# Neanderthals and Modern Humans Across Eurasia

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**Abstract**

Neanderthals, a European population was undoubtedly successful in surviving through several glacial periods. Their population, originally spread across Europe, composed of small communities but succeeded to maintain their relationships and their mating systems and thus secured their biological survival. Published samples of aDNA and teeth indicate that they formed a particular population, although morphological deviations from the western European relics are found at the edges of their geographic distribution. The expansions of Neanderthals into western Asia and reaching the Altai Mountains reflect their successful adaptations to variable environments. Their demise was caused, among others, by the expansion of groups of modern humans of African origins. The cultural traits of the new invading and colonizing people included high degree of mobility, signs of group identity, new cloths, use of ornaments, new hunting tools, and means of communication. The interactions of modern humans with the Neanderthals, discussed in the paper, provide a foundation for further research along economic and biological considerations that may provide a more sound explanation for the disappearance of a past successful meta-population.

**Keywords**

Eurasia • Expansions • Modern humans • Neanderthals

## 2.1 Opening Remarks

This paper approaches the issue of Neanderthals and Modern humans as the story of two competing prehistoric meta-populations, a situation that probably occurred to other populations during the long sequence of human evolution. It is also a sort of an eclectic summary of my personal thoughts and comments that I gathered while being involved in this important evolutionary topic. Therefore this is not a comprehensive summary concerning Neanderthals and modern humans; rather it is my current view.

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During the last two decades I felt that rarely scholars who study human groups since they emerged as "tool makers" discuss issues of human extinctions. The underpinning positive attitude embedded in the study of palaeoanthropology and prehistoric archaeology masks the question of what happened to those whose discarded artifacts and kitchen debris who are identified by us as representing different groups of foragers, and their time-length of survival is based of radiometric dates. Gaps in stratified sites indicate that they disappeared within several thousand years. In our interpretations we are limited in naming the humans themselves but use the labels given to their fossil bones. Another difficulty in our interpretations is that we often assume that Paleolithic human relics found in archaeological contexts were also the makers of the stone tools. Thus we find it an uneasy question to ask "how" the taphonomic processes in the formation of the site

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or a particular layer resulted in the observed combination of stone tools with fragmentary human bones. Site formation processes is one of the under-studied and poorly understood in prehistoric archaeology. Although major progress was made in recent decades through the use of micromorphology and other methods, we are far from having objective, scientific interpretations of how assemblages of bones and stones became an entity in stratified sites (e.g., Goldberg and Macphail 2006).

The cumulative experience of archaeologists during the last century and a half has demonstrated that human fossils are few and isolated, or missing altogether, but the concrete evidence for their existence are the cultural remains that were subject to changes, and sometimes to total disappearance due to geomorphic processes or modern development. Past human activities are thus observed through the analysis of their lithic assemblages and animal bones, and occasionally by additional remains such as bone, antler and ivory objects, wooden artifacts, fire-wood, edible plants and body decorations. The clues for identifying human groups in the past are therefore minimal. Most informative are the different ways of making stone artifacts, systematically recorded in the operational sequences (*chaïne opératoire*). This kind of analytical method assists us in relating lithic assemblages to particular prehistoric groups or populations (e.g., Lemonnier 1976, 1992; Boeda et al. 1990; Boëda 1995; Bar-Yosef and van Peer 2009 and references therein). We interpret this information as flagging the tradition of teaching and learning processes among past societies that often lasted through many generations. However, when a major change is documented we often tend to assume that the "transition" or the "shift" took place within the same population although it may or may not indicates a "replacement" caused by the arrival of new people. This kind of interpretation is essential for the discussion of "Neanderthals and modern humans" although with evidence for a certain degree of interbreeding (e.g., Green et al. 2010), past heated debates are reduced to the practical questions of "when" and "where." Yet each of these two meta-populations was composed of different groups thus motivating me and other colleagues to identify each "culture" and reconstruct its "history." Therefore the foundation for such investigation lies in the traditional anthropological methods and cumulative observations concerning life ways of hunting and gathering societies, as well as in-detailed knowledge of how stone tools and other objects were made and used. It is not an accident that the term "prehistory" means people without history, including some who lived dring historical periods (e.g., Wolf 1982).

There are many observations to support "cultural breaks," often documented by stratigraphic gaps that occurred despite various subsistence options and survival strategies. Moreover, there is a wealth of evidence to demonstrate that our definition of "cultural continuity" in the sense of biological continuity existed during the Lower and Middle Pleistocene. Similar records of Upper Pleistocene age are retrieved in several regions in mid-latitudes, such as the long-term survival of Neanderthals even in spite of worsening climatic conditions such as those of the glacial cycles. What we do not know is how many groups of this meta-population became extinct because others survived and enabled the preservation of the genetic basis. Similarly, the debated issue of "replacement" may indicate that the new meta-population of modern humans took over many territories. A few examples from well-known Paleolithic records will illustrate this phenomenon although their selection here is not necessarily in geographical or chronological order.

Eclectic examples for "replacement" or "turnover" include the Bohunician in Moravia (e.g., Svoboda 2005), in Crimea by Upper Paleolithic groups of blade makers (e.g., Chabai 2003, and references therein; Chabai and Monigal 1999). Further east, on both sides of the Caucasus mountains similar groups of bearers of blade/bladelet industries replaced the locally two different Mousterian industries (e.g., Adler et al. 2006, 2008; Golovanova and Doronichev 2003; Golovanova et al. 2010). In the Levant an earlier replacement of the Acheulo-Yabrudian by the Mousterian ("Tabun D-type"), produced technically Levallois industries, as recorded in the occupations of Tabun, Zuttiyeh, Hayonim caves (e.g., Hovers 2006; Hovers and Kuhn 2006 and papers therein; Shea 2003); In the Maghreb in North Africa the Aterian was replaced by makers of microlthic industries such as the Iberomuarusian; South Africa produced a good example with the disappearance of the Howeison's Poort and the re-occupations by bearers of late Middle Stone Age industry (Wadley 2001, 2008; Jacobs et al. 2008; Villa et al. 2010), and then by blade/microlithic industries of the Late Stone Age (Deacon and Deacon 1999).

All these replacements took place regardless of close sources of good quality raw materials and the continued exploitation of essentially the same or similar faunas and plants. Therefore, in my current view, these cases are examples for "moving in" and "pushed out" of different populations, or competitive exclusion. The variable survival of particular cultures is intriguing because it creates an evolutionary cultural puzzle that is hard to decipher due to many missing pieces of information. Examples include several cultures dated to the Late Middle and Upper Pleistocene which lasted 4–8 Ka (e.g., the Aurignacian in Europe or the Kebaran complex in the Levant) or 10–20 Ka (e.g., the Howiesons Poort), versus those that lasted 40–80 Ka (e.g., early, middle and late Mousterian in the Levant, Mousterian of Acheulian Tradition, etc.) However, it is still one of our missions as archaeologists to try and explain the variable survival time of these well-dated and in-depth studied cultures as defined on the basis of their lithic industries.

On the optimistic side, there are cases when people survived as makers of essentially the same stone tools regardless of shifting climatic conditions such as the glacial cycles. These include various different groups of Neanderthals in Europe, Lower and Middle Paleolithic "core and flake" makers in China, the Acheulian of India, Mousterian industries in the Levant, and more. Perhaps the safer conclusion would be that when human groups were smaller, less dense over the landscape, but still in touch within their meta-population for securing reproduction, changes were not needed, expected or expressed in materials that were not preserved. However, as the number of people grew, migrations of foraging groups were feasible, the spread of the same industries took place, splitting populations changed their tool-kits, in the same way that a language, once removed from its original homeland, develops dialects or even turns into new languages.

Western Europe is undoubtedly still the best studied region, rich in archaeological documents that demonstrate the relatively rapid changing technical and typological variability within stone, antler, bone and ivory tools, figurines and body decorations from ca. 45/40,000 to 11,000 years ago known as the Upper Paleolithic (Klein 2009). Whether this richness emanated or encouraged by local conditions (social? climatic? increasing densities of people?) is an open question. Undoubtedly the region enjoyed the favorable Atlantic climatic conditions and thus served as a home for locals and as a desired refugium for foreigners who moved in from different directions from time to time.

In sum, we often adopt an interpretation that claims that when the subsistence strategy changed dramatically, humans opted to change their stone tools. However, in more than one example the production of the same tools, designed by essentially the same operational sequence(s) continued after the crisis supports the conclusion of biological continuity. When no changes of paleo-ecological conditions are documented, we view major shifts in the artifact assemblages as evidence for the presence of "new people," or do our best to disclose how employing new tool making techniques occurred within the same population and define it as a cultural "transition."

However, in a few cases, due to terminological conundrum and old excavation techniques, often derived from the work of previous generations of archaeologists, we are unable to interpret the past. Unintentionally the terms originally created in need to classify the finds in a relative chronology, mask important variability. Labels such as "Middle Paleolithic", "Middle Stone Age" or "Mousterian industry" that we often use (as in this paper) are today meaningless as much as the word "transportation" that without specifying the means of transport would include everything from horses to bicycles, cars, trains, boats and planes.

The following comments refer only to social and cultural issues derived from observations and reports on stratigraphies and lithic assemblages. I refrained from summarizing the full range of daily activities of either Neanderthals or modern humans. I will not discuss their subsistence systems, whether the amount of meat surpasses the plant food, or the techniques of hunting, trapping, use of fire, clothing, body decorations, and more. Reviewing all these aspects requires a wider in-depth summary of the available literature and is beyond the main scope of this paper.

## 2.2 Neanderthals: Social Organization and Geographic Expansion

Neanderthals are known as a European population that emerged some 400–200,000 years ago or earlier around 600–400,000 years. They were undoubtedly a successful meta-population surviving through several glacial periods across most of Eurasia. Their remains include human fossils (buried or as isolated bones and teeth), food refuse (mostly bones, rare plants), preserved hearths (in particular conditions such as the Mediterranean basin), and most commonly plenty of stone tools. The information was collected since the mid-Nineteen century through the excavations of numerous sites and the published reports are available in many languages. Traditionally, archaeologists attributed the Neanderthals to the time known as the "Middle Paleolithic," a term coined in the same century when, in the absence of radiometric dates, the Paleolithic was subdivided into three main phases (Lower, Middle and Upper Paleolithic).

For a long time Neanderthals were thought to have evolved into modern humans called Cro-Magnons, after the discovery of a modern human skeleton in a rockshelter in Southwest France, excavated in the mid-nineteenth century by the common crude techniques of that time, but was recently dated to a historical period. In due course during the late nineteenth and the early twentieth centuries several hypotheses were suggested to explain how and when did this evolutionary stage happened. Evidence of both physical and cultural remains was employed for this purpose. This is a major issue generally referred to as the "Middle to Upper Paleolithic transition" which is still under discussion in recent decades. Today, however, the genetic evidence clearly indicates that this "transition" was more a "replacement" of one population by another one, although it is accepted that both the old and new populations could have interbreed (see below). In addition, radiometric dates indicated that both populations were contemporary in various regions of Eurasia (see below) possibly for several millennia.

It is generally assumed that Neanderthals lived in small communities that were spread over large territories but succeeded to maintain their mating systems and through secure through close relationships their biological survival. When viewed through the few published samples of aDNA or their teeth across Eurasia it seems that these samples represent

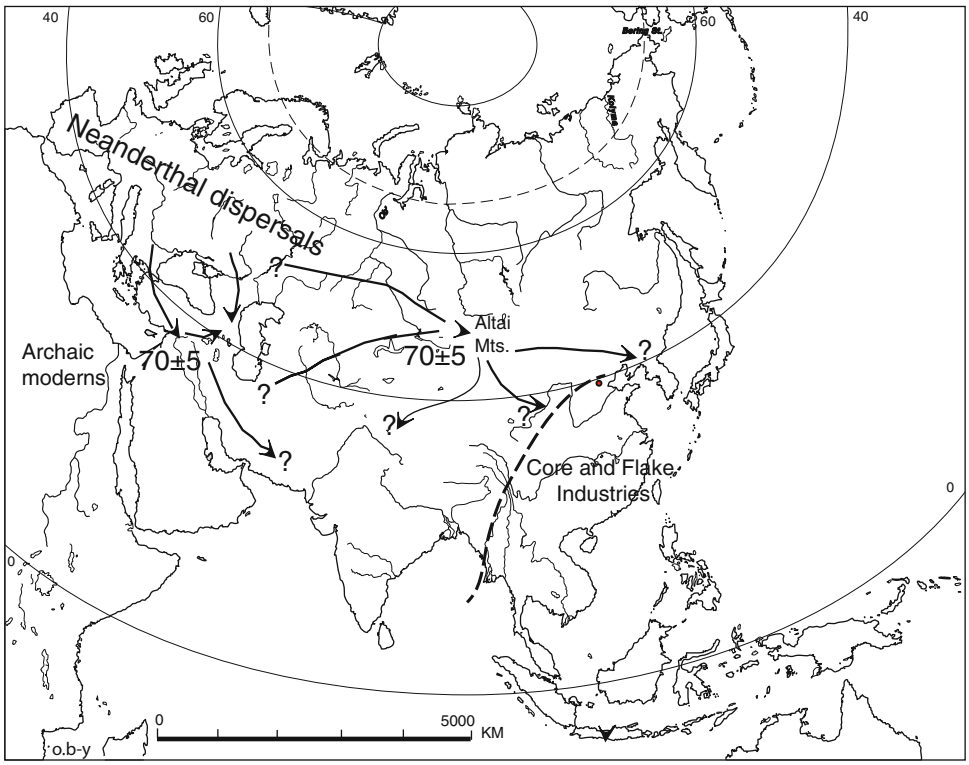


**Fig. 2.1** The expansions of Neanderthals across Eurasia

a particular population (e.g., Krause et al. 2007; Bailey and Hublin 2006). However, deviations of morphological attributes between the "classical" Neanderthals from western Europe were generally found at the edges of their spatial distribution, assumed to represent either different environmental conditions or a degree of interbreeding with archaic modern humans (e.g., Arensburg and Belfer-Cohen 1998; Trinkaus 2007).

Like similar successful populations in human history Neanderthals expanded their "tribal" territories beyond their European "homeland," raising the option that their group sizes were after all not so small, or they had some effective means of communication (Fig. 2.1). Their presence in western Asia is fully supported by the Levantine fossils (dated to post—80/70,000 years ago) uncovered in Dederiyeh, Amud, Tabun and Kebara caves. Further east several skeletons turned up in the excavations of Shanidar cave in the Zagros mountains (northern Iraq), a skull fragment found in Sakjia cave, in the southern foothills of the Caucasus, as well as the human burial in Mezmaiskaya cave (Russia), on the northern slopes of the Caucasus, Teshik Tash in Uzbekistan and further east in caves of the Altai mountains.

## 2.3 Stone Tool Kits of Neanderthals

We often identify the so-called Middle Paleolithic stone tool assemblages, first studied, during many decades in Europe, on the basis of technological (various core reduction techniques) and typological aspects (i.e., blanks that were shaped into tools). Among the latter archaeologists define side scrapers and points, shaped by retouch, some of which were made of thicker flakes and were constantly resharpened such as the scrapers of the Quina type (e.g., Bourguignon 1996). Special types are handaxes, large and small, considered as indicating cultural heritage from the earlier European Acheulian Complex, sometimes used a "cores" (e.g., Soressi 2002; Soressi and Hays 2003), and foliates that could be seen as improved versions of bifacial objects (*kielmesser*) used as knives, mostly common across northern Europe (e.g., Jöris 2006).

Recent studies in Southwest France expose an interesting view where four different industries characterized by their operational sequences and patterns of mobility, seem to be partially or fully contemporary. The new scheme resembles the original proposal of F. Bordes (1961) who suggested to see the different industries as representing different tribes. Although the new investigations deviate to a degree they benefitted from the wealth of data accumulated during the last 50 years (e.g., Meignen et al. 2009; Delagnes and Rendu 2011). The four groups are named as (a) Levallois and Laminar flaking system, (b) Mousterian of Acheulian Tradition (MTA) shaping system, (c) Quina falking system, and (d) Discoidal-Denticulate flaking system. Chronologically (based on Table 2.1 in Delagnes and Rendu 2011 with my minor modifications), the first group survived from the end of MIS6 through 40/38 Ka BP.

**Table 2.1** The new characteristics of upper Paleolithic times

| |
|---|
| *A. The nature of the new economy and social strategies* |
| – Improved subsistence strategies with new techniques and tool types |
| – New hunting devices—spear throwers, earliest archery? boomerangs? |
| – Improved clothing, especially the kind needed in the northern latitudes |
| – Use of grinding stones for food processing |
| – Increased number of exploited raw materials such as antlers, ivory and bones, special hard rocks |
| – Long distance procurement of raw materials and quarrying activities |
| – Improved systems of long distance intergroup communication |
| – The invention of seafaring vessels |
| *B. Short term results* |
| – Increased rate of survival of newborns |
| – Prolonged survival for the elders of the group |
| – Better planning depth of subsistence strategies (due to increase in monitoring larger environments) |
| – Changes in the intensity of symbolic behavior reflected in the new expressions of self-awareness, intra and inter-societal attitudes, rituals, etc |
| *C. Long-term results* |
| – Selective advantages in long term monitoring the environments expressed in the prolonged "living memory" of the group |
| – Formation of long-distance alliances |
| – Increased rate of technological adaptations to specific regional environment (e.g., the formation of regional cultures identified by their tool-kits) |

The MTA lasted from about the start of the MIS 4 (ca. 75/70 Ka BP) to ca. 40 Ka but seems to have deeper roots in the Micoquian of an age earlier than MIS6. The third group, the Quina type, dates to ca. 65 Ka through ca. 40 Ka BP, and the last one, dominated by discoidal cores and denticulates, considered to have deeper roots, perhaps from MIS5 through ca. 40 Ka BP.

The search for the original appearance of the industries is definitely important and would be difficult to resolve without stratified sites. However, another possibility is that similar operation sequences could have been invented at an earlier age and then disappeared when the makers died out. In addition, the established chronologies for three groups from the cold period of MIS4 to the arrival of modern humans sometime around 43/40 Ka BP could be explained as the presence of three different tribes, speaking their own languages and follow their own particular subsistence system, while physically being all Neanderthals. This interpretation, enhanced by the information for those "Middle Paleolithic" industries from central and eastern Europe (e.g., Conard and Fischer 2000; Burdukiewicz 2000), support the notion that they were all within the meta-population of Eurasian Neanderthals.

The European research achievements recognized prehistoric "culture (s)" based on the technical expressions of people who kept manufacturing their traditional artifacts regardless of environmental fluctuations can be trace across Asia. For example, the evidence from the Altai Mountains caves (e.g., Derevianko and Shunkov 2002; Derevianko and Markin 1995; Derevianko 2011) includes lithics, fossils and aDNA of Neanderthals (Krause et al. 2007). However, the recent surprise brought by this type of biological analysis was the discovery of an unknown population called the Denisovans (Reich et al. 2011). Thus, if we assume that the correlation between fossils and lithic industries prior to the arrival of modern humans is rather simple, we face the challenge to uncover the culture of the Denisovans.

A similar situation occurred within the study of Middle Paleolithic fossils in the Levant known from the 1930s. The Levantine Mousterian Complex, a field of prehistoric research I know better, is currently divided into three industries, often uncovered in a stratigraphic order from about 220/250,000–50/47,000 years ago, and are known as "Tabun D-type, C-type and B-type" or as Early, Middle and Late Levantine Mousterian. Each of these entities survived for a long time keeping their technological traditions (Ronen 1995), whether employin one or several Levallois methods (Meignen 1998a, b). The assemblages of the Late Levantine Mousterian, rich in Levallois triangular points, contained burials and remains of local Neanderthals (e.g., Dederiyeh, Kebara, and Amud caves as well as layer B in Tabun cave). These fossils differ in their skull morphology from the "classical European Neanderthals." But the main surprise occurred already in the 1930s when the fossils uncovered with "Tabun C-type" (Middle Mousterian) assemblage in well arranged graves in Skhul and Qafzeh caves. These humans classified as a type of archaic *Homo sapiens* or near-modern humans, and once even labeled as "Proto-Cro-Magnons," were considered until the early 1980s as the ancestors of modern humans. Todate no identifiable human remains associated with the Tabun D type assemblages. Perhaps they were "near modern" (or archaic modern) humans, but further discussion of this issue is beyond the scope of this paper.

The human groups who occupied the Taurus, Zagros and southern Caucasus mountain areas made industries rich in retouched pieces (scrapers and points). They differed from the sites on the northern slopes of the Caucasus, represented by the finds from Mezmaiskaya cave, where the tool kits contained the small bifaces or foliates and were part of the Eastern Micoquian known from the European plains.

Further east the Neanderthals are found in Uzbekistan, Siberia and their industries near the Yellow River (Qu et al. 2012). It is hypothesized that Neanderthal remains (or perhaps the Denisovans) should be expected in northern China (Bar-Yosef and Wang 2012). Thus, in a growing number of geographic regions we already recognize territorial boundaries of Neanderthal groups (cultures? tribes?) across Eurasia.

In reconstructing the operational sequences employed by Neanderthals, and their contemporaries, we face the practical issue of interpreting the detailed recorded lithic products. One question, in the face of lack of detailed refitting is how to identify the knapper's intention?. I suggested that the first third or half of the detached blanks that follow the removal of the cortex are essentially the desired products. Therefore the morphological type-list of the cores found in the excavated context reflect their status as discarded products by the experienced knapper as well as their use by others. One real life option, when we consider the role of children watching adults making stone tools, is that the children would try to imitate their actions. Possibly, for the purpose of teaching the adults demonstrated how to do the first stage of knapping, all the youngsters learned how rocks could be fractured. Thus, quite often, in the counts of core types, a certain amount that does not fit the main operation sequences could represent children's activities and/or expedient use of the residual cores. For example, when two thirds of the balnks and a major portion of the rocks would fit the "convergent Levallois method" the remainders that would fall under the category of "discoidal cores" may represent teaching and/or children activities.

Moreover, a particular degree of skill is needed to practice the various Levallois methods (e.g., Boëda et al.1990; Boëda 1995) with the recent current additions (Meignen et al. 2009). When replicating past activities we recognize that particular methods take between many hours to several months of training to achieve the desired shapes of blanks such as the symmetrical Levallois triangular points (e.g., Eren et al. 2011, 2012). Thus we should consider the hypothesis that people with knapping skills had a special social place within their own society be they Neanderthals or modern humans.

## 2.4 Modern Humans: Some Interpretation of Their Evolutionary Advantages

It is important to remember, for historical reasons, that prior to our enthusiasm about the advances in molecular, nuclear and in particular aDNA that the "out of Africa" of modern humans was already suggested by earlier scholars such as W.W. Howells (1974). Today, following the pioneering paper of Cann et al. (1987) the estimates for this event are around 60–50,000 years ago. Several migration paths leading into Eurasia were suggested (Fig. 2.2). The southern one that ended with humans landing in Sahul is thought to be the earliest. The northern one led through the Levant or across south Arabia, through the Zagros mountains and beyond the Caspian Sea into central Asia. Another route employed the Levantine corridor and then into Europe and possibly had an eastern branch leading to the Caucasus region and in tow sideways around the Black Sea (Fig. 2.3).

The new people were culturally different as expressed In the European sites by the prehistoric records of the Upper Paleolithic that we employed for many years as a model for modern humans. True, it is still the best studied and most detailed for a region that in a global scope is quite small. The Cro-Magnons, as modern humans, were considered as the authors of the Upper Paleolithic stone tool assemblages first identified by Abbé H. Breuil (1913). He defined what we would call today a "cultural complex" named "Aurignacian." Later he realized that the three subdivisions of Early, Middle and Late Aurignacian would be better defined as three different cultures, namely, Châtelperronian, Aurignacian, and Gravettian. The later French Upper Paleolithic entities were the Solutrean, Magdalenian and Azilian. Each of these cultural units was characterized by the presence of particular tool stone, bone and antler tools ("*fossil directuer*"), and ornaments. Mobile art objects such as figurines and the increasing number of caves with rock art, located in the Franco-Cantabrian area, were attributed to the Aurignacian and all the ensuing cultures, and were considered as indicating the cognitive capacities of modern humans. Thus they were seen as our direct ancestors (e.g., Klein 2009).

Adopting the definitions of this cultural sequence to other regions across Eurasia caused confusion and unnecessary generalizations about modern humans and their cognition. For example, not all humans painted caves even when such localities exist and in abundance (e.g., compare the Franco-Cantabrian region to the western Caucasus). Making plenty of bone tools is not necessarily a sign of particular modern behavior. Even when where various deer species were available, antler tools could be rare (compare, for example, western Europe to East Asia). We should not hold as an assumption that the availability of natural resources such as suitable rocks for knapping, certain animals that can be hunted, trapped or caught by nets were always exploited following an optimal design. Undoubtedly for biological survival people would use the approach of "optimal foraging." But competition with other groups, abrupt climatic changes, failure of procurement techniques, and more may cause deviations. The results in a various cases could be disastrous. Thus "cultural breaks" are recorded across Eurasia and evidence-supported instances of such shifts should be given second thought of what could have happened.

We often attribute a series of cultural traits to modern humans although not all formed a real "package" and a good number emerged in earlier period mostly in Africa (e.g., McBrearty and Brooks 2000; Henshilwood and Marean 2003). However, in spite of the early making of bone objects or clear

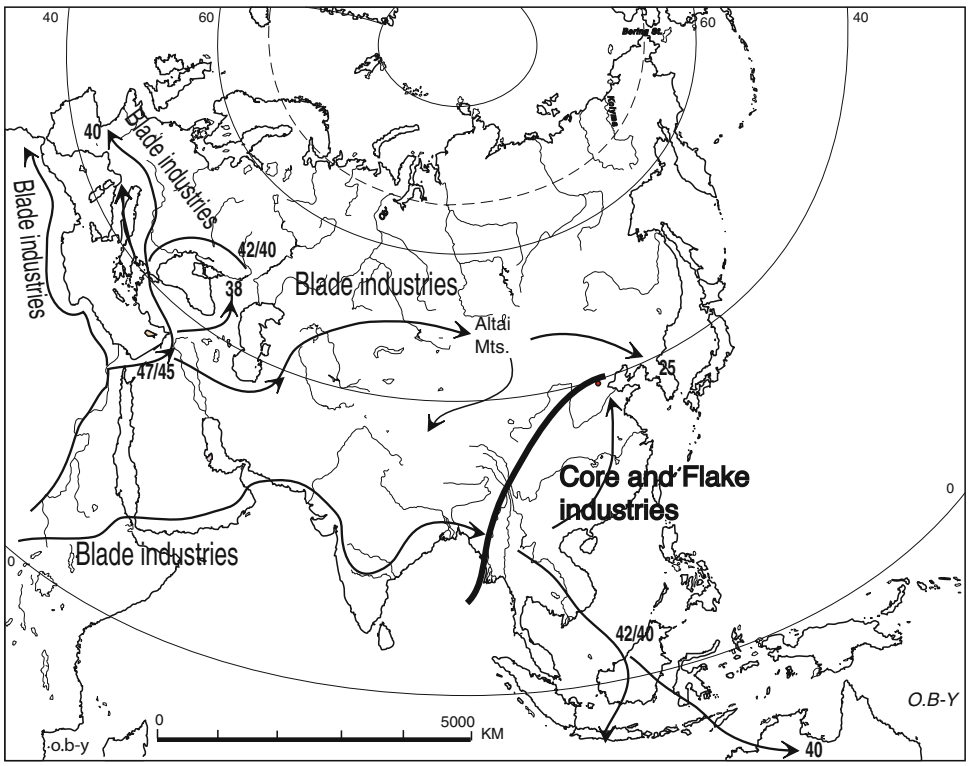


**Fig. 2.2** The expansions of modern humans across Eurasia. Note that early colonization of Sahul was done by bearer of core and flake industries

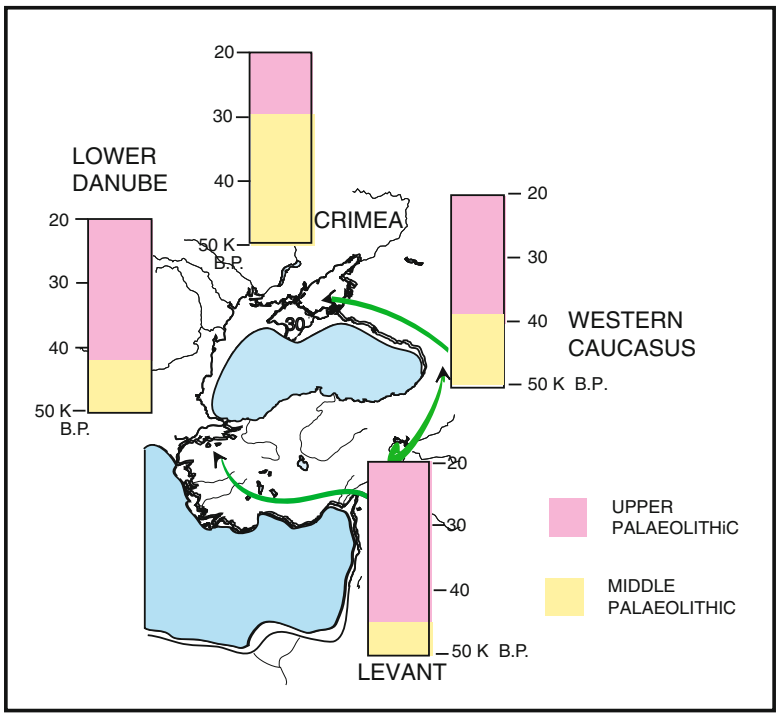


**Fig. 2.3** Replacement of Mousterian industries by Upper Paleolithic early blade industries around the Black Sea

signs for symbolic behavior, the major cultural shift in the lithic industries was recorded in the Levant, across Europe, or other regions such as the Caucasus area and the Altai mountains, and took place in a short time of a few millennia beginning by 47/45,000 years ago.

The main changes that took place during the first several millennia in Eurasia and mark the onset of what traditionally we name as the Upper Paleolithic is presented in Table 2.1 (Bar-Yosef 1994, 2000, 2002; Kozlowski 2004; Kuhn et al. 2004; Lewis-Williams 1997; Vishnyatsky 2005). I feel that this list of changes and/ or innovations, probably improved along the routes of expansion/migration, describe the advantages of modern humans over the Neanderthals.

Several of these cultural-technological traits mentioned above were recognized earlier in the African records (McBrearty and Brooks 2000). Others seem to appear in the Upper Paleolithic contexts of Eurasia. For example, grinding stones appear first in the Japanese archipelago (ca. 40/35 Ka cal BP), and later in the Levant (ca. 30–26 Ka cal BP).

At the time of writing my 1994 paper I did not pay attention to the issue of languages and dialects and only implicitly considered the impact of education. A few years later I realized how much teaching and learning processes impact the degree of technical traditions (Bar-Yosef 1998). The investment in teaching and learning social skills, and survival techniques takes extra effort, and prehistoric societies guarded their traditions for many millennia. Both social traits and the making of objects determined success and failure in biological survival. Hence, abrupt or even slow climatic changes may not have had real effect on how people made their stone tools, how they used their well-established operational sequences, or the morphology of the desired objects that were mostly "carpentry-kitchen" equipment, with a few projectiles.

Environmental conditions provided the means (abundant plant and animal food stuffs) to support the basic structure and size of a population but and favored a minimal increase in numbers, causing successful populations to expand. Infrequently they migrated into empty territories, such as the Americas, or the northern latitudes of Eurasia. However, sometimes they moved into areas inhabited by other forages. Then "foreigners" and "locals" could either ignore each other, or adopt variable interaction modes whether peaceful or violent. Undoubtedly, certain interbreeding in a small number of cases was an option now shown through the aDNA studies. Thus, although one may expect that lithic techniques would be part and parcel of such interactions, demonstrating the process of acculturations in the archaeological records is not an easy task. This is exemplified by the ambiguous interpretation of the Châtelprronian culture in the French records which is briefly described here.

In the 1950s a rich assemblages of ornaments, bone objects, isolated Neanderthal teeth and a fragment of a temporal bone were found in a context attributed to the Châtelprronian recorded in the excavations conducted by A. Leroi-Gourhan in Grotte du Renne (Zilhão and d'Errico 2003 and papers therein; Zilhao et al. 2006). This discovery was reinforced in the early 1980s with the finding of a Neanderthal secondary burial apparently in a similar context of stone artifacts in St. Cesaire (Lévêque et al. 1993 and chapters therein). Thus the early Upper Paleolithic culture became known as the product of Neanderthals who either invented the making of body ornaments or learned how to make them from incoming modern humans. In brief, the options are independent invention or acculturation. Questions concerning the validity of the published stratigraphies including the role of taphonomic processes and human activities in the formation of the excavated deposits of the two sites, were not asked until recently (e.g., Higham et al. 2010; Bar-Yosef and Bordes 2010). Adherents to the old interpretations responded by repeating essentially the two past interpretations and by adding the distribution of objects and another series of dates (Hublin et al. 2012, and references therein), but not by providing a full report with, for example, the counts of artifacts. Thus the previous suggestion to view Châtelprronian as the result of acculturation by Neanderthals who interacted with modern humans is still the favorite interpretation by many (D'Errico et al. 1998, 2003; Zilhao et al. 2007; Hublin et al. 2012). The option that the Châtelprronian was simply the culture of modern humans who took over the sites of Neanderthals, as done by previous occupants of rockshelters and caves, was not suggested. The meaning of why in Grotte du Renne the Châtelprronians dug into the earlier Mousterian deposits, and produced, in addition to their lithics, a very rich assemblage of body decorations and other objects, possibly indicating the place of a shaman, was not even considered.

Most populations of modern humans grew in numbers and were technically successful. Indeed, like their predecessors in Eurasia they took over new territories by expanding in the same way as was done by the Neanderthals. A good example is the Western European Aurignacian culture, rich in artistic objects, ivory, antler, and bone industries, that emerged in the west and expanded eastward (e.g., Bolus 2003; Kozlowski and Otte 2000; Bon and Bodin 2002; Teyssandier 2008; Conard 2006). A few groups reached the coastal Levant and are characterized by their stone tools and especially by rare and typical split based points (e.g., Bar-Yosef and Belfer-Cohen 1996; Belfer-Cohen and Bar-Yosef 1999; Bar-Yosef and Zilhao 2006; Kuhn 2003). However, in all these cases we should ask what happened to the local inhabitants? Notoriously evidence for violence such as projectiles embedded in human bones are hard to find even in later periods.

Several modern human groups practiced both semi-sedentary settlement pattern as well as high degree of mobility. They produced signs for group identity, and use of ornaments. Thus, they were capable of symbolic behavior that is expressed in the Franco-Cantabrian region by cave art, mobile art objects (found also in other regions), and in a few localities open-air rock art such as the CÔa valley in Portugal.

Spatial arrangements including hearth, use of rocks for warmth banking, are cited as typical features of sites of modern humans but are also found in Neanderthal sites. Higher degree of efficiency in hunting and attributed to better hunting tools, use of nets, perhaps early use of poison and more. Among the lithics we often stress the blade making which requires different skills than producing the Levallois products through a change in conceiving the volume of the nodules as cylindrical instead of "flattish," but these attributes more common in western Eurasia than in central or eastern Asia. In addition, the making of blades as we demonstrated is a reduction sequences that appeared and disappeared in earlier times (Bar-Yosef and Kuhn 1999) but became constant during the Upper Paleolithic whether for the production of blade by direct percussion, with the use of a punch or by pressure flaking. It is important to mention that not all modern humans made blades as, for example, the colonizers of Australia some 45,000 years ago produced flake tools while blade making arrived there only in the Holocene (Habgood and Franklin 2008). Not all modern humans groups shared artistic expressions, and similarly, shell beads that were already shaped in a few Middle Paleolithic contexts and are suggested to herald self-awareness, were not common in all Upper Paleolithic sites.

## 2.5 Interactions Between Neanderthals and Modern Humans

In reviewing the interactions between the two populations we need to take into consideration the continental-wide archaeological information concerning the lithic industries of local Neanderthals. The best records are available from all over Europe and western Asia. The main discussion here revolves around the contemporaneity between the two populations and in this context some earlier observations that once were interpreted as either the evolution of Neanderthals into modern humans or evidence for mixing between the two populations, should be briefly mentioned. Among the previous studies one should mention the analysis conducted by Thoma (1965) who recognized some traits of modern humans among the Neanderthal fossils. Another effort to explain the change was done by Gilman (1984) who proposed an economic shift on the basis of Marxist analysis.

However, contemporaneity among prehistoric populations is an issue dealt with from Lower Paleolithic (e.g., Calctonian and Acheulian) to Holocene sites in the Maghreb to mention just a few examples (e.g., Ashton et al. 1994; Rahmani 2004). Thus, in reviewing the changing climatic and social conditions during the second part of the Upper Pleistocene we may get some clues for the contemporaneity of both populations as well as indications for the demise of the Neanderthals.

We already know from numerous European investigations that the Neanderthals in temperate Europe responded to climatic calamities by shifting and expanding their territories into western and central Asia. During the cold period of MIS4 (ca. 75–60/57,000 years ago) Neanderthals in the north European plains either died out or moved into refugia in southwest and southeast Europe resulting in the depopulation of a large region (Bar-Yosef 1988; Hublin and Roebroeks 2009). Indeed, contrary to the prevailing views of the last decade that their demise was due to climatic fluctuations during MIS3 (e.g., Gamble et al. 2004) or the effects of the Campanian volcanic eruption in Europe (Golovanova et al. 2010), recent studies indicated that both hypotheses are wrong and instead supported the interaction with the colonizing groups of modern humans (Lowe et al. 2012). Even the worsening conditions towards the end of the MIS3 did not cause the disappearance of the Neanderthals but their demise was determined by the activities of the new migrants-the modern humans (Figs. 2.4 and 2.5). However, during this time interactions between the two meta-populations took place in various regions and included among other competition for the better resources, which explains the presence of their genes in recent populations from the Atlantic coast to the Pacific (Bar-Yosef 2011).

When modern humans interact with local Neanderthals we may detect some evidence in the archaeological assemblages. It was already suggested that in Central Europe the Szeletian culture of the Neanderthals indicates the adoption of the technique of detaching blades from prismatic cores (Svoboda 2005). This observation is supported by the partial overlap of the Bohunician and Szeletian dates. The same conclusion holds for the so-called Danubian Szeletian located in the path of modern humans moving around the western side of the Black Sea. A similar case is the Jerzmanovician entity in Poland that is rich in foliates and dates to the same period. For example, the Krakow-Zweirzyniec with its proliferation of arched back blades (ca. 36–28 Ka BP) could indicate the presence of modern humans (Kozlowski 2000).

Further east there is seemingly additional evidence for interactions between these two populations in the area of Kostenki, the middle Don River area, and Crimea (Chabai 2003, 2007; Marks and Chabai 2006; Anikovich et al. 2007). The observed variability of lithic industries led researchers to propose that the Mousterian of Western Crimea and the Eastern Micoquian represent Neanderthal groups in this resource rich peninsula. Radiocarbon dates of both entities demonstrate a high degree of contemporaneity (36–28 Ka according to Chabai 2003) between the Streletskaya (ca. 36–27 Ka) and the Spitsynska (ca. 36–32 Ka) "cultures." The Streletskaya entity contains bifacial points resembling typical arrowheads, foliates, discoidal cores and "flat faced" opposed platform cores that resembles the "Eastern

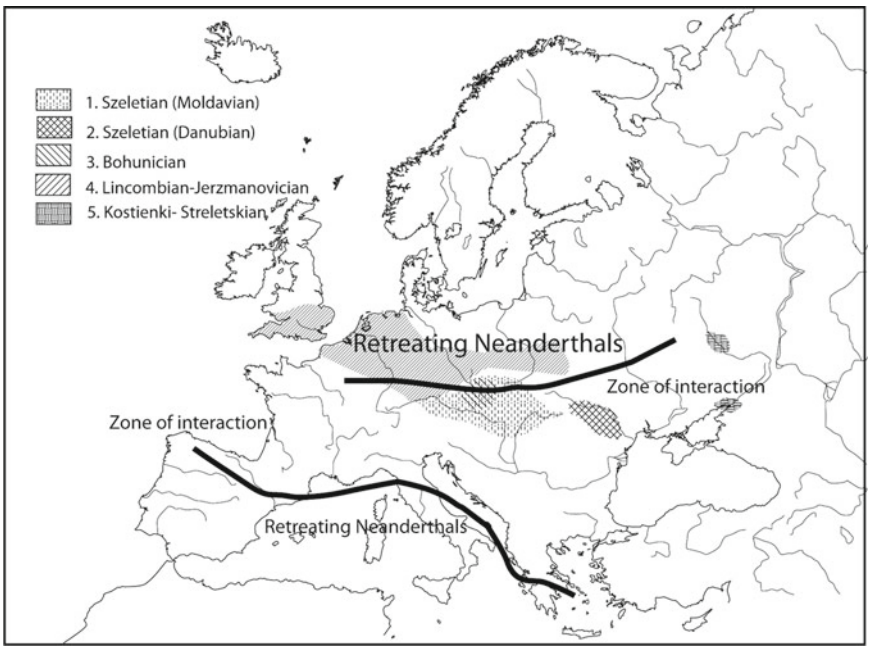


**Fig. 2.4** The retreat of Neanderthal across Europe in both southern and northern directions and locations where archaeological evidence indicates acculturations. The basic map of different Middle Palaeolithc industries is courtesy of J. Kozlowski

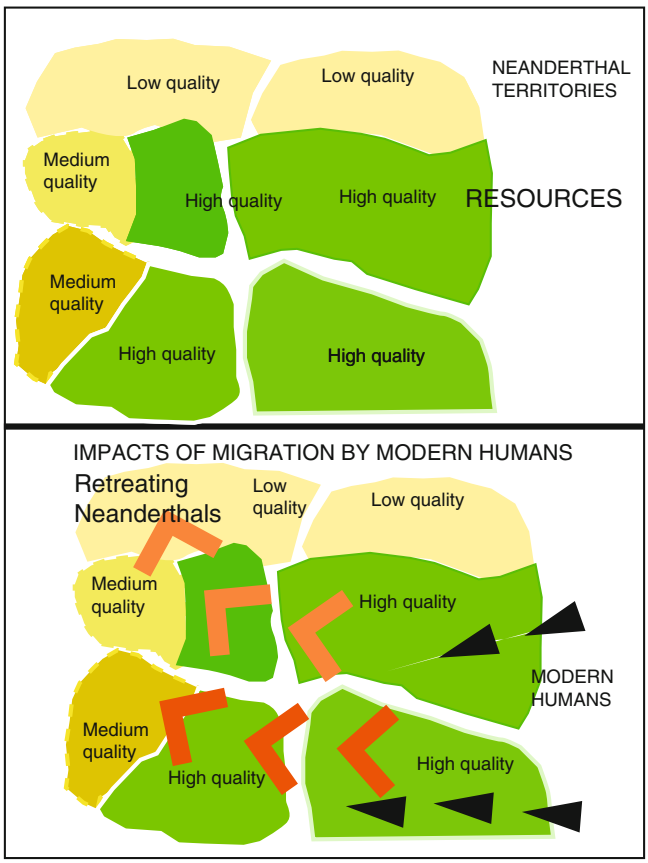


**Fig. 2.5** A model of patchy resource distribution and the impacts of migrating modern humans

Szeletian" in Buran Kaya III (Marks and Monigal 2000). Thus the Eastern Szeletian culture is interpreted as demonstrating Neanderthal lithic technology influenced by interactions with modern humans occurred in a wide geographic distribution from Crimea, the middle and lower Don valley to the central and northern Urals (Chabai 2007 and references therein). Given the northern dispersals of the makers of the Streletskaya industry, I propose to interpret this prehistoric situation as reflecting the geographic retreat the Neanderthals under the pressures of the expanding modern humans (Fig. 2.4).

The Gorodtsovskaya culture (ca. 30/28–26 Ka) with its rich bone and ivory objects is seen as the product of modern human groups. A similar interpretation is suggested for the Spitsynskaya entity due to its dominant blade industry and the bone and ivory elements. Hence, the archaeological data from southeastern Europe supports the notion of non-violent encounters between the two populations. Anikovich and associates (2007) in a review of the Kostenki area suggested a model of acculturation resulting from steady interactions and possible interbreeding between modern humans and Neanderthals. They stress the validity of their observation by noting that on the Russian plain in general (including Kostenki) there are no real Middle Paleolithic sites. They describe their cultural observations of the studied assemblages as "symbiotic industries," meaning the outcome of constant meetings between the two populations.

## 2.6 Final Remarks

Resolving issues related to Neanderthals and modern humans required moving away from European terminology and the imposition of the Upper Paleolithic sequence of this continent. Scholars realized that regional sequences across Asia

should be reconstructed on the basis of systematic excavations and properly dated contexts. However, we still do not have a comparable level of knowledge except perhaps in the Levant, particular areas within the landmass of Siberia, and the Japanese archipelago. But recent decades reveal fast accumulating information in other regions. Thus it is a fruitless effort to provide here a comprehensive summary. Suffice it to say from my viewpoint, that in every country that is being studied in detail we discover not only the local cultural characteristics but also commonalities or boundaries with other prehistoric entities in neighboring areas. For example, the overall phenomena of microblade industries from north China, Mongolia, Siberia, Korean peninsula, the Japanese archipelago, Alaska and a portion of the North American West Coast, could be identified with waves of migrations from a general "homeland" and/or secondary "homelands" mostly following a geographic trajectory from west to east. In some cases, if we take up the challenge, it allows us to have a more general understanding of past human history that determined what happened later during the Holocene.

In addition to the spatial distribution of Neanderthal and modern humans meta-populations and their history, the importance attributed in the RNMH project to the processes of teaching and learning and their impacts on the formation of lithic traditions we should continue to reveal the various operational sequences practiced during the Upper Pleistocene. In several schools of Archaeology experiments in replications and refitting are already conducted the more would improve our ability to carry out comparisons over long distances. However, we also need to try and move beyond the mere descriptions of the operational sequences into as yet poorly studied domains.

The first is the realm of real people by forming hypotheses that would compare the variability among the languages with our prehistoric data sets. The second would be to consider biological issues when two meta-populations interact and clash with each other. One of these subjects is the impact of modern humans on the spatial distribution of food resources when they enter the territories of the Neanderthals (Fig. 2.5). Reduction in the quality of food resources and their dispersed distribution would affect the retreating population. Modelers can calculate how long a certain population of the Neanderthals would survive a decrease in their Total Fertility Rate. A published essay (Sørensen 2011) demonstrates how within a few centuries for a small population would disappear due to constant reduction in the number of births as well as high infant mortality. He tests the model with the age distribution of fossils published by Trinkaus (1995). An unpublished experimental model done by the author indicated the same. Just a small fraction of 0.05 in the Total Fertility Rate would constantly decrease a population. Employing newly accumulated palaeoanthropological information concerning Neanderthals' demography should test these hypotheses. Hence, by testing various hypotheses that should take into account the successful range of interbreeding between these two populations, even if limited, we can come closer to reconstructing the history of recent humankind.

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