Reconsidering the geochronological framework of Lateglacial hunter-gatherer colonization of southern Scandinavia

Berit Valentin Eriksen

Abstract

The author contributes a southern Scandinavian perspective to the ongoing debate on Lateglacial human colonization of northern Europe. The discussion concentrates on two primary issues: (1) the need for a reliable correlation of the relative archaeological and absolute geochronological frameworks for the Lateglacial, and (2) the question of the timing and nature of colonization in relation to the environmental preconditions in southern Scandinavia. It is argued that the 1974 chronostratigraphic framework (defined by Mangerud et al. *1974) no longer presents an optimal geochronological frame of reference for archaeological sites. It may be used for a rough comparison of the relative archaeological contemporaneity of cultures and technocomplexes on a regional scale. However, for a more detailed investigation of exact relationships, i.e. an actual contemporaneity or co-existence of specific entities, culture groups or even sites, it is not satisfactory. In the present contribution, a brief presentation of the Lateglacial event stratigraphy defined by the INTIMATE group (Björck* et al. *1998) and available geochronological observations from Late Palaeolithic sites thus forms the basis for a discussion of the need to reconsider the timing and nature of Lateglacial hunter-gatherer colonization of southern Scandinavia.*

From an archaeological point of view the present chapter is in many respects controversial. The objective is to engage the reader in a discussion of current geochronological problems, which the author considers essential in relation to the future agenda of the U.I.S.P.P. Commission on "The Final Palaeolithic of the Great European Plain". Many of the problems that will be addressed in the following are particularly well-known to archaeologists doing research within the field of "Behaviour and Landscape Use in the Final Palaeolithic of the European Plain" (i.e. the topic of the Stockholm symposium). Thus, the perceptive reader will undoubtedly concede, that a number of questions must be left open, but the point is whether there will also be agreement as to the art and nature of the questions that are left to debate. *Questioning the questions* is in fact a primary aim of the present contribution – i.e. to encourage discussion on issues which have for various reasons become accepted over the years, but which may still be open to debate, for example when seen in relation to recent progress in our knowledge of the geochronological framework of the Lateglacial. Accordingly, the purpose of the paper is not so much to "reconsider the geochronological

framework of Lateglacial hunter-gatherer colonization of southern Scandinavia", but rather to assert the *need* for such a reconsideration.

There are many pertinent issues in current southern Scandinavian Late Palaeolithic research. At the basis of our investigations, and thus essential to the solving of all other problems, however, is *the need for a reliable correlation of the relative archaeological and absolute geochronological framework for the Lateglacial*. Moreover, of central importance to the issue of "Behaviour and Landscape Use" is the question of *the timing and nature of colonization in relation to the environmental preconditions of the Lateglacial*.

Discussion of these two, obviously interrelated, questions will be based on the simple premise that a society, whose subsistence economy is based exclusively on hunting and gathering, will exploit a marginal region merely to the degree made possible by the more or less favourable natural preconditions reflected in the biostratigraphical record of contemporary climate, flora and fauna. For a thorough methodological discussion of the reliability of the preserved record and the problems pertaining to our inference of Lateglacial climatic conditions from this record, please refer to Kolstrup this volume.

Considering the environmentalist approach of this paper, it is stressed that the natural environment only designates one of perhaps many thresholds which a group of hunter-gatherers (did) have to cope with. The importance of socio-cultural relationships must not be underestimated. Prehistoric people would move to colonize a new region only when and if their social structure permitted it (see for example Åkerlund this volume for a discussion of these issues). In the present paper a discussion of the socio-cultural premises will largely have to be omitted, but it is emphasised that the (re-)colonization of northern Europe during the Lateglacial should be regarded as a cultural process, not as an event (cf also Housley *et al.* 1997).

The need for a reliable correlation of the relative archaeological and the absolute geochronological frameworks for the Lateglacial

Geochronological framework

For a number of years, we have had a distinct perception of the Lateglacial chronological framework in southern Scandinavia. Most scholars

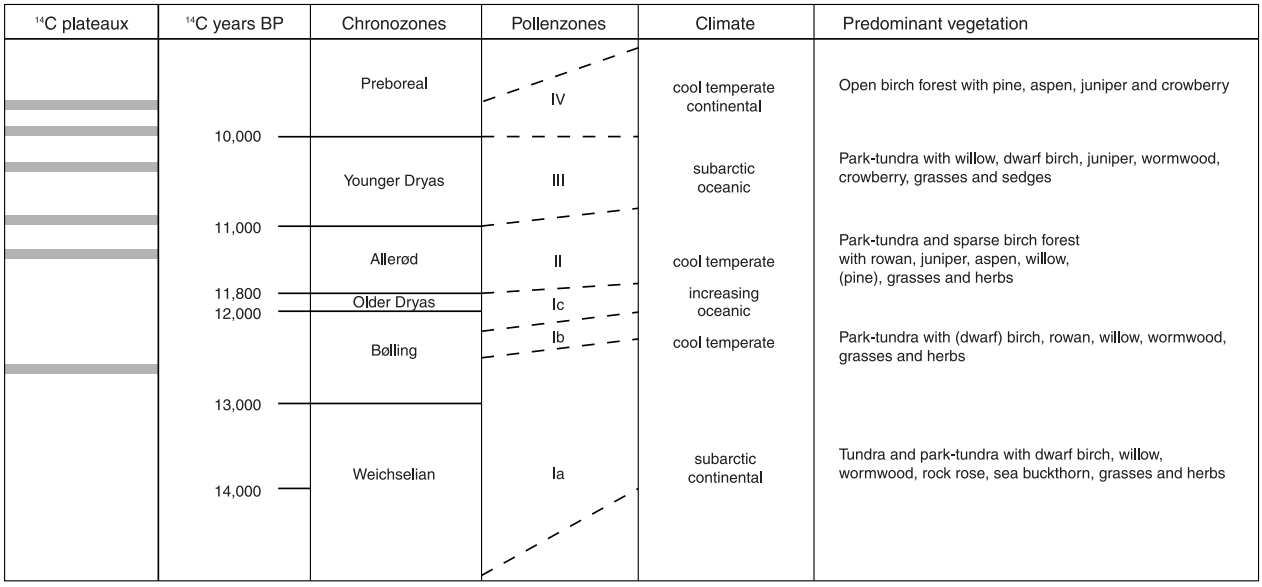

Figure 1. Schematic outline of Lateglacial chronostratigraphy, climate and vegetation in southern Scandinavia. Chronozones according to Mangerud et al. *1974. Pollenzones according to Iversen 1942 and 1954. Radiocarbon plateaux according to Björck* et al. *1998 and Kromer & Becker 1993.*

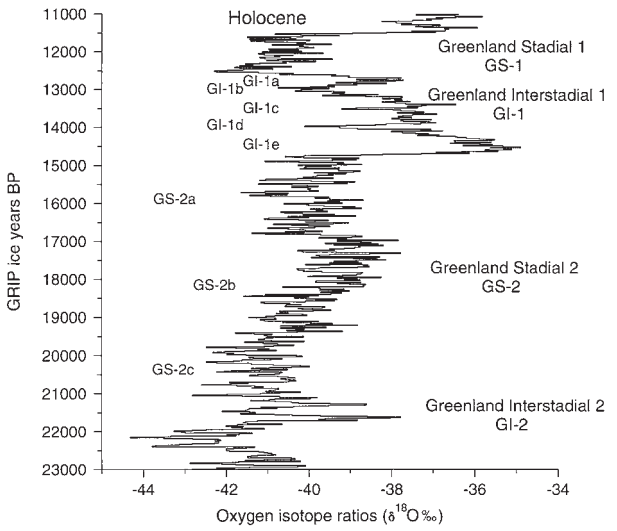

Figure 2. The Lateglacial event stratigraphy based on the high-resolution oxygen isotope record in the GRIP Greenland ice-core as suggested by the INTIMATE group. Greenland Stadial 1 (GS-1) corresponds to the Younger Dryas chronozone and Greenland Interstadial 1 (GI-1e through 1a) corresponds to the Bølling - Older Dryas - Allerød chronozones sensu Mangerud et al. *1974. Reproduced from Björck* et al. *1998 by permission of John Wiley & Sons Ltd.*

adhere to the chronozones defined by Mangerud *et al.* in 1974 (Figure 1). This chronostratigraphic framework is simple and straight-forward, and in southern Scandinavia it is also well-founded. Therefore it is still considered valid for a rough comparison of the relative archaeological contemporaneity or probable co-existence of various cultures or technocomplexes on a regional scale (Eriksen 1996a; Eriksen 1996b). However, for a more detailed investigation of the exact relationships, i.e. the actual contemporaneity or co-existence of specific entities, culture groups or even sites, it is not satisfactory.

From a geological point of view it has also been criticised for lack of detail, and members of the INTIMATE group have recently suggested (Björck *et al.* 1998; Walker *et al.* 1999) that the 1974 chronostratigraphic framework for the Lateglacial should be replaced by a more detailed event stratigraphy (Figure 2) based on the high-resolution oxygen isotope record in the GRIP Greenland ice-core. The argumentation for the necessity of this new classificatory scheme is multifarious, but may be summarised under the following headings: *Terminology, time transgression* and *radiocarbon dating.*

Terminology

In brief, this problem relates to the fact, that the terms used largely derive from early palaeobotanical studies (Björck *et al.* 1998, 285ff). Moreover, the original biostratigraphical classification (Jessen 1934; Iversen 1942; Iversen 1954), as well as the 1974 chronostratigraphical framework (Mangerud *et al.* 1974), was meant to cover northwestern Europe, but has been applied to other parts of Europe (e.g. Straus 1996, 84ff) and to some extent (i.e., the Younger Dryas event) even to more distant regions of the world. Inevitably, this has led to a lack of clarity and to ambiguity in stratigraphic usage.

As a result many archaeologists have not grasped the difference between chronozones and biozones/pollen zones. Unfortunately this confusion is not confined to archaeologists alone, and the problem is undoubtedly due to the fact that similar names, such as Bølling and Allerød, are used to designate different chronostratigraphical entities. For example, the Bølling chronozone (often referred to as Bølling *sensu lato*) covers the period from 13,000 – 12,000 radiocarbon years BP and according to the definition offered by Mangerud *et al.* (1974, 117): "The Bølling Chronozone thus comprises the Oldest Dryas and Bølling periods or pollen zones Ia and Ib of Iversen (1954)". In Denmark the term Bølling may thus also be used to designate a specific pollen zone, as defined by Iversen. This Bølling interstadial is separated from the Allerød interstadial by the Older Dryas climatic deterioration. However, due to problems in recognising the Older Dryas stadial in many pollen stratigraphies (Berglund 1979, 110; Lowe & Gray 1980, 158; Menke 1983, 229; Kolstrup 1991, 4; Kolstrup, this volume), including even a fairly recent pollen diagram from the classic Bølling bog (Stockmarr 1975), the equivalent of the Danish Bølling interstadial has in northern Germany been termed the Meiendorf interstadial (Stephan 1995, 11; Clausen 1998; Usinger 1998) (Figure 3), and the term Bølling is here used to

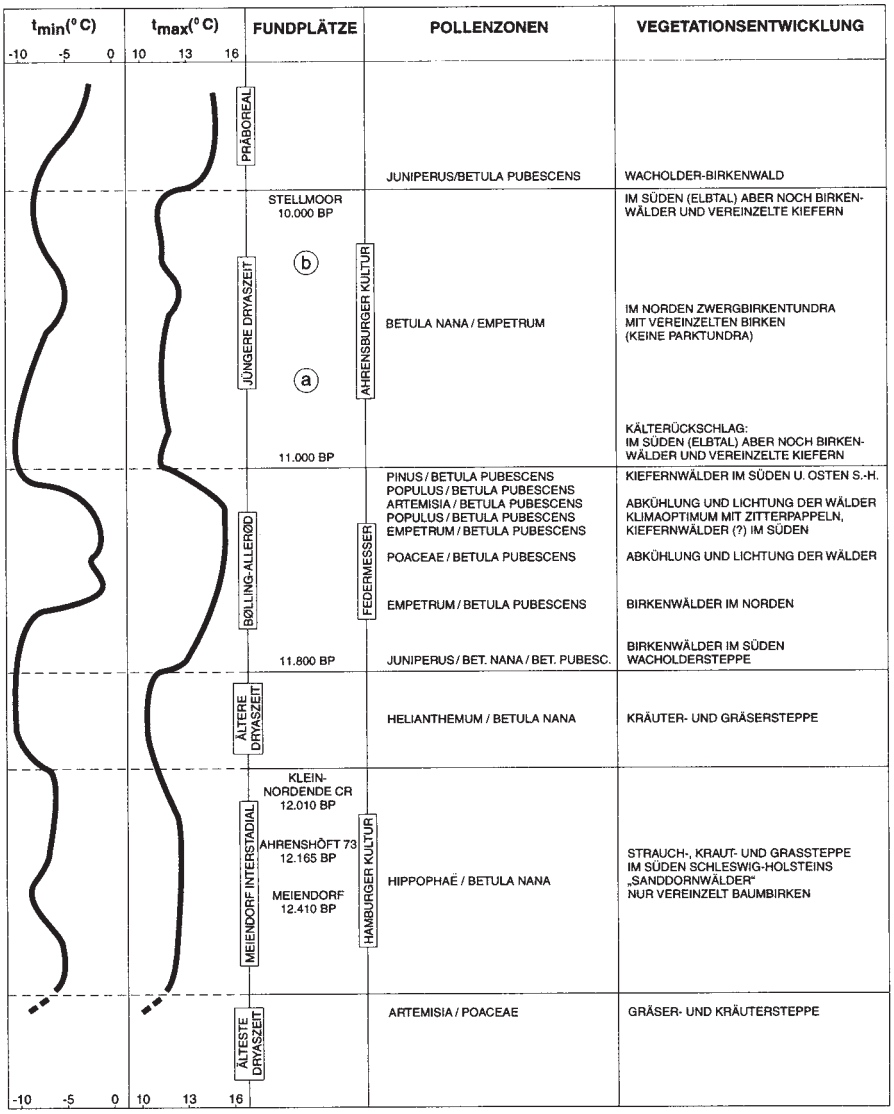

Figure 3. Vegetation and climate in Lateglacial Schleswig-Holstein according to German scholars. Reproduced from Clausen 1998 by permission of Archäologische Gesellschaft Schleswig-Holstein.

designate an early part of the Allerød interstadial.

It has been argued that the original definition of the Danish Bølling pollen zone (Iversen 1942, 144; Iversen 1947, 73ff; Iversen 1954, 94) was based on a misinterpretation of the data (Usinger 1998, 61). However, the new interpretation does not seem to be without complications either (Usinger 1998, 61ff). Thus in the original publication, the Meiendorf interstadial was defined as a genuine pre-Bølling (*sensu* Iversen 1954) biostratigraphical phenomenon with local significance only (Menke 1968, 80). Consequently, the "new terminology" has found occasional acceptance among German scholars (Baales 2000, 240), but there is no general consensus in this respect. Scholars working in northeastern Germany (i.e. in the vicinity of the *locus classicus* of the Meiendorf interstadial) are thus reluctant in applying the term "Meiendorf interstadial" and prefer the term "Hippophaë-Phase" to designate the earliest Lateglacial (Bølling/Meiendorf) interstadial (Kaiser *et al.* 1999). Neither has the new terminology been applied in any of the neighbouring countries.

Obviously, this is not just a controversy over the naming of bio- or chronostratigraphical phases. More than anything else, the current palynological terminology debate stresses the complicated nature of early Lateglacial chronostratigraphy. First and foremost, it is evident that an archaeological site that has been assigned a Bølling-age is not necessarily contemporary (not even from an archaeological point of view) with another site that has been assigned a Bølling-age. And even if

we do confine ourselves to chronozones only, two sites assigned a Bølling-age may still be almost a thousand radiocarbon years apart.

Time transgression

Time transgression is also a matter of ambiguity, which is complicated even further by the terminological problem outlined above (Björck *et al.* 1998, 286). In brief, this issue relates to the fact that the chronozones, which by definition are synchronous within northwestern Europe, are in effect based on radiocarbon-dated *biozones*, whose boundaries are as a rule diachronous on a spatio-temporal scale. For example, the Bølling biozone and the Bølling chronozone are most probably *not* synchronous, even within neighbouring regions. So we are asserting synchronous boundaries which are in fact non-existent, except perhaps for the one at the end of the Younger Dryas biozone/chronozone. This boundary, i.e. the onset of the Preboreal oscillation, seems to be fairly synchronous on a regional, and perhaps even a global, scale. The absolute dating of this boundary, however, is still a matter of some discrepancy because of methodological problems in correlating observations from the more or less fixed or floating, absolute or relative chronological series in varves, deep sea or ice cores, dendrochronological series, palynological series, etc. – and not least the problems associated with obtaining reliable radiometric datings of the observed phenomena.

Radiocarbon dating

According to the INTIMATE group, the 1974 chronostratigraphic scheme is far too reliant on radiocarbon datings (Björck *et al.* 1998, 286ff). In fact, the chronozone boundaries are defined directly in radiocarbon years and without reference to type-sequences or type-sections proper. This is obviously problematic. For instance, the end of the Younger Dryas (the one probable synchronous boundary) coincides with a radiocarbon plateau at 10,000 BP. So far, five such plateaux have been identified within the Lateglacial (Björck *et al.* 1998, 286). There are more severe problems pertaining to both long- and short-term variations in atmospheric radiocarbon ($^{14}C/^{12}C$ ratio), causing temporal distortions in the radiocarbon time-scale. It is therefore necessary to calibrate radiocarbon dates (Blockley *et al.* 2000), but as regards the Lateglacial (and in fact the early Postglacial as well) this is still very difficult (Housley *et al.* 2000).

Based on the above considerations pertaining to *terminology*, *time transgression* and *radiocarbon dating*, the INTIMATE group has stressed the need for an alternative classificatory scheme *not* based exclusively on radiocarbon dating of time transgressive biozone boundaries. This need is also manifest when we look at the archaeological framework.

Archaeological framework

The archaeological record from the period in question has been dealt with in a number of recent papers (Eriksen 1999; Larsson 1999; Eriksen 2000; Johansen 2000; Johansson this volume; Kindgren this volume) and will merely be reviewed very briefly below.

We have evidence of four major Late Palaeolithic cultures or culture groups in southern Scandinavia: Hamburgian, *Federmesser*, Brommean and Ahrensburgian. However, from a source-critical point of view, the evidence is highly varied and also rather unevenly distributed on a spatio-temporal scale.

The *Hamburgian* finds are few – a total of six conclusive settlement sites and a few single finds (Figure 4). They are strictly confined to the southernmost part of the area, with a possible, though not unambiguous, exception from Mölleröd, Central Scania, southern Sweden (Larsson 1999, 180). Moreover, all settlement sites belong to the Havelte group, i.e. a typologically late phase of the Hamburgian culture. In all likelihood, these sites thus represent an ephemeral exploitation of the recently deglaciated young morainic areas in an early phase of the Lateglacial, i.e. presumably the late Bølling and early Older Dryas chronozones. However, the exact dating is vastly problematic. The Jels sites have been tentatively dated by thermoluminescence and by geological observations, but for various

Figure 4. Map showing the location of Danish Hamburgian settlement sites (triangles) and single finds (dots) in relation to the overall distribution of the Hamburgian culture (hatched area) and the macro-topography of the Bølling chronozone (ice front and coast line at approximately 12,500 BP)

reasons these datings merely confirm a late Weichselian age (Huxtable & Mejdahl 1992). In all probability this means a pre-Allerød age, i.e. the late Bølling – Older Dryas chronozones. Fortunately, this tentative dating has recently found support in the dating of a small Havelte-inventory from Ahrenshöft (northern Germany). Radiocarbon dates place this inventory in the late Bølling chronozone, and palynological analyses confirm an attribution to the climax of the Meiendorf interstadial (Clausen 1998, 38ff; Usinger 1998, 68) (Figure 3).

Recent geological analyses of sediments from the Slotseng kettle-hole confirm the presence of man in southernmost Denmark during the later part of the Bølling chronozone (Nielsen 1998). Unfortunately there are no culture-specific artefacts associated with the evidence – only charcoal fragments, flint chips and an increased amount of phosphorus and nitrogen in the soil. Thus, we do not know if the evidence relate to the nearby Hamburgian or *Federmesser* settlement sites. The same problem pertains to the single published ^{14}C determination from Slotseng (12,520 ± 190 BP; AAR-906) (Holm 1996, 53). From an archaeological as well as from a palaeoenvironmental point of view, Slotseng is one of the most important Danish Lateglacial sites. It is currently being reinvestigated, and the new excavations of the

sediments in the kettle-hole will hopefully bring some clarity to these chronological issues (Jørgen Holm and Charlie Christensen, personal communication).

The *Federmesser* finds are few and highly problematic (Figure 5). Only two regular settlement sites have been excavated, both of which are from Slotseng and situated within a few metres of two Hamburgian sites (Holm & Rieck 1992; Holm 1996). A third site, Rundebakke, is known from surface finds only (Petersen 1994). There are also a few single finds of arch-backed points, but the majority of finds represent *Federmesser* types found in connection with other Late Palaeolithic (Hamburgian or Brommean) artefacts. Some of these mixed assemblages comprise a significant *Federmesser* element, e.g. Sølbjerg 2 (Johansen 2000, 199), Hasselø (Johansen 2000, 201), and Stoksbjerg West (Johansson this volume). None of the Danish *Federmesser* finds has been dated by means of radiocarbon dating or geochronological methods. For an indication of their age, we have to rely on purely archaeological reasoning. With reference to the radiocarbon- and pollen-dated inventory from Klein Nordende CR in northern Germany (Bokelmann 1983) it is customary to presume a late Bølling – Older Dryas – early Allerød age (chronozones!) for the Danish inventories. But again this dating is tentative, and moreover Klein Nordende CR (with *Federmesser* artefacts) and one of the Ahrenshöft sites (LA 58 D with Havelte type Hamburgian artefacts) have

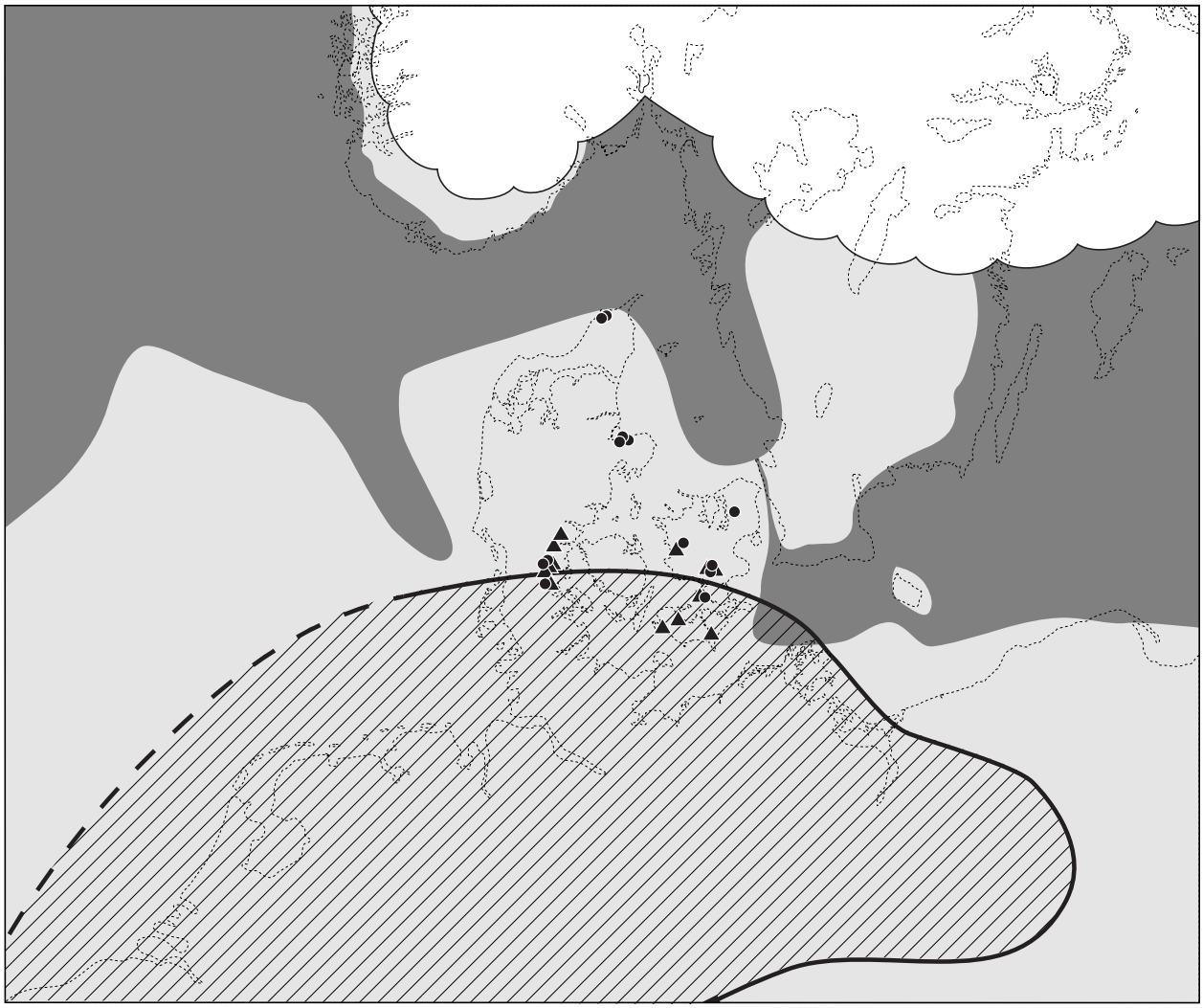

Figure 5. Map showing the location of Danish Federmesser settlement sites (triangles) and single finds (dots) in relation to the overall distribution of the Federmesser culture (hatched area) and the macro-topography of the Allerød chronozone (ice front and coast line at approximately 11,500 BP)

produced almost identical radiocarbon dates (cf. Table 1):

Klein Nordende CR, 12,035 ± 110 BP
Ahrenshöft LA 58 D, 12,030 ± 60 BP

There is a handful of well-dated *Federmesser* sites in the Rhineland, all of middle to late Allerød (chronozone!) age (Street *et al.* 1999, 453), and slightly older sites are known from northern France for example (Fagnart & Coudret 2000, 115, 117ff), but given the problematic nature of the majority of Danish *Federmesser* sites, it is not sensible to infer an absolute dating over such long distances. Obviously, the Danish inventories are situated at the periphery of the *Federmesser* groups area of distribution, and the impression of a pioneer-settlement, albeit somewhat expanded and perhaps even fairly consolidated, still prevails.

The *Brommean* finds are numerous – some 75 settlement sites and 240 single finds (Figure 6). Most of the sites consist of lithic scatters only, and the dating accordingly is problematic. A few sites have been dated by means of radiocarbon, geological or palynological analysis (Table 1-2). The thus-available dates concentrate in the (late) Allerød and early Younger Dryas chronozones, but due to the nature of the sites most of these datings are tentative only. On the other hand, the distribution of the find localities all over the young morainic area, as well as the general amount of

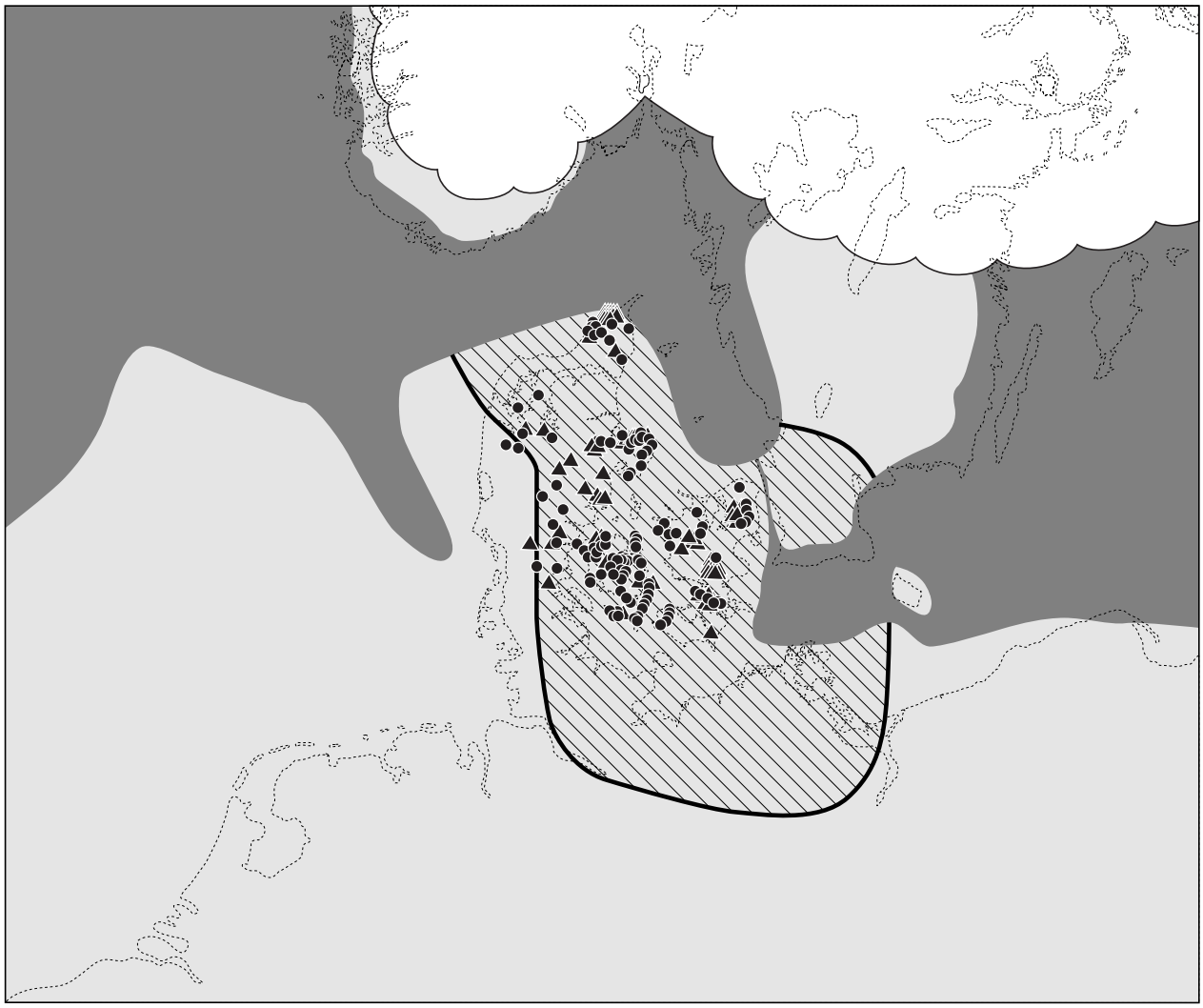

Figure 6. Map showing the location of Danish Brommean settlement sites (triangles) and single finds (dots) in relation to the overall distribution of the Bromme culture (hatched area) and the macro-topography of the Allerød chronozone (ice front and coast line at approximately 11,500 BP)

Site (country)	Cultural group or find association	Radiocarbon years BP	Laboratory number	Dating method	Material dated	Reference
Solrød Strand (DK)	unknown (single find)	12,140 ± 110	AAR-1036	AMS	worked antler	Fischer 1996, 158
Slotseng (DK)	Hamburgian or *Federmesser* (no directly associated cultural horizon)	12,520 ± 190	AAR-906	AMS	bone/antler	Holm 1996, 53
Ahrenshöft LA 58 D (D)	Hamburgian, Havelte group	12,030 ± 60	AAR-2784	AMS	charcoal	Clausen 1998, 37
Klein Nordende CR (D)	*Federmesser*	12,035 ± 110	KI-2124	conv.	charcoal	Bokelmann 1983, 210
Klein Nordende CR (D)	*Federmesser?* (no associated finds, but same geological horizon as KI-2124)	11,990 ± 100	KI-2152	conv.	charcoal	Bokelmann 1983, 210
Trollesgave (DK)	Brommean	11,070 ± 120	K-2641	conv.	charcoal	Fischer 1996, 158
Trollesgave (DK)	Brommean	11,100 ± 160	K-2509	conv.	charcoal	Fischer 1996, 158
Fensmark Skydebane (DK)	Brommean (solifluidal horizon)	10,810 ± 120	OxA-3614	AMS	charcoal	Fischer 1996, 158
Bromme (DK)	Brommean	10,720 ± 90	AAR-4539	AMS	bone	Heinemeier & Rud 2000, 302
Mickelsmossen (S)	Ahrensburgian? (single find)	10,980 ± 110	OxA-2791	AMS	reindeer antler club	Hedges *et al.* 1995, 417
Arreskov (DK)	Ahrensburgian? (single find)	10,600 ± 100	OxA-3173	AMS	reindeer antler club	Fischer 1996, 158

Table 1. Radiocarbon dated Late Palaeolithic finds from southern Scandinavia and selected dates from northern Germany (only reasonable determinations have been included)

Site (country)	Cultural group	Dating method and age estimate	Reference
Jels (DK)	Hamburgian	Thermoluminescence dates of burned flint and geological observations confirm a late Weichselian age	Huxtable & Mejdahl 1992
Bromme (DK)	Brommean	Geological and palynological analyses confirm an Allerød date with a possible continuation into early Younger Dryas	Iversen 1946, 205 & 208
Bro (DK)	Brommean	Geological observations indicate an early Younger Dryas date	Andersen 1973, 47
Nr. Lyngby (DK)	Brommean (single find)	Geological and palynological analyses confirm an (early) Younger Dryas date for the classic arrowhead	Iversen 1942, 146
Segebro (S)	Brommean	Geological observations indicate an Allerød or early Younger Dryas date	Salomonsson 1964, 2

Table 2. Late Palaeolithic finds from southern Scandinavia with reasonable palynological or geological age determinations

finds, may well indicate that they belong to a mild interstadial period – probably the Allerød chronozone. Moreover, there is clear evidence of a permanent, i.e. year-round, exploitation of southern Scandinavia. The map in Figure 6 distinctly displays the core area of Brommean settlement in Denmark, southernmost Sweden (Scania) and northernmost Germany.

Finally the *Ahrensburgian* finds – there is one properly-excavated, definite settlement site (Sølbjerg 1) (Petersen & Johansen 1993), some five to ten possible, but mixed, ones, and about 15 single finds of Ahrensburgian-type tanged points (Figure 7). Again, none of these finds has been unambiguously dated by means of radiocarbon dating or geochronological methods. For an indication of their age, we generally have to rely on pure archaeological reasoning. With reference to the radiocarbon-dated inventory from the *locus classicus* of Stellmoor (Fischer & Tauber 1987), we tend to presume a late Younger Dryas age (chronozone!) for the Danish/southern Scandinavian finds, but this is not supported by any kind of geochronological observation. Incidentally, the distribution of typical Ahrensburgian finds (thus excluding the Ahrensburgian-like,

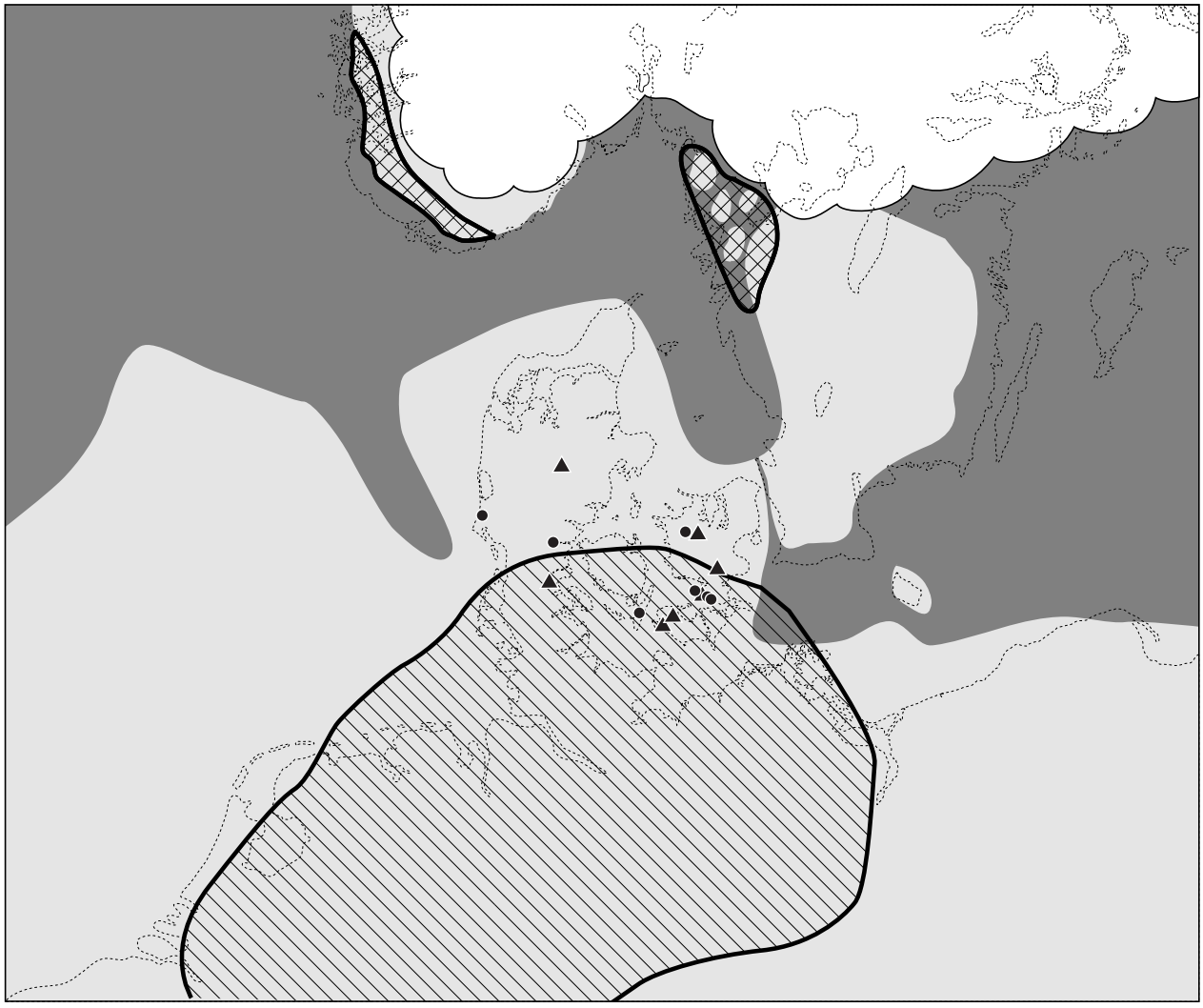

Figure 7. Map showing the location of Danish Ahrensburgian settlement sites (triangles) and single finds (dots) in relation to the overall distribution of the Ahrensburgian culture (hatched area), the Lateglacial Fosna-Hensbacka culture (crosshatched area) and the macro-topography of the Younger Dryas chronozone (ice front and coast line at approximately 10,300 BP)

Lateglacial Fosna-Hensbacka inventories from southern Norway and southwestern Sweden) is fairly strongly biased towards the southernmost part of the area. The main question is whether this distributional pattern is true, or whether we are facing some major methodological problems here. Most probably, however, the sites mapped in Figure 7 do *not* constitute a random sample of the original occurrence of sites.

Evidently, we are having problems concerning the details of the archaeological framework, and the problems increase when we approach a discussion of the second issue, i.e. the timing and nature of colonization.

Timing and nature of colonization in relation to the environmental preconditions of the Lateglacial

Lateglacial southern Scandinavia offers an apparently perfect setting for discussing issues of hunter-gatherer colonization. We are dealing with a completely virgin area, which was becoming available for exploitation and eventually a more permanent settlement. We have quite a good idea of the palaeoenvironmental conditions during the Lateglacial, and all we need to do is to correlate the archaeological and the geochronological frameworks.

In Lateglacial archaeology, radiocarbon dating is often the only scientific dating method available, and until now a correlation of the archaeological and the palaeoenvironmental evidence has first and foremost been based on the few available, more or less reliable, radiocarbon determinations relating the archaeological sites to the 1974 chronostratigraphical framework.

Recently, two very inspiring papers, discussing "radiocarbon evidence for Lateglacial human recolonization" of different parts of northern Europe appeared in *Proceedings of the Prehistoric Society* (Charles 1996; Housley *et al.* 1997). Both papers raised some very interesting issues, for example pertaining to the question of a pioneer phase followed by a residential phase. Given the above-mentioned "perfect setting", it is tempting to contribute a southern Scandinavian perspective to this debate, but it is also very difficult, especially when proceeding from the radiocarbon evidence. Both papers thus tend to neglect a very fundamental question: how do we handle isolated radiocarbon determinations, i.e. dates that are neither supplemented nor supported by other chronostratigraphical observations? Most of the southern Scandinavian dates belong to this group (Table 1-2).

From the above presentation of the archaeological framework, it is evident that we still face a severe lack of absolute dates and chronostratigraphical observations in the southern Scandinavian record. For methodological reasons, most of the Lateglacial assemblages are datable within a relative typological framework only. As a consequence, we find ourselves largely unable to distinguish between absolute and relative contemporaneity of most archaeological sites, and, as a consequence, between degrees of co-existence of certain major cultural groups or traditions during the period in question. However, despite these difficulties there still is ample potential for discussing the timing and nature of colonization, as well as evidence of a pioneer phase followed by a residential phase.

There can be no doubt, that the first hunter-gatherer groups to reach the virgin areas of Lateglacial southern Scandinavia were the Hamburgians. Perhaps even the hunters of the typologically early Meiendorf or *Kerbspitz* phase attempted a pioneer-like exploitation of the southernmost part of the area, but the first unmistakable evidence belongs to the later Havelte phase. Presumably these few sites represent an ephemeral exploitation of the recently-deglaciated area during an early phase of the Lateglacial, probably in the late Bølling and early Older Dryas chronozones.

Unfortunately, the pattern of Hamburgian settlement sites known within southern Scandinavia represents a major source-critical problem. It has thus been argued (Holm 1996, 54ff; Petersen 1995, 5; Petersen & Johansen 1996, 75) that the Hamburgian people expanded rapidly throughout the region, and probably left a number of settlement sites behind – we just have not found them yet, or they have fallen victim to post-depositional erosion. The current paper is not quite in accordance with this view. Here it is argued that despite the current state of absolute chronology, we should not expect to find any large number of Hamburgian sites in the young morainic areas. In fact, the lack of Hamburgian sites in this area is not a coincidence, neither is it a plain methodological question of missing evidence or insufficient conditions for preservation. It is rather a question of *when* in the course of the Lateglacial the recently-deglaciated areas became suitable for human exploitation. All of the region was ice-free in, or even before, the early Bølling chronozone, but there surely would have been a certain time-lag before the major plant and especially animal resources suitable for hunter-gatherer exploitation had attained sufficient abundance, perhaps even a delay of as much as one thousand years – which would correspond to the Bølling chronozone. During this period, human (Hamburgian) exploitation may be expected to have been both episodic and ephemeral, and at any rate limited by seasonal or cyclical fluctuations in resource availability.

Accordingly, it is suggested that the young morainic areas would have favoured a sustained tundra vegetation throughout the Bølling chronozone and thus provided a perfect winter-pasture for reindeer during this period, while the area was still too moist, and represented too uniform a habitat, to allow for a more permanent human

exploitation. Reindeer seem to have been present in southern Scandinavia from very early in the Lateglacial (Aaris-Sørensen 1992). Their presumed abundance during the cold season is based on: (1) finds of cast antlers evidencing the presence of reindeer during this time of the year (Degerbøl & Krog 1959, 97), (2) a modest snow-cover enabling the animals to access their favourite lichens during winter-time (Iversen 1954, 103), and (3) a presumed plague of reindeer flies/mosquitoes during the warm season, caused by the moist character of the landscape (Degerbøl & Krog 1959, 101ff).

However, despite the fact that Lateglacial hunter-gather groups preyed upon reindeer, their habitat preferences were still quite different, and a 'cost-benefit' analysis would soon reveal that to the early Lateglacial hunter-gatherer groups, the young morainic landscapes of southern Scandinavia were still too hostile. Thus, as stated by Kolstrup this volume, even during the Allerød (chronozone) there may only have been modest shelter to protect against the dust- and snowstorms of the cold season. Besides, reindeer herds usually split up into small and scattered groups during winter. Hunting reindeer during this time of the year, under these circumstances, must have been a fairly unpredictable subsistence activity. In conclusion, it is quite likely that reindeer would roam the young morainic areas of southern Scandinavia long before the land was ready to be colonized/settled by human groups.

As stated in the introduction, the colonization of northern Europe during the Lateglacial should be regarded as a cultural process, not as an event. However, the process was not necessarily continuous, and in the beginning it may well have had an event-like character. Based on the above considerations, the Danish Hamburgian sites are accordingly best interpreted as pioneer settlements, i.e. singular or repeated events, of the late Havelte phase out into the recently deglaciated young morainic areas.

When discussing the process of colonization, we also have to consider the issue of contemporaneity. If the Danish Hamburgian inventories from Jels, Slotseng, and Sølbjerg are fifty or hundred years apart – they may be regarded as singular events, but they are still archaeologically contemporary. If they are no more than a few years apart, we are dealing with repeated events. The situational character of the sites indicates that the latter is rather more likely. The settlement sites of Jels 1 and 2 are situated only some 30 metres apart. In the same valley system, about 5.5 km away, we find Slotseng A and C, which are also situated some 30 metres apart. At Sølbjerg in eastern Denmark, the two Hamburgian settlement sites (Sølbjerg 2 and 3) are situated roughly 200 metres apart. If these six sites were the remains of singular events, one would expect a much more random locational pattern. Perhaps even more striking, however, is the close association between Hamburgian and *Federmesser* inventories at Slotseng and Sølbjerg (cf below).

It is of course also possible, that (some of) the Hamburgian settlements are truly, and not just archaeologically, contemporary. The situation would then be comparable to the late Pleniglacial Gravettian settlement in southwestern Germany: out of a total of five Gravettian settlement sites within the Swabian Alb, four are located in the Ach Valley. Three of these sites are directly connected by refitting of lithic artefacts (Scheer 1993, 203ff), while the fourth site displays close typological, technological and not least raw material affinities with the former three, and thus very probably belongs to the same settlement pattern, i.e. the same course of events. These observations may be interpreted as the result of either true or limited contemporaneity involving one or more groups of people (Scheer 1993, 205ff).

The Gravettian of southwestern Germany has been radiocarbon dated to approximately 20,000-23,000 BP and is thus chronologically separated from the preceding Aurignacian as well as the succeeding Magdalenian by some 3-5000 radiocarbon years. For a quick interpretation, leaving reservations regarding late Weichselian sedimentation processes aside, the Gravettian settlement of the Swabian Alb would thus appear to be a more or less isolated, event-like phenomenon – lasting perhaps only one or a few seasons, and involving the movements of a few, or perhaps only one, human group. However controversial this interpretation may seem, we have to

acknowledge the possibility that it might actually pertain for some of the Danish Hamburgian settlement sites: that the Jels and Slotseng sites might belong to the same course of events – lasting perhaps only one or a few seasons, and involving the movements of a few (or perhaps only one) human groups.

On a regional scale, the Hamburgian culture is succeeded geographically as well as chronologically by the *Federmesser*, or Arch-Backed Piece Complex. The existence of a genuine *Federmesser* occupation in southern Scandinavia is highly controversial, and there is wide, though not unanimous, agreement that some *Federmesser* types constitute an integral part of the early Brommean artefact inventory. On the other hand, *Federmesser* types are also often found in close association with Hamburgian assemblages (e.g. at Slotseng and Sølbjerg), and when considering the, albeit tentative, dating from northern Germany, we must acknowledge some degree of (archaeological, or even true!) contemporaneity between the late Hamburgian Havelte sites and the *Federmesser* ones. Does this mean that in southern Scandinavia the *Federmesser* is nothing more than a brief transitory phase between the Hamburgian and the Brommean? It is clear that further research is needed in order to clarify these aspects.

By 'long-distance' reference to well-dated sites from the Rhineland (Street *et al.* 1999, 453), most of the *Federmesser* sites are considered to belong to the Allerød chronozone, which, mostly by convention, makes them largely contemporary with the Brommean culture. The Brommean culture, however, has a distinctively northerly distribution of sites. Clearly these sites represent the first permanent exploitation, or residential occupation, of the southern Scandinavian young morainic areas. If the Brommean and the *Federmesser* are indeed contemporary (which is also quite possible, despite the lack of unambiguous evidence), we are dealing with a highly interesting socio-cultural boundary in the southern part of the area, but we still have not accounted for the relationship (either chronological or socio-cultural) between these two cultures/culture groups. On the other hand, there is also a possibility that some of the late (northerly) Brommean inventories are partially contemporary with some of the early (southerly) Ahrensburgian ones.

Apparently, southern Scandinavia was left largely uninhabited during the Younger Dryas, but is this really so? If the environmental conditions were too hostile during the mild Bølling oscillation, they surely would have felt no less harsh during the Younger Dryas climatic deterioration – or would they? This discussion concerns the question of prehistoric hunter-gatherer perception of (and adaptation to) their environment: to what degree do our notions of a hostile environment fit the prehistoric reality? For example, during the late Younger Dryas, hunter-gatherer groups appear to have subsisted in an exposed, harsh and cold environment very close to the Scandinavian glaciers in southwestern Sweden and southern Norway (Kindgren this volume), while the more southerly and warmer regions of Denmark appear to have been uninhabited. Was this really so – or is it rather a question of missing evidence or inadequate preservation conditions in Younger Dryas Denmark?

Once they are well-adapted to a specific landscape or situation, human beings are able to withstand quite dramatic climatic changes. One may make comparison with the fate that struck the Norse settlement on Greenland during the late medieval precursor to the so-called "Little Ice Age" in the 15th century. The Norse settlers were not well-adapted: they vanished, whereas the Eskimos (unjustly referred to as "Skraellinger", i.e. weaklings, by the Norse) even survived the Little Ice Age without major problems. The comparison may seem far-fetched, but the question is whether it is at all unlikely that the Bromme culture continued in the north, while the Ahrensburgian culture developed in the south? The palynological dating of the classic Bromme type tanged point from Nørre Lyngby (*locus classicus* of the now obsolete Lyngby culture) indicates that this is indeed a possibility (Iversen 1942, 146).

As indicated above, the Younger Dryas cultural development also presents another, and quite intricate, set of problems – associated with the Ahrensburgian-like, Lateglacial Fosna-Hensbacka inventories from southern Norway and southwestern Sweden, and, of course, the transition from

Lateglacial hunters to Postglacial/Mesolithic economies. In an attempt to deal with these issues, without including the presumably uninhabited parts of Younger Dryas Denmark (and southernmost Sweden?), many researchers have started to look west – to the so-called Doggerland.

One of the most intriguing, but also inaccessible, phenomena in Lateglacial landscape development concerns the now-submerged North Sea Plain. In the early Postglacial, Denmark, northern Germany, Holland and Great Britain were connected in a cultural sense as well as in the plain terrestrial sense. The characteristics of the "Broad (Star Carr) Mesolithic" and the Maglemosean indicate that these far-apart assemblages belonged to the same cultural tradition, and archaeological finds dredged from the North Sea prove that the Doggerland was indeed settled by these people. But in the Lateglacial the situation is more obscure. In fact, when examining the lithic inventories, Denmark and Great Britain would rather seem to have been *divided* by the very same North Sea land bridge. If Doggerland was exploited (or settled) during the Lateglacial, this is likely to have been at a fairly late stage. Moreover, the lack of Brommean finds in western Jutland (Figure 6) indicates that even in the Allerød chronozone there was only a modest (pioneer-like?) exploitation of the old morainic inland area bordering the eastern parts of the Doggerland. Presumably the exploitation of this vast area would have concentrated along the large rivers (e.g. the Elbe), and perhaps it even favoured the young morainic soils and the more temperate western parts. Or perhaps it was first and foremost a coastal settlement subsisting on the rich marine fauna of the North Sea, like the early Fosna-Hensbacka culture in southern Norway and southwestern Sweden. At any rate, the evidence is now lost!

Concluding remarks

During the Lateglacial, the natural environment of the European Plain was characterised by a magnitude of changes in climate, landscape, vegetation and fauna that very probably would have had major influence on contemporary hunter-gatherer land-use patterns. When exploring the diversity of man and environment relationships during the period in question, archaeologists often aim at a generalised synthesis of cultural and environmental changes on a regional scale (Eriksen 1996a; Eriksen 1996b). However, due to the outlined shortcomings of the chronological framework, the result is usually disappointing: a static (two-dimensional) picture of past dynamic (four-dimensional) relationships.

The 1974 chronostratigraphic framework by Mangerud *et al.* may still be used for a rough comparison of the relative archaeological contemporaneity of cultures and technocomplexes on a regional scale. But if we want to find out what really happened in southern Scandinavia in the course of the Lateglacial when the Hamburgian, *Federmesser*, Brommean and Ahrensburgian groups were moving back and forth, it is not sufficiently detailed. These complex spatio-temporal relationships are best illustrated by fitting the archaeological sites into a chronologically-significant grid system which is completely (or as far as possible) devoid of archaeological/methodological interpretation. In my opinion, the Lateglacial event stratigraphy as defined by the INTIMATE group (Björck *et al.* 1998) would seem to represent such a grid.

If we can associate our archaeological sites with the event stratigraphy, we may establish an almost exact relationship between the process of colonization and specific palaeoenvironmental conditions/events. We can find out when various areas were ready to be exploited, and examine which thresholds were more important than others. And most importantly, we can relate all this to a comprehensible timescale in sidereal years. In southern Scandinavia, the previously-mentioned recent geological analyses from Slotseng represent a first attempt in this direction (Nielsen 1998, 110-11).

It ought to be mentioned that the INTIMATE group uses the GRIP ice core as a basis for the proposed event stratigraphy because it presents "a continuous, high-resolution, proxy climatic record that spans the entire period from the Last Glacial Maximum through Termination 1 of

the marine isotope sequence to the Pleistocene-Holocene boundary" (Björck *et al.* 1998, 288). Other researchers prefer to use the GISP-2 ice core (Street *et al.* 1999), but as regards the Lateglacial period, differences between GRIP and GISP-2 are in fact negligible (Jöris & Weninger 2000, 31, figure 7).

Obviously, it is not without problem to replace a local, biostratigraphical, climatic record with a high-resolution oxygen isotope record from far-away Greenland (whether it is GRIP or GISP-2). Numerous regional or local differences in climate, as well as different vegetational, faunal, etc., responses to climatic changes, may prevent a reliable correlation. On the other hand, the proposal of the INTIMATE group is not to replace but to complement the local stratigraphic schemes (Björck *et al.* 1998, 290). Oxygen isotope, and other high-resolution, climatic records are available from all over Europe, and there are a number of chronological markers (events) which may be used to link far-apart regions into a net of local and regional event stratigraphies. One such marker is the LST (Laacher See Tephra) horizon, which allow the synchronisation of Allerød climate records over most of central (and in part, northern) Europe (Jöris & Weninger 2000, 38, figure 10). The LST is even present in the Lateglacial stratigraphy from Vallensgårds Mose on Bornholm, and would thus provide a link between southern Scandinavian and central European event stratigraphies (Usinger 1978).

In order to proceed along these lines, however, we need a lot more interdisciplinary research. Most importantly, this research must be based on a set of well-defined questions pertinent to both archaeologists and palaeoenvironmentalists. Truly interdisciplinary research is not a matter of purchasing scientific assistance or technical advice, neither is it a matter of adding a human/social perspective to a hard-core science project. A successful geoarchaeological approach is based on mutual inspiration and close co-operation. Lateglacial hunter-gatherer groups were themselves part of the environment which they were exploiting. Accordingly, the study of prehistoric human behaviour is just as important to palaeoenvironmental research as the palaeoenvironmental results are to archaeological research.

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