The Upper-Late Palaeolithic Transition in Western Central Europe. Typology, Technology, Environment and Demography. Report on the workshop held in Rösrath, 21st – 24th June 2012.

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Zusammenfassung – Übergänge, wie der Wechsel vom Jung- zum Spätpaläolithikum in Europa, sind Zeiträume kulturellen und demographischen Wandels, die Fragen nach möglichen Kausalbeziehungen zwischen sich ändernder Umwelt und menschlichem Verhalten aufwerfen. Der Workshop The Upper-Late Palaeolithic Transition in Western Central Europe. Typology, Technology, Environment and Demography, der durch den Sonderforschungsbereich 806 ausgerichtet wurde, thematisierte diese Aspekte. Experten aus sieben europäischen Ländern berichteten und diskutierten über die bisherigen Kenntnisse und neuesten Forschungen zu Typologie, Technologie, Ökologie und Populationsdynamik während des Übergangs vom Jung- zum Spätpaläolithikum (14,700 - 13,500 calBP) im nordwestlichen Europa. Die Vorträge zu Methoden der Paläodemographie umfassten Beispiele aus dem Paläolithikum und Neolithikum Europas.

Schlüsselwörter – Übergang Jung- zu Spätpaläolithikum, West-Europa, Typologie, Technologie, Ökologie, Populationsdynamik

Abstract – Transitions, such as the one from the Upper to Late Palaeolithic in Europe, are episodes of cultural and demographic change, which raise questions about possible causal connections between environmental changes and human behaviour. The workshop The Upper-Late Palaeolithic Transition in Western Central Europe. Typology, Technology, Environment and Demography, organised by the Collaborative Research Centre 806, focused on discussing and disentangling these aspects. Experts from seven European countries reported the current state of knowledge and recent research on typology, technology, ecology, and population dynamics during the Upper to Late Palaeolithic transition (14,700 – 13,500 calBP) in north-western Europe. The presentations concerning the methods of palaeodemography included examples from the European Palaeolithic and Neolithic.

Keywords – U*pper-Late Palaeolithic Transition, Western Central Europe, Typology, Technology, Environment, Demography*

1. Introduction

Relatively little is known about the environmental, demographic and cultural changes and continuities, which accompanied the Late Upper to Late Palaeolithic transition in western central Europe and the North European Plain. A workshop, organised by members of the Collaborative Research Centre 806 "Our Way to Europe" provided a welcome opportunity for interdisciplinary discussions on recent results and hypotheses concerning this period. The presented contributions covered typology, technology, environmental change and population dynamics at the transition mainly from regional and supra-regional angles; the attendant reports on methods of demographical research also included case studies from the Neolithic and the Upper Palaeolithic.

The onset of the Late Upper to Late Palaeolithic transition can be observed between 14,700 and 14,000 calBP, thus during Greenland Interstadial 1e (GI-1e); that is the Bølling Interstadial (sensu Iversen 1942), or the Meiendorf Interstadial (sensu Litt et al. 2007). During this phase of pronounced environmental changes, the Final Magdalenian assemblages show an increasing morphological variability in the spectrum of lithic points and a corresponding increase in the usage of soft stone hammers to obtain blades with a straight profile for their production (Valentin 2000; Bodu et al. 2006; Weber 2006). Whereas for the Paris Basin this process is comparatively well investigated and commonly termed "azilianisation" (Sonneville-Bordes 1960; Bodu 1998; Bodu et al. 2006), the passage from the Magdalenian, Creswellian and Hamburgian to the Late Palaeolithic industries in north- western and central Europe remains poorly understood owing to a general lack of stratified and well-dated sites. Nevertheless, a regional diversification into several spatio-temporal units such as the Early Azilian, Havelte Group, continental Creswellian, or Early Federmesser-Gruppen can be determined and some human remains from burial sites allow valuable insights into contemporaneous foragers' life-ways during this time. Whilst few and not unproblematic, radiocarbon dates place the first "transitional" sites in western central Europe to GI-1c3, the birch phase of the Allerød Interstadial between 14,000 and 13,500 calBP. During the following pine phase between 13,500 – 13,000 calBP, GI-

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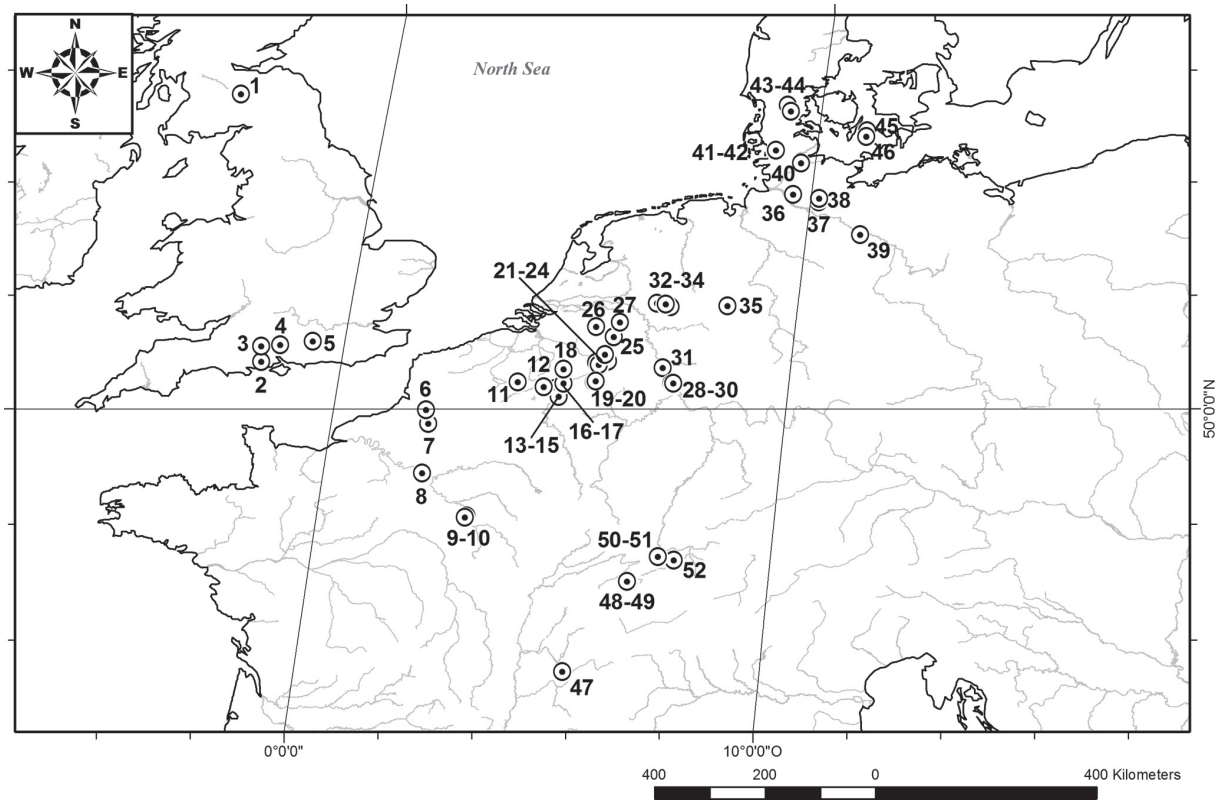

Fig. 1 Map with sites of the Late Upper to Late Palaeolithic transition in Western Central and Northwestern Europe mentioned in the abstracts. 1: Howburn Fram, 2: Hengistbury Head, 3: Nea Farm, 4: La Sagesse, 5: Brockhill, 6: Hangest-sur-Somme, 7: Conty Le Marais, 8: Le Closeau, 9: Étigny-Le-Brassot, 10: Marsangy, 11: Obourg, 12: Presle, 13: Trou de Chaleux, 14: Dinant, 15: Furfooz (Trou du Frontal), 16: Bois Laiterie, 17: Grotte Goyet, 18: Orp le Grand, 19: La Préalle, 20: Remauchamps, 21:Kanne, 22 :Mesch, 23 : Sweikhuizen, 24: Eyserheide, 25: Neer II, 26: Geldrop, 27: Op de Hees, 28: Andernach-Martinsberg, 29: Gönnersdorf, 30: Irlich, 31: Bonn Oberkassel, 32 Borken-Gemenkrückling, 33 Reken, 34 Haltern-Lavesum, 35: Rietberg, 36: Klein Nordende CR, 37: Poggenwisch, 38: Teltwisch, 39: Weitsche, 40: Alt Duvenstedt LA 120 B, 41: Ahrenshöft LA 58, 42: Ahrenshöft LA 73, 43: Slotseng, 44: Jels, 45: Krogsbølle, 46: Søbjerg, 47: Abri de la Fru, 48: Monruz, 49: Champéveyres, 50: Kastelhöhle Nord, 51: Kohlerhöhle, 52: Käsloch.

1c1, this diversity disappears in favour of a rather homogeneous archaeological entity named Late Azilian or Late Federmesser-Gruppen, which is mainly characterised by the production of short, straight blanks and curve-backed points, the eponymous Federmesser.

Changes of cultural systems and changes in archaeological data are often closely linked with demographical processes. This applies also to the transition from the Upper to Late Palaeolithic, arguably reflected in changes of typological and technological concepts in the stone artefact spectrum and the corresponding chaînes opératoires on the one hand and the simultaneous resettlement of new regions on the other. Demographic variables in general are very important in human cultures – they affect not only marriage systems and households organisation, but also patterns of social information transmission, subsistence strategies, and mobility patterns. Moreover demography is considered to be an important push-factor for migratory events. Thus, the investigation of demography can contribute critically to our understanding of hunter-gatherer migratory and dispersal processes during times of change such as the repopulation of central and northern Europe after the Last Glacial Maximum or the Upper-Late Palaeolithic transition. Various inferential methods for investigating demographical processes in Palaeolithic time periods are available, drawing on, for example, ethnographic datasets, skeletal remains, radiocarbon dating distributions, number of artefacts and faunal remains, climate data, or catchment analyses as sources of evidence. In the following, the contributions to our workshop will be presented in brief abstracts to give the reader an overview of the discussed topics and case studies. In conclusion, the main topics will be discussed comprehensively.

2. Abstracts of contributions

2.1 Demographic studies and prehistoric population densities

The Rhine-LUCIFS-Project: Prehistoric Population Densities and Land Use Patterns from the Neolithic to Preindustrial Modern Times

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The Rhine-LUCIFS project, funded by the German Research Foundation, is part of the international LUCIFS-research framework, an interdisciplinary cooperation of projects concerning the influence of land use and climate on fluvial systems. In Germany the river Rhine is main-subject and the period under consideration covers a time span from ~5300 BC (Bandkeramik) to 1830 AD (Preindustrial Modern Times).

The final goal of the archaeological part of the project is to model land use systems, for which the calculation of population densities proved necessary. It is considered a key variable, giving access to demographic processes as well as to economic and social aspects. A hierarchical model, based on the controlled transfer of data between different archaeological scale levels is developed, applying a bundle of GIS-methods. On the first two steps, population densities are calculated at lower scales, the levels of excavation and key area. On the lowest level, archaeological features are counted in order to determine the mean amount of households per settlement. In a second step the identification and analysis of key areas takes place, these being regions where the archaeological knowledge is considered to be optimal (i.e. in open lignite mining areas at the Aldenhovener Platte). Here, it is possible to determine the density of households per square kilometre, using Thiessen-Polygons. The next level is the regional study, which is represented by archaeological site distribution maps concerning large areas. After statistical analysis of the site density, settlement areas are identified and visualised by isolines. The mean density of households derived from the key areas is transferred unto these areas and in combination with a reliable assumption about the number of people per household the population density is calculated.

Beside demographics, settlement areas are used for analysis of land use patterns, to weight factors of source criticism, diachronic and regional comparisons and are helping to integrate processes of cultural history into interpretation.

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Palaeodemography of the European Late Upper Palaeolithic: Estimating population densities of huntergatherer societies

Inga Kretschmer

The Ph.D-project "Analysis of the Palaeodemography of hunters and gatherers of the Late Upper Palaeolithic in Europe" is part of the CRC 806 funded by the German Research Foundation. The project investigates the demography and mobility patterns of Late Upper Palaeolithic hunter-gatherer populations during the time, when Europe was repopulated after the Last Glacial Maximum. The aim is to develop a method for estimating regional differentiated population densities and to investigate the associated settlement patterns.

A method based on GIS techniques is used to upscale archaeological data from selected key sites and key regions to culturally homogenous contextual areas in Europe (Zimmermann et al. 2004). Largest Empty Circles measure the distances of neighbouring sites, which are interpolated by Kriging. The GIS-calculated regions are interpreted as indicators for settlement areas of Late Upper Palaeolithic hunter-gatherer groups.

The origin of primarily used raw materials from key sites indicates site catchments and, if evaluated collectively, minimal seasonal or annual areas exploited by a group of hunters and gatherers. The size of a settlement area divided by the average sizes of single site catchments gives thus the number of annual areas. This number is thought to be equivalent to the number of hunter-gatherer groups living within the settlement area. Ethnographic records (Binford 2001) relating to forager societies practicing similar subsistence strategies as those applied by Late Upper Palaeolithic hunters and gatherers are taken to reconstruct prehistoric group sizes to estimate the potential number of people per settlement region.

The results would be compared with on-site information from well-known key sites about settlement sizes, duration of stay and seasonality, for validating the correct group sizes and the presumed settlement patterns.

The applied database consists of around two thousand sites of the Magdalenian, Hamburgian and Epigravettian. The first results indicate several different settlement regions for the Late Magdalenian, such as eastern central Europe, the Rhine-Meuse-Area, the Paris Basin, the Swabian-Franconian Jura, the Swiss and French Jura Mountains, the Aquitaine basin and the Pyrenees. In some of these regions, the origin of raw materials has been well studied (e. g. Floss 1994, Féblot-Augustins 1997, Demars 1998, Affolter 2002). The outcome of the catchment analyses of the Late Magdalenian allow for estimations about regionally differentiated population densities. For instance, in south-western France short distances of non-local raw material result in small single site catchments, whereas in eastern central Europe single site catchments are much larger. Consequently, the numerous small single site catchments in south-western France are seen as evidence for a much higher population density than in eastern central Europe where few and wide catchments are reconstructed. In summary, the various settlement regions are characterised by different population densities due to differences in single site catchments, group numbers and settlement patterns. Different factors, such as continental or maritime climate, flora and fauna, topography of landscape as well as economical issues, such as raw material or seasonal activities, could account for the diversity of Late Upper Palaeolithic settlement patterns in Europe. Especially the investigation of transitional periods, such as the Upper-Late Palaeolithic transition would contribute to our understanding of human migration and dispersal processes.

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Land Use and Palaeodemography in the Middle and Upper Palaeolithic of the Iberian Peninsula

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Various studies suggest that the human population on the Iberian Peninsula was directly affected by the extremely variable climatic conditions of the Late Pleistocene – especially during Heinrich Events (HE). Southern Iberia has been frequently proposed as a refugium for hunter-gatherer populations during these phases of climatic deterioration. We took a sample of 152 controlled caves and rock shelters from a total of 300 Late Pleistocene sites. Four technocomplexes were studied: Late Middle Palaeolithic (LMP), Early Upper Palaeolithic (EUP), Gravettian and Solutrean. Our aim was to test whether these defined changes of technology, which coincide with climatic events (Schmidt et al. 2012), also had an impact on human presence on the landscape – from both, an isochronic as well as diachronic perspective.

Simple plotting of sites already reveals strong diachronic differences between technocomplexes. Separating northern and southern Iberia along the 40° latitude displays similar diachronic differences between northern and southern Iberia. But at the same time human presence is significantly lower in southern Iberia compared to northern Iberia. This pattern changes for the first time during the Solutrean, when site numbers in southern Iberia are as high as in northern Iberia. A diachronic and isochronic patterning of site density becomes visible. To study this patterning in more detail we performed a kernel density estimation (KDE) for the georeferenced sites per technocomplex. With the bandwidth hold constant (25 km), the maps display different patterns for each technocomplex, probably related to different forms of land use. While in the LMP sites are distributed from the coast to the interior, EUP site distribution is strongly limited to the coast. This break in land use is supported by hiatuses after the LMP in many sites with long stratigraphical sequences (Maillol et al. 2012). In our sample, more than half of LMP sites were not reoccupied; neither in the EUP nor the Gravettian. During the Gravettian, expansion into the coastal hinterland starts; resettlement of the interior is documented for the Solutrean. This suggests that changes of technocomplexes are linked to changes of human land use. To get an idea of population densities in the Late Pleistocene we estimated population density by using ethnohistoric data (Binford 2001). We took two different estimates for hunter gather groups: One derived from a global sample (0.034 persons/km2), the other from subarctic groups only (0.019 persons/km2). The two estimates were calculated for two areas: A minimum area that is covered by the 25 km radius of the kernel density estimation (KDE), and a maximum area covering the entire Iberian Peninsula (IP). Taking areas below 1000 m asl as potential occupation areas, we arrive for the KDE area at population estimates of 2825 and 1579 individuals,

respectively. For the entire Peninsula estimates range between 16862 and 9423, respectively. If we consider a reduction of the occupation area to below 500 m asl during extreme climatic phases such as the HE, population estimates decrease down to 1689 and 944 individuals for the KDE area and 7939 and 4437 individuals for the entire IP. These low population estimates might have had consequences for Palaeolithic mating networks and therefore for the stability of human populations. Additionally, a stretched network along coastal areas increases the distances between possible mates disproportionally and increase the cost for contact between mates, contrary to a homogeneous site distribution in other studies (cf. BANKS ET AL. 2011). Translated to the Iberian situation, this means that the pronounced settlement of the coastal regions may have resulted in highly vulnerable networks. In times of severe climatic deterioration, as can be expected at least for the southern part of Iberia, the probability of a population collapse would be high.

The analysis of site numbers and density per technocomplex revealed the existence of clear regional differences between the northern and southern part of Iberia, and diachronic changes during the Late Pleistocene. In comparison to the northern regions, southern Iberia appears more sensitive towards the environmental impact of HE. Human presence is weaker and more dispersed. This can be recognised in a number of demographic variables (site frequency, geographic distribution, and occupation intensity). Similar observations are made for all technocomplexes under study, which also indicate decisive diachronic changes in land use. Concerning the reasons underlying cultural change, HE must be regarded as major driving forces. The data allow suggesting that their environmental impact on the Iberian Peninsula must have been so severe - especially in southern Iberia - that a widespread disintegration of habitats into isolated and patchy refugia occurred. Although the majority of species are still traceable in stratigraphic sequences, environmental conditions probably pushed habitat patchiness beyond a threshold that did not further support the previously stable hunter-gatherer economic and social organization on a regional scale. This scenario has been recently proposed as the "Leopard coat model" (SCHMIDT ET AL. 2012). Although difficult to test, due to the shortness of the environmental effects of HE, it is corroborated by the preliminary estimates of hunter-gatherer populations for the IP presented here. The low estimates speak for themselves, obtained when altitude is simply considered as a delimiting factor of potential occupation areas during HE. Other variables that affect economy and maintenance of networks, such as clustering of sites, the frequently observed presence of empty spaces, and the coastally oriented distribution of sites, will most probably additionally reduce our estimates – and increase the detectable vulnerability of hunter-gatherer populations.

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Demography and cultural transmission in later prehistory: Some implications for earlier hunter-gatherer studies

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We argue that as past human population size and density are demonstrably key parameters shaping human evolution, archaeologists should give more thought to understanding and accounting for demographic processes (SHENNAN 2000/2001/2002; POWELL ET AL. 2009). Using the Western European Neolithic Demographic transition (NDT) as a case study, we show how a population level approach yields new insight into relationships between human population fluctuations, cultural transmission processes, and economies. We suggest this methodology, developed for analysing the NDT, may be equally productive for Palaeolithic researchers.

Demographic age-profile reconstructions from graveyard contexts have recently gone a considerable way to explain differential patterns of cultural attributes over time and space over the period of the European NDT (BOCQUET-APPEL 2011). Here we present another demographic method, one using probabilistic densities derived from summed and calibrated radiocarbon measurements. Previous radiocarbon based population reconstructions have accounted for various research biases (COLLARD 2010). Here our highly conservative method goes much further. We now construct a formal null model of no significant population events through time, and establish precisely the extent to which this null is supported, or violated, by the available radiocarbon evidence. Long term population increase and taphonomic loss are accounted for

by applying an exponential general linear model with a Poisson distributed error to our summed radiocarbon data (Surovell 2007, 2009; Shennan et al. submitted). This arithmetic method addresses both sample size biases and calibration curve wiggles using a computationally intensive simulation based approach. Our results give the probability of any given calendar year having either a positive or negative demographic signal, which can then be cross-referenced with various other lines of archaeological and climate related evidence.

Woodbridge (et al. in prep.) demonstrates that in the case of the British Neolithic transition, the relationship between pollen and demography shows climate change was not causally related to demographic change. Whether or not this pattern is repeated geographically elsewhere over the European Neolithic, and is perhaps a generalizable explanation for the NDT, is a very good question.

To illustrate how this type of radiocarbon analysis can be highly informative in terms of understanding cultural changes, we use prehistoric European mining activity as an example, and note how it relates to cultural change at a first order of approximation (Kerig 2012). Here we show how fluctuations in European mining activity inferred from all available mining radiocarbon dates, directly relate to the temperate European wide demographic proxy signal. Flint mining activity and the phases of intense copper use (Strahm 2010) are negatively correlated. Substantial flint mining starts with the Early Neolithic and becomes intensified when flint axes were first used as prestige items. In what can be called the metallurgical *"innovation phase"* (Strahm & Hauptmann 2009), flint mining activity significantly reduces. This trend lasts until the interruption of metallurgical traditions between 3300 – 2800 calBC, correlated with a demographic crisis: In this period flint mining activity increases again. The following *"consolidation phase"* in metallurgy (Strahm 2010) is again connected to higher population levels after 2800 calBC. The transmission of ores and/or metallurgical knowledge across Europe seems to be closely linked with higher population densities, while later flint mining activity is in general more regionalised and points to relatively restricted spatial networks. At this first order of approximation, the development of production for both of these wide ranging exchange networks can thus be explained by demography. Precisely how finer-scaled fluctuations in demography relate to economic activities such as mining and metallurgy, remains an active area of research, which is explored elsewhere in considerable detail (Kerig 2012).

It seems reasonable to suggest that during the Pleistocene, a period with a much lower census population (Zimmerman et al. 2009a, 2009b, 2010; see this volume) and with much less favourable environmental conditions in Western Europe than the Holocene, climate and not demography may drive cultural change. As developments in radiometric dating and model construction progress at pace, we believe that our methodological approach can be used for investigating similar issues in the Palaeolithic period, right up to the chronological limits of radiocarbon calibration, but especially after the Last Glacial Maximum (Gamble et al. 2004; 2005). These methods may prove invaluable in the quest to explain, rather than merely describe, the relationship between demographic fluctuations and cultural variation in much earlier hunter-gatherer populations.

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Spatial and temporal dynamics in hunter-gatherer demography
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Data derived from a global sample of recent hunter-gatherer societies demonstrates that population densities amongst such small-scale societies are strongly linked to ecosystem productivity and diversity (Binford 2001). In particular, temperature (Tallavaara & Seppä 2012) and large mammal diversity (Morin 2008) show strong and statistically significant relationships to known forager population densities. Given such a link, dynamic temperature records (e.g. the Greenland ice-cores) and palaeontological data can be used to reconstruct Late Glacial demography in northern Europe as an equally dynamic property. For central Europe, both proxies yield results comparable with other studies (see Bocquet-Appel et al. 2005; Zimmermann 1996), but, importantly, they suggest

an effective population density of 0 for northern regions such as southern Scandinavia during GI-1e (Riede 2009 a). Clearly, sites such as Jels, Slotseng, Sølbjerg and Krogsbølle in Denmark demonstrate that people were present in this area, but likely only in small numbers and for very short periods. These demographic reconstruction underline that – much like in earlier periods (Roebroeks et al 2011) – northern Europe probably experienced repeated colonisation-extinction-colonisation cycles also during the Late Glacial. Exact reconstructions of past population densities are deemed impossible, but major modulations in past population densities can be recognised and substantiated though a judicious combination of modelling, the use of ethnographic sources and archaeological data. The vulnerability of past forager populations to such demographic oscillations is conditioned by climatic and environmental factors as well as by historical dimensions such as mobility strategies, patterns of fertility and mortality, and the spatial configurations of particular groups at particular places and times (Riede 2009 b), i.e. their embeddedness in risk-buffering social networks In addition, relative levels of population density and population connectedness have a major frame-setting impact on patterns of cultural transmission (Henrich 2004; Powell et al. 2009; Riede 2008). Although perhaps difficult to handle analytically, an appreciation of possible demographic fluctuations in past hunter-gatherer societies is therefore critical for our general understanding of cultural change and stability in, for instance, the Late Glacial of northern Europe.

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2.2 Reports on the Upper-Late Palaeolithic transition in different regions of Western central and north-western Europe

The Magdalenian substrate and its impact on the Late Upper to Late Palaeolithic transition

Andreas Maier

With the climatic amelioration after the Last Glacial Maximum, hunter-gatherers started extensively to re-occupy central Europe from about 18,000 calBP onwards. Already around 16,000 calBP, a coarse-mashed settlement system covered again the area from the Atlantic Ocean to the Carpathian Mountains, within which densely occupied areas alternated with unoccupied ones. Traditionally, the course of this resettlement process is viewed as a unidirectional expansion of hunter-gatherer groups from south-western Europe towards the east (e.g. Bosinski 1992; Miller 2012; Otte 2012). A recent re-evaluation of the central European Magdalenian record, however, brought about evidence for a different hypothesis (Maier 2012). With regard to observations of the acquisition pattern of raw materials and mollusc shells as well as to a statistical evaluation of typological differences, it becomes apparent that two spatially separated but communicating populations, one situated in south-western and the other in the eastern central Europe, were the agents of this resettlement. Thus, both communities re-occupied central Europe after the LGM in a bidirectional way. This process eventually brought both populations, which previously already formed a kind of informational network, also into immediate spatial neighbourhood. Here, the region between Rhine-Meuse area (which was resettled from the west) and Eastern Germany up to the Hercynian Mountains (which was resettled from the east) remained a kind of no-man's land in the border area between the western and eastern Magdalenian community (Maier 2012). This phenomenon becomes especially clear with regard to the Westphalian Bay, from which no Magdalenian sites are known so far. And not only Magdalenian people avoided this region, but hunter-gatherers of the subsequently emerging Hamburgian did not occupy it either (Holzkämper & Maier 2012 a). It thus remained virtually free of human occupation until the time of the Late Upper to Late Palaeolithic transition, when a small group of people, probably coming from the west, resettled this area and left some traces of their presence, the assemblages of the Rietberg facies (see Holzkämper et al. this article).

Social constrains regarding the borderland between the western and eastern Magdalenian community may explain the avoidance of this area during the early phase of the resettlement process. However, they hardly explain why it remained unoccupied until the onset of GI-1c$_3$, roughly about 13,800 calBP. Here, the technological changes of this time may provide a possible explanation. Whereas the highly standardised and elaborate *chaîne opératoire* of Late Upper Palaeolithic blade production had to rely on high-quality raw material, the more flexible blank production of the

Early Federmesser-Gruppen also allowed for the exploitation of rather low-quality raw materials. This may have enabled the bearer of the Rietberg facies to successfully settle in the Westphalian Bay, a region, which yielded rather low-quality raw material sources but provided a species-rich vegetation and game, which had not yet been depleted by hunting.

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The landscape in northern central Europe at the time of the Upper-Late Palaeolithic transition
Johanna A. A. Bos, Jutta Meurers-Balke, Arie J. Kalis, Andreas Maier

At the Late Glacial site of Rietberg in Westphalia, a permanently high groundwater-level accounted for excellent conditions for the preservation of botanical material and allowed to conduct extensive archaeobotanical research (Meurers-Balke et al. 2012). Rietberg provides thus one of the rare opportunities to directly link an on-site palynological sequence with a Palaeolithic occupation. The analysed macro-remains and the large amount of more than one hundred identified pollen taxa permitted a detailed reconstruction of the vegetation at the site itself and in its surrounding areas. The hunter-gatherer camp was located close to a small body of standing water, which was surrounded by reed bed and swamp vegetation. In the wider landscape, a mosaic-like plant cover with patches of trees and shrubs, steppe and sandy grassland at dryer stands as well as perennials at moister stands, characterised the vegetation. For 60 species found in the Late Glacial sediments, the average July temperatures, on which they thrive today in their refuge locations in Great Britain, could be identified. On this basis, the average July temperatures during the Late Glacial occupation (the GI-1c3) were estimated to have been between 14 and 16.4 °C. The pollen diagram shows that birch trees were already a common element of the landscape from the beginning of the pollen sequence onwards, whereas pines only started to make their appearance. The lower part of the pollen sequence is dated by three AMS dates obtained on terrestrial plant remains to 13,790 - 13,630 calBP and thus to the Early Allerød, the GI-1c3 (Meurers-Balke et al. 2012). The immigration of pines during this period is also attested in other pollen diagrams from the region (e.g. Hoek 1997; Bos 1998; Merkt & Müller 1999). This aspect is vital for a precise dating of the Late Palaeolithic occupation at Rietberg. A conventional radiocarbon measurement gave a date of 12,000 ± 380 BP and thus a calibrated timespan of more than 1000 calendar years (14,740 – 13,620 calBP) which ranges from the Late Pleniglacial up to the Early Allerød. Since the immigration of pine trees in Westphalia is not to be expected prior to the Early Allerød (the GI-1c3), the otherwise rather imprecise date can be significantly reduced to a period of about 200 years. The fact that macroscopic pieces of charcoal were detected during the archaeobotanical screening only in those sediments that corresponds to the lower part of the pollen profile, additionally links the Palaeolithic occupation with the GI-1c3, more precise with the time between 13,800 and 13,600 calBP.

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The Rietberg Facies – Upper-Late Palaeolithic transitional sites in the Westphalian Bay
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The resettlement of north-western central Europe after the LGM happened in two mayor steps: Initially, the area up to the low mountain ranges became occupied by Magdalenian groups during the end of GS-2, from about 16,000 calBP onwards. Later, during GI-1e between 14,700 and 14,000 calBP, the northern European lowlands became populated by Hamburgian hunter-gatherers. Conspicuously, the settlement areas of both entities are separated from each other by a broad zone of about 100 km, from where no sites of the respective period are reported (Holzkämper & Maier 2012a, b). This spatial void corresponds with a temporal gap, as the earliest traces of a post-LGM occupation of this zone were attributed to the Late Federmesser-Gruppen and dated to the GI-1c1 between 13,500 and 13,000 calBP. Current research of the CRC 806 sheds new light on the colonisation of this area. A re-evaluation of four assemblages from Rietberg, Reken, Borken-Gemenkrückling and Haltern-Lavesum suggests that the resettlement already took place during the GI-1c3, that is between 14,000 and 13,500 calBP (Richter 2012; Holzkämper et al. in prep.). These four assemblages from the Westphalian Bay include typological and technological

elements of the Late Upper as well as the Late Palaeolithic. The assemblages are characterised by regular blades with a straight or only slightly curved profile, which exhibit attributes of the soft stone mode of percussion, such as impact points and esquillements du bulbes, whereas en éperon preparation is absent. Core reduction was carried out in a unipolar way. If present, a second striking platform only served to restore the convexity of the striking face or to remove hinge fractures. The tool spectrum shows a high morphological variability of lithic points, among which shouldered, angle-backed and curve-backed forms as well as long B-points and bipoints occur. Burins and scrapers are frequently made on blades, the latter often showing lateral retouches. Besides, zinken and becs occur regularly, while backed bladelets are rare. With reference to Rietberg, the so far best investigated site in the Westphalian Bay (Richter 2012), we subsume the assemblages from Rietberg, Reken, Borken-Gemenkrückling and Haltern-Lavesum under the term "Rietberg facies". Best typological and technological similarities can be found with assemblages from northern France, such as the lower levels of Hangest-sur-Somme III.1 and Conty Le Marais, (Fagnart 1997) as well as with southern Great Britain (the Hengistbury type sites), which are assigned to the Early Federmesser-Gruppen (Barton 2010; Pettit this article). Furthermore, a strong linkage with the westward adjacent regions is supported by imported Rijckholt or Meuse gravel flint in the inventories of Haltern-Lavesum and Reken.

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Re-occupation of Gönnersdorf and Andernach-Martinsberg (Central Rhineland, Germany) during the Upper-Final Palaeolithic transition?
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Gönnersdorf and Andernach - Martinsberg are large and complex Late Glacial settlement sites located in the German central Rhineland (Bosinski 2007). Burial under ash deposits of the Laacher See volcanic eruption (~ 11,000 ^{14}C BP) effectively protected them from destruction by erosional processes and their good preservation has allowed detailed investigations into many aspects of Late Magdalenian technology and subsistence, spatial organisation, mobility within the landscape and socio-cultural behaviour. At Andernach a younger re-occupation of the site by hunter-gatherers in the Federmesser-Gruppen tradition was also documented.

Magdalenian occupation of both sites is radiometrically dated towards the end of a cold and very dry stadial event, before the onset of the Late Glacial Greenland Interstadial (GI 1e). The fauna hunted during the Magdalenian is composed of species typical of cold and dry steppe-tundra conditions. The age of the Federmesser-Gruppen occupation at Andernach (and at other sites in the region) is less precisely defined, with radiocarbon dates spread between ~ 12,000 and 11,800 BP. Nevertheless, all dates assign Federmesser-Gruppen presence in the central Rhineland to the later part of Greenland Interstadial I, equivalent to the Allerød pollen zone, and the associated fauna is characterised by species typical of open woodland.

Analyses at Gönnersdorf suggested that a small amount of material from a restricted spatial area might represent human activities younger than the intensive Magdalenian settlement documented for most of the site. This appears to be confirmed by radiometric dating. At Andernach, a small number of faunal remains show anomalous features by comparison with the Magdalenian and Federmesser-Gruppen faunal assemblages. Targeted dating produced an age similar to that for the material from Gönnersdorf. These dating results chronologically intermediate to those for the Magdalenian and Federmesser-Gruppen suggest that both sites were re-occupied during a phase transitional between these two well-established entities. However, human presence appears to have been only ephemeral and the processes and mechanisms of change from the central Rhineland Magdalenian hunters of the loess steppe to those of the Allerød woodland Federmesser-Gruppen remain poorly understood.

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A new research project about the Late Palaeolithic double burial from Bonn-Oberkassel, Germany – preliminary results

Liane Giemsch, Ralf W. Schmitz

The LVR-Landesmuseum Bonn houses the Late Palaeolithic human remains from the double burial of Bonn-Oberkassel, discovered by workers in the so-called „Rabenlay" quarry in February, 1914. It consists of the skeletal remains of a woman at least 20 years of age and a 40-45-year-old man, as well as two art objects made of bone and antler, the skeletal remains of a dog and further animal bones.

With an ^{14}C-dating between 11507±134 and 12458 ± 339 calBC (Street & Wüller 1998; Street 2002) the find ensemble of Bonn-Oberkassel, with its unique combination of finds is one of the most important research sources for the Late Ice Age in central Europe. Due to the large number of questions concerning the find complex, Late Palaeolithic humans in general, and also due to the approaching 100th anniversary of the discovery, the LVR-LandesMuseum has launched a complete scientific reinvestigation of the find complex (Schmitz & Giemsch 2011). The age of the finds, individual ages, injuries, diseases and deficiency symptoms of the human skeletons, migration movements, degree of relationship and the phylogenetic position into the European populations, the nutrition, the hematite dispersal in the burial, questions about the art objects as well as dog's domestic history will be clarified inter alia by DNA-analysis, CT, microCT, scanning electron microscope (REM) and the analysis of stable isotopes (Giemsch & Schmitz 2011).

Among others the genetic analysis yielded some interesting initial results. It was able to generate the complete mtDNA genomes of both individuals (Fu et al. 2013). From this analysis, it appears that the two are not directly maternally related, meaning they are not siblings. The data obtained from the carbon / nitrogen ratio of the bone material indicates a carnivorous diet for the Oberkassel humans, but also some freshwater fish consumption; they are not-high enough though, to indicate that freshwater fish were the main diet source (Giemsch & Schmitz 2012). The microCT-data of the human skeletal remains serve as a base for the 3-D prints of skeleton parts including the cranium, which will be used for the facial reconstructions of the Oberkassel humans.

In addition, further fieldwork at the Oberkassel site is planed, with the intention to get more details about the find circumstances and to create a 3-D reconstruction of the original burial. It is possible that missing parts of the find complex could be rediscovered. In fact it might also reveal whether the burial from the Rabenlay is a singular event, part of a repeatedly visited burial site or whether it corresponds to a nearby, as yet undiscovered living site (Giemsch & Schmitz 2012).

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Human remains from the Late Upper Palaeolithic of Irlich, Germany – A preliminary report

Jörg Orschiedt, Axel von Berg, Michael Baales, Stefan Flohr

Human remains from the Late Upper Palaeolithic in Europe are rare. Thus far, 71 individuals from 17 sites dating between about 13ky and 10ky are described (Pettitt 2012). In central Europe human remains from the LUP are the exception. The double burial from Bonn-Oberkassel (Germany) is the most important find from this period. In 1953 some human bones, covered with red ochre, and associated artefacts were discovered in sediment taken from a sand pit near the city of Irlich, Rheinland-Pfalz, Germany (Orschiedt 2000, Street et al. 2006b). Re-investigations at the site are not possible due to heavy mining activities during the last decades. The finds were not described or otherwise noticed, and subsequently stored in a local museum archive. In 2000 the finds were re-discovered and later analyzed with macroscopic, radiological, and histological techniques. AMS dating of the bones revealed an age of 12,500 to 11,900 calBC (von Berg et al. 2002). The artefacts found with the human remains consist of an antler point, two flint artefacts (backed knife, burin spall), and a left mandibular first incisor of a red deer with 10 grooves and a perforation on the root. The use of red ochre is evident on all of the human remains and can be found as well within the groves of the decorated red deer canine. The bones could be assigned to at least four individuals, represented by a few complete bones or bone fragments each. Age at death of individual 1 was estimated at 20-30 years. An intact femur and a distal ulna from this individual exhibit a layer of porotic bone

formation. This is indicative of a pathological process stimulating periosteal bone apposition caused by a systemic disorder like vitamin C deficiency (scurvy) or blood clotting disorders. Age at death of individual 2 was estimated at 8 to 12 years that of individual 3 at about 6 to 12 months, and individual 4 was probably aged between 4 and 8 years. These individuals show no signs of pathological conditions. The scanty fossil report of individuals from this time period makes even poorly documented and fragmented material an important source for LUP. The finds from Irlich might represent a multiple or several isolated burials.

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Between the Magdalenian and Federmesser-Gruppen. The archaeological evidence from the Southern Netherlands

Eelco Rensink

In the Southern Netherlands, the Magdalenian represents the earliest human occupation after the Last Glacial Maximum. Taking into consideration 1) the stratigraphical position of the archaeological materials embedded in loess sediments and 2) the occurrence of Dutch Cretaceous flint in Andernach and Gönnersdorf in the central Rhineland and the dating evidence of both sites, the Magdalenian open-air sites of Sweikhuizen, Mesch and Eyserheide can be dated to the final phase of the Pleniglacial, ca. 13,300-12,700 BP. What happened between this period and the first occupation of people of the Federmesser-Gruppen, around 11,500 BP, is largely unknown due to the absence of well-dated and well-excavated sites.

Looking at the archaeological evidence of the Southern Netherlands the main conclusions concerning the Upper – Late Palaeolithic transition are:

1. Magdalenian occupation of the Southern Netherlands (ca. 13,300-12,700 BP) clearly predates the Upper – Late Palaeolithic transition. From a technological point of view the Magdalenian open-air sites show characteristics of 'le débitage magdalénien classique' (Rensink 2011). There are backed bladelets and no backed points among the stone tools.

2. In the Southern Netherlands, Federmesser sites are preliminary known from the sandy area of the provinces of Limburg and Brabant. Radiocarbon dates of Federmesser sites range between 11,500 BP and 10,800 BP pointing to Late Palaeolithic occupation of the sandy area at least 1200 radiocarbon years after the Magdalenian occupation of the loess area.

3. Small and distinctive concentrations of Upper- or Late Palaeolithic artefacts with an adequate sample of diagnostic tool types (for instance Creswellian points) and which are not classified as Magdalenian or belonging to the Federmesser-Gruppen are absent. Large sites in or on top of coversand deposits or on top of Meuse gravels are presumably palimpsests assemblages reflecting numerous Late Palaeolithic occupations. There are no Creswellian sites meeting the criteria as defined by D. Stapert (1985) that sites should represent a single occupation, at which over 50 % of the classifiable points show Creswellian and Cheddarian typology, while steep retouched blades are absent.

4. In Neer II and in some other (mixed) surface collections Creswellian points are present that may relate to Creswellian (or Early Federmesser?) occupation of the area. However, because of the mixed character of these assemblages, a final assessment of the cultural significance of these points is not possible (see also Kramer 2012).

Recommendations for future research of the Upper – Late Palaeolithic transition of the Southern Netherlands are:

1. Systematic (re-) study of amateur-collections;

2. Consistent typological and technological descriptions of the stone artefacts;

3. Determination of raw materials and their provenance. In the Late Palaeolithic sites of Op de Hees and Neer II some of the artefacts are made of dark-grey fine-grained transparent flint that possibly originates from the surroundings of Obourg;

4. Technological studies: chaîne opératoires and assessment of mode of preparation of striking surface (evidence of en éperon).

Moreover, small-scale excavations of 'old sites' and of newly discovered Late Palaeolithic sites comprising Creswellian and/or Cheddar points are necessary in order to document archaeological

materials in sound stratigraphical context, preferably in association with (burnt) organic materials providing opportunities for radiocarbon dating.

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The transition from Oldest Dryas to Younger Dryas in Belgium
Marcel Otte

The Late Magdalenian is well represented in Belgium during the final phase Pleniglacial (Oldest Dryas), for example at Chaleux, Furfooz and Dinant. It possesses all of the technological, typological and artistic traits typical of the Magdalenian of the Paris Basin. Lithics and fossil marine shells manifest identical geographic relationships, always in the same direction: from the south to the northeast and then toward the Rhine valley where "Belgian flint" is also present. This axis is clearly oriented toward the north around 13,000 BP. It shows that better technological and ideological adaptations led to territorial expansion prior to climatic warming (Vaucelles at 14,000 BP).

During the Bølling (GI-1e), the natural and cultural landscape was profoundly transformed. Evidence for migrations from the north becomes apparent in the form of Hamburgian (Obourg) and Creswellian (Presles) assemblages, at around 12,000 BP. All of these traditions share with the Late Magdalenian (Marsangy) the abundant use of shouldered bases. The most probable explanation for such an adaptive unity in such different, but contemporaneous, cultural contexts, would appear to lie in the same response: the massive utilization of the bow.

During the late phase (Allerød), a complete unification of the tool kit and techniques combines all of these trends into a unique complex termed the "Creswello-Tjongerian" (Dewez 1987). Shouldered or truncated armatures persist, as in the preceding Creswellian (La Préalle at Aywaille). Yet the most common armature is the curved backed point, as common in the French Azilian as in the German "Federmesser-Gruppen". Sites are now extremely dense (Van Noten 1967), reflecting both demographic success and the tendency toward more permanent occupations.

The cold phase of the Younger Dryas caused a recurrence of migrations from the north, in the form of the Ahrensburgian reindeer hunters, represented by several cave sites (Remouchamps). The two contemporaneous artistic patterns demonstrate the new relationship between societies and their destiny. The first is that of total abstraction in the form of complex networks of engraved rectilinear traits. The second is the representation of realistic human figures (Geldrop). Both foreshadow the spiritual control over nature, well before the Neolithic.

The Mesolithic of the Preboreal participates in this generic duality: truncated pieces persist while the tool kit is dominated by "segments" directly derived from curved backed points. Climatic amelioration incites intense demographic expansion, cultural fragmentation as never before observed and thus a predisposition to control of dietary production thanks to the preponderant role that man created for himself over nature.

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Late Glacial interstadial Archeaology in Britain
Paul Pettitt

The British Late Upper Palaeolithic record has been constructed largely through cave excavations conducted in the infancy of archaeology, with correspondingly poor control over stratigraphy and associations. The current framework has been established through the judicious use of radiocarbon dating of humanly-modified faunal remains (e. g. Jacobi & Higham 2009; Jacobi et al. 2009), and modest excavations of stratified materials (Barton 1991, 1992). Unstable processes of deglaciation began around 19,000 calBP; reindeer were re-established in the southwest by around 17,000 BP, and reindeer, horse and hare – with their Upper Palaeolithic hunters – by around 15,000 BP (Pettitt & White 2012). Radiocarbon dating demonstrates that Late Upper Palaeolithic groups were operating in Britain during the Meiendorf (GI-1e) and Allerød, and at the end of the Younger Dryas. The relatively low-density of sites and findspots suggests that they were present infrequently, and that absence, rather than presence, was the rule. Archaeological assemblages have been defined as Creswellian/Late Magdalenian (Meiendorf), Hengistbury Type (probably very late Meiendorf (GI-1e) or Early Allerød and either Hamburgian

or Early Federmesser affiliated, although no radiocarbon measurements exist for these sites), Curved Backed Point/Federmesser-Gruppen (Allerød) and Long Blade Assemblages/ (Epi) Ahrensburgian (Younger Dryas and Preboreal). The nomenclature conceals complexity, however, as British assemblages bear both similarities and differences with contemporary industries of the continent noted in this paper, consistent with the regional diversity noted in the introduction. The differences essentially relate to the absence in Britain of elements characteristic of continental assemblages (e.g. burins de lacan and straight-backed blades, and the rarity on the continent of elements common in Britain such as Creswell and Cheddar Points.

In terms of the Late Glacial Interstadial the three assemblage types well-documented for the period share a number of characteristics: blade production on unipolar and (especially) bipolar cores; use of the cresting technique; the dominance of endscrapers on blades and burins of dihedral and truncation form, and the presence of curved-backed points. Shouldered and angle-backed points are furthermore shared by Creswellian/Final Magdalenian and Hamburgian assemblages although have not been recovered in clear association with Curved Backed Point assemblages. Only the use of the en éperon technique distinguishes one from the rest, being found only in Creswellian/Final Magdalenian assemblages (Barton 1990).

Some 35 locations have yielded material attributed to the Creswellian/Final Magdalenian, although most of these are single findspots of diagnostic angle-backed (Cheddar and Creswell) points. Techonological similarities can be identified with contemporary sites on neighbouring regions of the continent, particularly the production of blades from typically bipolar cores; a degree of use of en éperon platforms and use of resulting blades for tools; the oblique truncation of blades; and the presence in low number of shouldered and curved-backed points, enough to warrant abandonment of the term ‚Creswellian' (which Garrod coined to emphasise difference) and adoption of Final Magdalenian. In Britain, however, the role of retouched bladelets fell to obliquely retouched points, a similarity with northern Dutch sites. The distribution of sites is consistent with a westerwards movement of groups from neighbouring parts of the continent, notably northern Netherlands and Belgium.

At least 25 sites/findspots of assemblages dominated by shouldered points typically of Hamburgian (but not Havelte) form are known, but are undated beyond a stratigraphic placement in the Late Glacial Interstadial and are poorly understood. The apparent lack of Havelte points possibly indicates that they predate 14,200 calBP, although it is also possible that they represent an early facies of Federmesser affiliation. They are typically small, focus on major rivers, and their distribution is consistent with a westwards movement of Hamburgian/Early Federmesser-Gruppen ideas, perhaps in a similar way to which such reached Le Tureau des Gardes 7 (Weber 2006).

Some 37 sites/findspots of lithics attributable to the Federmesser-Gruppen are known, some of which have yielded radiocarbon dates on associated fauna or harpoons which confirm their placement in the Allerød, clustering between 13,400 and 12,800 calBP. As with the preceding 'Hamburgian' they focus on rivers, and seem to represent a marked diminution in the use of caves.

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It takes more than one tang to make a difference – a technological comparison of classic Hamburgian and Havelte Group lithic inventories from northernmost Germany

Mara-Julia Weber

In the western part of the North European Plain, the transition from the Upper to the Late Palaeolithic involves the classic Hamburgian, the Havelte Group and the Federmesser-Gruppen. Due to a lack of suitable material but also investigations, it has not been established yet whether the step from the Hamburgian to the Federmesser-Gruppen represented an adaptation to environmental conditions or the arrival of new ideas and/or humans from the south. However, the first step, within the Hamburgian, can be studied from different perspectives and constitutes the topic of this paper.

A review of the available radiocarbon dates for classic Hamburgian and Havelte Group sites suggests that inventories characterised by Hamburgian shouldered points have a tendency to be older (ca. 12,900-12,050 ^{14}C BP) than those dominated by Havelte tanged points (ca. 12,700-11,970 ^{14}C BP; Grimm & Weber 2008). This observation is not only in accordance with the originally pro-

posed chronological order based on typology but also with palynological results and the stratigraphic evidence at Ahrenshöft LA 73 (Nordfriesland; Clausen 1998; Usinger 1998), situated in the north-western part of Schleswig-Holstein. Therefore, it seems to be justified to consider a technical development from shouldered to tanged points.

On the one hand, this leads to functional questions as to the weapons these projectile points armed and the way they were hafted, in relation to the hunting circumstances they were used in. On the other hand, a crucial question concerns those parts of the lithic chaîne opératoire preceding modification: did the change in projectile implements induce more profound changes, both of the objectives and the modalities of blade production? This issue is primarily addressed by a technological comparison of the lithic inventories from the classic Hamburgian sites Teltwisch 1 and Poggenwisch (both Stormarn) and the Havelte Group site Ahrenshöft LA 58 D (Nordfriesland), all situated in Schleswig-Holstein.

At the present state of research, no significant differences can be observed between blade production at the classic Hamburgian and the Havelte Group sites. Their common objectives were regular blades for tools and projectile points, with a tendency of the latter to possess smaller dimensions than the former. The chaîne opératoire comprises the selection of flint nodules with an oblong to oval section, which often present frost-shattered surfaces at Ahrenshöft LA 58 D due to the periglacial conditions affecting the Saalian moraine area during the Weichselian. The configuration of the volumes was carried out with the help of crests, which were also used at later reduction stages in order to correct the volumes. Subsequently, blades were detached from two opposite platforms, alternated at different rhythms, and on one reduction face, which led to generally straight longitudinal blade profiles. In the classic Hamburgian assemblages, soft organic hammers seem to have been used preferably in the first stages of blade production, sometimes after preparation of the platform edges en éperon, and were followed by soft hammerstones employed in the same tangential way as the organic hammers. The combination of both knapping instruments can also be observed in the Havelte Group inventory, which thus far contains one blade end scraper with a butt prepared en éperon. However, the distinction between these two types of hammers is often difficult, and for Ahrenshöft LA 58 D, the analysis of the knapping features needs to be completed before the roles of the different knapping instruments can be determined. In the light of the development from the Magdalenian to the Azilian in northern France, the importance of the different hammers and their modalities of use may be significant for the understanding of the processes leading from the Late Glacial pioneers to the forest hunters on the North European Plain.

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From the Hamburgian culture to the Federmesser-Gruppen in southern Scandinavia
Felix Riede

Around the GI-1d (Older Dryas) cold phase southern Scandinavia witnessed a marked cultural change: The Hamburgian culture – with Upper Palaeolithic affinities – comes to an end and is replaced by a northern variant of the Late or Final Palaeolithic, the so-called Federmesser-Gruppen. Setting the spatial extent of the Hamburgian culture in relation to climate reconstructions for GI-1d illustrates how the expansion of hunter-gatherers into southern Scandinavia may have been constrained by temperature gradients (e.g. Renssen & Isarin 2001); all northernmost locales of the Hamburgian culture – the known Danish sites of Jels, Slotseng, Sølbjerg and the newly discovered site of Krogsbølle as well as the controversial geographic outlier of Howburn Farm in Scotland – belong to its late Havelte phase and lie at or just beyond significant temperature isolines. Exploratory Bayesian analysis of the radiocarbon database for this period under a range of model parameters suggests a very rapid transition from the Hamburgian culture to the Federmesser-Gruppen. The fact that both the Hamburgian culture and the Federmesser-Gruppen ultimately derive from closely related cultural ancestors makes a definitive analysis of these groups' historical ancestor-descendant relationship difficult. Yet, the considerable formal technological and typological material culture differences between these two techno-complexes allows such a rapid transition to be interpreted as a demographic collapse or local extinction of the forager groups carrying a Hamburgian tradition at, during, or just after GI-1d, followed be a re-colonisation of southern Scandinavia in early GI-1c (the Early Allerød; see

also Riede 2007, 2009 b). Pronounced demographic variability is well attested to in the ethnographic record of hunter-gatherers, even under the rather more benign climatic conditions of the recent past (Tallavaara & Seppä 2012). The fragility of the Late Glacial landscapes of southern Scandinavia, the likely lack of key organic resources in this region, and the risk-laden economic specialisation practised by the foragers of the Hamburgian culture all would have contributed to the vulnerability of these forager communities to climate-driven destabilisation. Both the cooling during GI-1d as well as the rapid warming during GI-1c – mediated via their impacts on fertility, mobility and prey abundance – could have been major triggers of societal collapse at this northern frontier. Finally, it can be suggested that much like Late Glacial plant and animal communities are considered 'disharmonious' or 'non-analogue' (i.e. without modern counterparts and unstable evolutionarily – see Aaris-Sørensen 2009; Mortensen et al. 2011; Stewart & Lister 2001), contemporaneous hunter-gather communities – especially the Hamburgian culture – also have no analogues in the ethnographic present. The Late Glacial human re-colonisation of northern Europe could thus be seen as a cultural evolutionary experiment that, at times, failed. Our reconstructions of Late Glacial culture-history should therefore account for the seemingly paradoxical differences between the various archaeological cultures of that time (i.e. the Hamburgian vis-à-vis the later Federmesser-Gruppen and the Ahrensburgian) as well as the major differences between these and later ethnographically documented societies (Riede in press - a, b).

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Phase transition in behaviour? From Magdalenian to Federmesser-Gruppen in western central Europe
Sonja B. Grimm

In historical and archaeological sciences transitions represent a major concept to describe the change from one observed group to another, often a successive one. In general, the process of change was thought of either as a gradual transformation reflecting continuous adaptation or as a rapid shift reflecting a revolutionary process or replacement. However, research on individual learning (Zanone & Kelso 1992) and alliance-formations (Gavrilets et al. 2008) in humans as well as on adaptive cycles in ecosystems (Holling 2001) suggested a combination of the two processes in so-called phase transitions. The continuous adaptations in a system lead to an instability of the system and, subsequently, require qualitative changes to surpass a threshold to a new stable state.

In Late Glacial north-western Europe the Late Magdalenian and the Federmesser-Gruppen were chronologically successive groups. Since no other information system (cf. Wallhon 2006) than the ones based on a Magdalenian substratum were observed, the transition from the Late Magdalenian to the Federmesser-Gruppen represented a change within a single social system and adoption as reason for sudden changes can be excluded. Particularly well-preserved archaeological remains of these two major groups were found underneath the Laacher See tephra in the central Rhineland (Street et al. 2006 a). In this region, a minimum of 500 calendar years had passed between the last unambiguous Late Magdalenian occupation (c. 15,070 -12,900 years calBC*) and the first Federmesser-Gruppen settlement (c. 12,370 - 10,720 calBC*). The archaeological remains reflected two behavioural complexes, which were clearly distinct in their subsistence and exploitation strategies as well as their technical and spatial organisation. These differences were assessed from several taxonomic characteristics in the assemblages such as the prey choice, the blank production process, the projectile morphology, or the presence of evident structures such as hearths. Even though the range areas appeared relatively similar, two different land use systems were also deduced for the two groups from the distribution of sites, their assumed function, and the origin of raw materials (Street et al. 2012; Baales 2002).

In the transition period between the two groups, the rapid onset of the Weichselian Late Glacial Interstadial (GI-1) and the shifts within its early part represented significant climatic alterations leading also to changes in the natural environment of north-western Europe. Thus, the Federmesser-Gruppen probably evolved from the Late Magdalenian due to the varying resource availability and necessities to cope this changing environment.

To reconstruct the progress of this process, the scarce evidence from the central Rhineland consisting of material from the south-western

corner of Gönnersdorf, a ^{14}C-dated bone from Andernach, and the human remains from Irlich and Bonn-Oberkassel needs to be augmented by further sites from the transition period such as Le Closeau, Étigny-Le Brassot, and Marsangy in the Paris Basin (Valentin 2008), Hangest-sur-Somme III.1 and Conty in the valley of the Somme and its tributaries (Fagnart 1997), and Bois Laiterie in the Belgian uplands (Otte & Straus 1997). These assemblages revealed a gradual transformation of the lithic inventories concerning the blank production process, the composition of the retouched inventories, and the morphology of projectile implements. The composition of the hunted fauna was adapted flexibly depending on the seasonal as well as general presence of species. However, group migratory game such as reindeer or greylag goose had disappeared from the faunal assemblages of the studied area in the mid-Late Glacial Interstadial (GI-1c). Changing preservation conditions limit the survey on the development of organic implements but the sparse pieces indicated the process of increased intra-group diversity and suggested an already established regionalisation by GI-1c. To what extent this regionalisation development led to the separation of distinct groups in northern Europe has to be discussed elsewhere. In contrast to the other taxonomic characteristics, the disappearance of evident settlement structures from the archaeological record occurred suddenly between the sub-periods GI-1e and GI-1c3. Moreover, the assumed burials of Irlich and Bonn-Oberkassel dated to this short period and reflected a behaviour, which was otherwise not attested for the Late Glacial in the central Rhineland. Perhaps, the change in the settlement structures and the appearance of specific mortuary practices reveal an important disruption in the otherwise continuous process of adaptation. Clearly, after this period a new relatively stable state with qualitatively different characteristics had arisen and, therefore, the entire process can be considered as a phase transition in behaviour.

Footnote**:** * These ages are 95 % confidence margins of calibrated ^{14}C dates. These dates were calibrated with the CalPal program using the CalPal-2007$_{\text{HULU}}$ calibration curve (Weninger & Jöris 2008).

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The Upper Palaeolithic-Late Palaeolithic transition in Switzerland

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The Upper Palaeolithic-Late Palaeolithic transition in Switzerland is characterised by rapid environmental changes, notably by a well-defined vegetation succession that can be correlated with the GRIP event stratigraphy. The major botanical event in this sequence is the expansion of juniper (Juniperus), concurrent with the significant rise in temperature at the start of Greenland Interstadial 1e (GI-1e). Before this event, dwarf birch (*Betula nana*) and various low to the ground growing willow species (*Salix sp.*) were the only wood species in a vegetation cover that was dominated by herbaceous plants. After the colonisation by juniper, tree birch (*Betula sp.*), poplar (*Populus sp.*) and pine (*Pinus sylvestris*) arrived successively in this specific order. However, archaeological horizons that can be placed into this biostratigraphic framework on the basis of botanical data remain few and most chronological positions are therefore inferred from 14C dates only (Leesch & Müller 2012; Leesch et al. 2012). Two exceptions are the large open-air sites Monruz and Champréveyres located at the shore of Lake Neuchâtel, both excavated in the 1980ies in the course of the construction of a motorway (Leesch 1997; Bullinger et al. 2006). In addition to these well-preserved archaeological sites, a long section including many thin layers of organic deposits has been documented at Rouges-Terres, a site that is located only few hundred meters away from Champréveyres and that has become a regional reference sequence for the Oldest Dryas-Bølling (GI-1e) transition (Thew et al. 2009).

Monruz and Champréveyres have produced several Late Magdalenian and Early Azilian occupation horizons, embedded in Late Glacial sedimentary sequences that have produced rich botanical and faunal remains, including insects and molluscs as well as a large set of radiocarbon dates (Leesch et al. 2004). At both sites, the Magdalenian horizons are dated towards the end of Greenland Stadial 2 (Oldest Dryas), whereas the Azilian horizons are correlated with Greenland Interstadial 1e. These correlations are established on the basis of botanical data: The Magdalenian hearths contain nearly exclusively charcoal fragments from dwarf willow (*Salix retusa type*), while the Azilian hearths contain almost only juniper (*Juniperus sp.*). It is therefore irrefutable that the Azilian technocomplex starts before the expansion of pine (*Pinus sylvestris*)

in a still open landscape in which reindeer had been replaced by red deer, but in which horse was still common. The shift from Magdalenian to Azilian seems to be abrupt. However, various Magdalenian assemblages from other sites in Switzerland, e. g. Kastelhöhle Nord, Käsloch and Kohlerhöhle, characterised by angle-backed points and shouldered points, may represent "transitional" assemblages. They are associated with reindeer but have not produced any charcoal fragments that would allow to place them within the regional botanical "event stratigraphy". Thus, the biostratigraphic position of those assemblages remains ambiguous, i. e. it is unclear whether they are contemporaneous with the Salix/Betula nana phase or with the Juniperus phase.

In any case, the emergence of the Azilian occurs in an open environment. Therefore, the bow and arrow cannot be considered to be an adaption to forested environments. Nor can this equipment be considered to be better adapted for hunting red deer, since this species was hunted successfully with the spear thrower during the Magdalenian. This new technology – a more efficient weapon – spread rapidly all over Europe as a cultural phenomenon, independently of the environmental changes that occurred at the transition from Oldest Dryas to Bølling (GI-1e). However, in contrast to the obvious cultural changes that the utilization of this new weapon induced, no significant transformation can be observed in the overall subsistence system.

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Adoption or adaptation? Late Magdalenian and Early Azilian societies in northern French Alps
Ludovic Mevel

The innovations that characterise the last Upper Palaeolithic societies and especially their techno-economical systems have been finally analysed and modelled based on the Magdalenian and Azilian deposits from the Paris basin (Bodu 1998; Valentin 1995, 2008). The transformation of the hunting behaviour has been one of the major vehicles of the technical modification of the lithic industries at the end of the Magdalenian and/or at the beginning of the Azilian (Pelegrin 2000; Bignon 2008). Needs in lithic projectile points, replacing bone projectile points – less easy to replace lost in a forested environment – should have constituted a major transformation in the production of the lithic equipment (Pelegrin 2000) coinciding with a generalization in the use of soft stone hammers in blade production. If they do not contradict the primum movens of the "azilianisation" process (Pelegrin 2000), the techno-economical analysis of Upper Magdalenian and Early Azilian settlements from northern French Alps (rock shelter of La Fru, Savoie, France) and their comparison with the environmental data allows to discuss the emergence of these new behaviours in this context. Are the causes which lead Magdalenians to adapt their behaviour always the same in the different places where Azilian tradition appears? Are the evolutionary paths always the same?

Although we perceive several and clear technical and typological variations between the Upper Magdalenian and the Early Azilian (such as the identification of the soft hammer technique, the generalization of the curved backed point and some typological aspects as the resharpening of blades), it should not hide real affinities between the Upper Magdalenian and Early Azilian industries, in particular in terms of technological aspect: same debitage process, also discernible in the economical behaviour, with high quality raw material and high productivity of the blade production in a same economical model (Mevel 2010).

Therefore, the Early Azilian can be considered as a Final Magdalenian as much as an initial phase of the Azilian. Moreover, the strong similarity of the lithic industries of the Early Azilian from the Paris basin probably until the edges of the Mediterranean area, suggests a diffusion of these new technical behaviours more than a transformation inside each regional cultural substratum. The intensity of the supra-regional relationship during the Upper-Final Magdalenian does not contradict this scenario. Thus, if the evolution of the lithic equipment may have been progressive in several areas (including the Paris basin, Great Britain and the north of Germany), they may have been more sudden in adjacent areas, where these new ideas were diffusing. Also, if the Northern French Alps data does not refute the preliminary model, they highlight the possibilities of several scenarios for the expansion of the Early Azilian and the possibilities, in several geographical areas, of an adoption more than an adaptation linked to the same environmental change. In the northern French Alps, the characteristic and the behaviour

of the animal biomass should have played a role in the modification of the lithic equipment. The hypothesis of the simplification of the knapping methods from the beginning of the Early Azilian has been discarded for a long time to explain the success of these new technical behaviours during the Bølling. The selection of high quality flint for producing lithic artefacts adds a further level of requirement in the lithic technological system.

May the rapid disappearance of the Early Azilian to the benefit of more „classical" Azilian industries be partly due to this technical system being too restrictive? The expedient trait of the flint production during the recent Azilian and a radical change of the economical model was certainly more linked to a necessary adaptation of the behaviour (Mevel et al. in press).

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More to the Point: Developing an Multi-Faceted Approach to Investigating the Curation of Magdalenian Osseous Projectile Points
Michelle C. Langley

Magdalenian (20,500 - 14,000 cal BP) osseous projectile points are carefully worked components of a technological system vital to the acquisition of subsistence resources, and as such, it is important to understand the entire chaînes opératoire of these artefacts. Significant attention has been given to the manufacturing and use phases of these implements with recent studies focusing on manufacturing stigmata and use wear (Langley et al. 2012; Langley et al. in prep.). While a number of studies have established the durability and efficiency of osseous projectile points, only a handful have touched on the final phases of the chaînes opératoire – restoration, recycling and eventual discard with the embedded issue of curation. As Dibble (1995, 303) succinctly put it, "artefacts are analysed to understand not only why and how they were manufactured, but also why they were thrown away".

While analysts have previously stated that the importance of osseous point restoration and reduction is 'impossible to evaluate', the work currently underway is already demonstrating that through integrating metric and use wear analysis, experimental replication and ethnography, insights into how Middle – Late Magdalenians maintained and discarded their projectile points can be obtained (Langley in press.). The methods and methodology developed in this study can then be applied to other osseous projectile point assemblages including those found both within (e. g. Azilian, Gravettian, Aurignacian etc.) and outside of Europe (e. g. the North African Iberomaurusian). Once these dataset have been collated, comparison of spatial and temporal neighbouring assemblages can then be compared and contrasted to gain further insights into the nature of cultural transitions in various geographical regions.

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3. Summary and discussion

The climatic amelioration that started with the onset of the GI-1e (Bølling/Meiendorf) lead to a successive but also time- and space-transgressive change in vegetation, which is well-defined regionally and can be correlated with the GRIP event stratigraphy (contribution Leesch). Characteristic for GI-1e is a spread of denser shrub vegetation in an otherwise still open landscape. In the southern part of central Europe, the expansion of juniper is a main feature, whereas in northern Germany and Scandinavia a maximum of Hippophaë pollen is observable (contributions Leesch; Weber; Bos et al.). Regional differences become also obvious in the faunal assemblages. While horse is present everywhere in central Europe, reindeer is already replaced by red deer in the south (contribution Leesch), but its remains are still abundant in the north. For the following GI-1c3 (birch Allerød), the case study of Rietberg explores in detail the environmental conditions in one particular area, the cover sand region north of the low mountain range (contribution Bos et al.). The palynological investigations argue for a mosaic-like landscape with stands of birches and sporadically pines within species-rich patches of steppe and meadow vegetation. Red deer, elk, aurochs and beaver are the characteristic species in this increasingly forested landscape (Bosinski 2008, 372).

The environmental changes during the Late Glacial led to a transformation of the hunting

techniques and corresponding modifications of the lithic industries (contribution GRIMM, MEVEL). Here, the increasing use of soft stone hammers to obtain blades with a straight profile for the production of lithic points is characteristic. Several inventories from north-western and western central Europe combine Upper and Late Palaeolithic features such as shouldered points, angle-backed points, bipoints, long B-points, curve-backed points, backed bladelets, zinken/ becs, burins on blades, laterally retouched endscrapers on blades, and scrapers on flakes (HOLZKÄMPER ET AL. in prep.). These are, for instance, assemblages of the Hengistbury type sites from Southern England (contribution Pettitt) and the Rietberg facies from Western Germany (contribution HOLZKÄMPER & MAIER & RICHTER). They are comparable to inventories of Hangest-sur-Somme and Conty Le Marais in northern France, which are typologically assigned to the Early Federmesser-Gruppen. In the light of recent research, it seems possible that the Rietberg facies represents the migration of first Late Palaeolithic hunter-gatherer groups originally coming from the west expanding their territory into the hitherto unpopulated Westphalian lowlands. Few radiocarbon dates place the Early Federmesser assemblages in France and Germany into GI-1c3 and thus after the Early Azilian of the Paris Basin. They may be contemporaneous with the continental Creswellian sites in the northern Netherlands, which are interpreted by stratigraphical observations as belonging to the Allerød Interstadial (STAPERT 1985; KRAMER ET AL 1985). So far, secure Early Federmesser sites are unknown in the Netherlands (contribution RENSINK) and Belgium (contribution OTTE). The Final Magdalenian assemblage of Bois Laiterie probably marks the beginning of the transition period for this region. Further evidence of an occupation between the Magdalenian and the Late Federmesser-Gruppen is documented by radiocarbon dated faunal remains from the famous sites of Gönnersdorf and Andernach-Martinsberg (contribution STREET), although such occupation cannot be further backed-up or elaborated on as the associated lithic assemblage from Gönnersdorf is unfortunately rather small.

Different scenarios are discussed for the transition from the Hamburgian to the Federmesser-Gruppen in the North European Plain. Generally, these scenarios vary between the assumption of a gradual adaptation or an abrupt shift in hunter-gatherer behaviour (contribution Grimm). For the North European Plain, a demographic collapse due to the climatic change during GI-1d and a resettlement by hunter-gatherer groups during GI-1c3 coming from the south or alternatively the arrival and adoption of new ideas and concepts or a regional adaptation to environmental changes are discussed (contributions WEBER; RIEDE). Either way, a Bayesian analyses of the radiocarbon dates suggest a very rapid transition from the Hamburgian to the Federmesser-Gruppen (contribution RIEDE). The Havelte Group occupation at Ahrenshöft LA 58 D seems to belong to GI-1d or early GI-1c3, and northern Federmesser assemblages of the sites Alt Duvenstedt LA 120 B and Klein-Nordende date to GI-1c3, although the latter with its very early but also rather old date is being re-dated at present. Together with Weitsche, these assemblages show typological and technologic features which appear to be characteristic for the Early Federmesser-Gruppen.

The Upper to Late Palaeolithic transition in the southern part of western central Europe seems to take place during GI-1e. Whereas the stratigraphical sequence in the best investigated Swiss sites Monruz and Champréveyres argues for an abrupt shift from the Magdalenian to the Early Azilian, evidences for transitional assemblages associated with faunal remains of reindeer exist at other Swiss sites like Kastelhöhle Nord, Käsloch and Kohlerhöhle (contribution LEESCH). Unfortunately, it is unclear whether they date to GS-2 or GI-1e. In recent investigations of the site La Fru from the northern French Alps, differences but also strong technological similarities between Magdalenian and the Early Azilian assemblages are emphasised (contribution Mevel). This applies for the debitage process and the economical behaviour, with high quality raw material and intensive blade production. Concerning the expansion of the Early Azilian in a changing environment, different scenarios for various geographical areas are conceivable. The processes seem to represent rather an adoption than an adaptation.

The burials from Bonn-Oberkassel (contribution GIEMSCH & SCHMITZ) and Irlich-Sandgrube (contribution ORSCHIEDT ET AL.) in western Germany provide a rare research opportunity, since human remains are extremely scarce in the Late Palaeolithic. Therefore, detailed reinvestigations were begun for both find complexes during the last couple of years. Previous results give information on nutrition and degree of relationships (Bonn Oberkassel) as well as individual age and deficiency symptoms (Irlich-Sandgrube). Future

investigations on the Bonn-Oberkassel burial aim also at detecting the phylogenetic position in the European populations and possible migration movements, which might give new impulses for demographic studies.

Different methods for identifying past demographical parameters such as population density or distribution are known. These include settlement density estimations based on presence/absence data of archaeological sites (contributions Hilpert et al.; Kretschmer; Weniger et al.), and models based on radiocarbon measurement distributions (contribution Edinborough et al.). Moreover, hierarchical models and site catchment analyses (contributions Hilpert et al.; Kretschmer) as well as ethnographic data are included to a certain extent (contributions Weniger et al.; Kretschmer) as are data on ecosystems and climate (contributions Riede; Weniger et al.). Critically, the differences between the distinct European regions, the settled areas within the seemingly vast empty spaces and the uninhabited areas are frequently discussed. The existence of clearly densely populated regions as well as less intensively settled areas gives the impression that certain regions were preferred, while others were apparently inhabited just for short periods. It is past people in these latter regions of ephemeral or peripheral presence that may have been particularly vulnerable under difficult climatic and environmental conditions. The discussion and analysis of such demographic fluctuations is especially pertinent for transitional periods.

In conclusion, it can be stated that the Upper to Late Palaeolithic transition represents a critical and important period in the development of hunter-gatherer societies; critical, because people had to adapt to a rapidly changing environment, and important, because the archaeological remains of this period provide a case study of the interwoven relations between environmental, demographic and cultural change. There appear to be strong links, in many cases probably causal, between the observed climatic and environmental changes and the cultural transitions in most if not all regions. By the same token, however, these changes clearly underdetermine the specific cultural responses documented in the archaeological record – i. e. we cannot relate specific faunal or floral changes with particular projectile point variants. These cultural changes are historically contingent and relate as much to internal cultural dynamics and demographically driven patterns of population movement, connectedness and isolation. Yet, despite its obvious scientific potential, this period remains under-investigated. One reason for this conspicuous lack of research may very well be the scarcity of securely dated and stratified sites from this period. Another related reason might be that the archaeological visibility of assemblages dating to precisely this period is low, since the joint occurrence of artefacts usually associated with either Upper or Late Palaeolithic assemblages, led to the classification of many collections as "mixed". We hope that this workshop report helps to shed new light on this interesting period and encourages new projects in this field of research.

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