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19 Points of contact. Reflections on Bandkeramik-Mesolithic interactions west of the Rhine.

Marjorie de Grooth

19.1 Introduction

Shortly before the end of the second millennium AD, two well-preserved Late Mesolithic wetland sites were excavated at Hardinxveld-Giessendam, in the western part of the Netherlands (Louwe Kooijmans 2001a; 2001b). In his synthesis, Leendert Louwe Kooijmans ruminated on possible connections between the seasonal visitors of these river dunes (*donken*) and Bandkeramik farmers in Limburg and adjoining regions, such as might be deduced from the presence of arrowheads and flint nodules with a south-eastern origin. Some years earlier, the Early Bandkeramik settlement of Geleen-Janskamperveld (JKV) had been excavated in precisely that region (Louwe Kooijmans *et al*. 2003; Van de Velde *et al*. in press). As the JKV flint assemblage comprised a few microliths (De Grooth 2007), I thought it might be a good idea to explore the possibilities of such contacts, and thus maybe contribute to the never-ending debate on Mesolithic-Neolithic interactions, a theme that forms the essence of Leendert Louwe Kooijmans' research interest (cf. Louwe Kooijmans 1974). Of necessity, I shall do so from the perspective of one firmly rooted in Bandkeramik research traditions (De Grooth 1977; 2005). Thus, my view may be biased, overemphasizing the diversity its *aficionados* observe in the LBK, and missing out on the subtleties of Mesolithic lifestyles (and microliths). I may thus mistakenly perceive the two millennia of Late Mesolithic seasonal mobility, with its systematic and long-term use of specific locations in the landscape as a period of marked uniformity (cf. Modderman 1988). Although microliths, especially arrowheads inevitably will play a role in this story, I hope to achieve a broader scope of interpretation, involving an evaluation of raw material procurement strategies and flint working technology (cf. Allard 2007).

19.2 Chronological framework

Despite a large corpus of radiocarbon dates, the absolute chronology of the Linearbandkeramik is still controversial (Lanting/Van der Plicht 2000; Lüning 2005, Stäuble 2005; Stöckli 2002). The ongoing debate has partly to with the nature of the samples ('old wood' effects for charcoal samples; reservoir effects as the result of fish consumption affecting human and canine bones; lumping together of several fragments of carbonized grain to get a sufficient sample). Other factors are the relationship between the dated material and its surmised archaeological context, (cf. the AMS dates for the Merzbach valley discussed below), the place of isolated dated events in a settlement's history, and the integration of absolute dates and relative chronologies based on archaeological interpretations of settlement structures and pottery styles. Matters are not helped by the unfortunate fact that the INTCAL 04 calibration curve shows two important plateaux in the relevant period. The first is located between 6.300 and 6.250 BP (or *c*. 5.300-5.220 cal BC); the second from 6.200 to 6.140 BP (or 5.210-5.060 cal BC). Thus, radiocarbon dates falling within the ranges of these plateaux, after calibration show a wide range of possible calendar ages. Moreover, while a considerable number of dates on samples from short-living species have been published for the Earliest LBK (ELBK), very few such dates are available for the Flomborn and younger periods. The eight AMS dates recently performed on carbonized seeds from Geleen-JKV (Van de Velde 2007) are thus extremely important, especially as this settlement was mainly inhabited during the Flomborn phase.

19.2.1 Geleen-Janskamperveld

The Geleen-JKV dates range from 6.260 ± 50 BP to 6.110 ± 45 BP. In his interpretation, Van de Velde (2007) pooled the four dates for houses 12 and 13, thought to represent the earliest habitation at the site, with a weighted average of 6.204 ± 22 BP, converting to a wide range between 5.214-5.078. Then, assuming that this average could be some ten to fifteen years younger than the beginning of the two houses, the start of the Bandkeramik habitation in the Graetheide region was placed in the decennium around 5.220 cal BC. Although this fits rather well with the ideas expressed by Lanting and Van der Plicht (2000) and Stöckli (2002), the two older JKV dates should be taken into consideration as well. The sample from pit 20.027, belonging to house 49, has a date of 6.260 ± 50 BP or 5.310-5.205 cal BC, and one of the dates for house 12 reads 6.240 ± 70 BP, converting to a range between 5.303 and 5.076 cal BC. Even if the first date does not quite fit with the expected age of the decorated pottery found in the same pit, it should, in my opinion, be taken at its own value, which indicates that settlement at JKV may have started at least some fifty years earlier, and perhaps even as early as *c*. 5.300 cal BC.

19.2.2 Younger LBK Rhine-Meuse region

The six dates on carbonized grains published from the Aldenhovener Platte, presumed to be associated with the house generations XI to XIII, *i.e.* Modderman IIb-IIc, range between 6.290 ± 70 BP and 6.160 ± BP (Lanting/Van der Plicht 2000 referring to Hedges *et al.* 1993). Thus, they all overlap with JKV's Flomborn dates. As the three settlements in question, Langweiler 2, Langweiler 8 and Langweiler 9, were inhabited during a long time span (Stehli 1994), this discrepancy in itself can be explained, but that does not make it less unsatisfactory. Thus, the only reliable figures for the Younger LBK are dendrochronological dates for two construction phases of the well at Erkelenz-Kückhoven: 5.090 and 5.057 ± 5 cal BC (Weiner 1998). Although habitation at this settlement is thought to have started during the Flomborn period, the ceramics associated with the well clearly belong to the Younger LBK (Lehmann 2004). The two AMS dates 6.165 ± 45 BP and 6.115 ± BP for Liège-Place St. Lambert, S.D.T. sector, bridge the gap, but the associated sherds have not yet been stylistically dated (Van der Sloot *et al.* 2003). Older finds, from the eastern zone of the site, belong to Modderman's phases Id-IId (Rousselle 1984). The S.D.T. sector is of special importance, as here for the first time a clear stratigraphical succession of Late Mesolithic, Final Mesolithic, and Early Neolithic (LBK) could be documented and dated. Unfortunately, the stratigraphical position of the La Hoguette and Limburg sherds is still unclear. The Place Saint Lambert site as a whole is located on alluvial deposits of the river Légia, and its formation and post-depositional history were not only influenced by the dynamics of this river, but also by important building activities, notably the erection and demolition of Liege's Medieval Saint Lambert cathedral (Otte 1984b; Van der Sloot *et al.* 2003).

19.2.3 Earliest LBK

The dates procured from samples from short-living species (mainly carbonized grains, food remains and bones) currently available for the Earliest LBK (ELBK) in Austria and Germany range between 6.460 ± 80 BP and 5.970 ± 105 BP (Stäuble 2005). While a good many fall between 6.400 BP and 6.300 BP, a whole number of dates fall in the Flomborn range of Geleen-JKV. This is not only the case at Friedberg-Bruchenbrücken, where they partly may result from intrusion of younger LBK material into the ELBK pits, but also at Goddelau and Schwanfeld, where only ELBK was found. The dates for Schwanfeld fall between 6.380 ± 100 BP and 6.240 ± 55 BP, those for Goddelau between 6.370 ± 35 BP and 6.260 ± 40 BP.

19.2.4 Hardinxveld-Giessendam

The chronology of the Hardinxveld-Giessendam sites seems comparatively unproblematic, as it is based on a considerable number radiocarbon dates of samples from short-living species, in combination with lithostratigraphical observations (Louwe Kooijmans/Mol 2001; Mol/Louwe Kooijmans 2001). At Polderweg three phases are distinguished. Phase 1, a complex of refuse layers formed on the slopes of the dune as the result of colluviation, is dated between 5.500-5.300 cal BC. After a hiatus, inhabitation continued in Phase 2/1 (*c*. 5.100 cal BC) and Phase 2 (*c*. 5000 cal BC), known from material recovered from peat layers covering the higher parts of the slopes. Use of the other river dune, De Bruin, also started at *c*. 5.500 cal BC. Here, the first Late Mesolithic phase lasted till 5.100 cal BC. In the second phase, dated between 5.100-4.800 cal BC, very early Swifterbant pottery of northern Late Mesolithic tradition, was used alongside some pottery assigned to the Blicquy group. The makers of this pottery had a fully agrarian subsistence system, documented in settlements in the Hesbaye and the upper Dendre regions of Belgium. During the final phase, between 4.700-44.50 cal BC, Swifterbant pottery was still being used in a fishing/hunting/gathering setting.

19.2.5 Rhine Basin Group

Radiocarbon dates comparable to those from Polderweg and De Bruin have recently been published for the Final Mesolithic at Liège-Place Saint Lambert, S.D.T. sector (Van der Sloot *et al.* 2003). They range between 6.485 ± 80 BP and 6.220 ± 45 BP. No dated Late Mesolithic sites are known from the vast area between Liège and Hardinxveld-Giessendam, *i.e.* in the southern part of the Netherlands and lowland Belgium. Vanmontfort (2007) recently succinctly has summarized the situation: "These sites are often palimpsests and even if they are excavated, their absolute dating is confronted with major problems. Bad or doubtful spatial associations between dated samples and archaeological assemblages, dislocation of artefacts and samples caused by bioturbation, and problems related to the nature of samples are frequently mentioned obstructing factors. (…) As a consequence (…) there are no well characterised and well dated sites that can be used as a reference to relatively date the later Mesolithic" (Vanmontfort 2007, 106).

19.2.6 La Hoguette and Limburg

Finally, to conclude the chronological positioning of the protagonists of this story, the single reliable radiocarbon date currently available for the La Hoguette group must be mentioned. Carbonized food remains on a La Hoguette sherd recovered from a trial excavation in the Wilhelma Zoo of Stuttgart-Bad Cannstatt yielded a date of 6.353 ± 45 BP or between 5.380 and 5.300 cal BC (Kalis *et al.* 2001). The dates for layer 5 of the Bavans rock shelter in my opinion are not suitable to date La Hoguette. They range between 7.130 ± 70 BP and 4.310 ± 90 BP (Aimé 1987), indicating that the layer contained intrusive material from both older and younger periods (cf. Allard 2005).

For Limburg pottery only indirect data are available, through their being found in refuse pits of settlements west of the Rhine from the Flomborn period onwards, and in RRBP and Villeneuve-St. Germain contexts in more westerly regions (Constantin 1985; Allard 2005). The sites where Limburg pottery was found on its own, unfortunately, must all be regarded as palimpsests. As they are located in cover sand areas, bioturbation makes it impossible to separate assemblages in terms of time and space (Bubel 2003). At Kesseleik, the site where Limburg pottery was first found outside a LBK context, the sherds were found to be mixed not only with flints dating between the Early Mesolithic (an Ahrensburg point) and the Late Neolithic, but with Michelsberg and Beaker pottery as well (Modderman/Deckers 1984).

19.2.7 Discussion

In the end, which absolute chronology for the western LBK is favoured depends pretty much on one's appreciation of the value of the 'house generations' relative chronology developed for the middle Merzbach valley in the Rhineland (Stehli 1994), and on one's willingness to accept the possibility that ELB and Flomborn LBK partly co-existed (Lüning 2005). The 'house generation' scheme is quite practical for establishing relative chronologies and links between settlements on a regional (*e.g*. Claßen 2006; Kerig 2005), and even super-regional scale (Stehli/Strien 1986). Ultimately, however, it is a statistical construct, developed in the nineteen seventies, based on the seriation of decorated pottery found as secondary refuse in construction pits, educated guesses on the lifespan of Bandkeramik longhouses and on the overall duration of the LBK inhabitation.

Given all these considerations, I think it not unreasonable to adhere to the chronological framework recently proposed by Lüning (Price *et al*. 2001; Lüning 2005; 2007). In this view, the ELBK first appeared in Hungary, around 5.700 cal BC. Afterwards, it spread east, north and west, reaching the Rhine and Neckar valleys at around 5.500 cal BC. The subsequent Flomborn LBK is thought to have developed in the Upper Neckar valley and northwest Bohemia (Strien 2000), at *c*. 5.375 cal BC. Again spreading to the west, the Alsace and the Rhineland were reached *c*. 5.300 cal BC, where the expansion halted for a short time. Meanwhile, at some settlements, notably Friedberg-Bruchenbrücken and Goddelau, ELBK habitation continued till *c*. 5.180 cal BC (Stäuble 2005). West of the Rhine, Geleen-JKV was a 'first generation' settlement, as were Geleen-Kluis, Sittard, Elsloo and Stein. In other words, inhabitation west of the river Rhine was not a gradual, tentative step-by-step process, but started with a great leap westward, followed by filling-in of the areas in between. Several sites in this hinterland were settled in the same early stage as well, the best-studied one being Langweiler 8 on the Aldenhovener Platte (Boelicke *et al*. 1988). This interpretation corresponds nicely with the 'frog leap' models propagated in recent discussions on the expansion of both the ELBK and the Flomborn LBK (cf. Lukes/Zvelebil 2004; Whittle/Cummings 2007).

The first habitation phase at the Hardinxveld-Giessendam river dunes thus would have been contemporary with the Late Mesolithic at Liège-Place St. Lambert, with the early part of ELBK and the La Hoguette visits to Stuttgart-Bad Cannstatt, and with the start of Flomborn. Possibly, at that time the Graetheide already was part of the Flomborn LBK world, but this remains open to debate. Geleen-JKV certainly was contemporary with the second habitation phase at Hardinxveld-Giessendam, with the Final Mesolithic of Liège-Place Saint Lambert, and with the later ELBK of Friedberg-Bruchenbrücken and Goddelau. At the end, it may overlap with the start of LBK settlement at Liège-Place Saint Lambert.

19.3 Procurement strategies

One of the ways to establish possible contacts between different groups is to investigate to what extent they shared lithic resources. The inhabitants of all settlements under discussion knew wide-ranging networks through which raw materials circulated. Yet, present evidence suggests little or no overlap between them.

19.3.1 Geleen-Janskamperveld

At Geleen-JKV, little or no use was made of flints available in the immediate vicinity of the settlement: only seventeen out of almost 8.000 artefacts – including three cores but no retouched tools – originate from gravels deposited by the Pleistocene river Meuse, three of them could be classed as Oligocene or Miocene beach pebbles ('Meuse eggs', see below). Almost 98% of the raw material seems to originate from a single source, located at Banholt (Margraten, NL), some 25 km to the south of the settlement. Here, flint nodules from the western facies of the Lanaye member of the upper Cretaceous Gulpen Formation – commonly called 'Rijckholt flint' by archaeologists – occur in residual loams (Felder 1998; Brounen/Peeters 2001; De Warrimont/Groenendijk 1993). The Banholt eluvial variety may be distinguished from Lanaye flints from primary and slope deposits, because many nodules display considerable alterations as a result of their long stay in the residual loams – notably a higher translucency, the presence of a glass-like reddish-brown zone underneath the cortex, and of yellowish-brown streaks penetrating into the originally dark to light grey flint matrix (De Grooth in press c).

Other flint types outcropping in the region between Maastricht (NL), Liège (B) and Aix-la-Chapelle (D) were used only sporadically by JKV's inhabitants. The majority (n=33) have their origin in the Hesbaye region near Liège in Belgium (cf. Löhr *et al.* 1977; Cahen *et al.* 1986, Allard 2005). Fifteen of them are blade tools (45%). Not all this material reached JKV as blades or tools however, as is witnessed by the presence of one core on which a hammerstone fragment and a flake could be refitted, and of an end-scraper made on a crested blade. Flints from the Emael member – known to archaeologists as Valkenburg flint (*e.g.* Brounen/ Ploegaert 1992) – are mainly represented in the waste material, one retouched flake and one hammerstone fragment being the exceptions (n=27). Only five artefacts, four of them tools, were identified as flint of the Rullen type. Finally, four tools – one of whose LBK age is dubious – were made of the very dark grey, glossy and highly translucent flint originating from the Late Campanian Zeven Wegen member (Felder/ Felder 1998). Flint types from the eastern part of the limestone area, notably Lousberg, Vetschau and Simpelveld flint, were absent. For a detailed description of these flint types refer to De Grooth (in press c).

The inhabitants of the Bandkeramik sites at Elsloo and Beek-Kerkeveld also mainly used Lanaye flint of the Banholt variety (observation by the present author). Given the mention of transparent reddish-brown zones as typical for the so-called 'Rijckholt' flint encountered in the Rhineland (*e.g.* Deutmann 1997; Löhr *et al.*1977; Zimmermann 1988, 606), it seems plausible that most of this material mainly originated from Banholt as well. The 'Bandkeramians' from the Hesbaye region in Belgium, at sites such as Liège-Place St. Lambert, Darion, and Verlaine, predominantly used the locally available vitreous 'fine grained Hesbaye' flint – '*silex à grain fin d'Hesbaye*' (Allard 2005; Cahen *et al.* 1986; Caspar/Burnez-Lanotte 2006) or '*hellgrauer belgischer Silex*' in the terminology of Löhr *et al.* (1977). This was either collected from a secondary depositional position in river gravels (Liège, Otte 1984a), in residual loams (Verlaine, Petit Paradis, Allard 2005), or from primary deposits (Vaux-et-Borset, Caspar/Burnez-Lanotte 2006). At these sites a small amount of less fine grained flint – '*silex grenu d'Hesbaye*' (Allard 2005) was found as well, which could either derive from Lanaye deposits west of the Meuse, and thus be of local origin, or be considered imports from the Dutch outcrops (Otte 1984a).

19.3.2 ELBK

In most Oldest Bandkeramik settlements in southern, south-western and central Germany (Bavaria, Baden-Württemberg, Hessen) a variety of different flint and chert types were worked. Even if material of reasonable quality was locally available, considerable amounts of 'exotic' imported materials were used as well (Gronenborn 2003, Mateiciucová 2004). The most important of these were radiolarites from Szentgál, close to lake Balaton in Hungary, Jurassic cherts from the Franconian and Suabian Albs (in Bavaria and Baden-Württemberg), with cherts from the Wittlinger Chalks to the south of Stuttgart forming a special subtype (Strien 2000), and northern erratic flints, occurring in ice-pushed deposits, *e.g.* in Lower Saxony and Thuringia. A good example of this raw material variety is offered by the Bavarian site of Schwanfeld (Ldkr. Schweinfurt, Lower Franconia), to the north of Würzburg (Gronenborn 1997b). Here, 50% of the assemblage consisted of cherts from the Franconian Alb, 60-80 km to the south; 30% were probably erratic northern flints, which occur some 150 km to the north. Finally, 1% of the assemblage was formed by Szentgál radiolarites, outcropping some 650 km tot the east. This pattern clearly indicates the existence of stable long-distance exchange networks.

For the present study, the ELBK raw material procurement practices in Hessen are of special interest, as here flint types originating in the Aix-la-Chapelle/Maastricht/Liège area played an important role beside the northern and south-eastern varieties. This was especially the case at Friedberg-Bruchenbrücken (Wetteraukreis), where over 81% of *c.* 200 flints from the first excavation campaign are of the Lanaye/ Rijckholt and of the Vetschau type (Gronenborn 1997a; 1997b). The fact that blanks of both raw materials display similar knapping characteristics supports the idea that both were produced locally. Given the low numbers recovered, the absence of Lanaye/Rijckholt cores is not surprising. At least two artefacts made of the Banholt variety were identified among the Oldest Bandkeramik material from the second excavation campaign by A.L. Fischer and the present author (Fischer 2005; De Grooth in press c). Interestingly, local materials were all but absent from the Bruchenbrücken assemblage, although good-quality quartzite abounds in this part of Hessen (Sommer 2006). At Steinfurth (Wetteraukreis), too, over half of the 45 artefacts were of western origin. Here, even though the vitreous Hesbaye flints appear to be quite numerous, Lanaye/Rijckholt and Vetschau material was identified as well, as were northern erratic flints and south-eastern Jurassic cherts (Gronenborn 1997b). At Goddelau (Kr. Groß Gerau), finally, the majority of the material that could be sourced consisted of Jurassic cherts (especially Wittlinger chert), and only two probable western artefacts were present (Gronenborn 1997b).

19.3.3 Hardinxveld-Giessendam

Polderweg and De Bruin are situated in an area where flints and other flakable stones do not occur locally (Van Gijn *et al*. 2001a; 2001b). At both sites the vast majority of flint artefacts were made from a special type of small flint nodules (Polderweg 80% in the first two phases; 56% in the youngest one; De Bruin: phase 1 :82%; phase 2: 57%, phase 3: 46%). These so-called 'Meuse eggs' possess heavily abraded, glossy dark grey or sometimes red or yellow natural surfaces. They originate from the limestone area of the provinces of Limburg (NL and B) and Liège (B), and had been part of an Oligocene or Miocene pebble beach before being transported northwards by the river Meuse during the Pleistocene (Felder 1998; Berendsen 2004). Other flints from river gravels were the second most important source at Polderweg (between 16% and 14%). At De Bruin, however, erratic flints with a northern origin were increasingly important: from 13% in phase 1 to 39 and 47% in phases 2 and 3 respectively.

For all three varieties, the occurrences nearest to Hardinxveld would be at a distance of some 60-80 km to the east, in the vicinity of Arnhem and Nijmegen, either in the northernmost extension of the terraces of the Meuse and Rhine, or in ice-pushed deposits such as occur in the Veluwe and the Rijk van Nijmegen, to the north of the Meuse and Rhine river valleys. Although the southern flints were originally transported by the river Meuse, they may be found in Rhine deposits as well, because during the Pleistocene Rhine and Meuse repeatedly changed their course and thus alternately cut into each other's deposits (Berendsen 2004). The preference for 'Meuse eggs', however, seems to indicate that southern material may have been collected further upstream the Meuse. According to Arora (1979) such pebbles are only rarely found to the north of a line connecting Venlo (NL) on the Meuse and Krefeld (D) on the Rhine, whilst concentrations of 'Meuse eggs' may be found at an outcrop at the Süchtelner Höhen, near Viersen (D), *i.e.* just to the east of Venlo (Löhr *et al*. 1977). Their small size may have had one advantage, in that they may be more stable than other gravel flints, showing fewer hidden cracks and thus causing fewer unpleasant surprises when being reduced.

Among the less frequently used materials, two are of special interest to the present study. At Polderweg, in all phases a small amount of Lanaye/Rijckholt flints was found, whose primary and eluvial outcrops are located some 120 km to the southeast of the site. The presence of cortical flakes and especially of a pre-core with a weight of *c*. 4 kgs (Phase 1) indicates that not only blanks and tools were brought into the site, but that this material was worked locally. The amount varies from 3.4% in phase 1 to almost 30% of all artefacts whose raw material could be determined in phase 2. This type of flint was of less importance at De Bruin, although some specimens of 'Hesbaye' flint from the Liège area were documented. At both sites, Wommersom quartzite is found in only very low numbers – at Polderweg eight artefacts, all but one belonging to the first habitation phase; at De Bruin 7 artefacts (Van Gijn *et al*. 2001a; 2001b). This material originates from an outcrop close to Tienen (Flemish Brabant, B), some 90 km to the southeast (Gendel 1982).

19.3.4 Rhine Basin Group

In general, the inhabitants of Late and Final Mesolithic sites of the Rhine Basin Group – or Rhine-Meuse-Schelde B (RMS B) complex (cf. Gob 1985) – for which data on raw material procurement have been published, are thought to have collected their flints at the closest possible source. Thus, the majority of them used pebbles and rolled nodules from local (or regional) river gravels, even if it was of poor quality. This even holds true for sites located at a similar distance to the limestone area as was Geleen-JKV, such as Dilsen-Dilserheide (De Bie *et al*. 1991) or Opglabbeek-Ruiterskuil (Vermeersch *et al*. 1974). Even at Mesch-Stenenberg (Eijsden, NL), a Late Mesolithic site only three to four kilometres distant from the Lanaye flint extraction points at Rijckholt, Banholt, and Mheer, a different type of flint was used (De Warrimont/Wouters 1981). Interpreting this assemblage is not altogether unproblematic. Most of the published microliths actually cannot be linked reliably to the site (De Warrimont pers. comm. November 2007), and the Mesolithic date of core and flake axes in the southern Netherlands is recently under discussion (Verhart/Groenendijk 2005). Moreover, the original raw material identification should be revised. According to A. Wouters the material, a vitreous, translucent very dark grey or black flint with few light inclusions, was of northern, erratic origin (and thus suggested the presence or influence of northern Mesolithic traditions in the southern parts of the Netherlands). Nowadays, the material is thought to be local, originating from the Zeven Wegen member of the Gulpen Formation (Felder 1998), and collected from a secondary depositional context in the slopes of the river Voer valley (De Warrimont pers. comm. November 2007).

The flints worked in the Late Mesolithic occupation of the S.D.T. sector at Liège-Place St. Lambert had the same source as those described earlier for the LBK habitation: they were transported nodules from vitreous Hesbaye flint, collected locally in deposits of the river Légia (Van der Sloot 1999). Material from bedrock (or slope) deposits in the Vetschauerberg/Lousberg area was of regional importance, being mainly used at sites located within 35 km from the outcrops, although it was transported to the other side of the Rhine, up to 100 km from the source, where it made up 1-2% of some Early Mesolithic assemblages (Arora 1979).

Merselo-Haag (Venray), in the north Limburg Meuse valley seems an exception to this general pattern (Verhart 2000). Although the majority of flints are made from nodules collected from local gravels, some material is thought to derive from residual loams or from slope deposits in the Dutch/Belgian limestone area. It is not easy, however, to determine the proportion of primary and residual material from Verhart's (2000) descriptions. This problem is caused by ambiguities in the way material originating from primary and secondary depositional contexts was differentiated. It should be noted that the cortex of flints from terrace deposits close to the limestone area may be very little altered (Löhr *et al*. 1977), whilst the cortex of most Lanaye nodules from residual loams is still rough (De Grooth in press b). However, I do not doubt that some of the Merselo flints indeed originate from the limestone area, and I even think it plausible that some of the material described as having a reddish or brownish zone under the cortex may have been collected at the Banholt extraction point.

At almost all Late Mesolithic sites, however, varying amounts of imported material were worked and used as well, notably the characteristic quartzite outcropping only at Wommersom, near Tienen in northern Belgium (Gendel 1982). It is ubiquitously present in Belgium and the southern part of the Netherlands, but becomes rare north and east of the Rhine. The percentages vary from almost 50% to less than one percent.

19.3.5 La Hoguette

To my knowledge, at present only two sites exist of which something may be said about lithic raw materials associated with La Hoguette pottery or its *Begleitkeramik* (cf. Jeunesse 1994; Brounen 1999): the Wilhelma site of Stuttgart-Bad Cannstatt in Baden-Württemberg (Strien/Tillmann 2001) and Haelen-Broekweg in middle Limburg (Bats *et al*. 2002). At Wilhelma, the predominant material (nine out of 16 artefacts) is Wittlinger chert (from Jurassic outcrops in the Suabian Alb, some 40 km to the south of Stuttgart). Other Jurassic cherts may originate from the Suabian or Franconian Alb. At least two artefacts are made of a vitreous, translucent Upper Cretaceous flint called 'pseudo-Baltic' or 'Tétange' flint in German literature (Zimmermann 1995), whose origin is controversial. Finally, the raw material of one artefact resembles that used at the Bavans rock shelter in the French Jura. At Haelen, the artefacts associated with La Hoguette *Begleitkeramik* in all probability were made from Lanaye flints (Bats *et al*. 2002). As they lack cortex or other natural surfaces, the depositional context cannot be assessed. Their somewhat bleached aspect, however, suggests an eluvial origin.

19.4 KNAPPING STYLES

In this section, I shall not try to reconstruct precise knapping techniques applied, because it is well-known that different techniques may be used to obtain identical results (Newcomer 1975; Tixier 1982; Inizan *et al*. 1992). My purpose is rather to describe the characteristics left on cores and blanks by whichever technical procedure was used in the reduction process. Differences in these procedures are thought not to be a matter of technical necessity, but of choice, and thus ultimately they reflect technological and cultural traditions (Lemonnier 1993). The most important, and best observable, variables are the desired angle between striking platform and core face – visible directly on cores and in the *angle de chasse* between butt and dorsal face on blanks (Inizan *et al*. 1992), and the ways striking platform or core face were readjusted during knapping, so as to maintain the required angle between them.

19.4.1 Geleen-Janskamperveld

Despite the presence of flake cores and of a great many flakes, Geleen-JKV's assemblage may be described as a blade industry, because the majority of tools were made on blades and there is evidence that partially reduced blade cores were exported from the site to be further reduced at other LBK settlements (De Grooth 2007; in press a).

Most blade cores are cylindrical in shape and possess only a single striking platform. Striking platforms were made by the removal of one or several large decortication flakes. The desired flaking angle was *c*. 90°. This angle was maintained in different ways. Firstly, a somewhat perfunctory type of dorsal reduction was commonly practiced. Subsequently, larger flakes were removed centripetally from the striking platform (resulting in faceted core platforms and flat or dihedral butts on the blades). The final and most drastic stage of readjustment consisted of the detachment of a rejuvenation tablet. The same core face remained in use, but the blades produced were 1-2 cms shorter.

In general, the blades are rather short and stocky: the average length of entire blades is 40.3 mms (range between 17 and 81 mms), and the length and width of complete blade tools – other than arrowheads – averaged 39.8 mms (range 16-86 mms) and 22 mms (range 8-39 mms). The mean Length:Width index of complete blades is 2.6. As a result of the way striking platforms were prepared and maintained, the surface of the butts was plain (52%) or dihedral (46%). The majority of butts are oval in shape (63 %), the others mostly semi-oval or ribbon-like (16% and 17% respectively). Linear or point-like butts are virtually absent. The butts are comparatively large (platform width mean 10.6 mms, sd 3.1; platform thickness mean 4.3 mms, sd. 1.4). Their width, however, is always considerably smaller than the maximum width of the blade. The bulbs of percussion mostly are diffuse (75%), and often a slight ventral lip is present (66%). Lance scars and pronounced *eraillures* (bulbar flakes) occur quite often too (59%).

A knapping style very similar to the one described for JKV was practiced at other Flomborn sites, *e.g*. Elsloo

(De Grooth 1987), Langweiler 8 in the Rhineland (Zimmermann 1988) and Gerlingen and Vaihingen in Baden-Württemberg (Strien 1999; 2000). Moreover, this general knapping style was widely spread in the subsequent LBK of Central Europe, *e.g*. at Hienheim in Bavaria (De Grooth 1977). By and large, this style continued to be used in the younger sites of the Graetheide cluster and in the Hesbaye, although some subtle differences are apparent. The inhabitants of Beek-Kerkeveld also used the Banholt raw material source, but produced considerably longer blades. The amount of dorsal reduction decreased too, as did the practice of platform readjustment through the removal of centripetal flakes (De Grooth 1987). This trend is even more marked in the Hesbaye settlements Liège-Place St. Lambert (Cahen 1984) and Verlaine, Petit-Paradis (Allard 2005). Platforms preferably were rejuvenated by means of the systematic, almost exuberant removal of whole series of tablets, a method highly wasteful in terms of raw material economy (but quite nice for modern refitters). However, according to Allard (2007), centripetal flaking to prepare platforms was widely used in the LBK of the Paris Basin.

19.4.2 ELBK

In the last two decades a great deal of information on the ELBK knapping style has become available (Tillmann 1993; Gronenborn 1997b; Mateiciucová 2004). In Bavaria, Baden-Württemberg and Hessen the favoured angle between striking platform and core face was *c*. 90°. Preparation by dorsal reduction was practically unknown. Fine-tuning instead took place through the removal of tiny chips from the striking platform before each blade was detached. This preparation was performed to such an extent, that the faceted part was almost as wide as the blade to be. This procedure resulted in blades with a 'primary faceted' butt, *i.e*. a butt on which complete negatives of chip removals are present. Intermittently, a number of blades was produced without readjustment of the angle, resulting in butts with secondary facets, *i.e*. incomplete negatives. The butts were wide, reaching 50-70% of the maximum width of the blade, and most blades had both a ventral lip and a pronounced bulb of percussion. The blades are long and slender with straight, parallel edges and with a Length:Width index of at least 1:3. This knapping style is indistinguishable from the one practiced by Late/Final Mesolithic groups in southern and south-western Germany (Tillmann 1993; Gronenborn 1999).

Once more Bruchenbrücken is exceptional, and again, it should be noted that evaluation and interpretation of its data are problematic, as most ELBK refuse pits contained important amounts of younger, intrusive, Bandkeramik material as well (Gronenborn 1997a). However, many regular blades and tools made of 'western' Cretaceous flints (from the Meuse region) possess the pronounced bulbs and wide, primary faceted butts characteristic for the ELBK. In addition, a few (n=9) blades with diffuse bulbs, dorsal reduction and small butts were found in pits assigned to the ELBK. These are seen to represent a (north-)western European Late Mesolithic knapping style, and hence to document the coexistence of two different cultural traditions in the settlement (Gronenborn 1999). Alternatively, they could be the result from contacts with the ELBK settlement cluster around at Eilsleben (Kr. Wansleben, Saxony-Anhalt) and Eitzum (Ldkr. Wolfenbüttel, Lower Saxony), where cores with acute detachment angles, and sometimes with alternately worked opposed platforms were worked according to northern Mesolithic traditions, producing blades with small plain or punctiform butts (Wechler 1992).

19.4.3 Hardinxveld-Giessendam

The knapping performed at the Polderweg and De Bruin sites resulted mainly in irregular flakes. This happened especially when the bipolar (or 'hammer-and-anvil') technique was used on 'Meuse egg' flints, and the assemblage accordingly is described as a flake industry (Van Gijn *et al*. 2001a; 2001b). However, a small number of regular blades and blade tools were present at the sites as well. It is impossible to determine whether they were made by the river dunes' inhabitants, at one of their other seasonal camps (perhaps located in the vicinity of extraction points), or were acquired from others through some form of exchange. Although no detailed technological analyses were performed, the knapping style displayed by these artefacts fits into the general flint knapping tradition of the Rhine Basin Group/RMS B complex, described below.

19.4.4 Rhine Basin Group/RMS B Complex

In this tradition, the desired angle between striking platform and core face is acute. The initial striking platform was formed by the removal of one decortication flake. The preferred way of readjustment of the flaking angle consisted of dorsal reduction, *i.e*. the removal of tiny chips off the proximal part of the core face. This resulted in blades with either a plain or a dihedral butt, and an acute *angle de chasse*, generally speaking between 75°and 85°. Occasionally, the striking platform was rejuvenated by centripetally removing short, wide flakes, or by the detachment of a rejuvenation tablet. The majority of cores possessed a single platform, or two opposed or orthogonal platforms that were used consecutively.

Within this general tradition two knapping styles are distinguished. The first, the so-called Coincy style, as defined originally by Rozoy (1968a) for the French Middle Tardenoisian (Middle Mesolithic), is characterized by short, stocky blades. Dorsal reduction was careful and extensive, resulting in butts that are both markedly narrower than the width, and thinner than the thickness of the blade. The blades are sinuous in longitudinal section, especially in the distal part, although not really plunging. The second, the Montbani style (Rozoy 1968a), connected to the recent phase of the Tardenoisian in which trapezes are present (Late and/or Final Mesolithic), has slender, very thin, regular blades, with parallel sides and dorsal ridges. The thickness is constant over their entire length, and Montbani-style blades are less sinuous than their Coincy counterparts. Dorsal reduction is less pronounced than in the Coincy style, resulting in butts that are thinner than the thickness, but not narrower than the width of the blade. In several cases, however, blades with really small, thin, and narrow butts too are described as displaying the Montbani knapping style – *e.g.* at Weelde-Paardsdrank (Huyge/Vermeersch 1982) and Haelen-Broekweg (Bats *et al*. 2002). Obviously the criteria 'slender', straight', 'with parallel edges and arises' are deemed sufficiently characteristic.

Both styles are found not only in the area of the Rhine Basin Group, but also further to the south. The Montbani style occurs for example in the Mesolithic layers of the Bavans rock shelter (Aimé/Jeunesse 1986). In Belgium and the southern part of the Netherlands, both styles were practised at broadly coeval sites. At some sites, such as Weelde-Voorheide (Verbeek/Vermeersch 1995), artefacts made from locally available flint display the Coincy style, whilst most of the Wommersom artefacts were made in the Montbani style. At others, such as Weelde-Paardsdrank 5 (Huyge/Vermeersch 1982) flint and Wommersom blades alike are described as being Montbani-like in knapping style; the *angles de chasse* are *c*. 75° (Gronenborn 1997b). At Merselo-Haag (Venray), a number of long, regular blades of Wommersom quartzite in Montbani-style, are thought to have been imported and not produced locally (Verhart 2000).

The site of Liège-Place St. Lambert, sector S.D.T., again is of special interest, because of its proximity to Geleen-JKV both in time and in space. This assemblage is characterised by Van der Sloot (1999) as resembling the 'style de Coincy'. This holds true for both artefacts made from locally collected Hesbaye flint and for artefacts made of imported Wommersom quartzite. At this site the majority (52%) of butts are linear or punctiform in shape. 34% Of the blades have a plain butt. Dihedral or faceted butts are the exception (4%). The blades are stocky, with irregular, sub-parallel edges and arises. The length of entire blades lies between 20 and 50 mms, and their width mainly between 10 and 15 mms. The Length:Width index varies between 2 and 3, but the majority of blades has an index close to 2.

19.4.5 La Hoguette

The blades and tools found associated with *Begleitkeramik* at Haelen are slender and regular (Bats *et al*. 2002), with a width between 15 and 25 mms. Their butts are plain, relatively narrow and thin, with extensive, careful dorsal reduction. The bulbs of percussion are diffuse, with few (and then tiny) bulbar scars. Most blades carry a clear ventral lip. They rather bring the 'imported' blades of Merselo-Haag (Verhart 2000) to mind. The few blades found at the La Hoguette site of Stuttgart-Bad Cannstatt (Strien/Tillmann 2001) possess small, plain or dihedral butts. The negatives on the dihedral butts are relatively large, and some dorsal reduction is present. In size, they are considerably larger than the blades known from regional LBK settlements. They are thought to resemble French Late Mesolithic assemblages. For neither of these two La Hoguette assemblages data on the *angle de chasse* are at present available, but both could have been made in the Montbani style.

19.5 Arrowheads

Recent discussions on Mesolithic-Bandkeramik interactions west of the Rhine, and on the possible relationships existing there between the LBK and the La Hoguette and Limburg groups focus almost exclusively on arrowheads (*e.g*. Löhr 1994; Gronenborn 1990; 1999; Jeunesse 2002; Gehlen 2006; Heinen 2006; but see *e.g*. Allard 2005; Hauzeur 2006 for a critical view). They are seen as markers for cultural identity, providing an insight into regional and supra-regional traditions and connections (Gehlen 2006). Focal in these discussions are the so-called Bandkeramik arrowheads (Danubian points or *pointes Danubiennes*), and a group of points known as 'Bandkeramik-like points' or 'points of Danubian type', such as found in a Late Mesolithic context at Weelde-Paardsdrank 5 (Huyge/Vermeersch 1982). Unfortunately, despite the frequent use of these labels, and especially in view of the far-reaching interpretations based upon their occurrence, these types are not very well-defined.

Defining characteristics for the 'classic' Bandkeramik points originally were an asymmetric triangular outline and one obtuse basal angle (Bohmers/Bruijn 1958). Considerable variation was allowed in the shape of the base and the ways base and long sides were retouched. Thus, the base could be unretouched or carry a flat ventral retouch, that may or may not be combined with steep retouch on the dorsal face, resulting in a slightly hollow base. Additionally, one of the long sides usually carries more intensive retouch than the other one. In recent literature, the flat ventral basal retouch is commonly called '*retouche inverse plate* (RIP)' (Rozoy 1978; Löhr 1994), or '*retouche plate inverse* (RPI)', according to Jeunesse (2002). For Newell (1970), the basal angles were of no interest. He insisted on asymmetry and the shorter of the sides being shaped by a burin scar on the tip, combined with flat dorsal retouch on the rest of that side, whilst the longer side remained unretouched. Nowadays, both the obtuse basal angle and the burin scar seem to have lost definitional importance. Instead, slight asymmetry (with acute basal angles) suffices, but a base shaped by flat retouch on the ventral site, preferably combined with steep retouch on the dorsal face, is a *conditio sine qua non*. Ideally, the base should be concave, but straight ones are acceptable as well. Additionally, one of the long sides should be left unretouched. Unfortunately, no clear definitions are offered that would lead to unambiguous, replicable distinctions between symmetric and asymmetric triangular points. Thus, some perfectly symmetrical points are included too, such as the three points found at the ELBK settlement at Goddelau in Hessen (Gronenborn 1997b). Even quadrilaterals, especially those with flat ventral basal retouch sometimes are included among the 'Bandkeramik points' (*e.g.* Brounen/Peeters 2001).

Matters are even more confusing because asymmetric triangular points with flat ventral retouch on the base found in a Late Mesolithic context commonly are called 'Bandkeramik-like' points (*e.g.* Huyge/Vermeersch 1982), or even 'Danubian point' (*pointe danubienne*, Rozoy 1968b). Originally, the label 'Bandkeramik-like' seemed to make sense, because these points were thought to have been made under the influence of true LBK examples, such as were often found outside the areas settled by Bandkeramik farmers. Nowadays, an entirely different argumentation prevails, and the 'Bandkeramik-like' points are regarded as the prototypes. Their origin is sought in (south-)western European Mesolithic traditions (Löhr 1994; Jeunesse 2002; Gronenborn 1999; Gehlen 2006) and they would have been introduced to the incoming farmers by local hunter-gatherers, or even be evidence for a profound involvement of those indigenous groups in shaping the western Bandkeramik world. Thus, this point of view returns to the one already formulated by Newell (1970), but with different arguments, and involving different Mesolithic groups (*e.g.* Heinen 2006).

The argumentation is based on several typomorphological observations. The first of these has to do with the occurrence of flat ventral retouch (RIP) on the base of both symmetric and asymmetric arrowheads. This trait is encountered on many Late Mesolithic trapezes, and its origins are sought in central and south-western France (Gehlen 2006), where it is commonly found on both trapezes and triangular points belonging to the Early Neolithic Rocadourian Culture (Roussot-Larroque 1990). The second observation considers regional traditions in the lateralisation of trapezes and asymmetric triangular points. To assess this lateralisation, the artefact is observed with the dorsal face up, the base closest to an imaginary X-axis and the longest side parallel to the Y-axis. The location of the shortest parallel side (for trapezes and quadrilaterals) or of the angle between base and shortest side (for triangles) determines whether the point is regarded as right-winged or left-winged (Löhr 1994). According to Löhr (1994) and Jeunesse (2002), left-winged arrowheads prevail in Alsace, along the Neckar and the Moselle river area, whilst right-winged arrowheads are predominant in the LBK of Dutch Limburg, Belgium and north-western France. This east-west dichotomy is thought to have its origins in Late Mesolithic traditions, where right-winged asymmetric trapezes are found mainly in the area between the river Seine and the Lower Rhine (as well as on the northwest European Plain and in Denmark). Left-winged trapezes have a more southerly distribution, with concentrations in southern France, Switzerland and northern Italy.

The combination of these two phenomena, on many arrowheads found in the flint industry of both western Bandkeramik groups and their successors such as the Rubané Récent du Bassin Parisien and the Villeneuve-Saint-Germain group (Allard 2005) is seen as evidence for interactions between the LBK newcomers and a local substrate. Moreover, both Löhr (1994) and Jeunesse (2002) see a connection between the distribution areas of asymmetric arrowheads and the Early Neolithic non-Bandkeramik pottery groups La Hoguette and Limburg: left-winged points mainly occur in the area where La Hoguette pottery prevails, whilst right-winged points have a similar distribution as Limburg pottery. Finally, the use of the microburin technique too is seen as evidence of Mesolithic influence.

Additionally, it should be noted that triangular points with a retouched base (and with RIP) are found only rarely in a Late Mesolithic context in the southern part of the Netherlands and lowland Belgium. In this region, mistletoe leaf points (*feuilles de gui*), and other points with surface retouch are thought to be characteristic for the Middle Mesolithic (Rhine-Meuse-Schelde group A), with trapezes and backed bladelets marking the start of the Late Mesolithic (Rhine Basin group or RMS B) (Gob 1985, Otte/Noiret 2006). In the Upper Danube Valley, the Jura and northern Switzerland, however, triangular points with basal retouch have a long tradition, going back to the Early Mesolithic (Gehlen 2006; Thévenin 1992). Thus, the triangular points with RIP in the Rhine-Meuse-Schelde region would point to southern connections.

Finally, it is often assumed that the Middle Mesolithic types with surface retouch continued to be used during the Late Mesolithic (Gob 1985; Heinen 2006). This claim is difficult to assess, because of the lack of well-dated, briefly occupied or well stratified sites mentioned in an earlier section (cf. Vanmontfort 2007; Vermeersch 2006). Anyhow, here as in almost every part of Late Mesolithic Europe, trapezes, mostly made of standardized, regular blades, were the most common type of projectile point.

Besides the similarities, there also exist clear differences between 'Bandkeramik' points from a direct LBK context, and their Mesolithic counterparts (Huyge/Vermeersch 1982; Allard 2007). Belland *et al*. (1985) have sought to outline these differences through the comparison of a group of asymmetric triangular points with bifacial basal retouch ('points with Bandkeramik affinities') from the Himeling surface site (Moselle department in northern France, just south of Luxembourg) with points from a secure LBK context in Lorraine. They found that the Mesolithic specimens in general were smaller and narrower and less intensively retouched. By definition all the bases carried flat ventral retouch (RIP), and mostly steep dorsal retouch as well. In the Himeling sample most points had only one retouched long side, and bifacial retouch of the long sides occurred less frequently too than in the Lorraine sample.

19.5.1 Geleen-Janskamperveld

Given its Early LBK date, a study of the Geleen-JKV arrowheads may provide a valuable contribution to the present discussion, especially as this settlement is located in a region where La Hoguette/*Begleitkeramik* and Limburg ceramics are found not only in Bandkeramik refuse pits (Brounen/Vromen 1990; Van de Velde 2007), but also independently (Modderman/Deckers 1984; Modderman 1987; Brounen 1999; Tol 2000; Bats *et al*. 2002).

Among the *c*. 7000 flint artefacts excavated at Geleen-Janskamperveld, three microlithic points were found. One of these was incomplete, two could be identified as B-points, *i.e*. microliths with an oblique, partial dorsal retouch along one of the edges; one of them had some slight retouches on the base as well.

Initially, following existing typomorphological sequences (*e.g*. Verhart/Arts 2005; Verhart/Groenendijk 2005; Wansleeben/Verhart 1992) I readily assigned them to the Early Mesolithic and thought them to represent activities predating the LBK by some millennia (De Grooth 2007). Given the Hardinxveld-Giessendam evidence for B-points still being used at the time of JKV's Bandkeramik habitation, this conclusion was somewhat premature. The points are unweathered, and made of Lanaye flint from an unspecified depositional context. Moreover, the same pit contained several bladelets that would not have been out of place in a Mesolithic context. At present, I see no possibilities to decide whether the microliths indeed predate JKV, or are proof of contacts between Bandkeramik settlers and local hunter-gatherers. In general, the idea still prevails that LBK settled in areas that were only marginally exploited by hunter-gatherers. Microliths found at western LBK-sites are presumed to be considerably older, especially as they include Middle Mesolithic types that are assumed to have been out of use since the middle of the 7th millennium cal BC (Vanmontfort 2007).

Of the 48 other arrowheads that could be described in typomorphological terms, 21 were asymmetric triangles, and three asymmetric quadrilaterals, thus 50% may be described as asymmetric (table 19.1). Ten of the asymmetric triangles are left-winged, the other eleven and the three quadrilaterals were right-winged. The intensity of retouches could be assessed for 42 of the points. Quite a number of bases are unretouched, not only on the symmetric points, but also on three out of 14 right-winged ones. RIP, with or without accompanying steep dorsal retouch, is found on 50% of the left-winged points and on even fewer of the other two varieties (35-39%). 90% Of the left-winged points had retouches on both long edges, as have 76% of the symmetrical points, but only 10% of the right-winged ones display such retouch.

Finally, a slight majority of JKV's points (55%) does not display bifacial retouch on either one or both of the long sides. This especially holds true for the right-winged asymmetric group, and to a lesser extent for the left-winged ones. For the symmetric ones the situation is reversed: two thirds are bifacially retouched on either one or on both long sides. Pronounced asymmetry, characterizing 'Bandkeramik points *sensu* Bohmers/Bruijn' (1958), with an obtuse angle between the base and one of the long sides, however, is found on only ten of them (21%), equally divided among the right- and the left-winged specimens.

19.5.2 Hardinxveld-Giessendam

The points from Hardinxveld-Giessendam, too, are of special interest, because they were found in a stratified, well-dated context (Van Gijn *et al*. 2001a; 2001b). Four of the triangular points thought to posses Bandkeramik affinities – two from each site – strongly resemble the 'Bandkeramik-like' points from *e.g*. Weelde-Paardsdrank 5 (Huyge/Vermeersch 1982), Merselo-Haag (Verhart 2000) and Himeling (Belland *et al*. 1985). The two others, however, from a typomorphological point of view really would not be out of place in a LBK context. The first one, from Polderweg phase 1 (5500-5300 cal BC), is a left-winged asymmetrical point, its basal angles are acute, the base is concave and shaped by RIP and steep dorsal retouch. Both long sides are retouched too, the left one more intensely than the right one. One of the De Bruin phase 2 points, too, would on the basis of the Himeling criteria rather fit into an Early Neolithic than a Mesolithic context.

19.5.3 ELBK, La Hoguette

The characteristic projectile points found in ELBK settlements are small, mostly symmetric, trapezes. They are very similar to the ones used during the Late Mesolithic of southern and south-western Germany (Gehlen 2006; Gronenborn 1999). Although some associations between left-winged asymmetric points and La Hoguette ceramics are documented (Gehlen 2006), trapezes were present at both Stuttgart-Bad Cannstatt and Haelen-Broekweg. The triangular

		left-winged	right-winged	symmetric	?
lateralization		10	14	18	6
basis					
	RIP+Dorsal	3	4	3	
	RIP	2	1	4	
	dorsal	5	6	3	
	no retouch	0	3	7	
long sides					
	one side retouched	1	8	1	
	two sides retouched	9	6	17	
	bifacial retouch	4	3	12	
dimensions					all
(mean range stdev)					(N=48)
	length	31.0	24.9	27.9	27.2
		26-34	22-34	19-44	19-44
		3.8	3.8	6.3	5.3
	width	16.5	15.9	17.1	16.6
		14-18	11-22	11-23	11-23
		1.9	2.8	4.0	3.3
	thickness	4.3	3.8	3.7	3.9
		3-5	3-5	3-5	3-6
		1.0	0.8	0.8	0.9

Table 19.1 Geleen-Janskamperveld, characteristics of arrowheads.

point found at the latter site resembles the Himeling sample; both it and one of the trapezes are left-winged. The few triangular points found at Bruchenbrücken and Goddelau are often presented as evidence for Late Mesolithic or La Hoguette influences (Gronenborn 1990; 1999; 2007). As all but one of them are symmetric, and given the partial contemporaneity of these sites and Flomborn settlements, I think it more plausible that they are the result of ELBK and Flomborn interactions.

19.6 Interpretations

Before discussing the possible connections between JKV and its Mesolithic contemporaries, a closer look at the development of the Flomborn LBK is called for. The data on procurement strategies, knapping techniques and projectile points alike suggest that indigenous hunter-gatherers were notably involved in the development of the ELBK in southern and central Germany. If the new chronological framework is accepted, such an involvement seems inevitable, because the spread of the new lifestyle was too rapid and extensive to be explained in terms of migration.

Instead, models combining demic diffusion and acculturation are discussed (Frirdich 2005; Lüning 2007; cf. several contributions in Lukes/Zvelebil 2004 and Whittle/Cummings 2007). Small groups of farmers continuously split off, moving – in a ‘leap frog’ action – a considerable distance away, to the next favourable settlement area, where they successfully tried to convince neighbouring hunter-gatherers that theirs was the real life. The incentive for this action would have little to do with environmental factors or population pressure, but is seen as one way of acquiring prestige (Frirdich 2005).

Recent research on both ELBK and Flomborn-time settlements, suggests that the two traditions differed in many, fundamental ways (Sommer 2001). ‘Becoming Flomborn’, in this view, necessitated doing as many things differently as was possible without alienating the ancestors, or lead the preceding generations to severe the supply chains of *e.g.* adzes. The changes concerned fundamental habits of behaviour and thought, ways of grouping and organising people, the way the members of a community were brought up, and through which they – usually unconsciously or semiconsciously 'reproduced' themselves and which were transmitted to the next generation (De Grooth/Van de Velde 2005). Animal husbandry and crop cultivation remained the subsistence basis, although some new species apparently were adopted. Houses still should be long, of sturdy construction and necessitating the felling of a large number of huge trees, and adzes continued to be used in such lumbering and building activities. The architecture of the houses, however, underwent notable changes (Stäuble 2005). Not only did the trenches outside the house wall disappear, but a much higher number of posts were placed in the interior, creating the impression of living inside a domesticated version of the forest outside (Hodder 1990). Additionally, changes occurred in the temper of pottery (from chaff to grog and mineral tempers), in the shape of vessels and in details of ornamentation (Sommer 2001).

This entire process in many cases was accompanied by a change of settlement location as well (Cladders/Stäuble 2003). The majority of Flomborn LBK settlements were newly founded, and even when they succeeded the ELBK on place, a habitation hiatus occurred – *e.g.* at Bruchenbrücken (Kloos 1997), Gerlingen (Neth 1999) or Vaihingen a.d. Enz (Strien 2005). Often, however, in such newly established Early Flomborn settlements, a few ELBK decorated sherds are still present, or the oldest house plans show architectural details reminiscent of ELBK traditions, notably the presence of the stabilization trench outside the house wall (Stäuble 2005). A good example of this phenomenon is offered by Niederkassel-Uckendorf, lying just to the south of Cologne on the east bank of the river Rhine (Heinen 2005; Heinen *et al.* 2003).

Evidence based on the strontium isotope analysis of Flomborn-time skeletons, moreover suggest a marked demographic heterogeneity (Bentley 2007) and a high degree of mobility. Many people buried in the Flomborn cemetery, men and women alike, had spent considerable parts of their lives in other regions. (Price *et al.* 2001).

This change of habits at the start of the Flomborn LBK included a change of knapping style. In contrast to what may have happened in the ELBK, I think this new knapping style was not directly derived from Mesolithic techniques. Although the primary platform preparation (with southwest German Mesolithic roots) popular in the ELBK was abandoned in favour of dorsal reduction, the approximately right angles between striking platform and core face were retained, and were not replaced by the acute angles common in the Coincy or Montbani styles such as practised west of the Rhine.

The Flomborn LBK flint working style thus is an amalgamation of two traditions, resulting in a distinctive own style. Such a change should not be simply regarded as a matter of fashion change. It rather is a drastic transformation because it involved the abandonment of the traditional way of doing things, that one had practiced since childhood, and that had proved its worth for generations, and the mastering of a whole set of new skills and kinetic patterns (cf. Sommer 2001).

The background of this change may be understood through the situation at Bruchenbrücken. There two different styles existed alongside each other. One ultimately derived from southern and south-western Late Mesolithic traditions, but was incorporated in the ELBK, the other was of northern or north-western origin. Conceivably, elsewhere in the region, the process of 'becoming Flomborn' resulted in an amalgam of both the previously practiced styles. This probably happened in the Flomborn core region, where it is present at an early stage in settlements such as Gerlingen (Strien 1999) and Vaihingen (Strien 2005). Its continued use during later Central European LBK stages is documented at *e.g.* Hienheim (De Grooth 1977). The need to do thing differently also affected the archers' equipment. ELBK projectile points were small, mainly symmetrical trapezes, in the indigenous Late Mesolithic tradition. The Flombornians, in contrast, chose a triangular shape. Available evidence suggests that Flomborn points originally may have been symmetric, because that is the shape found almost exclusively among Flomborn and later Bandkeramik sites east of the Rhine (Davis 1975; De Grooth 1977) and in the Alsace (Hauzeur 2006; Allard 2007). Then, they may have been retouched more intensively on the long edges than their Mesolithic counterparts. Their concave bases and RIP would indicate that people having their roots in eastern and central France could have participated in this transformation (Gehlen 2006; Thévenin 1992). Their influence or presence may also have resulted in the slightly left-winged points found in the Flomborn assemblage.

'Becoming Flomborn' was also connected with a change in flint supply networks. In the Flomborn core region, the Neckar valley and northern Bohemia, the established raw material sources went on being exploited. Contrastingly, the westernmost settlement that showed ELBK reminiscences, Niederkassel-Uckendorf (Heinen *et al.* 2003), used Meuse flints of the gravel variety (cf. Weiner 1997), although a few Jurassic cherts from Bavaria had been brought into this settlement as well – covering a distance of at least 350 km. Thus, the change to eluvial Lanaye/Rijckholt flints may have occurred some generations later, after the western Rhineland and Graetheide region became settled. It seems plausible that right from the beginning the inhabitants of Geleen-JKV not only extracted Banholt flint for their own use. They may also have acted as suppliers of partially worked cores that were exported to contemporary settlements in the Rhineland, and finally even reached Flomborn sites in Hesse, *e.g*. Griedel (Wetteraukreis), some 10 km north of Bruchenbrücken (Zimmermann 1995). This distribution network was not uni-directional: adzes made from amphibolites travelled west. Actually, the major incentive to maintain alliances with eastern neighbours and kin may have been the western settlers' need of a continuous supply of amphibolite and basalt adzes (De Grooth 2007; in press a).

When the Flomborn LBK arrived at JKV, all its characteristic elements were already present, the new flint knapping style included. The availability of seemingly unlimited amounts of good quality flints may have helped its full development, but the improvement in blade quality seen at sites such as Beek-Kerkeveld, Liège and Verlaine suggests that fully mastering it may have taken some generations. The symmetric arrowheads found at JKV would represent an original Flomborn element. The intensely retouched long sides of the left-winged points may be regarded as evidence of longer lasting interactions between Flomborn 'Bandkeramians' and 'La Hoguettians', suggesting that their association had taken place before Graetheide was settled. Some 'La Hoguettians' thus may indeed have been incorporated in the Flomborn Bandkeramik society, before it reached the Graetheide region.

19.7 Possible connections between Geleen-JKV and the Rhine Basin Group

Despite the shared application of dorsal reduction, and the occasional occurrence of centripetal flakes and rejuvenation tablets, important differences in knapping style existed between Geleen-JKV and the Rhine Basin Late Mesolithic. The lack of slender, regular Montbani blades, generally thought to be connected to the later stages of the Late Mesolithic (Otte/Noiret 2006) is not crucial, because stocky, Coincy-like blades were still being produced at *e.g*. the S.D.T. sector of Liège-Place St. Lambert. In my view, the real importance lies in the differences in the core shapes. At JKV we find *c*. 90º angles between platforms and core faces, whereas Late Mesolithic cores have acute ones. Another feature is the lack of linear or punctiform butts at JKV, compared to their preponderance at Liège-Place Saint Lambert. Additionally, the exuberant use of tablets as a means of rejuvenation at JKV could be mentioned.

The strategies in raw material procurement, too, have little in common. The Rhine Basin Late Mesolithic groups basically made do with the closest sources of raw material, even if better-quality resources would have been available at only slightly longer distances. On the other hand, they all participated in the network distributing Wommersom quartzite (Gendel 1982). This is thought to be based on a shared notion of group identity, perhaps on the level of belonging to the same dialectic tribe (Louwe Kooijmans 2001b). The small amount of Wommersom quartzite recovered from the Hardinxveld-Giessendam sites shows their inhabitants too were included in the Rhine Basin social interaction sphere, which to the east just reached the Rhine (Arora 1979). On a more mundane level, they had connections with north Limburg and adjacent parts of the Rhineland (where Meuse eggs and other gravel flints could be collected, possibly in the framework of seasonal mobility). There are several ways they could have acquired their Rijckholt/Lanaye nodules: firstly through contacts in north Limburg, with people such as used the Merselo-Haag site. Alternatively, they could have collected them in passing on extraction trips to the Ardennes, or they may have been the result of incidental meetings with Graetheide 'Bandkeramians', who also used rocks to be found in the Ardennes (Bakels 1978).

Neither the good quality vitreous Hesbaye flints, nor Rijckholt/Lanaye flints from primary or eluvial deposits, nor flints from the Vetschau/Lousberg area had a structural role in the Late Mesolithic exchange network. Nor were JKV or its LBK contemporaries connected to the Wommersom circuit. Of course, the small amounts of Hesbaye and Zeven Wegen flints could be the result of links with indigenous hunter-gatherers, but independent acquisition seems just as likely, assuming open access to the extraction points (De Grooth 1997).

In this context, some comments on the Bruchenbrücken situation should be presented. Originally, the presence of western flints at this settlement was seen as evidence for the existence of cross-cultural exchange networks, linking the ELBK with either hunter-gatherers of the Rhine Basin Group or with people making La Hoguette and/or *Begleitkeramik*. The use of Rijckholt/Lanaye flints at Haelen-Broekweg, may support this notion, but other considerations contradict it. Those Late/Final Mesolithic groups that used Vetschau and Lousberg flints, did not exploit Lanaye/Rijckholt flints, so their combined presence at Bruchenbrücken would need additional explanations. This same problem arises, when the Flomborn inhabitants of the Graetheide and the western Rhineland are seen as suppliers at the beginning of a down-the-line exchange system, because Vetschau flint was not one of their favoured raw materials.

An alternative explanation could be based on the notion of mobility, inherent in the way Bandkeramik expansion is now modelled. The 'Great Leap Westward' model is unthinkable without extensive scouting expeditions, which would not only have looked for suitable arable land, but for raw material sources too. In that scenario, the presence of Vetschau flint suddenly makes sense: the Lousberg and the Vetschauerberg are located opposite the north-westernmost spurs of the Eifel foothills. Being the first hills containing chalk in their subsoil, they would have been easily recognisable, not only by their shape and location but also by their vegetation. They would have marked the beginning of 'Flintland' for expeditions coming from the southeast. One can imagine them to have collected a few nodules as a souvenir of this landmark. Although Lousberg flint is the better recognizable and more attractive of the two, it is utterly unsuitable for making blades. Therefore Vetschau would have been chosen as material reminder of this special location.

Nevertheless, with due effort, some Rhine Basin Mesolithic influences may be detected on the Graetheide. The less intensely retouched right-winged arrowheads, still strongly resembling Mesolithic examples, could indicate that contacts with locals belonging to the right-lateralized world (*i.e*. people belonging to the Rhine-Basin Group/RMS B complex), started only after JKV and its contemporaries were settled. Perhaps the B-points and bladelets found at JKV are the result of such contacts too. In subsequent LBK stages Mesolithic influences would be discernible in the increased proportion of right-winged points at the Elsloo graveyard (Modderman 1970), and in the LBK of the Hesbaye and Hainault (Allard 2007). Some important, active involvement may be seen in the introduction of the microburin technique of blade breaking in some Hesbaye sites (Eloy 1963). Also worth mentioning is the Kleine Gete LBK settlement cluster (Lodwijckx/Bakels 2000). These outlying sites, located very close to the Wommersom outcrops and dated to the Younger LBK, are remarkable because of the production of adzes made from phtanite d'Ottignies, a preferred Mesolithic raw material, which then circulated through the Bandkeramik world (Bakels 1987).

Last but not least, the Hardinxveld-Giessendam points play a role too. As mentioned earlier, most of the triangular points with RIP found at the Hardinxveld-Giessendam sites display clear affinities with the 'Bandkeramik-like' points like those known from Weelde-Paardsdrank (Huyge/ Vermeersch 1982), Merselo-Haag (Verhart 2000) or Himeling (Belland *et al*. 1985). They, therefore, would not be indicative of contacts with Bandkeramik groups, but rather be the result of inter-Mesolithic relationships. Two points, in my opinion, fit much better into a true LBK context. The oldest one, from Polderweg phase 1, is described as being of 'Rijckholt' flint, but in the absence of cortex nothing definitive can be said about the ultimate depositional context of the material. Given its shape and its raw material, this artefact could be seen to be the result of real contacts between the Polderweg hunter-gatherers and JKV (or its neighbours) – if one is willing to accept that the Graetheide was already settled at that time. If not, two possibilities remain. Firstly, that the point was intrusive to the phase 1 deposits, and actually was discarded at some later time, but this may be too easy an explanation. Secondly, it could derive from contacts with 'Flombornians' such as inhabited Niederkassel-Uckendorf, who used Lanaye/Rijckholt flints from a gravel context and made triangular arrowheads. The second suspected Bandkeramik arrowhead comes from De Bruin's phase 2, *i.e*. the period in which Blicquy pottery occurred. Its left-winged lateralization, however, would be rather out of place in the Blicquy Group, whereas such points were still being used on the Graetheide and the Hesbaye during the Younger LBK.

A re-evaluation of points called 'Bandkeramik' or 'Band-keramik-like' found outside the LBK settlement zone is clearly called for. In my view, it would be premature to throw them all out by simply assigning them to the Mesolithic instead (Lanting/Van der Plicht 1998). This holds true especially in view of the similar distribution pattern of a great number of LBK adzes (Verhart 2000), that had not been made locally from local or regional raw materials, but were imported as finished objects from Central Europe (Bakels 1978; 1987).

19.8 Final remarks

All in all precious little evidence for linking JKV to the Late Mesolithic sphere of the Hardinxveld-Giessendam sites has come to light. They may have been aware of each other's existence, and may even have met occasionally on raw material collecting trips in Limburg or in the Ardennes, but that is it.

The new models for the spread of the LBK (and thus for neolithisation) are much more plausible than either the idea of acculturation or of demic diffusion (De Grooth/Van de Velde 2005). Nevertheless, in some aspects, they smack conspicuously of a reinvention of Europe's modern colonial past: the omniscient newcomers doing it all for the benefit of the natives, but in the meantime creating a position of power because of their privileged knowledge on *e.g*. agriculture, herding, or house building. Therefore I am glad to conclude with the observation that the hunter-gatherers west of the Rhine were much less inclined to 'go over' than their Central European counterparts. As Leendert has known al along (Louwe Kooijmans 2007), they obviously were not impressed by the new lifestyle and continued to live as hunter-gatherers, happily, if not ever-after.

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