Damlien, H. (2014)
Eastern pioneers in westernmost territories? Current perspectives on Mesolithic hunter-gatherer large-scale interaction and migration within Northern Eurasia. *Quaternary International*.

Link to published article:
http://dx.doi.org/10.1016/j.quaint.2014.02.023
(Access to content may be restricted)

Eastern pioneers in westernmost territories? Current perspectives on Mesolithic hunter-gatherer large-scale interaction and migration within Northern Eurasia.

Hege Damlien.

Abstract

The aim of this paper is to present a dynamic approach to material culture that may inform new perspectives on large-scale hunter–gatherer interactions and migrations within Early Holocene northern Eurasia. Recent analyses of technological aspects on a large geographical scale, challenge previous research hypotheses that derive the Mesolithic of Norway from a purely West European late Palaeolithic tradition, and highlights the existence of cultural traits which were shared by a wide range of hunter–gatherers within northern Eurasia in the Holocene. A new technological concept for lithic blade production, referred to as the conical core pressure blade concept, can be traced in the Norwegian archaeological record from the Preboreal/Boreal transition. It is suggested that the introduction of the concept represents the first migration of people and technological knowledge from the eastern Russian plains and the Baltic into the north-westernmost part of Europe. Yet, there have been few attempts to discuss the Norwegian archaeological record in relation to such an eastern cultural tradition. In the following exploration of how the hypothesis relates to the Norwegian archaeological record, results from technological analysis of previously only preliminarily surveyed blade assemblages from southeastern Norway will be presented and discussed against conceptions of the principles of technological transmission and change.

---

1. Introduction and background

The earliest settlement of Norway has been subject to a long research history. Among the most frequently discussed topics are the origin of the earliest population and the direction of initial migration into the area. Today, most scholars accept that the first human occupation of Norway can be dated to the early Preboreal period of the Holocene. The Palaeolithic setting of continental northwestern Europe is considered the backdrop (Bjerck, 1994, Bjerck, 2008, Bang-Andersen, 2003, Bang-Andersen, 2012, Fuglestvedt, 2003, Fuglestvedt, 2005, Fuglestvedt, 2009, Rankama and Kankaanpää, 2011 and Glørstad, 2013). The cultural influence from continental Europe, and South Scandinavia in particular, is traditionally seen as remaining stable throughout the Mesolithic (ca. 9500–3800 cal. BC). A reason is that the early prehistory of Scandinavia has predominantly been studied employing typological approaches to formal tool types, focusing on regionally defined archaeological material on local or national geographical scales (Sørensen et al., 2013). Further, the international political situation during the 1980s and 1990s have, together with language barriers contributed to research policy structures dividing Europe in two. A consequence is a lack of comparative research between eastern Europe and western Scandinavia. Recent alternative research focusing on technological aspects at a large geographical scale challenge previous research hypotheses that derive the Mesolithic of Norway from a purely West European late

Palaeolithic tradition, and provide new perspectives on large-scale human interaction and migration within Eurasia in the early Holocene (Sørensen et al., 2013).

Blades and bladelets were the principal blanks used for tool production over large parts of northern Eurasia throughout the Mesolithic. Blades were obtained through different core reduction techniques and from a variety of core types, differentiated in time and space (Kozlowski, 2009). A new technological concept for lithic blade production, referred to as the conical core pressure blade concept (Sørensen et al., 2013) can be traced in the north Scandinavian archaeological record from the Preboreal/Boreal transition. The concept involves a method in which pressure technique was applied in the process of blade detachment from conical and sub-conical cores (Fig. 1). In northeastern Europe, pressure technique was used from the Late Palaeolithic onward to produce very regular blades while in other regions the technique was introduced at a later stage in prehistory (Kozlowski, 2009). Recently, it has been suggested that the identification and spread of this concept represents the first migration of people, technology and ideas into Scandinavia from the Baltic and the Russian plains (Sørensen et al., 2013).

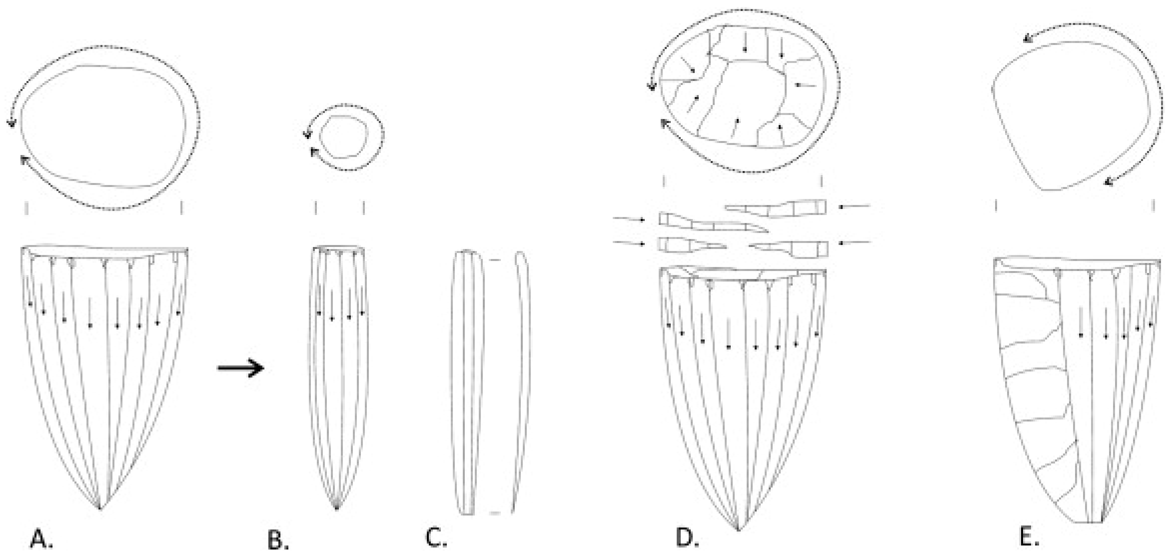

Fig. 1.

The conical core pressure blade concept. Schematized conical core morphologies are illustrated by stage of pressure blade production: A) conical core with a smooth platform; B) bullet-shaped conical core with a smooth platform; C) the typical pressure blade morphology; D) conical core with faceted platform; E) conical core with unexploited back side (sub-conical) (after Sørensen et al., 2013).

In the last decade, several attempts have been made mapping the chronological and spatial distribution of the use of pressure blade technique (Desrosiers, 2012 and Sørensen et al., 2013). Blade production by pressure technique is seen to have emerged in Eurasia around 20 000 years ago, and is documented in a large area centred in Siberia, Mongolia, Japan, and northern China. The earliest manifestation is related to production of microblades detached from wedge-shaped cores, involving the Yubestu-method. The origin of blade production by pressure from conical or “bullet shaped” cores is somewhat uncertain, but the concept is known to appear in southern Siberia, the Ural regions and Central Asia during the Late Pleistocene and early Holocene (Brunet, 2012, Inizan, 2012, Tabarev, 2012 and Takakura, 2012). The pressure technology is suggested to have spread from east to west during the last glacial maximum. The arguments in favour of a single invention centre are based on the presence of the tradition from the Palaeolithic onward in Asia, and on its absence in western Eurasia prior to the Holocene (Inizan, 2012).

In northwestern Russia and the Baltic, blade production by pressure from conical and sub-conical cores is documented in Preboreal and Boreal blade assemblages, related to the “post-Swiderian” complexes (Fig. 2, Table 1). In northwestern Russia, pressure blade technology is found in the Veretye Culture South-east of Lake Onega and the Butovo Culture in the upper Volga basin, on sites dated to the Early and Middle Mesolithic. Over the years, a large number of sites related to the Butovo and Veretye Culture have been excavated. The earliest Veretye sites, Veretye 1, Pechhanitsa and Popove are dated to ca. 9600 cal. BC and the earliest Butovo site, Stanovoye 4 to about 9300 cal. BC (Koltsov and Zhilin, 1999, Oshibkina, 1999, Hertell and Tallavaara, 2011 and Sørensen et al., 2013). In the Baltic region, blade production by pressure is seen in relation to the Kunda Culture, and documented at sites such as Pulli (ca. 8700 cal. BC) and Kunda Lammasmägi (ca. 8500 cal. BC) in Estonia, and Zvejnieki II (ca. 8500 cal. BC) in Latvia (Åkerlund et al., 1996, Sulgostowska, 1999 and Zagorska, 2009). The origin of the Kunda Culture is debated, but the technological resemblance with northwestern Russia is a strong argument for an eastward connection (e.g. Koltsov and Zhilin, 1999, Sørensen, 2012 and Sørensen et al., 2013). Characteristic blade production within these complexes involves pressure technique from conical and sub-conical cores, with facetted platforms. The striking platform was formed and rejuvenated by repeated detachments of core tablets and continues shaping, adjustments and trimming. The blade length indicates large sizes of the initial stage cores that were gradually reduced, resulting in a variety of tool blanks. Other reduction strategies involved production of blades from narrow faced (wedge-like) cores, a strategy resulting in more standardized blanks size (Hertell and Tallavaara, 2011 and Sørensen et al., 2013). Other characteristic features are absence of microburin technique, snapping blades into shorter sections, tanged points, and polished stone axes (Fig. 3) (e.g. Koltsov and Zhilin, 1999, Veski et al., 2005, Rankama and Kankaanpää, 2007, Hertell and Tallavaara, 2011, Sørensen, 2012 and Sørensen et al., 2013). In recent years, pressure blade technique from conical and sub-conical cores with facetted platforms has been identified in newly excavated or surveyed Late Preboreal and Boreal sites in Scandinavia (Sørensen et al., 2013). To date, the earliest documented presence of the concept in Scandinavia is from the Finnish Sujala site in northern Lapland, radiocarbon dated to ca. 8300–8200 cal. BC (Rankama and Kankaanpää, 2007 and Rankama and Kankaanpää, 2011). A site with identical finds has been identified near the Varangerfjord in northern Norway (Rankama and Kankaanpää, 2011).

Table 1.

Sites mentioned in the text within North-western Russia, the Baltic and Finland with the presence of the conical core pressure blade concept (*dated by typology).

Site	Country	Lab. code	Uncal. BP	cal. BC	Reference
Stanovoye 4	Russia	Kia-35152	9879 ± 50	9375–9275	Sørensen et al., 2013
		Kia-35155	8315 ± 48	7480–7330	Sørensen et al., 2013
Zaborovje 2	Russia		ca. 9700–9000*		Zhilin, 2007
Peschanitsa	Russia	GIN-4858	9890 ± 120	9660–9240	Sørensen et al., 2013
Popovo	Russia	GIN-4856	9730 ± 110	9300–8850	Sørensen et al., 2013
Butovo	Russia	GIN-5441	9310 ± 110	8560	Hertell and Tallavaara, 2011
Veretye 1	Russia	Le-1469	9600 ± 80	9180–8830	Sørensen et al., 2013
		GIN-4031	9050 ± 80	8265	Hertell and Tallavaara, 2011
		GIN-4869	8790 ± 100	7893	Hertell and Tallavaara, 2011
		LE-1472	8750 ± 70	7807	Hertell and Tallavaara, 2011
		GIN-2452.U	8560 ± 120	7614	Hertell and Tallavaara, 2011
		GIN-40-30	8520 ± 80	7560	Hertell and Tallavaara, 2011
		GIN-2452.D	8520 ± 130	7566	Hertell and Tallavaara, 2011
Pulli	Estonia	Ua-13351	9385 ± 95	8800–8480	Sørensen et al., 2013
		Ua-13353	9145 ± 115	8550–8260	Sørensen et al., 2013
		Ua-13352	9095 ± 90	8324	Hertell and Tallavaara, 2011
		TA-176	9575 ± 115	8969	Hertell and Tallavaara, 2011
		TA-175	9300 ± 75	8541	Hertell and Tallavaara, 2011
		TA-949	9350 ± 60	8618	Hertell and Tallavaara, 2011

Site	Country	Lab. code	Uncal. BP	cal. BC	Reference
		TA-245	9600 ± 120	8987	Hertell and Tallavaara, 2011
		TA-284	9285 ± 120	8532	Hertell and Tallavaara, 2011
		Hel 2206A	9620 ± 120	9001	Hertell and Tallavaara, 2011
		Hel 2206B	9290 ± 120	8539	Hertell and Tallavaara, 2011
Kunda Lammasmägi	Estonia	Ua-3005	9330 ± 120		Åkerlund et al., 1996
		Ua-3003	9085 ± 100		Åkerlund et al., 1996
		TA-14	8340 ± 280	7830	Liiva and Loze, 1993
Zvejnieki II	Latvia	Ua-18201	9415 ± 80	8800–8560	Zagorska, 1999
		Tln-296	8500 ± 460	8300–7000	Zagorska, 1999
			8240 ± 70		Zagorska, pers.comm
Sujala	Finland	Hela-1102	9265 ± 65	8610–8350	Rankama and Kankaanpää, 2011
		Hela-1442	9240 ± 60	8550–8340	Rankama and Kankaanpää, 2011
		Hela-1441	9140 ± 60	8440–8280	Rankama and Kankaanpää, 2011
		Hela-1103	8940 ± 80	8260–7960	Rankama and Kankaanpää, 2011
		Hele-1104	8930 ± 85	8250–7660	Rankama and Kankaanpää, 2011

Fig. 2.

Sites mentioned in the text. 1) Tørkop, 2) Rørmyr 2, 3) Fiskum, 4) Ragnhildrød, 5) Hovland 2, 6) Hovland 4, 7) Hovland 5, 8) Anvik, 9) Nedre Hobekk 3, 10) Bakke, 11) Solum 1, 12) Bjørkeli, 13) Knubba, 14) Myrvatn site I, 15) Fløyrlivatnet site 6, 16) Fløyrlivatnet site 7, 17) Hå, 18) Galta 3, 19) Moldvika, 20) Hellevik 3a, 21) Botten 1, 22) Lindøy 1b, 23) Austerheim, 24) Ölmevalla, 25–26) Hästhagen, Eldsberga 74, 27) Sujala, 28) Fàllegoahtesaiegualbba, 29) Zvejnieki II, 30) Pulli, 31) Kunda Lammasmägi, 32) Butovo, 33) Zaborovje 2, 34) Stanovoye 4, 35) Veretye 1, 36) Pechhanitsa, 37) Popove. Map by: Magne Samdal.

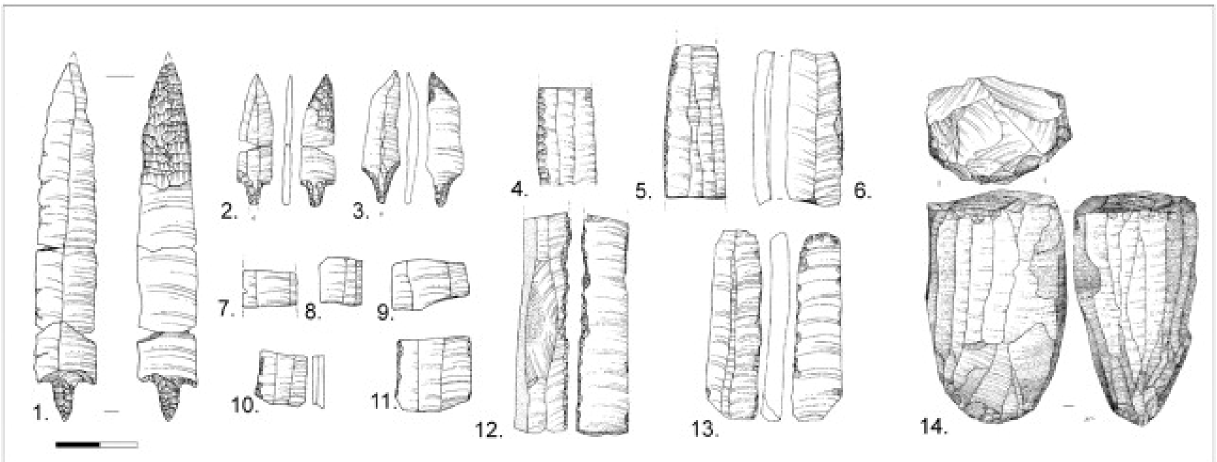

Fig. 3.

Typical artefacts from the Butovo and Kunda Cultures. 1,3,5,7,9–12 Kunda Culture, 3,6,10–11 Butovo Culture (after Sørensen et al. 2013, Fig. 2).

The identification of blade production by pressure in northern Scandinavia at such an early date was unexpected because the technique was supposed to first have reached this region via southern Scandinavia during the Atlantic period (Rankama and Kankaanpää, 2011). In southern Scandinavia, the earliest occurrence is documented in Maglemoseian techno-complex 3, about 7000 cal. BC (Sørensen, 2012). This is evidence for a previously unsuspected northern European route for the spread of pressure blade technique (Inizan, 2012). Radiocarbon dates indicate a gradual spread from northwestern Russia via northern Fennoscandia, into central Sweden, Norway and down along the Norwegian coast. Concurrently, the same concept spread to the eastern Baltic and finally into southern Scandinavia in the late 8th millennium BC. Northernmost Norway and Finland are considered to represent regions where the concept spread by direct eastern migration, whereas it spread as borrowed knowledge west of these regions (Rankama and Kankaanpää, 2011 and Sørensen et al., 2013).

The principal aim of this paper is to clarify how this hypothesis relates to the South Norwegian archaeological record. An initial survey documents the presence of the concept in Norwegian Middle Mesolithic (8250–6300 cal. BC) blade assemblages (Bjerck, 1986, Ballin, 1999 and Sørensen et al., 2013). Until now, few technological studies of blade collections in southern Norway have been conducted. Studies that can clarify the precise technology, if there are regional differences as well as evaluate the dating of the assemblages, are needed.

In order to explore this issue, results from ongoing technological analysis of newly excavated, and previously only preliminarily surveyed, blade assemblages from southeastern Norway will be presented. The observations will be discussed against specific attributes of pressure blade technique within the region, as well as conceptions of the principles of technological transmission and change. The following questions will be addressed: when, how and why did the pressure blade concept emerge within this region? Was it due to a local invention, transmission of knowledge between groups belonging to different traditions, or does the pressure blade concept represent the first eastern pioneers migrating into this region?

2. Cultural transmission and technological change – methodological approach

Ethnographic studies indicate that hunter–gatherer societies are extremely conservative on learning craft skills. This is substantially due to a reliance on learning strategies emphasizing vertical and oblique transmission related to craft techniques, reflecting conservative transmission modes that assure slow evolution (e.g. Hewlett and Cavalli-Sforza, 1986, Shennan and Steele, 1999, Hosfield, 2009, Powell et al., 2010 and Hewlett et al., 2011). The archaeological record is generally characterized by continuity and conservatism in technological practice, rather than change (O'Brien and Shennan, 2010). It seems to be the constraint of existing practice to keep things the same rather than changing them. Most inventions never appear to have been adapted at a collective scale, and just as many innovations fail (Palmer, 2010). Consequently, it is reasonable to assume that the mode of transmission of craft skills within Mesolithic hunter–gatherer societies is comparable to those documented ethnographically. However, within long periods of stability more or less rapid changes can be documented in the archaeological record, often recognized as the presence of something new and different. What should be considered the prime drivers for change in prehistoric hunter–gatherer societies?

In the last two decades, there has been renewed interest in explaining prehistoric cultural change within a methodological evolutionary framework, focusing on identifying mechanisms that guide and regulate transmission of cultural traits (Eerkens and Lipo, 2005). In particular, the concepts of innovation and horizontal transmission between groups have played significant roles in structuring arguments on how and why human behaviour changes (Guglielmino et al., 1995, Eerkens and Lipo, 2007, Hosfield, 2009 and O'Brien and Shennan, 2010). Cultural transmission within hunter–gatherer societies is not exclusively vertical. Other forms of transmission mechanisms such as horizontal, one-to-many or many-to-many, play an important part in shaping material culture development, and should not be underestimated. Several ethnographic studies have demonstrated a clear association between horizontal modes of transmission and innovative patterns in craft skills (e.g. Boyd and Richerson, 1985, Boyd and Richerson, 2005, Riede, 2008 and Hosfield, 2009). This has important implications for archaeological analysis of technological development and change. Different transmission mechanisms are suggested to produce different trajectories of change. These factors can potentially be traced archaeologically and thereby recognised through studies of rate, spread and variability of change in the material culture (Henrich, 2001 and Bettinger, 2008).

In Scandinavian archaeology, evolutionary research is criticized for focusing on the end product rather than the process of change, and for emphasising the appearance of cultural innovation as almost a pre-programmed event, which kicked in whenever a cultural group needed to overcome a social- or physical environmental problem (Apel and Darmark, 2009 and O'Brien and Shennan, 2010). Archaeologists working within a sociological framework have stressed how transmission of technology requires repeated practice. Such practice is part of a historical sequence that takes place in the context of social interaction (VanPool, 2008). Within this approach focus has favoured long-term (*longue durée*) historical structures, intentionality and individual agency over short-term events (e.g. Dobres and Robb, 2000, VanPool, 2008 and Apel and Darmark, 2009), but often without commenting as to how and why the innovation arose and accelerated in the first place.

Recently, several researchers have argued that archaeologists do not need to reject history to develop a scientific approach to cultural change (Eerkens and Lipo, 2007, Riede, 2008, VanPool, 2008 and Prentiss, 2011). One significant reason is that humans are actively creating and modifying the social and physical environments to which they adapt. The overall purpose for archaeologists working within either evolutionary- or sociological frameworks is to explain transmission of cultural traits between people, and how and why certain cultural traits are selected and thereby over time become more common than other competing traits (e.g. VanPool, 2008). However, as emphasized by Apel and Darmark (2009), the two perspectives operate on different temporalities and consequently answer different kinds of questions. Evolution theories contribute basic knowledge concerning certain mechanisms which are fundamental to history and which can be used to put individual historical events and trends in the course of history into a larger picture by creating a link between events and process in a historical setting. Accordingly, studies of individual choices and historical events or processes in prehistory are needed because they are important parts of evolutionary history (Shennan, 2000 and Apel and Darmark, 2009). A methodological approach that can contribute to overcome this challenge and establish links between the two perspectives is *chaîne opératoire*.

As a method for investigating the cognitive aspect of prehistoric humans through their manufacture of lithic artefacts (Audoze, 2002), *chaîne opératoire* enables analysis of technological process as cultural transmission embedded in formative principles of every technological complex (Sørensen et al., 2013). When applied to prehistoric stone industries, the method highlights the importance of logical study of detachment techniques in order to address relationships between different and/or successive techno-complexes (Inizan, 2012). *Chaîne opératoire* places the individual artefact in the context of a technological process at any stage, from raw material procurement via production and use to discard (Eriksen, 2000 and Sørensen et al., 2013). This provides access to a particular quality of cultural reproduction and the knowledge applied in specific technologies, at an individual scale reflecting the society in which the given action is inscribed (Leroi-Gourhan, 1964, Lemmonier, 1986, Pelegrin, 1990, Inizan et al., 1999 and Sørensen et al., 2013). As a result, the method enables definition of prehistoric human traditions through identification of certain aspects of traditional knowledge inherent in the material processes and, on this basis, the study of invention, adaption and diffusion of specific technological traditions (Apel and Darmark, 2007, Apel, 2009 and Sørensen et al., 2013).

Techniques of blade production by pressure represent highly effective and refined means of producing blades. As an elaborate evolution of tool-making techniques, pressure-related blade production can be regarded as an indicator of particular cultural traditions and of diffusion of technical innovation (Chabot and Pelegrin, 2012). Studies of the technique are consequently of great potential since they give important insights into the dynamics of interaction between prehistoric society and technology, by directing explicit attention towards skill, craft learning and transmission underlying the technological practice (Migal, 2006 and Takakura, 2012). Understanding the timing of its appearance has therefore been of notable archaeological interest in evaluating technological temporal changes, as well as the socioeconomic conditions in relation to the adoption of the technique (Rahmani and Lubell, 2012).

Recognition of pressure technique in blade assemblages is based on specific lithic criteria and stigmata found by experimental work, and by analogy, identified in prehistoric lithic assemblages (Inizan et al., 1992, Sørensen, 2006, Sørensen, 2012 and Pelegrin, 2012). These criteria are: a) extreme regularity, b) rare occurrence of ripples, c) straightness, and d) small but distinct bulb in combination with lip formation (e.g. Sørensen et al., 2013). Several experimental studies demonstrate that pressure blade techniques requires specific knowledge regarding the repertoire of gestures, the use of special tools and knapping methods, as well as high degree of know-how which can only be acquired through repeated practice (Pelegrin, 2003, Pelegrin, 2006, Pelegrin, 2012 and Apel, 2008). This implies that someone who have never seen or heard that stone can be detached by pressure technique has very little chance to discover the technique. Jacques Pelegrin (2012) has for many years of experimental work recognized the development of pressure techniques, and identified several modes or techniques for detachment of blades by pressure. Each mode provides the possibility to produce larger blades with greater ease. Different modes require specific conditions for transmitting the knowledge and know-how involved. Some modes, such as the production of microblades and bladelets detached from handheld cores, is a technical invention considered easily transmitted. Larger products, which require devices for the immobilization of the core to facilitate the application of pressure, suggest however the existence of more complex skills and, therefore, were probably more difficult to pass on and to spread over a wider area (Inizan, 2012 and Pelegrin, 2012). Valentine Roux (2010) argue that because techniques are cumulative their evolution follows a certain development order. However, this does not mean that order is the same everywhere. Some groups can ignore certain technological stages and jump directly to more complex stages, given certain environmental or cultural factors. Consequently, the presence of a certain mode of pressure within an archaeological tradition can inform as to how the mode was invented, adapted and transmitted.

3. Blade industries in southeastern Norway, research material and results

The lithic data discussed in this paper comprises case studies from two different areas within southeastern Norway: the Oslofjord region and the Gråfjell/Rena River in the interior of eastern Norway. The eastern part of southern Norway extends an area of roughly 95 000 km^2. The study region is delimited by the Swedish border to the east, by mountains in the north and west and by the Oslofjord and Skagerrak to the south. In recent years large scale excavations within this region have produced a series of well-defined and well-dated lithic assemblages from the Preboreal and Boreal periods (e.g. Jaksland, 2012a, Jaksland, 2012b, Solheim and Damlien, 2013 and Melvold and Persson, 2014). Due to the heavy land uplift after the last Ice Age the coastal areas of southeastern Norway is one of few places in Scandinavia where Mesolithic coastal sites are situated on present-day dry land. The sites are located high above present sea level (59–155 m asl) in forested areas, and have consequently not been disturbed by modern activity. The sites represent chronological undisturbed short occupations in succession. These conditions provide a good starting point for discussing chronological and cultural development in technology over time. The blade assemblages from this region have great potential to shed light on the emergence of the concept within Scandinavia. In addition, a few sites have been excavated in Gråfjell and along Rena River in Hedmark County, an area located in the lower forested valleys of southeastern Norway, close to the Swedish border (Amundsen, 2007 and Stene, 2010). The post-glacial pioneer phase in this region occurred as late as about 8200 cal. BC, when the Scandinavian ice sheet finally retreated.

Raw material strategies and blade production methods and techniques from 13 sites (Fig. 4, Table 2) within southeastern Norway have been investigated and defined. A dynamical technological classification is employed, by which the blade assemblages are classified according to the stage in the production process and specific technical attributes (see Sørensen, 2006 for a detailed description of the method). Based on radiocarbon dates and the shoreline displacement curve the sites date from ca. 8800–7500 cal. BC. In addition, studies of blade assemblages from Early and Middle Mesolithic sites within Rogaland County in southwestern Norway, Halland in southern Sweden, Estonia and Latvia have been conducted (Fig. 2, Table 3). These sites serve as important references for the southeastern Norwegian assemblages.

Table 2.

Dates and technological concept for blade production on analysed sites within the Oslofjord and Rena River region (*dated by shoreline/typology, **cal. bp).

Site name	County	Lab.code	Uncal. BP	cal. BC	Blade technology	Reference
Rørmyr 2	Østfold			ca. 9000–8800*	Opposed platforms, conical/sub-conical cores. Direct percussion.	Skar and Coulsen, 1986
Bakke	Vestfold			ca. 8850–8550*	Opposed platforms, conical/sub-conical cores. Direct percussion.	Nyland, 2012
Solum 1	Vestfold			ca. 8500*	Opposed platform core. Direct percussion.	Fossum, 2014a
Fiskum	Buskerud			ca. 8300*	Conical core pressure blade concept	Eymundsson and Gaut, 2013
Anvik	Vestfold			ca. 8300–8200*	Conical core pressure blade concept	Eymundsson and Mjærum, 2014
Nedre Hobekk 3	Vestfold			ca. 8200–8100*	Platform core. Indirect percussion and pressure.	Fossum, 2014b
Ragnhildrød	Vestfold			ca. 8000–7900*	Conical core pressure blade concept	Mjærum, 2012

Site name	County	Lab.code	Uncal. BP	cal. BC	Blade technology	Reference
Tørkop	Østfold	T-2134	8790 ± 100	8171–7681	Conical core pressure blade concept	Mikkelsen. 1975b
		T-2194	8590 ± 140	7932–7491		
		T-1872	8180 ± 170	7481–6868		
Hovland 5	Vestfold	Ua-45490	8775 ± 52	7952–7741	Conical core pressure blade concept	Mansrud and Koxvold, 2013
Hovland 4	Vestfold	Ua-45493	8568 ± 51	7606–7545	Conical core pressure blade concept	Mansrud, 2013
		Ua-45499	8526 ± 52	7590–7541		
		Ua-45499	8630 ± 49	7680–7587		
		Ua-45500	8747 ± 64	7938–7657		
Hovland 2	Vestfold			ca. 8300–7900*	Conical core pressure blade concept	Koxvold, 2013
Bjørkeli	Hedmark	X3226	11270 ± 710 bp**	9270 ± 710 (10,800–7900)	Conical core pressure blade concept	Damlien, 2010
Knubba	Hedmark	T-18132	8595 ± 120	7845–7500	Indication of conical core pressure blade concept	Amundsen, 2007
		Beta-216497	8780 ± 80	8150–7720		
		T-18133	8545 ± 120	7690–7445		

Table 3.

Dates and technological concept for blade production on analysed sites within southwestern Norway and southern Sweden (*dated by shoreline/typology, **Lab. code and cal. BC not published).

Site	County	Lab. code	Uncal. BP	cal. BC	Blade technology	Reference
Moldvika	Rogaland		ca. 9900–9700*		Opposed platforms, conical/sub-conical cores. Direct percussion.	Høgestøl, 1995
Galta 3	Rogaland		Older than 9700*		Opposed platforms, conical/sub-conical cores. Direct percussion.	Fuglestvedt, 2007
Hellevik 3A	Rogaland		ca. 9700–9000*		Opposed platforms, sub-conical cores. Direct percussion.	Skjelstad, 2011
Austerheim	Rogaland		ca. 9500–9000*		Opposed platforms, sub-conical cores. Direct percussion.	Sæther and Nærøy 2005
Flørlivatnet 6	Rogaland	Beta-141289	9360 ± 80	8790–8325	Opposed platforms, sub-conical cores. Direct percussion.	Bang-Andersen, 2006
		Beta-141300	9460 ± 70	9160–8615		Bang-Andersen, 2006
		Beta-141301	9740 ± 80	9305–8910		Bang-Andersen, 2006
		Beta-141302	9560 ± 80	9220–8625		Bang-Andersen, 2006
		Beta-141303	9430 ± 70	9110–8545		Bang-Andersen, 2006
		Beta-141304	9450 ± 70	9125–8565		Bang-Andersen, 2006

Site	County	Lab. code	Uncal. BP	cal. BC	Blade technology	Reference
Flørlivatnet 7	Rogaland	Beta-131305	9630 ± 80	9245–8750	Opposed platforms cores. Direct percussion.	Bang-Andersen, 2006
		Beta-141294	9360 ± 80	8790–8415		Bang-Andersen, 2006
		Beta-141294	9400 ± 70	9080–9035		Bang-Andersen, 2006
Myrvatn, site I	Rogaland	T-7994	9040 ± 130	8600–7750	Opposed platforms, conical/sub-conical cores. Direct percussion.	Bang-Andersen, 2006
Hå	Rogaland	T-7138	8430 ± 170		Conical core pressure blade concept	Bang-Andersen and Thomsen, 1993
		T-5972	8140 ± 90			
		T-7173	7950 ± 90			
Lindøy 1B,	Rogaland	Beta-237319	8020 ± 50	7060–6820	Conical core pressure blade concept	Skjelstad, 2011
Botten 1	Rogaland	Beta-197313	7900 ± 40	6830–6650	Conical core pressure blade concept	Skjelstad, 2011
		Beta-1978763	7420 ± BP	6370–6320		Skjelstad, 2011
Hästhagen	Sweden		9260 ± 90**		Conical core pressure blade concept, plain platforms	Anberg, 1996
			8630 ± 80**			Anberg, 1996
Eldsberga 74	Sweden		8230 ± 100		Conical core pressure blade concept	Anberg, 1996
			8255 ± 255			Anberg, 1996
Ölmevalla	Sweden		8630–7450		Conical core pressure blade concept	Anberg, pers. comm

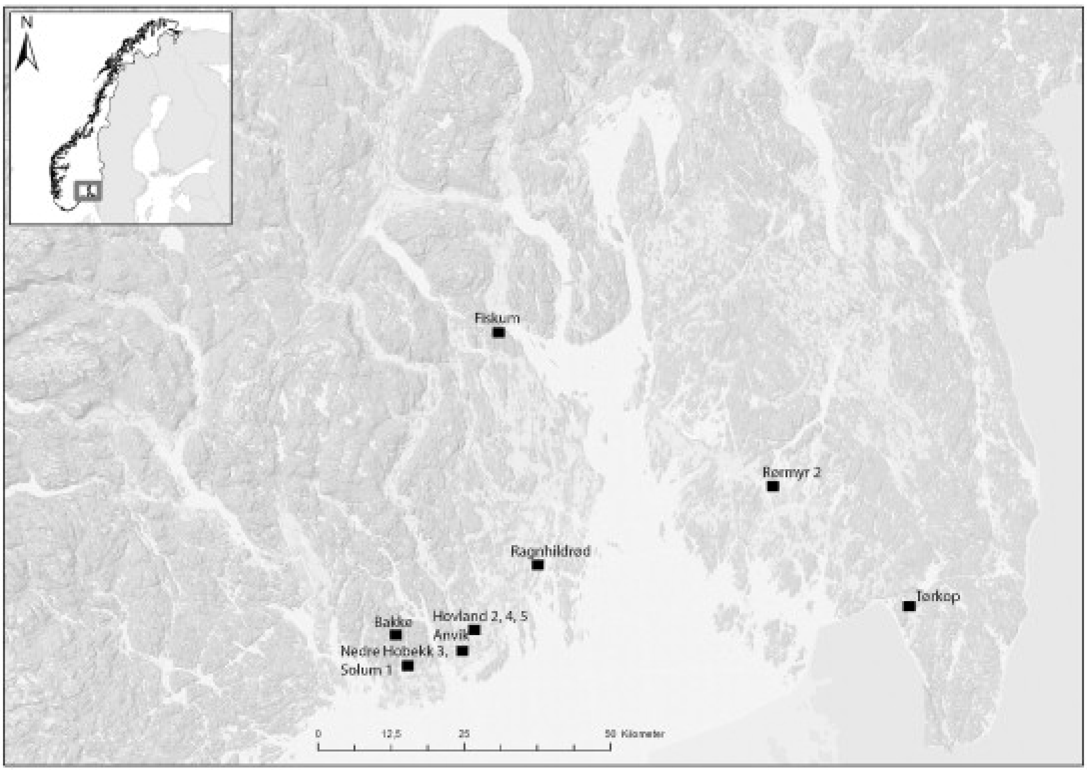

Fig. 4.

The sites location in the Oslofjord region. Map by: Magne Samdal.

As illustrated in Table 2, detailed analysis clearly shows a change in the blade production strategy in southeastern Norway about 8200 cal. BC. Typical assemblages before this date demonstrate blade production involving knapping schemes derived from one-sided cores with opposed platforms, conical or sub-conical cores with flat, plain platforms and an acute angle, indicating use of both soft and medium hard hammer percussion. From about 8200 cal. BC a well-developed conical core pressure blade concept, producing very regular blades from conical or sub-conical cores (Fig. 5a) with facetted platforms (Fig. 5b) and an angle close to 90°, is documented. Morphometric analysis shows the production of a consistent range of blade blanks (Fig. 6a,b), which in turn allowed the production of standardized tools as triangular microliths as well as snapped section blades, probably used as inserts into slotted bone points and as burins. The technique seems connected to both fine-grained flint and non-flint raw materials. At coastal sites, raw material procurement was essentially local. Prepared cores seem to have been made from small and medium-sized beach flint nodules. In the interior, a variety of both local and imported raw materials were used.

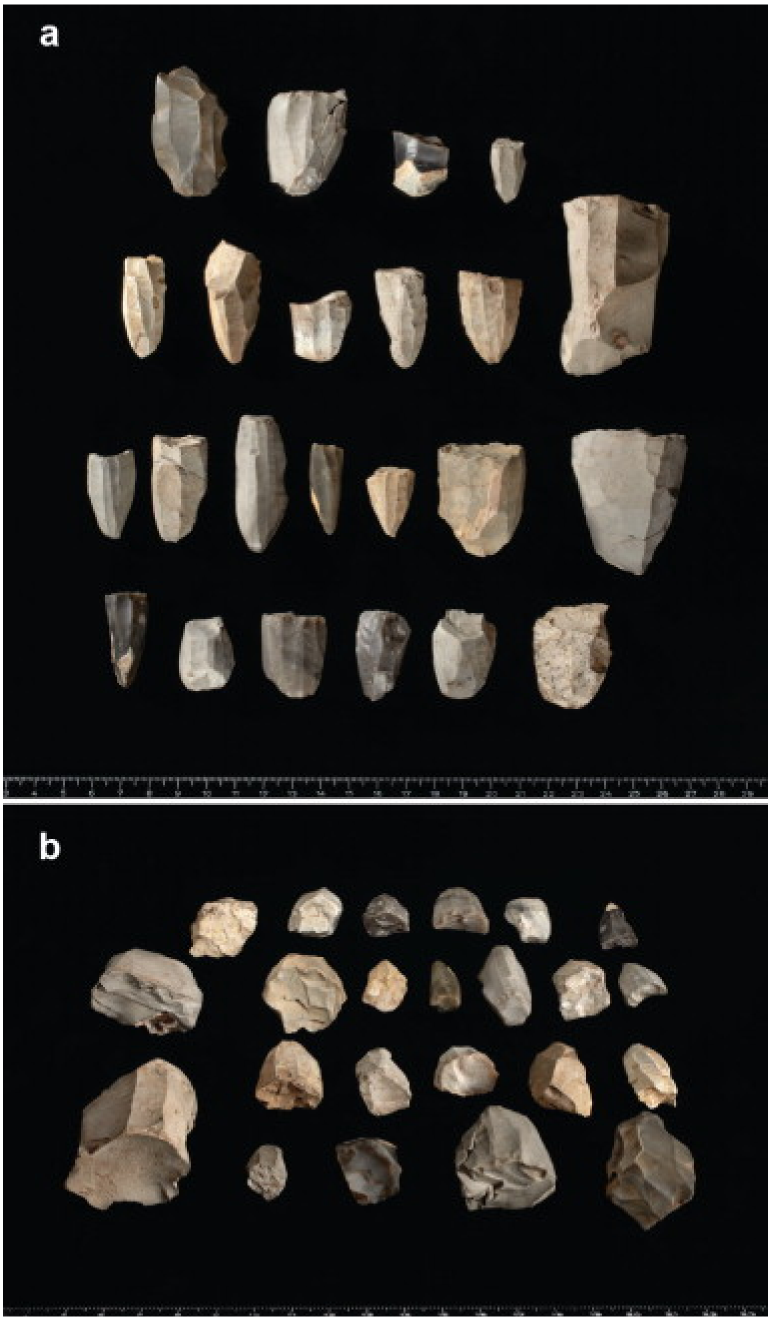

Fig. 5.

a) Conical and sub-conical cores with (b) facetted platforms from Middle Mesolithic sites in the Oslofjord region. Photo: Ellen Holte, Museum of Cultural History, University of Oslo (after Solheim and Damlien (eds.), 2013).

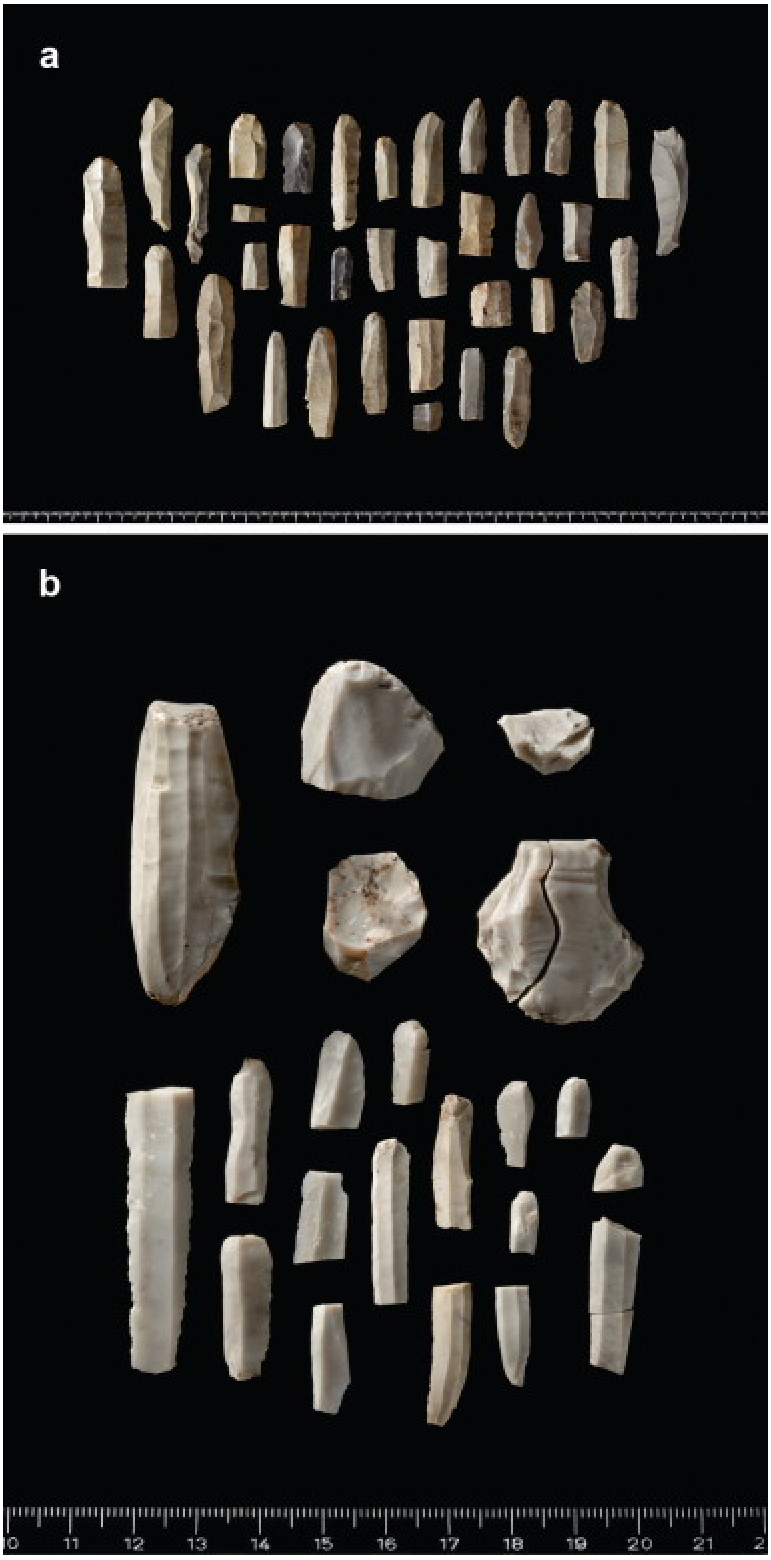

Fig. 6.

a) Selection of blades and bladelets from Middle Mesolithic sites in the Oslofjord region, b) Reduction sequence from a Middle Mesolithic site in Larvik, Vestfold Photo: Ellen Holte, Museum of Cultural History, University of Oslo (after Solheim and Damlien (eds.), 2013).

The *chaîne opératoire* for obtaining the blades seems to correspond within the research area. After collecting suitable raw material, the knappers started by creating the striking platform and preparing two or three crests that were used to shape the core. Indirect percussion and direct percussion techniques were used for the refined pre-shaping of the cores and for repairing or rejuvenating the flaking surface. The strategy for the preparation of the core platform prior to blade detachment consists of both edge abrasions for rubbing down the overhang, and faceting the platform surface. The platform surface was prepared by removing small flakes, usually terminated in hinges. The striking platform was formed and rejuvenated by repeated detachments of core tablets. These core tablets also usually terminated in hinges. This is considered a deliberate strategy aimed at preventing the tablet from plunging and destroying the core face on the opposite side of the platform (Rankama and Kankaanpää, 2011). Blade width varies, but there is no indication of separate macro- and microblade production. Rather, there is a gradual reduction of the core from the widest to the narrowest blades. The blades seem, however, to have been produced using two different concepts: One for production of macroblades by indirect percussion, and one for production of narrower blades up to 11 mm wide by a pressure technique. In many contexts, indirect percussion is known to exist alongside pressure for the production of larger blades. Few blades extend to 5 cm in length, although there are few complete blades.

4. The emergence of pressure blade technology; when, how and why?

The introduction of pressure blade technology in southeastern Norway marks the end of technological long-term stability, and thereby a transition involving an innovative novelty. The earliest presence of the technique in coastal areas of southeastern Norway is documented at the sites Tørkop, Hovland 5 and Hovland 4, radiocarbon dated to ca. 8170–7950 cal. BC (Mikkelsen, 1975a, Mikkelsen, 1975b and Solheim and Damlien, 2013). However, pressure blade technique is also documented on costal sites shoreline dated to 8300–8200 cal. BC. In the interior of eastern Norway the oldest evidence of the concept is from the site Knubba radiocarbon dated to 8150–7445 cal. BC (Amundsen, 2007) and Bjørkeli OSL-dated (optically stimulated luminescence) between 10800 and 7900 cal. BC (Damlien, 2010). The emergence of the concept in both interior and coastal areas seems to correspond, and to have been relatively rapid.

The ways in which skills were transmitted are essential to understand why the pressure blade concept emerged within eastern Norway at the Preboreal/Boreal transition. Based on experimental work (Pelegrin, 2012) the technological analysis of blade assemblages within southeastern Norway indicates detachment of blades by pressure either by using a shoulder crutch immobilizing the core with a hand-held grooved device (Pelegrin's mode 2), or more possible based on the regularity and width of the blades, by sitting pressure using a short crutch immobilizing the core in a grooved device against the ground (Pelegrin's mode 3). Experimental work suggests that mode 2 accounts for detachment of blades by pressure up to 10 mm wide, whereas mode 3 can produce blades up to 12 mm wide and about 8 cm long, possible explaining the production of macroblades by indirect percussion. These modes of pressure require discrete knowledge and invisible know-how, suggesting the existence of complex skills difficult to pass on by imitation and thereby also difficult to spread over a wider area. The presence of such complex modes indicates that it is not likely that the technique was invented independently in this region (e.g. Pelegrin, 2012). Consequently, the adaption of this specific mode into a society, inexperienced with blade detachment by pressure, suggests that the introduction of the technology must be related to interaction with populations already in possession of it and living geographically close (Pelegrin, 2012). The key question is whether the concept was transmitted into the area by migrating groups, or by direct and repeated social contact between different groups.

The pressure blade concept in southeastern Norway displays strong similarities with Preboreal assemblages from northern Scandinavia as well as western Russia and the Baltic, especially with regards to shaping of the core and preparation of the platform (Fig. 7). Furthermore, recent analysis suggests the use of comparable modes for detaching blades by pressure at sites in southeastern Norway and at sites such as Butovo and Zaborovje 2 in northwestern Russia. Indirect percussion appear to have been used for producing macroblades, and pressure technique for the production of bladelets and microblades (Berg-Hansen et al., 2012). This strategy is also identified in the Maglemosian techno-complex 3 in South Scandinavia. However, in this region the platforms were not faceted (Sørensen, 2012). At the Sujala-site, pressure technique was also used for production of macroblades (Rankama and Kankaanpää, 2011). Other characteristic features such as snapping the blades into shorter sections, the presence of polished axes as well as the almost complete absence of microburin technique, are documented in the southeastern Norwegian assemblages. However, there also seems to be differences. No tanged points of “post-Swiderian” type have been identified in the south Norwegian assemblages, and few narrow face cores have been documented.

Fig. 7.

Conical cores with facetted platforms and blades from the Butovo-site, Russia. Photos: Niko Anttiroiko.

The strong resemblances with the eastern tradition and the sudden appearance of the concept could reflect a migration of experienced knappers of eastern origin into southeastern Norway or adjacent areas in the late 9th millennia BC. This is supported by the fact that not only did the pressure blade production technique arrive, but so did the same method and mode for producing the blades. However, the differences might support the hypotheses that the knowledge of the concept was transmitted horizontally in connection with direct and repeated social contact between groups belonging to different traditions, and then spread over large part of the region (e.g. Sørensen et al., 2013). The production of macroblades by pressure from conical cores on Sujala (Rankama and Kankaanpää, 2011) indicates that pressure technique was applied using different modes in these areas. Differences are also documented in southern Sweden and Denmark where the core platforms were remained plain. This may imply different groups' local adaption of the concept, possibly due to the raw material availability in the regions, but also the probability of several potential routes for the concept to spread into present-day southern Norway.

At the onset to the Boreal period, the technique, the *chaîne opératoire* and the final tools in southeastern Norwegian blade assemblages changed, suggesting a technological response to new conditions. In general, evidence of structural change to prehistoric hunter–gatherer cultural and socioeconomic strategies is rare. So, what makes the diffusion of innovations successful? Several researchers have argued that vertical transmission is primarily adaptive in relatively stable environments (McElreath and Strimling, 2008) and that technological innovation and change are more likely to happen in young systems still in development or in older systems under pressure (Pfaffenberger, 1992, Apel, 2009 and Riede, 2009). What should be considered the prime drivers of change in the Late Preboreal period in southeastern Norway? Lithic blade technology and raw material procurement and use played an integral part in the lives of hunter–gatherers. This implies that when social and natural environments and dwelt-in landscapes change, so does the way that people engage with their surroundings. Several researchers (e.g. Sorokin, 1999, Sulgostowska, 1999, Zaliznyak, 1999 and Zhilin, 1999) have seen the development of “post-Swiderian” complexes in Russia and the Baltic in the Early Holocene, as an adaptive response to changing taiga forest environments and the introduction of species such as elk and beaver. The appearance of the conical core pressure blade concept in southern Norway roughly corresponds to the Late Preboreal climatic changes and warmer and drier conditions, affecting the natural environment, vegetation, fauna and distribution and availability of resources. The melting and retreating Scandinavian ice sheet toward the end of the Preboreal opened up new and uninhabited land in the interior of eastern Norway, but it also made other areas unavailable. The paleogeography must be taken into consideration as having played an important role for understanding when humans and different types of animals migrated to the northern parts of Scandinavia during the Late Palaeolithic and Mesolithic (Sørensen and Casati, 2010). The development of the Baltic Sea during the Late Glacial and Early Holocene may have had an important impact, perhaps in more indirect ways for Mesolithic groups in southeastern Norway. The isostatic elevation known as the Ancylus transgression caused dramatic rise in the Baltic Sea level (Ancylus Lake) culminating around 8300–8200 cal. BC (Fig. 8). This incident resulted in the flooding of large landmasses especially in southern Scandinavia and the Baltic region. However, a regression followed (ca. 8200–8000 cal. BC) and large coastal landmasses became available (Jensen et al., 2002, Veski et al., 2005 and Sørensen and Casati, 2010).

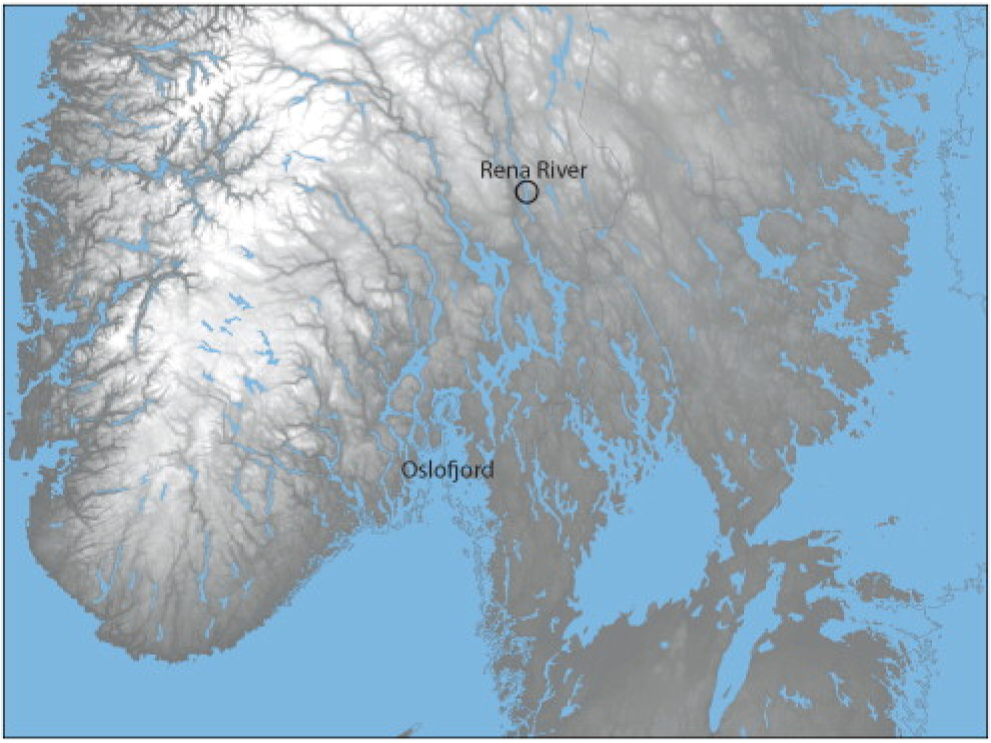

Fig. 8.

Shoreline of parts of southern Norway and Sweden about 8200 cal. BC. The Rena River and Oslofjord-area is marked. Map by Tore Påsse/SGU, Geological Survey of Sweden (after Stene, 2010).

The changes to both land and sea had great influence on both humans and animals that inhabited the more flint-rich areas of southern parts of Sweden and the Baltic region. The flooding may have resulted in people needing to increase the frequency and scale of residential moves into new hunting grounds and social territories (Sørensen and Casati, 2010). New biotopes and landscapes where taken into use. Within these new landscapes, hunter–gatherers faced a situation where sources of high quality lithic raw materials were unevenly distributed and restricted in size. Changes of residential moves seems to have favoured lightening of portable tool kits and effective use of raw materials designed to minimize stone transport costs and overcome risk (Elston and Brantingham, 2002, Hertell and Tallavaara, 2011 and Takakura, 2012). The pioneer settlement in the interior of eastern Norway around 8200 cal. BC might be connected to these events. Raw material procurement and use within this area displays great variability, and reflects strong connections towards central Sweden (Stene, 2010 and Melvold, 2011) an area showing clear links to the eastern tradition (Knutsson and Knutsson, 2012). An interesting question is, how the changes were brought about. Were the responses to changing conditions a function of individual learning, social transmission, adaption or a combination of several factors?

Due to its raw material efficiency and the potential to produce a wide diversity of tool blanks, the pressure blade concept is considered a production strategy suitable for mobile foragers especially in connection with colonisation of new and unknown land (Hertell and Tallavaara, 2011). Direct percussion blade technologies are considered sensitive to changes in raw material availability and the confrontation with other cultural traditions (Knutsson and Knutsson, 2012). Within this scenario, the conical core pressure blade concept could have been transmitted as part of increased regional contact between groups belonging to different traditions, but involving new and overlapping social territories or areas for foraging. New meeting points for transmission of knowledge were created. Social transmission is considered to generate change most rapidly when the population is heterogeneous and substantially large parts have an innovation, while large parts still lack it (Bettinger, 2008). The relatively sudden adoption and development of conical core pressure blade concept in southeastern Norway may be closely related to these requirements, and implies well-established social networks, and that interregional cultural encounters and horizontal transmission of knowledge was widespread and frequent (e.g. Sørensen et al., 2013). When pointing to prime drivers for change in hunter–gatherer societies in the early Holocene, this inference may have important implications as to precisely why the concept was able to disperse across the overall area of northern Scandinavia.

5. Conclusion

This paper attempts to address how lithic blade technology might broaden our perspective on large-scale human interactions and migrations within Eurasia in the early Holocene. More research is needed from adjacent areas to southeastern Norway in order to clarify the development of pressure knapping techniques within the region. However, even at this early stage, investigations focusing on technological aspects at a large geographical scale make it evident that the cultural influence from eastern Eurasia in particular has been significantly underestimated in earlier research on the Mesolithic of Norway. The preliminary results thereby highlight the existence of cultural traits shared by a wide range of hunter–gatherers within Eurasia's early prehistory. The identified distribution indicates that there was a strong selection towards the incorporation of this particular technological element across this vast geographical area, transgressing climatic, topographic and socioeconomic boundaries. As suggested by several researchers (e.g. Chabot and Pelegrin, 2012 and Desrosiers, 2012), it is important to continue the work of identifying the pressure blade concept, and to try to determine whether it was locally invented, acquired by social transmission or transferred by experienced knappers. This work is already in progress as part of a collaborative effort within the Nordic Blade Technology Network. Recent and planned analyses of Late Palaeolithic and Early and Middle Mesolithic blade assemblages in Scandinavia, Poland, Russia and the Baltic, will contribute to shed further light on the emergence of the concept. Within this work, an important future focus will be a detailed study of chronological and regional distribution of the concept in adjacent regions of southeastern Norway. The study will potentially clarify in more detail whether the concept was modified according to local traditions or, alternatively, whether it demonstrates strong similarity between adjacent areas (e.g. Sørensen et al., 2013). In this manner, the study of lithic blade technology can contribute to detection and interpretation of demographic events and social interaction that generated knowledge transmission across continents.

Acknowledgments

I wish to thank the editors of this volume, Peter Jordan and Andrzej Weber for an interesting and inspiring session at the 19th EAA Annual Meeting. I also wish to thank the anonymous reviewers, Kjel Knutsson, Steinar Solheim and Per D. Fredriksen for their helpful comments on the manuscript. Thanks to my generous colleagues for access to unpublished collections, and Lotte Eigeland and colleagues within the Nordic Blade Technology Network for sharing their valuable knowledge on lithic blade technology. Thanks to Niko Anttiroiko for letting me use his photos from the workshop in Tver, and to Magne Samdal for producing the maps.

References

Åkerlund, A., Regnell, M., Possnert, G., 1996. Stratigraphy and Chronology of the Lammasmägi Site at Kunda – Coastal Estonia. In: *Recent Advances in Environmental and Cultural History*, pp. 253-272. PACT, 51. Rixensart

Amundsen, T., 2007. *Elgfangst og bosetning i Gråfjellområdet. Gråfjellprosjektet*. In: Varia 64, Bind II. Fornminneseksjonen, Kulturhistorisk museum, Universitetet i Oslo.

Anberg, S., 1996. Genevad, en överlagrad mesolitisk boplats i Södre Halland. *Arkeologiske rapporter från Hallands Länsmuseer* 1996:5. RAÄ 74, Tönnersa 16: 2, Eldsberga socken, Halland. Unpublished report.

Apel, J., 2008. Knowledge, know-how and raw material e the production of Late Neolithic Flint Daggers in Scandinavia. *Journal of Archaeological Method and Theory* 15 (1), 91-111.

Apel, J., 2009. Historiska og transhistoriska studier av förhistorisk hantverk. In: Lund, J., Melheim, L. (Eds.), *Håndverk og produksjon. Et møte mellom ulike perspektiver,* Oslo arkeologiske serie nr. 12, pp. 111-127.

Apel, J., Darmark, K., 2007. Den flathuggna pilspetsens fylogeni. Mellansvenskt stenhantverk ur ett kulturevolusjonisktiskt perspektiv. In: Stenbäck, N. (Ed.), *Stenålder i Uppland. Uppdragsarkeologi och eftertanke*, Arkeologi E4 Uppland - Studier, vol. 1, pp. 31-65.

Apel, J., Darmark, K., 2009. Evolution and material culture. *Current Swedish Archaeology* 17, 11-28.

Audoze, F., 2002. Leroi-Gourhan, a philosopher of technique and evolution. *Journal of Archaeological Research* 10, 277-306.

Ballin, T.B., 1999. The Middle Mesolithic in southern Norway. In: Boaz, J. (Ed.), The *Mesolithic in Central Scandinavia*, vol. 22. Universitetets Oldsaksamlings Skrifter, Ny Rekke, pp. 203-215.

Bang-Andersen, S., 2003. Southwest Norway at the Pleistocene/Holocene transition: landscape development, colonization, site types, settlement patterns. *Norwegian Archaeological Review* 36 (1), 5-25.

Bang-Andersen, S., 2006. Charcoal in hearths: a clue to the reconstruction of the palaeo-environment of Mesolithic dwelling sites. In: Linderholm, J., Engelmark, R. (Eds.), *Proceedings from the VIII Nordic Conference on the Applications of Scientific Methods in Archaeology, Umeå 2001, Archaeology and Environment*, vol. 21, pp. 5-16. Umeå.

Bang-Andersen, S., 2012. Colonizing contrasting landscapes. The pioneer coast settlement and inland utilization in Southern Norway 10.000-9500 years before present. *Oxford Journal of Archaeology* 31 (2), 103-120.

Bang-Andersen, A., Thomsen, H., 1993. Innberetning om arkeologisk undersøkelse av Tapes-transgredert steinalderboplass på «Hå gamle prestegård», Hå gnr. 10, bnr. 1, Hå k., i april/mai 1986. Topografisk arkiv, Arkeologisk museum. Unpublished Report.

Berg-Hansen, I., Anttiroiko, N., Sjerna, R., Ekholm, T., 2012. Report. Study of Collections in Tver, Russia. STINT-project. Nordic Blade Technology Network. Unpublished Report.

Bettinger, R.L., 2008. Cultural transmission and archaeology. In: O'Brien, M.J. (Ed.), *Cultural Transmission and Archaeology. Issues and Case Studies*. SAA, Washington, pp. 1-9.

Bjerck, H.B., 1986. The Fosna-Nøstvet problem: a consideration of archaeological units and chronozones in the South Norwegian Mesolithic Period. *Norwegian Archaeological Review* 19 (2), 103-121.

Bjerck, H.B., 1994. Nordsjøfastlandet og pionerbosetningen i Norge. *Viking* LVII, 25-58.

Bjerck, H.B., 2008. Norwegian Mesolithic trends: a review. In: Bailey, G., Spikins, P. (Eds.), *Mesolithic Europe*. Cambridge University Press, Singapore, pp. 60-106.

Boyd, R., Richerson, P.J., 1985. *Culture and the Evolutionary Process*. University of Chicago Press, Chicago.

Boyd, R., Richerson, P.J., 2005. *The Origin and Evolution of Cultures*. Oxford University Press, Oxford.

Brunet, F., 2012. The technique of pressure knapping in Central Asia: innovation or diffusion? In: Desrosiers, P.M. (Ed.), *The Emergence of Pressure Blade Making. From Origin to Modern Experimentation*. Springer, New York, pp. 307-328.

Chabot, J., Pelegrin, J., 2012. Two examples of pressure blade production with a lever: recent research from the southern Caucasus (Armenia) and Northern Mesopotamia (Syria, Iraq). In: Desrosiers, P.M. (Ed.), *The Emergence of Pressure Blade Making. From Origin to Modern Experimentation*. Springer, New York, pp. 181-198.

Damlien, H., 2010. Kap. 3.3.1. Bjørkeli-en mellommesolittisk lokalitet. In: Stene, K. (Ed.), *Steinalderundersøkelser ved Rena elv. Gråfjellprosjektet*, Varia 76, Bind III. Kulturhistorisk museum, Fornminneseksjonen, Oslo, pp. 236-265.

Desrosiers, P.M. (Ed.), 2012. *The Emergence of Pressure Blade Making. From Origin to Modern Experimentation*. Springer, New York.

Dobres, M.A., Robb, J.E., 2000. Agency in Archaeology. Routledge, London.
Eerkens, J.W., Lipo, C.P., 2005. Cultural transmission, copying errors, and the generation of variation in material culture in the archaeological record. *Journal of Anthropological Archaeology* 24, 316-334.

Eerkens, J.W., Lipo, C.P., 2007. Cultural transmission theory and the archaeological record: providing context to understanding variation and temporal changes in material culture. *Journal of Archaeological Research* 15, 239-274.

Elston, R.G., Brantingham, P.J., 2002. Microlithic technology in northern Asia: a riskminimizing strategy of the Late Paleolithic and Early Holocene. *Archaeological Papers of the American Anthropological Association* 12 (1), 103-116.

Eriksen, B.V., 2000. "Chaîne Opératoire" – den operative proces og kunsten at tænke som en flinthugger. In: Eriksen, B.V. (Ed.), *Flintstudier. En håndbog i systematiske analyser af flintinventarer*. Aarhus Universitetsforlag, Aarhus, pp. 75-101.

Eymundsson, C., Gaut, B., 2013. *Steinalderlokalitet og førreformatorisk dyrkingslag. Fiskum prestegård, 154/1. Øvre Eiker, Buskerud. Rapport arkeologisk utgravning.* Topografisk arkiv. Kulturhistorisk museum, Oslo.

Eymundsson, C., Mjærum, A., 2014. *Steinalderlokalitet. Anvik, 4067/9. Larvik, Vestfold. Rapport arkeologisk utgravning. Topografisk arkiv*. Kulturhistorisk museum, Oslo (in preparation).

Fossum, G., 2014a. Solum 1. En tidligmesolittisk boplass med metaryolitt. In: Melvold, S.A., Persson, P. (Eds.), *Tidlig- og Mellommesolittiske lokaliteter i Vestfold og Telemark. Vestfoldbaneprosjektet, Bind 1*. Fagbokforlaget (in press).

Fossum, G., 2014b. Nedre Hobekk 3 – en lokalitet fra starten av mellommesolittisk tid. In: Melvold, S.A., Persson, P. (Eds.), *Tidlig- og, Mellommesolittiske lokaliteter i Vestfold og Telemark. Vestfoldbaneprosjektet, Bind 1*. Fagbokforlaget (in press).

Fuglestvedt, I., 2003. Enculturating the landscape beyond Doggerland. In: Larsson, L., Kindgren, H., Knutsson, K., Loefler, D., Åkerlund, A. (Eds.), *Mesolithic on the Move. Papers Presented at the Sixth International Conference on the Mesolithic in Europe, Stockholm 2000*. Oxbow Books, Oxford, pp. 103-107.

Fuglestvedt, I., 2005. Contact and communication in northern europe 10 200-9000/8500 BP – a phenomenological approach to the connection between technology, skill and landscape. In: Knutsson, H. (Ed.), *Pioneer Settlements and Colonization Processes in the Barents Region, Vuollerim Papers on Hunter-Gatherer Archaeology*, vol. 1, pp. 79-96. Voullerim.

Fuglestvedt, I., 2007. The Ahrensburgian Galta 3 site in SW Norway. Dating, technology and cultural affinity. *Acta Archaeologica* 78, 87-110.

Fuglestvedt, I., 2009. *Phenomenology and the Pioneer Settlement on the Western Scandinavian Peninsula*. Bricoleur Press, Gothenburg.

Glørstad, H., 2013. Where are the missing boats. The pioneer settlement of Norway as long-term history. *Norwegian Archaeological Review*, 57-80.

Guglielmino, C.R., Viganotti, C., Hewlett, B., Cavalli-Sforza, L.L., 1995. *Cultural variation in Africa: role of mechanisms of transmission and adaption. Proceedings of the National Academy of Sciences of the United States of America 92*, 7585-7589.

Henrich, J., 2001. Cultural transmission and the diffusion of innovations: adoptions dynamics indicate that biased cultural transmission is the predominate force in behavioural change. *American Anthropologist* 103, 992-1013.

Hertell, E., Tallavaara, M., 2011. Hunteregatherer mobility and the organisation of core technology in the Mesolithic North-Eastern Europe. In: Rankama, T. (Ed.), *Mesolithic Interfaces – Variability in Lithic Technologies in Eastern Fennoscandia*, pp. 94-111. Helsinki.

Hewlett, B.S., Cavalli-Sforza, L.L., 1986. Cultural transmission among Aka Pygmies. *American Anthropologist* 88, 922-934.

Hewlett, B.S., Fouts, H.N., Boyette, A.H., Hewlett, B.L., 2011. Social learning among Congo Basin hunter-gatherers. *Philosophical Transactions of the Royal Society B* 366, 1168-1178.

Høgestøl, M., 1995. *Arkeologiske undersøkelser i Rennesøy kommune, Rogaland, Sørvest-Norge*. AmS-Varia 23. Arkeologisk museum i Stavanger.

Hosfield, R., 2009. Modes of transmission and material culture in craft skills. In: Shennan, S. (Ed.), *Pattern and Process in Cultural Evolution*. University of California Press, pp. 45-60.

Inizan, M.L., 2012. Pressure débitage in the Old World: forerunners, researchers, geopolitics ehanding on the baton (Chapter 2). In: Desrosiers, P.M. (Ed.), *The Emergence of Pressure Blade Making. From Origin to Modern Experimentation*. Springer, Canada, pp. 11-42.

Inizan, M.L., Lechevallier, M., Plumet, P., 1992. A technological marker of the penetration into North America: pressure microblade debitage. Its origin in the Paleolitihic of North Asia and its diffusion. In: Vandiver, P.M., Druzik, J.R., Wheeler, G.S., Freestone, I.C. (Eds.), *Materials Issues in Art and Archaeology, III., Material Research Symposium Proceedings* 26, pp. 661-681. Pittsburgh.

Inizan, M.L., Reduron-Ballinger, M., Roche, H., Tixier, J., 1999. *Technology and Terminology of Knapped Stone.* CREP, Nanterre.

Jaksland, L. (Ed.), 2012a. *E18 Undersøkte lokaliteter fra tidligmesolitikum. Brunlanesprosjektet.* Varia 80, Bind II. Kulturhistorisk Museum, Fornminneseksjonen, Oslo.

Jaksland, L. (Ed.), 2012b. *E18 Undersøkte lokaliteter fra tidligmesolitikum og senere. Brunlanesprosjektet.* Varia 81, Bind III. Kulturhistorisk Museum, Fornminneseksjonen, Oslo.

Jensen, J.B., Kuipers, A., Bennike, O., Lemke, W., December 2002. BALKAT. Østersøen uden grænser. *Nyt fra GEUS*. Nr. 4, pp. 2-19. København.

Knutsson, H., Knutsson, K., 2012. The Postglacial colonization of humans, fauna and plants in northern Sweden. *Arkeologi i Norr* 13. Umeå, 004618 461003-.

Koltsov, L.V., Zhilin, M.G., 1999. Tanged point cultures in the Upper Volga Basin. In: Kozlowski, S., Gurba, J., Zaliznyak, L.L. (Eds.), *Tanged Points Cultures in Europe. International Archaeological Symposium, Lublin, September, 13-16,* 1993 Maria Curie-Sklodowska University Press, Lublin, pp. 346-360.

Koxvold, L.U., 2013. Hovland 2 – En mellomesolittisk lokalitet med flere opphold og et råstoffdepot. In: Solheim, S., Damlien, H. (Eds.), *E18 Bommestad-Sky. Undersøkelser av lokaliteter fra mellommesolitikum, Larvik kommune, Vestfold fylke.* Fagbokforlaget, pp. 80–106.

Kozlowski, S., 2009. Thinking Mesolithic. Oxbow books.
Lemmonier, P., 1986. The study of material culture today: towards anthropology of technical systems. *Journal of Anthropological Archaeology* 5, 147-186.

Leroi-Gourhan, A., 1964. La geste et parole. In: I *Technique et language*. Albin Michel, Paris.

Liiva, A., Loze, I., 1993. Mesolithic and Neolithic habitation of the Eastern Baltic. *Radiocarbon* 35, 503–506.

Mansrud, A., 2013. Hovland 4 – Mellommesolittisk lokalitet med fire funnkonsentrasjoner og ti struktuer. In: Solheim, S., Damlien, H. (Eds.*), E18 Bommestad- Sky. Undersøkelser av lokaliteter fra mellommesolitikum, Larvik kommune, Vestfold fylke.* Fagbokforlaget, pp. 145-172.

Mansrud, A., Koxvold, L.U., 2013. Hovland 5 – En mellommesolittisk lokalitet med spor etter økseproduksjon. In: Solheim, S., Damlien, H. (Eds.), *E18 Bommestad-Sky. Undersøkelser av lokaliteter fra mellommesolitikum, Larvik kommune, Vestfold fylke. Fagbokforlaget, pp. 59-79.*

McElreath, R., Strimling, P., 2008. When natural selection favours learning from parents. *Current Anthropology* 49, 307-316.

Melvold, S., 2011. Råstoff og kommunikasjon i pionerfasen ved Rena elv. *Primitive Tider* 13, 47-60. Oslo.

Melvold, S.A., Persson, P. (Eds.), 2014. *Tidlig- og Mellommesolittiske lokaliteter i Vestfold og Telemark. Vestfoldbaneprosjektet,* Bind 1. Fagbokforlaget (in press).

Migal, W., 2006. The Macrolithic Flint blades of the Neolithic times in Poland. In: Apel, J., Knutsson, K. (Eds.), *Skilled Production and Social Reproduction, SAU Stone Studies 2.* Societas Archaeologica Upsaliensis, Uppsala, pp. 387-398.

Mikkelsen, E., 1975a. Mesolithic in South-Eastern Norway. *Norwegian Archaeological Review* 8 (1), 19-35.

Mikkelsen, E., 1975b. Noen betraktninger omkring C14-datering av Tørkop-boplassen i Idd. In: *Nicolay* 19, pp. 19-21. Oslo.

Mjærum, A., 2012. Boplasspor fra mellommesolitikum og bosetnings- og dyrkningsspor fra eldre jernalder på Unnerstvedt og Ragnhildrød (lok.35). In: Gjerpe, L.E., Mjærum, A. (Eds.), *E18-prosjektet Gulli-Langåker. Jorbruksbosetning og graver i Tønsberg og Stokke,* Bind 2. Fagbokforlaget, Oslo, pp. 19-71.

Nyland, A., 2012. Bakke-en boplass fra tidligmesolitikum. In: Jaksland, L. (Ed.), *E18 Undersøkte lokaliteter fra tidligmesolitikum og senere. Brunlanesprosjektet,* Varia 81, Bind III. Kulturhistorisk museum, Fornminneseksjonen, Oslo, pp. 143-198.

O'Brien, M., Shennan, S.J. (Eds.), 2010. *Innovation in Cultural Systems. Contributions from Evolutionary Anthropology.* Cambridge, London.

Oshibkina, S.V., 1999. Tanged point industries in the north-west Russia. In: Kozlowski, S., Gurba, J., Zaliznyak, L.L. (Eds.), *Tanged Points Cultures in Europe. Read at the International Archaeological Symposium, Lublin, September,13-16, 1993.* Maria Curie-Sklodowska University Press, Lublin, pp. 325-336.

Palmer, C.T., 2010. Cultural traditions and the evolutionary advantages of non-innovation. In: O'Brien, M., Shennan, S.J. (Eds.), *Innovation in Cultural Systems. Contributions from Evolutionary Anthropology,* pp. 161-174. Cambridge, London.

Pelegrin, J., 1990. Prehistoric Lithic Technology. Some Aspects of Research. In: *Archaeological Review from Cambridge* 9, pp. 116-125. Cambridge
.
Pelegrin, J., 2003. Blade-making techniques from the Old World: insights and applications to Mesoamerican Obsidian lithic technology. In: Hirth, K. (Ed.), *Mesoamerican Lithic Technology: Experimentation and Interpretation*. University of Utah Press, Salt Lake City, pp. 55-71.

Pelegrin, J., 2006. Long blade technology in the Old World: an experimental approach and some archaeological results. In: Apel, J., Knutsson, K. (Eds.), *Skilled Production and Social Reproduction, Stone Studies 2.* Societas Archaeologica Upsaliensis, Uppsala, pp. 37-68.

Pelegrin, J., 2012. New experimental observations for the characterization of pressure blade production techniques (Chapter 18). In: Desrosiers, P.M. (Ed.), *The Emergence of Pressure Blade Making. From Origin to Modern Experimentation.* Springer, Canada, pp. 465-496.

Pfaffenberger, B., 1992. Technological dramas. Science, *Technology & Human Values* 17, 282-312.

Powell, A., Shennan, S.J., Thomas, M.G., 2010. Demography and variation in the accumulation of cultural inherited skills. In: O'Brien, M., Shennan, S.J. (Eds.), *Innovation in Cultural Systems. Contributions from Evolutionary Anthropology*, pp. 137-160. Cambridge, London.

Prentiss, A.M., 2011. Social histories of complex hunter-gatherers: Pacific North-west prehistory in a macroevolutionary framework. In: Sassaman, K.E., Holly Jr., D.H. (Eds.), *Hunter-Gatherer Archaeology as Historical Process. Amerind Studies in Archaeology*. The University of Arizona Press, Tucson, pp. 17-33.

Rahmani, N., Lubell, D., 2012. Early Holocene climate change and the adoption of pressure technique in the Maghreb: the Capsian sequence at Kef Zoura D (Eastern Algeria) (Chapter 4). In: Desrosiers, P.M. (Ed.), *The Emergence of Pressure Blade Making. From Origin to Modern Experimentation*. Springer, Canada, pp. 465-496.

Rankama, T., Kankaanpää, J., 2007. The earliest postglacial inland settlement of Lapland. In: Volokitin, A.V., Karmanov, V.N., Pavlov, P.J. (Eds.), *Kamennyy vek Evropeyskogo Severa.* Russian Academy of Science, Ural Branch, Komi Scientific Centre, Institute of Language, Literature and History, Syktyvkar, pp. 44-65.

Rankama, T., Kankaanpää, J., 2011. First evidence of eastern Preboreal pioneers in Arctic Finland and Norway. *Quartär*, 183-209.

Riede, F., 2008. Maglemosian Memes: technological ontogeny, craft traditions, and the evolution of northern Europan Barbed points. In: O'Brien, M. (Ed.), *Cultural Transmission and Archaeology. Issues and Case Studies*. SAA, Washington, pp. 178-189.

Riede, F., 2009. Climate and demography in early prehistory: using calibrated 14C dates as population proxies. *Human Biology* 81 (2-3). Article 11.

Roux, V., 2010. Technological innovations and development trajectories: social factors as evolutionary Forces. In: O'Brien, M., Shennan, S.J. (Eds.), Innovation in Cultural Systems. *Contributions from Evolutionary Anthropology*, pp. 217-234. Cambridge, London.

Shennan, S.J., 2000. Population, culture history, and the dynamics of culture change. *Current Anthropology* 41 (5), 811-835.
Shennan, S.J., Steele, J., 1999. Cultural learning in hominids: a behavioural ecological approach. In: Box, H.O., Gibson, K.R. (Eds.), *Mammalian Social Learning*

Comparative and Ecological Perspectives. Cambridge University Press, Cambridge, pp. 367-388.

Skar, B., Coulsen, S., 1986. Evidence of behaviour from refitting – a case study. *Norwegian Archaeological Review* 19 (2), 90–102.

Skjelstad, G. (Ed.), 2011. *Steinalderboplasser på Fosenhalvøya. Arkeologiske og naturvitenskapelige undersøkelser 2004-2007. T-forbindelsen, Karmøy kommune, Nord-Rogaland*. AmS-Varia 52. Arkeologisk museum, Universitetet i Stavanger.

Solheim, S., Damlien, H. (Eds.), 2013. E18 *Bommestad-Sky. Undersøkelser av lokaliteter fra mellommesolitikum, Larvik kommune, Vestfold fylke*. Fagbokforlaget.

Sørensen, M., 2006. Teknologiske traditioner i Maglemosekulturen. En diakron analyse af Maglemosekulturens flækkeindustri. In: Eriksen, B.V. (Ed.), *Stenalderstudier. Tidligt mesolitiske jægere og samlere i Sydskandinavien.* Jysk Arkæologisk Selskab, pp. 19–76.

Sørensen, M., 2012. The arrival and development of pressure blade technology in southern Scandinavia (Chapter 9). In: Desrosiers, P.M. (Ed.), *The Emergence of Pressure Blade Making. From Origin to Modern Experimentation*. Springer, New York, pp. 237-260.

Sørensen, J., Casati, C., 2010. *The Maglemose Culture in the Southern Baltic* (Master thesis). Faculty of Humanities. University of Copenhagen.

Sørensen, M., Rankama, T., Kankaapää, J., Knutsson, K., Knutsson, H., Melvold, S., Eriksen, B.V., Glørstad, H., 2013. The first eastern migrations of people and knowledge into Scandinavia: evidence from studies of Mesolithic technology, 9-8 millennium BC. *Norwegian Archaeological Review*, 19–56.

Sorokin, A.N., 1999. Neighbours of the Butovo Culture on the upper Volga and Oka Rivers. In: Kozlowski, S., Gurba, J., Zaliznyak, L.L. (Eds.), *Tanged Points Cultures in Europe. Read at the International Archaeological Symposium, Lubin, September, 13-16, 1993*. Maria Curie-Sklodowska University Press, Lublin, pp. 311-317.

Stene, K. (Ed.), 2010. *Steinalderundersøkelser ved Rena elv. Gråfjellprosjektet.* Varia 76, Bind III. Kulturhistorisk museum, Fornminneseksjonen, Oslo.

Sulgostowska, Z., 1999. Final palaeolithic Masovian Cycle and mesolithic kunda culture relations. In: Kozlowski, S., Gurba, J., Zaliznyak, L.L. (Eds.), *Tanged Points Cultures in Europe. Read at the International Archaeological Symposium, Lubin, September, 13-16, 1993*. Maria Curie-Sklodowska University Press, Lublin, pp. 85-92.

Sæther, K., Nærøy, A.J., 2005. Innberetnig fra utgravning på Austerheim 27/16, Utsira kommune. Arkeologisk museum i Stavanger. Unpublished Report.

Tabarev, A.V., 2012. Blades and microblades, percussion and pressure: towards the evolution of lithic technologies of the Stone Age Period, Russian Far East (Chapter 13). In: Desrosiers, P.M. (Ed.), *The Emergence of Pressure Blade Making. From Origin to Modern Experimentation*. Springer, Canada, pp. 329-346.

Takakura, J., 2012. Emergence and development of the pressure microblade production: a view from the Upper Paleolithic of Northern Japan (Chapter 11). In: Desrosiers, P.M. (Ed.), *The Emergence of Pressure Blade Making. From Origin to Modern Experimentation*. Springer, Canada, pp. 285-306.

VanPool, C.S., 2008. Agents and cultural transmission. In: O'Brien, M. (Ed.), *Cultural Transmission and Archaeology. Issues and Case Studies*. SAA, Washington, pp. 190-200.

Veski, S., Heinsalu, A., Klassen, V., Kriiska, A., Lóugas, L., Poska, A., Saluäär, U., 2005. Early Holocene coastal settlements and palaeoenvironment on the shore of the Baltic Sea at Pärnu, southwestern Estonia. *Quaternary International* 130, 75-85.

Zagorska, I., 2009. People and places in the Latvian Mesolithic: a case study from the Zvejnieki archaeological complex. In: McCartan, S., Schulting, R.,Warren, G., Woodman, P. (Eds.), *Mesolithic Horizons, Papers Presented at the Seventh International Conference on the Mesolithic in Europe, Belfast 2005*, vol. 1. Oxbow books, pp. 255-260.

Zaliznyak, L.L., 1999. Tanged point cultures in the western part of Eastern Europe. In: Kozlowski, S., Gurba, J., Zaliznyak, L.L. (Eds.), *Tanged Points Cultures in Europe. Read at the International Archaeological Symposium, Lubin, September, 13-16, 1993*. Maria Curie-Sklodowska University Press, Lublin, pp. 202-218.

Zhilin, M.G., 1999. New Mesolithic peat sites on the Upper Volga. In: Kozlowski, S., Gurba, J., Zaliznyak, L.L. (Eds.), *Tanged Points Cultures in Europe. International Archaeological Symposium, Lubin, September, 13-16, 1993*. Maria Curie-Sklodowska University Press, Lublin, pp. 295–310.

Zhilin, M.G., 2007. The early Mesolithic of the Upper Volga: selected problems. In: Masojc, M., Plonka, T., Ginter, B., Kozlowski, S. (Eds.), *Contributions to the central european Mesolihic.* Wroclaw, pp. 89–104.