Analecta Praehistorica Leidensia 42 / Eyserheide : a Magdalenian open-air site in the loess area of the Netherlands and its archaeological context

Rensink, Eelco; Bakels, Corrie; Kamermans, Hans

ANALECTA
PRAEHISTORICA
LEIDENSIA 42

PUBLICATION OF THE FACULTY OF ARCHAEOLOGY
LEIDEN UNIVERSITY

EELCO RENSINK

EYSERHEIDE

A MAGDALENIAN OPEN-AIR SITE IN THE LOESS AREA OF THE NETHERLANDS AND ITS ARCHAEOLOGICAL CONTEXT

LEIDEN UNIVERSITY 2010

Series editors: Corrie Bakels / Hans Kamermans

Editor of illustrations: Joanne Porck

Translation: Kelly Fennema

ISSN 0169-7447
ISBN 978-90-818109-0-6

Subscriptions to the series *Analecta Praehistorica Leidensia*
and single volumes can be ordered exclusively at:

P.J.R. Modderman Stichting
Faculty of Archaeology
P.O. Box 9515
NL-2300 RA Leiden
The Netherlands

This publication was made possible with a grant from Cultural Heritage Agency, Amersfoort

8 Northwest European context

8.1 Introduction

The sites of the Meuse-Rhine loess area that were discussed in chapter 7 are the remnants of small camp sites of Magdalenian hunters and gatherers who, about five thousands of C^{14} years after the extreme cold of the Last Glacial Maximum around 18,000 BP and following the colonisation of more southerly (South Germany) and easterly (Thuringia, southern Poland) regions, dispersed over parts of Northwest Europe (Housley *et al*. 1997; Blockley *et al*. 2000; Blackwell and Buck 2003). From this point of view, they should be studied in the broader perspective of colonisation and the exploration and exploitation of 'marginal' areas which had not seen human occupation for many thousands of years. A research theme that fits in this broader perspective is the relationship between the Magdalenian occupation of geographically distinct areas. Is there a relationship between the occupation of the Meuse-Rhine loess area and that of nearby areas, and if so which are the indications of this? Should the northern loess zone be regarded as part of a more extensive territory of hunters and gatherers from the Magdalenian? And on which points was there complementarity between areas, for instance in the exploitation of food and raw material resources? In order to be able to answer these questions, it is necessary to place the sites of the Meuse-Rhine loess area in a larger geographical framework. In view of the topographical location of the sites of the Meuse-Rhine loess area on the northwestern fringe of Magdalenian territory, it seems evident to include data on more southerly regions in the research.

As discussed in chapter 7, prehistoric organic remains in the northern sites have not been preserved as a result of post-depositional processes. For the examination of relationships between the Magdalenian occupations of the Meuse-Rhine loess area and those known from other areas, we therefore have to turn to characteristics of stone artefacts. Determinations of stones have provided valuable insights for numerous sites in several European regions into the presence, provenance and use of local and non-local raw materials, and into the distances over which and the directions from where raw materials have been transported. Starting from the linear distance between locations of sites and the associated source areas, inferences have been made on (changes in) mobility and on the size of territories of Palaeolithic hunters and gatherers (Demars 1982; Mauger 1983, 1985; Geneste 1988; Roebroeks *et al*. 1988; Féblot-Augustins 1997, 1999). An important assumption in these studies is that raw materials were not obtained by exchange between human groups or by means of special expeditions (direct procurement), but that the exploitation and transport of these were embedded in seasonal migrations or hunting trips of human groups in the course of their annual round (Binford 1979). Based also on transport distances of lithic materials, a high degree of residential mobility is assumed for the Magdalenian of Northwest Europe. Straus (1991, 171) remarks in this regard:

> "If the Magdalenian hunters of the North European Plain engaged in very extensive residential mobility over vast ranges and obtained flints that are highly nonlocal with respect to such sites as Pincevent, Chaleux and Gönnersdorf, either through contacts with other groups or by visiting the actual sources, that was not necessarily the case in other European regions inhabited in the same periods of time. The emerging Magdalenian model of the North European Plain must not be uncritically applied in other regions."

The investigation of non-local materials further offers for stratified sites the possibility of obtaining an insight into trends and continuity in long-term land use of Magdalenian hunters and gatherers. A good example is Pincevent and the information that can be inferred from a non-local, Tertiary brown flint (*silex brun*). Artefacts made of this flint first came to light during the investigation of Habitation no.1 (Leroi-Gourhan and Brézillon 1966). In subsequent years, small quantities of artefacts of s*ilex brun* were also recovered from other habitation units during excavations. As the flint mainly occurs as retouched tools and blades/bladelets, it is assumed that the artefacts formed part of a transported, light-weight toolkit that was brought to Pincevent in anticipation of use during the first days of occupation of the new camp there. The source area of *silex brun* is the area of the confluence of the Marne and Seine rivers, c. 50 km north and northwest of Pincevent (Mauger 1985). Importantly, artefacts of this Tertiary flint have been found in several habiation units associated with different stratigraphical levels.

This observation points to planned and annually (?) recurring migrations of groups of Magdalenians from the Marne area to the location of Pincevent. The picture emerges of small, mobile groups that anticipated the arrival of reindeer and the possibility of a collective hunt in a favourable location (river crossing) near Pincevent in the late summer and/or autumn, as can be inferred from characteristics of the faunal remains (David and Enloe 1992). Such planning and organisation directed at a successful exploitation of a heavily clustered, in time and space, food resource require thorough knowledge not only of the topography of the regional landscape (where) but also of the migratory behaviour of reindeer (when) during the cold phase of the Early Dryas stadial.

The leitmotiv of this chapter is formed by the data about presence, provenance and use of non-local lithic materials in Magdalenian sites in the Meuse-Rhine loess area and in two more southerly regions, namely the Central Rhineland in Germany and the Ardennes Massif in Belgium. After we have presented an overview of non-local lithic materials in the northern loess sites (8.2), we will examine which stone varieties Magdalenian hunters and gatherers in the Central Rhineland used for the manufacture of stone tools (8.3). The question whether both areas formed part of the annual range (or territory) of the same human groups we will address in paragraph 8.4. Next, the focus is on the Magdalenian occupation of Belgian caves and its relationship with the open-air sites of the Meuse-Rhine loess area (8.5). In paragraph 8.6 we will discuss some trends in the procurement and use of Dutch flint materials in the northern Magdalenian. At the end of this chapter (8.7), concluding remarks are made concerning the relationship between Magdalenian sites in Northwest Europe, also taking into consideration the chronological position of Eyserheide and the other open-air sites in the Meuse-Rhine loess area.

8.2 Meuse-Rhine loess area: non-local raw materials

Most of the Magdalenian open-air sites in the Meuse-Rhine loess area are characterised by the occurrence of (small quantities of) stone artefacts made of non-local materials, that is to say of stones of which the source locations are minimally 10 km (as the crows flies) from the camp sites. They are present in all sites located outside the area with Cretaceous flint sources, but the amount and the technological and typological form in which artefacts occur vary between sites. Sites located within short distance from Cretaceous flint sources (Orp-le-Grand, Kanne, Mesch and Eyserheide) have yielded almost no artefacts of non-local stone. In the inventory of Mesch we are dealing with one roughly knapped piece (pre-core) of Simpelveld flint.

Natural occurrences of this type of flint lie c. 10-15 km northeast of Mesch in the eastern part of Dutch South Limburg and east of the small river Geul where Eyserheide is located. Non-local raw materials recovered from sites located outside the area with Cretaceous flint sources include the following types of stone (tables 8.1-8.2):

Baltic flint:
Löhr (1979, 36) points to the presence of artefacts of northern erratic flint (Baltic flint or *Baltischer Feuerstein*) in the inventory of Alsdorf, imported over a distance of minimally 70 km from the northern moraine area. According to Löhr, the inventory comprises three tools and 15 blades of this flint. Regarding these artefacts, he speaks of a primary toolkit or “eine zum Lagerplatz mitgebrachte Grundausstattung” (cf. artefacts of *silex brun* in Pincevent). Three artefacts of the inventory of Beeck have been described as Baltic flint, including one blade end scraper. This scraper is distinguished from two other scrapers made of local Meuse terrace flint by a regular, semi-circular working edge (Jöris et al. 1993, fig. 7.2). The finds of the surface site of Kamphausen, situated c. 35 km from the northern moraine area contains two backed bladelets possibly of Baltic flint. Because of the small size and the absence of cortex, the determination of the raw material is however not certain. Also for other sites we should bear in mind the possibility of uncertain attributions for the same reason. In contrast to the mentioned German sites, no artefacts of Baltic flint were recovered in Eyserheide and the other Dutch sites (or were not recognised as such?).

Simpelveld flint:
This type of flint is present as non-local raw material in the inventories of Sweikhuizen-GP and Sweikhuizen-KW. Its natural source area, i.e. the area of Simpelveld-Wittem in the eastern part of Dutch South Limburg, is situated c. 10-15 km southeast of both sites. In the completely excavated site of Sweikhuizen-GP these are end products of the stage of *plein débitage*, namely five blades and eleven blades and bladelets retouched into tools. The tools consist of three backed bladelets, three burins, a composite tool and four retouched and used blades. A core and some flakes of Simpelveld flint are present in Sweikhuizen-KW. The other artefacts agree with the picture of Sweikhuizen-GP and consist of seven blades and seven tools. Of the finds recovered from the surface at Kamphausen, one artefact, a fragment of a blade with an oblique end retouch, has been described as Simpelveld flint (Höpken 1994, plate 6:18). The distance between the source area and Kamphausen is at least 30 km. For the small and incomplete inventories of the surface sites of Beeck and Galgenberg no mention has been made of the occurrence of Simpelveld flint.

Site number	Site name	Raw material	N	%	Source	Distance (km)
1	Eyserheide	South-Limburg flint	1603	47	Meuse gravel deposits, slope deposits	<5
		Orsbach flint	1213	36	residual and/or slope deposits	<5
		Simpelveld flint	517	15	residual and/or slope deposits	<5
		Valkenburg flint	40	1	residual and/or slope deposits	<5
2	Mesch	Rullen flint	3050	86	gravel deposits, eluvium, slope deposits	<5
		Rijckholt flint	480	13	gravel deposits, eluvium, slope deposits	<5
		Simpelveld flint	1	<1	residual and/or slope deposits	10-15
3	Sweikhuizen OS	terrace flint	.	>99	Meuse gravel deposits	<5
		yellow-brownish quartzite	3	<1	indet	indet
		yellow-brownish, translucid flint	.	<1	indet	indet
4	Sweikhuizen GP	terrace flint	12174	>99	Meuse gravel deposits	<5
		Simpelveld flint	16	<1	residual and/or slope deposits	10-15
		freshwater quartzite	7	<1	indet	indet
5	Sweikhuizen KW	terrace flint	.	>99	Meuse gravel deposits	<5
		Simpelveld flint	19	<1	residual and/or slope deposits	10-15
6	Koningsbosch	terrace flint	58	>98	Meuse gravel deposits	<5
7	Griendtsveen	southern silex	>1200	>99	Meuse gravel deposits	<1
		translucid flint	.	<1	indet	indet
		freshwater quartzite	10	<1	indet	indet
8	Kanne C.	silex	15748	100	chalk outcrops, residual and/or slope deposits	<1
	Kanne S.	silex	1765	100	chalk outcrops, residual and/or slope deposits	<1
9	Orp-le-Grand W.	silex	10005	100	chalk outcrops	<1
	Orp-le-Grand E.	silex	83411	100	chalk outcrops	<1
10	Alsdorf	terrace flint	9567	99	Meuse gravel deposits	<5
		Vetschauer flint	5	<1	residual and/or slope deposits	10
		Baltic flint	18	<1	ground moraine	70
		Jurassic chert	87	<1	Main gravel deposits	200
11	Beeck	terrace flint	.	>99	Meuse gravel deposits	<5
		Orsbach flint	5	<1	residual and/or slope deposits	20
		Baltic flint	3	<1	ground moraine	80
12	Kamphausen	terrace flint	189	57	Meuse gravel deposits	<5
		Orsbach flint	122	37	residual and/or slope deposits	35
		Obourg flint?	6	2	chalk layers near Mons?	>150
		Simpelveld flint	1	<1	residual and/or slope deposits	35
		Baltic flint?	2	<1	ground moraine	35
		Chalcedon?	9	3	Rhine gravel deposits?	?
13	Galgenberg	terrace flint	23	>99	Meuse gravel deposits	<5

Table 8.1 Magdalenian sites of the Meuse-Rhine loess area. Data on raw materials used and distance to source locations.

Moraine flint	**Cores**	**Tools**	**Blades**	**Flakes**	**Other artefacts**	**N**
Eyserheide	.	.	.	.	.	0
Mesch	.	.	.	.	.	0
Sweikhuizen-GP	.	.	.	.	.	0
Sweikhuizen-KW	.	.	.	.	.	0
Alsdorf	.	3	15	.	.	18
Beeck	.	1	.	.	2	3
Kamphausen	.	2?	.	.	.	2?
Total	0	6	15	0	2	23
Simpelveld flint	**Cores**	**Tools**	**Blades**	**Flakes**	**Other artefacts**	**N**
Eyserheide	3	9	167	196	142	517
Mesch	1	.	.	.	.	1
Sweikhuizen-GP	.	11	5	.	.	16
Sweikhuizen-KW	1	7	7	4		19
Alsdorf	.	.	.	.	.	0
Beeck	.	.	.	.	.	0
Kamphausen	.	1	.	.	.	1
Total	5	28	179	200	142	554
Orsbach flint	**Cores**	**Tools**	**Blades**	**Flakes**	**Other artefacts**	**N**
Eyserheide	2	41	282	334	554	1213
Mesch	.	.	.	.	.	0
Sweikhuizen-GP	.	.	.	.	.	0
Sweikhuizen-KW	.	.	.	.	.	0
Alsdorf	.	.	.	.	.	0
Beeck	.	.	.	.	5	5
Kamphausen	2	22	67	44	2	137
Total	4	63	349	378	561	1355

Table 8.2 Numbers of artefacts of non-local raw materials per artefact type.

Orsbach flint:
In the Lower Rhineland sites of Kamphausen and Beeck, artefacts have been found of grey, very homogeneous flint with a milky, dull-blue patina. This flint bears a strong resemblance to the flint that in Eyserheide has been described as Orsbach flint (see chapter 4). In Kamphausen, Orsbach flint with over 100 artefacts takes up a substantial proportion (36%) of the lithic materials. The artefacts consist of a small exhausted core, flakes, blades, crested blades and tools. This broad composition of different types of artefacts points to transport of prepared cores, blades and/or tools from the eastern part of Dutch South Limburg or the adjacent German part (vicinity of the small village of Orsbach) to the camp site of Kamphausen. That Orsbach flint was important for the production of tools is shown in the fact that c. two thirds of the tools of Kamphausen has been made of this type of flint. The tools are larger and broader than the unworked blades found at the site, which may indicate the transport and bringing in of ready-made tools. Also, blades used for tools may have been manufactured in the camp site of Kamphausen itself, struck from cores that at that moment still had relatively large dimensions.

In Beeck, five artefacts were found of the same, very homogeneous flint that was described as Orsbach flint in Kamphausen. Which artefacts are represented in this small group, could not be made out from the publication of this site (Jöris et al. 1993).

In Alsdorf occur two cores and some blocks (*Trümmer*) of a rather similar flint which is described as *Vetschauer Feuerstein* by Floss (1994, 264-265). The distance of the site

to the nearest source locations of this flint is c. 15 km. In contrast to Simpelveld flint in Sweikhuizen-GP and Jurassic chert in Alsdorf (see below), we are dealing here with an indication of transport of cores.

Freshwater quartzite:
Artefacts of a fine-grained freshwater quartzite are known from the inventory of Sweikhuizen-GP in the form of seven backed bladelets (Arts and Deeben 1987b). As no waste products of this quartzite have been found, these artefacts probably entered the site in the form of ready-made (and probably hafted) tools. The quartzite may derive from primary Tertiary sources in the German Central Rhineland, but this could not be confirmed by a neutron activation analysis of some of the quartzite artefacts found at Sweikhuizen (for comparable analyses of freshwater quartzite in Andernach, see Grünberg 1986).

Jurassic chert:
In Alsdorf, 87 artefacts have been found of a dull-yellow, very homogeneous stone that Löhr (1979, 1995) describes as Jurassic chert (*Jurahornstein*). The artefacts are 71 bladelets, six burins, five backed bladelets, a retouched blade and four burin spalls. Löhr (1979, 36) mentions as raw material source the terraces of the river Main in the southern Mainz Basin, which would mean a transport distance of c. 200 km. According to Floss (1994, 264), the artefacts were struck from five different pieces, which he regards as an argument for a provenance from the terraces of the Main where Jurassic chert is amply available. Because this chert only occurs sporadically in the terraces of the Rhine, the deposits of this river are considered less likely as natural source.

Thanks to the presence and identification of the above mentioned, non-local stone varieties, we catch glimpses of an important part of the organisation of the lithic technology of hunters and gatherers from the northern Magdalenian, namely the transport and use of artefacts of non-local materials. Looking at the artefacts of Simpelveld flint in Sweikhuizen-GP and Mesch, two different transport strategies seem to have been used, namely that of blades and tools in the former site versus that of a pre-core in Mesch. At Kamphausen, Orsbach flint seems to have entered the site in the form of cores, blades and finished tools. The data correspond with those of Magdalenian sites in other regions: good quality flint and/or other stone materials were worked in the extraction places or in temporary camp sites in the vicinity of the source locations and subsequently, probably through strategies of embedded procurement (see 8.4), were transported to camp sites outside the natural source area of the lithic materials concerned. Both types of flint, Simpelveld flint in Sweikhuizen-GP, Sweikhuizen-KW and Kamphausen, and of Orsbach flint in Alsdorf, Beeck and Kamphausen, link these sites to Dutch South Limburg east of the Geul, in the case of Orsbach flint possibly also to the adjacent German area.

In this context, the Eyserheide site and its location in the source area of Simpelveld flint and Orsbach flint deserves full attention. As discussed in chapter 4, this site yielded numerous artefacts (including cores, flakes, blades and small debitage) of both flint types reflecting all stages of flint knapping. At Eyserheide, at least three nodules of Simpelveld flint and ten nodules of Orsbach flint were transported to the site and were worked there. We should therefore take into account that the camp site of Eyserheide or similar (but not documented) camp sites, situated in the same area and also providing evidence of an extensive use of locally available Simpelveld flint and Orsbach flint, may have functioned as suppliers of artefacts of both types of stone. In anticipation of future use, partially prepared cores, blades and-or finished tools were produced at these sites and transported to camp sites located outside the area with primary Cretaceous flint sources.

In an attempt to test the above proposed relationship between sites, we compared the dimensions of retouched tools and blades of Simpelveld flint from Eyserheide with those of Sweikhuizen-GP and Sweikhuizen-KW. As almost all implements of this flint are broken, little can be said about the original lengths of the blades that served as initial form for the manufacture of these tools. In general, retouched tools and blades of the Eyserheide site, both complete and broken pieces, are longer than those recovered from the Sweikhuizen sites (table 8.3a). This observation is in line with our expectations, given the different topographical position of Eyserheide and Sweikhuizen in relation to source locations of Simpelveld flint. Concerning the width of the tools, we should mention the very uniform width of three backed bladelets of Simpelveld flint in Sweikhuizen-GP: they were made of narrow bladelets with a width of 0.6 cm. Other types of tools are manufactured of blades and have widths that vary between 1.1 and 1.9 cm and, in this respect, no real differences exist with the retouched tools recovered from Sweikhuizen-KW (widths between 1.2 and 1.9 cm). Compared with these, the retouched tools of Simpelveld flint in Eyserheide are generally wider: only one piece is narrower than 2 cm and has a comparable width to the tools of Sweikhuizen-GP and -KW (table 8.3b). This could indicate that in the camp site of Eyserheide, or in a comparable camp site located nearby, relatively narrow blades of Simpelveld flint were selected for future use in more northern locations in the Meuse-Rhine loess area. Data on the widths of the (non-retouched) blades in Sweikhuizen-GP and -KW are in agreement with those of Eyserheide. For this reason it is very

	Retouched tools			Blades		
Length in mm	Eyserheide	Sweikhuizen-GP	Sweikhuizen-KW	Eyserheide	Sweikhuizen-GP	Sweikhuizen-KW
0 - 9	1	1	.	2	.	.
10-19	.	3	1	18	1	3
20-29	.	.	1	27	3	2
30-39	.	.	2	26	1	1
40-49	1	1	1	29	.	.
50-59	.	1	.	16	1	.
60-69	1	1	.	9	.	.
70-79	1	.	.	6	.	.
80-89	2	.	.	3	.	.
> 90	2	.	.	11	.	.
Total	8	7	5	147	6	6
	Retouched tools			**Blades**		
Width in mm	Eyserheide	Sweikhuizen-GP	Sweikhuizen-KW	Eyserheide	Sweikhuizen-GP	Sweikhuizen-KW
0-5	.	.	.	.	.	.
6-9	.	3	.	6	.	1
10-14	1	1	3	24	1	3
15-19	.	3	2	44	3	.
20-24	6	.	.	49	2	2
25-29	1	.	.	20	.	.
30-34	.	.	.	3	.	.
>35	.	.	.	1	.	.
Total	8	7	5	147	6	6

Table 8.3 Length (above) and width (below) of retouched tools and blades (complete and fragments) of Simpelveld flint in Eyserheide, Sweikhuizen-GP and Sweikhuizen-KW. Counts after refitting of broken pieces, tools made of blades only.

well possible that they were struck in the camp site of Eyserheide (or, again, in a comparable and nearby camp site) and were transported from there to the loess plateau at Sweikhuizen. There are no indications that would point to a similar transport of bladelets of Simpelveld flint from Eyserheide to other sites. As discussed in chapter 4, in Eyserheide the production of such artefacts, which were important for the manufacturing of hunting gear (backed bladelets), does not seem to have played an important role.

From the data presented above, it is (of course) difficult to draw conclusions about a relationship and contemporaneous occupation between Eyserheide and the Sweikhuizen sites. In fact, though such a relationship is possible, it cannot be demonstrated with certainty on the basis of the presence and dimensions of artefacts of Simpelveld flint in last-mentioned sites. It is clear that such a proof of contemporaneous occupations can only be obtained through refitting and the establishment of refits between artefacts recovered from Sweikhuizen-GP and -KW and artefacts from Eyserheide. An attempt to do this has however not yet been made.

If we look at lithic technologies of hunter-gatherer societies in a more general sense, several factors may have played a role in the handling of lithic raw materials, such as the character of the exploited food resources (Torrence 1983) and settlement mobility (Binford 1980; Kelly 1983; Shott 1986). Moreover, differences may be expected in response to variations in the availability of good quality raw materials (Schiffer 1975; Bamforth 1986). Wiant and Hassen (1984, 105) state that technology "is organized as an adaptive response to geographic and temporal variations in lithic and biotic resources and is designed to minimize tool costs." Cores of good quality, non-local raw materials have generally been worked in a more systematic and careful manner than their counterparts of local raw materials. Moreover, blades and finished tools of non-local stone have been used and maintained in a more durable manner (curated technology). Cores made of local and often inferior types of stone attest to a more opportunistic (*ad hoc*) working (expedient technology). Apparently, less stringent requirements had to be met of the quality (length, thickness and regularity) of the end products The blades are generally shorter and more irregular and tools are less carefully retouched. Also the resharpening and rejuvenation of the working edge has occurred less frequently, in other words less time and energy have been invested to extend the life span of artefacts. From this can be inferred that technological and typological characteristics of Late Upper Palaeolithic assemblages to a large extent may be determined by the way in which local and non-local lithic materials were dealt with.

Contrary to the statements made above, in the area with good quality Cretaceous flint sources (Orp-le-Grand, Kanne, Mesch and Eyserheide) strategies of core reduction seem to have been totally unrelated to the use of local or non-local raw materials. Both strategies, careful versus rudimentary, occur side by side, whereby exclusive use was made of *local* flint varieties (see 7.6.2) All the same, within the supply of local raw materials, selection probably did take place of flint nodules with specific properties (size, shape, quality) with a view to the application of *le débitage magdalénien classique*. Cores that show these properties but were worked less carefully are possibly the product of less gifted flint knappers or an apprentice flint knapper. Besides, we can imagine that not every activity required an optimal set of blades and/or tools. Depending on the nature of the activity and on whether this activity was planned or not, a less careful form of stone working and a less durable use of tools sufficed (expedient technology).

For the Magdalenian sites outside the area of Cretaceous flint sources though, we can speak of a relationship between the provenance and use of raw materials. For the site of Beeck is pointed out the less than economical use of local terrace flint. Relatively large nodules of homogeneous terrace flint, that in principle was suitable for blade production, were worked rudimentarily and discarded in an early stage of core reduction (Jöris et al. 1993, 261). Another observation concerns the retouched tools. Pieces of non-local raw materials were made of larger and more regular blades (Kamphausen), were more regularly retouched (blade scraper from Beeck) and/or more frequently resharpened (burin spalls and/or retouch waste in Alsdorf) than pieces made of local raw materials. As far as can be deduced from the published data, characteristics of *le débitage magdalénien classique* can be observed in particular on artefacts made of non-local raw materials in Kamphausen and Beeck. Cores and corresponding knapping products of local Meuse terrace flint are smaller in size and have a less regular form. Examples of ad hoc tools recovered from other sites are scrapers on flakes in Alsdorf and dihedral burins made of thick flakes in Echt-Koningsbosch.

8.3 Central Rhineland

In the Niederrheinische Bucht in the eastern part of the Meuse-Rhine loess area, the Rhine is by far the most important river. If we follow the river upstream from Cologne and in a southerly direction, we come to a classic region for research of the northern Magdalenian, namely the Neuwied Basin in the Central Rhineland. This relatively low-lying basin (c. 20 × 30 km) near Koblenz was formed by tectonic movement and is surrounded by the Eifel in the west, the Hunsrück in the southwest and the Westerwald in

the east. At the northwestern end of the Neuwied Basin, not far from the Andernach Gate (*Andernacher Pforte*) where the Rhine leaves the basin, are the famous open-air sites of Andernach and Gönnersdorf, respectively west and east of the river (fig. 8.1). The distance between the two locations is at most 2 km. They belong to the most important and most extensively researched and published Magdalenian sites of Europe.

Excavations on the Martinsberg in Andernach started in 1883 by H. Schaaffhausen (1888, see Bolus and Street 1985). The investigation was directed at parts of an extensive settlement from the Magdalenian, covered by a four metres thick layer of volcanic ash originating from the Maria Laach volcano. Little under a century after their discovery, the finds of these early excavations, among which 849 stone artefacts, were described by G. Bosinski and J. Hahn (1972). Fieldwork was again undertaken in Andernach from 1979 to 1983. On the basis of refitting of stone artefacts and of faunal remains, the proximity of the old excavation pits of Schaaffhausen could be determined. An adjacent and intact part of the settlement was also excavated over an area of c. 140 m^2 (Veil 1982, 1984). The excavation revealed three concentrations of archaeological material, of which concentrations CI and CIII could no longer be investigated completely. In addition, it became clear that above the level with artefacts from the Magdalenian there was a second archaeological layer present with finds belonging to the *Federmesser* culture.

The site of Gönnersdorf lies c. 40 m above the present water level of the Rhine and is nearer to the river than that of Andernach. In 1968 during the digging of a wine cellar, a rich site from the Magdalenian was revealed, embedded in loess sediments which in turn were covered by a layer of volcanic ash from the volcano of Maria Laach. This eruption of this volcano, at the end of the Allerød interstadial in the Eifel, is

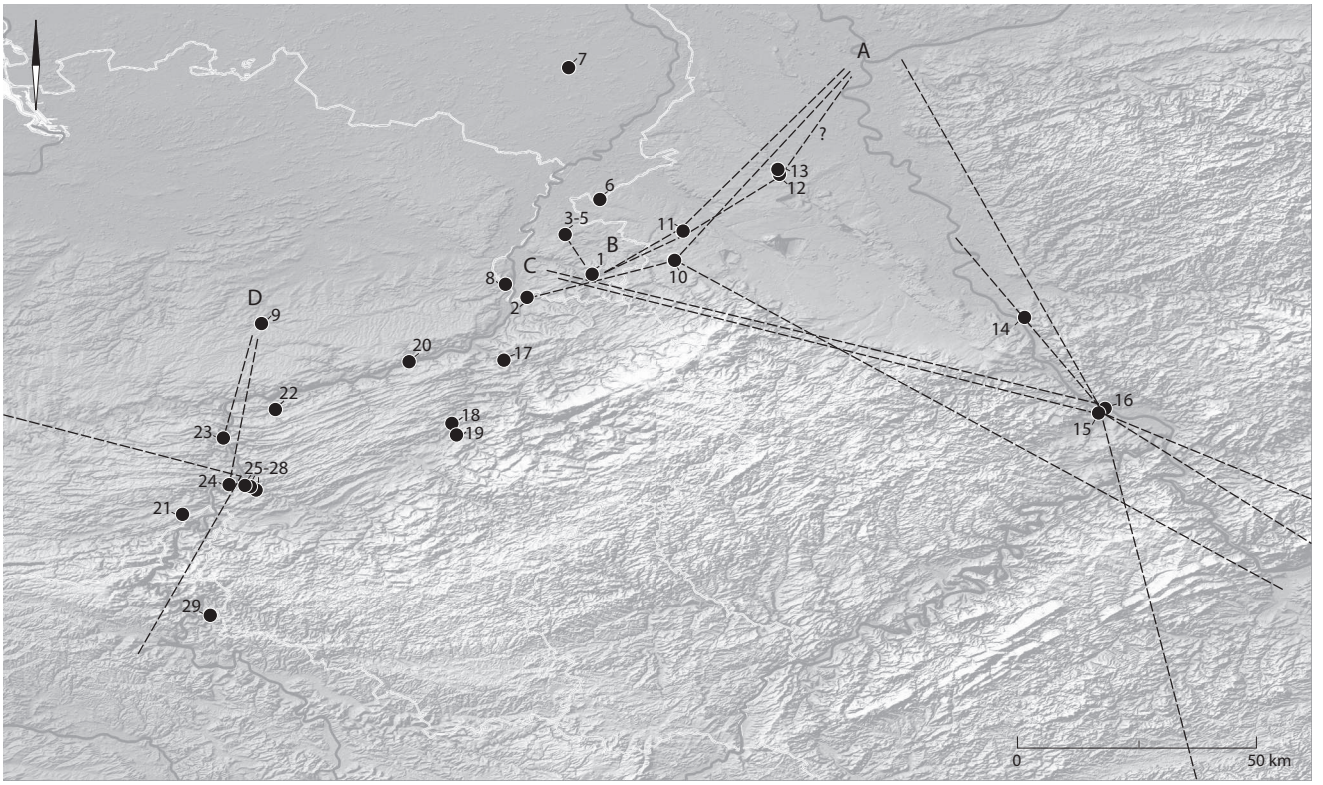

Figure 8.1 Contour map of Northwest Europe with the location of Magdalenian sites. The lines link sites to raw material areas. 1 Eyserheide, 2 Mesch-Steenberg, 3-5 Sweikhuizen, 6 Echt-Koningsbosch, 7 Griendtsveen, 8 Kanne, 9 Orp-le-Grand, 10 Alsdorf, 11 Beeck, 12 Kamphausen, 13 Galgenberg, 14 Oberkassel, 15 Andernach, 16 Gönnersdorf, 17 Grotte Walou, 18 Verlaine, 19 Grotte du Coléoptère, 20 Engis, 21 Trou des Blaireaux, 22 Grottes de Goyet, 23 Bois Laiterie, 24 Trou Da Somme, 25 Trou Magrite, 26 Chaleux, 27 Trou du Frontal, 28 Trou des Nutons, 29 Roc-la-Tour.
A= source area of moraine flint (Baltic flint), B= source area of Simpelveld flint and Orsbach flint, C= source area of Rijckholt flint, D= source area of Senonien flint.

dated by radiocarbon around 11,000 BP (or c. 11,000 cal BC, see Street et al. 1994). In 1968, 1970-1974 and 1976 under the supervision of G. Bosinski, the remains of three large habitation structures and a smaller structure were excavated over an area of 687 m^2 (Bosinksi 1979). In 1968, the excavation was directed at concentration CI, of which a part had already been dug up during the construction of the wine cellar. The field work in 1970-1976 yielded the remains of two large habitation structures (CII and CIII) and a smaller structure (CIV). The large structures are oval to round in shape and have a diameter of c. six to eight metres. They consist of stone slabs, small pits and very rich accumulations of settlement waste, such as stone artefacts and fragments of animal bones. Figurative images are present in the form of line engravings of animals and schematically represented female figures in stone (Bosinski and Fischer 1974, 1980) and small statues of human figures made of antler and ivory. In the northern part of the excavated area, CIV consists of a circle of stones with a central hearth (Terberger 1992).

Due to the good conditions of preservation, the presence of hearth and habitation structures and the wealth and diversity of the finds, Andernach and Gönnersdorf are very important for the research of the material culture, food economy, and settlement types of the northern Magdalenian. Moreover, from the presence at both sites of ornamental molluscs, originating from distant source areas, including species from the Mediterranean, we catch glimpses of the existence of social relationships between human groups. The available data point to the circulation of ornamental molluscs in exchange networks that extended over large parts of Magdalenian territory. From the patterns we can infer that human populations living in different areas were not 'autonomous', but operated within a framework of social alliances (Rensink 1993, chapter 6).

For both Andernach and Gönnersdorf, extensive research has been undertaken into the nature and provenance of the broad spectrum of lithic raw materials used for tool production, including a comparative study of artefacts and geological samples by Floss (1994; see tables 8.4 to 8.6). In the Central Rhineland, fine-grained, good quality flint does not occur in primary or in secondary (for instance river deposits) contexts. Two regionally available stones, Tertiary quartzite (*Tertiärquarzit*) and chalcedony, offered a good alternative for the manufacture of long and regular blades. In Andernach (excavations 1979-1983), artefacts struck from several varieties of fine-grained and homogeneous Tertiary quartzite make up 68% of the inventory of stone artefacts. In Gönnersdorf, this percentage is 19%. The number of artefacts of chalcedony is lower in both sites. Despite the relatively small distance to the source areas, both types of raw

	Distance						
Raw materials	Km	CI %	CII %	CIII %	N	%	Weight	%
Tertiary quartzite (*Tertiärquarzit*)	30-40	90.3	5.0	84.2	15822	68.3	19650	78.2
Chalcedony	40	2.2	0.2	8.8	684	2.9	475	1.9
Baltic flint (*Baltischer Feuerstein*)	100	7.5	0.3	7.0	1199	5.2	950	3.8
Meuse flint (*Maasfeuerstein*)	100	.	86.5	.	5001	21.6	3185	12.7
Palaeozoic quartzite (*Paläozoischer Quarzit*)	80?	.	8.0	.	460	2.0	865	3.4
Total		100	100	100	23166	100	25125	100

Table 8.4 Andernach-Martinsberg. Numbers of artefacts (>3 mm) per flint type and divided over three concentrations (excavation 1979-1983), and distance of site to the nearest raw material source. After Floss 1994, 196, 210.

	Distance					
Raw materials	Km	Cores	Blades / bladelets	Flakes	N	%
Tertiary quartzite (*Tertiärquarzit*)	30-40	39	2456	1790	4285	80.3
Chalcedony	40	3	87	106	196	3.7
Baltic flint (*Baltischer Feuerstein*)	100	5	220	140	365	6.8
Meuse flint (*Maasfeuerstein*)	100	.	380	.	380	7.1
Palaeozoic quartzite (*Paläozoischer Quarzit*)	80?	.	109	.	109	2.1
Total		47	3252	2036	5335	100

Table 8.5 Andernach-Martinsberg. Numbers of cores, blades/bladelets and flakes per flint type (excavation 1979-1983) After Floss 1994, 193 ff.

	Distance							
Raw material	Km	CI %	CII %	CIII %	N	%	Weight (kg)	%
Tertiary quartzite (*Tertiärquarzit*)	12	44.8	3.1	14.8	15181	18.6	19396	25.4
Idem, Ratingen type	45	1.1	.	.	212	0.2	265	0.3
Chalcedony	30-40	1.3	2.0	7.0	2893	3.5	767	1.0
Brown flint (*Kieseloolith*)	70	.	0.8	7.7	1934	2.4	1098	1.4
Baltic flint (*Baltischer Feuerstein*)	100	39.6	.	4.8	9093	11.1	6000	7.8
Meuse flint (*Maasfeuerstein*)	80-100	10.4	68.8	11.3	31024	37.9	15540	20.3
Patinated flint	.	.	12.8	.	9204	11.2	5000	6.5
Siliceous slate (*Kieselschiefer*)	<5	2.5	4.8	41.4	12035	14.7	28000	36.6
Palaeozoic quartzite (*Paläozoischer Quarzit*)	80?	0.1	0.2	0.2	146	0.2	280	0.4
Chert (*Hornstein*)	<5	.	<0.1	0.1	30	<0.1	15	<0.1
Other raw materials	.	0.1	<0.1	0.3	34	<0.1	31	<0.1
Total		99.9	92.7	87.6	81786	100	76392	99.7

Table 8.6 Gönnersdorf. Numbers of artefacts (>3 mm) per flint type and divided over three concentrations, and distance of site to nearest raw material source. After Floss 1994, 219 ff.

materials were dealt with in a careful and economic way as can be inferred from the intensive use of cores, the high amount of retouched tools and the frequent occurrence of use-wear traces on artefacts. Regarding the cores in Andernach, three pieces of chalcedony have an average length of 5.5 cm. The average length of complete blades is no more than 4.4 cm.

Besides locally and regionally available raw materials, the occupants of the settlements of Andernach and Gönnersdorf used non-local stone varieties (Floss 1994). A raw material that connects both German sites with the northern moraine area is Baltic flint (*Baltischer Feuerstein*). The southernmost limit of this area is near Düsseldorf and Krefeld, c. 100 km north of Gönnersdorf and Andernach. Baltic flint makes up 5% of the total number of artefacts in Andernach, and 11.1% in Gönnersdorf. With the exception of CII, it occurs in Gönnersdorf in all concentrations, with the highest amont in CI (39.6%).

Of direct importance for the investigation of the Magdalenian occupation of the Meuse-Rhine loess area is the occurrence of so-called Meuse flint (*Maasfeuerstein*) in both German assemblages. The area with Cretaceous flint sources between Liège, Maastricht and Aachen is considered as source area of this flint, that is to say the central part of the Meuse-Rhine loess area in which the open-air sites of Kanne, Mesch and Eyserheide are located. Over 21% of the artefacts from Andernach (n=5001, weight=3185 grams) was made of non-local Meuse flint, among which the majority (86.5%) of the artefacts in CII. The artefacts of this group have been described as Rijckholt flint. It is a black to dark grey flint with a transparent matt shine (*im Glanz glasig-matten*). The cortex was described as ”hellbraun, kreidig und hart” with a 1 to 2 mm thick edge (Floss 1994, 205). Characteristics of the cortex point to a provenance from primary (Cretaceous deposits) and/or secondary (residual or slope deposits) context. On only two artefacts (<0.1%) are traces visible that point to an origin from terrace deposits. In Gönnersdorf, Meuse flint is quantitatively the most frequently used stone (37.9%). Also for this site is there a clear relationship between this flint and CII, where 68.8% of the artefacts were made of Meuse flint. But Meuse flint also occurs in the other concentrations. Within the extensive group of Meuse flint (n=31024, weight=15540 grams), three sub-groups are distinguished: brown flint (*Kieselfeuerstein*), Rijckholt flint (*Rijckholt-Feuerstein*) and dark grey-yellow Meuse flint (Floss 1994, 229). The cortex of the first two is light in colour and not rolled, which indicates a provenance from primary context (*Bergfrisch*) or from residual and/or slope deposits. Together, they make up c. 99% of the total of Meuse flint. About the provenance of both brown flint and Rijckholt flint, Floss (1994, 229) remarks the following:

> “Beide Feuersteine wurden in primären Kreidekalken des Maasgebietes gefunden, wahrscheinlich zwischen Lüttich und Maastricht, wo die Maas primäre Kreideschichten durchschnitt. Für diese Herkunftsbestimmung sprechen auch die mikroskopischen Erscheinungsbilder von Proben des Maasgebietes und aus Gönnersdorf.”

The dark grey-yellow Meuse flint is synonymous with Meuse terrace flint and forms only c. 1% of the total group. As potential source area Floss names the western part of the Niederrheinische Bucht, northeast of Eschweiler and along the Rur, where flint-bearing terraces of the Meuse are lying at the surface (Floss 1994, fig. 35).

In view of the location of Eyserheide near primary sources of Simpelveld flint, three blades manufactured of this flint in Andernach should be mentioned, of which two pieces could be refitted dorsally/ventrally (Floss 1994, fig. 219 nos. 14 and 15). The artefacts were lying in CIII at the edge of the area excavated in 1979-1983 and were probably associated with a part of the settlement located outside this area. There is no spatial connection with CII. In Gönnersdorf, also three artefacts of Simpelveld flint were recovered which in all cases are retouched tools: a burin on truncation, a burin on a break and a fragment of a burin that was secondarily reworked into a scraper (Floss 1994, fig. 220, nos 1-3). The tools are made of blades and display traces of a long and intensive use. They were found dispersed in CI, CIII and CIV and do not show a relationship with CII, this despite the fact that CII is characterised by a high amount of Meuse flint originating from the same source area.

For non-local Meuse flint, Floss (1994, 205) speaks of a high degree of utilisation (*Ausnutzungsgrad*). Of all blades and bladelets recovered in Andernach (n=380), 66% is retouched, while use-wear traces have been observed on 60% of all retouched blades and bladelets. No cores were retrieved of this flint, but exclusively tools, blades, bladelets and small debitage. Small flint chips are probably connected with the resharpening and retouching of stone tools. The picture emerges of ready-manufactured blades and tools that were brought from the Liège-Maastricht-Aachen region to the settlement of Andernach, and that were possibly also used in previously occupied camp sites in between (*en route*). Besides blades and tools, in Gönnersdorf also prepared cores of Meuse flint were brought into the site. All these data strengthen the idea of a systematic exploitation of Cretaceous sources of good quality flint in the Meuse Rhine loess area, at a distance of 100-120 km from both German sites.

Finally, it is striking that artefacts of terrace flint with fluvial rolled cortex are almost completely absent in the inventories of Andernach and Gönnersdorf. The low percentages of terrace flint in both settlements are in stark contrast to the high percentages of artefacts made of (locally available) Meuse terrace flint in Eyserheide, Sweikhuizen-GP and -KW, Alsdorf, Kamphausen and Beeck. In paragraph 8.7 we will go into the possible meaning of this discrepancy.

8.4 Interpretation of raw material data

The broad spectrum of non-local raw materials in the inventories of Andernach and Gönnersdorf and data on the provenance of these materials may give an indication of, in general terms, the size of the territory exploited by the occupants of both settlements. The following explanations are possible for the presence of Meuse flint among the finds of the two German sites (Rensink 1993):

1. The occupants of the settlements of Andernach and Gönnersdorf obtained good quality, non-local Meuse flint by means of exchange. It could involve two autonomous, regional groups that kept in contact with each other and that exchanged stones with each other in the form of prepared cores, blades and tools.
2. The occupants of the settlements of Andernach and Gönnersdorf mounted special expeditions to primary flint sources in the Meuse-Rhine loess area in order to obtain good quality flint. Their stay in the source areas was short and specifically directed at the exploitation of flint (direct procurement, cf. Binford 1979).
3. The occupants of the settlements of Andernach and Gönnersdorf did not stay the entire year in the Central Rhineland but exploited food and other resources also in more northern areas as part of the annual mobility cycle. Depending on variations in the supply of food sources in the Central Rhineland, the occupation of camp sites in the Meuse-Rhine loess area was brief and incidental, or longer and more structural (for instance one season) in character. Lithic raw materials were obtained by means of embedded procurement (cf. Binford 1979) and subsequently transported from the Meuse-Rhine loess area to the Central Rhineland.

Although above mentioned explanations are presented here in the first instance in order to account for the presence of artefacts of Meuse flint in the settlements of Andernach and Gönnersdorf, they are also relevant for our picture of the social context in which Magdalenian hunters and gatherers operated in the Meuse-Rhine loess area. Taking into consideration antropological, ethnoarchaeological and archaeological studies on the social structure of hunter-gatherers (see for instance Steward 1969, Wobst 1974, Binford 1979), in the case of the first explanation we are dealing with a maximum band (30 to more than 100 individuals) in the area, and in the case of the second explanation with specialised working parties consisting of few individuals only. Regarding the third explanation, we must consider one small social unit or one nuclear family (represented by the father, mother, childeren and/or grandparents) as the inhabitants of Magdalenian camp sites of the Meuse-Rhine loess area.

The first explanation, i.e. that Magdalenian hunters and gatherers formed an autonomous maximum band in the Meuse-Rhine loess area is not considered likely. Against this explanation argues the geographical position of the open-air sites on the very northern margin of Magdalenian territory. This peripheral position, combined with the context of colonisation in which the northern loess sites should be placed (chapter 7), cannot be reconciled well with a permanent stay and a year-round mobility cycle of Magdalenian hunters and gatherers. Moreover, in the case of an autonomous maximum band, the occurrence of aggregation camps of smaller social units (nuclear families) belonging to two or microbands can be assumed. Remains of such large residential camp sites ('aggregation sites') are not known from the Meuse-Rhine loess area.

The second explanation assumes special expeditions from the Central Rhineland to Cretaceous source locations in the Liège-Maastricht-Aachen region ".. for the express and exclusive purpose of obtaining raw material for tools" (direct procurement, cf. Binford 1979). This explanation fits well with the remark made by Vermeersch et al. (1987, 54) that Magdalenian hunter-gatherers were in sites such as Orp-le-Grand and Kanne "… en quête de matière première, sans jamais y rester longtemps." Also, this explanation fits with the hypothesis made by Straus and Otte (1998, 264) that "… the open-air Magdalenian sites of Limburg, Brabant and Hainaut were mainly occupied by people in the warm season. These places would be repeatedly visited specifically for their abundant, high quality flint." and with the overall classification of the sites as 'quarry-workshops' (Straus and Otte 1998, 262). Nonetheless, there are some objections againt above mentioned views, for the following reasons:

1) With the exception of Kanne, the sites are situated on loess-covered plateaus, at a distance of at least hundreds of metres from the locations where flint is extracted and collected.
2) A number of Dutch and German sites (Sweikhuizen, Echt-Koningsbosch, Alsdorf, Kamphausen, Galgenberg, Beeck) is located *outside* the area with Cretaceous sources of good quality flint.
3) With the exception of Mesch and Kanne, the sites show relatively high numbers and high diversity of retouched tools, which is not in agreement with the interpretation of the locations as flint exploitation sites (see 7.6).

Besides the above arguments, there is an additional argument that is related to the availability of raw materials in the Central Rhineland itself. The occupants of Andernach and Gönnersdorf used on a large scale a fine-grained, homogeneous Tertiary quartzite. This quartzite is eminently suitable for the production of blades, as can be inferred from the occurrence of up to 22.2 cm long blades with regular parallel sides in Andernach (Floss 1994, 197). Floss speaks in this connection of "hervorragenden Bearbeitungseigenschaften". Sources of Tertiary quartzite are present in large numbers in the Central Rhineland, at a relatively short distance from the two German settlements. From a point of view of raw material supply, the mounting of special expeditions aimed at the exploitation of flint sources at a distance of 100-120 km from both sites was therefore not necessary (G. Bosinski pers. comm. 1988).

According to the author, the third explanation, namely the exploitation of Cretaceous Meuse flint as part of regular, seasonal movements of Magdalenian hunters and gatherers (embedded procurement), fits well into the picture of the broader context of colonisation and the northward movement coupled with it. The explanation moreover fits in with characteristics of the artefacts made of Meuse flint. They indicate a light-weight toolkit and components of a curated technology, which were probably used and maintained in a durable way in small temporary camp sites ('transit camps') after leaving the source locations in the Liège-Maastricht area and before reaching their final destination, i.e. the settlements of Gönnersdorf and Andernach (see also 8.6). In this context, we can also refer to Floss (1994, 265) who mentions a comparable interpretation for the occurrence of artefacts of northern Baltic flint and Jurassic chert (*Hornstein*) in Alsdorf: "Sie wurden in einer Grundausstattung bei der Erstbegehung des Platzes eingebracht. Es bestehen keine Argumente, in den aus ortsfremden Rohstoffen bestehenden Artefakten einen Beleg von Tausch-kontakten zu sehen (vgl. H. Löhr 1979, 43)."

Last but not least, the exploitation of Meuse flint through strategies of embedded procurement is also in agreement with the interpretation of the majority of the northern loess sites as briefly used base camps of, in each case, one small social unit (nuclear family), and not as flint exploitation sites, and with the provisional interpretation of these sites as seasonal, summer occupations (see 7.9).

Based on the arguments presented above, we conclude that the Magdalenian sites of the Meuse-Rhine loess area form the remains of camp sites of small human groups that in other periods of the annual mobility cycle were in the Central Rhineland. In other words, the presence in Andernach and Gönnersdorf of non-local, 'Dutch Cretaceous flints' is interpreted as a reflection of embedded procurement, and not that of exchange or direct procurement. This, of course, has important consequences for our picture of the Meuse-Rhine loess sites in the settlement system of the northern Magdalenian. Following this interpretation, the sites do not reflect a complete but only a partial settlement record. The same applies, of course, to Andernach and Gönnersdorf in the German Central Rhineland and particularly for the concentrations (in both sites CII) in which Cretaceous Meuse flint is the dominant raw material. In this respect, we should point out the clear differences in characteristics of the archaeological record of both areas. As discussed in chapter 7, the northern open-air sites are small in size and consist of clearly smaller numbers of retouched tools than the German sites. Moreover, during the excavations of Orp-le-Grand, Kanne, Sweikhuizen, Mesch and Eyserheide no large settlement features and no indications of artistic activity were found, in contrast to Andernach and Gönnersdorf. Also, no surface complexes are known from the Meuse-Rhine loess area that remind us slightly in size, and in numbers and composition of the stone artefacts of Andernach and Gönnersdorf and, hence, could possibly be the remains of comparable camp sites. Obviously, we are dealing with differences not only in intensity and/or duration of occupation, but also in site function(s) and the frequency with which specific locations in the landscape were returned to.

The differences mentioned above seem important for the distinction between an initial pioneer phase and a residential camp phase of occupation as Housley et al. (1997) proposed in their work on the recolonisation of the northern parts of Europe after the Glacial Maximum of the Weichsel ice age.

The archaeological record of the Meuse-Rhine loess area fits well into the picture of an initial pioneer phase of occupation, "… when only a few small hunting parties moved to explore the previously unpopulated areas" (Housley et al. 1997, 45). The archaeological evidence of Andernach and Gönnersdorf, with extensive habitation and hearth structures, artistic objects, large quantities of artefacts and tools, and a large variety in lithic raw materials, however does not fit the image of small 'hunting parties'. These characteristics seem consistent with repeated and longer occupied settlements in a residential camp phase, erected at strategic locations on either side of the Rhine at a short distance from the spot where the river leaves the Neuwied Basin. In accordance with this, the settlements of Gönnersdorf and Andernach reflect residential camps, or "… the places from which the next pioneer phase was launched into previously unoccupied territory" (Housley et al. 1997, 45).

To conclude this paragraph, the following three points are considered important for the research into the earliest human occupation of the Meuse-Rhine loess area after the Last Glacial Maximum:

1) Magdalenian sites reflect an initial pioneering phase of occupation, consisting of incidental and/or seasonal hunting expeditions and other activities, among which the exploitation of good quality flint sources. Apparently, and in contrast to the more southerly regions such as Southern Germany, the Central Rhineland and the Belgian Ardennes, this initial pioneering phase of occupation was not followed by a permanent, residential camp phase of occupation. The absence of very find-rich and extensive settlements with large habituation and hearth structures, as known from Gönnersdorf and Andernach, and with artistic representations in stone form an important indication of this (see later in this chapter).
2) The Magdalenian occupation of the Meuse-Rhine loess area was contemporaneous with or falls in any case in the same time span as that of Gönnersdorf and Andernach. If we look at the series of AMS radiocarbon dates of Andernach and Gönnersdorf, for both sites ranging from c. 13,300 BP to 12,700 BP (Street, pers. comm. 2011), this means a possible time depth of the northern Magdalenian open-air sites of c. 600 C^{14} years. If we use calibrated dates, then all AMS radiocarbon dates fall before 15,000 cal BP (Street et al. 1994; Blockley et al. 2000). Thus, they date the Magdalenian occupation of Andernach and Gönnersdorf and, in an indirect way, those of the open-air sites of the Meuse-Rhine loess area at the end of the Pleniglacial (climatic event GS 2 as recorded in the Greenland GRIP ice core, Johnsen et al. 1997) and prior to the prominent and sudden warming that marks the beginning of the Late Glacial interstadial (climatic event Gl 1, reffered to as Meiendorf interstadial in Central Europe and Bølling interstadial in West-Europe). On the basis of dates obtained from Greenland ice cores, the beginning of this interstadial is dated to around 14,700 cal BP (see also Street 2000, 63).
3) Assuming that the open-air sites of the Meuse-Rhine loess sites were occupied in the warm season (summer), this would mean that Magdalenian groups were not present in the Central Rhineland in this period of the year, but returned to their camp-sites there at the end of or after the summer. Importantly, this scenario would fit very well with data on seasonality from the faunal remains (and especially horse) of Gönnersdorf. These data point to the hunting of horse all year round, with the exception of summer (July, August and September, M. Street, pers. comm. 2011).

Concerning the second point, we would like to remind that as a result of the complete decay of organic remains in the northern loess sites, the possibility of synchronous occupation with Magdalenian sites in the Central Rhineland based on radiocarbon dates cannot be investigated further. From the stratigraphical position of the archaeological layer in for instance Eyserheide, associated with the Bt-horizon of a Holocene loess soil, can be inferred that after the camp site was abandoned, loess sedimentation still continued. At this location, but also at the other sites located nearby a loess layer with a thickness of at least 25 cm was deposited on the occupation surface. A comparable stratigraphical position applies to Gönnersdorf, where the excavated concentrations of archaeological material were also covered by a thin layer (c. 20 cm) of loess.

8.5 Relationship with cave sites in the Ardennes Massif?

Although the above relationship between the Magdalenian occupation of the Meuse-Rhine loess area and that of the German Central Rhineland, in view of similarities in the provenance of the used lithic raw materials, may be obvious, the presented 'model' also has a limitation or weakness: it regards the sites of the Meuse-Rhine loess area in a chronological and cultural perspective as a homogeneous group. Without further considerations, all sites are treated *a priori* as one group and are related to the Magdalenian occupation of the Central Rhineland. Hence, the 'model' does not take into account 1) the time depth that these sites possibly represent, 2) shifts of territories through time and the dynamic character of land use of mobile hunters and gatherers, and 3) the rich Magdalenian record of Belgian caves on the northern and northwestern margins of the Ardennes Massif (Dewez 1987, 1992). Although in a clearly different geological and landscape setting, namely in the steep valley slopes of the Meuse and tributaries (Lesse, Ourthe), some of these caves are located within a distance of less than 70 km (as the crow flies) from Orp-le-Grand, Kanne, Mesch and Eyserheide. The distance between Grotte Walou and the site of Mesch is only 25 km (fig. 8.1). We should therefore bear in mind the possibility that not only the occupants of the settlements of Andernach and Gönnersdorf, but also those of Belgian caves may have visited (parts of) the Meuse-Rhine loess area and exploited sources of good quality flint there.

As in the Central Rhineland, the research of Magdalenian sites in the Belgian Ardennes goes back to the 19th century. There was an important difference in the focus of research though. In contrast to the excavations of the open-air settlement of Andernach by Schaaffhausen, research in the Ardennes Massif was exclusively directed at caves and abris (rock shelters). Already between 1865 and 1870, E. Dupont investigated caves in the steep valley of the Lesse, a tributary

of the Meuse in southern Belgium (Dupont 1867, 1872). The locations concerned, among which Trou de Chaleux, Trou des Nutons and Trou du Frontal, yielded for that time unprecedented rich assemblages of stones and organic tools, remains of hunting game, art objects and ornamental fossil shells. Later in the 19th century, similar finds were made in Grotte de Goyet, east of Namur, and in a cave near Verlaine in the valley of the Ourthe near Liège.

After the pioneering work of Dupont, excavations were carried out in the 20th century in Grotte du Coléoptère in Bomal-sur-Ourthe (Dewez 1987), Trou des Blaireaux in Vaucelles (Bellier and Cattelain 1986), Bois Laiterie (Otte and Straus 1997), Trou Da Somme (Miller and Noiret 2009), and Grotte Walou in Trooz (Dewez et al. 1993). Renewed research was also carried out in locations already investigated long ago, for instance in Chaleux in 1985-1988 (Otte ed. 1994). A site of a totally different nature is Roc-la-Tour at the southern margin and in the French part of the Ardennes Massif (Rozoy 1988, 1989). This is the only Magdalenian open-air site that is at present known in the area. Over an area of 110 m^2, the site yielded no less than 1600 retouched stone artefacts and slabs of schist with line engravings. In contrast to the Belgian caves, organic materials have not been preserved here.

In a recently published article on the Magdalenian in Belgium, Miller and Noiret (2009) make a distinction between two clusters of sites (see also Charles 1996; Straus and Otte 1998, 263). The first cluster, designated the Meuse Valley group, corresponds with the upstream part of the Meuse and includes the small tributary of the Lesse. The cluster comprises Trou Da Somme, Trou du Frontal, Trou des Nutons, Trou de Chaleux, Trou Magrite, Bois Laiterie, Goyet, and Vaucelles (fig. 8.1). This cluster corresponds with an area where flint sources are lacking. Moreover, other formations comprising stone materials suitable for blade production, such as Tertiary quartzite in the Central Rhineland, are also absent there (see for data on raw material sources in Belgium, Caspar 1984; Krupa 1990). Only sporadic use was made of local stone that could be collected in the immediate vicinity of the caves, such as lydite in Chaleux. As a result of this geological situation, the occupants of the caves in the Belgian Ardennes had to resort to importing flint from elsewhere. For the flints recovered by E. Dupont in Trou de Chaleux and in other caves in the valley of the Lesse, three possible source areas are mentioned (Otte 1994, 24, table 1): the Champagne area in northern France, the region of Hainaut (Henegouwen) in southern Belgium, and the province of Liège in northeast Belgium. Determinations of the artefacts excavated in 1985-1988 in the cave of Chaleux indicate a provenance of the majority of the flint from Hainaut (Otte 1994, 90-93). A small part of the flint is possibly from the Champagne region. According to the Dutch geologist W.M. Felder, who was involved in the determination of the flint of Chaleux, there is no flint from Haspengouwen among the artefacts collected in 1985-1988. Cave sites in the Meuse Valley group have also yielded silicified limestone from the region Charleville-Mézières in Champagne in northern France. Of this raw material, more than half (57%) of the artefacts in Trou Da Somme was made. Artefacts of this stone are also represented in the inventories of Bois Laiterie, Trou de Chaleux, and Trou du Frontal but in lower percentages. In the latter three sites, fine-grained flint is the dominant raw material. Regarding the provenance of the flint in the relatively small inventories of Trou Da Somme and Bois Laiterie, Miller and Noiret (2009, 43) state the following:

"Macroscopic comparison of flint from the cave sites of Trou Da Somme and Bois Laiterie and the open-air workshop sites of Orp and Kanne suggests that the fine-grained, white-patinated flint from the cave sites is similar to that of Orp. The flint at Kanne, in eastern Belgium near the Dutch border, is quite different, particularly with respect to cortical characteristics, and does not seem to have been transported to the western group sites."

The fact that flint artefacts occur in all cave sites and often in large numbers, shows that Magdalenian hunters and gatherers regularly visited and exploited sources of good quality flint outside the Ardennes area. In the publication on Chaleux, three strategies are mentioned with regard to the provision of non-local flint (Otte 1994, 94): as rough pieces of flint, as prepared cores, and as end products in the form of blades and finished tools. As a result of the continuous working of the cores and intensive use and resharpening of tools, partly *en route* in earlier visited camp sites, the dimensions of the artefacts were strongly reduced. This is well illustrated by the cores of Chaleux, originating from the excavations by Dupont. These pieces show a distinct economic use of the flint, in many cases to the stage of complete exhaustion (*l'épuisement*). Of 167 cores, the average length varies from 4.3 cm (cores with one striking platform) to 4.85 cm (cores with two or more striking platforms). The maximum dimensions range from 7.9 to 8.6 cm (Dewez 1987, 57). Also pointed out is the production of small flakes at the end of the process of core reduction. Two methods of debitage of cores of non-local flint are mentioned for Chaleux (Otte 1994, 27):

"En conclusion, deux types de débitage semblent se dégager à travers les nucléus découverts dans la grotte. Le premier très soigné, démontre une bonne maîtrise de la taille, bien que les produits de ce débitage ne soient pas très homogène. On observe une utilisation maximale de la matière première, probablement due à l'éloignement des gisements de silex. Le second type de taille, beaucoup plus simple, a essentiellement fourni des éclats. Des rognons entiers ou

fragmentaires ont été exploités afin d'en extraire quelques produits souvent petits et informes. Ici aussi, il semble que les tailleurs de Chaleux désiraient exploiter au maximum la matière première présente sur le site. Toutefois, on peut se demander pourquoi des rognons de mauvaise qualité étaient rapportés sur le gisement."

Looking at the proximal fragments of blades found at Chaleux (Otte 1994, 99), it appears that an important characteristic of *le débitage magdalénien classique*, viz. *en éperon* preparation of the striking platform, was applied by the flint workers, as part of the first strategy mentioned in above quotation.

If we follow the Meuse downstream from Namur in the direction of Liège, we reach the second cluster of sites, that of the Ourthe Valley group (Miller and Noiret 2009). The group consists of Grotte Walou, Grotte de Verlaine, Grotte du Coléoptère, and Engis (fig. 8.1). Of these, Grotte Walou is located in the valley of the small river Magne, at a distance of only 20-30 km (as the crow flies) from the open-air sites of Mesch and Kanne. Engis is located between Huy and Liège in the valley of the Meuse, while Grotte du Coléoptère and Grotte de Verlaine are located at less than 5 km from each at the edge of the valley of the Ourthe. In view of the position of the Ourthe Valley group at a short distance from the Meuse-Rhine loess area, these sites will be discussed here briefly:

Grotte Walou:
In Grotte Walou (province of Liège, Belgium), excavations were carried out between 1985 and 1990 by La Société wallonne de Palethnologie (Dewez et al. 1993) and between 1996 and 2004 by l'Association pour la Promotion et la Protection de l'Environnement wallon (Draily 1998).
Of all Belgian caves, this cave comprises the most complete and well-documented sequence of sediments from the Upper Pleistocene, from the Holocene into the Pre-Weichselian (probably Eemian; Pirson et al. 2006). Grotte Wallou has yielded fauna remains and artefacts in different stratigraphical levels and different Palaeolithic periods: Creswellian, Magdalenian (couche B4), Gravettian (couche B5), Aurignacian and Mousterian (unit C). The campaigns between 1996 and 2004 were aimed at the oldest level with Mousterian artefacts, as the Late Upper Palaeolithic levels had largely then been dug up already. Data on the artefacts from the Magdalenian have hardly been published. Grotte Walou is located near the Plateau of Herve (*Plateau de Herve*) and in the immediate vicinity (within a radius of 5 km) of natural occurrences of flint (Draily 1997, 117). It is unlikely, however, that these nodules were used by Magdalenian flint knappers for the production of long and regular blades. Dewez (1987, 16) writes de following on this:

"Dans le sud de la Hesbaye, de même que sur les parties hautes du Plateau de Herve, le Maestrichtien n'est plus quère représenté que par ses faciès d'altération c'est-à-dire sous forme d'un conglomérat à silex. Ce dernier est essentiellement consititué de rognons et de débris de silex, plus ou moins altérés en surface et enrobés dans une gangue argileuse."

Grotte de Verlaine:
Grotte de Verlaine, near the river Ourthe, was excavated by P. Destinex and L. Moreels (1888) and amateur archaeologists. During these digging activities the infill of the cave was completely removed. Both stone artefacts and worked bone, among which a uniserial harpoon / barbed point of reindeer antler could be attributed to the Magdalenian. The fauna assemblage consists of different species of animals, among which mammoth, bear and hyena, but is probably only partially connected to occupation of the cave in the Magdalenian (Charles 1996). A description of the lithic raw materials and types of tools used in the cave of Verlaine is by Dewez (1987, 368-374). The description shows that the lithic material consists almost exclusively of flint and that the majority is patinated. Within this group dominates a rather fine-grained flint of good quality, which is dark grey in colour (sometimes almost black) and in which lighter specks are visible. Also occurring is a less fine-grained, greyish flint with yellowish or beige specks. Dewez (1987, 368) further mentions "quelques silex à texture grenue de teinte beige, qui se patinent de taches grisâtres disséminées sur toute la surface. Cette variété de silex nous paraît étrangère au pays."

In Grotte de Verlaine, the largest of twelve measured cores is 9.1 cm (Dewez 1987, 369). From this core a few flakes were removed, without there being an exhausted core. The length of other cores varies from 3.2 to 5.9 cm. These dimensions are comparable with those of the cores of Chaleux and are significantly smaller than the majority of cores in Kanne, Mesch and Eyserheide. The complete blades of Grotte de Verlaine have an average length of 5.5 cm, while the longest piece measures 13.1 cm. Among the retouched tools are backed bladelets, truncated blades (*troncatures*), a blade with notch, borers, blade scrapers, burins and two artefacts with alternating retouch (Dewez 1987, figs. 241-243).
Apart from flint, four fragments of chalcedony and two fragments of a fine-grained quartzite form part of the finds examined by Dewez. According to Dewez, the quartzite resembles Wommersom quartzite, as known from Mesolithic sites in Belgium and southern Netherlands.

Grotte du Coléoptère:
This small cave was excavated completely by Hamal-Nandrin and Servais (1925) in 1923 and 1924, during which also an adjoining part of the terrace was investigated. The

publication on this research is just a summary. Between 1972 and 1978 other parts of the terrace were excavated, the first results of which were published in the form of a preliminary report (Dewez 1975). Underneath a layer with find material from the Bronze Age (couche 4), Mesolithic (couche 5) and Ahrensburg culture (couche 6) was a layer with artefacts from the Magdalenian (couche 8). The layer comprised amongst others stone artefacts (backed bladelets, burins, end scrapers), objects of bone and antler (among which harpoons of reindeer antler, *pointes de sagaies*, a *double biseau* and a *bâton de renne munis d'une perforation*) and partially perforated fossil molluscs. The Paris Basin is mentioned as provenance area of these molluscs. An important part of the flint is dark grey to almost black in colour and has lighter specks.

Engis:
This cave site is located close to the Meuse between Huy and Liège. Around 1830, P.C. Schmerling carried out the first excavations in this cave. Apart from stone artefacts from the Mousterian and Perigordian, a child's skull of a Neandertal and finds from later phases of prehistory, the cave probably also contains artefacts from the Magdalenian, among which backed bladelets. Further data, for instance on the composition and provenance of lithic raw materials, are lacking.

An important observation made by Dewez (1987, 368) is that artefacts made of a dark grey to almost black, good quality flint predominate in Grotte de Verlaine and Grotte du Coléoptère, and that this flint is only sparsely present in caves located in the more southerly valley of the Lesse (Chaleux, Trou des Nutons). This difference could point to the exploitation of two geographically distinct source areas, namely the region of Hainaut by the occupants of caves in the Lesse valley versus the region of Haspengouwen and/or the Liège-Maastricht region by the occupants of caves in the Ourthe area. According to this scenario, we could be dealing here with two regional groups ('maximum bands') that functioned independently of each other in time and/or space. Unfortunately, for the sites of the Ourthe Valley group, data on the provenance of raw materials are at present insufficient to test this hypothesis. In this context, and following Miller and Noiret (2009), both a connection with Magdalenian sites in the Meuse-Rhine loess area (Kanne, Mesch) and with the Magdalenian occupation of the German Central Rhineland (Gönnersdorf and Andernach) cannot be excluded.

8.6 Discussion

Although little can be said about migration routes of important hunting game (reindeer and horse) at the time of occupation of Magdalenian sites in Northwest Europe (but, see Gordon 1988), we can imagine that the river valleys of Rhine and Meuse were important, natural corridors of both animals and people between the Belgian-German uplands and the adjacent, southern part of the Northwest European Plain. From the northern exit of the Neuwied Basin northwestwards, the Rhine transects the Rhenish Slate Massif over a distance of c. 40 km. In this zone, the Rhine valley forms a narrow gorge before fanning out further downstream, near the present town of Bonn, into the southern part of the Niederrheinische Bucht. With the exception of the Ahr, important rivers flowing into the Rhine do not occur in this part of the Rhenish Slate Massif. We can well imagine that Magdalenian hunters and gatherers followed the banks of the Rhine from the Neuwied Basin (Andernach and Gönnersdorf) up to the present town of Cologne in the Niederrheinische Bucht. From this point, sources of good quality flint were 'within reach', that is in the Liège-Maastricht-Aachen region c. 60 km west and in the northern moraine area c. 60 km north. Indications of migrations of human groups from the Central Rhineland northwards and over comparable distances are also available for earlier and later phases of the Palaeolithic. Thus flint from Cretaceous deposits in the Liège-Maastricht-Aachen region has been recovered in Middle Palaeolithic (Plaidter Hummerich, Tönchesberg), Early Upper Palaeolithic and Late Palaeolithic contexts in the Central Rhineland (Floss 1994, Bosinski et al. 1995). And though it is tempting to connect this consistent pattern of transport of non-local flints with the presence of the Rhine valley, serving as natural corridor and providing direction for movements of Palaeolithic hunter-gatherers, this cannot be stated with certainty. In this respect, Floss (1994, 145) remarks regarding sites from the Middle Palaeolithic:

> "Auch wenn der Ausgangspunkt des Transportes, das Maasgebiet, bekannt ist, muß der genaue Wanderweg der Gruppe angesichts fehlender Silices, die auf dem Wege in das Neuwieder Becken hinzukamen, offen bleiben. Die Wanderweg dürfte über die Eifel verlaufen sein".

In the discussion of the raw materials used in the settlements of Gönnersdorf and Andernach (8.3), we reported the near absence of artefacts of Meuse *terrace flint* in the inventories of these two sites. This observation is at odds with the large-scale use of them in the camp sites in the central and eastern part of the Meuse-Rhine loess area: Eyserheide, Sweikhuizen-GP and -KW, Alsdorf, Beeck, and Kamphausen. This discrepancy in used raw materials indicates that occupants of these camp sites mainly exploited terrace flint for local needs and not in anticipation of use during a later phase of the mobility cycle, for instance in the camp sites in the Central Rhine Valley. Because of its absence in all other sites, the working of Valkenburg flint in Eyserheide can also be regarded as meeting local demand. In view of the suitable

properties for the production of blades, it is striking that Simpelveld flint and Orsbach flint have hardly played a role in the raw material provision of Andernach and Gönnersdorf. Apparently, we are dealing with flint types of which the exploitation was directed at and met both *local* (Eyserheide) and *regional* demands. The fact that Simpelveld flint was a raw material of regional importance can be inferred from its occurrence in the sites of Mesch, Sweikhuizen-GP, Sweikhuizen-OS, and Kamphausen. In addition, numerous artefacts of Orsbach flint have been recovered in Kamphausen. Eyserheide and other camp sites, located near natural sources of Simpelveld flint and Orsbach flint, possibly functioned as operating base for expeditions in a northerly and northeasterly direction. With a view to these expeditions, cores were worked and blades and tools manufactured that were subsequently taken away to locations outside the Cretaceous area (see 8.2).

Compared to the types of flint mentioned, Rijckholt flint, and collected from primary or secondary contexts, that is to say with 'eluvial cortex', played a different role in the technological organisation of Magdalenian groups. In view of the very high proportion of Rijckholt flint within the group of Meuse flint in the inventories of Andernach and Gönnersdorf, we can speak of an '*export product*' of supra-regional importance. The composition of lithic raw materials in sites in the Meuse-Rhine loess area itself underlines this notion. Despite the location of Eyserheide at less than 5 km from the nearest source locations, Rijckholt flint collected from secondary, residual and/or slope deposits makes up only a small part of the inventory of this site (RMU M19, n= 83). Given the strong dominance (>99%) of Meuse terrace flint in Sweikhuizen-GP, Alsdorf, Kamphausen and Beeck, this type of flint also did not play an important role in the camp sites in the central and eastern part of the Meuse-Rhine loess area. Apparently we are dealing with a stone of which the exploitation and working was not primarily meant for local (as indicated by the inventory of Eyserheide) or regional use. It is rather a raw material that was exploited with a view to use in camp sites in the Central Rhineland and possibly also in the cave sites of the Ourthe Valley group in the Belgian Ardennes.

A possibility is that Magdalenian hunters and gatherers extracted and worked Rijckholt flint at or near the source locations and immediately prior to their departure to camp sites in the Central Rhineland and/or Belgian Ardennes. Floss (1994, 229) mentions the formations of chalk between Liège and Maastricht as probable source of Rijckholt flint, of which artefacts have been retrieved in Gönnersdorf (and Andernach). Based on the distribution of the Lanaye Chalk and the location of Neolithic exploitation places, primary (Chalk deposits) and secondary (residual and slope deposits) occurrences of Rijckholt flint are limited to the southwest of Dutch Limburg, i.e. the area west and south of the river Geul, and to the adjacent Belgian area (F. Brounen, pers. comm. 2011). In this area are two Magdalenian sites located on either side of the Meuse and only 5 km from each other, viz. Kanne and Mesch. Hence, the question that presents itself is whether these locations are related to the Magdalenian occupation of the German Central Rhineland. Can we make further statements about this, based on data from the two sites?

Artefacts from the excavated sections in Kanne were made of a very homogeneous and good quality flint from the Gulpen Formation (Vermeersch et al. 1985, 27). This flint, in the shape of large nodules, can be collected in large quantities along the slopes of the Geer valley. The flint is fine-grained and has a blue-whitish colour and sometimes shows a gradual change to more coarse-grained parts. The cortex is not fluvially rolled, but very crumbly and thick. These characteristics correspond with those of Rijckholt flint collected from primary and/or secondary contexts. Thus Kanne, with a position on the flank of the valley of the river Geer, not only from its location in the landscape takes up a special position in the Meuse-Rhine loess area. It also is the only Magdalenian site where Rijckholt flint, collected from primary or secondary (slope) deposits, has been worked at or very close to the exploitation locations themselves.

Of the site of Mesch, 480 artefacts larger than 2 cm have been described as flint of the type Rijckholt, of which five cores and 24 tools (Rensink 1991). At this site, however, the flint originates only partially from primary or secondary contexts: of many artefacts, the cortex is heavily rolled as a result of fluvial transport and incorporation of the flint nodules into the bed of the Pleistocene Meuse. A function of the camp site of Mesch as supplier of Rijckholt flint (in the form of prepared cores, blades, tools) for use in camp sites in the Central Rhine region seems less likely for this reason. This site does provide important information, though, on the role that Rijckholt flint may have played in the Magdalenian of Northwest Europe. A look at the ratios between artefacts struck of Rullen flint (of which most artefacts were found in Mesch) and those of Rijckholt flint, shows that this ratio for cores is 10:1, for flakes larger than 2 cm 8:1, for blades 11:1, and for tools 2:1 (Rensink 1991, tables 4-7). The latter ratio forms an indication of the importance of Rijckholt flint for the manufacture of stone tools. It has also been demonstrated that medial blade fragments made of this flint were on average broader than those of Rullen flint. A few tools were made of strikingly broad blades of Rijckholt flint, among which a blade end scraper with a width of 4.1 cm. These data are possibly an indication of a different use ('status') of

Rijckholt flint compared to, also locally available, Rullen flint. In this respect, the high proportion of retouched tools (n=10) and blades displaying edge damage (n=2) in the group of Rijckholt flint in Eyserheide also should be pointed out. Moreover, the broadest scraper of this site (width of 3.6 cm) is made of flint of Rijckholt (see chapter 4).

8.7 Conclusion

Data on the provenance of lithic materials used in the Central Rhine Valley and the Belgian cave sites have contributed to a better understanding of the relationship between the Magdalenian occupation of the Meuse-Rhine loess area and that of other regions. The occurrence of Cretaceous flint from sources c. 30 km north of the Meuse (the area of Orp-le-Grand) in cave sites south of Namur (Trou Da Somme and Bois Laiterie) qualifies the image that *all* sites are related to the Magdalenian occupation of the Central Rhine Valley. Based on the data presented in this chapter, the following relationship beween areas and sites is suggested as hypothesis for future research (fig. 8.2):

– Orp-le-Grand. Both camp sites (Orp-West and Orp-East) are located in the immediate vicinity of sources of good quality flint from the Senonian. The occurrence of these sources has probably to a large extent determined the choice of the location of both camp sites. Flint was worked and blades were produced on a large scale in both locations, probably partially with a view to future use in caves (of which Trou Da Somme and Bois Laiterie could be examples) south of Namur along the flanks of the Meuse valley and at the western edge of the Ardennes. Data on the provenance of flint materials do not point to a relationship between Orp-le-Grand and other, more easterly open-air sites of the Meuse-Rhine loess area.
– Kanne and Mesch. Within the group of northern open-air sites, these sites are most flint exploitation sites in nature. They can be regarded as locations where blades and tools were manufactured of Rijckholt flint (Kanne) and Rullen flint and Rijckholt flint (Mesch) for use in the camp sites themselves, but probably also in anticipation of future use in camp sites outside the Dutch-Belgian Cretaceous area. In view of their position near primary sources of Rijckholt flint and the extensive use of this flint in Gönnersdorf and Andernach, it is evident to link both sites to the Magdalenian occupation of the German Rhineland (Andernach and Gönnersdorf). In view of the

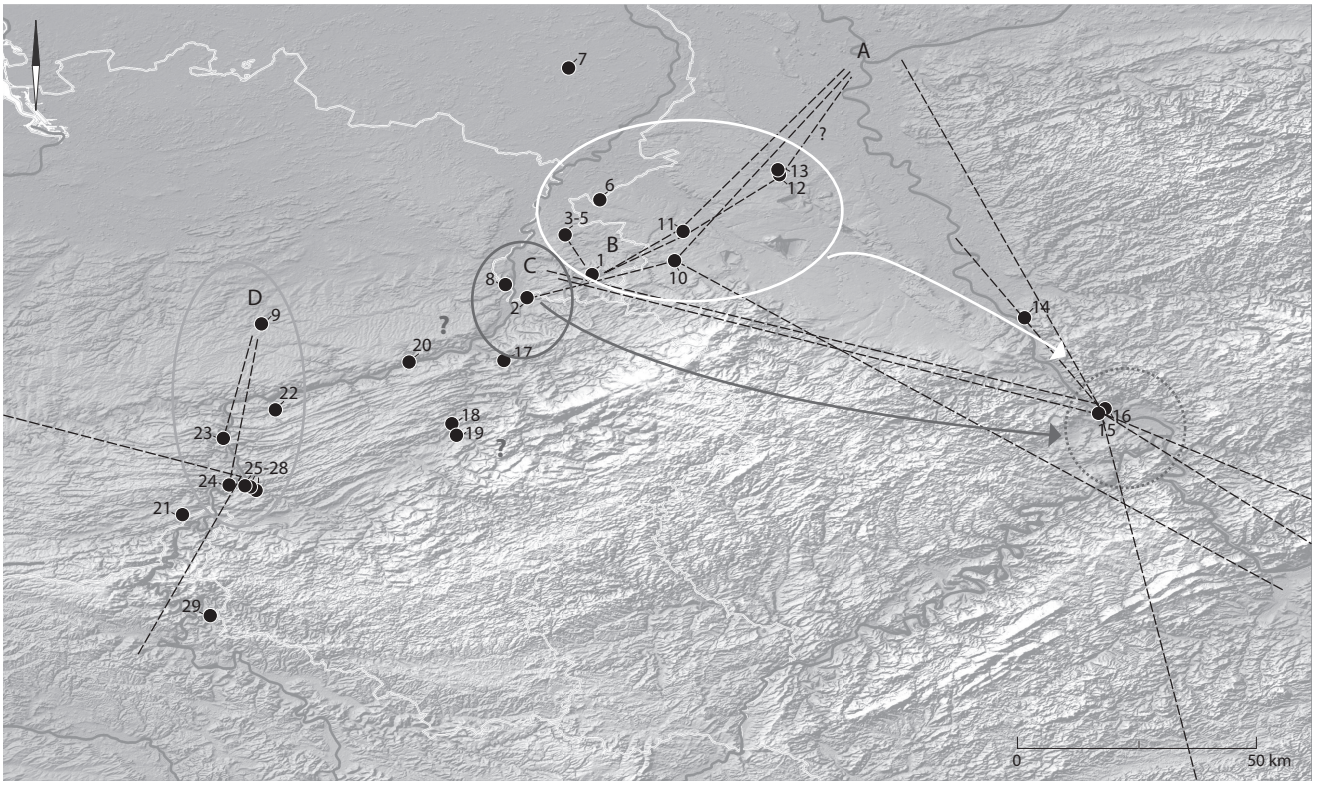

Figure 8.2 Relationships between areas and sites in the northern Magdalenian. For explanation, see text, and for legend, see figure 8.1.

short distance of Kanne and Mesch to the catchment area of the Ourthe, a relationship with the cave sites of the Ourthe Valley group is also a possibility. Further research into the exact character and origin of the worked flint in these sites (Verlaine, Coléoptère) is necessary to give a decisive answer to this point.

– Eyserheide, Alsdorf, Sweikhuizen-GP and -KW, Beeck and Kamphausen. With the exception of Eyserheide, these sites are located at least 10 km away from primary sources of Cretaceous flint. On this basis as well as the composition of the artefacts, they cannot be designated as flint exploitation sites. An interpretation as briefly occupied base camps by a small social unit (one nuclear family) is considered likely (see 7.9). For the production of stone artefacts use was made mainly of local terrace flint, but also artefacts of Orsbach flint, Simpelveld flint, Baltic flint (*Baltischer Feuerstein*) and, in Eyserheide, eluvial Rijckholt flint form part of the inventories. Both latter types of flint occur as non-local materials in Gönnersdorf and Andernach (see 8.3). Moreover, Sweikhuizen-GP has yielded artefacts of a freshwater quartzite which possibly originates from the Central Rhineland. For this reason it is evident to (also) link the above six sites to the Magdalenian occupation of the Central Rhine Valley.

We conclude this chapter with the (possible) implications of the presented data for the date and time depth of Magdalenian occupation of the Meuse-Rhine loess area. Earlier in this chapter, prior to the discussion of the Belgian cave sites, we indicated that the AMS radiocarbon dates of Gönnersdorf and Andernach (c. 13,300-12,700 BP) could be regarded as directional for the date of Eyserheide and nearby sites, namely in a late phase of the Pleniglacial (climatic event GS 2 as recorded in the Greenland GRIP ice core) and some C^{14} centuries prior to the prominent and sudden warming at the onset of the Late Glacial interglacial, that is to say prior to climatic event Gl 1e (in Central Europe: Meiendorf interstadial) (see 8.4). The notion that occupants of Belgian caves exploited flint sources in the western part of the Meuse-Rhine loess area and may have erected camp sites there (Orp-le-Grand, Kanne and Mesch?), seems to have no real implications for the time span in which the northern loess sites should be placed. Based on AMS radiocarbon dates, Charles (1996) assumes the time span of 12,900 to 12,600 BP as peak of Magdalenian occupation of caves in the Belgian Ardennes. Bearing this time span in mind, we can assume a slightly longer period within which sources of good quality flint in the Belgian-Dutch Cretaceous area could have been exploited, namely from 13,300 to 12,600 BP.