Neanderthal origins are rooted deeply in the Middle Pleistocene (e.g., Hublin, 2007; cf. Arsuaga et al., 1997; Condemi, 2000), and while these archaic humans share many genetic and behavioral traits in common with Modern Humans (e.g., Zilhão, 2006a), they are generally perceived to have lived fundamentally different lives (e.g., Verpoorte, 2006; cf. Roebroeks, 2008). Recent data obtained from the nuclear (Noonan et al., 2006; cf. Green et al., 2006) and mtDNA (Green et al., 2008; cf. Beerli and Edwards, 2002; Krings et al., 1999; Ovchinnikov et al., 2000) of Neanderthals suggest that both lineages separated 660,000 ± 140,000 years (Green et al., 2008) ago when Eurasia north of the Alpine mountains (ca. north of 46° N) was occupied for the first time (Parfitt et al., 2005; cf. Jöris, 2005). Further genetic exchange between both lineages – Neanderthals and African populations that subsequently evolved into Anatomically Modern Humans (AMH) – was limited (Green et al., 2006), and it appears that Neanderthals did not significantly contribute to the modern human gene pool (cf. Serre et al., 2004; Excoffier, 2006; cf. Eswaran et al., 2005). In addition to the fossil genetic evidence, both mtDNA (Kivisild, 2007) and Y-chromosome (Underhill et al., 2007) studies of recent Modern Humans allow the reconstruction of the routes taken by expanding populations of Early Anatomically Modern Humans (eAMH) into Eurasia (e.g., Forster and Matsumura, 2005; Forster et al., 2004) and the parallel extinction of all other archaic hominins (Trinkaus, 2007; cf. Fig. 1).

The routes taken by eAMH into Eurasia are also a subject of considerable debate within the archaeological community (Bar-Yosef, 2007; Mellars, 2006a; Otte, 2007). Since direct evidence for the invention of watercraft appears relatively late in the archaeological record (e.g., Burov, 1996; cf. Breunig, 1996; Andersen, 1996; see also discussion in Pickard and Bonsall, 2004), most marine channels likely represented significant barriers to prehistoric human expansion. For example, the Strait of Gibraltar functioned as a paleodemographic and cultural barrier, probably until the Mesolithic (cf. discussion in Derricourt, 2005), implying that eAMH entered Eurasia primarily, if not solely over land through the Near and Middle East (Bar-Yosef, 2007), ultimately reaching the southwestern tip of Europe, i.e., the Iberian Peninsula (Mellars 2004, 2006b, 2006c; Zilhão, 2006a, 2006b; contra: Jöris et al., 2003).

While Gorham’s Cave, Gibraltar, currently represents a key site at the center of this discussion (Finlayson et al., 2005), the interpretation of the radiocarbon data derived from the site is highly controversial (Zilhão and Pettitt, 2006). However, the early appearance of eAMH in Sahul by roughly 45–42,000 years ago (O’Connell and Allen, 2007) indicates that the knowledge of watercraft may have already existed when eAMH were expanding into Eurasia (cf. discussion in Derricourt, 2005).

But the fossil data also suggest that the spread of eAMH was not straightforward (Fig. 1; Shea, 2007; Svoboda, 2007). While eAMH may have
reached the Near East (Shea, 2007; cf. Grün et al., 2005) and probably even southern China (Shen and Michel, 2007) as early as 100,000 years ago (cf. Schillaci, 2008), their ultimate spread into the north (i.e., north of 33° N) may have started only as late as 43–42,000 years ago (Jöris and Street, 2008; cf. Zilhão et al., 2007; Shang et al., 2007). This is the period during which eAMH and Neanderthals, or other late archaic humans may have met (Figs. 2–4). How long this period of contact lasted is, however, a matter of ongoing debate (e.g., Mellars, 2006b; Turney et al. 2006; Mellars, 2006d), and depends not only on the earliest evidence of eAMH in Europe (Fig. 2), but also, and to a large degree on the interpretation of the youngest securely dated Neanderthals (Fig. 4; Jöris and Street, 2008; Jöris et al., 2008, with references therein). The directly 14C-dated remains from Mezmaiskaya and Vindija suggest additional refugia for late Neanderthals, distinct from the Iberian Peninsula (see above). While late Neanderthal survival in the latter region is a plausible scenario within the wider frame of the eAMH spread into Europe, claims that Mezmaiskaya (Ovchinnikov et al., 2000) and Vindija (Smith et al., 1999) harbored late surviving Neanderthals are far less convincing, and the extremely divergent dates recently produced by three different laboratories from the same Neanderthal bone (humerus) from Okladnikov (Fig. 4) imply serious problems in dissolving remnant contaminants (cf. Kräume et al., 2007). Stratigraphic, contextual and dating issues at Mezmaiskaya, for example, all contradict the young 14C date obtained directly from the infant Neanderthal and suggest a far older age (see discussion in: Adler et al., 2008; Jöris et al., in press; cf. Skinner et al., 2005). Concerning the age of the Vindija hominin fossils it is hard to imagine that a small ‘cell’ of Neanderthals persisted in the region for several millennia after eAMH were already established along the Danube (see discussion in: Jöris et al., in press; cf. Conard and Bolus, 2003; 2008) or in Northern Italy (Giagio et al., 2006; cf. Broglio, 2001). In other parts of Italy and in Bulgaria, Protoaurignacian and Bachokirian contexts stratigraphically fixed below tephras assigned to the Campanian Ignimbrite (Giagio et al., 2006; cf. Fedele et al., 2008) that erupted some 40,000 years ago in Central Italy (i.e., some 35.0 ka 14C
BP; cf. Weninger and Jöris, 2008; cf. Fedele et al., 2008; Giaggio et al., 2006) provide no evidence for late Neanderthal survival in neighboring regions. To the contrary, the similarities of these industries with Aurignacian inventories may indicate the establishment of eAMH populations within these regions (cf. discussion in Teyssandier, 2007) and even further to the east (Hoffecker et al., 2008) at an early date. If correct, this would make the late survival of Neandertals in some ‘island population’ at and around Vindija extremely unlikely. In comparison to the first series of $^{14}$C measurements obtained directly from Neanderthal bones (Smith et al., 1999), the recent direct re-dating of the Vindija layer G1 fossils with new “ultrafiltration” pre-treatment technology resulted in significantly older age estimates (Higham et al., 2006a), making the specimens slightly older than the Mladec eAMH remains (Wild et al., 2005). Nevertheless, the new dates from Vindija are still younger than those obtained from the Pesteru cu Oase eAMH remains (Zilhão et al., 2007). In this context even the newly ‘corrected’ Vindija dates might be regarded as minimum age-estimates only (Higham et al., 2006a). On the other hand the Oase fossils are not associated with any archaeological material (Zilhão et al., 2007), thus the makers of the early Aurignacian remain unknown (cf. Roebroeks, 2008).

With the establishment of AMH and the termination of Neanderthal settlement in Eurasia, the Middle to Upper Palaeolthic boundary also marks an important threshold in human cultural evolution (Mellars et al., 2007, and papers therein). As such the demographic and cultural processes underlying this “transition” throughout Eurasia are among the most debated issues in Palaeoanthropology (e.g., Trinkaus, 2007) and Palaeolithic archaeology (e.g., Mellars, 2006e). These debates often center on only a few key issues, which will be addressed below. Since the available chronometric data can be interpreted in a variety of ways, researchers tend to perceive the “transition” as either a biological process of population replacement (in terms of a strict ‘boundary’) or as a ‘true’ transition represented by fossils and/or material culture intermediate between the Middle and Upper Palaeolithic.

In this regard the degree to which Neanderthals and eAMH can be equated with the Middle and/or Upper Palaeolithic techno-complexes, respectively (discussion in Jöris and Street, 2008; Kozlowski, 2007), is of crucial importance. Concerning the Near Eastern record, it seems that both hominins produced Middle Palaeolithic assemblages (cf. Shea, 2007), which eventually evolved into industries assigned to the “Initial Upper Palaeolithic” (IUP). However, the lack of associated hominin fossils dating to between ca. 38–32 ka $^{14}$C BP (Trinkaus, 2005) makes it impossible to know which hominin species produced the Near Eastern IUP, just as in Europe the producers of the early Aurignacian remain unknown (cf. Roebroeks, 2008).

The ‘innovative’ aspects of material culture that differentiate the Upper from the Middle Palaeolithic depends on the interpretation of certain expressions in material culture, in particular those connected with symbolic behavior often interpreted as part of the ‘modern human behavioral repertoire’. In addition to apparently more functional innovations, such as split-based points (cf. Soler Sublis et al., 2008), some authors view art (cf. discussion in Pettitt, 2008) and/or the use of personal ornaments as a behavior restricted to Modern Humans (Álvarez Fernández and Jöris, 2008), while others argue that it reflects an interspecific behavior found among both Neandertals and Modern Humans (d’Errico, 2003). Because the earliest evidence of personal ornaments dates to the early Upper Pleistocene and (given the early evidence on the African continent) appears to be associated with eAMH (Vanhaeren et al., 2006; cf. Bouzouggar et al., 2007; Henshilwood, 2007), one could argue that only Modern Humans developed a state of cognition suitable for higher levels of abstraction, such as that underlying the production and use of personal ornaments, art, music, and various forms of ritual (cf. Dunbar, 2004, 2007). In contrast, other authors repeatedly argue for a regional evolution of personal ornaments within the European Final Middle Palaeolithic (FMP), independent of and chronologically preceding the first appearance of eAMH within specific regions, for example the Châtelperronian in France (Zilhão, 2007). A third group of researchers argues that Neanderthals became acculturated through their imitation of specific aspects of material culture, namely personal ornaments, introduced by eAMH spreading into Europe (cf.
Hublin et al., 1996; Mellars, 2000; cf. discussion in d’Errico et al., 1998).

Personal ornaments are the most common non-utilitarian objects regularly found within Protoaurignacian and Aurignacian contexts (Álvarez Fernández and Jöris, 2008; cf. White, 2001; 2007), however in several isolated cases they are associated with FMP assemblages (Zilhão, 2007). This implies that personal ornaments should be regarded as integral elements of Protoaurignacian and Aurignacian material culture (the latter of which is most likely the product of eAMH; Bailey and Hublin, 2005, 2006; cf. reviews by Jöris and Street, 2008; Jöris et al., in press), while they were of limited importance during the FMP. Nevertheless, the occasional discovery of personal ornaments in FMP sites is inevitably interpreted as resulting from either the contamination of a specific FMP layer with material from later occupations (e.g., White, 2001) or the independent invention of ‘aboriginal’ European Neanderthals (Zilhão, 2007). Indeed, recent excavations at European FMP sites have yet to produce any evidence for personal ornaments, while excavations in Protoaurignacian and Aurignacian contexts routinely recover such material, sometimes in high frequencies (e.g., White, 2007; cf. Bolus and Conard, 2008). In contrast, researchers who claim personal ornament use during the FMP (e.g., Bernaldo de Quiros et al., 2008), that is prior to and independent of any eAMH influence, have yet to prove the antiquity of the relevant FMP layers.

Directly relevant to this discussion, which has thus far focused almost exclusively on European finds, is material recently discovered in Siberia indicating the use of personal ornaments at an equally early, if not earlier age (cf. discussion in Kuzmin, 2008; cf. Lbova, 2008). If future research confirms these early discoveries, it will become necessary to reconsider just how pervasive certain culturally mediated ideas can be and how rapidly these may spread – even over long distances (cf. discussion in Bolus and Conard; 2008; Álvarez Fernández and Jöris, 2008).

Time helps to structure the past, however, dramatically different interpretations of absolute age determinations have been proposed to explain what can be characterized as a fundamental shift.
in the way humans conceived of and interacted with one another and the world around them. Since the large chronological overlap (10,000 radiocarbon years) observed between unfiltered $^{14}$C-data series of FMP and Protoaurignacian/Aurignacian assemblages (e.g., van Andel and Davies, 2003, and papers therein; cf. Jöris et al., 2003, 2006, and discussion in Jöris and Street, 2008; Jöris et al., in press) allows different interpretations of the relationship between Late Neanderthals and eAMH, the building of a reliable chronology for this period, which is at the very limits of the radiocarbon method, is of paramount importance (Blockley et al., 2008; cf. Weninger and Jöris, 2008). Many researchers interpret the chronometric data as evidence for a relatively slow, gradual spread of eAMH “Out of Africa” and into Eurasia via particular routes (i.e., the “Danube corridor”; Conard and Bolus, 2003) and their later expansion into surrounding areas (e.g., Boquet-Appel and Demars, 2000; Zilhão, 2006a; cf. Zilhão, 1993, 2000; Vega Toscano, 1990, 1993), with the great temporal depth allowing for both cultural and biological intermixtures (Zilhão, 2006a). Only the later phase of AMH population expansion is argued to have instigated the extinction of Neanderthals in their last remaining refugia (Boquet-Appel and Demars, 2000; discussion in d’Errico and Sánchez Goni, 2003; Finlayson et al., 2006). Each model developed to explain the relationship between Neanderthals and eAMH and the differences between the Middle and Upper Palaeolithic is based not only on the interpretation of hominin fossils and material culture from specific sites, but also, and to a large degree, on our perception of the underlying chronological schemes (see discussion in Mellars, 2006b; Turney et al. 2006; Mellars, 2006d).

Recent progress within the geosciences, specifically in palaeoenvironmental studies that aim to establish an absolute chronological framework for Last Glacial climate change (e.g., GICC05-chronology: Andersen et al., 2006, 2007; Svensson et al., 2006; Hulu-chronology: Wang et al., 2001), have significantly altered our temporal perception of the Palaeolithic. Ongoing research on the age calibration of the radiocarbon timescale – although disputed by some (e.g., Bronk Ramsey et al., 2006) and not entirely understood at the very limits of the radiocarbon method (cf. discussion in Balter, 2006) – indicates that, over much of the Last Glacial Cycle, radiocarbon age determinations underestimate calendar age estimates by several thousand years (Weninger and Jöris, 2008; cf. Hughen et al., 2006). This in turn makes “calibrated” radiocarbon ages older and shifts them closer to the calendar age scale established by other methods of dating that do not re-
Fig. 4. Compilation of directly $^{14}$C-dated Eurasian hominins (compiled after various sources; cf. Jöris and Street, 2008; Jöris et al., in press; Semal et al., 2008). The most plausible age ranges for hominins from Middle Palaeolithic (Neanderthal) and Aurignacian (eAMH) sites are highlighted in grey. The eAMH fossils from Oase have no archaeological association (cf. Zilhão et al., 2007), while Tianyuan (Shang et al., 2007), Paviland (after Jacobi and Higham, 2008), and Cro Magnon (see discussion in: Henri-Gambier, 2002) are of unclear archaeological contexts. Mid-Upper Palaeolithic (MUP) humans (AMH) are compiled after Trinkaus, 2005. Although the new dates from Paviland are significantly older than any other dated MUP burial, the grave appears to be of similar character as most other MUP burials identified throughout Western Eurasia (cf. Aldhouse-Green and Pettitt, 1998).
quire calibration (i.e., TL/OSL, ESR, U/Th; cf. Richter et al., 2008). In addition, technical advances within different dating techniques, especially in the pre-treatment of radiocarbon samples (e.g., Bronk Ramsey et al., 2004; Higham et al., 2006b), will continue to significantly alter the interpretation of the radiometric record at the Middle to Upper Palaeolithic boundary.

Against this background, the selective highlighting of particular radiometric dates from archaeological contexts or the uncritical use of bulk collections of unfiltered data in support of any of the models outlined above, should be viewed as too simplistic, and thus unable to resolve the complex factors involved at the Middle to Upper Palaeolithic boundary. Archaeologists must be aware that radiometric dates provided by the ‘hard sciences’ cannot simply be accepted at face value. Instead, such estimates always require critical evaluation against their stratigraphic, archaeological, and taphonomic contexts. This awareness demands the development of a systematic apparatus of quality control and its adoption by the larger archaeological community (e.g., Blockley et al., 2008; Lowe and Walker, 2000; Pettitt et al., 2003) as the only way to assure an improved spatio-temporal understanding of the demographic and cultural processes underlying the Middle to Upper Palaeolithic boundary in Eurasia.

It was with these issues in mind that session C57, entitled “Setting the Record Straight: Toward a Systematic Chronological Understanding of the Middle to Upper Palaeolithic Boundary in Eurasia”, was organized for the 15th meeting of the International Union for Prehistoric and Protohistoric Sciences (UISPP), on the 5th of September 2006 in Lisbon, Portugal. The session addressed recent advances in radiometric dating and interpretation against which existing and new regional Middle and Upper Palaeolithic chronometric records were referenced.

Though many questions concerning the Middle to Upper Palaeolithic boundary remain unanswered, some common ground was identified, notably that concerning the adjustment of time scales against which chronometric records are referenced. Radiocarbon “age-calibration”, or radiocarbon age “comparison” as some term it (e.g., van der Plicht et al., 2004), produces age estimates in close agreement with dates obtained by other dating methods (see above), and allows researchers to reference the archaeological record against regional and inter-regional palaeoclimate signatures developed during the last 15 years (e.g., Zilhão et al., 2007). For example, the Campanian Ignimbrite tephras, which erupted roughly 40,000 years ago in the vicinity of Naples, Italy, are central to this discussion, since they form a wide-spread chronostratigraphic marker horizon that allows inter-calibration of records between different regions of Europe (cf. Blockley et al., 2008). Papers from session C57 that contribute to this broad issue (Fedele et al., 2008; Hoffecker et al., 2008), including long cross-dated stratigraphic sequences (Ortvale Klide: Adler et al., 2008) and key sites that are so important to our understanding of the “transitional” period (Bohunic: Richter et al., 2008), are summarized in a special issue of the Journal of Human Evolution (2008, 55/5) which is published in tandem with the present volume.

The eight papers assembled in this special issue of Eurasian Prehistory are a sample of those presented in Lisbon, and represent case studies of the Middle and Upper Palaeolithic and the timing of the “transition”/replacement within specific regions of Eurasia (Fig. 1). While they span a range of research traditions and geographic regions, from Siberia to Western Europe (Figs. 2–3), the goal of each paper is to clarify the chronological and cultural aspects of the periods, populations and cultures in question. This approach does not allow a comprehensive, interregional consideration of site-specific archaeological records. Therefore this special issue does not provide a synthetic overview of the key events associated with this boundary, but, rather, highlights and recasts several important issues related to specific sites that so often dominate studies of the Middle and Upper Palaeolithic.

In this respect, the papers assembled in this special issue represent a diversity of views on the Middle to Upper Palaeolithic boundary which have a strong focus on site-specific data. Several papers present detailed discussions of the stratigraphic and chronometric records of sites that feature prominently in debates surrounding the “transition” on the one hand, and the appearance of the Initial/Early Upper Palaeolithic/Aurignacian on the other (Elefanti et al., 2008; Lengyel
These site-specific studies are complemented by two regional syntheses (Kuzmin, 2008; Lbova, 2008) that address the Siberian record and so offer broader perspectives on the Middle to Upper Palaeolithic “transition”/replacement that provide important challenges to traditional models that are often based exclusively on Western Eurasian data. Other papers critically review the available archaeological, chronometric and taphonomic data, and in two cases (Soler Sublis et al., 2008; Bernaldo de Quiros et al., 2008) the authors do so with an eye toward answering recent critics, while in another (Lengyel and Mester, 2008) they question the archaeological and cultural reality of a classic “transitional” industry.

The two introductory papers (Bolus and Conard, 2008; Álvarez Fernández and Jöris, 2008) focus on the spatio-temporal dimensions of Upper Palaeolithic “innovations” within material culture and symbolic behavior. Several independent centers of Upper Palaeolithic innovation are proposed by Bolus and Conard (2008: e.g., Swabian Jura: early Aurignacian; Spain: Fumanian), while Álvarez Fernández and Jöris (2008) argue that personal ornaments appear in Europe only with the arrival of eAMH after roughly 38,000$^{13}$C BP. Both papers are contrasted and in some respects challenged by subsequent papers that address some of the same case studies in further detail.

As might be expected, the results of this common exercise in critical reanalysis are in no way uniform and perhaps reflect the specific paradigms within which researchers operate as much as any real Palaeolithic behavioral variability. As such no consensus is attempted regarding major issues such as the makers of “transitional” industries (in those cases where such industries have survived close scrutiny; cf. discussion in Jöris and Street, 2008; Jöris et al., in press), the definition or origin of the Aurignacian (Bar-Yosef, 2006; Bar-Yosef and Zilhão, 2006, and papers therein; cf. discussion in Zilhão and d’Errico, 2003), or the precise timing of the Middle to Upper Palaeolithic “transition”/replacement (cf. papers in Adler and Jöris, 2008). Such precise definitions and associations, which have been the traditional goal of Palaeolithic research, are flawed in that they seek to establish a narrow, static understand-

ing of what was surely a complex process of population movement, interaction, and replacement that varied across space and time. The best way to appreciate the inherent variability in this continental process of Neanderthal extinction and Modern Human ascendance is to expand the available patchwork of high-quality regional data. Together, the nineteen papers published here and in the Journal of Human Evolution (2008, 55/5) sample the latest chronometric and archaeological advances in Middle and Upper Palaeolithic research in Eurasia, and contribute to our ongoing understanding of the biological, cultural, and demographic processes that underlie the Middle to Upper Palaeolithic “transition”/replacement.

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