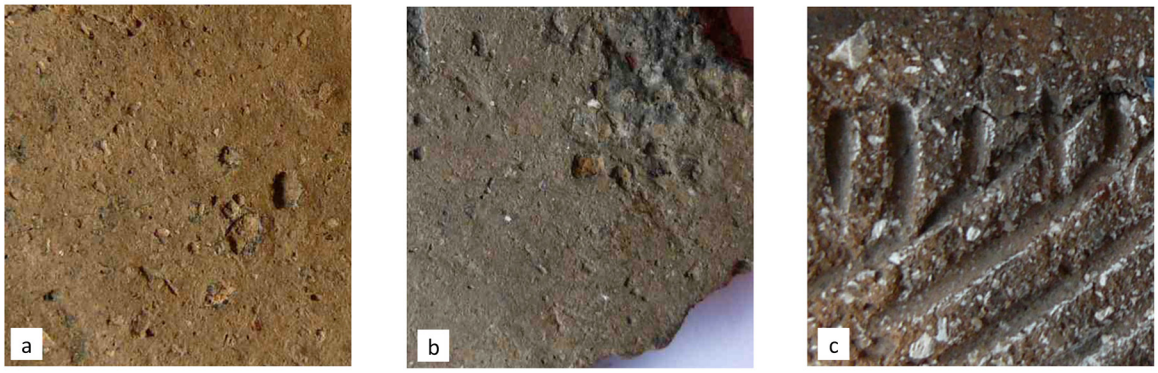


Fig. 15 – The three types of tempers identified at Rosmeer. a: grog; b: haematite; c: bone particles.
***Fig. 15** – Les trois types de dégraissants identifiées à Rosmeer. a : chamotte; b : hématite ; c : particules osseuses.*

Fig. 16 – Characteristic configuration observed on the edge of vertical fractures of the vessels associated with the forming method ROS1 (coils with oblique alternate overlapping).
***Fig. 16** – Configuration caractéristique observée en plan radial sur les vases associés à la méthode de façonnage ROS1 (colombins écrasés en chevauchement oblique alterné).*

Fig. 17 – Characteristic configuration observed on the edge of vertical fractures of the vessels associated with the forming method ROS2 (coils with oblique external overlapping).
***Fig. 17** – Configuration caractéristique observée en plan radial sur les vases associés à la méthode de façonnage ROS2 (colombins écrasés en chevauchement oblique externe).*

Diversity of tempers

The nature of the temper used has been recorded for each vessel. These inclusions fall into three distinct classes (fig. 15):

– grains characterised by a powdery consistency and having a pale grey to pinkish colour, or less frequently brown. This is probably grog (crushed fired clay);

– orange-coloured inclusions, which we suggest are haematite. This type of material has previously been identified in La Hoguette vessels (Lüning et al., 1989), but in certain cases, such as at Friedberg-Bruchenbrücken in Hesse, it has been interpreted as being a natural part of the clay rather than a deliberate addition (Maletschek, 2010);

– particles of burnt and crushed bone.

The majority of vessels belonging to the category of decorated fine ware includes a temper, although at times the concentration is low. Certain vessels reveal mineral inclusions, such as small grains of rolled quartz, which appear to form part of the clay matrix. Visible inclusions were not apparent in 39 vessels, although it should be noted that it is always difficult to affirm the presence of temper on the

basis of a single sherd. While grog was normally used on its own, bone was nearly always used in association with at least one other type of inclusion, i.e. grog and/or haematite (only one vessel has bone inclusions on their own).

Within the assemblage, two distinct groups can be identified:

– vessels containing only powdery grains;

– vessels with bone particles as well as grog and/or haematite, the latter possibly present naturally in the clay.

Dichotomy in pot-forming

Analysis has revealed two predominant forming processes, mainly distinguished by the way the vessel body is made. The first way of doing, ROS1, is characterized by the use of coils, with oblique alternate overlapping, to form the body of the vessel (fig. 16). The second way of doing, ROS2, is defined by the use of coils, with oblique external overlapping, to form the body (fig. 17).

The ROS1 way of forming has been identified for most vessels within the series; it represents 88 vessels, while ROS2 represents only 12 vessels. When looking at the morphological distribution of these two methods, it appears that ROS1 encompasses almost all of the vessels of LBK style, namely globular-shaped pots with typical LBK decoration, as well as about half of the vessels of Limburg style, generally having open shapes. In contrast, ROS2 is only identified in vessels of Limburg style. Two different ways of doing were thus used to build the Limburg vessels at Rosmeer.

What are the links between forming methods and tempers?

Opposing tendencies have been observed between the ROS1 and ROS2 ways of doing:

– in the case of ROS1, powdery grains are predominant (62 LBK vessels and 5 Limburg vessels);

– in the case of ROS2, bone, accompanied by powdery grains and/or haematite, is most common (10 Limburg vessels). The two LBK vessels associated with ROS2 are tempered only with grog.

When we look at the spatial distribution of the two identified technical groups (fig. 18), namely the vessels made according to ROS1 with grog temper, and those made according to ROS2 with bone and grog and/or hematite temper, we find that they are often associated in the same features. This suggests that they were both used at the same time, especially if we take into account recent work showing that LBK refuse pits only remained open for a relatively short period of time (Allard et al., 2013). Moreover, most of the Limburg style vessels associated either with the first or the second technical group come from five houses located in the south-eastern part of the site and attributed to at least two different settlement phases (Gomart and Burnez-Lanotte, 2012). This indicates that the two methods were transmitted over time in the Rosmeer settlement, thus allowing them to be defined as technical traditions (Roux, 2010).

Discussion

In summary, at Rosmeer two distinct technical traditions characterise the bulk of the ceramic production. The ROS1 technical tradition encompasses the vast majority of fine- and coarse-ware LBK vessels and half of the total number of Limburg vessels. The tradition is characterised by the predominant use of grog as a temper, regardless of the style of vessel being produced. Vases falling within this technical group are found throughout the site.

The ROS2 technical tradition almost exclusively encompasses Limburg style vessels (and 2 vases of LBK style). It is distinguishable by the predominant presence of bone particles (along with grog and/or haematite). The vessels associated with this tradition mainly come from the south-eastern sector of the site. This technical tradition has been identified on several LBK sites within the Limburg pottery distribution zone, such as Cuirylès-Chaudardes, Aubechies, and Fexhe-le-Haut-Clocher (Constantin, Allard et al., 2010; Gomart, 2014).

These two technical traditions appear to reflect the existence of two distinct social groups. A first group (represented by the ROS1 technical tradition), which is predominant, was responsible for the bulk of the LBK style vessels and only a portion of the Limburg style vessels. The products of this group appear to be present throughout the village. A second group (represented by the ROS1 technical tradition), was more limited in size, and created vessels of non-LBK style (and perhaps occasionally LBK style vessels). The ware produced by this group is concentrated in the south-eastern sector of the village, in houses that were built or re-built in close proximity to each other (fig. 18).

These observations allow us to envisage a situation where part of the Limburg style production was carried out by individuals who made virtually only this type of ware (followers of the ROS2 tradition), the other part of this production being carried out by individuals who usually made a wide range of LBK style vessels (followers of the ROS1 tradition). On the basis of this hypothesis, we can suggest that producers within the ROS1 tradition imitated the ‘Limburg style’ (form and decoration), while conserving their own technical tradition.

It should be noted that the use of grog (accompanied or not by bone particles) in almost all of the Limburg style vessels associated with the ROS2 tradition, could indicate an instance of technical borrowing: followers of the ROS2 tradition may have borrowed the temper preferred by followers of the ROS1 tradition. Moreover, the presence in the assemblage of two vessels of LBK form, made following the ROS2 tradition of pot-forming, but

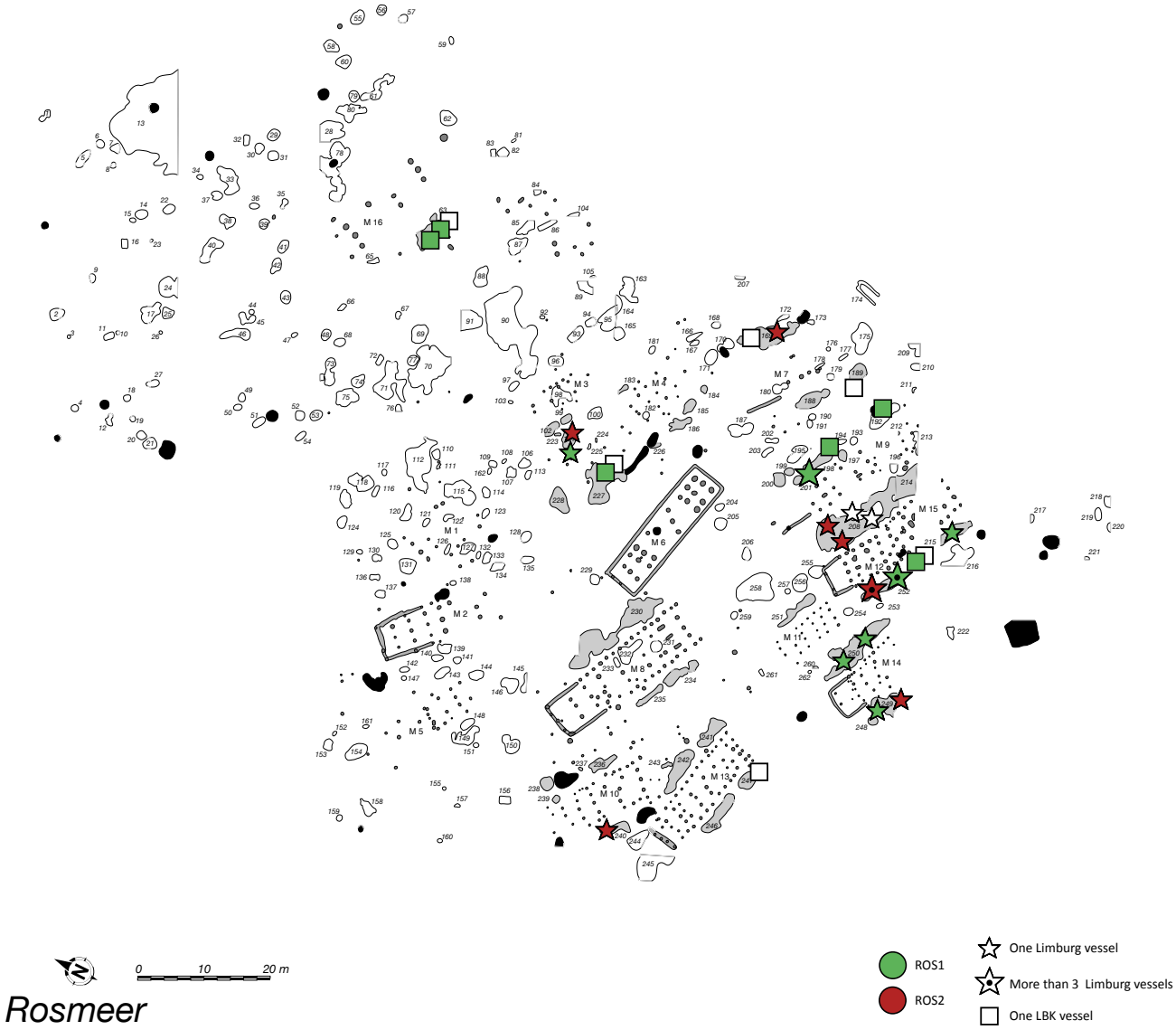


Fig. 18 – Spatial distribution of the two prevailing forming methods at Rosmeer, according to the formal style of the vessels (squares: LBK vessels; stars: Limburg vessels).
***Fig. 18** – Distribution spatiale des deux méthodes de façonnage prédominantes à Rosmeer, en fonction du style formel des vases (carrés : vases rubanés ; étoiles : vases Limbourg).*

only using grog temper (no bone), suggests occasional imitation of the LBK style by followers of the ROS2 tradition.

While no direct evidence for on-site ceramic production has been identified at Rosmeer, and a complete study of the clay raw materials has yet to be undertaken, the fact that producers within the ROS2 technical tradition used grog as well as bone, which was usually added to Limburg vessels, suggests that there were close interactions with the producers of LBK pottery.

CONCLUSION

The characterisation of the clay recipes and their correlation with the forming processes offers a complex view of the contexts of pottery production at Cuiry-lès-Chaudardes and Rosmeer. It enables a better understanding, at a fine resolution, of the dynamics of persistence *versus* transformation of the technical practices and knowledge transfers between groups of producers. We could not identify any unequivocal relationship between clay recipes and forming processes: the spatial and temporal variations identified suggest that, within a single apprenticeship network, producers maintained their traditional practices for forming of vessels but could change their clay recipes depending on the production site or the type of vessel to be made. Thus, during the middle and late occupation phases of Cuiry-lès-Chaudardes, incoming producers, who appear to have come from other villages or regions occupied by LBK communities, retained their non-local forming tradition but preferentially adopted a clay recipe that was dominant during the village's founding phase (addition of shell temper). In Rosmeer, the producers usually

engaged in the manufacture of LBK style vessels maintained their methods of forming pots when they imitated the Limburg style, but changed their approach when it came to preparing the clay: in the majority of cases they added bone to the grog which they normally used when making LBK vessels.

This investigation also provides insights into LBK sociology. At Cuiry-lès-Chaudardes, the spatial analysis of the clay recipes and the forming processes revealed a production carried out at the house scale, by several social groups with complex settlement dynamics. Thus, a first group, present during the village's founding, seems to be gradually replaced by another group towards the end of the occupation. Moreover, throughout the village occupation, the largest houses show a strong continuity in forming processes, suggesting a transmission of technical know-how within the village. In contrast, new technical traditions are observed in some smaller houses, suggesting arrivals of new populations in the village. Collaboration between the larger and the smaller houses can be hypothesised: in some small houses, the inhabitants might have produced only one part of the house pottery range, and they would have received some pots from the contemporary largest houses. At Rosmeer, the data collected do not permit analysis at the house scale. Nevertheless, cross-analysis of the clay recipes and forming methods allows the identification of mechanisms of stylistic imitation and of technical transfers between (i) a group of producers involved in the production of LBK style ware spread throughout the village and (ii) a group of producers mainly producing Limburg vessels distributed in a particular sector of the village, and recognized in other LBK settlement areas (Constantin, 1985; Gomart, 2014). Ultimately, the ideas and hypothesis outlined in this paper need to be further tested through large-scale cross analyses, which should extend to include the study of the clay raw materials used by LBK and Limburg ware producers, both in representative chronological and regional contexts and at the scale of the LBK culture.

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NOTES

(1) La Hoguette ware was not present in the assemblages studied.

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