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Research Article

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The Mechanisms of Neolithisation of Western Europe: Beyond a South/North Approach

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Abstract: Up until now, the neolithisation of Western Europe during the sixth millennium BCE has mainly been approached through the characterisation of its diffusion vectors (cultural vs demic diffusion) and the emergence of technoeconomic innovations (rhythms, scenarios, and transmission). Traditionally, two primary routes of agricultural diffusion are distinguished: one extending along the Danube river corridor to the Atlantic coast (*Linearbandkeramik*) and the other along the Mediterranean coastal zone (Impressed Ware). To move beyond this dichotomy, this article proposes a first attempt at an integrated approach to the mechanisms of neolithisation in Western Europe, one of the few territories where it is possible, and therefore necessary, to investigate the processes that are common to both of these principal neolithisation complexes. The most widely held vision, inherited from the 1980s, of a European Neolithic that developed from east to west following a regular rhythm has progressively been replaced by a more complex model of diffusion characterised by arrhythmia and cultural reconfigurations. Despite having different origins and trajectories, the expansion of the first farmers was made possible by a number of common mechanisms. *Impresso-Cardial* and *Linearbandkeramik* societies faced similar constraints, especially with regard to ensuring the stability of their social and economic models, while minimising the risks inherent to the colonisation of new territories. Three main mechanisms would have structured the first neolithisation phases of both spheres: a strong mobility of populations regulated to varying degrees by social rules, a strong solidarity expressed at multiple levels of interactions within each sphere, and, finally, the existence of syncretism and cultural recompositions including close and long-distance relations.

Keywords: neolithisation, western Europe, Impressed Ware culture, Linearbandkeramik, pioneers, networks, cultural recomposition

1 Introduction

At a global scale, the processes of neolithisation are characterised by very different onset dates, diffusion modalities, and rhythms. Primary heartlands of neolithisation, such as the Middle East, attest to a more or less rapid evolution towards a sedentary way of life, with domestication of native wild animals and plants

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and the adoption of innovative techniques in daily life (e.g. the production of pottery and polished stone tools). At a later stage, other regions were neolithicised from these core areas through the movement of populations, the diffusion of know-how and ideas between neighbouring groups, or by a combination of mechanisms. In Western Europe, these Neolithic techno-economic innovations were introduced for the first time in the sixth millennium BCE. They were diffused from east to west following two broad currents: the Impressed Ware culture (also known as *Impresso-Cardial*) which spread along the Mediterranean coastline and the *Linearbandkeramik* culture (also known as the LBK, Linear Ceramic or *Rubané*) which spread throughout Continental Europe from Transdanubia.

Up until then, these regions had been occupied by Later Mesolithic hunter-gatherer populations; this occupation was far from uniform, however, and certain areas (e.g. the Alps and the Atlantic/English Channel façade stretching from Flanders to Portugal) had quite a strong presence while others, for unknown reasons, appear to have been virtually deserted (e.g. much of coastal France, Corsica, and Catalonia). The fundamental question of the impact of these Mesolithic hunter-gatherer populations on the dynamics of the diffusion of the Neolithic agro-pastoral economy is still debated. It must be said, however, that the tools available to archaeologists are as yet inadequate to deal with the complexity of these phenomena, particularly when we consider that some of these steps may have occurred over the span of just a few decades.

Far from being uniform, the cultural, economic, and symbolic components of the first agro-pastoral societies of Western Europe attest to very different trajectories. From a historiographical point of view, studies of the two spheres of neolithisation – Mediterranean and Continental – have tended to be conducted in parallel rather than in conjunction; there are several reasons for this. First, since the emergence of the Impressed Ware culture precedes the first evidence for the LBK culture in the Rhine Valley by about 500 years, the significant chronological gap between the two currents of neolithisation has in fact limited direct comparisons of the modalities of neolithisation to within a common chronological interval. The fact that the neolithisation of the Mediterranean began earlier also largely explains why potential parallels and contacts between the two spheres from the end of the sixth millennium were generally envisaged in terms of a south to north diffusion (i.e. from the Cardial Ware culture to the Linear Pottery and Blicquy-Villeneuve-Saint-Germain [BVSG] cultures) rather than the inverse. Furthermore, because of the very nature of the archaeological data, the use of different methods to determine the chronologies (absolute *versus* relative methods) has limited comparisons between the two cultural areas. In the Mediterranean region, absolute chronology is one of the foundation stones of reflection on the processes of neolithisation which are envisaged as a mosaic of facies that evolved over almost a millennium; this is a context in which relative chronology, defined on the basis of settlement types and polymorphic find assemblages, does not allow a detailed understanding of the evolutive rhythms. In contrast, relative chronology, defined on the basis of the technological and stylistic characteristics of finds directly associated with individualised household units, is the basis of discussions regarding LBK neolithisation. In fact, in contexts marked by rare stratigraphic records, relative dating provides us with a fine-resolution chronology, in the order of a generation, in circumstances where absolute chronology has its limits.

This dual approach can also be explained by the fact that it involves comparison of the modalities of the settlement of what is now France by populations who were evolving in contrasting landscapes and climatic zones, namely Mediterranean Europe and Continental Europe. How, therefore, can we compare the diversity – and sometimes the transience – of the modes of settlement favoured by the Impressed Ware populations (caves, rock shelters, and open air sites), understood as adaptations to differing territories (plains, coastlines, and mountains), to the relative uniformity of LBK long-house villages, which are generally situated in valley and plateau contexts under the influence of a continental climate?

In an attempt to move away from this perception, in this article we intend to focus on those mechanisms that are common to both currents of neolithisation, i.e. Mediterranean and Continental. In fact, the current study proposes scenarios in which the rhythms and trajectories of neolithisation reveal a true complexity and in which mechanisms of cultural recomposition appear to be central. We have decided to concentrate on the specificities offered by the neolithisation of Western Europe (Demoule, 2010; Guilaine, 2003) and in particular of present-day France. In fact, this is one of the rare zones where it appears to be possible to explore in detail the interactions between the two principal currents of neolithisation. Furthermore, the Atlantic façade is a kind of *Finistère* (literally a "lands' end"), a natural geographical limit to the westward expansion of Neolithic populations. This fact almost certainly had a deep impact on the colonisation strategies and the associated social responses of Neolithic populations and possibly led to a revision of the models of colonisation on these fringes.

2 A Territory Populated by Mesolithic Hunter-Gatherer? Complexity and Scenarios for Hypothetical Interactions

Despite an abundance of theoretical studies on the modalities of territorial coexistence, on the interactions, or integration, between the last hunter-gatherer populations and the first agro-pastoral populations, it is still difficult to base to identify reliable contexts and truly relevant find assemblages on which to base our discussion (Perrin et al., 2009). In the current state of knowledge, the rarity of Late Mesolithic sites occupying the same chronological interval as the first Neolithic settlements (Figure 1) suggests that the agropastoralists were arriving in areas that had recently been "abandoned." The geographical zones traditionally envisaged as zones of contact are limited to just a few areas (Perrin, 2013): Mediterranean

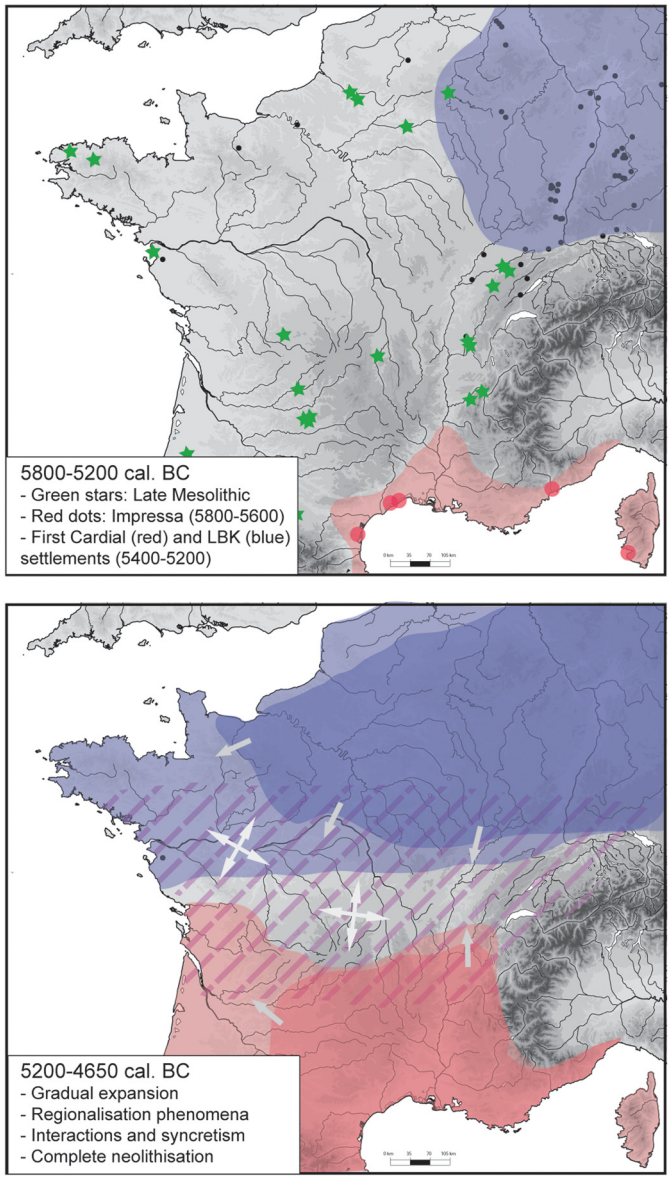

Figure 1: Schematic maps of the spatial and temporal dynamics of expansion of the first farmers in France. In green: Late Mesolithic sites; in red: the Impressed Ware culture (Impressa/Cardial and Epicardial facies) which spread along the Mediterranean coastline; and in blue: the *Linearbandkeramik* culture (also known as the LBK, Linear Ceramic or *Rubané*) which spread throughout Continental Europe (DAO: C. Manen).

hinterlands, the Alpine and Jura regions, and the Atlantic/English Channel coastline. But, whether in stratified contexts or in open air settlements, the evidence has proved to be inconsistent.

In the hinterlands of the French Mediterranean, the particularities of the economic and cultural expressions of sixth millennium populations have long been interpreted as being the result of interactions between the last groups of hunters–gatherers and the first agropastoralists; the Roucadourian of the South of France is a well-known example. However, all recent studies have shown that these suggestions are based on unreliable stratigraphic and chronometric contexts and on limited bodies of finds (Marchand, 1999; Perrin, Manen, Valdeyron, & Guilaine, 2017). In the middle and upper valleys of the Ebro, scenarios in which interactions had a positive influence on the diffusion dynamics of the Neolithic economy have been proposed but the reliability of many of the archaeological contexts is still questionable (García-Martínez de Lagrán, 2014; Zilhão, 2011). In Brittany, located on the Atlantic façade, where models of coexistence have been proposed, recent re-calibration of radiocarbon dates to take account of the ocean reservoir effect has led to the "appearance" of a hiatus between the last continental manifestations of the Mesolithic and the onset of the Early Neolithic (Marchand, 2014).

In regions where the conditions of geographical and chronological proximity appear to coincide, the existence of "particularities and continuities" in material culture and subsistence practices are highlighted in order to support contact hypotheses. Thus, similarities in the management of lithic resources and the lack of any real technical transfers in the production of arrowheads have been discussed in the case of the North of France (Allard, 2005). Because of their stylistic particularities with regard to LBK productions, the origin of the producers of the emblematic La Hoguette and Limbourg wares remains hotly debated, and in particular the hypothesis that these wares were produced by "ceramicised" hunters who were influenced by Mediterranean Neolithic societies. But the close links that have been identified between the Limbourg and LBK spheres might instead suggest that the former pottery was fully part of the LBK tradition (Gomart, 2014). Finally, while certain studies see the important role of hunting in some agro-pastoral sites as proof of the assimilation of hunter-gatherer populations by Neolithic populations, they generally ignore the possibility that Neolithic people themselves drew on wild resources for a certain proportion of their subsistence (Antolín, 2015; Hachem, 2018).

Incontestable evidence for contacts and interactions between the last Mesolithic groups and the first agro-pastoralists thus remains limited, or even invisible, over a large part of the western fringes of the European continent. Only a few regions have yielded reliable data. One notable example is the Jura where alternate occupation of the same territory by different groups has been proposed on the basis of the stratigraphy of the Gardon cave site (Perrin, 2003) (Figure 2). In southern Portugal, the hypothesis of the existence of Mesolithic enclaves, which would have survived for a considerable time after the establishment of the first Neolithic communities, also lacks solid evidence (Zilhão, 2011). In Flanders, an area stretching from Northern France to the Netherlands, there is a complete absence of organised LBK village settlements (Praud et al., 2018). It has been suggested that, in the sandy coastal areas, exchanges occurred between coastal Mesolithic groups, who settled these areas at a relatively late date, and LBK communities who occupied the loess soils to the south of this geographical frontier; in particular, this hypothesis has been proposed for the estuaries of the Escault and Rhine-Meuse where sherds of both LBK and Limbourg pottery have been found in Final Mesolithic contexts (Crombé, Sergant, Perdaen, Meylemanskoen, & Deforce, 2015; Louwe Kooijmans, 2003; Vanmontfort, 2008) (Figure 3).

Finally, it is worth pointing out that recent paleogenetic analyses carried out in several contexts reveal that individuals with haplotypes typical of Mesolithic populations were present among LBK and Impressed Ware groups. However, the unfathomable chronometric scale of phylogenies does not always allow us to determine exactly when and where these contacts and assimilations between populations occurred. Genetic ties have been identified between Mesolithic populations and Neolithic populations in the Balkans, long before the arrival of the latter in Southern Italy and before the diffusion of the Impressed Ware culture further west; a similar phenomenon appears to have occurred in Hungary, the cradle of the LBK culture. Nevertheless, the significant proportion of this Mesolithic haplogroup among certain Early and Middle Neolithic groups suggests that these assimilation phenomena were locally very significant (Rivollat et al., 2020).

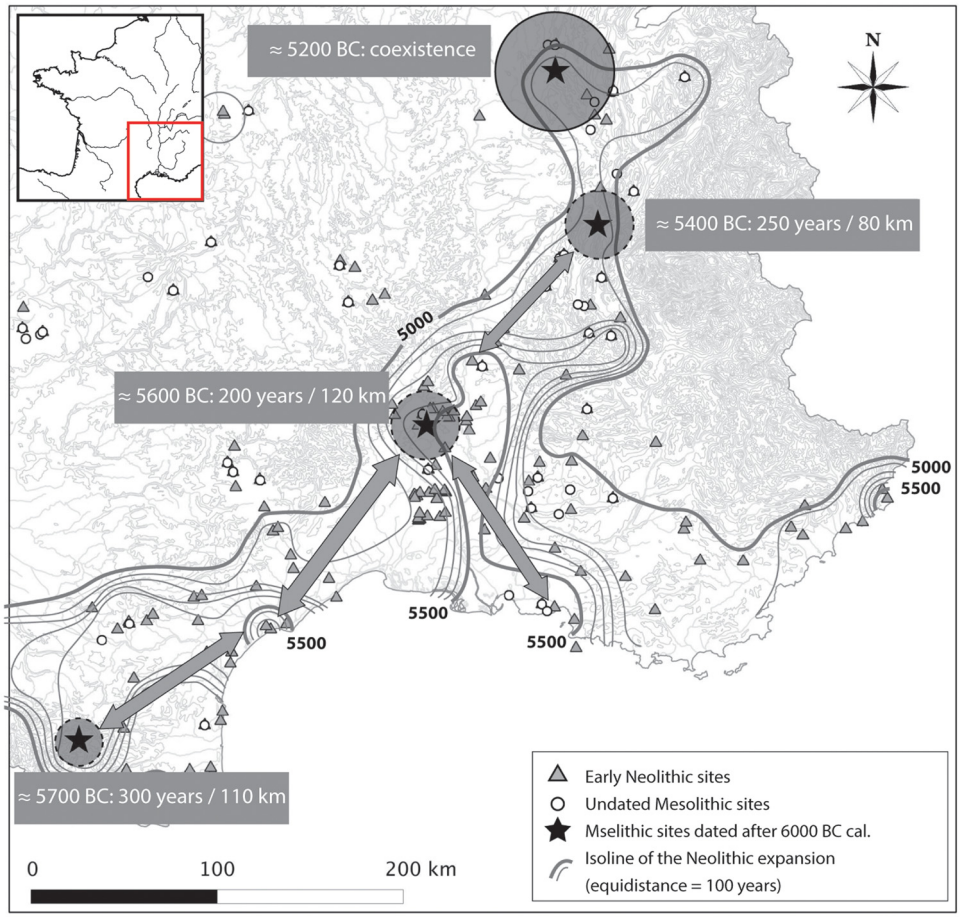

Figure 2: Map of the potentialities of contacts between the last communities of hunters–gathers and the first farmers in southern France (after Perrin, 2013).

In Western Europe, therefore, there appear to be three principal possible scenarios: a very rapid assimilation of Mesolithic populations who tend to be invisible in archaeological contexts but whose presence is sometimes perceptible in certain lingering technical and symbolic traits (Rigaud, d'Errico, & Vanhaeren, 2015); an "exodus" of Mesolithic people who were pushed towards coastal and mountainous areas; and finally, the disappearance of a large part of the Mesolithic population (perhaps due to epidemics) prior to the arrival of the Neolithic colonists (Perrin & Manen, 2021). In all cases, even in the regions where coexistences appear to be attested, the phase of population substitution was sufficiently rapid to leave few traces. This raises the question, among others, of the degree of social cohesion among the very last hunter-gatherer populations inhabiting certain parts of Western Europe.

3 Pioneer Dynamics and First Agro-Pastoralists, a Western Model?

The first agro-pastoralist populations that emerged from the Mediterranean and Continental currents are part of a colonisation pioneer dynamic. In both cases, the ability of part of the farming community to move towards new territories constitutes the rule. Each of the communities would also have sought to promote social mechanisms capable of guaranteeing the survival of these first settlements in order to ensure the territorial expansion and the success of the colonisation process.

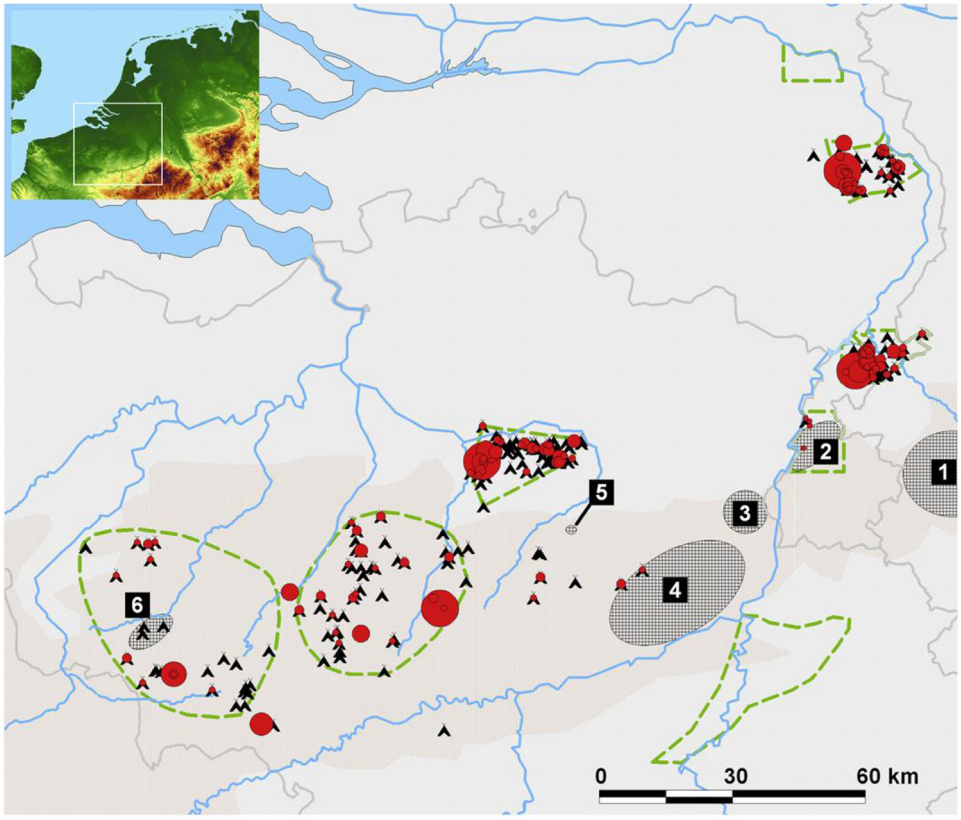

Figure 3: Spatial distribution of microliths in the loess area and its margins, with localisation of LBK clusters (after Vanmontfort, 2008, Figure 5).

The earliest farming communities were established in the Western Mediterranean between 5800 and 5600 BCE (Figure 1). If we take the French Languedocian model as a reference (Guilaine, Manen, & Vigne, 2007; Manen et al., 2019b), these groups of pioneering colonists were made up of small family units whose economy was largely based on the raising of sheep and goats and the cultivation of emmer. The technical products of these communities display clear links with the Impressed Ware complex of Italy and suggest different areas of origin. The finding of objects that were acquired or made several hundreds of kilometres away (obsidian and ceramics) reinforces the hypothesis of the movement of pioneering groups within the Mediterranean region (Gabriele et al., 2019) (Figure 4). While these pioneering communities reproduced the Italian technical and economic model, the scale of their settlement is more limited than those well-known in the Impressed-Ware core area (S.-E. Italy). But their structure and number are perhaps completely underestimated in southern France. The future of these groups and their impact within the overall process of neolithisation in the South of France are still difficult to estimate. The same is true in the Iberian Peninsula where data remain too scarce to allow this type of pioneering settlement to be identified (Bernabeu Aubàn & Martí Oliver, 2014).

Around 5500–5400 cal. BCE a new cultural and social complex, the Cardial culture, became established in the South of France and in Spain (Figure 1). Its genesis is still poorly understood. Major discontinuities are observed between the Impressed Ware and Cardial complexes, in terms of not only their lithic and ceramic material culture but also their raw material supply networks (e.g. total absence of obsidian) and their systems of animal exploitation. Of course, a process of cultural recomposition is probably at the origin of these discontinuities but many links are still missing between these two entities. We cannot clearly find a transitional phase in southern France: a transition that could have occurred elsewhere in the Mediterranean space. The distribution map of sites (Perrin et al., 2017) reflects a significant geographical expansion, probably linked to demographic growth, which encompasses a mosaic of different landscapes (on open coastal plains or in areas isolated by coastal relief, near lagoons, in alluvial valleys, on adjacent plateaux,

Figure 4: Schematic map of the extension of exogeneous raw material provenance in the Early Neolithic (Impressa) site of Pont de Roque-Haute (Hérault, France) (after Guilaine et al., 2007).

in mountainous areas, etc.). The modalities of expansion (space-time) towards mountainous areas and the Atlantic façade remain unclear and it is probable that the appropriation of these new biogeographical spaces necessitated a reworking of the economic model and an adaptation of know-how (Manen, Carozza, Marchand, & Perrin, 2018). From the point of view of food resources, the raising of sheep and goats and the cultivation of cereals dominate on numerous sites despite a non-negligible proportion of wild resources (Bouby et al., 2020; Vigne, 2007). Marine resources appear to have played a very secondary role in the diet. The settlements established by Cardial communities take many forms, mirroring the diversity of the environments occupied: open-air wetland settlements made up of several individual dwellings; cave and rock-shelter settlements in limestone uplands, etc. (Sénépart & Beeching, 2009). The hypothesis that communities were organised around a system of mobility between permanent settlement sites and sites where specialised activities took place (e.g. hunting camps, short-stay camps, shepherds' camps, etc.) is still difficult to prove due to our poor understanding of the effective distribution and density of sites, as well as of the rhythms and durations of their occupations. This variety in settlement sites far exceeds the simplistic dichotomy between cave sites and open-air sites and reflects the social and structural dimensions of groups in the South of France. Far from reproducing a preconceived settlement model, these communities appear to have pragmatically sought to optimise the location and organisation of the settlement itself as a function of the specific characteristics of the site and available resources (Manen et al., 2021, this volume).

These communities were part of networks that defined fully connected cultural territories, which we get a glimpse of through their management of mineral resources (flint, clay, and hard stones) (Figure 5). From about 5200 BCE, in parallel with a clear rise in the density of territorial occupation, marked regionalisation phenomena emerge (Guilaine, 2018); these regionalisms are particularly evident in the realm of ceramics (Later Cardial style, Epicardial, PostCardial, Square Mouthed Vases, etc.). It is also in this period that we get direct evidence for interactions between the Mediterranean and Continental cultural complexes (cf. *infra*).

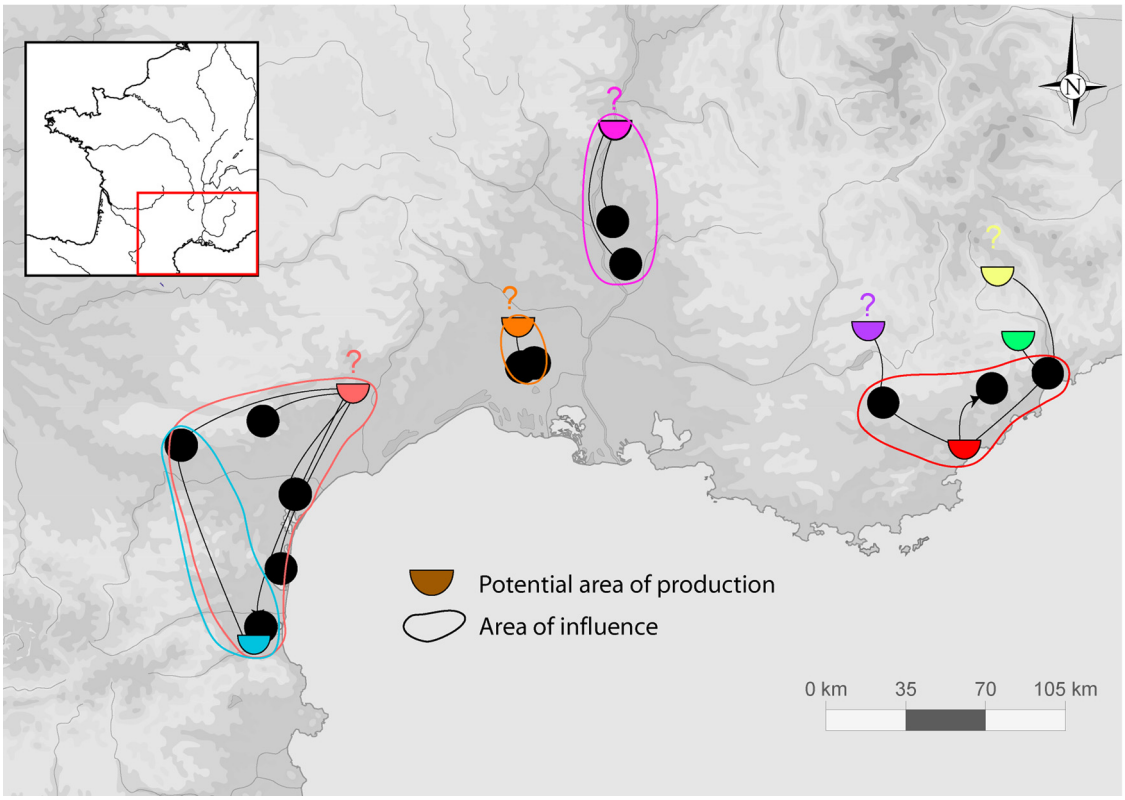

Figure 5: Map of the influence areas and the territories based on the ceramic raw material analysis of the first farmers communities in Southern France (after Binder, Clop Garcia, Convertini, Manen, & Sénépart, 2010).

The second major neolithisation current, which originated in Transdanubia around 5500 cal. BCE, reached the Rhine Basin about 5300–5200 cal. BCE, before extending as far as the shores of the English Channel by the turn of the fifth millennium BCE (Figure 1). Over most of present-day France, the pioneering LBK settlements were established in areas that had been recently cleared in order to accommodate settlement, cultivation, and animal husbandry (Bosquet, Salavert, & Golitko, 2010), thus reproducing a model that is encountered throughout continental Europe. The establishment of hamlets to create an often dense and continuous settlement network was a priority; on certain alluvial valley bottoms and plateaux, Linear Ceramic sites occur every 3–4 km. Short-occupation hamlets (inhabited for about a generation) appear to have co-existed alongside more permanent settlements, occupied for up to two centuries (Figure 6). The long houses that make up these settlements are a true marker of Linear Ceramic identity; the dimensions of these houses, built on a tri-partite arrangement of postholes, vary according to the number of inhabitants (Dubouloz, 2012a) and their level of economic maturity (Gomart, Hachem, Hamon, Giligny, & Ilett, 2015). In western regions, cereal growing and animal husbandry (cattle, caprines, and pigs) form the basis of the economy, while hunting appears to be a fully integrated part of the food procurement and symbolic systems of each household (Hachem, 2018). The circulation of raw materials and of technical traditions suggests significant movement of individuals and strong integration of know-how from multiple origins within each Linear Ceramic settlement area (Blouet, Klag, Petitdidier, & Thomashausen, 2013; Meunier, 2012). They reflect the heritage of the regions of origin, the integration of sites within exchange networks, and the very strong interdependence that existed between neighbouring regions.

As it extended west of the Rhine, LBK colonisation appears to have re-invented a number of its cultural traits. Village layouts become less dense and buildings increasingly appear to have been abandoned rather than rebuilt. In other words, the conception of village space appears to expand as the colonisers moved westward, a pattern that is also observed in other areas of LBK expansion (Pyzel, 2019). In certain regions,

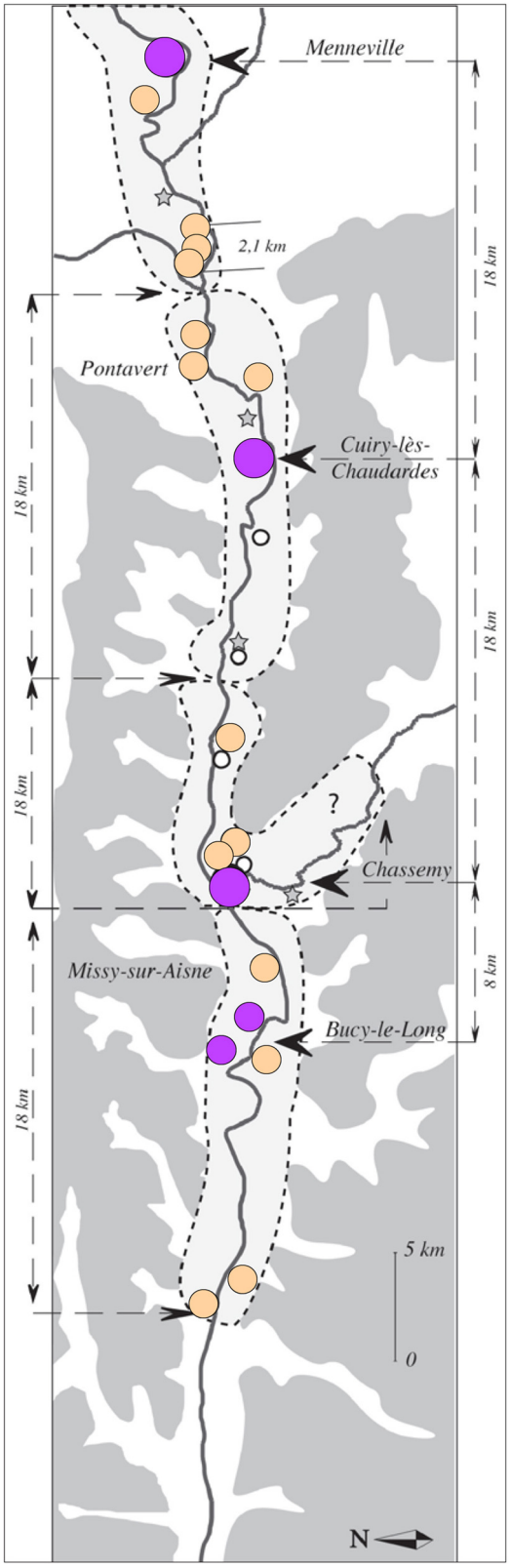

Figure 6: Distribution of main and secondary LBK sites in the Aisne valley. Purple dots: main sites; yellow dots: secondary sites; and white dots: other sites (after Dubouloz, 2012b, Figure 6; et Ilett & Plateaux, 1995, Figure 6).

we observe a multiplication of enclosing ditches, both defensive and ceremonial (Blouet, 2017; Bosquet & Golitko, 2012; Golitko & Keeley, 2007; Orschiedt & Haidle, 2007) (Figure 7), while no examples are known west of Menneville (Thevenet, 2016). Finally, in terms of funerary practices, to the west of the Rhine and

Figure 7: Pioneer houses and enclosed LBK village of Fexhe le-Haut-Clocher and Remicourt En Bia Flo II (Hesbaye) (after Bosquet & Golitko, 2012, Figures 4 and 5).

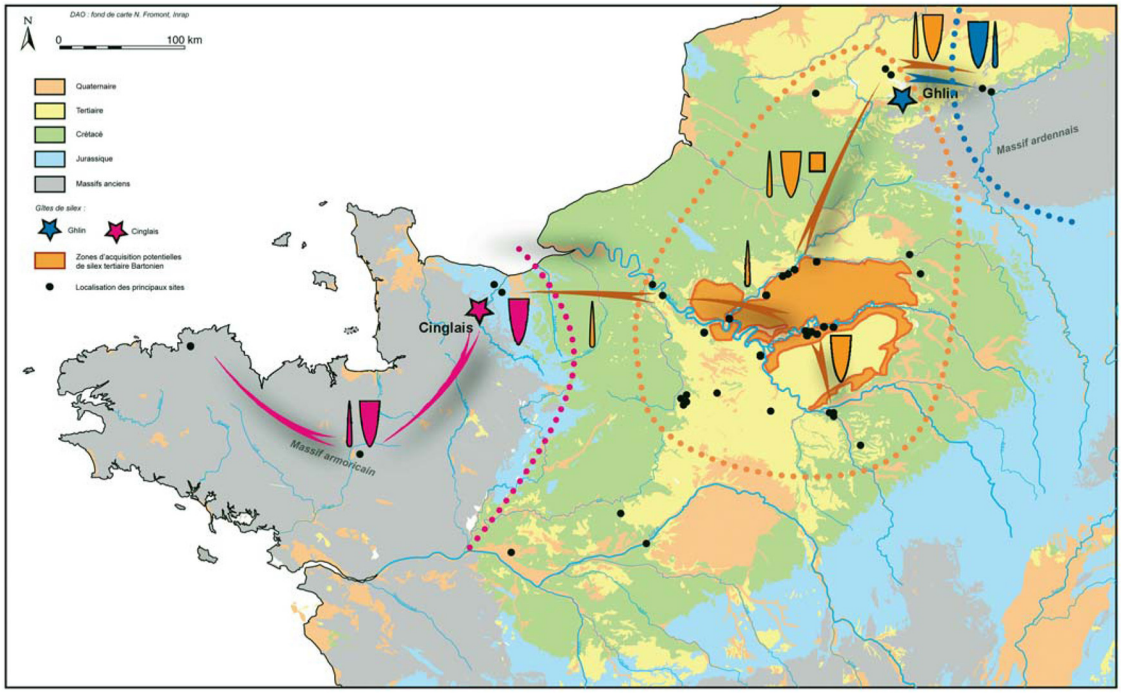

Figure 8: Schematic representation of flint supply sources and territories in the Paris Basin and its margins during the middle stage of the BVSG culture, with indication of the circulation of nucleus (conic form) or blades (elongated form) (after Bostyn et al., 2019, Figure 5).

Meuse Valleys, the vast cemeteries of Central Europe give way to inhumations that are directly associated with domestic spaces (Jeunesse, 1997). Despite their highly symbolic character, polished stone tools, which are omnipresent in the cemeteries and houses of Central Europe, appear to lose their importance and deliberate deposits of quern stones start to appear (Hamon, 2020). Taken together, these evolving characteristics suggest if not a rupture, then at least a real evolution of expressions of LBK identity.

From about 5050 cal. BCE, the emergence of what are termed post-LBK groups – such as the Hinkelstein in the Rhine Basin and the BVSG further west (Denaire, 2009; Ilett, 2010) – is accompanied by the appearance of more marked regionalisation in terms of house plans, agro-pastoral practices, and technical traditions. This phenomenon appears to be attributable to internal evolutions (Allard & Bostyn, 2006), which in part include the integration of exogenous influxes from other regions, particularly from the Mediterranean, in the south and west of the BVSG cultural zone (Marcigny, Ghesquiere, Juhel, & Charraud, 2010; Meunier, 2012). These cultural mutations coincide with a densification of territorial occupation and in the case of the BVSG with an expansion of the territory as far as the western point of Brittany, the Atlantic Coast, and the Massif Central. The circulation of certain raw materials (flint and schist) took place over very long distances within competing areas of diffusion (Bostyn, Charraud, & Denis, 2019; Fromont, 2013) (Figure 8). The increasing regionalisation within these cultural groups would eventually lead to their dislocation around 4650 cal. BCE.

4 Exploration, Settlement, and Expansion: Similar Neolithisation Mechanisms?

4.1 Demic Models

In both the Continental and Mediterranean spheres, neolithisation hinges on demic models in which a portion of communities moved, although the possibility of local cultural diffusion cannot be excluded (cf. *infra*).

Recent paleogenetic studies have confirmed the very close degree of relatedness within both Cardial and LBK populations throughout their respective expansion routes, and an admixture with hunter-gatherer populations in a later neolithic phase (Brunel et al., 2020). This reinforces the hypothesis of demic diffusion of the first Neolithic cultures of Europe. In the Mediterranean zone, the first Impressed Ware influences are consistent with the model whereby the Neolithic "package" was diffused through the movement of human groups (Guilaine, 2018). The geographically discontinuous nature of these settlements is suggestive of the hypothesis of "leapfrog colonisation". For the moment, however, no hypothesis specifies the distances that may have been travelled or the itineraries followed by these Neolithic colonisers. The Mediterranean space no doubt offered the possibility of multi-directional circulations and gave rise to geographical and cultural discontinuities that are as yet difficult to organise (Manen et al., 2019a). Furthermore, this situation could only represent an artefact of research linked to a lack of data for the initial phases of the Impressa culture.

In the Linear Ceramic area, a mosaic of regional colonisation fronts, interacting with each other, would have advanced in multiple directions according to various factors related to opportunity (access routes through the landscape), attractivity (availability of water, mineral resources, and good quality soils), and repulsivity (mountainous environments). Within this scheme, the risks associated with settlement are effectively limited through direct support provided by the home community to the pioneers through what is termed a "network of solidarity" (Hoffmann, 2016). Moreover, each newly colonised region would have functioned like a "melting pot" within "a world open to multiple interactions" (Blouet et al., 2013, p. 349).

4.2 An Arrhythmic Diffusion

Within both spheres, the scenarios for the dispersion of the Neolithic economy are inconsistent with the hypothesis of an "advancing population wave."

In the western Mediterranean area, available radiocarbon data do not allow us to observe a progressive, continuous diffusion from southern Italy to the Iberian Peninsula. In fact, the first Impressed Ware settlements in the South of France are only slightly later than those of southern Italy (Binder et al., 2017) and at the moment even appear to predate the first Neolithic settlements in Tyrrhenian Italy. Furthermore, in certain regions (e.g. Mediterranean Languedoc), a real chronological hiatus is currently observed between the establishment of these first Impressed Ware communities and those of the subsequent Cardial (Manen et al., 2019a).

For its part, the original continental neolithisation involved a single progression flow, which was ultimately more arrhythmic (Guilaine, 2020) than continuous, across all of Europe. While the colonisation appears to have been rapid in terms of the distances travelled in just a few centuries, in reality phases of particularly rapid and large-scale settlement advances alternated with more static phases in which we see a densification of settlement at a micro-regional scale (Dubouloz, Bocquet-Appel, & Moussa, 2017). Between the Upper Rhine Valley and more western regions, Neolithic colonisation is marked by brief hiatuses and phases of acceleration. Schematically, these correspond to the passage from one cultural phase to another. Thus, we observe a hiatus between the end of the LBK and the appearance of the Hinkelstein in the Rhine Valley (Denaire et al., 2017), and, inversely, what appears to be a very rapid transition between the very end of the LBK and the very beginning of the BVSG in the Paris Basin (Meunier, 2012).

4.3 Exploration and Regulation, Motors of Movement?

Between social regulation and the need for exploration, demic models of neolithisation have very diverse causes and expressions, depending on the contexts. At the scale of the Impressed Ware complex, pioneer sites in the South of France as well as early incursions towards the islands, evidenced by the exploitation of

obsidian in Sicily, Sardinia, and Palmarola (Binder, Gratuze, & Vaquer, 2012), reinforce the hypothesis of exploratory behaviour sustained by the maritime space.

As regards the Cardial and LBK, it is more likely that we are looking at a model of gradual colonisation from area to neighbouring area. In both cases, the phenomena of segmentation and subsequent expansion are often envisaged as a direct consequence of demographic pressure on available local resources. By acting as a regulator in the case of social "stress," this scission would have constituted a kind of "survival reflex" for the first Neolithic populations. However, we cannot ignore the potential social, formative, or even "heroic" values that may have been attached to exploratory activity.

5 Cultural Recomposition at the Heart of the Neolithisation Processes in Western Europe?

Cardial and LBK societies therefore had to deal with the same initial constraints, namely ensuring the stability of their social model while at the same time minimising the risks inherent to the colonisation of new territories. However, the solutions that they adopted were, to all appearances, radically different.

The LBK populations appear to have favoured a social system that ensured group cohesion through a high degree of reproducibility in their settlement landscapes, living spaces, material culture, and, more generally, their cultural and symbolic practices and expressions. The social rules established clearly permitted these groups to rapidly colonise and put down firm roots in new territories. In order to ensure its long-term continuity in the face of various types of risks (diseases, poor harvests, collapse of social connections, etc.) the Linear Ceramic social system had to integrate compensatory and regulatory mechanisms. The latter linked new settlements to the village of origin, to other villages within the micro-area, and to other villages within the wider region. The pioneers, therefore, directly stemmed from a distant village; in the LBK context this usually meant a village a few kilometres or perhaps up to a day's walk, away. They benefitted from the support of the original community for forest clearance, house construction, the building up of a livestock herd, and the provision of seed for crop cultivation. They would remain a part of previously established circulation networks for goods and people, while also integrating individuals of indigenous origin, as is suggested by the introduction of outside ceramic traditions (Gomart, 2014).

Procurement of mineral raw materials was organised around multi-source, direct, and village-to-village circulation networks. Evident variations in products (e.g. ceramic styles and decoration, personal ornaments, etc.) probably attest to the integration of outsiders within the initial community; the integration of such individuals may have been seen as a necessary regeneration factor for ensuring cultural cohesion. This mode of functioning would thus have aimed to ensure the survival of the LBK cultural model.

In order to ensure the success of their colonisation efforts, Cardial societies, which had to deal with diverse ecosystems marked by a contrasted Mediterranean climate (hot summers with a threat of drought, rare but violent precipitation, etc.), appear to have adapted their economic practices to the extent that the latter sometimes depart quite significantly from the original model. Thus, in a very short interval, between 5200 and 4900 BCE, we observe the colonisation of a variety of ecosystems whose exploitation attests to a desire to exploit all potential resources (including wild resources); it appears that the goal was to minimise the risks by multiplying the range of food resources exploited and by developing complementary economic activities (Antolín, 2015; Perrin et al., 2017). It also seems probable that the mosaic of settled territories led to system of dispersed settlement featuring a low density of household units. It therefore appears that the early exploration of very diverse territories and the capacity to adapt and to innovate were key to the process of neolithisation in the South of France. To sum up, LBK and Cardial societies developed two quite different solutions in order to respond to the risks inherent to colonisation and to ensure the continuation of their economic and social systems. LBK society constructed a social model that ensured the reproducibility of its cultural rules and the control of processes of technical innovation; Cardial society opted to abandon

its original models by enlarging the spectrum of possibilities while at the same time maintaining a dense network of interactions.

However, in both spheres of neolithisation, the processes of neolithisation in reality involve mechanisms that are much more similar than they might seem at first glance, and which are based on systems of mobility, structured social networks, and also phenomena of recomposition. Marriage rules, exchanges of goods, and the organisation of apprenticeship networks undoubtedly promoted the transmission, circulation, and transformation of cultural traditions. In fact, the genesis of the regional and chronological facies of the LBK and Cardial cultures integrates multiple influences that are often internal to the communities themselves and that are particularly perceptible through ceramic styles and traditions. These mechanisms for the integration of elements, and even of populations, from outside the initial community are inherent to the very process of LBK colonisation; this is an idea that was initially proposed by M. Lichardus in the 1980s. Indeed, this phenomenon of recomposition might even have constituted a key element in the survival, be it biological (livestock and people) or cultural, of Neolithic communities in general.

Such mechanisms would explain the difficulties encountered when trying to untangle, in regions very far from the two "primary" centres of neolithisation (van Willigen, 2018), the respective proportions of Continental and Mediterranean influxes; we could cite, for example, the discussions generated by the rare evidence for contact between Cardial and LBK groups or by the emergence of the BVSG (Bostyn, 2010). In other words, the neolithisation of regions stretching from the Atlantic façade to the Alps should not be envisaged in terms of these Mediterranean and Continental neolithisations. Instead, these areas should be seen as melting pots where novel processes of recomposition took place followed by new diffusions. Thus, each region settled by these Neolithic pioneers, even when this settlement took place at quite a late date, was subject to processes that borrowed from multiple influences. The social phenomena underlying these diffusions/circulations remain poorly defined. They probably relate to marriage networks, systems of itinerant traders, and circulation from village to village, phenomena which may have operated independently or in combination. The distances travelled might also have been greater than initially thought if we consider, for example, the long distance circulation of marine spondylus, the variscite bead discovered on the LBK site at Colombelles, almost 1,700 km from the raw material extraction site (Billard et al., 2014), the issues surrounding the diffusion of the poppy plant (Salavert, Martin, Antolín, & Zazzo, 2018) or the discovery of the N1 haplogroup (typical of Linear Ceramic groups of Central Europe) in the genetic makeup of an individual found in an Epi-Cardial context in the El Trocs cave site in the Spanish province of Huesca (García-Martínez de Lagrán, Fernández-Dominguez, & Rojo Guerra, 2017).

Clearly, it took communities a certain time to move beyond the coastal and continental tropisms that are at the origins of the Impressed and LBK diffusion currents, respectively. Arrival at the geographical boundaries of the European territory probably exacerbated the limits of a system based on colonisation, forcing communities to revise significantly the mechanisms that regulated their society and to revisit progressively the expressions that had constituted their cultural identity up until then.

6 Conclusion

The north–south dual vision, which up to now has shaped our understanding of the modalities of the appearance and development of the Neolithic in Western Europe, needs to be nuanced so as to open up new perspectives on the neolithisation of the European West. Despite having different origins and trajectories, the two principal streams of European Neolithic colonisation, namely Mediterranean and Continental, shared comparable colonisation mechanisms, although with a time lag of several centuries between them. Once the first settlements had become firmly established, there followed a phase of territorial expansion and demographic densification, with a concomitant evolution of cultural characteristics. This heralded a growth in regionalisation, a process that culminated with the dislocation of the Impressed Ware and LBK cultural complexes around the mid-fifth millennium BCE. These processes are dependent on a three-part mechanism: a high level of population mobility while ensuring internal social regulation; a

solidarity network structured by multiple intra-regional interactions within each sphere of neolithisation; and phenomena of cultural syncretism and recomposition involving close and very long-distance relationships. Here, we are touching the very foundations of the Neolithic world, experienced as an open and interconnected space with eminently permeable frontiers.

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