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8

L'ESSOR DU MAGDALÉNIEN
ASPECTS CULTURELS, SYMBOLIQUES ET TECHNIQUES DES FACIÈS À NAVETTES ET À LUSSAC-ANGLES

ACTES DE LA SÉANCE
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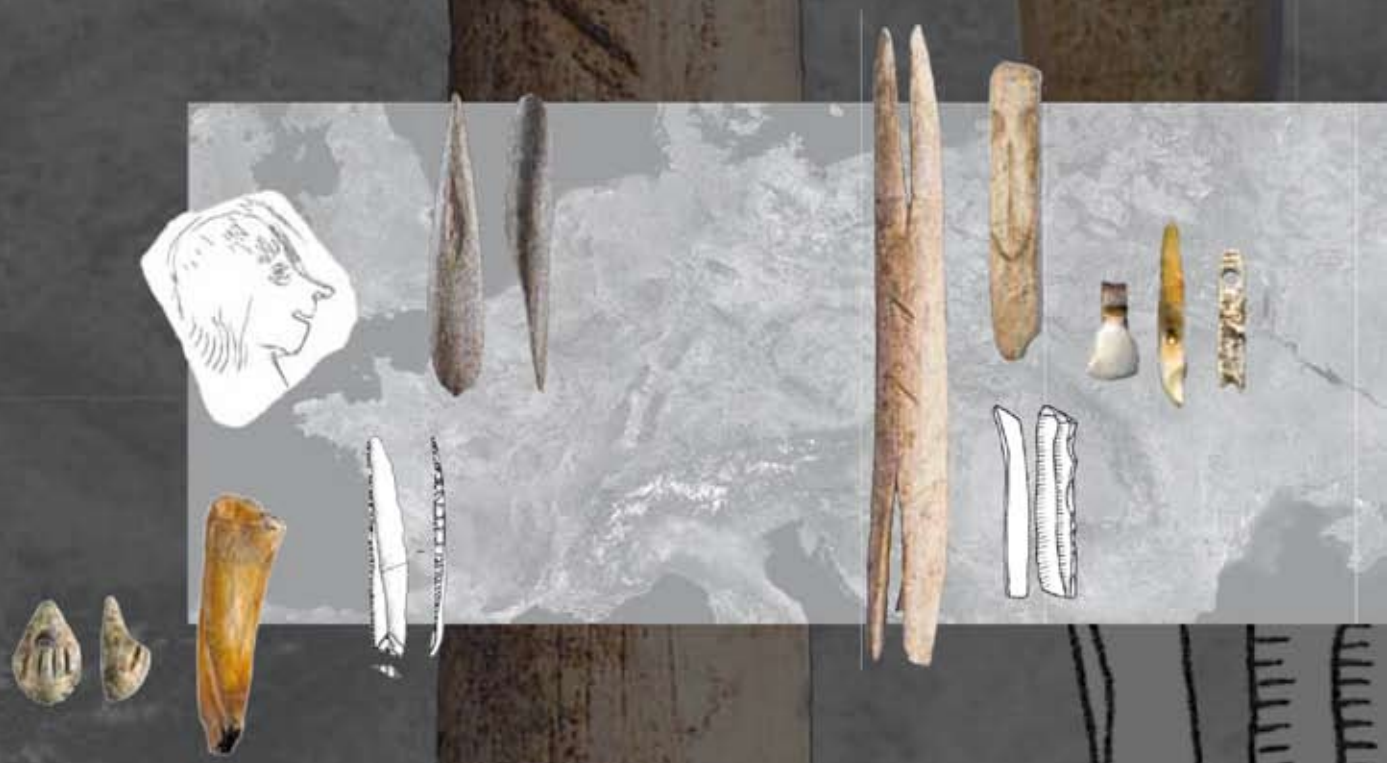

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Expansion or communication?

The phenomenon of the Magdalenian *à navettes* from a Central European point of view

Andreas Maier

Abstract: From a Central European point of view, the phenomenon of the Magdalenian *à navettes* is rather puzzling. Today, only one site of this facies is known from east of the Rhine river (Maszycka Cave in the Polish Jura) and this site is located 1,300 km apart from its closest *navettes*-bearing neighbor (Grotte Grappin in the French Jura). Moreover, all Magdalenian sites from Germany and Bohemia are clearly younger. This finding raises the question as to how such a spatial pattern can form. Two scenarios seem to offer a reasonable explanation. The first argues that the pattern is caused by people expanding from Western Europe to the East. The second suggests that communication between two populations, one located in Western Europe, the other in Eastern Central Europe, is a probable explanation. This paper explores which scenario is more likely to approximate the prehistoric processes that led to the observable pattern by discussing necessary assumptions of each against the background of the archaeological record.

Keywords: Magdalenian *à navettes*, expansion, communication, recolonization, Central Europe.

Résumé : Du point de vue de l'Europe centrale, le phénomène du Magdalénien « à navettes » est assez curieux. Actuellement, un seul gisement rapporté à ce faciès est connu à l'est du Rhin (la grotte de Maszycka dans le Jura polonais), situé à 1 300 km de distance du site à navettes le plus proche (la grotte Grappin dans le Jura français). En outre, tous les gisements magdaléniens d'Allemagne et de Bohème sont nettement plus récents. Cette situation soulève ainsi la question de l'origine d'une telle répartition spatiale. Deux scénarios semblent fournir une explication raisonnable. Dans le premier, cette répartition résulte d'une expansion démographique depuis l'Europe occidentale vers l'Europe orientale. Dans un second scénario, il est également probable d'envisager la communication entre deux populations, l'une située en Europe occidentale, l'autre en Europe centrale. Cet article examine ces deux modèles afin de déterminer celui à même d'approcher au mieux les processus préhistoriques ayant mené à cette répartition, en confrontant les postulats véhiculés par chacun d'eux aux données archéologiques.

Mots-clés : Magdalénien « à navettes », expansion, communication, recolonisation, Europe centrale.

The Magdalenian facies called *à navettes* comprises assemblages from eight sites, which share a set of distinct objects. Beside the eponymous *navettes*, double beveled points, figurative items such as phalliform *bâtons perçés* and sculpted and engraved human faces are said to be common features of this facies (Allain et al., 1985; for a critical view see Vialou, 2009). Chronologically, the facies *à navettes* is generally attributed to the Middle Magdalenian. The precise temporal position is, however, difficult to assess, since radiocarbon dates, if available, are often plagued with high standard deviations or an uncertain association with the *à navettes* assemblage (Allain et al., 1985). Considering only AMS ^{14}C-dates with a standard deviation of ≤ 100, reported from La Garenne, Grotte Grappin and Maszycka Cave, it can be assumed that the *à navettes* facies occurred during a comparatively short period of about 500 years, roughly between 18,500 and 18,000 cal. BP (table 1). Most of the sites attributed to the Magdalenian *à navettes* are located in Western Europe (fig. 1). Indeed, there is only a single site of this facies known today, which is located east of the Rhine river. This site, Maszycka Cave in the Polish Jura (Kozłowski et al., 1995 and 2012), is situated at a distance of about 1,300 km from its closets *navettes*-bearing neighbor, the site of Grotte Grappin at Arlay in the French Jura (Cupillard and Welté, 2006). To date, there

is no evidence of another assemblage yielding *navettes* from the area between both sites, comprising Southern Germany, Northern Austria and the Czech Republic. This *navettes*-free area has thus about twice the size as the entire area in Western Europe within which the sites of the *à navettes* facies are distributed (fig. 1). This observation alone is quite remarkable, particularly for a Paleolithic period as well investigated as the Magdalenian. However, the picture is getting even more peculiar when the fact is taken into consideration that all known Magdalenian sites in Germany and Bohemia, together about 200, are clearly younger than 18,000 cal. BP (see section 3.2.4; for details see Maier, 2015), the upper limit of the estimated period for the Magdalenian *à navettes* (table 1). In short, this means that researchers working on the phenomenon of the Magdalenian *à navettes* are confronted with a situation, where an archaeological facies with a rather distinct set of artefacts occurs seemingly isolated in an assemblage (Maszycka Cave) that is contemporaneous to but spatially separated from the next comparable site (Grotte Grappin) by a distance that roughly equals the double diameter of the entire distribution area of the remaining sites. Such an observation is highly unusual and demands an explanation.

Attempting to explain the spatial pattern of the Magdalenian *à navettes*, two scenarios can be formulated. The first scenario takes as a basis the hypothesis that the recolonization of Central Europe after the Last Glacial Maximum (LGM) took place as a unidirectional, wave-like expansion of Magdalenian hunter-gatherers

Site, Layer, Concentration	M	Sp	Lab. no.	BP	Std	cal. BP	Std	Reference
Garenne, Blanchard, B4	b	E	ETH-28494	15,010	90	18240	130	Despriée et al., 2009
Garenne, Blanchard, B5	b	B/B	ETH-28493	15,050	90	18290	130	Despriée et al., 2009
Garenne, Blanchard, B6	b	R	ETH-28492	15,290	90	18560	110	Despriée et al., 2009
Garenne, Grand-Abri, B	b	E	ETH-29157	14,840	100	18070	130	Despriée et al., 2009
Garenne, Grand-Abri, B1	b	E	ETH-29154	14,980	100	18210	140	Despriée et al., 2009
Garenne, Grand-Abri, B2	b	E	ETH-29158	15,020	100	18250	140	Despriée et al., 2009
Garenne, Grand-Abri, B	b	E	ETH-29156	15,070	100	18310	140	Despriée et al., 2009
Garenne, Grand-Abri, B2	b	E	ETH-29155	15,080	100	18320	140	Despriée et al., 2009
Grappin	b	R	OxA-19632	15,540	55	18800	70	Cupillard et al., 2008
Grappin	a	R	Ly-1509	14,220	560	17180	730	Allain et al., 1985
Grappin	a	R	Ly-1535	14,530	290	17660	360	Allain et al., 1985
Grappin, C	a	R	Ly-1510	14,820	370	18000	430	Allain et al., 1985
Grappin, C	ab	In	Ly-1536	14,840	360	18030	420	Allain et al., 1985
Grappin, C	n	R	Lyon-4867(GrA)	14,940	50	18160	100	Cupillard et al., 2008
Grappin, C	n	R	Ly-3877 (GrA)	15,260	70	18530	100	Cupillard et al., 2008
Grappin, C	b	E	Ly-3161 (Poz)	15,335	100	18600	120	Cupillard et al., 2008
Grappin, C	n	R	Ly-3160 (Poz)	16,840	110	20320	150	Cupillard et al., 2008
Grappin, C/D	b	In	Ly-497	15,320	370	18560	410	Allain et al., 1985
Grappin, C/D	b	In	Ly-559	15,770	390	19100	430	Allain et al., 1985
Maszycka	b	E	Ly-2453	14,520	240	17660	300	Allain et al., 1985
Maszycka	a	In	KIA-39225*	14,855	60	18080	90	Kozłowski et al., 2012
Maszycka	b	Ho	KIA-39227	15,015	50	18250	100	Kozłowski et al., 2012
Maszycka	a	In	KIA-39226*	15,025	50	18260	100	Kozłowski et al., 2012
Maszycka	b	Ho	KIA-39228	15,155	60	18420	90	Kozłowski et al., 2012
Maszycka	a	R	Ly-2454*	15,490	310	18760	350	Allain et al., 1985
Roc-de-Marcamps	n	In	Ly-2290	14,200	190	17260	260	Allain et al., 1985
Roc-de-Marcamps	b	In	Ly-2291	14,910	240	18140	280	Allain et al., 1985

Table 1 – Selected ^{14}C-dates for the Magdalenian *à navettes*. M: Material (a: antler; b: bone; ab: antler/bone; n: not determined); SP: Species (B/B: Bos/Bison; E: Equus; Ho: Homo; In: Indeterminate; R: Rangifer); *: date on humanly modified piece. The dates marked in dark grey were excluded due to a high standard deviation. All dates are calibrated with the CalPal2007 Hulu curve (Weninger and Jöris, 2008; Weninger et al., 2012).

Tabl. 1 *– Datations ^{14}C du Magdalénien « à navettes ». M : Matière (a : bois de cervidé ; b : os ; ab : bois de cervidé/os ; n : indéterminé) ; SP : Espèce (B/B :* Bos*/Bison ; E :* Equus*; Ho :* Homo*; In : Indéterminé ; R : Rangifer) ; * : date sur artéfact. Les dates en gris foncé ont été exclues en raison de la largeur de leur écart-type. Toutes les dates sont calibrées avec la courbe CalPal2007 Hulu (Weninger et Jöris, 2008 ; Weninger* et al.*, 2012).*

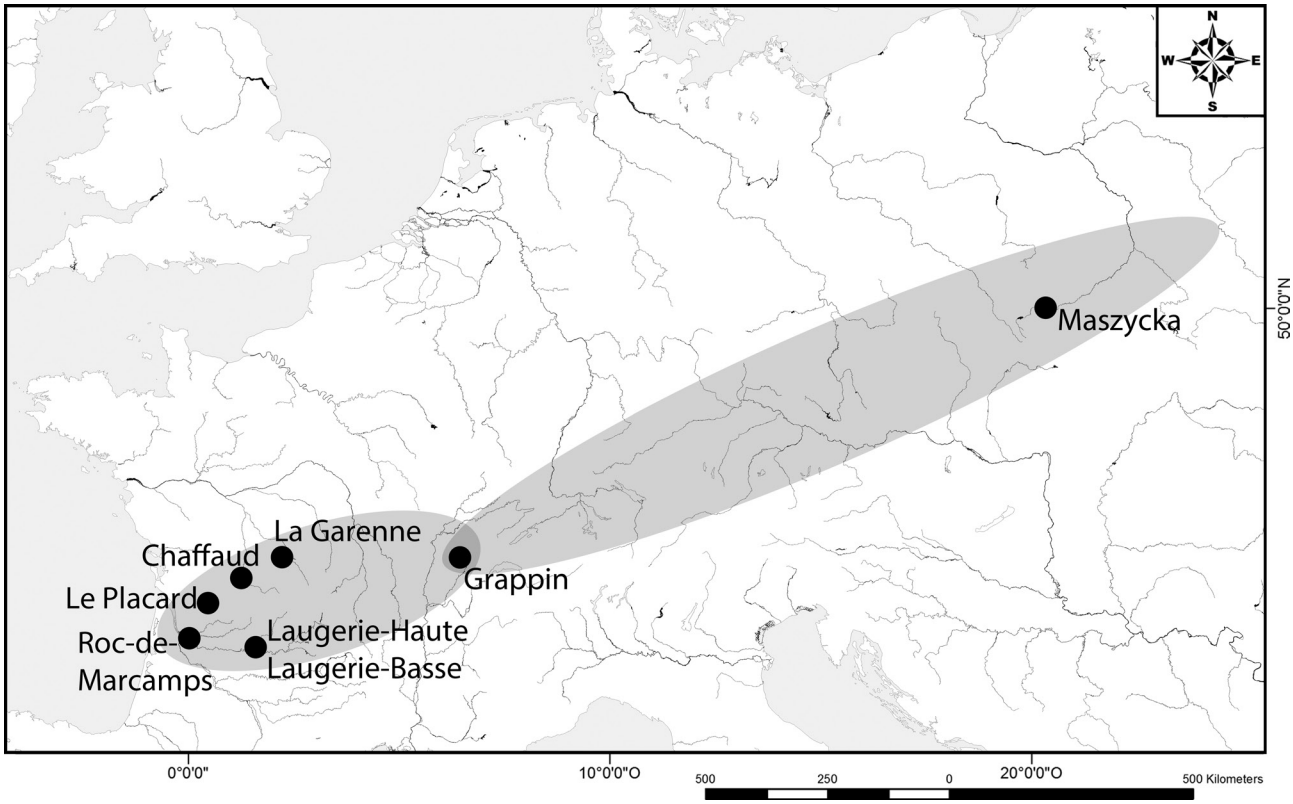

Fig. 1 – Distribution of the sites assigned to the Magdalenian *à navettes*.
Fig. 1 *– Répartition des sites rapportés au Magdalénien « à navettes ».*

from the Franco-Cantabrian region up to Eastern Poland and—given the presence of Volhynian flint at the site of Maszycka (Połtowicz, 2006)—the Bug river (e.g. Bosinski, 1990; Svoboda et al., 1996). In this view, Maszycka Cave represents the easternmost outpost of an "initial expansion" (Miller, 2012, p. 211) or the first of "a series of successive waves" (Otte, 2012, p. 358) in a "sequence of episodes of expansion, perhaps interrupted by phases of regional extinction" (Kozłowski et al., 2012, p. 295). This scenario thus suggests that during an early stage of the Magdalenian, a group of people separated from their population of origin in Western Europe and migrated in north-eastern direction into previously uninhabited regions. After their arrival in the Polish Jura, this pioneer group either went back home or suffered 'regional extinction'. Subsequently, new waves of expansion eventually led to the resettlement of Central Europe.

The second scenario is based on the assumption that the recolonization of Central Europe took place as a bidirectional process. In this view, two populations, one located in Western Europe and the other in Eastern Central Europe, were keeping loose contact already during the period between 23,000 and 20,000 cal. BP, as is indicated by the occurrence of similar typological and technological features east and west of the Alps (cf. Montet-White, 1994; Terberger and Street, 2002; Terberger, 2003). After the LGM, both populations expanded gradually into Western Central Europe. Each population knew about the existence and whereabouts of the respective other and communication was maintained by a small number of people travelling between the two on regular or irregular terms. Here, the occurrence of the *à navettes* facies at Maszycka Cave is seen as a result of the exchange of ideas.

The two scenarios offer contrasting but possible explanations for the occurrence of the *à navettes* facies at Maszycka Cave. In order to explore which one is more likely to approximate the prehistoric processes that led to the observable pattern, I will postulate assumptions as to in which way the two scenarios—if they had taken place—should be mirrored in the archaeological remains. Eventually, I will compare these assumptions with the archaeological record of both the Magdalenian *à navettes* and the Magdalenian in Central Europe as a whole to check which scenario is in better accordance with the observable patterns.

ASSUMPTIONS ABOUT THE SCENARIOS

The expansion scenario

The expansion scenario states that groups of people separated repeatedly from their population of origin in Western Europe and migrated in several waves towards the north-east. At least the first wave had to adapt to unknown and previously uninhabited regions. In order to be meaningful, this scenario requires the following assumptions:

(A1) People moving for the first time into previously uninhabited areas have no knowledge about the geographic and environmental conditions there. Therefore, they are assumed to keep regular contact with their population of origin, for instance in order to obtain help in times of unforeseen crises and to ensure the availability of marriage partners. This applies in particular for hunter-gatherers expanding into Central Europe at around 18,500 cal. BP, since they were living at the fringe of inhabitable Europe and therefore confronted with a high-risk environment, where subsistence stress is—at least from time to time—quite pronounced. Assuming regular contact between the expanding group and its parent population has consequences for the expectations about the archaeological record. Since contact should result in exchange of ideas and objects, a continuous distribution pattern of concepts and artefacts without major breaks and with only gradually changing spatial trends should be observable (cf. Neiman, 1995).

(A2) The need to keep contact with the parent population and the fact that people move into unknown regions both have limiting influence on the speed of expansion.

(A3) Acquiring knowledge about unknown areas should result in prolonged stays at known places to which exploration teams can return. Here, enough resources must be provided by other group members to compensate for hunting failure. At these camps, enough material should accumulate to result in an archaeologically recognizable site.

(A4) Given a unidirectional expansion, the oldest detectable sites per region should become gradually younger in direction of travel, since people take longer to reach remoter places. In the case of several wave-like expansions, the distribution of oldest sites can be more random.

The communication scenario

The communication scenario states that a small number of far-travelled individuals ensured the flow of information and the exchange of ideas between two otherwise independent populations in Western Europe and Eastern Central Europe. The assumptions for this scenario are:

(B1) There have to be sites in Eastern Central Europe that can be connected with an independent population prior to the period in question.

(B2) In case of communication, it is assumed that —despite an exchange of ideas—both populations keep archaeologically recognizable idiosyncrasies, which allow distinguishing them from one another. The archaeological record should thus display—apart from overall similarities—a discontinuous pattern of goods and concepts as opposed to the continuous pattern assumed for the first scenario.

(B3) Knowledge of the existence of another population and its whereabouts allows for fast and directed travels between both communities. The calculable demand of supplies renders prolonged stays unnecessary. Therefore, visiting trips between both communities do not result in the accumulation of enough material remains to be archaeologically visible.

(B4) Since both groups would gradually expand into Western Central Europe, radiocarbon dates should show two points of origin and sites should become gradually younger in—at least—two directions.

COMPARISON OF THE ASSUMPTIONS WITH THE ARCHAEOLOGICAL RECORD

The following section contrasts the above-stated assumptions with the archaeological record in two steps. First, the Magdalenian *à navettes* will be evaluated separately. Afterwards, the Magdalenian in Central Europe will be discussed as a whole to account for larger spatial and chronological trends. Here, aspects such as lithic raw materials, mollusk shells and lithic tool types will be compared, which provide information about interaction on different scales. Subsequently spatial gradients within the distribution of the oldest radiocarbon dates per region are examined.

The Magdalenian *à navettes*

Since the archaeological record of the Magdalenian *à navettes* in Central Europe currently consists of only one sites (Maszycka Cave), the possibilities to test the above-stated assumptions are somewhat limited. However, what can be observed is that the same facies appears virtually simultaneously at Maszycka and its closest neighboring site to the west (Grotte Grappin, see fig. 1) and the similarity of the two assemblages in both typological and technological terms is quite pronounced (Allain et al., 1985; Kozłowski et al., 1995 and 2012). Both sites are about 1,300 km apart from each other as the crow flies without any reported traces of comparable assemblages in between. While in Western Europe a comparatively large number of sites is dated immediately before or to the period of the Magdalenian à navettes, the situation in Eastern Central Europe is different. Here, traces of earlier or contemporaneous settlement activities are very limited (see below).

With regard to the scenarios, it can be said that both of them are supposed to result in the formation of similar assemblages, although the strongest similarities are expected for the expansion scenario (cf. A1 and B2). Since it is assumed that the bearers of this facies belonged to the first wave of people expanding towards the north-east, it should also be expected that they were moving rather slowly and, in need for orientation and exploration, had to take prolonged stays (cf. A1–A3). Here, the contemporaneity of Grappin and Maszycka and the lack of sites in between suggest that people travelled rather fast and in a directed way from one region to the other. These observations are in better accordance with the communication scenario (cf. B3), although the perceived contemporaneity must be evaluated against the (low) resolution of the

^{14}C-dates. The rarity of older or contemporaneous sites in Eastern Central Europe, however, violates assumption B1 and thus speaks against communication as an explanation. Thus far the comparison does not result in a conclusive outcome, but rather gives arguments for and against both scenarios. In order to see whether continuity or discontinuity in the archææological record (cf. A1 and B2) or chronological trends (cf. A4 and B4) can give clearer hints towards the one or the other, the next section will discuss the Magdalenian in Central Europe as a whole, since these features are not visible when focusing only on the record of the Magdalenian *à navettes*.

The Magdalenian in Central Europe

Lithic raw materials

Drawing on ethnographic reports as well as on archaeological studies, there is the well-founded assumption that hunter-gatherers acquired their raw materials usually not by exchange, but collected it embedded in their daily and seasonal movements (e.g. Binford, 1979; Holen, 1991; Floss, 1994). This means that a member of the group, who discarded a piece of lithic material at a site, usually was present personally at the source of that raw material. Therefore, mapping the procurement pattern of lithic raw materials informs us about the minimum range of the catchment area of a site (Floss, 1994, p. 320). Extensive overlaps of the catchment areas of different sites are, in turn, thought to mirror the movements of a group of people with a strong internal coherence, whose members exploit collectively the resources of the same region—in other words: a regional group (see Maier, 2015). In contrast, two clusters of sites with a mutually exclusive procurement pattern are probably the remnants of two different regional groups. The analysis of the Central European Magdalenian raw material procurement indicates strongly the existence of five non-overlapping exploitation areas or regional groups (fig. 2). These groups are located (1) around the French and Swiss Jura, (2) in the Swabian and Franconian Alb, (3) in the Meuse-Rhine region, (4) in Eastern Germany and Bohemia and (5) in Moravia and Poland (see fig. 2; for detailed information see Maier, 2015). Regarding the average transportation distances of raw materials in Central Europe, it stands out that Maszycka Cave is reported to have some very far-travelled lithics, which are thought to originate from the Regensburg region and even from the Swabian Alb (Kozłowski et al., 1995, p. 191). If these assignments are correct, they rather speak in favor of a fast and directed

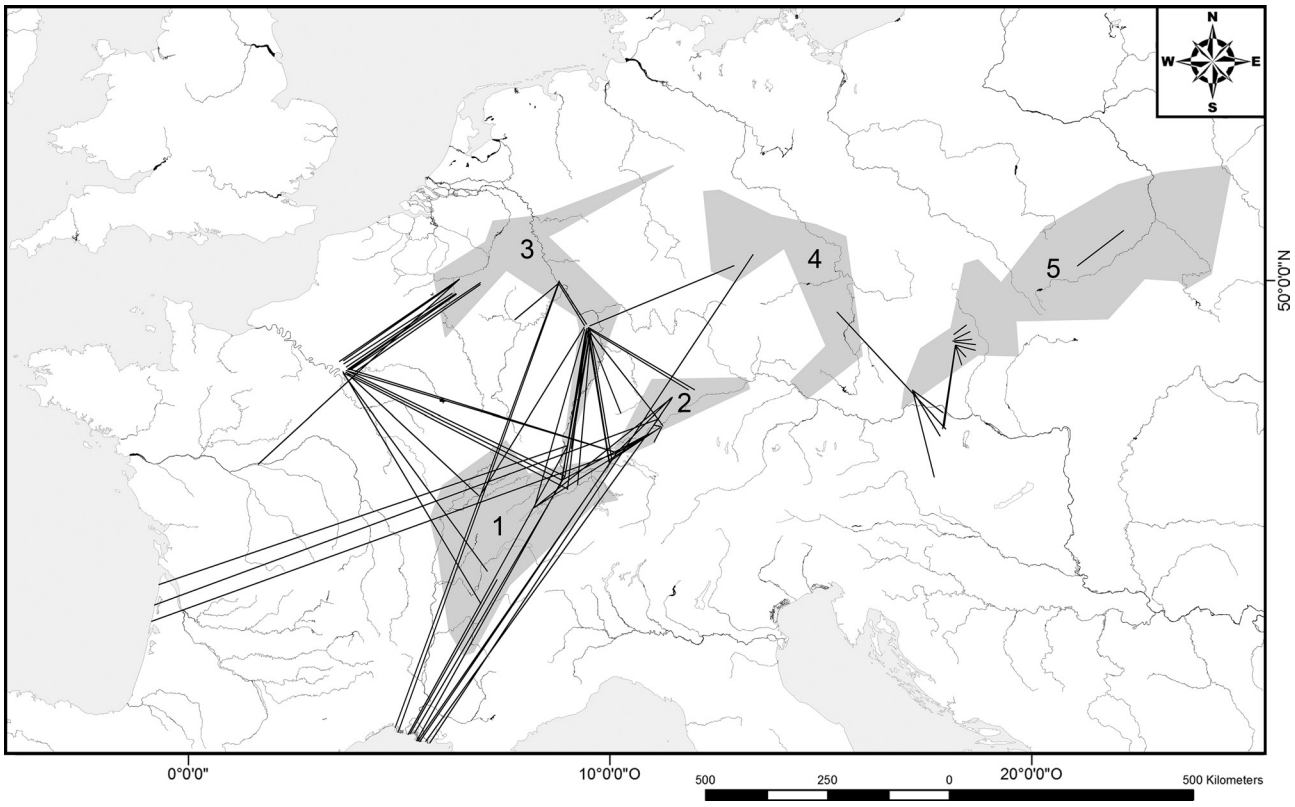

Fig. 2 – Distribution of the five regional groups of the Central European Magdalenian as inferred from raw material procurement (grey patches) and transportation pattern of fossil and sub-recent mollusk shells (black lines). 1: French and Swiss Jura; 2: Swabian and Franconian Alb; 3: Meuse-Rhine region; 4: Eastern Germany and Bohemia; 5: Moravia and Poland.'

***Fig. 2** – Répartition des cinq groupes régionaux du Magdalénien d'Europe centrale déterminés d'après l'approvisionnement en matières premières (zones grisées) et en coquillages fossiles et marins (lignes noires). 1 : Jura français et suisse ; 2 : Alpes souabes et franconiennes ; 3 : région Meuse-Rhin ; 4 : Allemagne de l'Est et Bohème ; 5 : Moravie et Pologne.*

travel from the Danube to the Polish Jura, which is in accordance with assumption B3 but rather at odds with A2 and A3.

Mollusk shells

Fossil and sub-recent mollusk shells were transported over more than 800 km during the Magdalenian (e.g. Albrecht et al., 1977; Bosinski, 2008, p. 322) and are probably the objects which travelled the farthest from their source to their place of discard. Since their transportation distances exceed regularly those of the lithic raw materials, they presumably represent supra-regional interaction between several regional groups. What becomes apparent by observing the transportation pattern of mollusk shells (fig. 2) is a pronounced discontinuous pattern. The western part of Central Europe is integrated in a far-reaching network, which spans from the Atlantic and Mediterranean coasts up to the Paris Basin, Belgium, the Rhineland and the Danube area. The eastern part, in contrast, which includes the regional groups in Eastern Germany and Bohemia as well as Moravia and Poland, does not participate in this network—except for the sites of Kniegrotte (Höck, 2000, p. 144) and Gera-Zwötzen (Küßner, 2009, p. 60) at the western fringe—but uses shells that can be gathered within a regional range around the sites (Maier, 2015). This discontinuous pattern stands in sharp contrast to assumption A1, but meets the expectation of assumption B1.

Tool types

In contrast to lithic raw materials and mollusk shells discussed above, tool types represent the distribution of concepts and thus can reflect the intensity of communication. Although differences in the distribution of concepts do not necessarily imply a lack of communication (Hodder, 1977, p. 269; Hodder, 1982), similarities in the choice of types do speak in favor of interaction, since it is highly likely that typological concepts will change in case of non-interaction (Neiman, 1995). To assess the similarities of tool types within assemblages of the Central European Magdalenian, I will present the results of a Linear Discriminant Analysis (LDA). Briefly stated, a LDA tests *a priori* defined groups according to independent variables. In this case, the *a priori* defined groups are the five regional groups detected during the catchment analysis (fig. 1). The independent variables are the typological compositions of the assemblages, more precisely, the ratio of tool types per inventory. The LDA then gives a *a posteriori* sorting of the assemblages according to their typological composition. In order to avoid distortions derived from site-function, only larger sites with at least 100 tools were selected for the analysis. Since common types (such as backed bladelets) strongly bias the results when a simple percentage ratio is used in the analysis, a Hellinger transformation (Legendre and Gallagher, 2001) was conducted prior to the analysis to account for rare and generally less numerous types (for more details see Maier, 2015). The results presented in tabl. 2 show that 76% of the assemblages are re-attributed *a posteriori* by the LDA to the *a priori* defined regional group. This suggests that the typological composition of an assemblage corresponds with its geographic position in one of the regional groups. Considering those assemblages that a re-attributed to another but the *a priori* defined group, it stands out that most assemblages are re-attributed to a neighboring group (tabl. 2).

Conspicuously, sites of the three western (1–3) and the two eastern (4–5) regional groups are preferentially re-attributed within the western and eastern part of the CEM, respectively. Moreover, when plotted in a diagram,

	n						%					
	1	**2**	**3**	**4**	**5**	**Total**		**1**	**2**	**3**	**4**	**5**
1	32	2	1	0	1	36	1	88.9	5.6	2.8	0	2.8
2	2	15	1	0	1	19	2	10.5	78.9	5.3	0	5.3
3	4	2	16	1	0	23	3	17.4	8.7	69.6	4.3	0
4	1	0	2	16	3	22	4	4.5	0	9.1	72.7	13.6
5	0	2	2	2	8	14	5	0	14.3	14.3	14.3	57.1
Total	**39**	**21**	**22**	**19**	**13**	**114**	**CR: 76.3 % are classified correctly**					

Table 2 – Results of the discriminant analysis. Cross-tabulation of *a priori* and *a posteriori* attribution. Each row corresponds to an *a priori* group and each column to the classification (*a posteriori* group) of the LDA (1: Jura Region; 2: Danube region; 3: Meuse-Rhine region; 4: Eastern Germany and Bohemia; 5: Moravia and Poland) with the left table giving the numbers and the right table displaying the row percentages. Thus row 1 in the left table should be read as follows: 32 assemblages of group 1 were classified as group 1; 2 as group 2; 1 as group 3; 0 as group 4 and 1 as group 5.

Tabl. 2 *– Résultats de l'analyse discriminante linéaire. Tableau de données croisées des attributions* a priori *et* a posteriori. *Chaque ligne correspond à un groupe défini* a priori *et chaque colonne à la classification (groupe* a posteriori*) de l'analyse discriminante Linéaire (1 : Jura français et suisse ; 2 : Alpes souabes et franconiennes ; 3 : région Meuse-Rhin ; 4 : Allemagne de l'Est et Bohème ; 5 : Moravie et Pologne). Le tableau de gauche donne les chiffres, le tableau de droite indique les pourcentages. Ainsi, la ligne 1 doit être lue ainsi : 32 assemblages du groupe 1 défini* a priori *furent classés dans le groupe 1 issu de la classification ; 2 dans le groupe 2 ; 1 dans le groupe 1 ; 0 dans le groupe 4 et 1 dans le groupe 5.*

it can be observed that the typological composition of the three regional groups in the western part (French/Swiss Jura, Swabian/Franconian Alb, Meuse-Rhine area) is best explained by a common axis. The typological variability of the two eastern groups (Eastern Germany/Bohemian, Moravia/Poland), in contrast, is best explained by a second axis running perpendicular to the former, indicating a clear separation in the typological composition of the sites attributed to these two parts (fig. 3). The discontinuous pattern with the sites in the west on the one hand and the sites in the east on the other repeats to a surprising extent the separation observed for the distribution of mollusk shells. Again, the observed discontinuity in the distribution of concepts contradicts the assumption of an expanding group keeping close contact with its group of origin (A1) and is rather in accordance with the scenario of two independent communities, who—despite contact—keep typologically discernible idiosyncrasies (B1).

Radiocarbon dates

Having examined the spatial distribution of objects and concepts, this section deals with spatial trends in the chronological framework of the recolonization of Central Europe after the LGM. Figure 4 shows the oldest radiocarbon-dates sites per region for the post-LGM occupation of Central Europe (see tables 1 and 3; for a detailed discussion of dates see Housley et al., 1997 and Maier, 2015). In the French Jura, the Magdalenian is attested between 18,500 and 8,000 cal. BP at the site of Grotte Grappin (Cupillard et al., 2008). In the Hegau region, the presence of Magdalenian hunter-gatherers can be traced from about 17,000 cal. BP at the sites of Kesslerloch and Schweizersbild (Street, 2000). Other dates from Munzingen or Schussenquelle are plagued with uncertainties and are therefore not considered here (cf. Housley et al., 1997). In the Swabian Alb dates from Holefels and Geißenklösterle

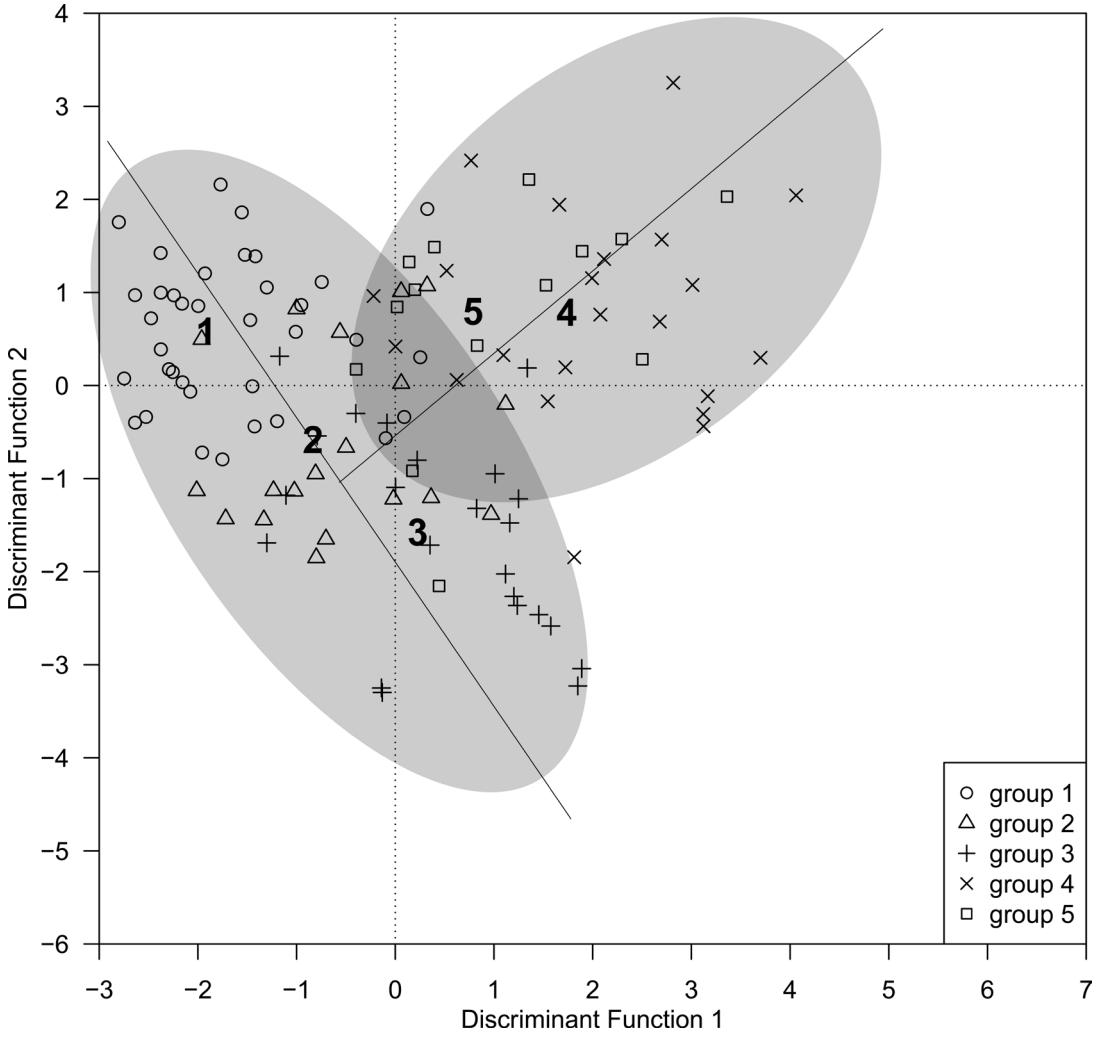

Fig. 3 – Results of the discriminant analysis. Positions of assemblages in the space of the first two discriminant functions. 1: Jura Region; 2: Danube region; 3: Meuse-Rhine region; 4: Eastern Germany and Bohemia; 5: Moravia and Poland. Bold-face numbers indicate the position of the groups' centroids.

***Fig. 3** – Résultats de l'Analyse Discriminante Linéaire. Projection des assemblages sur les deux premiers plans. 1 : Jura ; 2 : Danube ; 3 : Meuse-Rhin ; 4 : Allemagne de l'Est et Bohème ; 5 : Moravie et Pologne. Les chiffres en gras indiquent la position des centres des groupes.*

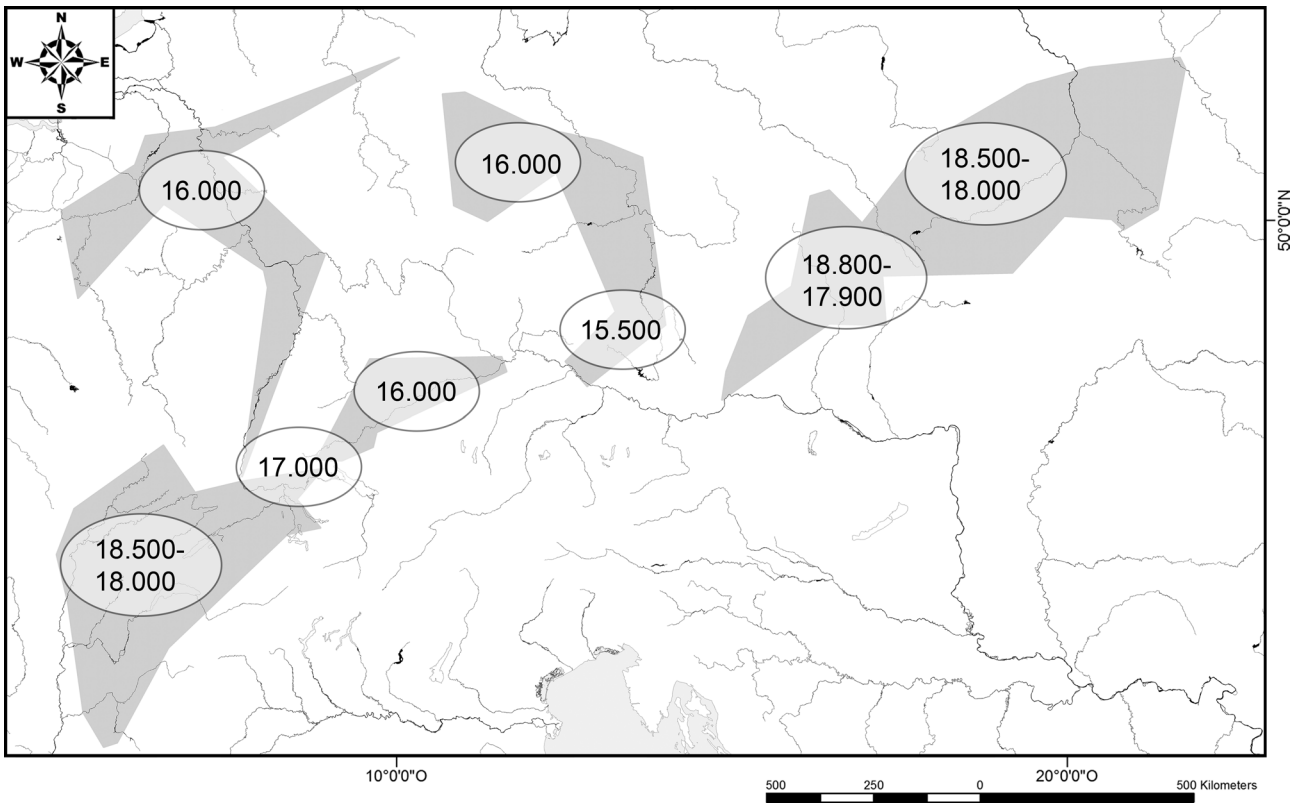

Fig. 4 – Distribution of the oldest ^{14}C-dates for the Magdalenian in Central Europe per region. Dates are given as cal. BP. For exact dates and references see table 3.
***Fig. 4** – Distribution des plus anciennes dates ^{14}C du Magdalénien d'Europe centrale par région. Les dates sont exprimées en cal. BP. Pour les dates exactes et les références bibliographiques, voir tabl. 3.*

indicate settlement activities from around 16,000 cal. BP onwards. Further to the east, ^{14}C-dates from Mittlere Klause, Sesselfelsgrotte and Kaufertsberg indicate prolonged stays in the Altmühl valley and Regensburg Basin only after 16,000 cal. BP (Housley et al., 1997). In the Meuse-Rhine area, radiocarbon measurements from Andernach-Martinsberg and Gönnersdorf show Magdalenian presence from around 16,000 cal. BP (Stevens et al., 2009). In Eastern Germany, the oldest dates of a Magdalenian occupation are reported from the site of Kniegrotte around 16,000 cal. BP (Housley et al., 1997). In Bohemia, a date on *Pinus* charcoal from Putim and human bone from Koněprusy attests human presence at around 15,500 cal. BP (Svoboda et al., 2002; Verpoorte and Šída, 2009).

In Moravia, the oldest site post-dating the LGM is probably Brno-Vídeňska Street, dated around 18,700 cal. BP (Verpoorte, 2004; Nerudová and Neruda, 2013). The assemblage can be attributed either to the Magdalenian (Svoboda and Novák, 2004) or to the Epigravettian, (Nerudová and Neruda, 2014). The dates of Maszycka Cave in the Polish Jura between 18,500 and 18,000 cal. BP are the oldest evidence for a Magdalenian occupation north of the Carpathian Mountains (Kozłowski et al., 2012). Slightly younger, the site of Zawalona provides two dates with a wide range between 18,500 and 17,000 cal. BP from a typologically rather indistinctive assemblage (Alexandrowicz et al., 1992). The assemblage of Balcarka, which can be clearly attributed to the Magdalenian, is dated to about 17,000 cal. BP (Valoch and Neruda, 2005). The

Table 3 (right) – Selected radiocarbon dates for early sites post-dating the LGM in Central Europe. M: Material (a: antler; b: bone; bb: burnt bone; c: charcoal; n: not determined; o: organic; t: tooth); SP: Species (Ax: *Alopex*; B/B: *Bos*/*Bison*; bulk: bulk sample; Cl: *Coelodonta*; E: *Equus*; Ho: *Homo*; In: indeterminate; Ma: *Mammuthus*; Pi: *Pinus*; R: *Rangifer*; Sg: *Saiga*; Ur: *Ursus*). *: date on humanly modified piece. 1: reliability questionable. All dates are calibrated with the CalPal2007 Hulu curve (Weninger and Jöris, 2008; Weninger et al., 2012).
***Tabl. 3 (page de droite)** – Datations ^{14}C des premiers gisements postérieurs au Dernier Maximum Glaciaire en Europe centrale. M : matière (a : bois de cervidé ; b : os ; bb : os brûlé ; c : charbon ; n : indéterminé) ; SP : espèce (Ax :* Alopex *; B/B :* Bos/Bison *; bulk : lot de vestiges osseux ; Cl :* Coelodonta *; E :* Equus *; Ho :* Homo *; In : indéterminé ; Ma :* Mammuthus *; Pi :* Pinus *; R :* Rangifer *; Sg :* Saiga *; Ur :* Ursus*) ; * : date sur artefact. 1 : fiabilité douteuse. Toutes les dates sont calibrées avec la courbe CalPal2007 Hulu (Weninger et Jöris, 2008 ; Weninger* et al.*, 2012).*

Site, Layer, Concentration	M	Sp	Lab. no.	BP	Std	cal. BP	Std	Reference
Andernach, 1883	b	E	OxA-10493	13,185	80	15,840	130	Street and Terberger, 2002
Andernach, 1883	b	E	OxA-10651	13,270	180	15,930	260	Street and Terberger, 2002
Andernach, 1883	b	E	OxA-10492	13,500	90	16,260	130	Street and Terberger, 2002
Andernach, I, Pit 21	b	E	OxA-1125	12,930	180	15,460	260	Hedges et al., 1987
Andernach, I	b	In	GrA-16985	13,110	80	15,720	140	Kegler, 2002
Andernach, I	b	E	OxA-V-2216-43	13,135	55	15,770	100	Stevens et al., 2009
Andernach, I	b	In	GrA-16986	13,180	70	15,840	110	Kegler, 2002
Andernach, II, Pit 35	b	E	OxA-1129	13,090	130	15,670	220	Hedges et al., 1987
Andernach, II, Pit 35	b	E	OxA-1128	13,200	140	15,840	210	Hedges et al., 1987
Andernach, II	b	E	OxA-V-2218-40	13,110	50	15,730	100	Stevens et al., 2009
Andernach, III; Pit 28	b	E	OxA-1130	12,950	140	15,500	210	Hedges et al., 1987
Balcarka	n	In	GrN-28448	13,930	100	17,080	90	Valoch and Neruda, 2005
Brno-Hospital	n	In	GdA-459	15,650	70	18,,900	90	Škrdla et al., 2005
Brno-Vídeňska Street	bb	bulk	GrN-9350	14,450	90	17620	130	Valoch, 1996
Brno-Vídeňska Street	b	R	GrA-20002*	14,820	120	18,050	150	Verpoorte, 2004
Brno-Vídeňska Street	t	Ma	OxA-26961	15,625	75	18,880	90	Nerudová and Neruda, 2013
Buttentalhöhle	b	R	OxA-4602	13,020	130	15,580	210	Housley et al., 1997
Buttentalhöhle	b	Ur	OxA-4982	13,100	140	15,690	230	Housley et al., 1997
Dzierżysław 35, 9a	b	Ma	GdA-70	13,220	70	16,140	360	Ginter et al., 2005
Dzierżysław 35, 9a	n	In	GdA-69	13,500	80	16,750	120	Ginter et al., 2005
Dzierżysław 35, 9a	o	In	Ki-89971	14,850	280	18,100	370	Ginter et al., 2005
Dzierżysław 35, 6	o	In	Ki-8951	13,700	350	16,630	720	Ginter et al., 2005
Geißenklösterle, AH I0	b	R	OxA-6254	13,130	100	15,750	170	Housley et al., 1997
Geißenklösterle, AH I0	b	Ur	OxA-4854	13,230	130	15,890	190	Housley et al., 1997
Gönnersdorf, I	b	E	OxA-V-2223-39	13,270	55	15,960	100	Stevens et al., 2009
Gönnersdorf, II	b	B/B	OxA-V-2223-41	13,095	55	15,710	110	Stevens et al., 2009
Gönnersdorf, II	b	E	OxA-V-2223-40	13165	55	15,820	100	Stevens et al., 2009
Gönnersdorf, II	t	Cl	OxA-10201	13,610	80	16,410	130	Stevens et al., 2009
Gönnersdorf, III	b	R	OxA-15295	13,060	60	15,640	120	Stevens et al., 2009
Gönnersdorf, III	b	R	OxA-V-2223-43	13,075	55	15,670	110	Stevens et al., 2009
Hohlefels, Ib	b	In	H-5119-4601	13,085	95	15,670	170	Housley et al., 1997
Hohlefels, HF 8, I	b	R	OxA-4596	13,240	110	15,910	160	Housley et al., 1997
Hohlefels, IIa1, 3a	b	In	OxA-4977	13,350	140	16,050	190	Housley et al., 1997
Kaufertsberg	a	R	OxA-5751	12,610	90	14,910	190	Housley et al., 1997
Kesslerloch, III Ac	a	R	OxA-5750*	13,670	100	16,,510	170	Housley et al., 1997
Kesslerloch, III Ac	a	R	OxA-5749*	14,150	100	17,230	150	Housley et al., 1997
Kniegrotte	b	Sg	OxA-4853	13,090	130	15,670	220	Housley et al., 1997
Kniegrotte	b	R	OxA-4845	13,120	130	15,720	220	Housley et al., 1997
Kniegrotte	b	Sg	OxA-4849	13,130	120	15,740	200	Housley et al., 1997
Kniegrotte	b	E	OxA-4848	13,150	130	15,760	210	Housley et al., 1997
Kniegrotte	b	Ax	OxA-4850	13,160	140	15,770	220	Housley et al., 1997
Kniegrotte	b	E	OxA-4846	13,190	130	15,830	200	Housley et al., 1997
Kniegrotte	b	R	OxA-4832	13,310	110	16,000	160	Housley et al., 1997
Kniegrotte	b	E	OxA-4852	13,520	130	16,,300	190	Housley et al., 1997
Kniegrotte	b	In	Bln-1564	13,585	165	16,400	240	Housley et al., 1997
Koněprusy	b	Ho	GrA-13696	12,870	70	15,380	130	Sviboda et al., 2002
Mittlere Klause, AH1	a	R	OxA-5718	13,160	130	15780	210	Housley et al., 1997
Putim	c	Pi	GrA-36010	13,010	60	15,580	80	Verpoorte and Šída, 2009
Schweizersbild	b	In	OxA-5745*	13,940	100	16,900	170	Housley et al., 1997
Sesselfelsgrotte, C2	b	In	OxA-5754	12,680	100	15,030	190	Housley et al., 1997
Sesselfelsgrotte, C2	b	In	OxA-5733	12740	90	15,160	140	Housley et al., 1997
Zawalona	b	In	Ly-2270	14,060	340	17,030	470	Alexandrowicz et al., 1992
Zawalona	b	In	Ly-2271	15,380	340	18,630	380	Alexandrowicz et al., 1992

site of Dzierżysław 35 is with an age of 16,600 cal. BP (Ginter et al., 2005) the oldest Magdalenian site North of the Sudeten Mountains.

Regarding the distribution of radiocarbon dates, a spatial gradient with sites becoming increasingly younger from west to east, as it has to be assumed for a unidirectional expansion (A2), can only be observed for the western part. In the eastern part, however, the oldest sites are about as old as those in the French Jura. The distribution of dates is thus not completely random, as can be expected for successive expansion waves reaching different locations at different times. What can be observed is a continuous spatiotemporal trend with dates becoming gradually younger from the west and from the east. This meets the expectation for two populations expanding gradually into Central Europe (B2).

The fact that the Magdalenian *à navettes* occurs more or less simultaneously in the French and in the Polish Jura indicates a surprisingly fast spread of this facies. This is at odds with the assumption that an expansion into unknown areas together with the need to keep contact to the parent population results in a gradual expansion at a rather low pace (A1–A3). It is, however, what one would expect if some individuals travel between two communicating populations (B3). The fact that there are no sites in Bohemia and Germany dated to the period of the Magdalenian *à navettes* is also in better accordance with the scenario of communication than with that of expansion. In the latter case, the necessity for prolonged stays fosters the accumulation of settlement-material and thus the archaeological visibility of related sites (A3). Fast-travelling individuals who are aware of their destination (B3) only leave ephemeral traces of their presence which are archaeologically effectively invisible.

Whereas the existence of hunter-gatherer groups prior to the Magdalenian (*à navettes*) is demonstrated beyond doubt for Western Europe, evidence for an independent population in Eastern Central Europe are few and patchy. However, human presence during the period between 23,000 and 18,000 cal. BP is attested for instance at the sites of Grubgraben (Terberger and Street, 2002), Stránská Skála IV (Svoboda, 1991), Kašov 1 (Svoboda and Novák, 2004), Deszczowa Cave (Kozłowski, 2001) and Sagvar (Vogel and Waterbolk, 1964; Krolopp and Sümegi, 2002). These occurrences are difficult to explain by short-term invasions alone and indicate—although not very clearly—an autochthonous hunter-gatherer population in Eastern Central Europe already prior to the arrival of the Magdalenian.

CONCLUSION

Initially, I presented two scenarios (expansion *vs*. communication) with the potential to explain the spatial pattern observable for the Magdalenian *à navettes* and postulated assumptions about the way both scenarios should be mirrored in the archaeological remains, which I consider necessary for the scenarios to be meaningful. A comparison between the assumptions and the archaeological record brought about several arguments for and against both scenarios (table 4). When only the findings of the Magdalenian *à navettes* are taken into consideration, the comparison gives only inconclusive results. Here, both scenarios seem more or less equally likely or unlikely to approximate the assumed prehistoric processes that led to the observable pattern. The strong similarities between the assemblages from Maszycka Cave and Grotte Grappin speak in favor of expansion, while the seemingly simultaneous appearance and the lack of other comparable sites in between seems to indicate communication. However, the fact that contemporaneous or immediately older sites are quite few in Poland and Moravia (Brno-Vídeňska Street, Brno-Hospital, Zawalona) makes the assumption of an independent population difficult. This situation changes if the record of the Magdalenian in Central Europe is considered as a whole. Here, all assumptions concerning the expansion scenario seem to be at odds with the archaeological record, whereas the assumptions of the communication scenario are mostly met. The larger spatial and temporal scale also increases the number of sites which can be attributed to an independent population in Eastern Central Europe, although the evidence is still rather faint. Eventually, it seems that communication is a better explanation for the occurrence of the *à navettes* facies at Maszycka than is an expansion from west to east, be it gradual or wave-like.

Scenario	Archaeological record	
	Navettes	General
Expansion		
Continuity (A1)	**yes**	no
Slow, visible (A2, A3)	no	no
Unidirectional/random (A4)	–	no
Communication		
Discontinuity (B2)	no	**yes**
Fast, invisible (B3)	**yes**	**yes**
Bidirectional (B4)	–	**yes**
Eastern origin (B1)	no	**yes**

Table 4 – Comparison of both scenarios with the archaeological record.
Tabl. 4 *– Confrontation des deux scénarios avec les données archéologiques.*

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