THE EARLY UPPER PALEOLITHIC BEYOND WESTERN EUROPE

EDITED BY

P. JEFFREY BRANTINGHAM, STEVEN L. KUHN AND KRISTOPHER W. KERRY

The Early Upper Paleolithic beyond Western Europe

The Early Upper Paleolithic beyond Western Europe

EDITED BY

P. Jeffrey Brantingham,
Steven L. Kuhn,
and Kristopher W. Kerry

UNIVERSITY OF CALIFORNIA PRESS
Berkeley Los Angeles London

University of California Press
Berkeley and Los Angeles, California

University of California Press, Ltd.
London, England

Library of Congress Cataloging-in-Publication Data

The early Upper Paleolithic beyond Western Europe / edited by P. Jeffrey Brantingham, Steven L. Kuhn, and Kristopher W. Kerry.
p. cm.
Includes bibliographical references and index.
ISBN 0-520-23851-6 (cloth : alk. paper)
1. Paleolithic period—Europe, Eastern. 2. Paleolithic period—Asia, Central. 3. Tools, Prehistoric—Europe, Eastern. 4. Tools, Prehistoric—Asia, Central. 5. Europe, Eastern—Antiquities. 6. Asia, Central—Antiquities. I. Brantingham, P. Jeffrey, 1970– II. Kuhn, Steven L., 1956– III. Kerry, Kristopher W., 1970–
GN772.2.A1 E37 2004
939′.6—dc21 2003010136

13 12 11 10 09 08 07 06 05 04
10 9 8 7 6 5 4 3 2 1

The paper used in this publication is both acid-free and totally chlorine-free (TCF). It meets the minimum requirements of ANSI/NISO Z39.48-1992 (R 1997) *(Permanence of Paper).*

CONTENTS

FIGURES AND TABLES

FIGURES

TABLES

PREFACE

For students new to the study of modern human origins, it might come as a surprise to learn that only recently has there been any semblance of a consensus that the Mousterian—and the Middle Paleolithic more generally—is in some way definitive of archaic behavior. Indeed, prior to the mid-1980s, one rarely encountered strict distinctions between "archaic" and "modern" behavior, and archaeologists seldom sought to assign the Mousterian and Aurignacian to these mutually exclusive categories. Archaeologists in western Europe have long recognized spectacular changes in the material record across the Middle and Upper Paleolithic boundary beginning perhaps as early as 45,000 years ago, but the recasting of the Mousterian as distinctly "archaic" and the Aurignacian as distinctly "modern" has really only come to the forefront of archaeological debate since the publication of the landmark study of mitochondrial genetic lineages by Cann et al. (1987) and the subsequent ascendance of the "Out of Africa" model of modern human origins (Mellars and Stringer 1989). With a few notable exceptions (e.g., Clark and Lindly 1989; Clark 1999), the better part of the past seventeen years has been dedicated to aligning the newly designated "archaic" and "modern" industries of western European Middle-Upper Paleolithic sequence with the predictions of the Out of Africa model. Having done so, many archaeologists conclude—although not without controversy—that the Middle-Upper Paleolithic transition in western Europe represents a rapid replacement of archaic with modern behavioral systems and therefore provides broad confirmation of the Out of Africa model.

The western European Aurignacian has served as the holotype, or template, for the initial wave of changes that mark the beginning of the Upper Paleolithic (e.g., Mellars 1973). The Aurignacian provides ample evidence of

1. The typological and technological diversification of stone tools, especially blade-based tools;
2. The frequent manufacture and use of tools based on novel organic materials, such as antler, bone, and ivory;
3. Changes in subsistence pursuits, including both greater hunting specialization and the use of such new resources as aquatic foods;
4. The increasing complexity of intergroup social interaction, linked possibly to rising population densities; and, quintessentially,
5. The emergence of complex symbolic behavior, including personal ornamentation as well as portable and stationary art.

Despite its continued importance to structuring archaeological research questions and analytical approaches, however, it is far from proven that the Aurignacian is the most appropriate template for what "modern human behavior" should look like. This volume, above all, is about broadening our geographic perspectives to consider patterns of cultural change during the earliest phases of the Upper Paleolithic in regions located well beyond western Europe and the "heartland" of the Aurignacian. There is reason to wonder whether an independent test of the predictions of Out of Africa—or any other model for the origins of the Upper Paleolithic—against archeological sequences from regions outside western Europe would lead to the same conclusions as past syntheses. The dispersal of anatomically modern humans (or the spread of modern human anatomy) and the behavioral changes that occurred with the Upper Paleolithic are, by definition, global processes. As such, they must be understood from a broad geographic perspective. The western European archaeological record may dominate current views of these processes with respect to both the quantity and the quality of information, but the fact remains that western Europe is a relatively small area and a geographical cul-de-sac.

In adopting a broader geographical perspective on the earliest Upper Paleolithic, it is useful to emphasize that we all hold certain expectations about what cultural change should look like over this critical time period. When turning to regions beyond western Europe, it is reasonable to ask: Are patterns of cultural change fairly abrupt, similar to those represented in western Europe? Are the trajectories of cultural change locally unique and difficult to fit into a global sequence? Or do patterns of cultural change show some globally common patterns and some locally unique attributes? If the answer to the first question is yes, then the pattern is consistent with models of singular shift away from archaic patterns toward modern patterns of behavior. A positive answer to the second question, in contrast, is consistent with models of a mosaic of shifting behavioral adaptations based on local archaic behavioral systems. The third, of course, falls somewhere in between, emphasizing the exogenous development of a modern behavioral package with the incorporation of local archaic behaviors.

Until very recently, there has been only limited opportunity to examine processes of behavioral change from the Middle to Upper Paleolithic outside the European centers of Paleolithic research. The most notable and earliest attempts focused on the Levant, another area with a long research history. However, the Levantine material record—especially the provocative evidence for continuity across the Middle-Upper Paleolithic boundary from sites such as Boker Tachtit—has continued to suffer under the impression that it represents only a minor exception to the dominant pattern of replacement identified in western Europe (Klein 1999). Without additional evidence from other regions, there is little hope of evaluating the validity of this assertion. After all, just because it is familiar to us does not mean that the record of western Europe is particularly representative.

This volume brings together some of the latest chronological, stratigraphic, and archaeological evidence concerning the earliest Upper Paleolithic from areas beyond western Europe. With the exceptions of the first and last chapters, the volume is organized geographically, beginning in central Europe and ending in eastern Eurasia. Chapter 1 develops several general conceptual tools for modeling evolutionary transitions and discusses how these may inform the study of the origins of modern human behavior and archaeological changes occurring with the transition from Middle to Upper Paleolithic. Chapters 2–6 consider the earliest Upper Paleolithic from central and eastern Europe, the Crimea, Ukraine, and the Russian Plain. Chapters 7–11 discuss recent archaeological studies in the Levant, Turkey, the Republic of Georgia, and central Asia. Finally, chapters 12–15 examine the earliest Upper Paleolithic from Siberia, Mongolia, and northwestern China. Chapter 16 summarizes and evaluates the evidence presented in the volume in terms of the conceptual models laid out in chapter 1.

This volume had its origins in a symposium at the 64th Annual Meeting of the Society of American Archaeology, held in Chicago, Illinois, 24–28 March 1999. We thank all of the authors for their timely and provocative contributions to the volume. The volume as a whole benefited from comments and critiques provided by Geoff Clark and an anonymous reviewer. We are particularly grateful to Blake Edgar at the University of California Press, who took a personal interest in seeing this volume to completion. Peter Strupp and Cyd Westmoreland at Princeton Editorial Associates proved invaluable in the final production process. Finally, we acknowledge the support of the various institutions that made this work possible, including the University of California, Los Angeles; the Santa Fe Institute; and the University of Arizona.

1

On the Difficulty of the Middle-Upper Paleolithic Transitions

P. J. Brantingham, S. L. Kuhn, and K. W. Kerry

BEHAVIORAL ADAPTATIONS AND HOMININ PHYLOGENY

The most recent Upper Paleolithic culture complexes differ in important ways from the latest Middle Paleolithic. Indeed, by 20,000–18,000 BP,[1] the height of the Last Glacial Maximum, many fundamental and unique features of modern human behavior—from the use of material culture as a medium of symbolic communication to the development of complex and costly technologies—are expressed on a global scale. The evolutionary roots of these behavioral characteristics may be much deeper, and, in a handful of places, they seem to be expressed precociously in time horizons considerably more ancient than the Last Glacial Maximum (McBrearty and Brooks 2000). Yet there is no consensus on where and when modern human behavior first appeared. More important, there is no consensus on what processes led to its emergence (Clark 1999).

The concept of the early Upper Paleolithic as a period distinct from both the late Middle Paleolithic and late Upper Paleolithic is intimately tied to these questions. The degree to which researchers emphasize the differences between the late Middle Paleolithic, early Upper Paleolithic, and late Upper Paleolithic is in part a function of where they work, but it is also connected with their views about the relationship between human behavioral and biological change. Much effort has been expended on characterizing the earlier of these transitions, between the late Middle and earliest Upper Paleolithic, in part because the earliest appearance of the Upper Paleolithic has long been associated with the origin and spread of anatomically modern humans. Supporters of models positing an abrupt replacement of indige-

1. Throughout the volume, all ages are reported in radiocarbon years before present (BP) or thousands of radiocarbon years before present (ka) unless otherwise noted.

nous archaic hominins (e.g., Neanderthals) by anatomically modern humans coming out of sub-Saharan Africa would like to see an abrupt archaeological break in the late Pleistocene archaeological sequence, perhaps coinciding with the appearance of the first Upper Paleolithic cultural complexes around 45,000 BP (e.g., Klein 1999; Mellars 1996, 1999). Supporters of models positing regional continuity in late Pleistocene cultural and biological evolution would like to see, in contrast, profound changes occurring only after anatomically modern humans evolved and became established across the globe, the behavioral transitions coinciding perhaps with the appearance of the late Upper Paleolithic around 20,000 BP (e.g., Strauss 1997). Neither of these expectations is particularly realistic.

The differences of interpretation stem in part from an insistence that behavioral evolution occurred in tandem with biological evolution. On the contrary, we see no necessary theoretical link between the transition from the Middle to the Upper Paleolithic and the biological origins of anatomically modern humans or, for that matter, the demise of archaic hominins. Nonhuman biological systems offer a wide range of examples where very complex behavioral transitions occurred repeatedly among unrelated taxa (see Camazine et al. 2001; Maynard Smith and Szathmáry 1995). Eusociality, for example, has evolved among sponge-dwelling shrimp (*Synalpheus* sp.) (Duffy et al. 2000), naked mole-rats *(Heterocephalus glaber)* (Sherman et al. 1991), termites (*Macrotermes* sp.) (Camazine et al. 2001) and bees and ants (Hymenoptera) (Wilson 1971)—within the last order at least a dozen times independently. Closer to home, the repeated independent origin of various complex stone core and tool technologies (Bar-Yosef and Kuhn 1999; Brantingham and Kuhn 2001), big- and small-game hunting (Stiner 2001, 2002), complex hunter-gatherer adaptations (Arnold 2001) and urbanism (Smith 2003) similarly do not diagnose biological transitions, and few anthropologists would argue that they do. What these examples illustrate is that, although phylogeny might be a good predictor of the probability that a particular behavioral feature might evolve, the opposite is not necessarily true: the presence of a specific behavior or behavioral system is not necessarily an accurate predictor of biological phylogeny. To wit, there is no more theoretical justification for saying that the Middle Paleolithic unequivocally diagnoses archaic hominins than there is for linking the Upper Paleolithic to the origins of anatomically modern humans.

Why continue to treat as problematic the relationship between the Middle and Upper Paleolithic if there is no necessary relationship between the evolution of "modern behavior" and the origin of modern humans? And why pay attention to the early Upper Paleolithic? We believe that it is precisely because of the potential for decoupling behavioral and biological evolution that the Middle-Upper Paleolithic transition is interesting. Indeed, the behavioral changes recognized within the early Upper Paleolithic signify a much more complex evolutionary process than is often imagined. Absent an assumed link between—or direct fossil evidence associating—individual hominin morphotypes and specific cultural complexes, anthropologists are forced to reevaluate their models for explaining the fundamental nature of behavioral change.

MODELING BEHAVIORAL TRANSITIONS

Use of the term "transition" to describe the emergence of the earliest Upper Paleolithic implies a jumping of significant evolutionary hurdles. There is little to dispute that imposing chemical, biological, and behavioral hurdles were jumped in the origins of self-replicating molecules, eukaryotic cells, and multicellular organisms (Maynard Smith and Szathmáry 1995; Michod 1999). These major evolutionary transitions were both difficult to achieve and astonishing precisely because of the hurdles that stood in their way. It is not immediately clear, in contrast, what evolutionary hurdles were jumped during the Middle-Upper Paleolithic transition. Although we agree that many of the features comprising the Upper Paleolithic are astonishing, this is no guarantee that the Middle-Upper Paleolithic transition was in some way evolutionarily difficult. The unprecedented developments of the Upper Paleolithic are no less impressive than the independent development of formalized systems of writing, mathematical notation, and logic among later cultures, but they need not have been enormously more difficult.

We believe that the most appropriate questions to ask at this juncture are: How "accessible" was the Upper Paleolithic, given what we know about Middle Paleolithic adaptations? Were Upper Paleolithic adaptations easily derived from many different starting points within the Middle Paleolithic, or only from a few discrete Middle Paleolithic variants? Was the Middle-Upper Paleolithic transition highly improbable, involving radical, unpredictable changes in the way that behavioral adaptations were organized? Or was the transition highly probable, involving small, predictable changes to existing adaptations?

The difficulty of an evolutionary transition is relatively straightforward to establish for genetic systems (Bärbel et al. 2001), and sometimes also for phenotypic systems (McGhee 1999). In such cases, metrics exist that provide reasonable measures of the distance between alternative states of the system. The distance between any two variants within a genotypic space, for example, is easily measured by the number of single base-pair mutations that it would take to transform one variant into the other. Thus, for a genetic string of length $N = 1$, the genotypic space consists of four alternative states (i.e., A, T, C, G) and it takes at most only one mutational step to get from any one variant to another. Assuming that mutation occurs at random—that there are no selective advantages to having any one genotype—it is clear that all areas of this very simple genotypic space are equally accessible from any starting point. For a genetic string of length $N > 1$, it becomes more difficult to access certain parts of the genotypic space: for a string of length $N = 2$ and a given starting point (e.g., AA), there will be exactly six genetic variants that are accessible through one mutational step (e.g., AT, TA, AC, CA, AG, GA), but an additional nine variants that are accessible only through two mutations (e.g., TT, TC, TG, . . ., GG). In the absence of selective pressures, we would classify transitions to any of the states two mutational steps away as fundamentally more difficult to access. Accordingly, the difficulty of a transition between any two genetic strings is measured by the distance in mutational steps between states.

Phenotypic spaces describing theoretically possible morphologies or behavioral organizations are often more difficult to map. There are straightforward mathematical models describing the range of theoretically possible univalve shell forms (Raup 1966; McGhee 1999), branching morphologies of trees (McGhee 1999), hominin cranial morphologies (Ponce de León and Zollikofer 2001), and even some stone core and tool technologies (Dibble 1995; Brantingham and Kuhn 2001). Although it is possible to measure distances within these phenotypic spaces, an assessment of the difficulty of transition between alternative phenotypic states is necessarily dependent upon our understanding of the biological and/or behavioral mechanisms generating these alternative states. For example, a mathematical model describing the morphological distance between the shell shapes of two gastropod species must reference the growth and development of the respective species before it can be established whether one morphological alternative is easy or difficult to access from the other (McGhee 1999): a dramatic change in shell morphology in one direction might prove to be easy to engineer developmentally, whereas a seemingly minor morphological change in another direction might be exceedingly difficult to accomplish. As will become apparent, moreover, transitions that are easily accomplished in one direction are not necessarily easy in reverse.

Arguably, the mechanisms generating different Paleolithic behavioral adaptations are not well known compared with either genetic or ontogenetic systems. As a consequence, even if we possessed all the necessary tools for measuring distances between alternative Paleolithic behavioral adaptations—something we are already prone to do informally and implicitly—it would be overly optimistic to assume that these measurements could immediately be used to evaluate how accessible the Upper Paleolithic was from the Middle Paleolithic. Although a realistic quantitative approach to this question is still a distant goal, it is possible to develop simple topological models that are conceptually useful for considering the difficulty of the Middle-Upper Paleolithic transition (see Bärbel et al. 2001). Our intention here in outlining the models is to provide a general but effective theoretical structure that readers may use in evaluating the origins of the Upper Paleolithic in the various geographic regions treated in this volume.

In much the same way that we would build a genotypic space for a genetic string of a certain length, assume that we could quantify all of the theoretically possible combinations of behaviors comprising Middle and Upper Paleolithic adaptations, respectively. Such combinatorial models might describe, for example, the possible foraging, mobility, and mating strategies and forms of social organization that could co-occur in a coherent Middle or Upper Paleolithic adaptation. Assume also that we understood the mechanisms by which a behavioral feature in one adaptation is modified or replaced, yielding an alternative adaptation; for example, through innovation, drift, or acculturation. Within each modeled Paleolithic phenotypic space, one could measure the distances between alternatively configured adaptations and compute how many steps it would take to transform one into the other. For example, we could conceivably identify within Upper Paleolithic phenotypic space the positions of adaptations from the Dordogne and the Levant, evaluate the distance between them, and, given a mechanism of behavioral change, establish how difficult it would reach one from the other. Of interest here is whether transitions between phenotypic spaces comprising the Middle Paleolithic and those comprising the Upper Paleolithic were inherently difficult or easy.

Figure 1.1 presents a number of possible topological relationships underlying the Middle-Upper Paleolithic transition. The light and dark gray boxes represent hypothetical phenotypic spaces for the Middle Paleolithic and Upper Paleolithic, respectively. The size of a given box captures conceptually the size of the phenotypic space, roughly the number of distinct behavioral combinations that could comprise a coherent adaptation. The distance between any two points within a space is proportional to number of steps that it would take to transform one adaptation into the other. Note that larger phenotypic spaces can accommodate much greater distances between any two adaptive configurations while still being classified as Middle or Upper Paleolithic. In this way, larger spaces imply greater phenotypic variability.

Leaving open the question of the potential fitness differences of alternative adaptations within a single phenotypic space, transitions between the Middle and Upper Paleolithic are assumed to entail distinct changes in fitness. Indeed, a common—albeit tacit—assumption is that Upper Paleolithic adaptations arising from modification of one or more Middle Paleolithic configurations have greater fitness, although it is difficult to demonstrate conclusively that this is the case. Figure 1.1 conveys these assumed fitness differences by mapping the Middle and Upper Paleolithic as separate phenotypic spaces and thus by requiring a transition between spaces.

The length of the edge shared between two phenotypic spaces in each of the graphic models represents the proportion of one adaptive space that is

Figure 1.1. Alternative topological models for the Middle-Upper Paleolithic transition. Light gray boxes represent phenotypic spaces for the Middle Paleolithic, and dark gray boxes represent those for the Upper Paleolithic.

directly accessible from the other (see Bärbel et al. 2001). If two phenotypic spaces are the same size and share an entire edge, then both spaces are of comparable combinatorial diversity and each adaptive configurations in one space is directly accessible through minor transformations of one or more adaptive configurations in the other space, and vice versa. At the other extreme, if two phenotypic spaces differ in size and share no edge, then the combinatorial diversity of one adaptive system is greater, and, more importantly, there are no transformations that lead between the two phenotypic spaces.

Panels 1 and 2 in figure 1.1 represent alternative topological models in which well-bounded Middle Paleolithic adaptations give rise to well-bounded Upper Paleolithic adaptations, with some probability that the reverse transition (i.e., "back reaction") will also occur. In panel 1, the phenotypic space representing the Middle Paleolithic is substantially smaller than that for the Upper Paleolithic, indicating a lower degree of phenotypic diversity in the Middle Paleolithic. The absolute length of the edge shared between the two phenotypic spaces is the same, but is larger as a proportion of the Middle Paleolithic space ($p = 0.5$) compared with the Upper Paleolithic ($p = 0.2$). This hypothetical relationship suggests that it is easier to exit the Middle Paleolithic through relatively minor modifications of existing adaptations. In other words, transitions in the direction of the Upper Paleolithic are much more easily achieved than transitions in the opposite direction. Numerically, we could suppose that approximately 50% of the adaptive configurations in the Middle Paleolithic are readily transformed into Upper Paleolithic configurations, whereas only 20% of the Upper Paleolithic configurations are easily transformed into characteristic Middle Paleolithic configurations. Symmetrically, of course, the other 50% of the modifications to Middle Paleolithic adaptations lead to alternative Middle Paleolithic adaptations, and the remaining 80% of the modifications to Upper Paleolithic adaptations lead to alternative Upper Paleolithic adaptations. Panel 2 represents a variant of the first postulated relationship, but in this case the Middle Paleolithic phenotypic space shares an entire edge with the Upper Paleolithic space. Hypothetically, then, all Middle Paleolithic adaptive configurations could lead to the Upper Paleolithic through simple transformations. However, a much smaller proportion of the Upper Paleolithic phenotypic space is easily transformed back into Middle Paleolithic adaptive configurations.

Panels 3 and 4 represent more complex topological relationships. Panel 3 illustrates a situation where the Middle Paleolithic is composed of two distinct phenotypic spaces representing nonoverlapping combinations of behaviors. One could interpret the two spaces as separate adaptive peaks (i.e., alternative equilibria) with similar—hence the Middle Paleolithic classifications—but not necessarily identical fitnesses. Generally speaking, there are no feasible transformations of adaptive configurations in one Middle Paleolithic space that lead *directly* to the other. The separate Middle Paleolithic spaces are, however, connected to a single Upper Paleolithic phenotypic space. This relationship implies that the two nonoverlapping Middle Paleolithic spaces could converge on a common set of Upper Paleolithic adaptations and, admitting the possibility, could also access one another through the Upper Paleolithic. In other words, one distinctive set of Middle Paleolithic adaptations could transition to an alternative, nonoverlapping set of Middle Paleolithic adaptations by first assuming an Upper Paleolithic configuration.

Finally, panel 4 illustrates a situation where one Middle Paleolithic phenotypic space is isolated from both an alternative set of Middle Paleolithic adaptive configurations and Upper Paleolithic configurations. In this case, there are no feasible transformations of the isolated set that lead to the Upper Paleolithic. Rather, the Upper Paleolithic arises from a relatively small and unique set of Middle Paleolithic adaptations.

How do these simple topological models map to current perspectives in the study of modern human origins and the Middle-Upper Paleolithic transition? There is no necessary or implied link between these topological models of behavioral transitions and the dynamics of hominin populations, although it may be tempting to interpret them in such terms. This said, the topologies represented by panels 1–3 are all broadly consistent with multiregional models of human behavioral evolution. Panels 1 and 2 are similar in suggesting that there are single phenotypic spaces, differentiated on the basis of fitness, for both the Middle and Upper Paleolithic. The topology represented in panel 2 corresponds to an extreme multiregional formulation in which all Middle Paleolithic variants lead easily into the Upper Paleolithic. Panel 1 is consistent with a less extreme interpretation in which a large proportion of local Middle Paleolithic variants lead easily to the Upper Paleolithic, whereas other local variants require more difficult (but not impossible) transformations to achieve the same result. Panel 3 is consistent with more complex multiregional models, ones that further underscore the decoupling of biological and behavioral evolution: variants of the Middle Paleolithic, perhaps geographically defined, are themselves nonoverlapping and possibly of very different fitness levels, but converge on a common set of Upper Paleolithic adaptations. This convergence would be impossible if the two phenotypic spaces classified as Middle Paleolithic diagnosed reproductively isolated archaic hominin populations, and the Upper Paleolithic diagnosed reproductively isolated anatomically modern humans. Interestingly, all three models imply the possibility of devolution from Upper to Middle Paleolithic patterns, a possibility seldom discussed.

Panel 4 is the only general topological form illustrated here that leads to interpretations of the origin of Upper Paleolithic strictly consistent with a model of complete biological replacement. In this case, a phenotypically restricted Middle Paleolithic gives rise to the Upper Paleolithic allowing for no contributions from Middle Paleolithic variants. This fourth alternative would correspond with a strict "Out of Africa" scenario, in which anatomically and behaviorally modern humans originated in sub-Saharan Africa and spread throughout the world with little or no genetic or cultural input from other contemporary hominin populations.

The above models are not meant to provide an exhaustive set of all theoretically possible relationships between the Middle and Upper Paleolithic. Rather, these simple examples are intended to provide a conceptual structure for the reader to begin considering the diversity of adaptations within the Middle and Upper Paleolithic and, in particular, what the early Upper Paleolithic tells us about how these phenotypic spaces were connected. The models are also intended to highlight the significant theoretical gaps in our understanding of the Middle-Upper Paleolithic and the position of the early Upper Paleolithic in the origins of modern human behavior. In particular,

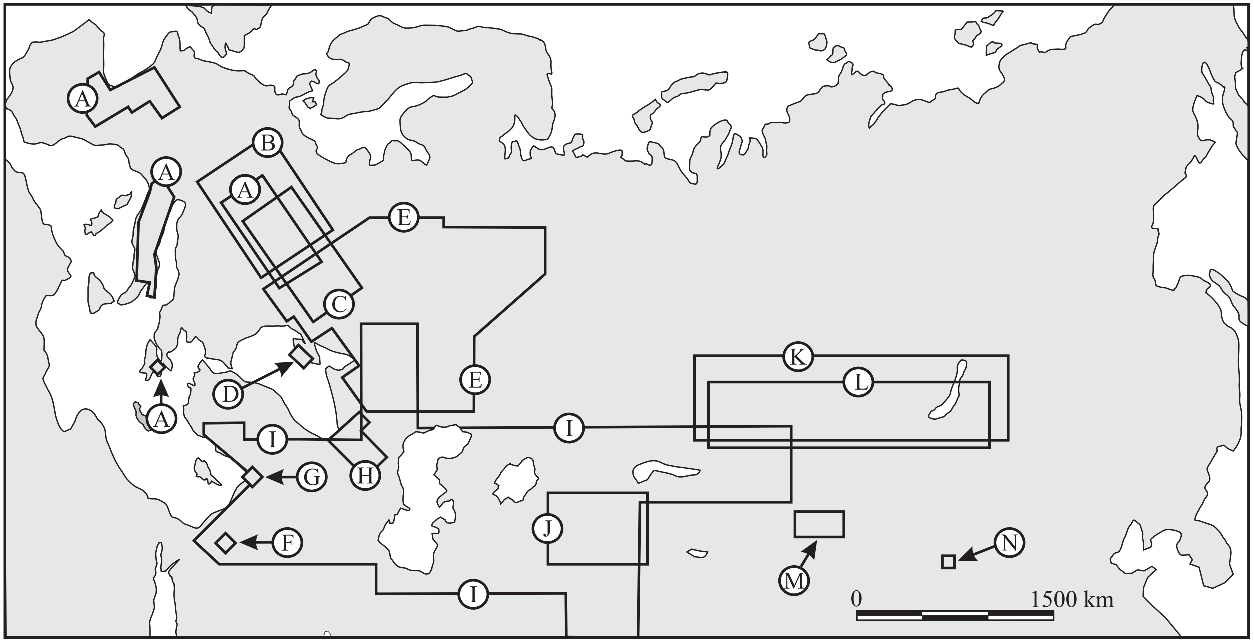

Figure 1.2. Map showing various areas and/or regions discussed in this book by chapter number. *Key:* A, chapter 2; B, chapter 3; C, chapter 4; D, chapter 5; E, chapter 6; F, chapter 7; G, chapter 8; H, chapter 9; I, chapter 10; J, chapter 11; K, chapter 12; L, chapter 13; M, chapter 14; N, chapter 15.

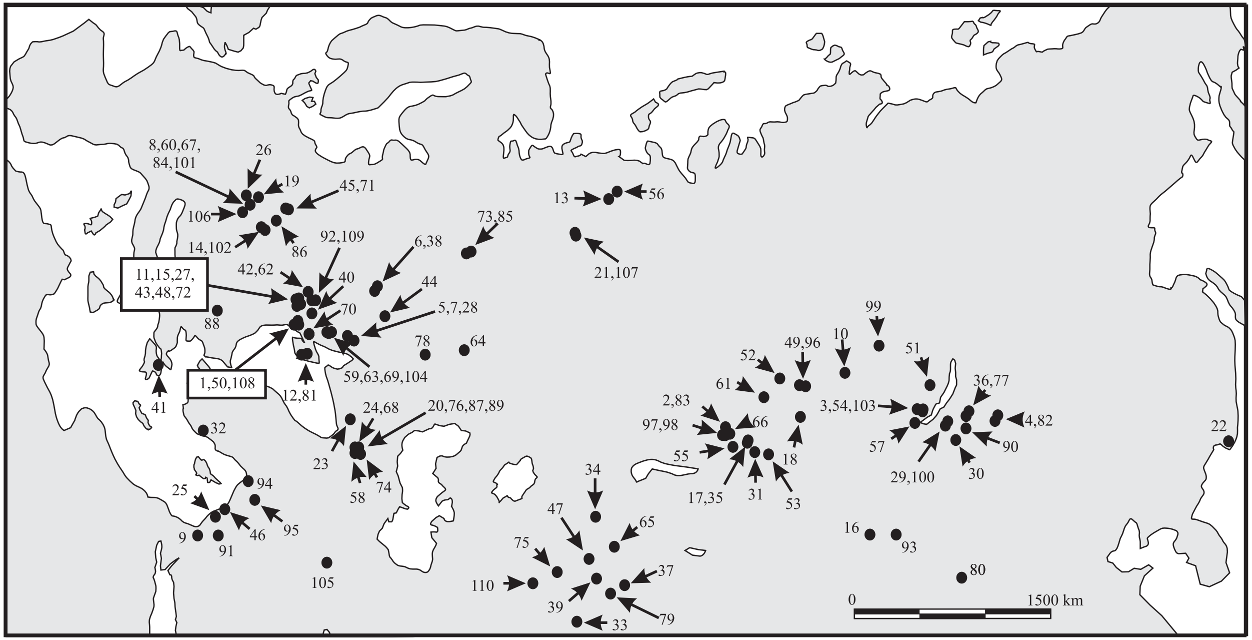
8,60,67,
84,101
26
19
45,71
106
14,102
86
92,109
11,15,27,
43,48,72
42,62
40
70
88
6,38
44
5,7,28
73,85
13
56
21,107
78
64
59,63,69,104
41
1,50,108
12,81
24,68
20,76,87,89
32
23
58
74
25
94
95
46
9
91
105
34
47
65
75
37
110
39
79
33
99
10
49,96
52
61
51
36,77
3,54,103
4,82
2,83
97,98
66
55
18
17,35
31
53
57
90
29,100
30
22
16
93
80
0
1500 km

Figure 1.3. Map showing sites discussed in this book. *Key:* 1, Anetovka 13; 2, Anuy; 3, Arembovskii; 4, Arta 2; 5, Belokuzminovka; 6, Betovo; 7, Biryuchia Balka; 8, Bohunice; 9, Boker Tachtit; 10, Brazhnoye; 11, Brynzeny 1; 12, Buran-Kaya III; 13, Byzovaya; 14, Čertova Pec; 15, Chervony Kamen; 16, Chikhen Agui; 17, Denisova; 18, Dvuglazka Cave; 19, Dzierzyslaw; 20, Dzudzuana; 21, Garchi 1; 22, Geographical Society Cave; 23, Gubski Rockshelter; 24, Gvardjilas Klde; 25, Hayonim Cave; 26, Hradsko; 27, Ivanychi; 28, Kalitvenka; 29, Kamenka; 30, Kandabaevo; 31, Kara Bom; 32, Karain B; 33, Kara Kamar; 34, Karasu; 35, Kara Tenesh; 36, Khotyk 3; 37, Khonako 3; 38, Khotylevo 2; 39, Khudji; 40, Klimautsy 1; 41, Klisoura Cave; 42, Korman 4; 43, Korpatch; 44, Kostenki; 45, Kraków-Zwierzyniec; 46, Ksar 'Akil; 47, Kulbulak; 48, Koulichivka; 49, Kurtak 4; 50, Leski; 51, Makarovo 4; 52, Malaia Syia ; 53, Maloialomanskaia; 54, Malta; 55, Malyi Yaloman; 56, Mamontovaya Kurya; 57, Mamony 2; 58, Mgvimevi; 59, Mira; 60, Mohelno; 61, Mokhovo 2; 62, Molodova 5; 63, Nenasytets; 64, Nepryakhino; 65, Obi Rakhmat; 66, Okladnikov Cave; 67, Ondratice; 68, Ortvale Klde; 69, Osokorovka; 70, Peremoga 1; 71, Piekaty II; 72, Ripiceni-Izvor; 73, Rusanikha; 74, Sagvardjile; 75, Samarkandskaya; 76, Samerzkhle Klde; 77, Sapun; 78, Shlyakh; 79, Shugnou; 80, Shuidonggou; 81, Siuren; 82, Sokhatino; 83, Strashnaya Cave; 84, Stránská skála; 85, Sungir; 86, Szeleta Cave; 87, Taro Klde; 88, Temnata Cave; 89, Togon Klde; 90, Tolbaga; 91, Tor Sadaf; 92, Tochilnitsa; 93, Tsagaan Agui; 94, Üçağılzı Cave; 95, Umm el Tlel; 96, Ust Izhul; 97, Ust Kanskaia; 98, Ust Karakol; 99, Ust Kova; 100, Varvarina Gora; 101, Vedrovice; 102, Vlčkovce; 103, Voennyi Gospital; 104, Vorona; 105, Warwasi; 106, Willendorf; 107, Zaozerie; 108, Zeleny Khutor; 109, Zhornov; 110, Zirabulak.

we believe that we have a poor grasp of the mechanisms that drive behavioral change. The models presented above clearly take their inspiration from theoretical approaches to biological evolution. In these theoretical models, adaptive organizations are graded in terms of fitness, and both selection and drift are primary mechanisms driving organizational changes and, ultimately, evolutionary transitions. Although fitness may yet be a primary currency in human behavioral evolution, and both selection and drift primary mechanisms of change, the models presented here are not restricted to these theoretical positions. Reasonable arguments could be made for innovation, acculturation, or other social and ideational mechanisms as the primary mechanisms underlying behavioral change. Regardless of one's theoretical choices in this domain, the above models demand that we evaluate the nature of the Middle-Upper Paleolithic transition in terms of its difficulty.

THE EARLY UPPER PALEOLITHIC BEYOND WESTERN EUROPE

The models presented in the previous section provide a framework for examining and evaluating evolutionary transitions in general. Another set of questions concerns where—geographically and chronologically—we should look to evaluate the Middle-Upper Paleolithic transition. Until 30 years ago, the accounts of the Middle-Upper Paleolithic transition found in European and American texts focused almost exclusively on southwestern Europe, especially southern France and northern Spain, and secondarily on the Levant. The resulting models of the Middle-Upper Paleolithic transition were relatively uncomplicated.

Such a myopic view was not simply a matter of chauvinism, however. In all fairness, these were the only parts of the world that the majority of European and American researchers knew much of anything about. Continued exploration of the archaeological record outside the traditional Paleolithic heartland, combined with the easing of restrictions on international travel and communication resulting from the collapse of the Soviet Union in 1991, has changed the situation radically. Teams of researchers from Western Europe and the United States are now able to excavate sites in Russia, Central Asia, Eastern Europe, and other areas formerly off limits to them. More important, scholars from these regions can now attend conferences and contribute to publications in Western countries, bringing with them the fruits of decades of dedicated research that many of their Western colleagues knew little or nothing about. Suddenly, for the Paleolithic specialist, the world is a much bigger and more complicated place.

This explosion of new information is welcome. Curiously, however, the recent increase in available data has had only limited influence on the accounts of modern human origins found in textbooks, synthetic papers, and popular articles. If anything, a consensus on where and when modern human behavior first appeared and the evolutionary processes that led to its emergence seems farther away. For too many scholars, the story devolves sooner or later to southwestern Europe and the now-familiar story of the Mousterian, Aurignacian, and Châtelperronian. A primary motive for assembling this volume, therefore, is to make available to anglophone scholars the most recent results on the beginnings of the Upper Paleolithic from areas outside Western Europe. The geographic coverage is not absolutely even, but we have tried to include those parts of Eurasia where there is active research on the early Upper Paleolithic (figures 1.2 and 1.3).

Although the chapters in this volume do not provide a complete consensus on the geographic nature, timing, and processes underlying the origins of modern human behavior, we believe that collectively, they put us in a much better position to assess the general topology of the Middle-Upper Paleolithic transition, or perhaps more accurately stated, the Middle-Upper Paleolithic transitions. We hope the reader will draw on the general theoretical models presented earlier in this chapter to organize their interpretations of the Middle-Upper Paleolithic transitions as seen in different regions: What is the range of early Upper Paleolithic phenotypic space? Is this a single, well-integrated phenotypic space, or is there reason to believe that there many independently organized spaces? What does the early Upper Paleolithic tell us about the region of contact between Middle and Upper Paleolithic cultural and behavioral adaptations? What does this region of contact (or lack thereof) tell us about the difficulty of the transition between phenotypic spaces? Do some lines of evidence (e.g., lithic technology) suggest relative ease of transition, whereas others (e.g., symbolic behavior) imply radical and difficult transformations? Many of the chapter authors postulate historical or phylogenetic relationships between local Middle and Upper Paleolithic cultures, irrespective of differences or similarities in adaptations. The relationship between evolutionary potential and phylogenetic history in the various regions is an issue of considerable interest. We return to these questions in the concluding chapter.

2

Early Upper Paleolithic Backed Blade Industries in Central and Eastern Europe

J. K. Kozłowski

TRANSITIONAL INDUSTRIES IN EUROPE

The term "transitional industry" refers to Interpleniglacial taxonomic units characterized by evolutionary dynamics in the spheres of technology, production, and morphology of stone blanks and tools leading from the Middle to the Upper Paleolithic. Bearing in mind that the broad chronological framework of these units spans from 50 to 30 ka, we cannot look for their genesis solely in a process of acculturation resulting from an encounter between Neanderthal groups and anatomically modern humans arriving in Europe (d'Errico et al. 1998; Zilhão and d'Errico 1999). The initial formation of transitional industries was certainly the result of internal developmental dynamics within local Middle Paleolithic units. But as Europe was undergoing leptolization, or a shift to using blade technologies, brought on by the diffusion of anatomically modern humans, the two types of populations and respective taxonomic units must have come into contact.

The diversity of transitional industries and their relationship to cultural variability at the end of the Middle Paleolithic is an argument in favor of local evolution, independent of the unifying influence of an Aurignacian diffusion. On the basis of stone technology and major tool categories we can separate three main transitional units (table 2.1):

1. Industries with a ubiquitous substratum of Upper Paleolithic tools (end scrapers, burins, truncations, retouched blades) accompanied by Middle Paleolithic tools (mainly side scrapers). These industries used, as a rule, blade technology derived from the Levallois tradition. Examples known from central Europe and the Balkans include the Bohunician in the Middle Danube basin, Carpathian basin, and Volhynia, assemblages from Temnata Cave layer VI in Bulgaria, and the upper layers at Korolevo I and

II in Transcarpathian Ukraine (Ginter et al. 1996; Svoboda et al. 1996; Kozłowski 2000a). It is possible that units like this also occur in western Europe e.g., San Romano, Italy) (Tavoso 1988).

2. Industries with leaf points such as the Szeletian in central Europe (Svoboda and Simán 1989) and the Streletskian in eastern Europe (Anikovich 1992), which are derived predominantly from the Micoquian technological tradition. The development of an Upper Paleolithic blade technique in these industries was a fairly slow process, autonomous in nature, and independent of the Levallois technique. In northwest Europe, a separate complex with leaf points emerged, described as the Lincombian-Ranisian-Jerzmanowician (Cambell 1980; Kozłowski 1982), which derived in all likelihood from Middle Paleolithic industries in the Upper Danube basin exhibiting Micoquian and Mousterian (Charentian) features.
3. Industries characterized by the presence of backed points; notably, segmented arched backed blades. These industries show the widest distribution, although they exist as regional clusters with no continuity between them. In these units, a specific blade technique emerged, which allowed the production of standardized blade blanks (and, in addition, microlithic blanks). The variability in blade technology, diversity of technological solutions in the production of backed tools, and mixture of associated tools are the basic elements that differentiate the early Upper Paleolithic industries with arched backed blades.

Three important industrial groups with arched backed blades have been distinguished. First, there is the western European Châtelperronian, generally derived from the Mousterian of Acheulian Tradition in France and northern Spain (Harrold 1989). This unit developed between 33 and 38 ka, although some TL and AMS radiocarbon dates (e.g., Le Moustier layer K) may reach back as far as 41–45 ka (d'Errico et al. 1998; Mellars 1999). In the Châtelperronian, a specific blade production technique appeared that was well suited to the concept of the point with an arched blunted back. Core reduction was based on thick flakes, plaquettes, or blocks. Following the preparation of a crest on the narrow side of the core preform, the core was then reduced using one or two opposed striking platforms to generate rectilinear blanks (Guilbaud 1987, 1996; Bodu 1990; Pelegrin 1995). To obtain such blanks, the knapper used direct percussion with a soft hammer. The best blades were used to make points, whereas substandard blanks were used to produce Upper Paleolithic type tools (end scrapers, truncations, retouched blades). Flakes from core preparation or maintenance were used to produce Middle Paleolithic type tools (side scrapers, becs, notched and denticulated tools).

A second cluster of arched backed blade industries is represented by the Uluzzian in Italy. Interestingly, the Uluzzian emerged sometime after the

TABLE 2.1 Stratigraphic Positions and Ages of Principal Leaf Point and Backed Blade Industries

Age (ka)	Levalloisian-Stemmed "Transitional" Industries	*Leaf Point Industries*			*Backed Blade Industries*		
		Szeletian	Jerzmanowician	Streletskian	Châtelperronian (Selected Dates)	Uluzzian	Eastern Europe
	Korolevo I/Ia 25.7 ± 0.4 (GrN-2773)						**Korpatch** 25.52 ± 0.3 (GrN-9758) **Ripiceni IIb** 28.42 ± 0.4 (Bln-809)
30	**Koulichivka III** 31 (Syinitsyn et al. 1997)	**Szeleta-Upper** 32.62 ± 0.4 (GrN-5130)	**Nietoperzowa 5a** 30.5 ± 1.1 (Gd-10023)	**Kostenki 6?II** 31.2 ± 0.5 (GrN-8572) **Kostenki 1/V** 32.3 ± 0.22 (GrN-5557) **Buran-Kaya IIIc** 32.2 ± 0.65 (OxA-6869) **Kostenki 1/V** 34.9 ± 3.5 (GrN-5245)	**Arcy** VIII: 33.5 ± 0.4 (GrN-1736) X: 33.82 ± 0.720 (OxA-3464) **Les Cottés G** 33.3 ± 0.5 (GrN-4333)	**Castelcivita** 14: 32.2 ± 0.78 (F-107) 10/11: 32.45 ± 0.65 (F-71) 12: 33.3 ± 0.43 (GrN-13985) 12: >34 (F-106)	
35	**Bohunice-Cihelna** 36 ± 1.1 (GrN-16920) **Stránská skála III-5** 38.2 ± 1.1 (GrN-12297) $38.5 \pm ^{1.4}_{1.2}$ (GrN-12298) **Korolevo II/II** 38.5 ± 1 (GrN-2774)	**Dzierżysław I** 36.5 ± 5.5 (TL) (GdTL-349) **Vedrovice V** 37.65 ± 0.55 (GrN-12374) 39.5 ± 1.1 (GrN-12375) **Radošina** $38.4 \pm ^{2.8}_{2.1}$ (GrN-2438)		**Kostenki 12/III** 36.28 ± 0.36 (GrN-5551) Buran-Kaya IIIc 36.7 ± 1.6 (OxA-6868) **Kostenki 1/V** $37.9 \pm ^{2.8}_{2.1}$ (GrN-5246)	**Combe Saunière X** 35.9 ± 1.1 (OxA-6503) **St. Césaire** EJOP (average) 36.3 ± 2.7 (TL)	**Cavallo E II-I** >31 (Palma di Cesnola 1989)	**Vlčkovce** (?) **Kraków-Zwierzyniec** (?)
40	**Bohunice-Kejbalay 4a** 40.173 ± 1.2 (Q-1044) $41.4 \pm ^{1.4}_{1.2}$ (GrN-6802) **Stránská skála IIIa-3** $41.3 \pm ^{3.1}_{2.2}$ (GrN-12606) **Bohunice-Cihelna-4a** $42.9 \pm ^{1.7}_{1.4}$ (GrN-6165)	**Szeleta-Lower** 43 ± 1.1 (Grn-6058)	**Nietoperzowa 6** 38.16 ± 1.25 (Gro-2181)		**Moustier K** (average) 42.6 ± 3.7 (TL)	**Klisoura Cave 1, V** >30.8 (Gd-10715) >31.1 (Gd-10714) 40.01 ± 0.74 (Gif-99168)	
45	**Temnata II/VI** ~50 (TL) **Korolevo II/II (PM>44)** 60 ± 8 (TL) (Adamenko and Gladilin 1989)						

NOTE: All ages are thousands of radiocarbon years before present (ka) unless otherwise indicated.

Châtelperronian, around 33–34 ka (Palma di Cesnola 1989). The Uluzzian has a complex structure. It is distributed in several microregions, such as Tuscany, the Salentian, Calabrian, and southern part of the Adriatic coast, and the Bay of Uluzzo. In each of these regions, the Uluzzian displays technological and morphological diversity. Diagnostic arched backed blades were made on blades derived from unprepared single-platform or polyhedral cores, but also cores on flakes and thin plaquettes. The bulk of Upper Paleolithic tools (with the exception of assemblages from Tuscany) were made on flakes. In terms of quantity, splintered pieces are the dominant group, combining the functions of both cores and tools. In most assemblages, tools make up more than 50% of the inventory. The considerable diversity of the Uluzzian may indicate polygenesis from a variety of Mousterian industries in the Mediterranean zone. The discovery of an assemblage typologically and morphologically similar to the Uluzzian in layer V at Cave 1 in the Klisoura Gorge, Greece, broadens the distribution of the Mediterranean arched backed blade industries to the Peloponnese.

Finally, sites with arched blacked blades in central and eastern Europe date to the younger part of the Interpleniglacial (25–35 ka). In these instances, arched backed blades were produced from blade blanks removed from volumetric cores (Kozłowski and Kozłowski 1996). The best-known sites are Kraków-Zwierzyniec in Poland (Kozłowski and Sachse-Kozłowska 1975), Vlčkovce in Slovakia (Bárta 1962), Korpatch I (layer 4) in the Republic of Moldova (Borziak et al. 1981), and Ripiceni-Izvor (layer IIb) in Romania (Paunescu 1993). These sites are dispersed over large territories and do not form clusters. They are characterized by the co-occurrence of arched backed blades and leaf points. In contrast to western Europe, where the Aurignacian diffusion checked the development of the Châtelperronian and Uluzzian, assemblages with arched backed blades in this unique region of central and eastern Europe developed without interruption: hence, this little known unit is discussed in greater detail (figures 2.1 and 2.2).

ZWIERZYNIECIAN ARCHED BACKED BLADE ASSEMBLAGES

Early Upper Paleolithic arched backed blades are known from several open sites in the weakly dissected loess uplands north and east of the Carpathians. The occurrence of these sites in varying stratigraphic sequences of loess, loesslike sediments ("suglinok") and fossil soils enables us, despite the few available radiometric dates, to define the absolute and relative chronology of the arched backed blade assemblages.

Among the oldest is the Kraków-Zwierzyniec site, where finds (regretfully, lithics only) were contained within a complex of Interpleniglacial soils (Madeyska 1981). The lower portion of the site consists of a slightly lehmified loess (layer 12) overlying a sandy loess of the Lower Pleniglacial

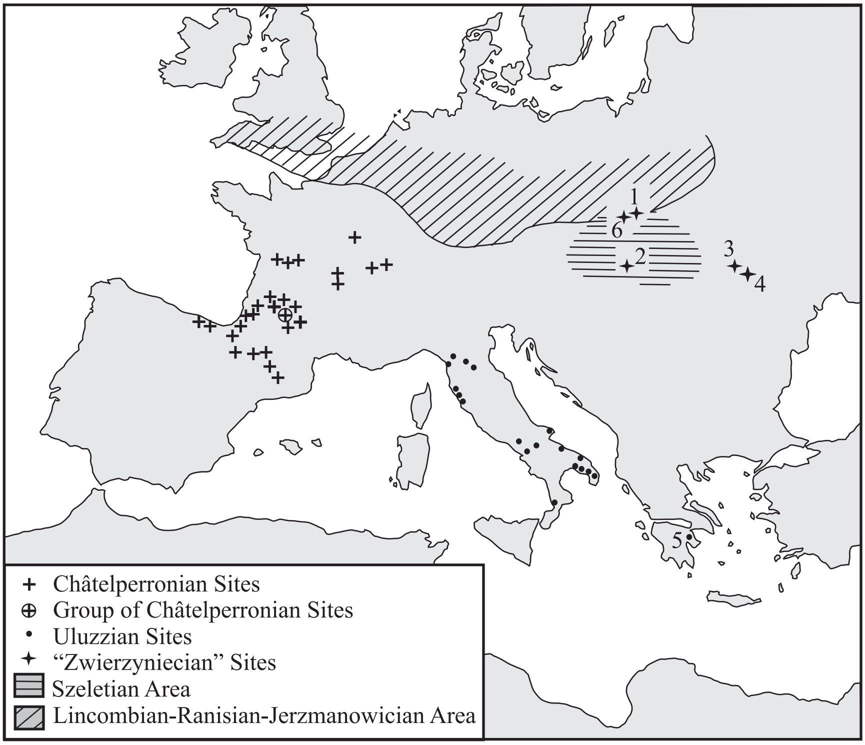

Figure 2.1. Map of Europe during the late Interpleniglacial. *Key:* 1, Kraków-Zwierzyniec; 2, Vlčkovce; 3, Korpatch; 4, Ripiceni-Izvor; 5, Klisoura Cave; 6, Piekary IIa.

(layer 11) TL dated between 67.6 and 71.7 ka (calendric). The lehmified loess is within the range of the first phase of Interpleniglacial pedogenesis. Overlying layer 12 is a humic soil (layer 13), the top portion of which has undergone solifluxion (layer 14). The lehmified loess is correlated with the lower portion of the pedological complex described as the "Komorniki soil." The lower part of this soil developed from 37.0 to 41.2 ka, during the Moershoofd and Hengelo warm episodes (Lindner 1992). The younger, humic portion of the Komorniki pedocomplex likely developed between 30 and 32 ka, which corresponds to the Denekamp-Arcy Interstadial. The primary deposit containing arched backed blades (the "Zwierzyniecian" layer) corresponds with the lower portion of the Komorniki soil. The age of this industry thus falls between 37 and 40 ka. The upper humic soil also contains arched backed blades, but these are most probably in secondary position as a result of solifluxion.

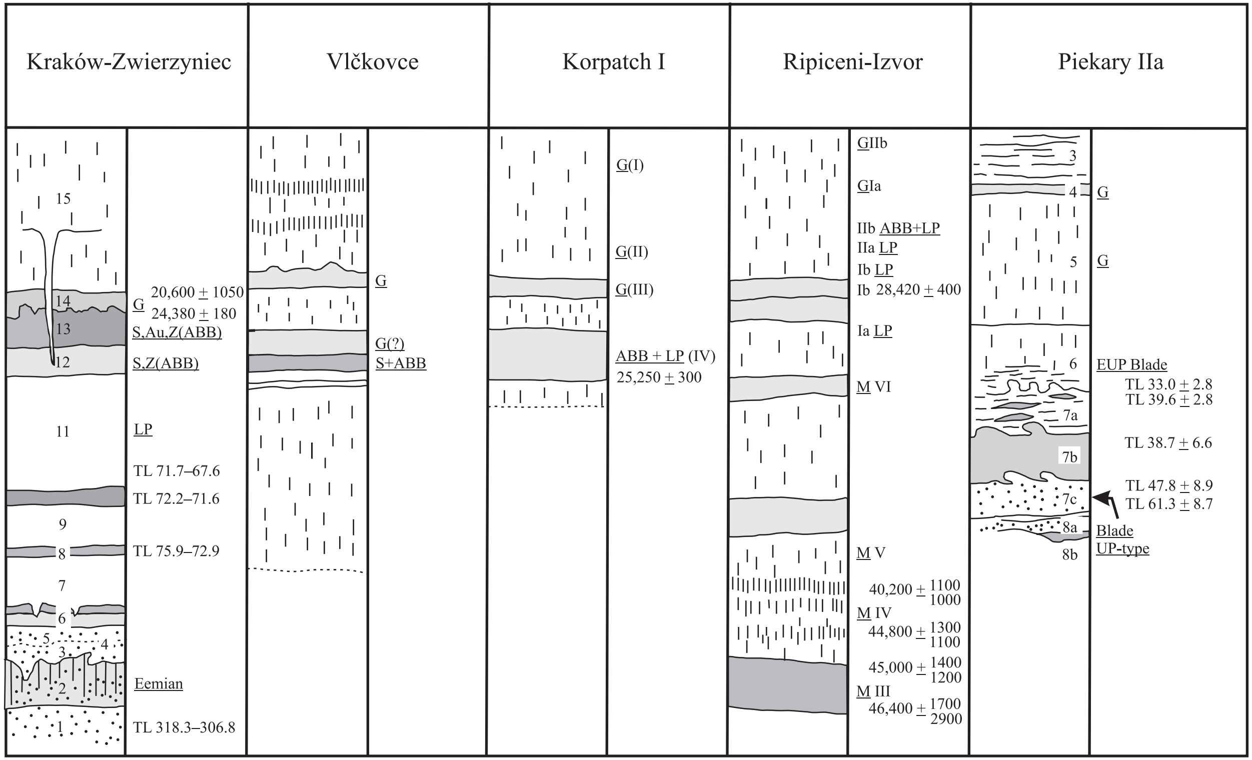

Figure 2.2. Sections of central European sites with arched backed blades (Kraków-Zwierzyniec, Vlčkovce, Korpatch, Ripiceni-Izvor) compared with position of early Upper Paleolithic blade industry at Piekary IIa. *Abbreviations:* ABB, arched backed blades; Au, Aurignacian; EUP, early Upper Paleolithic; G, Gravettian; LP, leaf point industries; M, Mousterian; S, Szeletian; UP, Upper Paleolithic; Z, Zwierzyniecian. Thermoluminescence dates (TL) are in thousands of years before present (ka calendric). All other dates are in radiocarbon years before present (BP).

What makes the interpretation of the taxonomic position of arched backed blades at Kraków-Zwierzyniec difficult is the occurrence in the same level, but at a different location, of Szeletian leaf points. Microscopic examination of the state of preservation of the surfaces of the recovered arched backed blades and Szeletian leaf points shows that the former were exposed to the action of postdepositional aeolian agents, whereas the latter exhibit the action of chemical agents and, subsequently, the influence of temperature and humidity changes typical of periglacial environments (Kozłowski and Kozłowski 1996: 117). We may assume that the early Upper Paleolithic arched backed blades (figure 2.3) were deposited during the cool interphase represented by layer 12, before vegetation developed and pedogenesis began. In contrast, the Szeletian points (figure 2.4) were deposited during the soil formation episode and remained on the surface during the following, periglacial phase. Further difficulties are apparent in trying to associate arched backed blades and Szeletian leaf points with other artifacts that commonly occur in the Komorniki soil complex at Kraków-Zwierzyniec. Arched backed blades are clearly associated with blade truncations, but the association of blade end scrapers and dihedral burins is less certain (figure 2.5).

Considering the controversies surrounding the association of arched backed blades and Szeletian leaf points at Kraków-Zwierzyniec, their coexistence in the very small assemblage from the lower layer at Vlčkovce in southwestern Slovakia is intriguing (Bárta 1962). This level contained a leaf point of the Moravany-Dlha type, arched backed blades, a unilaterally retouched blade, and two blade cores (figure 2.6). The artifacts occur in the lower portion of an Interpleniglacial soil, which developed in two episodes. The top portion of this soil contained Gravettian artifacts, as does the overlying brown soil. Although we do not have radiometric determinations, we can speculate that the two-episode soil complex at Vlčkovce corresponds to the younger part of the Interpleniglacial, in all likelihood the Arcy-Stillfried phase dating between 27 and 32 ka. That the chronological position of Vlčkovce is younger than Kraków-Zwierzyniec is corroborated by the presence of the Moravany-Dlha type point. These points are known to be younger than classic Szeletian points and are recorded in Gravettian assemblages such as at Trencianské Bohuslavice (Bárta 1986).

Sites in the Prut basin combine arched backed blades and leaf points have even later chronological positions. At Korpatch I, arched backed blades and leaf points (figures 2.7 and 2.8) occur within the lower portion of a fossil soil (layer IV) of the Chernozem type, overlain by a more weakly developed humic soil containing Gravettian materials. Layer IV is radiocarbon dated to 25,520 ± 300 BP. If we take this date and the paleoclimatic sequence into account, then both soils at Korpatch I are analogous to the Briansk soil in eastern Europe, a multiphase Chernozem complex dated to about 23–28

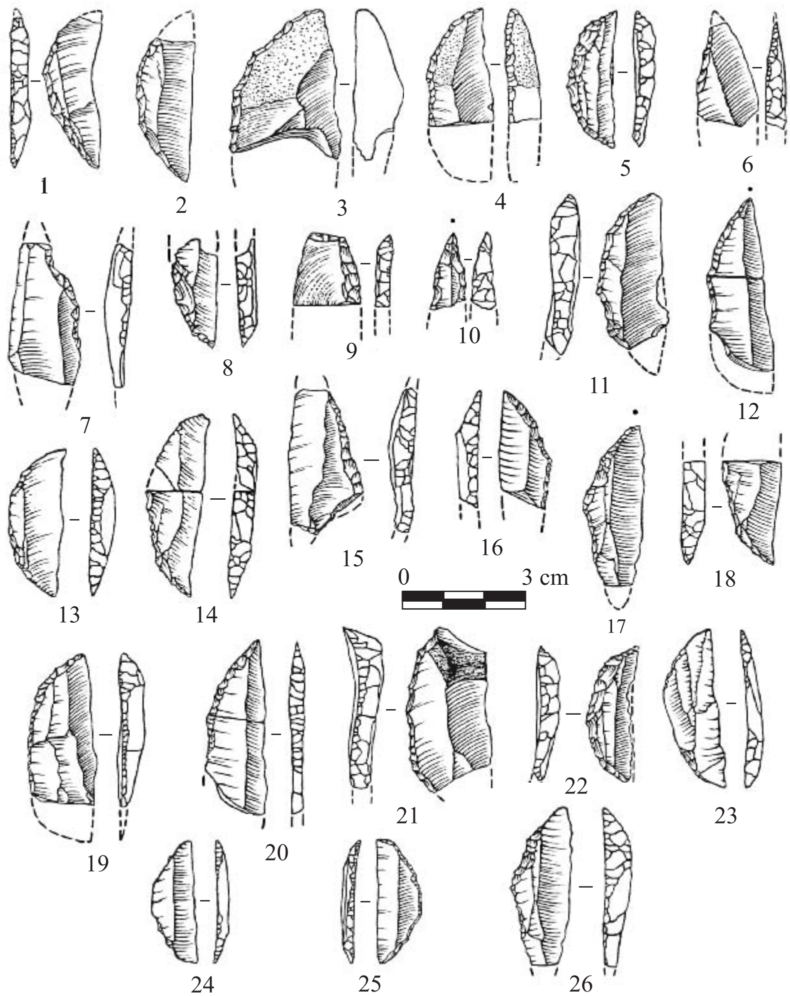

Figure 2.3. Kraków-Zwierzyniec, layers 12 (1–15) and 13 (16–26): arched backed blades. After Kozłowski and Sachse-Kozłowska (1975).

ka. If the lower soil at Korpatch I corresponds to the Maisières episode (27–28 ka) recognized in western Europe, then the available radiocarbon date may be too young. The pollen assemblage from the lower soil at Korpatch I is dominated by grass, notably Graminaea, and contains only small amounts of oak and elm. On the basis of the spatial pattern of finds in the culture layer, Grigorieva (1983a) believes that the association of arched backed blades with leaf points is unquestionable.

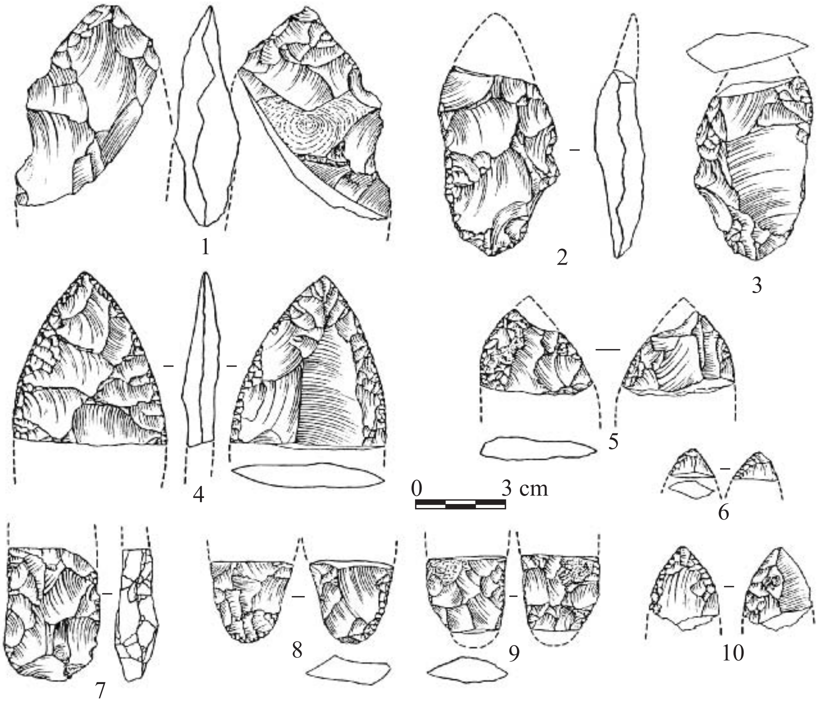

Figure 2.4. Kraków-Zwierzyniec, layers 12 and 13: leaf points.

A second site on the Prut River that combines arched backed blades and leaf points is Ripiceni-Izvor. Early Upper Paleolithic Szeletian leaf points are contained within the upper portion of a weakly developed Interpleniglacial fossil soil (level Ib) (figure 2.9). This soil has been radiocarbon dated to 28,420 ± 400 BP and appears to correspond to the Maisières episode. The overlying loess section preserves three additional archaeological levels with leaf points, the uppermost (level IIb) of which contains arched backed blades. Drawing on the radiocarbon determination from level Ib and correlations with Korpatch I, the assemblage from level IIb at Ripiceni-Izvor can be placed in the period between 25 and 28 ka. The relatively late age of level IIb at Ripiceni-Izvor is confirmed by the morphology of associated leaf points, which include specimens with both rounded (Szeletian) and concave bases. The later resemble Sungirian points (Paunescu 1993: figure 95:20).

Despite the problems of association at Kraków-Zwierzyniec, if we attempt to classify the central and eastern European arched backed blade industries as a single taxonomic unit (the Zwierzyniecian, proposed by Kozłowski and

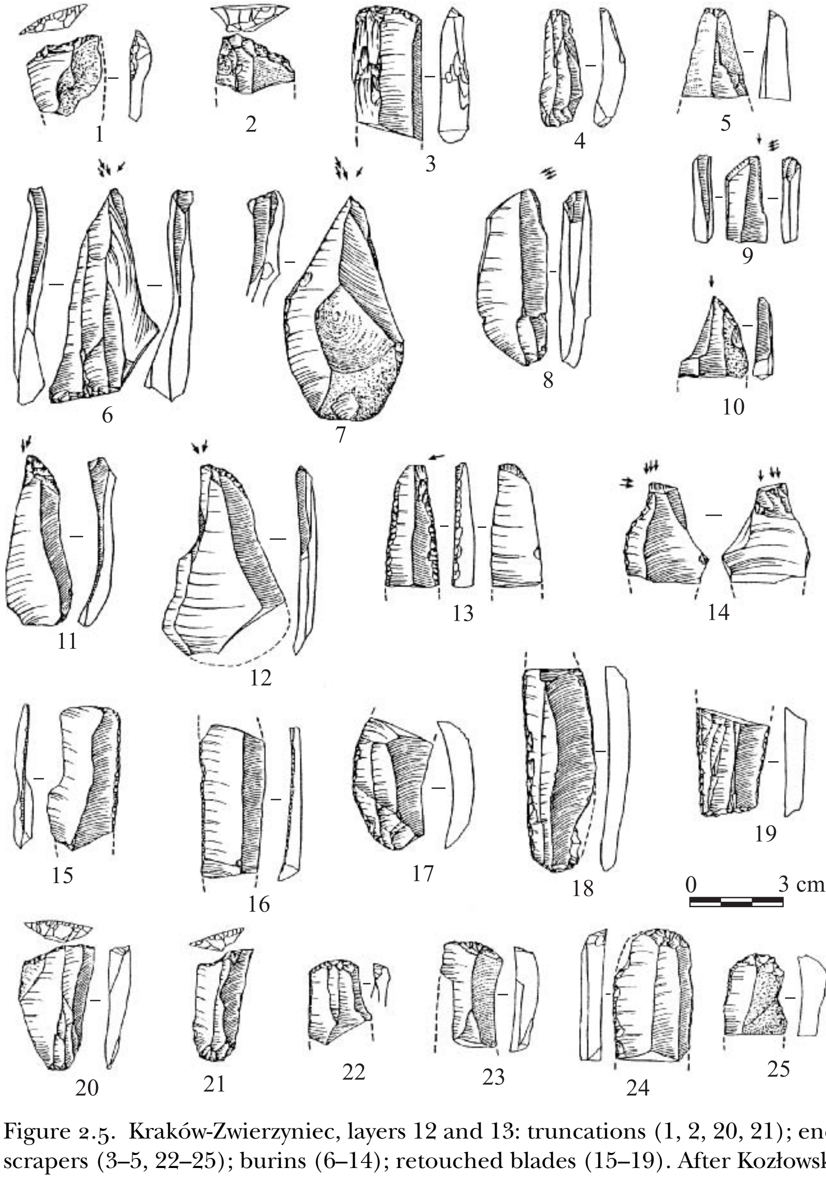

Figure 2.5. Kraków-Zwierzyniec, layers 12 and 13: truncations (1, 2, 20, 21); end scrapers (3–5, 22–25); burins (6–14); retouched blades (15–19). After Kozłowski and Sachse-Kozłowska (1975).

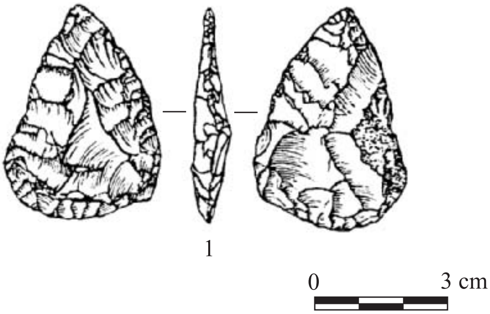

Figure 2.6. Vlčkovce: leaf point (1) and arched backed blade (2). After Bárta (1962, 1986).

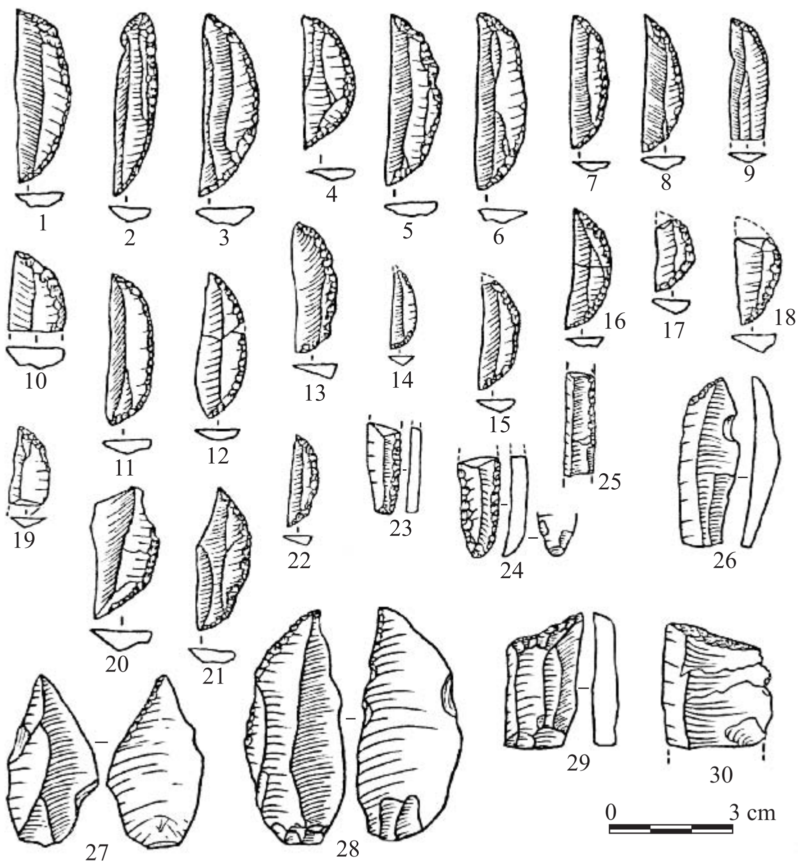

Figure 2.7. Korpatch, layer IV: arched backed blades (1–22); retouched blades (23–25); retouched truncations (26–30). After Grigoreva (1983a).

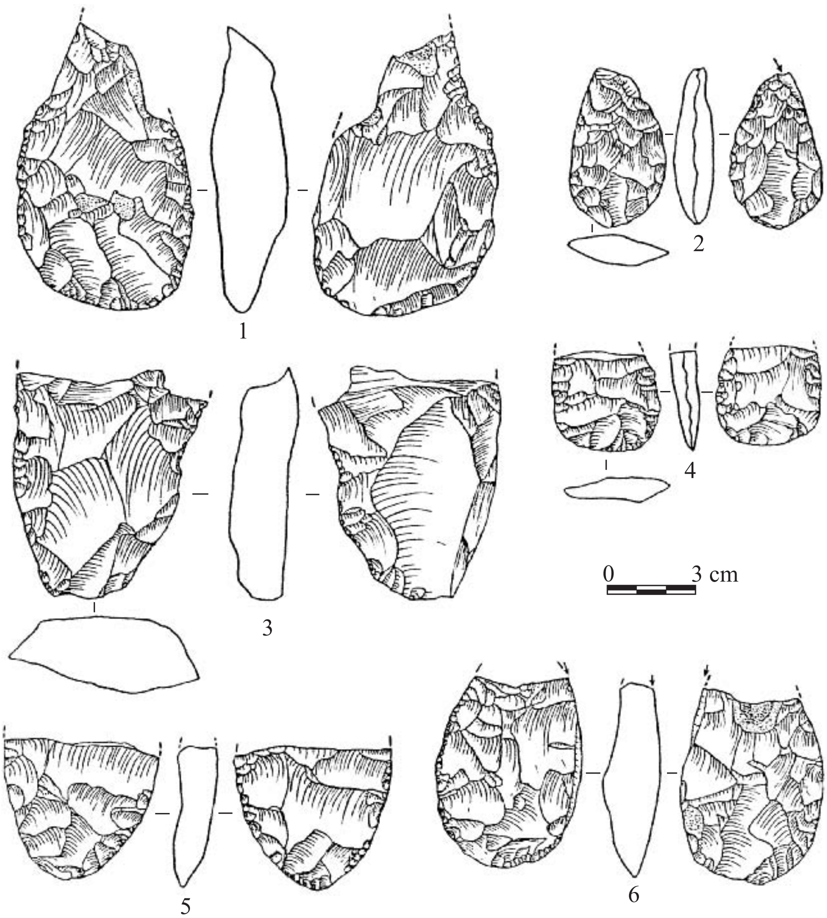

Figure 2.8. Korpatch, layer IV: leaf points. After Borziak et al. (1981).

Sachse-Kozłowska [1975]), then we must assume that it persisted from around 36–40 ka to 26–28 ka. In terms of technology, this would be a taxonomic unit that, from the very beginning, commanded the production of blades from well-prepared, single- and double-platform volumetric Upper Paleolithic cores. At Kraków-Zwierzyniec, all the arched backed blades were made on blades, primarily from single-platform cores, as were end scrapers, burins, and truncations. In layer IV at Korpatch I, the large assemblage of cores (n = 171) includes primarily blade cores, both single (n = 103) and double-platform (n = 53) types, but also discoidal flake cores (n = 15). The double-platform blade cores include opposed platform varieties, with common (n = 29) and separate flaking surfaces (n = 18), and several cores with

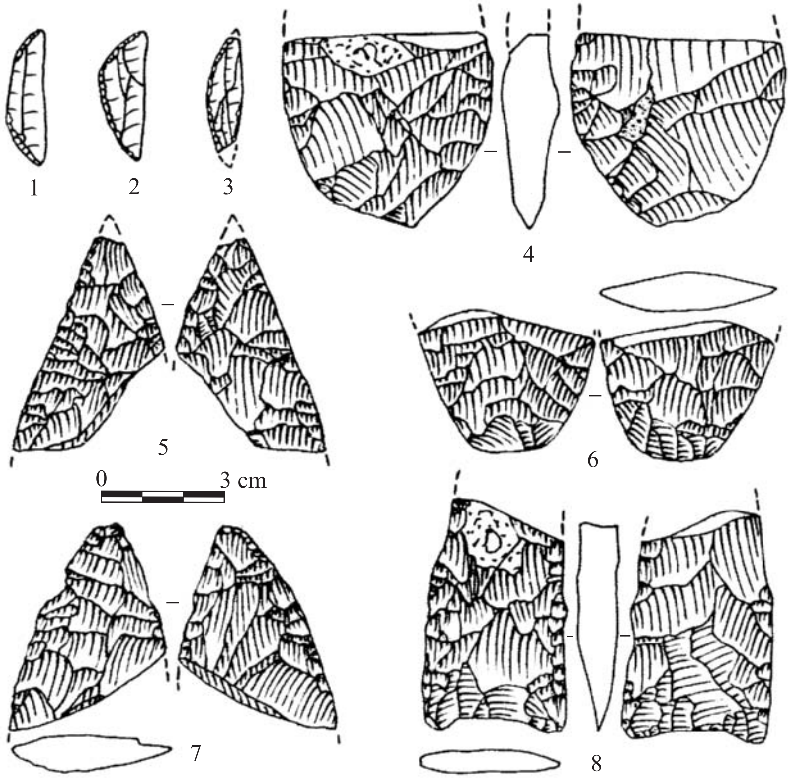

Figure 2.9. Ripiceni-Izvor, layer IIb: arched backed blades (1–3); leaf points (4–8). After Paunescu (1993).

flaking surfaces meeting at a ninety-degree angle ($n = 6$). Cores for flakes are rare at Korpatch I and are represented by discoidal ($n = 3$), subdiscoidal ($n = 2$) and amorphous ($n = 5$) specimens. Such marked domination of blade cores at Korpatch I is also reflected in the structure of major technological groups: there are only 151 large flakes and 404 small flakes compared with 2584 blades, even though raw materials processing at the site was intensive. In level IIb at Ripiceni-Izvor, by contrast, such dominance of blades does not occur: there are 1038 flakes compared with only 467 blades and bladelets. Among 193 cores recovered from Ripiceni-Izvor, the proportion dedicated to flake production is also higher.

In all the inventories of the Zwierzyniecian, retouched blade tools and retouched flake tools occur in addition to tools produced on chunks (some of the leaf points). Unfortunately, the quantitative relationships between these tool groups cannot be established at Kraków-Zwierzyniec, and at

Vlčkovce, the inventory is too small to establish quantitative structure. At Korpatch I (level IV), nearly half of the 203 tools (*n* = 107; arched backed blades, some of the end scrapers, burins) are made on blades, whereas few are made on flakes (*n* = 88; side scrapers, some of the end scrapers, notched tools). Korpatch I (level IV) also yielded eight leaf points for which we cannot reconstruct the initial blank type (Borziak et al. 1981). Approximately 60% (*n* = 172) of the retouched tools Ripiceni-Izvor (level IIb), including notches, side scrapers, and denticulates, were made on flakes. Seventeen leaf points were recovered from Ripiceni-Izvor (level IIb) (Paunescu 1993). There are no essential morphological differences in the retouched tools from Korpatch I and Ripiceni-Izvor. Some dissimilarities in the group of end scrapers and burins from Ripiceni-Izvor may be the result of admixture with the Aurignacian levels.

Approaching the central and eastern European arched backed blade industries diachronically suggests the following conclusions:

- Around 37–40 ka, a fully developed Upper Paleolithic industry appears in the upper Vistula basin, which made use of volumetric blade cores and blade blanks for the production of arched backed blades, backed blades with broken backs, and convex implements with partially blunted backs. The tools vary from small and thin items resembling segments to medium-size specimens, and from specimens with fine, marginal retouch to items with abrupt *croisée* retouch. This industry occurs simultaneously with the Szeletian.
- Around 28–32 ka, the blade tradition with arched backed blades crossed with the tradition emphasizing Late Szeletian leaf points of the Moravany-Dlha type. But the sparse assemblage from Vlčkovce does not allow us to fully understand this phase.
- Around 26–28 ka, rich assemblages with arched backed blades and leaf points appear in the Prut basin. The morphology of arched backed blades reveals greater standardization of shapes, although small segments continue to occur alongside larger ones (3–4 cm). At Korpatch I (level IV), the tradition of Szeletian points is stronger. These points continue to occur for a fairly long time in Moldavia as part of the Bryndzeny and Gordineshty cultures (Otte et al. 1996a; Allsworth-Jones 2000). At Ripiceni-Izvor (layer IIb), influences from eastern Europe appear in the form of Sungir type points (Paunescu 1993: figure 95:20).

The long sequence of arched backed blade assemblages in central Europe is composed of various types of sites, from large, residential camps with local flint processing, represented by the large *khshemenitsas* at Korpatch I (level IV) and Ripiceni-Izvor (layer IIb), to short-term hunting bivouacs, such as at Vlčkovce. Unfortunately, we do not know much about hunting strategies at these sites because of poor preservation of faunal remains. Indeed, Kraków-Zwierzyniec yielded no faunal remains, and other sites have produced single bones of horse and, at Vlčkovce, single bones of mammoth and bison.

In discussing the problem of the genesis of central and eastern European arched backed blade industries, we cannot overlook their potential relationship with the Châtelperronian and the Uluzzian. The range of dates for the Châtelperronian—TL ages from 36 to 45 ka (calendric) and radiocarbon ages from 30 to 33 ka (d'Errico et al. 1998)—may suggest that the early phase of the Châtelperronian precedes the Zwierzyniecian and therefore could be ancestral to it. However, the morphology of Châtelperronian backed blades with convex backs (which, as a rule, either do not cut the butt or are combined with oblique retouch cutting the butt) is different from the fully arched Zwierzyniecian backed blades. Similarly, Châtelperronian technology, with its numerous narrow-faced blade cores on flakes and plaquettes, is different from blade core reduction strategies used in central and eastern European assemblages. These differences may exclude the possibility of an ancestral relationship. Nonetheless, the morphology of side scrapers is similar in both the Châtelperronian and Zwierzyniecian, as is the high proportion of notched and denticulated tools. The substratum of Upper Paleolithic tools (end scrapers, burins) also suggests some similarities between the Châtelperronian and the central and eastern European arched backed blade assemblages. Yet the territorial gap is too great to allow us to speak of continuity.

When the same central and eastern European assemblages are compared with the Uluzzian, the similarities in the morphology of arched backed blades are striking (Palma di Cesnola 1989, 1993; Gambassini 1997). Based on the chronological framework for the Uluzzian in the Apenines (32.5–34 ka), it might be suggested that central and eastern Europe influenced the formation of the Uluzzian. Moreover, Palma di Cesnola (1993) is correct in saying that close bonds between the Uluzzian and the Châtelperronian are not well supported morphologically or technologically (contra Gioia 1988) but merely in the percentages of ordinary tool groups.

Recently, the question of the genesis of the Uluzzian has found new life in connection with the discovery of a similar industry at Cave 1 in Klisoura Gorge, Greece (Koumouzelis et al. 2001). In layer V, an industry with arched backed blades has been discovered below a long sequence of Aurignacian layers dated between 27 and 34 ka. Some of the arched backed blades are similar to those found in the Uluzzian. Dated to 40,010 ± 740 BP, it is intriguing that this arched backed blade industry places greater emphasis on large blades than do the later Aurignacian assemblages in the same sequence. Among the microliths recovered from layer V at Cave 1, there are geometric forms, including trapezes and Zonhoven points. Among the tools, there are side scrapers, end scrapers, and retouched blades. The presence of numerous splintered pieces also suggests a similarity with the Uluzzian. In the light of the discoveries in Cave 1, Klisoura Gorge, and providing the chronology of layer V is corroborated by further dates, then we may postulate an origin of the Uluzzian in the southern Balkans.

Regarding arched backed blade assemblages in central and eastern Europe, we draw attention to the possibility of a local origin. In the northern part of central Europe and in the Carpathian basin there are pre–Upper Paleolithic blade assemblages and developed volumetric core designs, with the flaking surface prepared from a central crest. Similar industries have been reported from the upper Vistula basin, although paleopedological analyses suggest pre-Eemian (>100 ka) ages for these sites (Morawski 1975, 1992; Sitlivy et al. 2000b). Recently, Valladas et al. (2003) and Mercier et al. (2003) have obtained TL dates for the blade industry from layer 3 (7c) at Piekary II, near Kraków, ranging from 47 to 61 ka (calendric). These dates support the hypothesis that this industry developed at the very beginning of the Interpleniglacial. Because this industry is based on both the reduction of single and double platform blade cores and on the production of Upper Paleolithic tools from blades (i.e., burins, backed blades with straight, convex or angular blunted backs), Piekary II (layer 3) may represent the starting point for the evolution of the Zwierzyniecian. At another site on the Vistula, the Prince Joseph Street site in Kraków, Levallois industries are found interstratified with volumetric blade core industries in Interpleniglacial sediments (Sitlivy et al. 2000a). This discovery may suggest the continuation of a blade tradition in the first half of the Interpleniglacial, possibly until the appearance of the Zwierzyniecian.

In sum, the various early Upper Paleolithic cultural traditions with arched backed blades (Châtelperronian, Uluzzian, Zwierzyniecian) developed independently in western, central and eastern, and Mediterranean Europe. Their sources lie either in certain Mousterian entities, or in pre-Upper Paleolithic blade industries. Thus, the emergence of early Upper Paleolithic arched backed blade industries was not the result of acculturation connected with an Aurignacian diffusion, but rather resulted from evolutionary dynamics within local Middle Paleolithic groups. Although the Aurignacian diffusion put an end to the development of the Châtelperronian and the Uluzzian, in central and eastern Europe, arched backed blade industries remained under the influence of the Late Szeletian, Brynzenian, and Sungirian until 25–28 ka, a parallel evolutionary course with the classic central European Gravettian.

3

Continuities, Discontinuities, and Interactions in Early Upper Paleolithic Technologies

A View from the Middle Danube

J. A. Svoboda

Existing studies of the Middle-Upper Paleolithic transition demonstrate how little theoretical ammunition we possess to explain the behavioral changes and technological acceleration evident at the end of the Middle Paleolithic and beginning of the Upper Paleolithic. Most of the transitional entities that appear after 50 ka retain important elements of Middle Paleolithic technologies, be it a Levallois or Levallois-leptolithic technique, as in the Emiran and Bohunician (Marks 1983b; Svoboda and Škrdla 1995); a bifacial technique, as in the Szeletian (Prošek 1953; Valoch 1990a, 1993); or simply a persistence of discoid and unprepared flake core reduction. At the same time, these diverse *chaînes opératoires* permitted a greater emphasis on blade production (Bar-Yosef and Kuhn 1999), and, implicitly, the development of the Upper Paleolithic. Important discussion has concentrated on the significance of decorative objects that appeared in some of these contexts (e.g., in the Châtelperronian) (d'Errico et al. 1998) and on the cultural meaning of the bifacial lithic leaf points and split-base and Mladeč-type bone projectiles (e.g., in the Szeletian) (Svoboda 2001a). Since a number of transitional entities, such as the Châtelperronian, were evidently produced by late Neanderthals (Lévêque and Vandermeersch 1980) and others, such as the Szeletian, possibly so (Svoboda 2001b), many researchers suppose that their emergence can be explained as either a direct or indirect result of contact with dispersing modern human populations.

Compared with these transitional entities, interpretation of the Aurignacian is relatively unproblematic. It is clearly associated with modern humans at some sites, such as Mladeč (Szombathy 1925; Svoboda et al. 2002) and Vogelherd (Floss and Niven 2000; Gambier 1989), and more generally with fully Upper Paleolithic technology and symbolism at many other localities (Hahn 1977). The outstanding problems center on empirical aspects of the chronology, point of origin, and pattern of dispersal of the Aurignacian, and theoretical questions about the influence that an Aurignacian dispersal would have had on local Middle Paleolithic groups. The earliest Aurignacian appears in Europe in an isolated manner around 38 ka, with considerable distances separating individual sites and site clusters. But because of the chronological overlap of this appearance with late transitional entities, the meaning of so-called Aurignacian features (e.g., body decoration, polished bone projectiles, particular stone tool types) in extra-Aurignacian contexts is controversial (see d'Errico et al. 1998).

Many recent discussions on the origins of the Upper Paleolithic are focused on the Near East and western Europe (Mellars and Stringer 1989; Nitecki and Nitecki 1994; Bar-Yosef and Pilbeam 2000). The middle Danube region, although located geographically between these points, has received considerably less attention (Allsworth-Jones 1986, 1990; Svoboda and Simán 1989; Valoch 1990b; Kozłowski 2000a). One of the reasons for this lack of attention is the nature of the available archaeological evidence: no site in the middle Danube region, be it a cave or open-air site, provides a continuous stratigraphic sequence of the Middle-Upper Paleolithic transition. An appraisal of the transition must, therefore, combine evidence from multiple sites, each of which may differ in terms of site function, postdepositional disturbances, and quality of excavation. Many of the relevant sites in the middle Danube represent specialized hunting posts (mostly in caves), regular settlements, or large open-air settlements in lithic exploitation areas. These sites frequently differ in size and technological/typological structure. Cryogenic postdepositional disturbances and erosion have affected local stratigraphic sequences more seriously in the middle Danube than elsewhere along the Mediterranean or Atlantic coasts. Several important caves in the region, which preserve relatively complex faunal, archaeological, and anthropological records, were excavated early in the past century with little attention to depositional contexts. Modern archaeological methods have been used in recently excavated open-air settlements. However, these sites generally provide poor conditions for organic preservation. A number of surface sites have also figured into recent discussion, bringing with them all of their attendant uncertainties.

Each of these concerns about the middle Danube record has an impact on diagnosing the relationship between particular hominin taxa and culturally diagnostic artifacts. Wherever a supposedly diagnostic artifact appears outside the cultural entity of its original definition, the question arises whether its occurrence is the result of a supercultural meaning (or function) carried by the artifact, acculturation between populations in contact, exchange between groups, or simply a function of postdepositional mixing of different occupations. How should we explain, for example, the presence of Szeletian (or Jerzmanowician) leaf points in the Bohunician at

Bohunice and Líšeň, Levallois flakes and points in the Szeletian at Neslovice, or Aurignacian bone and antler points in the Szeletian at Szeleta and Dzeravá skála? This problem is amplified at Vindija Cave (level G1), Croatia, where late Neanderthal fossils are associated with both Szeletian leaf points and Aurignacian organic material points.

Although the middle Danube may represent a unique geographic region between the Carpathians and the Alps, it is presently divided politically between several nations each with different research traditions and barriers to communication between researchers. During more than one hundred years of research, several cave sites in the middle Danube region have yielded Neanderthal fossils in Middle Paleolithic contexts (e.g., Krapina, Kůlna, Šipka, Subalyuk, Švédův stůl, Vindija) (Valoch 1965, 1988; Vlček 1969; Gábori 1976; Wolpoff 1999) and early Upper Paleolithic assemblages with lithic and bone projectiles, but rarely fossil human remains (e.g., Dzeravá skála, Istálloskö, Szeleta) (Prošek 1953; Allsworth-Jones 1986; Ringer et al. 1995) and modern human fossils (e.g., Mladeč) (Jelínek 1983; Wolpoff 1999; Svoboda 2001a). With the invention of the radiocarbon method, several of these caves attracted considerable attention by yielding surprisingly early dates of 40 ka for the Szeletian (e.g., Čertova pec and Szeleta caves). However, not all of these pioneering dates are accepted today. For example, the date of 44 ka for the supposed Aurignacian at Istálloskö Cave is now generally discounted. During the past twenty years, excavations at open-air sites have produced new radiocarbon data not only for the Szeletian (e.g., 38 ka for Vedrovice V) (Valoch 1993) but also for the newly defined Bohunician (e.g., 34.5–43 ka at Bohunice and Stránská skála) and the Early Aurignacian (e.g., 38 ka for layer 3 at Willendorf II) (Haesaerts et al. 1996), including the human fossil associations (34–35 ka for Mladeč; Svoboda et al. 2002).

This chapter examines the abovementioned questions in light of evidence from the middle Danube. Particular attention is given to Levallois-leptolithic industries from sites such as Stránská skála. Reference also is made to data from greater Eurasia, including the Early Aurignacian occurrences at Willendorf II and new dates from the neighboring parts of southern Germany (e.g., Geissenklösterle Cave) and the Balkans (Temnata Cave). Limitations in the regional record prevent me from drawing unequivocal conclusions. As a consequence, this chapter aims to update the available evidence and to define problems for future research.

THE LEVALLOIS-LEPTOLITHIC IN NORTHERN EURASIA

The Emiran-Bohunician likely represents a final stage of development of late Levallois technology synchronous with the Middle-Upper Paleolithic transition over a wide geographic area (figure 3.1) (Marks 1983b). As an example, core refits indicate that the principal Bohunician *chaîne opératoire* is a fusion of Middle and Upper Paleolithic technologies; cores begin as Upper Paleolithic crested cores and end as flat cores reminiscent of Levallois designs. In contrast to classic Levallois technology, Bohunician cores are oblong in shape, exploit a greater volume of raw material, and are frequently reduced in a bidirectional manner (Marks 1983b; Škrdla 1996; Svoboda and Škrdla 1995). Focusing on the resulting products, the core reduction sequence entails a shift from the production of convergent flake points to the production of bidirectional blade points (Demidenko and Usik 1993a).

The apparent continuity between classic Levallois technologies of the late Middle Paleolithic and the transitional technologies of the early Upper Paleolithic, although recognized over a vast geographic area, is still subject to certain regional restrictions. Several regions with well-defined, typical Mousterian industries based on Levallois technology present substantial evidence in favor of local development of the Levallois-leptolithic (e.g., the southern Levant, the Balkans, west Ukraine, and Altai; see figure 3.1). In other areas, such as north China (Brantingham et al., chapter 15, this volume) and the middle Danube, the typical Mousterian is absent and Levallois-leptolithic technology seems intrusive (figure 3.2). Despite regional differences in the typology of diagnostic artifacts (e.g., Emireh points and leaf points), the technological similarities recognized over larger distances may offer an opportunity to test hypotheses of parallel development in individual regions against those of diffusion and migration (Tostevin 2000).

Tables 3.1–3.3 correlate the available radiometric data for a range of Levallois-leptolithic assemblages. Acknowledging that the reported radiocarbon ages may underestimate the true calendar ages by as much as 2–4 ka, the collection of dates suggests that Levallois-leptolithic technology was used in the southern Levant by 46–47 ka (e.g., Boker Tachtit). Taking into account the available TL and ESR dates and stratigraphic evidence, the earliest Levallois-leptolithic assemblages from Temnata Cave in the Balkans and Kara Bom in Siberia may reach a comparable age of 45–50 ka. Similarly, the first TL date from Bohunice is 47.4 ka (calendric) (Valoch et al. 2000). The majority of radiometric dates from a much larger area of Eurasian territories, including the northern Levant (e.g., Üçağızlı; Kuhn et al., chapter 8, this volume), the Balkans (Temnata VI), the middle Danube (Bohunice, Stránská skála, Willendorf II), and Siberia (Kara Bom 5–6; Goebel, this volume; Kuzmin, this volume) cluster within a slightly later group between 37 and 43 ka. The latest radiometric dates indicate the persistence of Levallois-leptolithic technology in certain places to as late as 30–35 ka at Kara Bom 4, Stránská skála IIId, and possibly Koulichivka (Meignen et al., this volume). Ahmarian and Aurignacian radiometric dates, sometimes from the upper levels of the same sites and sections, demonstrate that during this late stage, the Levallois-leptolithic was either replaced or coexisted with classic Upper Paleolithic technologies.

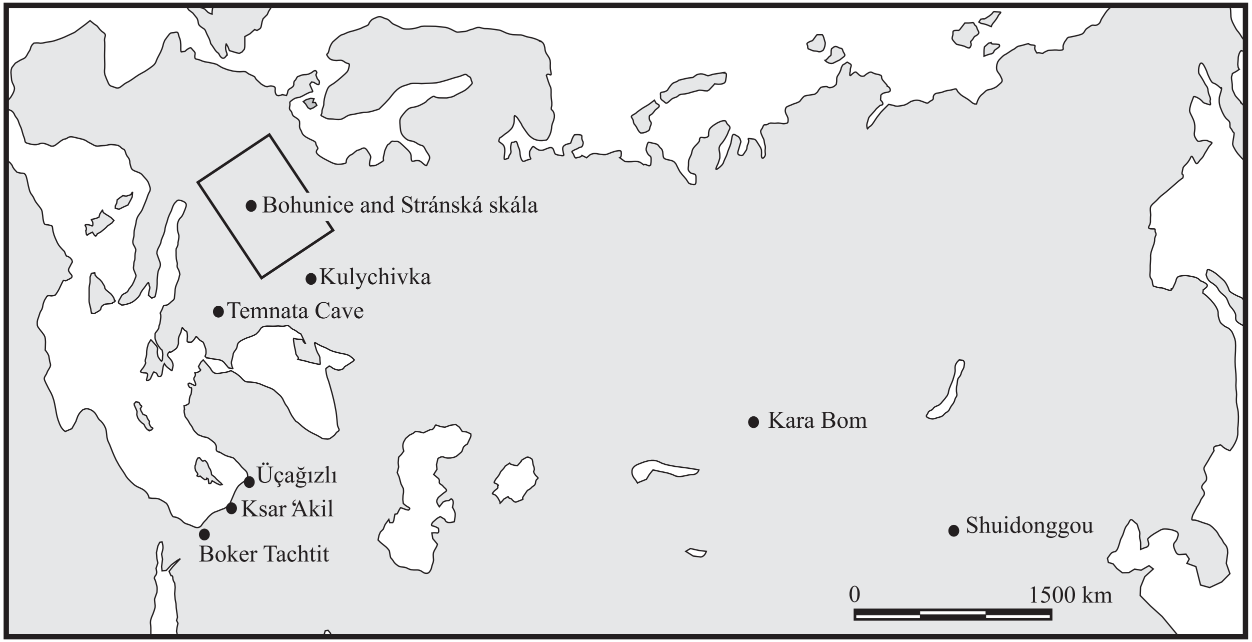

Figure 3.1. Map of northern Eurasia, showing the location of the Emiran, Bohunician, and related sites. Inset square indicates the middle Danube region (see figure 3.2).

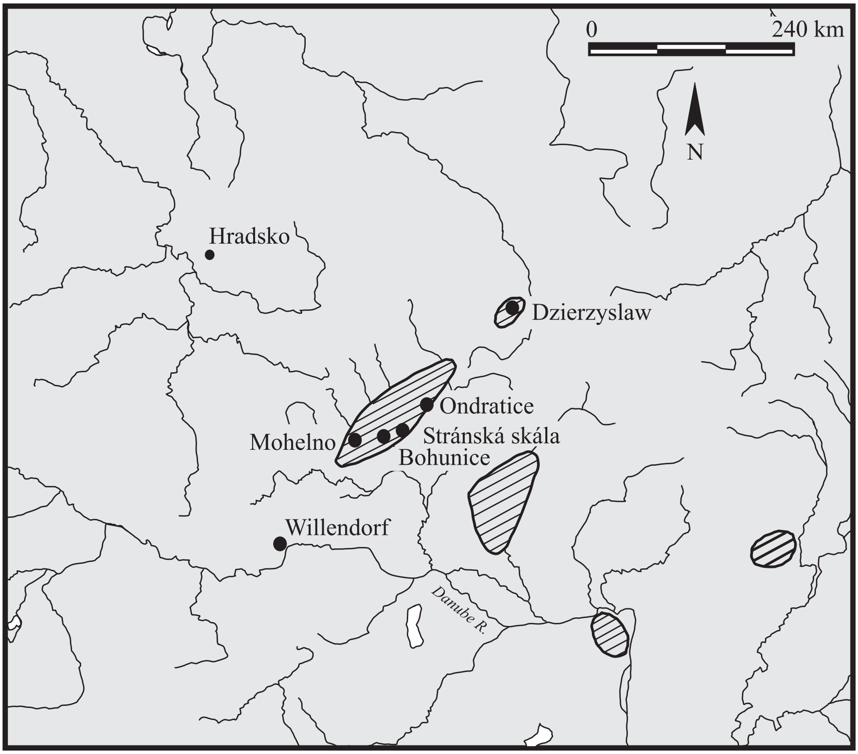

Figure 3.2. Map of middle Danube region, showing location of the Bohunician and related sites. Diagonally hatched areas indicate concentrations of Szeletian sites in Moravia, Silesia, west Slovakia, and central and east Hungary.

The following text and illustrations do not aim create an inventory of the considerable evidence for Levallois-leptolithic industries in greater Eurasia. Rather, I select a few examples to demonstrate the surprising level of technological and stylistic identity over this vast territory (see figures 3.3–3.5). I suspect that comparable *chaînes opératoires* may eventually be reconstructed for certain North African assemblages (Svoboda 1997).

The southern Levant contains a variety of Mousterian industries based on Levallois technology, many of which show tendencies toward blade production. Importantly, multilayered sites, including Ksar 'Akil and Boker Tachtit, preserve both the development of Levallois-leptolithic technology in relation to the regionally specific Emiran points and radiocarbon dates that are earlier than elsewhere (46–47 ka at Boker Tachtit) (Marks 1983b; Bar-Yosef and Pilbeam 2000). Finally, Üçağızlı Cave in the northern Levant demon-

TABLE 3.1 Comparative Radiometric Chronology of the Szeletian and Late Levallois (Emiran, Bohunician) in Eurasia Based on Conventional Radiocarbon Dates

Age (ka)	*Szeletian*	*Willendorf II*	*Bohunice and Stránská skála*	*Temnata*	*Üçağızlı*	*Boker Tachtit*	*Kara Bom*
33			**Aurignacian**				
							k4 33,780
34							k4 34,180
		s 34,530					
35	v 35,150		s 35,080				
			s 35,320				
36			b 36,000				
37	v 37,600		s 37,270				
	v 37,650		s 37,900			**Ahmarian**	
38	cp 38,400		s 38,200	**Aurignacian**			38,080
			s 38,300				
		Aurignacian	s 38,500	> 38,700	38,900		
39					39,400		
	v 39,500						
40			b 40,173				
41			s 41,300				
	sz > 41,700	l2 > 41,700 (?)	b 41,400				
42							
			b 42,900				
43							k5/6 43,200
							k5 43,300
44							
45							
46							
						46,930	
47						47,280	

NOTES: The appearance of classic Upper Paleolithic entities in the same sections is indicated. *Key:* b, Bohunice; cp, Čertova Pec Cave; k4, Kara Bom horizon 4; k5, Kara Bom horizon 5; k5/6, Kara Bom horizon, 5/6 boundary; sz, Szeleta Cave; s, Stránská skála; v, Vedrovice V.

TABLE 3.2 Radiocarbon Dates for the Emiran, Bohunician, and Other Levallois-Leptolithic Industries

Site and Provenance	*Age (BP)*	*Lab Number*
Boker Tachtit I	47,280 ± 950	SMU-580
Boker Tachtit I	46,930 ± 240	SMU-259
Üçağızlı Cave H	39,400 ± 1200	AA 27994
Üçağızlı Cave H	38,900 ± 1100	AA 27995
Kara Bom 6/5	43,200 ± 1500	GX 17597
Kara Bom 5	43,300 ± 1600	GX 17596
Kara Bom 4	34,180 ± 640	GX 17595
Kara Bom 6/4	33,780 ± 570	GX 17594
Temnata Cave, VI	> 38,700	Gd 4687
Bohunice-Kejbaly, layer 4a	$41{,}400 \pm {}^{1400}_{1200}$	GrN 6802
Bohunice-Kejbaly, 4a	40,173 ± 1200	Q 1044
Bohunice-Brickaard, 4a	$42{,}900 \pm {}^{1700}_{1400}$	GrN 6165
Bohunice-Brickaard, 4a	36,000 ± 1100	GrN 16920
Stránská skála IIIa, lower paleosol	$41{,}300 \pm {}^{3100}_{2200}$	GrN 12606
Stránská skála IIIc, lower paleosol	38,300 ± 1100	AA 32058
Stránská skála III, upper paleosol	38,200 ± 1100	GrN 12297
Stránská skála III, upper paleosol	$38{,}500 \pm {}^{1400}_{1200}$	GrN 12298
Stránská skála IIId, upper paleosol	37,900 ± 1100	AA 32058
Stránská skála IIId, upper paleosol	37,270 ± 990	AA 32060
Stránská skála IIId, upper paleosol	35,080 ± 830	AA 32061
Stránská skála IIId, upper paleosol	$34{,}530 \pm {}^{830}_{740}$	GrA 11504
Stránská skála IIId, upper paleosol	$35{,}320 \pm {}^{320}_{300}$	GrA 11808
Willendorf II, 2? (below layer 3)	$39{,}500 \pm {}^{1500}_{1200}$	GrN 11190
Willendorf II, 2? (below layer 3)	$41{,}600 \pm {}^{4100}_{2700}$	GrN 17806
Willendorf II, 2? (below layer 3)	$41{,}700 \pm {}^{3700}_{2500}$	GrN 11195

strates a territorial expansion of the Levallois-leptolithic during the following millennia (Kuhn et al. 1999, chapter 8, this volume).

The Balkans contain Middle Paleolithic assemblages that combine both the Levallois technique and leaf point production. The earliest assemblage that demonstrates transitional tendencies—an increased number of end scrapers, burins, elongated blade points—is Temnata Cave (layer VI, trench TD-II), Bulgaria (Ginter et al. 1996, 2000; Kozłowski 2000a). The stratigraphic position of layer VI (trench TD-II) precedes a well-dated early Aurignacian occupation, and TL dates places this assemblage as early as 45–50

TABLE 3.3 Radiocarbon Dates for the Szeletian

Site	*Age (BP)*	*Lab Number*
Szeleta Cave B, Hungary	> 41 700 BP	GXO-197
Vedrovice V, Moravia	39,500 ± 1100	GrN 12375
Vedrovice V, Moravia	37,650 ± 550	GrN 12374
Vedrovice V, Moravia	37,600 ± 800	GrN 15514
Vedrovice V, Moravia	35,150 ± 650	GrN 15513
Čertova Pec Cave, Slovakia	38,400 $\pm^{2800}_{2100}$	GrN 2438

ka (calendric). A single, infinite radiocarbon date indicates an age older than 38.7 ka. Bacho-Kiro Cave (layer 11) represents a technological variant of this industry in the same region (Kozłowski 1982).

West Ukraine, particularly the Dniestr valley, provides a series of typical Mousterian sites with Levallois technology (e.g., Molodova). The Levallois flakes and points from these sites are short and wide and are made from unidirectional Levallois cores. Koulichivka (Savich 1987; Demidenko and Usik 1993b; Meignen et al., this volume), a multilayer site located at an outcrop of high-quality flint, was intensively exploited from the early Upper Paleolithic to the Gravettian and even later prehistoric occupations. The excavations carried out by Savich between 1968 and 1981 unearthed hearths, features, and areas with dense artifact concentrations. Level 3, radiocarbon dated to 31 ka, contains an industry with bidirectional and unidirectional cores of prismatic, cubical, and flat forms. The products are predominantly blades, some of them quite long due to the good quality of the material, pointed blades (Levallois points), and flakes. Cortical flakes were systematically used as supports for end scrapers (figure 3.3). Levallois cores, points, and blades are present in level 2 (dated to 25 ka; Savich, pers. comm.), but it is unclear how much mixing there is with the Gravettian in layer 1. West Ukraine also provides evidence of other lines of development, as shown by refits from Korolevo (Gladilin and Demidenko 1989b).

Systematic regional research in the Altai region of southern Siberia has brought to light several important Mousterian sites with Levallois technology and bifaces (e.g., Denisova Cave) (Derevianko et al. 1998e, 1999, 2000c; Goebel, this volume; Kuzmin, this volume). A Middle-to-Upper Paleolithic sequence is represented at Kara Bom, a multilayer site on the Altairy River. A series of ESR and radiocarbon dates between 30–43 ka and 72 ka (calendric) suggests that the Upper Paleolithic emerged relatively early, between 40 and 50 ka. The transitional stone industry has bidirectional and unidirectional cores of both flat and prismatic shapes from which blades were produced (some extremely long), together with Levallois cores

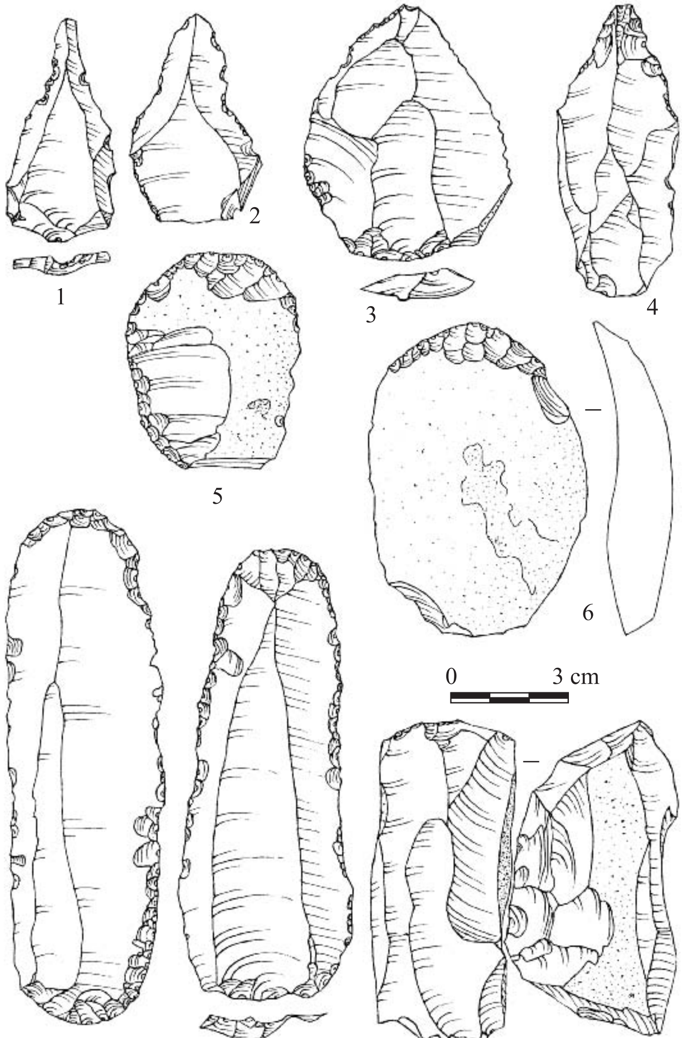

Figure 3.3. Artifacts from Koulichivka, layer 3, west Ukraine.

and points (figure 3.4). Typologically, the site has end scrapers, burins, and pointed blades, some of them typically Upper Paleolithic in style.

In Northern China, such sites as Shuidonggou, Ningxia Hui Autonomous Region, and 63601 and 63603 offer further examples of comparative materials (figure 3.5). Wu Rukang et al. (1989: 401) indicate ages for these assemblages of around 34–38 ka. The assemblages consist of bidirectional

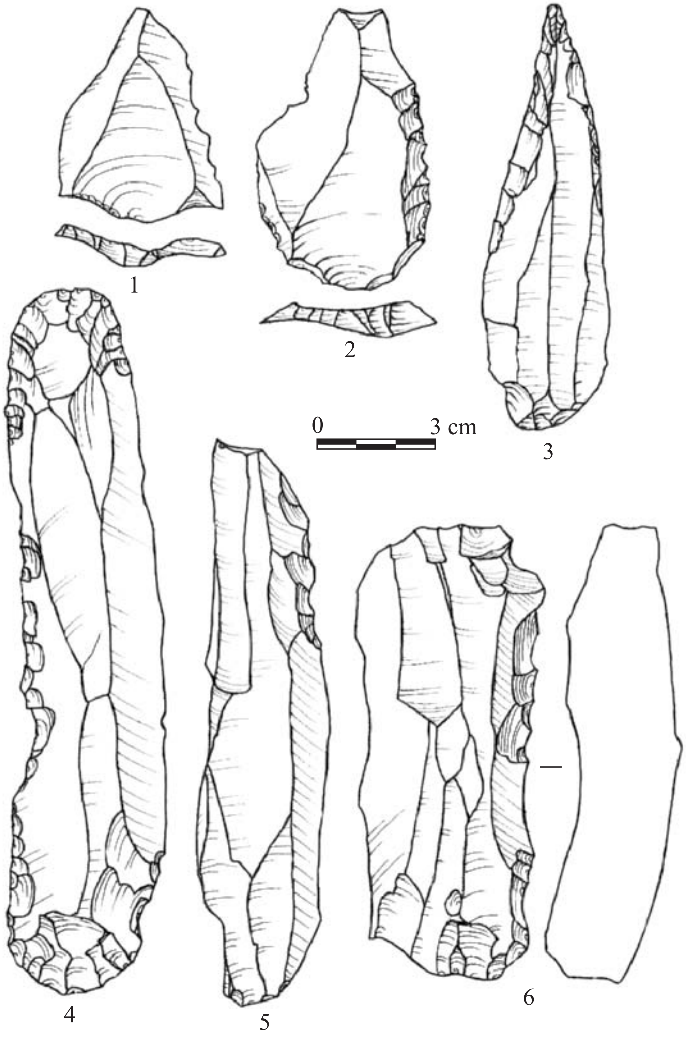

Figure 3.4. Artifacts from Kara Bom, Altai, Siberia.

and unidirectional cores of flat, prismatic and cubical shapes (including a typical core with upright preparation). Short and wide Levallois points were produced, together with Levallois flakes and blades (including crested blades). Typologically, the industries have end scrapers, side scrapers, pointed blades, and chisels. Site 63603 includes typical and elaborate bifaces of both Faustkeilblatt and leaf point types. Even though a number of analogous assemblages have been identified in surveys at open-air sites in

Mongolia, Levallois-leptolithic technology had little impact on later technological developments in China, nor does it have a local Middle Paleolithic predecessor.

The middle Danube represents another "peripheral" region where Bohunician Levallois-leptolithic technology may be intrusive from elsewhere. A few Mousterian and Jankovichian industries, some with Levallois flake technology, have been offered as potential predecessors to the Bohunician (e.g., the Jankovichian, Šipka and Subalyuk industries) (Gábori 1976; Svoboda and Simán 1989). However, these are restricted assemblages, derived primarily from cave settlements and hunting stations and yielding only partial pictures of the *chaînes opératoires* in use. Early Upper Paleolithic sites, on the contrary, are generally open-air occupations, many of which lie directly in stone raw material exploitation areas. As a result, these sites tend to present more complete *chaînes opératoires*. The conclusion about the intrusive character of the Bohunician is thus based primarily on comparisons between very different types of sites: the large, multilayered Middle Paleolithic cave sites such as Kůlna (Valoch 1988; Rink et al. 1996), on the one hand, and the open-air quarry sites of the early Upper Paleolithic, on the other. The cave sites tend to exhibit technological relationships with the Szeletian, but radical differences with the Bohunician.

What influence did blade technologies in the Bohunician, as a part of a Levallois-leptolithic technological system, have on Upper Paleolithic blade production in general? Despite the contradictory responses evoked by this question (see Valoch 1976, 1980; Svoboda 1980; Kozłowski 1988), it is unlikely that this technology simply vanished in a temporal and geographic cul-de-sac (Kozłowski 1988: 15). Its potential role in a global pattern of increasing dependence on blade technologies should not be discounted. It is difficult, however, to demonstrate how these influences operated in space and time. New dates suggesting that the late Bohunician coexisted with the early Aurignacian for at least several millennia excludes the possibility that the Bohunician was a direct predecessor of the Aurignacian (see table 3.1).

The largest excavated and dated Bohunician sites (e.g., Bohunice, Stránská skála II–III) are concentrated along the margins of the Brno basin, southern Moravia—ideal positions for exploiting Stránská skála chert outcrops (see figure 3.2) (Valoch 1976; Svoboda 1987, 1991; Valoch et al. 2000; Svoboda and Bar-Yosef 2003). Technologically related surface sites, also demonstrably connected by raw material importation, extend in a linear series 30–40 km to the northeast and southwest (e.g., Ondratice, Ořechov, Mohelno). The cultural diagnosis of some of these peripheral surface sites is not clear, given that they overlap geographically with the Szeletian and that the assemblages may be mixed.

Other possible Bohunician sites in the middle Danube region are little known in the literature. They appear in isolation, at great distances from

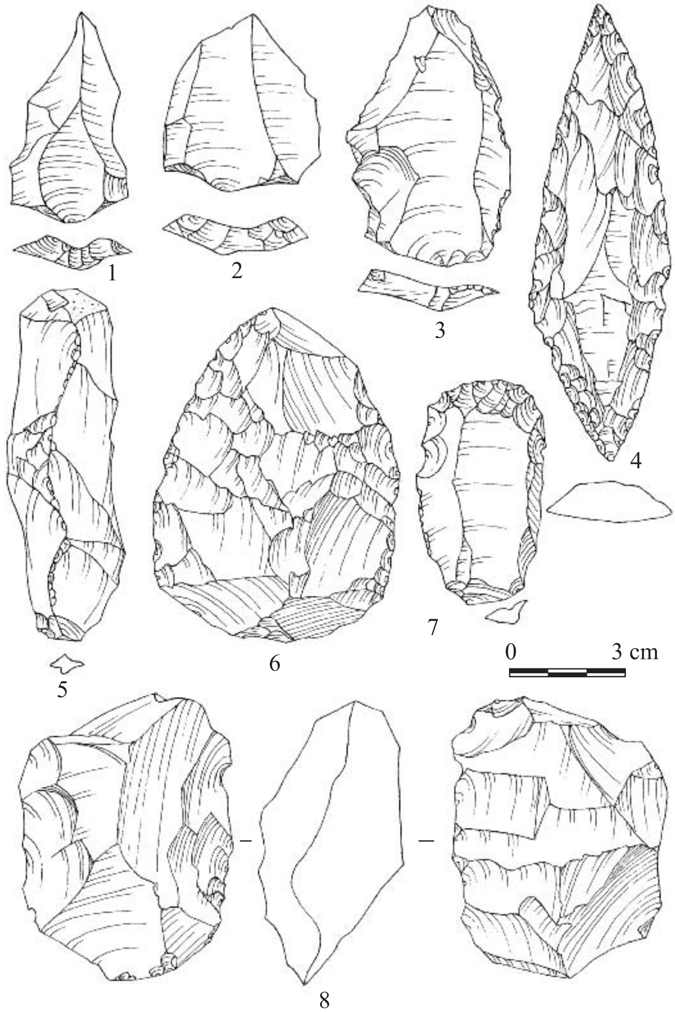

Figure 3.5. Artifacts from Shuidonggou and sites 63601 and 63603, north China.

one another, and their classification as Bohunician is not always clear. This uncertainty surrounds the possible stratified Bohunician-Szeletian sequence at Dzierzyslaw, Silesia, and associated surface assemblages (e.g., Třirebom) (Bluscz et al. 1994). Similarly, the famous Willendorf II sequence in lower Austria contains a transitional industry in layer 2, below the Aurignacian (layers 3–4). New dates of 31–38 ka have been obtained for the Aurignacian layers (Haesaerts et al. 1996; Neugebauer-Maresch 1999).

Radiocarbon samples from underlying deposits, probably from layer 2, were dated between 39 and 42 ka. Unfortunately, the layer 2 assemblage, made of radiolarite, is small and somewhat undiagnostic (figure 3.6). Its "Bohunician" classification thus needs to be treated with caution, although the stratigraphic position of this transitional industry below the early Aurignacian is of great interest. Finally, a flint and jasper "Aurignacian" industry with a strong Levallois component was excavated from redeposited sandy sediments on top of the sandstone formation at Hradsko, north Bohemia (figure 3.7) (Vencl 1977). It is probable that the sequence of assemblages was originally similar to that at Stránská skála, but the mixed Bohunician and Aurignacian components cannot now be separated.

As alluded to earlier in the chapter, the early Upper Paleolithic marked the end of large cave occupations common in the Middle Paleolithic (see Svoboda et al. 1996: 119). Those cave occupations that do occur during the early Upper Paleolithic are functionally specialized and frequently include leaf points (bifacial or partial). Their attribution to the Bohunician is a matter of debate (Oliva 1984; Allsworth-Jones 1990; Svoboda 1990). Indeed, some researchers prefer to classify isolated leaf points found in caves (also at open-air sites) as Szeletian, whereas partial leaf points are classified as Jerzmanowician. Naturally, these classifications may not represent different populations at all: it is entirely possible that Bohunician groups, equipped with the typical projectiles of their time, did occupy the caves of the middle Danube region.

Whereas Middle Paleolithic (Mousterian) Levallois technology has been found in association with both Neanderthals and modern humans in the Levant, in the middle Danube, we lack even the slightest indication of the taxonomic affiliation of the hominin populations responsible for the Levallois-leptolithic or Bohunician. Theoretically, both late Neanderthals and early modern humans are equally acceptable candidates. Given the intrusive character of the Bohunician in the middle Danube region, this unresolved question of taxonomic assignment is of great importance for models of regional behavioral development and the emergence of the Upper Paleolithic.

INDIGENOUS MIDDLE DANUBE TRENDS: THE BIFACIAL LINE

Recent research demonstrates a true mosaic of late Middle Paleolithic and transitional occurrences persisting until about 30 ka in various parts of the Iberian Peninsula, Italy, the Crimea, and the Caucasus (Bar-Yosef and Pilbeam 2000: 184). The Szeletian and related entities of the middle Danube region represent an important component of this overall picture. Some researchers are skeptical about the number of separate cultural entities differentiated in the middle Danube region on the basis of formal analysis of

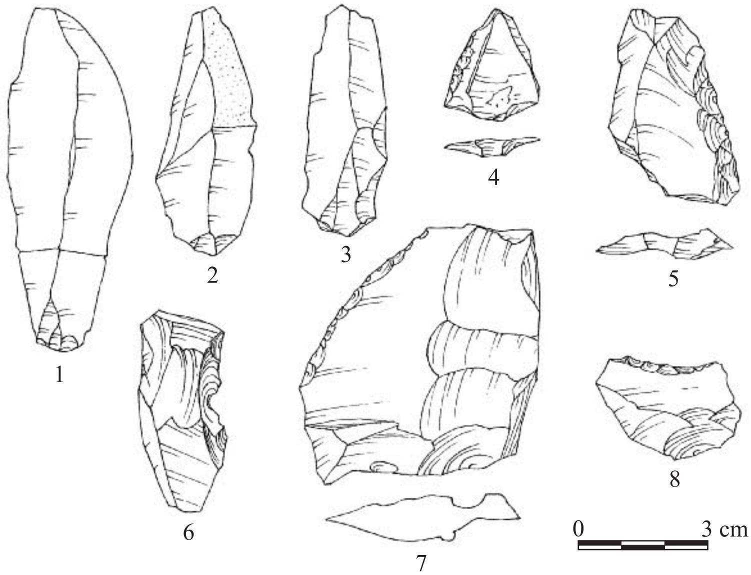

Figure 3.6. Transitional industry from Willendorf, layer 2 (below the Aurignacian), lower Austria.

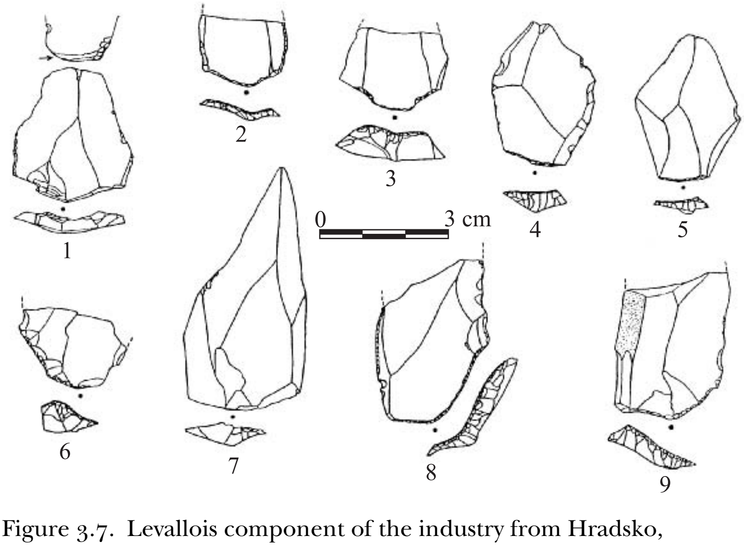

Figure 3.7. Levallois component of the industry from Hradsko, Bohemia. After Vencl (1977).

bifaces (e.g., Klein 1999). Such questions are raised not only about the Szeletian, but also about such entities as the Jankovichian during the late Middle Paleolithic (Gábori-Csánk 1994) and Jerzmanowician during the early Upper Paleolithic (Chmielewski 1961). To be sure, these formal definitions have a certain value chronologically, technologically, and stylistically. However, grouping these entities into same general developmental line allows us to leave open the question of the ultimate meaning (and magnitude) of formal differences between them.

Bifacial technologies may offer a demonstrable case of continuity across the Middle-Upper Paleolithic transition. Following Valoch (1980: 283), this transitional process is "absolutely clear" and provides one of the best-documented cases of cultural change during the Paleolithic in general. The main features of this development appear to be similar over the entire middle Danube region, regardless of the specific names that assemblages have received in local areas; for example, the Micoquian-Szeletian transition in Moravia (Valoch 1980, 1990a,b; Oliva 1991; Svoboda et al. 1996), the Babonyian-Szeletian transition in eastern Hungary (Ringer et al. 1995), or the Jankovichian in central Hungary (Gábori-Csánk 1994). The Middle Paleolithic units in each of these cases are based on the production of planoconvex bifacial pieces and, sporadically at first, leaf points. These technological features are found in association with discoid core reduction as at Kůlna (Valoch 1988; Boëda 1995b). The Levallois technique is not seen, the percentage of blades is low, and Upper Paleolithic tool types are absent or atypical in form. During the early Upper Paleolithic, geometric, symmetrical, and thin leaf points predominate over the larger bifaces (Fäustel, Faustkeilblatt), discoid cores are accompanied by blade cores of cubical and prismatic shapes, the percentage of blades increases, and Upper Paleolithic tool types (especially end scrapers) predominate. It is notable, however, that these changes are occurring essentially on the local Middle Paleolithic technological/typological background—some of the side scrapers do not change in morphology or quantitative representation.

Naturally, there is uncertainty about the moving force behind this technological development. For Žebera (1958) and Oliva (1991), the Szeletian was a spontaneous and linear development out of the Middle Paleolithic. In contrast, Prošek (1953) and Valoch (1980, 1990a,b) explain Upper Paleolithic tendencies in the Szeletian as a result of Aurignacian influences. However, we lack evidence for an Aurignacian earlier than 40 ka in the region. Rather, given the radiocarbon and stratigraphic data for the Bohunician (see table 3.1), Levallois-leptolithic technology in general is a more likely stimulus for this development (Svoboda 1980: 280).

For several researchers, the level of technological similarity between the bifacial Middle Paleolithic and the early Upper Paleolithic Szeletian evokes the idea of continuity in human anatomical evolution. With the data presently available, however, this is merely an a priori assumption of limited value. Indeed, no site in the region, with the possible exception of Vindija (see later in this chapter), has yielded an unquestionable Szeletian industry in association with unquestionable Neanderthal fossils (see Svoboda 2001b). Another indirect argument, also of limited value, plays on an analogy with the western European Châtelperronian, where Neanderthals are evidently associated with a different but parallel transitional industry. Direct evidence of bifacial assemblages in association with Neanderthal fossils is rare. Several Micoquian and Mousterian assemblages show evidence of this association for the Middle Paleolithic (e.g., Kůlna, Šipka, Subalyuk, Švédův stůl), but only individual human teeth of dubious taxonomic affiliation are known for the transitional Jankovichian or Szeletian period (e.g., Dzeravá skala in Slovakia, Remete Felsö in Hungary).

The late Neanderthal human fossils from Vindija G1, Croatia, associated with Szeletian leaf points and polished bone points typical of the Aurignacian, should be reevaluated in context of the above observations. Associated bear bones from Vindija G1 were first dated between 32 and 36 ka, whereas Neanderthal bones later yielded direct AMS radiocarbon dates between 28 and 29 ka (Karavanič 1995; Miracle 1998; Smith et al. 1999). Among the suggested interpretations of Vindija G1 are that either the Aurignacian producers were Neanderthals (Karavanič 1995; Karavanič and Smith 1998) or the supposed association is the result of mixture between late Middle Paleolithic and Aurignacian components (Kozłowski 1996). The question of the hominin association at Vindija G1 aside, bifacial lithic points occur with split-base, or Mladeč-type bone projectiles almost systematically in the Szeletian and related caves of this region (e.g., Dzeravá skála, Istálloskö, Mamutowa, Oblazowa, Szeleta) (Svoboda 2001a). In light of this, Vindija G1 may represent a late leaf point industry and provide the expected evidence of Neanderthal association with the bifacial line of development.

THE AURIGNACIAN EMERGENCE

Whereas the character of Bohunician and Szeletian technology tends to encourage researchers to look for the roots of the early Upper Paleolithic in local Middle Paleolithic entities, the Aurignacian is considered intrusive both in western Europe (Mellars 2000) and the Near East (Bar-Yosef and Pilbeam 2000). I favor a narrow definition of the Aurignacian in terms of blade and microblade lithic technology associated with thick, carinated tool types (end scrapers and burins, some of which may have functioned as microblade cores) and figural art. Other “Aurignacian” phenomena, such as polished bone projectiles and items of body decoration, may have broader (supercultural) significance during this time period. Thus defined, neither central nor southeastern Europe provides a convincing technological predecessor to the Aurignacian, although several technological entities have been examined as candidates, including the Mousterian, Krumlovian, Bachokirian, and Bohunician. Arguments in favor of each may be found in the earlier works of Vértés, Bánesz, Valoch, Kozłowski and Svoboda. Discontinuity in the archaeological sequence is in general accord with the accepted association of the Aurignacian with modern humans (e.g., at Vogelherd and Mladeč). Because it is impossible to trace an Aurignacian migration from any one point of origin, we must conclude that Aurignacian technology emerged as a local adaptation that took place simultaneously in several places in Europe, well after modern humans first reached the continent.

At Willendorf II, layer 3, the oldest Aurignacian dates are 37.9 ka and 38.8 ka. Similar ages of 38–39 ka have been obtained for the Aurignacian at Geissenklösterle (southern Germany) in layer III and for layer IV, horizons C–A, at Temnata cave (Bulgaria) (overlying transitional layer VI) (Ginter et al. 1996, 2000; Haesaerts et al. 1996; Richter et al. 2000). Discussions of Istálloskö, Vindija G1, and other caves in the region (Svoboda 2001a,b) have cautioned against taking polished bone points—both the split-base and the Mladeč types—as indications of Aurignacian presence in cases where the diagnostic Aurignacian lithics are absent. This uncertainty surrounds the site of Mladeč itself where the human remains, Mladeč-type points, and items of body decoration are found without typical Aurignacian stone tools. Even if there is serious reason to doubt its Aurignacian classification, efforts to date the sediments and objects from this hominin site remain important in a more general context.

At Mladeč, following Szombathy's (1925) description of "locus a" (Dome of the Dead), the human fossils were located directly below the surface calcite layer, and a similar position was reported later from another location of the same debris cone. In fact, portions of the calcite are still visible on some of the fossils preserved in the Vienna Natural History Museum. Two samples, both from the top calcite layers and 5 cm apart were collected recently and radiocarbon dated (Svoboda et al. 2002). The results obtained from the carbonate are 34,160 $\pm\,^{520}_{490}$ BP, for the upper sample (GrN-26333), and 34,930 $\pm\,^{520}_{490}$ BP, for the lower sample (GrN-26334). Because the interval between our two samples documents a rapid formation of the series of the calcite layers, we suggest that the deposition of human bodies was more or less contemporaneous or slightly earlier. We thus conclude that our two dates of 34–35 ka provide minimum ages for the fossils; a direct date from the human bone is still needed for confirmation.

CHRONOLOGY AND INTERACTIONS

There is no living analogy for the archaic human mind or archaic human behaviors. In trying to understand archaic human populations, we frequently interpolate somewhere between recent human hunter-gatherer populations and living nonhuman primates. In addition, we do not know how much of the "negative evidence" within the earlier Paleolithic record is the result of the "limited" mental capacities of archaic humans, or whether certain patterns of technological and symbolic behavior (necessary for our own existence) were simply unnecessary in archaic cultural systems (Mellars and Gibson 1996; Mithen 1996; Noble and Davidson 1996; Svoboda 2000). Any serious evaluation of the capacities of past human populations for technological innovation and acculturation seems problematic. As a result, recent discussions in the literature of the relationship between the Aurignacian and transitional industries such as the Châtelperronian (d'Errico et al. 1998; Zilhão and d'Errico 1999; Mellars 2000) have concentrated on chronology—the temporal sequence of cultural entities—rather than the processes of cultural transmission that may have been involved in any contact between archaic and modern human populations. To be certain, a solid chronological framework is a precondition for further discussion. Here I contribute to this discussion with chronological data from the middle Danube region.

Despite recent increases in the number of chronometric dates, our understanding of the chronological relationships between the primary early Upper Paleolithic entities in the middle Danube region (i.e., the Bohunician, Szeletian, and Aurignacian) has not changed dramatically. Bohunician technology is dated as early as 43 ka at Bohunice and first appeared as a blade technology closely tied to the Levallois technique. The Szeletian is dated as early as 41 ka at Szeleta Cave. After 40 ka, both transitional entities evolved in a parallel manner. If acculturation played any role in stimulating the development of blade technology, then the direction of this influence may well have been from the Bohunician to the Szeletian. Interestingly, there is no clear chronological boundary between the transitional technologies and the Aurignacian (see table 3.1). On the contrary, the first Aurignacian sites appear as isolated occurrences around 38 ka (e.g., Willendorf II, Geissenklösterle, Temnata Cave). This age assignment, even if preliminary, is too late for the Aurignacian to have had any direct influence on formation of transitional technologies in the middle Danube. Indeed, the persistence of late transitional industries until 33–34 ka (e.g., Stránská skála IIId) suggests a substantial period of coexistence with the early Aurignacian. After 33 ka, the Aurignacian comes to dominate the archaeological record in both number and density of sites over the entire middle Danube region.

ACKNOWLEDGMENTS

For access to original comparative materials, I thank Zhang Senshui, Institute of Vertebrate Paleontology and Paleoanthropology, Academia Sinica, Beijing; A. Derevianko, Institute of Archaeology, Ethnology and Anthropology, Russian Academy of Sciences, Novosibirsk; V. P. Savich and A. P. Chernysch, Institute of Social Sciences, Ukrainian Academy of Sciences, Lvov; and F. Barth, Natural History Museum, Vienna. For discussion and support during my search for Near Eastern parallels, I thank O. Bar-Yosef, the American School of Prehistoric Research, the American Research Institute in Turkey, and the Mellon Foundation. This chapter was prepared with support from the Granting Agency of the Czech Academy of Sciences, A9001901.

4

Koulichivka and Its Place in the Middle-Upper Paleolithic Transition in Eastern Europe

L. Meignen, J.-M. Geneste, L. Koulakovskaia, and A. Sytnik

The magnitude of cultural continuity between the Middle and Upper Paleolithic in different parts of Eurasia remains a topic of lively debate, especially in relation to modern peopling of the area. The phenomenon seems to be much more complex than initially thought. As pointed recently by Kozłowski (1996), various regions between 50,000 and 30,000 BP show evidence of both transformation of local cultural traditions toward greater dependence on blade technologies ("leptolithization") as well as the diffusion of allochthonous traditions. In fact, several different processes were probably involved in the appearance of the early Upper Paleolithic. Consequently, it is essential to document the Middle-Upper Paleolithic transition at a regional scale, and in multiple regions, based on data collected from different sites.

Only recently have such areas as eastern Europe and the Caucasus been regularly incorporated in the overall picture of the biological and technological changes of this period (Demidenko and Usik 1993a, 1995; Kozłowski 1996, 2000a; Derevianko et al. 1998d,e; Marks and Chabai 1998; Cohen and Stepanchuk 1999; Golovanova et al. 1999). Recent syntheses of the available archeological data have stressed the necessity to publish more details on Middle and early Upper Paleolithic assemblages from eastern Europe, especially the important western Ukrainian sites (e.g., Molodova 1 and 5, Korolevo, Koulichivka), for which a revised chronostratigraphic framework is needed. In 1998, we initiated an international research program together with Ukrainian, Moldavian, Belgian, and French researchers focused primarily on the cultural development, paleoenvironment, and chronology of the Paleolithic in western Ukraine. Preliminary results obtained from the sites of Koulichivka and Molodova are reported here.

The lower layer at Koulichivka, a site located near the city of Krzemieniec, Volhynia, western Ukraine, has been cited repeatedly in the literature as containing a Middle-Upper Paleolithic transitional assemblage (figure 4.1) (Demidenko and Usik 1993a,b; Kozłowski 1996; Svoboda and Škrdla 1995), although it has never been published in detail. Koulichivka—and western Ukraine in general—is all the more interesting in light of Svoboda and Škrdla's (1995) suggestion that Bohunician transitional industries in the Moravian basin lack any local predecessors (see also Svoboda, this volume). Taking into account the evident connection with Levallois technology, which is unknown in Moravia, they argue that the appearance of the Bohunician must be attributed to a migration into the area. The closest fully Levallois Middle Paleolithic occurrences are found in Germany, 500 km to the northwest, and in Ukraine, 700 km to the east. Accordingly, one of the candidates they cited as a source for the Bohunician is Molodova 1, layer 5, a Levallois Middle Paleolithic site in western Ukraine (Demidenko and Usik 1993a,b; Kozłowski 1996; Svoboda and Škrdla 1995). The presence of a transitional assemblage in the lower layer at Koulichivka—the same region as Molodova 1—allows us to investigate the role played by the Ukrainian Middle Paleolithic in the origin of the central and eastern European Upper Paleolithic.

LATE MIDDLE PALEOLITHIC IN WESTERN UKRAINE

In their recent synthesis of the transitional period in eastern Europe, Cohen and Stepanchuk (1999) emphasized the high degree of variability in the regional late Middle Paleolithic. In Ukraine, however, most of these late Middle Paleolithic variants can be classified into two major groups characterized by stylistic and technological differences (Kozłowski 1996):

- The Eastern Micoquian and its variants (the so-called para-Micoquian) (Cohen and Stepanchuk 1999) are widely represented in eastern Europe, and are especially numerous in Crimea. They are characterized primarily by bifacial technology (atypical biface-knives, bifacial points, side scrapers, leaf-pointlike pieces and unifacial flake tools). Recent dating programs show that the late Middle Paleolithic in this area ends around 30,000 BP (Marks and Chabai 1998; Pettitt 1998; Marks and Monigal, this volume).
- The Moustero-Levalloisian industries (or typical Mousterian with Levallois technique) are found primarily in the Dniester region (e.g., Molodova, Pronyatin) (Chernysch 1982, 1987; Bogutskij et al. 1997; Stepanchuk 1998), but also in the Middle Dnieper and Crimea (Marks and Chabai 1998).

Molodova 1 and 5

Known primarily for their loess sequences, archaeological materials from the multilayered open-air sites of Molodova 1 and 5, located along the Dni-

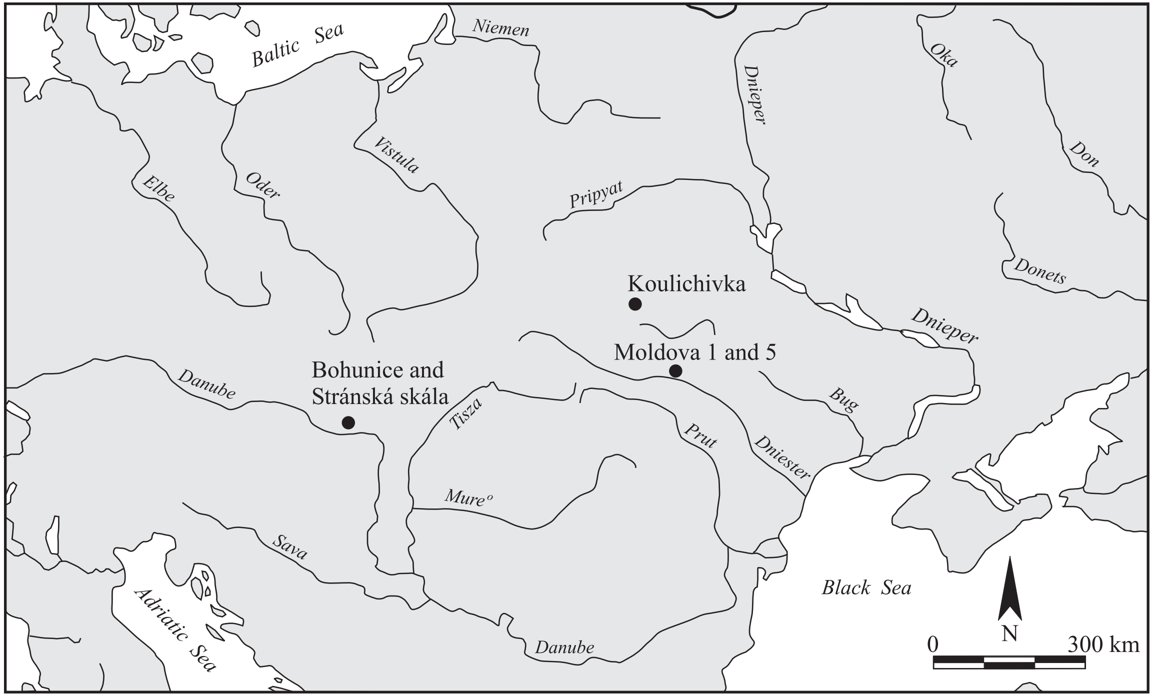

Figure 4.1. Map of east-central Europe.

ester River (see figure 4.1), have not yet been published in detail. Excavated by Chernysch between 1951 and 1964, the two sites provide a long stratigraphic sequence ranging from the Middle to Upper Paleolithic (Chernysch 1982, 1987). A series of infinite radiocarbon ages has been reported for the Mousterian layers (Chernysch 1982; Ivanova 1987): greater than 40,300 and 45,600 BP from layer 11 at Molodova 5, and greater than 44,000 BP from layer 4 at Molodova 1. Taking into account the composition of the faunal assemblages (which are dominated by *Equus* and *Rangifer*) and their stratigraphic positions, these Middle Paleolithic layers have generally been considered to date to the Brorup episode (Chernysch 1965; Ivanova 1969). Based on a general revision of the loess stratigraphy at the most important Paleolithic sites of eastern and central Europe, however, Haesaerts (pers. comm.) suggests that the lower complex of Molodova 5 could date as late as the first part of Oxygen Isotope Stage 3. A thorough geochronological dating program making use of paleomagnetism, magnetic susceptibility, and radiocarbon is under way.

The numerous Mousterian assemblages from Molodova 1 and 5 have never been studied in their entirety or published in detail. Gábori (1976), citing Chernysch's studies and his own observations, characterized the Molodova Middle Paleolithic as a specialized Levallois technology for producing laminar blanks with faceted striking platforms. Levallois points are present, as are simple side scrapers, convergent pieces, and retouched blades. Gladilin (1970) noted the peculiar character of these Mousterian assemblages, emphasizing the difference between them and late Middle Paleolithic assemblages from neighboring areas. Similarly, Gábori (1976) classified under the name *Levalloisien oriental du type de Molodova* all the Mousterian industries found in the limited area of the Dniester valley and considered it as a local group without any link with the western Levallois traditions. Influences from the southeast, especially the Balkans, were suggested.

Our examination of the Molodova assemblages clearly demonstrates the use of the classical Levallois method. At Molodova 1 (layers 4 and 5) and, to a lesser extent, Molodova 5 (layers 11 and 12), the core reduction strategy is primarily oriented toward the production of large, elongate Levallois blanks with faceted striking platforms (figure 4.2). These products, often 8–12 cm in length, are relatively wide and best classified as elongate Levallois flakes, rather than blades (contrary to Yamada and Sytnik [1997]). The majority of cores followed the recurrent Levallois method, in which the goal was to produce several Levallois blanks from each prepared flaking surface. Cores were shaped and exploited predominantly by unidirectional or bidirectional flaking. All the typical by-products of this type of core reduction strategy (*éclats/lames débordant(e)s, enlèvements II,* single and double platform cores) are present at the sites, which are close to good raw material sources.

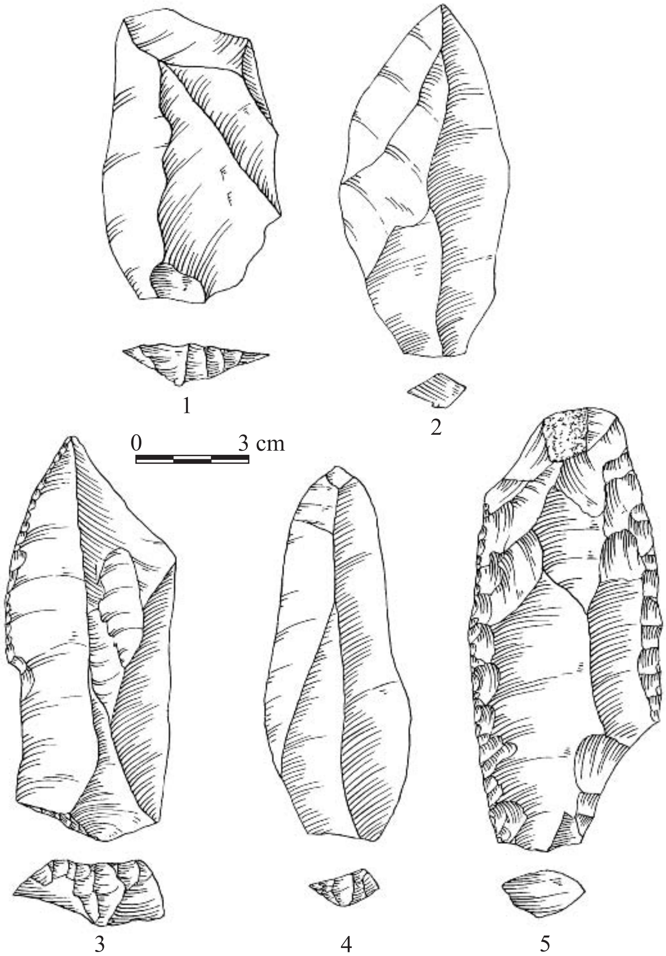

Figure 4.2. Molodova 1, layer 4, Middle Paleolithic industry: elongated Levallois blanks (1–4); side scraper on Levallois blank (5).

Retouched tools, mostly large side scrapers and retouched points, are not very common.

KOULICHIVKA LOWER LAYER

Koulichivka is located in the Volyno-Podillja massif, northeast of the Transcarpatian region, along the Ikva River, a tributary of the Bug River (see figure 4.1). Extensive excavations were conducted by Savich from 1968 to 1988.

The published stratigraphy shows, under Iron and Bronze Age occupations, three primary Upper Paleolithic archaeological levels characterized by a developed, soft hammer percussion prismatic blade technology. Savich (1975, 1987) described some Middle Paleolithic elements in the lower layer—called archeological level 3 or 4, depending on the excavation year—occurring together with classic Upper Paleolithic materials.

Our recent examination of Savich's field notes and the geological sections drawn during the excavations shows a complex stratigraphy with numerous lateral geological changes. In particular, postdepositional disturbances linked with frost action (gelifluction) are observed in localized portions of the lower stratigraphy. Figure 4.3 shows, for example, the deformation of the lower layers (bedded silts and gray and reddish sandy sediments) on the left part of the section, whereas on the right the same bedded sediments are not disturbed. Thus, cryogenic processes may have caused some local vertical movement of objects, resulting in the mixture of different lithic assemblages. This problem was encountered when studying part of the Koulichivka lithic collections at the National Institute of Science in Lviv. In his field notes for the 1984–85 seasons, however, Savich reported the presence of an archaeologically sterile layer separating portions of archaeological level 4 (geological layer 6) (containing Middle Paleolithic elements) from archaeological level 3 (geological layer 5) (strict Upper Paleolithic). These observations suggest that in some parts of the excavated area, archaeological level 4 (geological layer 6) was clearly discernible from the lowest Upper Paleolithic (figure 4.3). We therefore focused our research on the undisturbed part of this extensive site, which we refer to generally as the lower layer.

Koulichivka was a primary lithic workshop located at a high quality Turonian flint outcrop. In the lower layer at the site, thousands of large cortical flakes, debitage by-products, and cores were collected. The *chaîne opératoire* was aimed at the production of triangular blanks, mainly elongated points, as well as blades. Although present, short points are less common. The variability in the morphology of triangular blanks is important. Depending on the specific provenance on the flaking surface, triangular blanks may be relatively wide and either short or long, or extremely narrow (figure 4.4). The desired end products were obtained mostly by bidirectional flaking, as documented by dorsal scar patterns, using at most two different core reduction strategies. Core reduction always employed hard hammer percussion, and striking platforms were carefully prepared, resulting in a high frequency of points with faceted butts.

Three main cores types, with intermediate forms, have been identified. In the first group, "flat" cores are the most numerous (figure 4.5: 2, 4). Flaking is generally organized along the widest face of the block and involves the establishment of two different types of surfaces, one type serving as the strik-

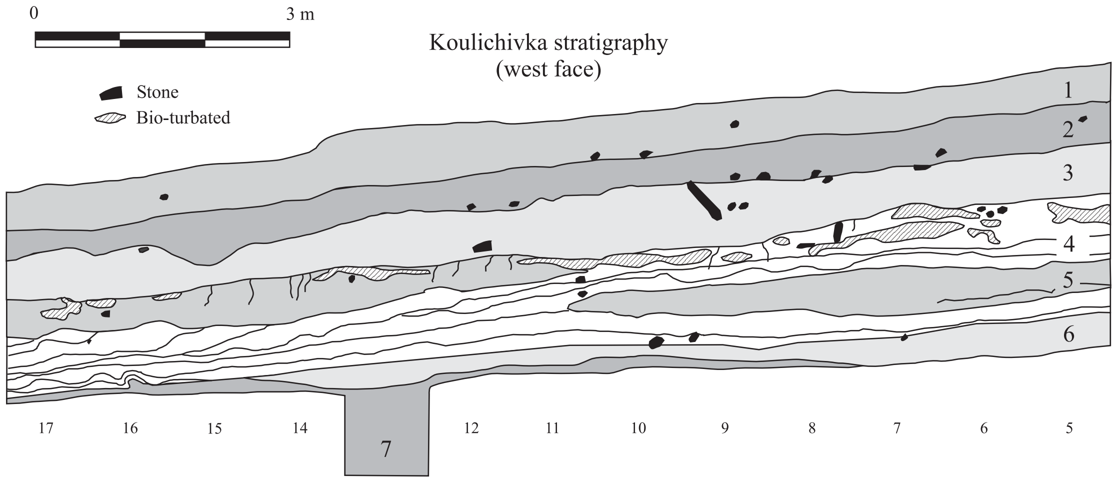

Figure 4.3. Koulichivka schematic stratigraphic section from the 1984–85 seasons. *Key:* layer 1, gray podzol—Bronze and Iron Age occupations; layer 2, dark brown silts—archaeological level 1 (Upper Paleolithic); layer 3, light brown yellowish silts—archaeological level 2 (Upper Paleolithic); layer 4, dark brown bedded sands with clay lenses; layer 5, relict dark brown Paudorf paleosol—archaeological level 3 (Upper Paleolithic); layer 6, dark brown bedded silts with light brown sandy beds—archaeological level 4 (transitional industries); and layer 7, carbonaceous gray clay. Profile grid numbers given along bottom.

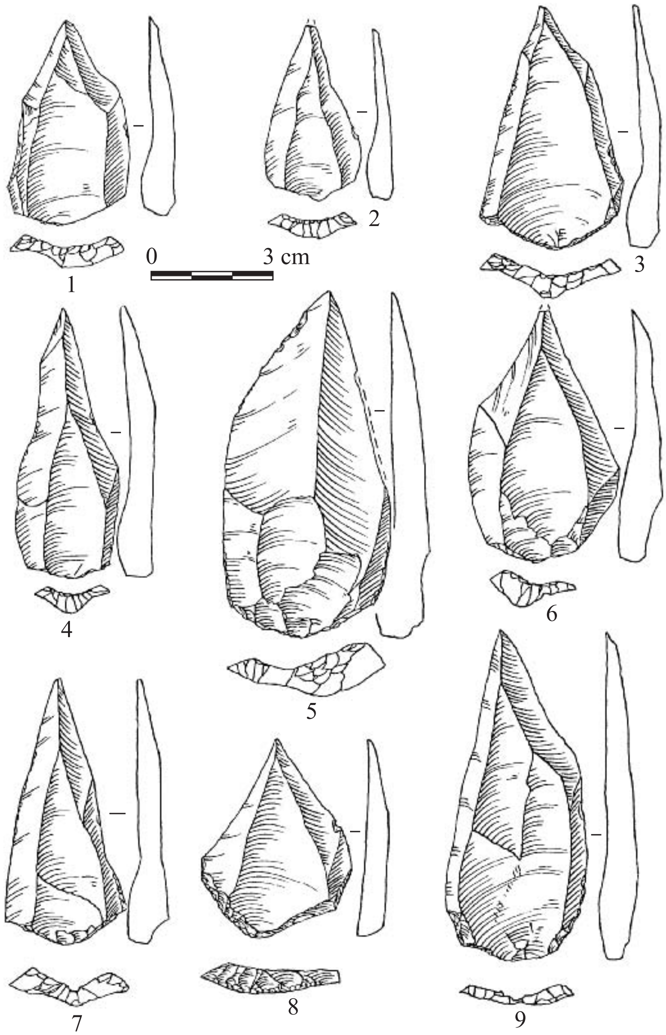

Figure 4.4. Koulichivka, lower layer: pointed blanks.

ing platform, the other the surface for blank production. The roles of these two surface types stay the same throughout the reduction sequence. In most cases, flat cores were exploited from two strictly opposed striking platforms. A series of triangular blanks was struck from the two prepared platforms for each prepared flaking surface (i.e., recurrent exploitation). Depending on the morphology of the initial block, short or elongated points were obtained. Most points derived from these cores are relatively wide because of the flat morphology of the primary flaking surface. In general, flat cores at Koulichivka correspond to the volumetric concept characteristic of the Levallois method. The resulting end products should be classified as Levallois points.

In the second group, core morphologies are closely related to the flat cores described above, but show additional reduction on the narrow side of the block (figure 4.5: 1, 3). In most cases, the narrow face was exploited first. A change in the orientation of the flakes preparing the striking platform was all that was needed to facilitate debitage production using the thickest dimension of the raw material block. The end products generated from this type of core include pointed blanks identical to those struck off the widest surface exploited by flat cores, as well as narrow, elongated blanks (blades) detached from the narrow side of the block.

The third group is composed mainly of Upper Paleolithic type cores (figure 4.6). One reduction method employed may be described as *débitage frontal,* whereby continuous flaking from two opposed striking platforms is limited to the narrow face of the block, generating a slightly convex debitage surface. A second method may be described as *débitage semi-tournant,* whereby a series of elongated blanks are struck from two opposed, but slightly twisted striking platforms prepared on thin nodules of raw material. This organization allows the flaking surface to be extended to the sides of the core, resulting in a semiprismatic, highly convex flaking surface. Crested blades were used often to control the shape of the core (i.e., regularity, longitudinal and transverse convexities, widening of the flaking surface), but core-backs were rarely shaped as is common in classic Upper Paleolithic assemblages. One exception to this general pattern is a core showing rejuvenation of convexities from the back to the side of the core (forming a posterior crest, or *crête postérieure*) (figure 4.6: 1). Both core reduction processes resulted in serial elongated blank production (blades and points).

That some of the Koulichivka core forms are transitional between the flat (Levallois-like) and Upper Paleolithic types suggests, as stressed by Svoboda and Škrdla (1995) for the Bohunician, that the two core reduction strategies were not strictly separated, as traditionally assumed. At Koulichivka, the lack of core refits prevents us from determining whether these two core reduction strategies—essentially two different volumetric concepts—were applied to the same block of raw material, or if nodules of different shapes and sizes were used for each core reduction strategy, depending on the desired end product.

Unfortunately, retouched tools are rare in the lower layer at Koulichivka. The numerous pointed blanks were often used unmodified, as demonstrated by functional analyses conducted by H. Plisson on a sample of elongated blanks (Plisson, pers. comm.). End scrapers based on large cortical flakes produced during the initial core-shaping phase are the most common

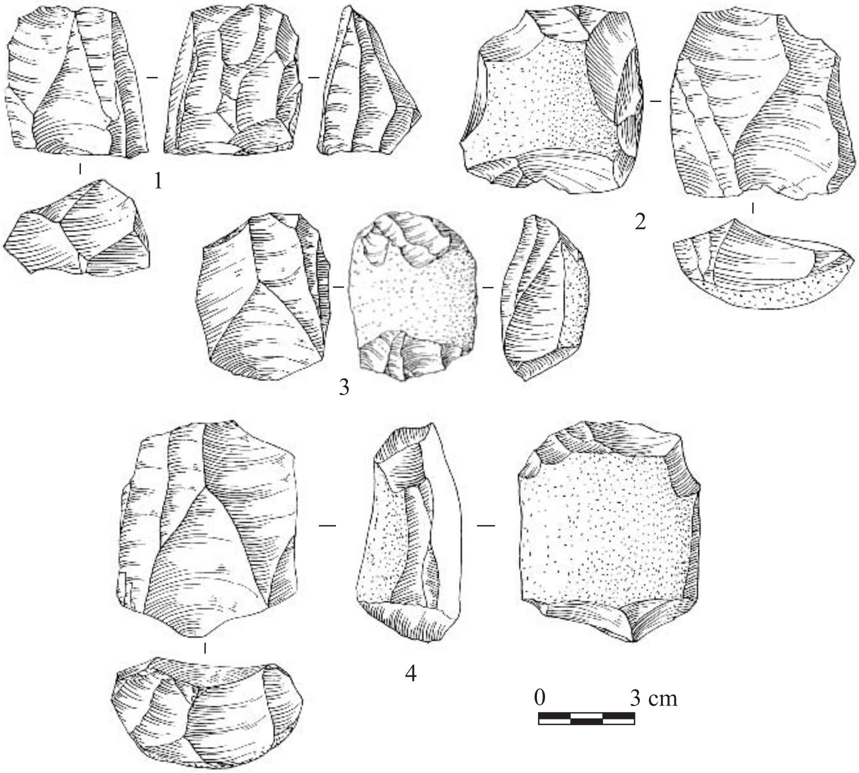

Figure 4.5. Koulichivka, lower layer: cores reduced along the widest surface and the narrow side (1, 3); flat Levallois cores (2, 4).

retouched tools. These tools are not thick and never of the Aurignacian type.

In sum, the Koulichivka lower layer lithic assemblage combines features of Middle Paleolithic technology, such as the Levallois method (careful platform preparation and hard hammer percussion) and Upper Paleolithic characteristics, such as the laminar volumetric concept (semiprismatic cores and the use of crested blades). Upper Paleolithic retouched tools dominate, but forms diagnostic of Aurignacian do not occur.

COMPARISONS

Lithic assemblages that exhibit technological and typological characteristics of the Upper Paleolithic alongside Middle Paleolithic traits are currently known in several distinct locations, including Europe, the Near East, and

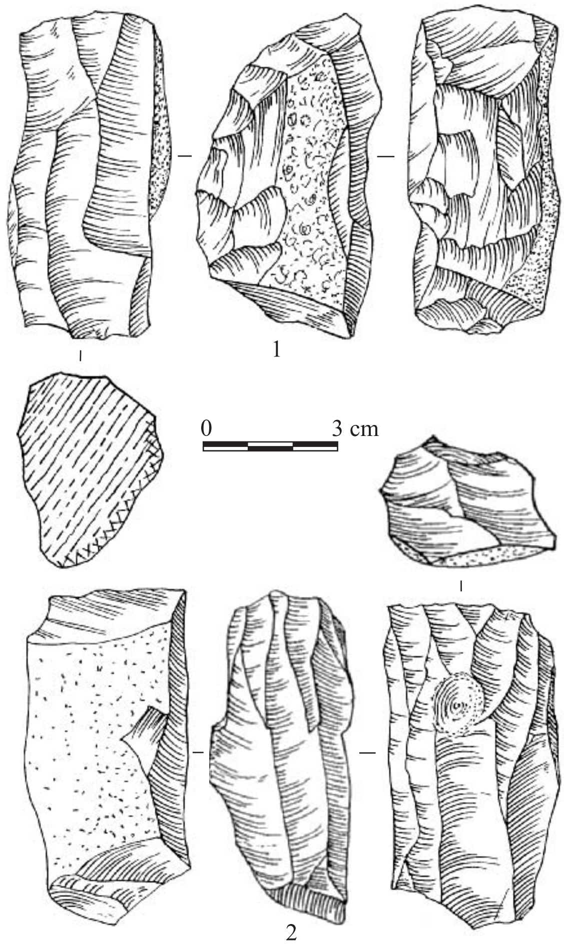

Figure 4.6. Koulichivka, lower layer: *débitage frontal* Upper Paleolithic type core (1); *débitage semi-tourant* Upper Paleolithic type core (2).

Asia. These so-called transitional industries are generally interpreted in terms of "intentional admixture involving the presence of artifacts bearing the attributes of an older industry, whether as blank production or tool types, together with the newly invented lithic forms" (Bar-Yosef and Pilbeam 2000: 184). It is important to stress, however, that the term "transitional" is simply a descriptive statement without any necessary biological implications. Indeed, the co-occurrence of Middle and Upper Paleolithic attributes at much earlier times during the Middle Paleolithic is well documented (see

Meignen 1994, 2000; Révillion 1994; Révillion and Tuffreau 1994; Schäfer and Ranov 1998; Bar-Yosef and Kuhn 1999). Clearly, stratigraphic position must be also taken into account to assess the Middle-Upper Paleolithic "transitional" character of an assemblage. For example, the Ain Difla assemblage, despite its technological characteristics, can no longer be considered a Middle-Upper Paleolithic transitional site (contra Demidenko and Usik 1993a). New radiometric dates place this assemblage much earlier in time (Clark et al. 1997).

More interestingly, perhaps, are the few cases where transitional features occur on the same piece of stone raw material, as demonstrated by core refits from the Bohunician at Stránská skála (Škrdla 1996; Svoboda and Škrdla 1995). It is clear that Bohunician knappers had already mastered both Middle and Upper Paleolithic technologies and were able to obtain the desired end products—in most cases, elongated blanks, points, and blades—by a mixed Middle-Upper Paleolithic core reduction strategy. At Koulichivka, we see a similar mixture of Middle and Upper Paleolithic technological features implemented on the same nodule; thin, relatively wide Levallois-like points were struck from the broadest working surface, and narrow Upper Paleolithic–type blades were extracted from the narrow face. Moreover, this mixed core reduction strategy is found alongside classic bidirectional Levallois cores and Upper Paleolithic type semiprismatic cores. The Middle Paleolithic roots at Koulichivka are obvious in all of the technological and typological features of the assemblage.

Between 50,000 and 35,000 BP, industries exhibiting elements of an Upper Paleolithic blade technology developed on a Levallois foundation and spread to various parts of the Old World. The Bohunician in central Europe undoubtedly shares many common technological traits with lithic production at Koulichivka. Dated between 38,000 and 43,000 BP at Bohunice and Stránská skála III and IIIa, the Bohunician *chaînes opératoires* are oriented toward the production of elongated blanks (points and blades), mostly through bidirectional flaking, on cores that display a conceptual fusion between Levallois and Upper Paleolithic techniques (Svoboda and Svoboda 1985; Svoboda and Simán 1989; Svoboda and Škrdla 1995; Škrdla 1996). At Stránská skála III and IIIa (lower layer), Škrdla (1996) stressed the morphological variability of the pointed end products (from flakelike to elongated), which reflects production from different kinds of cores, as described for Koulichivka. Despite some difference in terminology used, the flat (Svoboda and Škrdla 1995: figure 29-3), surface and lateral cores (Svoboda and Škrdla 1995: figure 29-10a), as well as Upper Paleolithic frontal debitage cores (Škrdla 1996: figure 4, illustrations 1 and 2), identified in the Bohunician, are present at Koulichivka. At Stránská skála, some core refits indicate that the different core morphologies could in fact correspond simply to different stages of reduction of the same raw material block (Svoboda and

Škrdla 1995). Comparable core morphologies, reflecting changes in the volumetric conception, have been recognized at Temnata (layer VI), which, even if not radiometrically dated, is stratigraphically intermediate between the Mousterian and Aurignacian levels (Ginter et al. 1996; Kozłowski 1996).

Although it is clear that Bohunician tool kits varied, depending on site location and age, Middle Paleolithic tool types, including Levallois points, side scrapers, notches, and denticulates, are always well represented alongside such Upper Paleolithic implements as burins and end scrapers. The later tools are mostly flat and often made on wide flakes, although in certain assemblages a few thick Aurignacian forms may occur (Svoboda 1988; Svoboda and Simán 1989). Few terminal-ventrally (Jerzmanowician) retouched points are present at Stránská skála. The problem of the very sporadic appearance of bifacial leaf points and of their in situ character is still open to question (Svoboda 1990, and references therein). All these observations lead to the conclusion that the manufacturers of the Bohunician industries, especially at Stránská skála, and the flint knappers at Koulichivka employed similar technical solutions in lithic tool production.

Another well-studied transitional lithic assemblage often cited in comparison with the Bohunician, and therefore of relevance to Koulichivka, is the Near Eastern site of Boker Tachtit (Negev Desert), dated to approximately 47,000–46,000 BP (Marks and Kaufman 1983; Marks and Volkman 1983; Marks and Ferring 1988). Technological and refitting studies show, in level 1, lower layer, blade and elongated point production primarily from bidirectional cores. Careful preparation of the striking platform resulted in numerous end products with faceted butts. The main characteristics of the bulbs of percussion and ventral surfaces of end products indicate use of a hard hammer direct percussion technique. Marks and Volkman (1983) describe a sustained tradition using crested blades both for initial shaping and maintenance of cores. Retouched tools are primarily Upper Paleolithic types, especially burins, together with Emireh points, which are known only from very few sites in the Near East (Marks and Kaufman 1983).

Taking into account recent technological studies, one of us (Meignen 1996) has argued that the core reduction strategies represented in Boker Tachtit level 1 are more closely related to the Upper Paleolithic volumetric concept than to the Levallois method. As at Koulichivka, several cores from Boker Tachtit level 1 exhibit a reduction sequence organized along the narrow side of the raw material block, a volumetric concept often related to the Upper Paleolithic (Marks and Kaufman 1983: figure 5-2c,e, 5-3e; Volkman 1983: figure 6-6). Moreover, the systematic use of the crested blade technique is a striking Upper Paleolithic trait of this assemblage. Even if Middle Paleolithic technical features are still present—hard hammer percussion, faceting of striking platforms, and low investment in the first stages of core-shaping, all leading to the production of irregular bladelike blanks—our examination of the Boker Tachtit level 1 assemblage suggests that it was already more "inserted" into Upper Paleolithic trends than that seen at Koulichivka. The imprint of Middle Paleolithic technology is stronger at Koulichivka, where flat cores, short blanks, and Mousterian retouched tools are represented at much higher frequencies.

Svoboda and Škrdla (1995) have stressed that the Levallois forerunners of Bohunician technology have not been found in central Europe. Looking to other regions, they suggested the Middle Paleolithic of western Ukraine, especially the uni- and bidirectional Levallois industries of Molodova 1, as a possible source for the Moravian Bohunician. In this context, the transitional industry of Koulichivka may provide a further example of the link between the Mousterian of Molodova and the Moravian Bohunician.

To test this hypothesis, however, we are faced with problems of chronology. As previously mentioned, chronological and geological research at both Koulichivka and Molodova 1 and 5 are still in progress. At present, the lower layers at Molodova 5 are considered to be late Mousterian, dated to Oxygen Isotope Stage 3. The Moravian Bohunician is dated between 38 and 43 ka. Unfortunately, only one radiocarbon date of about 31,000 BP is available for the lower layer at Koulichivka. Because it was collected during the old excavations, however, the exact provenance of the sample is unknown—it is also unpublished and not presented in the field reports. Only a reference to the layer is reported. Inasmuch as postdepositional processes seem to have affected the lower sediments in some areas at Koulichivka, it is difficult to be completely confident in this isolated date. At first glance, this age seems to be too young when compared with dates for the Bohunician. If we bear in mind, however, the recent radiometric age determinations obtained for the Mousterian in Crimea (a late-occurring Middle Paleolithic) (Marks and Monigal, this volume), an age of around 30,000 BP for a transitional industry in the Ukraine should not be completely discounted. If the radiocarbon date is correct, then Koulichivka would be among the latest occurrences of a Bohunician-type industry, and the only one found outside of the restricted geographical context where they have been recovered previously. In this case, Koulichivka would be too recent to be considered an intermediate between the Dniester Mousterian and the Moravian Bohunician.

New field investigations are needed to elucidate the relationships among the late Mousterian of western Ukraine, the Koulichivka lower layer assemblage, and the Bohunician complex. These investigations will be the next step in our project. As a good example of a transitional industry clearly rooted in the Levallois technical tradition, improved dating of Koulichivka and Molodova 1 and 5 will help to clarify the temporal and spatial characteristics of the shift from Middle to Upper Paleolithic technologies in eastern Europe.

5

Origins of the European Upper Paleolithic, Seen from Crimea

Simple Myth or Complex Reality?

A. E. Marks and K. Monigal

A few years ago, a new origin myth for modern behavior in Europe was proposed (Stringer and Gamble 1993). Although mainly using earlier observations (e.g., Mellars 1973, 1992; White 1982), it brought them together to form a single, simple story. This myth chronicles how we as a species passed from being essentially noncultural to becoming behaviorally modern about 40,000 years ago. This passage was not linked directly to a shift to modern anatomy, as that occurred some 70,000 years earlier in Africa (Klein 1998). Rather, this myth states that, "like the flick of a switch" (Stringer and Gamble 1993: 203, 218), somewhere people who were already anatomically modern began to symbol, attaining modern culture. At once, this new capability "spread like a plague" (Stringer and Gamble 1993: 218) among other moderns who, as yet, had not started to symbol and, thus, were still not behaviorally modern.

This almost instantaneous acquisition and use of symboling parallels the traditional Judeo-Christian myth (Genesis 3:2–7): the acquisition of the knowledge of "good and evil" and of human mortality is, by definition, impossible without symboling. It is after this, however, that these myths diverge. Whereas in the traditional Judeo-Christian myth, the material correlate of self-awareness was limited to the fig leaf (Genesis 3:7), in this new version, it consists of a whole complex of different items and processes—split-based bone points, carinated reduction of lithic materials, personal ornaments, blade technology, representational art—all those items that traditionally have been used to define the European Aurignacian (Hahn 1977; Stringer and Gamble 1993: 202). Thus, in the latter myth, the Aurignacian is the original, unique material culture arising out of our newly acquired modern behavior.

This myth is understandable and even satisfying from a Western European perspective. Not only was southwest Europe the cradle of prehistoric research, it also became the model for the study of almost all areas (Merejkowski 1884; Buzy 1929; Neuville 1934; Garrod and Bate 1937). Even today, conclusions regarding Neanderthal adaptations and capabilities have been generalized to the whole of their geographic range, largely based on data derived from southwestern Europe (Mellars 1996). The comparison between Neanderthal and modern behavior likewise has been based almost exclusively on research done in southwestern Europe (e.g., Mellars 1973, 1996; White 1982).

Without question, southwestern European data show marked contrasts between the Middle and Upper Paleolithic, with the Aurignacian clearly containing at least two attributes reasonably linked with symbolic behavior (representational art and personal ornaments) not seen in the local Middle Paleolithic (White 1993a,b; Mellars 1996). In addition, the archeological association of later Aurignacian with anatomically modern Cro-Magnon (Gambier 1989) provides a direct link between the two. The contrast between these periods, however, is not quite so stark. There is the problem of the Châtelperronian. F. Bordes, among others, believed that it represented an initial, indigenous French Upper Paleolithic, evolved from the local Mousterian of Acheulian Tradition, Type B (Bordes 1958), exhibiting a number of diagnostic Upper Paleolithic (modern) characteristics, including the production of personal ornaments (Bordes 1968). With the subsequent discovery that the Châtelperronian was directly associated with and therefore made by Neanderthals (Lévêque and Vandermeersch 1980; Lévêque et al. 1993), the Châtelperronian was relegated to a terminal Mousterian. What had been accepted as clearly modern characteristics were reinterpreted to have been the result of Neanderthal "imitation" of contemporary Aurignacian modern behavior, rather than independent invention (Stringer and Gamble 1993: 201; Harrold 2000: 67). This reinterpretation is essential for the new myth of a single, initial material manifestation of modern behavior but, with good reason, it has not been accepted by all (e.g., d'Ericco et al. 1998). If the Aurignacian was the material manifestation of the first behaviorally modern culture seen in southwestern Europe, does that mean that the Aurignacian was necessarily the original manifestation of modern, symbolic culture?

Certainly, in Central Europe, there is a tendency to view the Aurignacian as the original, modern material culture (e.g., Otte 1990; Kozłowski 1993). In the face of considerable technological and typological diversity at the Middle-Upper Paleolithic interface, interpretations have paralleled the Aurignacian/Châtelperronian debate. An industry with technological traits that may have originated in a Middle Paleolithic base (e.g., bifacial tool production, Levallois reduction) is classified as "transitional," rather than Upper Paleolithic, even when it contains significant typologically Upper Paleolithic traits. Such industries as the Szeletian (Allsworth-Jones 1986), the Bohunician (Oliva 1984), and the Jerzmanowician (Chmielewski 1961), fall into this "transitional" group and are viewed as being terminal Middle Paleolithic (Allsworth-Jones 1986; Valoch 1990b; Oliva 1991; Svoboda 1993). Only when an industry lacks seeming Middle Paleolithic roots is it considered possibly the result of modern behavior by anatomically modern people. An example is the Bacho Kirian, even though, at best, it has unconvincing "Aurignacian" traits (Kozłowski 1982) and unidentifiable hominid fragments (Glen and Kaczanowski 1982). In this sense, the interpretive approaches of many Western and Central European prehistorians are comparable. Although implicit, this approach assumes that any Middle Paleolithic or technologically related industry was made by Neanderthals and that any non-Middle Paleolithic industry was made by anatomically modern people. Given the paucity of clear fossil associations in this Middle Paleolithic/Upper Paleolithic interface, this assumption is far from proven.

Yet if the perceived differences in adaptations and material culture of Neanderthals and modern people in southwest and central Europe resulted from characteristics intrinsically unique to each, then those differences would be manifest anywhere and would explain comparable differences anywhere, even without clear fossil associations. The question arises, however, whether the starkly different, specific patterns of material culture seen in southwestern Europe between the Middle and Upper Paleolithic, in fact, are paralleled elsewhere.

ONE VIEW FROM EASTERN EUROPE

In eastern Europe, recent work in Crimea (Marks and Chabai 1998; Chabai and Monigal 1999; Chabai et al. 2000) has uncovered a complex matrix of late Middle Paleolithic and early Upper Paleolithic assemblages, which indicates the presence of several different industries between 40,000 BP and 30,000 BP. One site, Buran-Kaya III, has a stratified sequence of occupations spanning both periods (Yamada and Yanevich 1997; Yanevich et al. 1997; Janevič 1998; Marks 1998; Marks and Monigal 2000). One occupation, in particular, suggests that the current origin myth needs reevaluation.

Although no single Crimean site can fully document the regional Middle/Upper Paleolithic interface, the site of Buran-Kaya III comes close. Located at the northern edge of the second Crimean mountain range in the small Burulcha River valley, it lies about 15 km southwest of the town of Belogorsk (figure 5.1). Situated on the eastern valley edge in a low cliff, the site is a small collapsed rock shelter, 5 m deep by 6 m wide, some 8 m above the present river. Found by A. Yanevich in 1990 (Yanevich et al. 1996), it was initially tested that year and, again, in 1994, in cooperation with M. Yamada (Yamada and Yanevich 1997). These excavations exposed a long stratigraphic sequence from Middle Paleolithic into the Bronze Age, including a

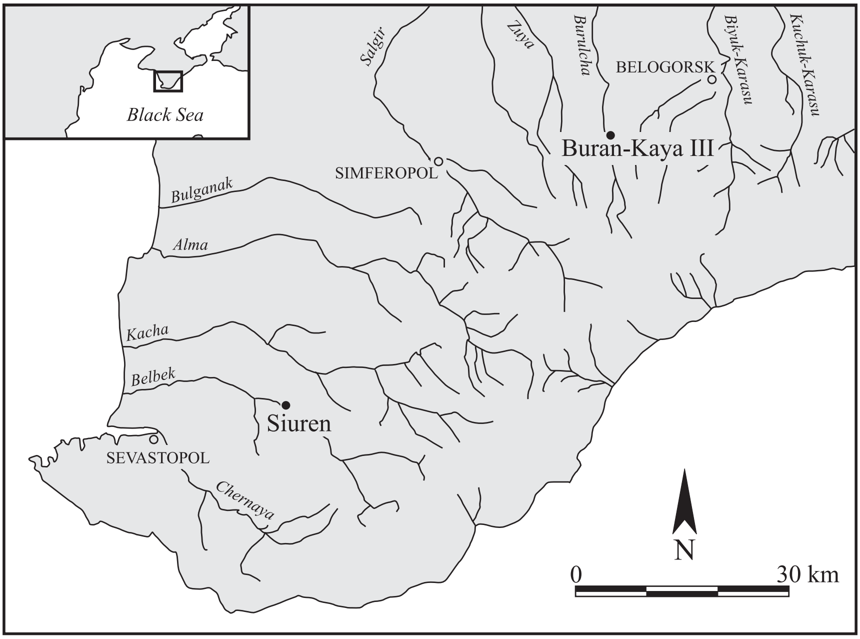

Figure 5.1. Map of Crimea showing the location of Buran-Kaya III.

number of early Upper Paleolithic occupations and a subjacent series, all of which were reported as Eastern Micoquian (Yamada 1996).

Additional excavations in 1996, a cooperative effort between A. Yanevich and the International Crimean Paleolithic Project, headed by V. Chabai, divided the responsibilities between A. Yanevich and M. Otte for the materials of the early Upper Paleolithic (Gravettian and Aurignacian), while Yu. Demidenko, V. Chabai, and the present authors undertook the study of the materials described by Yamada (1996) as Eastern Micoquian.

Stratigraphically, the contact between the earliest Upper Paleolithic and the Middle Paleolithic Eastern Micoquian occurred toward the back of the rock shelter (Marks and Monigal 2000: figure 2). Toward the front, this contact was separated by a sterile layer and farther from the back, in the area of overhang collapse, by both this sterile layer and by deposits derived from a higher elevation to the north of the rock shelter; Middle Paleolithic, Level A (Marks and Monigal 2000: figure 2). Four stratigraphically distinct occupation layers were recognized below the derived Level A, beginning with Level B, a dense layer of Crimean Micoquian of Kiik-Koba type (Demidenko, pers. comm.). Without question, the interface between the Kiik-Koba Micoquian and the earliest Upper Paleolithic represents the end of the Middle Paleolithic at Buran-Kaya III, but it does not represent the beginning of the Upper Paleolithic. With the larger samples obtained during the 1996 season, the lower levels (C–E) could not be attributed to the Eastern Micoquian. Level C, in particular, cannot even be attributed to the Middle Paleolithic, and it is the assemblage from this level that undercuts the current origin myth.

ABSOLUTE DATING

Bone samples were taken in 1996 for AMS radiocarbon dating by the Oxford radiocarbon laboratory (Pettitt 1998) from the early Upper Paleolithic and the uppermost two "Middle Paleolithic" levels (B and C). The dates (table 5.1) fall between about 36,000 BP and 30,000 BP and, therefore, cannot be differentiated in radiocarbon chronology. In part, this is due to the radiocarbon plateau between 38,000 BP and 32,500 BP (Jöris and Weninger 1996). Even where the dates can be chronologically ordered, however, there is sufficient temporal overlap to suggest that each assemblage was more or less contemporaneous with, at least, one other. In fact, only the actual stratigraphic sequence permits a secure temporal ordering of the assemblages.

Although the Gravettian appears to be quite early (table 5.1), the highly ephemeral Aurignacian level of seeming Krems-Dufour type, much better known and dated at the Crimean site of Siuren I (Demidenko et al. 1998), is late. The more accurate (that is, with smaller standard errors) Siuren I dates for the same assemblage type are (Otte et al. 1996b): Level Fb1, 29,950 ± 700 BP (OxA-5155) and Level Ga, 28,450 ± 600 BP (OxA-5154). These late dates are consistent with the earliest Upper Paleolithic reported from the northern Caucasus as well (Cohen and Stepanchuk 1999: 301).

The Crimean Micoquian of Kiik-Koba type provided two AMS dates younger than 30,000 BP (table 5.1), but these dates statistically overlap with the Aurignacian from Siuren I. Without the stratigraphy at Buran-Kaya III, the relative temporal sequencing of the two would not be possible. This indicates that, in spite of the sterile layer between part of the Aurignacian and the underlying Kiik-Koba occupation, this late Aurignacian and the Kiik-Koba Micoquian were essentially contemporaneous.

The dates from Level C at first glance appear inconsistent, but the radiocarbon plateau noted above shows that the dates are essentially the same. Whether a calibrated calendric date would be closer to 32,000 BP or to 38,000 BP is unknowable. What is important in this context is that this uncertainty applies to all standard radiocarbon and AMS dates in that time range, including most of the dated Early to Middle Aurignacian in Europe (Hahn 1993, 1995). Therefore Buran-Kaya III, Level C, might or might not be contemporaneous with the earliest Aurignacian in central Europe, at Geissenklösterle (Richter et al. 2000).

TABLE 5.1 AMS Radiocarbon Dates (on Bone) from Buran-Kaya III

Level	*Industry*	*Age (BP)*	*Lab Number*
17–18	Gravettian	30,740 ± 460	OxA-6882
20	Aurignacian (?)	34,400 ± 1200	OxA-6990
B1	Kiik-Koba	28,840 ± 460	OxA-6673
B1	Kiik-Koba	28,520 ± 460	OxA-6674
C	Early Streletskayan (?)	32,350 ± 700	OxA-6672
C	Early Streletskayan (?)	32,200 ± 650	OxA-6869
C	Early Streletskayan (?)	36,700 ± 1500	OxA-6868

SOURCE: After Pettitt (1998).

BURAN-KAYA III, LEVEL C

Although Level C is only one of four levels containing archaeological materials below the possible Aurignacian, the other three are either clearly Middle Paleolithic (Level B), or have too small samples to characterize safely (Levels D and E) (Marks and Monigal 2000). Level C, however, produced a reasonable artifact sample from a surface as close to primary context as possible. The 1996 excavations exposed about 10 m^2 of the Level C floor (figure 5.2), which consisted of clusters of flaking debris, debitage, and tools of the same raw material that appear to represent discrete reduction episodes. Although tools were found over the entire floor, they tended to be concentrated at the front of the cave, at and behind the drip line (figure 5.2). All artifacts were in pristine condition, without edge damage.

The total lithic sample consists of 2086 pieces, of which more than 90% measure less than 30 mm in greatest dimension. Pieces measuring less than 10 mm account for almost 30% of the total assemblage. Excluding the chips, the remaining sample consists of just over two hundred pieces, of which seventy-nine (37%) are either retouched tools or preforms of bifacial reduction. Not a single core was recovered, nor any debitage/blanks, which clearly would have come from such core reduction.

Technologically, virtually all the chippage, debitage, blanks, and other pieces of raw material indicate a flaking strategy wholly limited to bifacial reduction. Most pieces are extremely thin and incurvate, and almost all have small, lipped platforms. The few exceptions are blanks that appear to have come from early stages of bifacial preform shaping, as they have extensive dorsal cortex. A small percentage of the debitage/blanks has blade proportions: all are clearly bifacial shaping/thinning flakes or initial decortification flakes. Although the flint utilized in this assemblage ranges from translucent yellowish gray to opaque black, all items appear to have originated as either thin plaquettes or flattish, small pebbles. The nearest known source for such material is about 25 km distant.

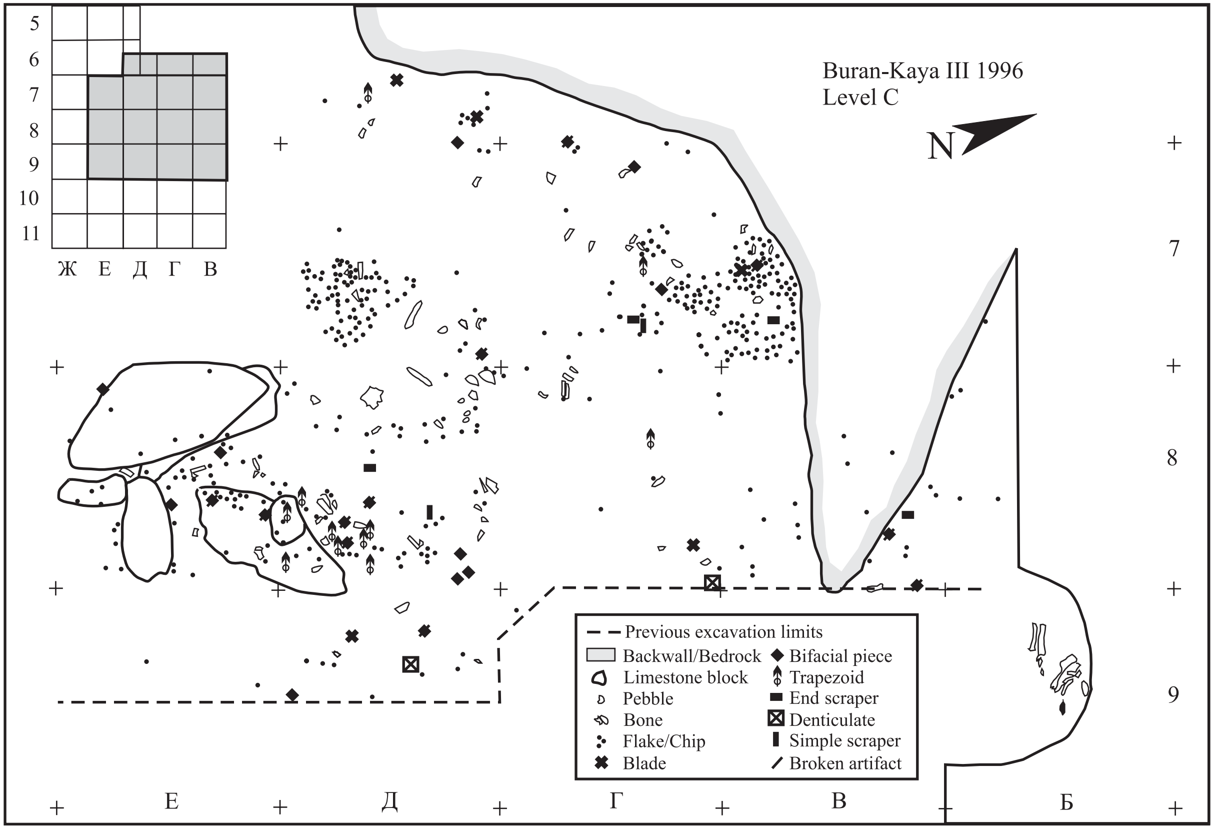

Figure 5.2. Plan of excavations of Buran-Kaya III, Level C.

The tool assemblage, including preforms, contains both bifacial (75%) and unifacial (25%) tools. Among the most striking is a small series of bifacial foliates. These are particularly well made by true bi-convex, bifacial reduction, with width:thickness ratios of over 4:1. In addition, they exhibit ground lateral edges. Most were broken during rejuvenation (figure 5.3: 4–6). Two complete examples (figure 5.3: 8, 9) have asymmetric outlines and thin, cortex-covered butts. A third complete example, morphologically closer to a point than to a foliate (figure 5.3: 7), also exhibits a small amount of cortex on one face of its base, ground edges adjacent to the base, and fine, parallel finishing retouch. In spite of the high quality of the retouch and the edge grinding, there is no evidence for pressure flaking on any of the pieces.

A second set of bifacial tools looks like unfinished foliates with one thin cortex-covered edge and one sharp bifacial edge (figure 5.3: 5, 6) but, in fact, they show clear use wear striations from extensive cutting (Hardy et al. 2001). These, too, are fragmentary and made on extremely thin plaquettes.

Among other bifacial or partly bifacial tools is an end scraper (figure 5.3: 3) made on a broken medial fragment of a foliate: the distal fragment of the original foliate is also present. There are also scaled pieces (figure 5.3: 1, 2), which were used as wedges on wood (Hardy et al. 2001). Most surprising, however, is a series (30% of tools) of microlithic trapezoidal tools that have two or three bifacially retouched edges (figure 5.4: 1–12). Although these certainly have a Mesolithic, or even more recent, microlith morphology, they clearly belong with the assemblage. They are made on thin bifacial thinning flakes of specific materials present in the assemblage, either as debitage or as tools, or both. The blank characteristics match those of the debitage in terms of dimensional attributes and technological characteristics, the retouch used is similar to that seen on the other tool classes, and a few of the pieces have been refit onto larger bifacial tools and preforms. In addition, partly finished examples of the trapezoidal tools are found (figure 5.4: 9–12). The trapezoids as a group are exceptionally standardized in appearance, size, and weight. They average 1.7 cm in length (S.D. = 0.17), 1.6 cm in width (S.D. = 0.11), 0.3 cm in thickness (S.D. = 0.04), and 0.88 g in weight (S.D. = 0.02). Use wear indicates they were hafted and used for cutting and/or chopping (Hardy et al. 2001). As such, these clearly were parts of a composite tool.

The unifacial tools include end scrapers with continuous bilateral retouch made on thin primary flakes (figure 5.4: 13–15), as well as a large end scraper with lateral retouch, again made on a primary flake. The latter piece was used for scraping wood at its distal end and for cutting along its lateral, retouched edge (Hardy et al. 2001). The other unifacial tools consist of a few bifacial thinning flakes with sections of steep retouch. In two cases, the retouch appears to have been done twice: once before a break and once after.

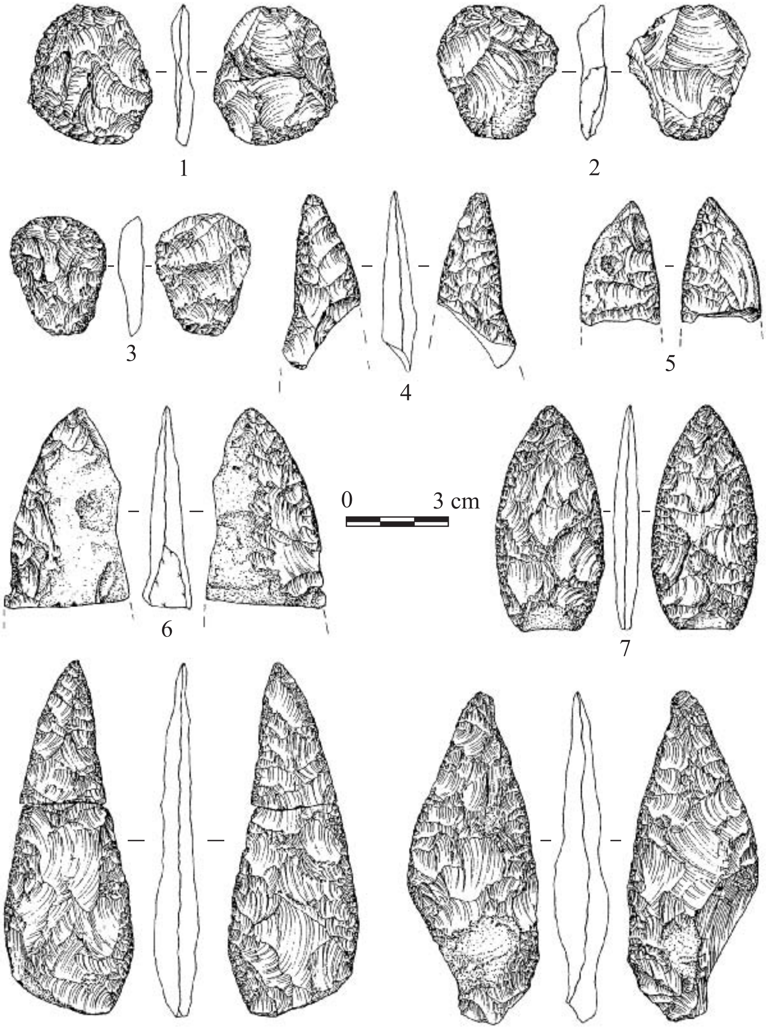

Figure 5.3. Buran-Kaya III, Level C: scaled pieces (1–2); end scraper on reworked foliate fragment (3); bifacial foliates (4–9).

In addition to the lithic tools, a number of worked bones, representing 20% of the small sample of recovered bone, was found, including bone tubes (d'Errico and Laroulandie 2000). One was made on a subadult wolf tibia (figure 5.4: 16); two others are on a rabbit tibia (figure 5.4: 17) and a femur (figure 5.4: 19). Two additional hare humeri (figure 5.4: 18, 20) are the by-products of bone tube manufacture. These five tubes were formed by sawing a series of adjoining notches around the bone's circumference, then snapping the bone in two. The original length of all the finished tubes would have been about 7 cm, despite the differences in length of wolf and hare long bones (d'Errico and Laroulandie 2000); that is, like the production of lithic artifacts, the production of bone tubes was also highly standardized. A bone handle made on an equid right metatarsal (figure 5.4: 21) was also recovered during the 1994 excavations (Yanevich et al. 1997). Although considerably more massive than the tubes, it was fabricated by the same method of notching and snapping as used on the tubes. Another equid metapodial seems to have been similarly modified but it was heavily gnawed, preventing a secure attribution. A few other bone fragments show signs of work: the fragments are small but the technique of modification is consistent with the larger worked pieces.

How can this assemblage be understood in terms of the current origin myth, as it applies in Europe? Given its dating, one of three possibilities exists: (1) it is some form of Aurignacian; (2) it is another example of a "transitional" industry—the work of acculturated but doomed Neanderthals; or, finally, (3) it is neither of the above. Deciding which interpretation is most reasonable depends on both what is present and what is absent from the Level C assemblage, relative to the Early Aurignacian and the "transitional" industries. There is no single diagnostic lithic feature that can be decisive. Initially, this assemblage was reported without a "cultural" attribution (Marks 1998). Subsequently (Marks and Monigal 2000), it was referred to provisionally as "Eastern Szeletian," using the Russian understanding of the term (non-Aurignacian early Upper Paleolithic industries with significant bifacial reduction, after, e.g., Efimenko [1956]; Anikovich [1992]). Because this particular term is not in widespread use and the assemblage differs considerably from the Szeletian of Hungary, Moravia, and Slovakia as currently understood, we have abandoned the term to avoid misinterpretations.

Early Aurignacian and even the "Pre-Aurignacian" (Bacho Kirian) lithic assemblages are recognized technologically by the presence of blade production and the absence of bifacial reduction. Typologically, these assemblages contain a heavy preponderance of "Upper Paleolithic" tools, such as end scrapers, burins, and marginally retouched blades (Kozłowski 1982). By post–40,000 BP, Aurignacian lithic tools include such diagnostic forms as carinated scrapers and Dufour bladelets (Hahn 1977). Along with the lithic materials, this post–40,000 BP Aurignacian also has split base and Mladeč bone points.

Buran-Kaya III, Level C lacks the technological traits of the Aurignacian and possesses specific typological traits that the Aurignacian does not. Typologically, while Buran-Kaya III, Level C has typical Upper Paleolithic end scrapers, it lacks burins and, of course, all marginally retouched blades and

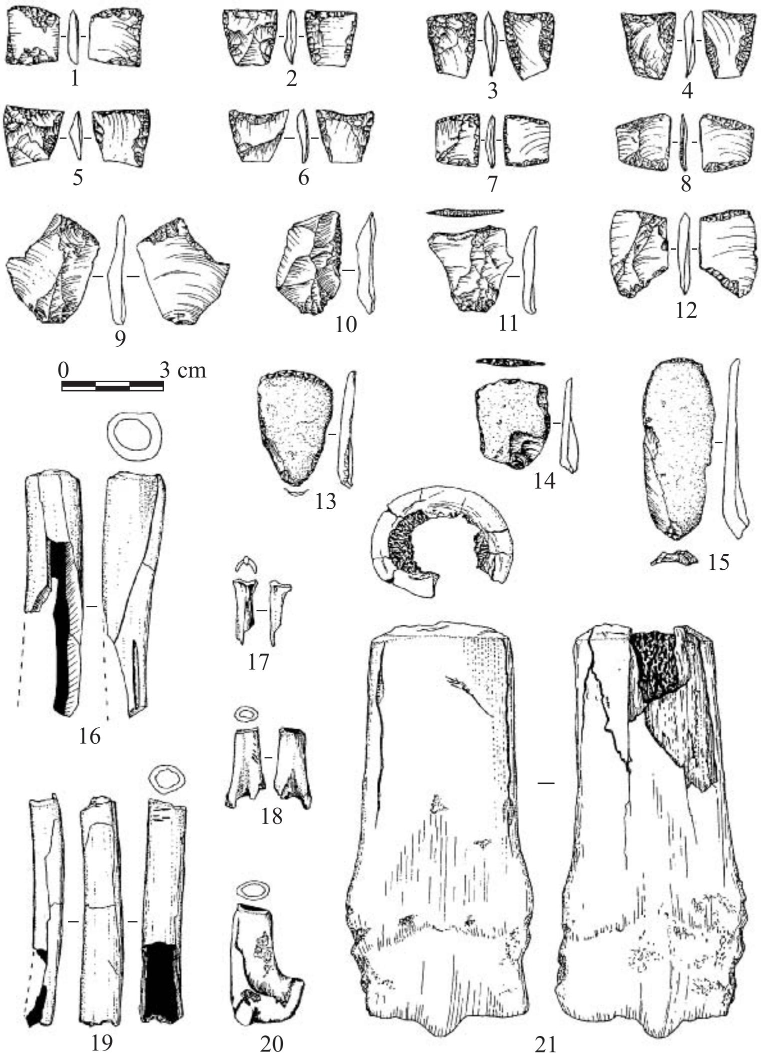

Figure 5.4. Buran-Kaya III, Level C: bifacial trapezoids (1–8); unfinished bifacial trapezoids (9–12); unifacial end scrapers (13–15); bone tube on wolf left tibia (16); bone tube fragment on hare left tibia (17); by-product of bone tube manufacture—hare right humerus proximal epiphysis (18); bone tube on hare right femur (19); by-product of bone tube manufacture—hare left humerus distal segment (20); bone handle on equid right metatarsal (21).

Dufour bladelets. There is not a sign of carination. At best, the unifacial tool component is generically Upper Paleolithic, but not Aurignacian.

Both Buran-Kaya III, Level C and the Early Aurignacian have bone tool technologies. Yet they are quite distinct from each other typologically; there are no bone points in Buran-Kaya III (even with much larger samples, there are not likely to be bone points) and bone tubes and handles occur only rarely in the Aurignacian and are usually made on bird bone or antler (Leroy-Prost 1975: 146–47; d'Errico and Laroulandie 2000).

In short, there is no basis for interpreting the Buran-Kaya III, Level C assemblage as being related, in any way, to the Aurignacian. In addition, there are no specific elements of Aurignacian lithic technology (e.g., large blade and bladelet production, carination) present at Buran-Kaya III that might be interpreted as borrowed. In fact, the bifacial geometric microliths of Buran-Kaya III, which are certainly a modern trait in prehistoric contexts, are lacking in the Aurignacian and cannot have been imitated from it.

Can the Buran-Kaya III, Level C assemblage be interpreted as "transitional" in the current sense of terminal Middle Paleolithic? One of the marked distinctions between the Middle Paleolithic transitional industries (e.g., Szeletian, Jerzmanowician, Jankovician) and the Aurignacian is the shift from stone spear points to bone or ivory ones (Knecht 1993: 137). In central Europe, bifacial foliates characterize the transitional industries, showing their link to a Micoquian base (Kozłowski 1990). The Buran-Kaya III, Level C assemblage is characterized, even dominated, by the production of bifacial foliates. Virtually all blanks for unifacial tools are derived from bifacial reduction. There could be no greater presence of bifacial technology than that seen here. On this level, the assemblage is close to the central European transitional industries—actually, an exaggeration of them. Yet does the presence of bifacial lithic reduction and foliate points, per se, indicate nonmodern behavior? The presence of both ground edges on the foliates and of small, symmetric bifacial points, both missing from transitional industries, makes this particular bifacial technology similar to the American Paleo-Indian point production. Although organic points served the Aurignacian well, bifacial stone points were equally effective for the American Indians, from Clovis on. Is a Clovis point less modern than a split-base bone point?

Although the Level C assemblage is highly bifacial, it lacks all other technological and typological components normally associated with either the central European or eastern European Micoquian transitional industries: a rich variety of single and multi-edged side scrapers, unifacial points, ventral thinning of retouched tools, denticulates, and discoidal, "primitive" prismatic, or even Levallois-related core reduction. No transitional assemblage has ever contained bifacial geometric microliths or any other element indicative of complex composite tools.

Although a few isolated bone tools have been recovered from transitional contexts (Valde-Nowak 1991), in no case has any transitional assemblage contained evidence for on-site, consistent bone working technology as that found at Buran-Kaya III.

It is only the bifacial technology itself that links the Buran-Kaya III, Level C assemblage to the group of transitional industries of central and eastern Europe and, even then, the Buran-Kaya III technology has traits unknown in those industries. Although superficially this is a strong link, it is only so if the possibilities are confined to a dichotomy between Aurignacian (modern) and anything with some possible base in the Middle Paleolithic (nonmodern). From our point of view, this dichotomy, so necessary for the current origin myth, is not reasonable, and so, along with reasons cited above, this technological link is insufficient to place Buran-Kaya III, Level C into the transitional industry group.

If the Buran-Kaya III, Level C assemblage is neither Aurignacian nor an example of a terminal Middle Paleolithic transitional industry, what is it? The most parsimonious interpretation is that it is a true early, non-Aurignacian Upper Paleolithic, in the sense that its elements may be reasonably seen as resulting from behavior comparable to that assumed for traditional Upper Paleolithic peoples:

1. The unifacial tools are consistent with traditional Upper Paleolithic types;
2. Although bifacial reduction has a Middle Paleolithic association, this technology is highly specialized, wholly bifacial, and contains specific elements known elsewhere only from fully modern cultural contexts;
3. The standardized geometric microlith production implies the presence of complex, composite tools. The use wear even indicates that these microliths were not simple barbs but, in fact, were part of a composite cutting tool. Such tools are generally associated with the late Upper Paleolithic/Mesolithic rather than with the early Upper Paleolithic; and
4. The presence of a consistent bone working technology that produced, at least, two types of tools—tubes and handles—is consonant with criteria used to describe the range of expected Upper Paleolithic behavior.

What European Upper Paleolithic traits does the Buran-Kaya III, Level C lack? Most notably, there is no blade technology. Yet, as recently demonstrated (Bar-Yosef and Kuhn 1999; Monigal 2001), blade production is situational and occurred in numerous prebehaviorally modern contexts, whereas it is missing or rare in many other, clearly behaviorally modern contexts, such as the Sebilian (Vignard 1928), Folsom (Amick 1999), or the Iberian Early Magdalenian (Marks and Mishoe 1997). To insist on its presence before an interpretation of modern behavior is possible harks back, at best, to mid-twentieth-century thinking (e.g., Oakley 1964).

There is also no evidence for art at Buran-Kaya III, Level C. Given the ephemeral occupation, its presence would be highly unusual. There are no shell or bone beads, unless the bone tubes served a similar function. If, however, every site had to have direct evidence for art and/or personal ornaments before it could be classified as Upper Paleolithic, only a small fraction of the presently recognized Upper Paleolithic sites would be included.

Finally, Buran-Kaya III, Level C lacks a direct association with an anatomically modern fossil, which is also true for the Aurignacian until as late as 31,500 BP (Zilhão and d'Errico 1999). Of course, it also lacks a direct association with a premodern fossil. In fact, most early Upper Paleolithic sites lack direct fossil associations.

In sum, the traits present at Buran-Kaya III, Level C indicate an Upper Paleolithic status, and the missing Upper Paleolithic traits are also missing from many, perhaps most, sites traditionally recognized as Upper Paleolithic. If Buran-Kaya III, Level C is Upper Paleolithic, as we believe, then the Aurignacian is not the only material manifestation of modern behavior to be found in Europe before 30,000 BP. In addition, the highly developed production of fine bifacial foliates and bifacial points is found in the general region, among the Kostenki-Streletskayan Upper Paleolithic assemblages of the Middle Don (Bradley et al. 1995). Although the latter assemblages possess a wide range of attributes not found at Buran-Kaya III, Level C, a full range of activities and their associated tools should not be expected at Buran-Kaya III, given its highly ephemeral occupation. Although additional materials are desirable, this assemblage appears most likely to be related to the early Streletskayan.

THE AURIGINACIAN AND BURAN-KAYA III IN BROADER CONTEXT

Because Crimea lies on the southeastern edge of Europe, bordering the Near East, a larger view than that afforded solely by Europe is appropriate. From a non-European perspective, the insistence that the Aurignacian was the first and quintessential modern material culture seems peculiar, as its distribution excludes the continent where anatomically modern people evolved. Although it has been postulated that modern behavior did not arise, even in Africa, until about 50,000 BP, it is also suggested that it was the movement of behaviorally modern Africans out of Africa that spread such behavior to the rest of the world (Klein 1998). As there is not the slightest trace of any Aurignacian in Africa, the material culture of those leaving Africa must have been non-Aurignacian. To avoid this contradiction, it is necessary to have anatomically modern, but still "precultural," people move out of Africa well prior to 50,000 BP and to have them become modern (Aurignacian) well away from Africa. The presence of anatomically modern, but culturally Middle Paleolithic, people in the Levant at about 100,000 BP is well documented (Vandermeersch 1981; Grün and Stringer 1991). Unfortunately, the fossil evidence stops there, and it is not until about 65,000 years later that the modern Cro-Magnon of Europe is found.

Because the current myth calls for a population replacement of culturally Middle Paleolithic Neanderthals specifically by Aurignacian Cro-Magnons, the geographic origin of the Aurignacian is important. As noted above, it was not in Africa. The Levant lies between Africa and Europe, and it is there that some proponents of this myth would place the original Aurignacian (Stringer and Gamble 1993: 202; Mellars 1996: 418–19). In fact, an Aurignacian has been long recognized in the Levant (Garrod 1929) and is a potential candidate for the Aurignacian that spread into Europe. Its geographic distribution and dating, however, clearly leads to the conclusion that it was intrusive into the Levant from the north (Marks and Ferring 1988; Kozłowski 1992; Bar-Yosef and Belfer-Cohen 1996: 145).

The earliest Levantine Upper Paleolithic, the Ahmarian, is in no way Aurignacian (Gilead 1981; Marks 1981), is dated well before the appearance of the local Aurignacian (Marks and Ferring 1988), and can be traced as a continuum from the initial Upper Paleolithic at 47,000 BP to the late Ahmarian at about 11,000 BP (Coinman 2000). The Ahmarian, however, lacks those Aurignacian traits that have been correlated strongly with modern behavior: art; a developed bone technology indicative of composite tools; personal ornaments; and a provable, direct association with anatomically modern fossils (e.g., Mellars 1973, 1996; White 1982; Stringer and Gamble 1993). Yet no one questions that the Ahmarian represents the material remains of behaviorally modern people. In comparison, the Buran-Kaya III, Level C assemblage is arguably more clearly modern than is the Ahmarian.

The Levant provides another line of evidence that calls into question part of the current origin myth, that all technologically and typologically Middle Paleolithic industries were made by Neanderthals. The Tabun C type Levantine Mousterian is firmly associated with anatomically modern fossils at both Qafzeh and Skhul (Vandermeersch 1981), but it is wholly and classically Middle Paleolithic in character (Garrod and Bate 1937). The relevance of this to the origin myth is clear. For the Aurignacian to have "spread like plague" to other anatomically modern people, there must have been some anatomically modern—but still nonsymboling—people well north of the Levant when the first epiphany of symboling took place.

What was their material culture? Might it have been highly variable, as Tabun C type Mousterian has no close links to its contemporary manifestations in immediately adjacent Northeast Africa (Marks 1990)? Whether uniform or variable as in the Levant, it would have been little different from the material culture produced by Neanderthals. Therefore, without actual, direct fossil associations, it is impossible to assign a human type as the maker of most Middle Paleolithic industries in eastern Europe and central Asia.

Such associations do exist, as for the Eastern Micoquian of Kiik-Koba and Ak-Kaya types in Crimea and the north Caucasus (Bonch-Osmolowski 1925; Hoffecker 1999), but these industries tend to show none of the "progressive" features of the so-called transitional industries. If the Levantine Mousterian was produced by both Neanderthals and anatomically modern people, why not the Micoquian or the Levallois Mousterian of the southern Caucasus or the Altai? From where did the bifacial technology at Buran-Kaya III derive, if not from some Micoquian-like base? The hard hammer macroblade technology at Kara Bom (Derevianko et al. 1998d) might well have a base in the elongated blank producing Middle Paleolithic Levallois technology of the southern Siberia (Schäfer and Ranov 1998). Would such a connection make it terminal Mousterian—the work of Neanderthals? If made by anatomically modern people with recently acquired modern culture, would it not be true Upper Paleolithic, in spite of its Middle Paleolithic roots and its lack of Aurignacian traits?

Although much additional work is needed to elucidate the relationship between the material culture of populations of anatomically modern people who crossed the boundary from noncultural to symbolically cultural behavior, it is already clear that the Aurignacian was not the only path taken.

ACKNOWLEDGMENTS

Recent excavations at Buran-Kaya III were made possible by a grant from the U.S. National Science Foundation (SBR-9506091), with additional support from INTAS (93-203), and in cooperation with Drs. V. P. Chabai and Yu. E. Demidenko, Crimean Branch of the Institute of Archaeology. As always, we are warmly grateful to the Crimean Branch of the Institute of Archaeology, Simferopol, Ukraine, for their continuing support.

6

The Beginning of the Upper Paleolithic on the Russian Plain

L. B. Vishnyatsky and P. E. Nehoroshev

CHRONOLOGICAL FRAMEWORK AND GEOGRAPHICAL DISTRIBUTION OF THE RELEVANT SITES

The period encompassing the Middle-Upper Paleolithic transition broadly corresponds to the Middle Valdai Megainterstadial (i.e., Middle Würm, Oxygen Isotope Stage 3; also known as the Mologa-Sheksna Interstadial). Lasting from about 55 to 25 ka, the Middle Valdai Megainterstadial separates the early (Kalinin) and late Valdai (Ostashkov) glacial stages (Zarrina 1991; Arslanov 1992). Late Middle Paleolithic sites on the Russian Plain date to the first half of the Middle Valdai Megainterstadial, whereas early Upper Paleolithic sites are known only from the second half. Assemblages older than 55 ka or younger than 25 ka are beyond the scope of this chapter.

Sites dating to the early stages of the Upper Paleolithic, as well as late Middle Paleolithic assemblages, are primarily concentrated in the southwestern and southern parts of the Russian Plain. Some early Upper Paleolithic sites are also known from the central part of the region, and a few may be found as far north as 65°, near the western foothills of the northern Ural Mountains (figure 6.1). In the west, where glaciation is thought to have been extensive, late Middle and early Upper Paleolithic assemblages are not known north of 52°. The two areas of the Russian Plain where most of the relevant sites are situated are, in the west, the Dniester basin, including adjacent parts of the upper Dnieper basin, and, in the south, the middle and lower Don basin. Single assemblages are known in the central part of the Plain (e.g., the Oka and Desna basins) and, as already mentioned, the northeast. The Crimean Peninsula, most of which belongs geographically to the Russian Plain, represents a very specific cultural area with extremely rich Paleolithic materials (see Marks and Monigal, this volume).

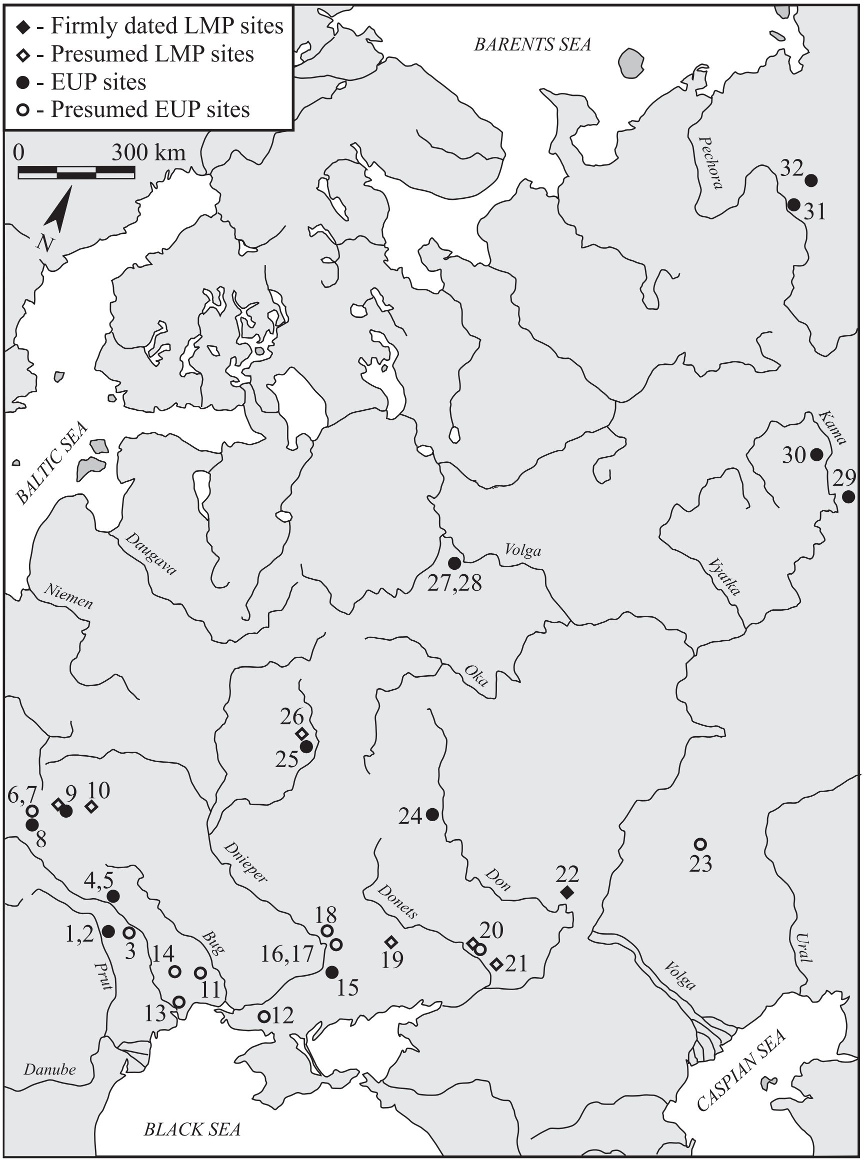

Figure 6.1. Distribution of late Middle Paleolithic (LMP) and early Upper Paleolithic (EUP) sites on the Russian Plain. *Key:* 1, Korpatch; 2, Brynzeny 1; 3, Klimautsy 1; 4, Moldova 5; 5, Korman 4; 6, Ivanychi; 7, Chervony Kamen; 8, Koulichivka; 9, Zhornov; 10, Tochilnitsa; 11, Anetovka 13; 12, Peremoga 1; 13, Zeleny Khutor; 14, Leski; 15, Mira; 16, Osokorovka; 17, Vorona 3; 18, Nenasytets; 19, Belokuzminovka; 20, Biryuchia Balka; 21, Kalitvenka; 22, Shlyakh; 23, Nepryankhino; 24, Kostenki; 25, Khotylevo 2; 26, Betovo; 27, Sungir; 28, Rusanikha; 29, Zaozerie; 30, Garchi 1; 31, Byzovaya; 32, Mamontovaya Kurya.

PALEOGEOGRAPHICAL BACKGROUND

In local stratigraphic units, the Middle Valdai Megainterstadial is correlated with the Leningrad horizon in the northwest of Russia, the Monchalovo horizon in the central part of the Russian Plain, and the Dofinovka horizon in the Ukraine. The Megainterstadial is usually divided into several warm and cold substages, the names and dates of which vary from area to area and author to author (table 6.1). Unfortunately, some of the names have been used in contradictory ways. For example, some authors have chosen the term "Kashin" to designate a cold period lasting from 42 to 39 ka (Chebotareva and Makarycheva 1982), whereas others have used the same label for a subsequent warm stage lasting from 37.5 to 34 ka (Spiridonova 1991; Zarrina 1991). The term "Grazhdanski" has been used in similarly contradictory ways to designate different substages.

To avoid any misunderstandings, we use ordinal numbers to refer to substages within the Megainterstadial, namely Middle Valdai Stages (MVS) 1–5. Most researchers agree that the Megainterstadial consisted of three relatively warm periods separated by two colder events. The climatic optimum marking the beginning of the Megainterstadial (MVS 1) may be correlated (at least in part) to the Moershoofd in western Europe. Around 40–42 ka MVS 1 was interrupted by a cold event (MVS 2), which was followed by another optimum (MVS 3) roughly coeval with the Hengelo (about 35–39 ka). The second cold period (MVS 4), having correlates in both western Europe and Siberia, ended around 32 ka. A final period of climatic amelioration (MVS 5) lasted for about 7 ka. Climate began to deteriorate around 24–25 ka, leading up to the Last Glacial Maximum. It is worthy of note that nearly all researchers agree on the chronological limits of MVS 5. To the west of the Russian Plain, MVS 5 is known variously as the Denekamp, Stillfried B, or Arcy event.

MVS 1, 3, and 5 are usually considered to represent typical interstadial conditions. Judging from available palynological data, paleolandscapes of MVS 1 were dominated by periglacial forest-steppes (with some admixture of broadleaf trees in the Dniester-Prut area), whereas MVS 3 and 5 witnessed warmer climates that resulted in an expansion of arboreal vegetation. In the Don-Oka area, particularly favorable conditions are thought to have occurred during MVS 3 (Spiridonova 1991: 185; Bolikhovskaya 1995: 188), whereas in the western Russian Plain, the maximum spread of deciduous forests is reported for MVS 5 (Bolikhovskaya 1995: 118). Of special importance for our understanding of the Middle-Upper Paleolithic transition may be a xeric phase preceding and/or partly coinciding with the beginning of MVS 3. According to Levkovskaya (1999), this phase has been traced palynologically over a vast area of temperate Eurasia from the Transcarpathians

TABLE 6.1 Major Subdivisions of the Middle Valdai Megainterstadial

Climatic Signal	Source: Chebotareva and Makarycheva 1982[1]	Zarrina 1991; Spiridonova 1991	Arslanov 1992	Bolikhovskaya 1995[2]	Present Chapter
Warm	Dunaevo 32–25	Dunaevo interstadial 32.5–24	Dunaevo interstadial 32–25	Dniester interstadial 32–24	MVS 5 32–25
Cold	Shensk 35–32	34–32.5	Leyascieme 36–32		MVS 4 35–32
Warm	Leningrad and Shapurovo[3] 39–36	Kashin 37.5–34	Grazhdanski interstadial 42.5–36	Molodova interstadial 39–35	MVS 3 39–35
Cold	Kashin 42–39	40–37.5	Shapki 45–42.5		MVS 2 42–39
Warm	Krasnogorsk 47–42	Grazhdanski interstadial 50–40	Krasnogorsk interstadial 58–45	Bailovo interstadial 50–44	MVS 1 50–42

NOTE: All ages given in ka. Missing entries signify that authors did not formally classify or provide ages.
[1]Chart is based on materials from the northern Russian Plain only (glacial area).
[2]Chart mainly reflects the situation in the southwest Russian Plain (Dniester and Prut basins).
[3]These two relatively warm periods are supposed to have been separated by a short-term fall in temperature designated as the Surozh phase.

to southern Siberia (including the Caucasus and the Russian Plain) and can be dated to 38–39 ka.

To conclude this very brief survey, we note that paleomagnetic excursions have been recorded in both the lower and uppermost strata of Megainterstadial deposits on the Russian Plain. The Kargopolovo excursion is dated to around 42–45 ka and the Mono excursion to around 24–25 ka. The presence of these excursions in the stratigraphic sections at several archaeological sites (e.g., Molodova 5, Kostenki, Shlyakh) provides both independent age estimates and points of correlation between sites.

EARLY UPPER PALEOLITHIC INDUSTRIES

Megainterstadial Upper Paleolithic industries from the Russian Plain are divided into two groups depending on their age (table 6.2). Those older than

MVS 5 (older than 32 ka) are designated as initial Upper Paleolithic and those postdating this boundary are combined under the label "late early Upper Paleolithic." It should be stressed that this division does not necessarily mean that the late early Upper Paleolithic industries were more developed or more advanced than those attributed to the initial Upper Paleolithic.

Initial Upper Paleolithic

On the Russian Plain, no more than a dozen archaeologically representative assemblages can be confidently dated to the initial Upper Paleolithic. The majority of these are concentrated within the borders of a small rural district (Kostenki) on the middle Don. One of the most conspicuous features of the initial Upper Paleolithic on the Russian Plain is its cultural diversity. Indeed, assemblages predating 32 ka have been assigned to several different archaeological cultures, based on the obvious technological and typological originality of the industries. Another interesting feature, making the initial Upper Paleolithic on the Russian Plain distinct from the rest of Europe, is the complete absence of the Aurignacian.

The earliest of the Kostenki assemblages are believed be older than 32 ka (table 6.2). This age assignment is supported both by a number of conventional and AMS radiocarbon dates (Sinitsyn et al. 1997) and by the stratigraphic position of some cultural layers within a fossil soil (lower humic bed) below a well-expressed volcanic ash horizon. The ash horizon is connected with one of the eruptions of the Phlegrean Fields in Italy and may be as old as 35–38 ka (Sinitsyn 1996: 279; Hoffecker 1999: 137). It would appear that the first Upper Paleolithic industries appeared along the middle Don no later than MVS 3. Some of the cultural layers found in the upper humic bed at the Kostenki sites, above the ash horizon, may well have ages in excess of 30 ka. The lowermost part of this fossil soil has been dated to about 32 ka, which supports the hypothesis that this soil formed under the warm conditions of MVS 5.

Most of the initial Upper Paleolithic sites from Kostenki are usually classified into two separate archaeological cultures, the Streletskian and the Spitsynian. In addition, there are several early assemblages of unclear affiliation, including layer IVb at Kostenki 14, which contains an extremely well-developed bone industry having no parallels among contemporary sites (Sinitsyn 2000).[1] The Streletskian is distinguished by the presence of bifacially worked triangular points with concave (figure 6.2: 5, 8, 9, 12) or, less frequently, straight bases (Rogachev 1957; Rogachev and Anikovich 1984: 179–81; Anikovich 1992: 226–31, 2000; Bradley et al. 1995). Both initial

1. Throughout this chapter, sites are designated by Arabic numerals and layers/assemblages by Roman numerals (e.g., Kostenki 17/II).

TABLE 6.2 Provisional Chronology for Early Upper Paleolithic Assemblages on the Russian Plain

		Location of Assemblage			
Age (ka)	Stage	West and Southwest	South	Central	Northeast
24			*Biryuchia Balka*	Khotylevo	
		Korpatch IV	*2/III*	Sungir	
	Late early	Koulichivka II		Rusanikha	
26		Brynzeny III			
	Upper	Korman 4/VII	Kostenki 17/I		
		Molodova 5/	Kostenki 16		
28	Paleolithic	VIII	Kostenki 8/II		
		Ivanychi	Kostenki 1/III		Garchi 1
		Zhornov IIa			Byzovaya
30					
		Molodova 5/	Kostenki 15		
		IX–X	Kostenki 14/II		
32			Kostenki 14/III		
		Mira II			
		Kulychivka III	*Biryuchia Balka*		Zaozerie
34			*1v/VII*		
	Initial				
36	Upper		Kostenki 1/V		
		Korman 4/X	Kostenki 12/II		
	Paleolithic	Molodova 5/	Kostenki 17/II		
38		Xa, Xb	Kostenki 12/III		
			Kostenki 14/IVb		
40					

NOTES: Based on stratigraphic positions and radiocarbon determinations (sites with no absolute dates are shown in italics). As in the text, Arabic and Roman numerals are used to designate sites and cultural layers, respectively.

and late early Upper Paleolithic Streletskian assemblages also include bifacial points with round bases (figure 6.2: 10, 11), short sub-triangular end scrapers with or without ventral thinning (figure 6.2: 1–4), chisel-like tools including typical *piéces esquillées* (figure 6.2: 16), Mousterian-like retouched points, and simple, convergent, and angular side scrapers (figure 6.2: 17, 18). Most cores are flat, and prismatic forms are extremely rare. Flakes strongly predominate over blades, and the majority of tools are made on

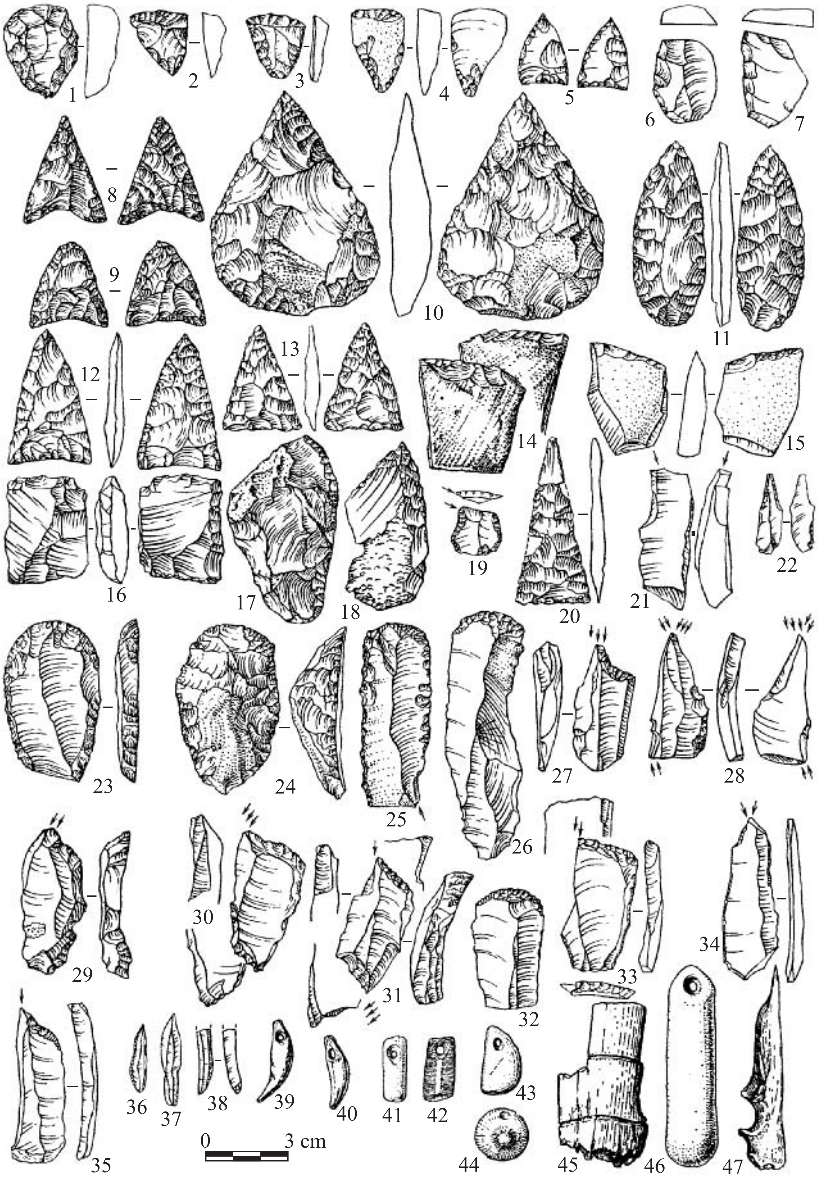

Figure 6.2. Artifacts associated with the Streletskayan (1–22) and Spitsynian (23–47) cultures. Kostenki 12/III (1, 10, 14, 17); Kostenki 1/V (3–7, 12, 15, 19, 22); Kostenki 6 (8, 9); Sungir (11, 13, 16, 18, 20, 21); Kostenki 17/II (23–47). After Rogachev and Anikovich (1984).

flakes. Overall, the Streletskian is characterized by many Middle Paleolithic features, which are perceptible not only in the earliest sites (Kostenki 12/III, Kostenki 6, Kostenki 1/V), but also in those postdating 32 ka and situated far to the north and south of Kostenki (see below). Bone tools and ornaments are absent from initial Upper Paleolithic Streletskian assemblages, although they are well represented in some late early Upper Paleolithic examples (e.g., Sungir).

The Spitsyn culture, in contrast to the Streletskian, is known only from Kostenki and only from under the ash horizon. There is one definitive assemblage representing this culture (Kostenki 17/II), and one candidate assemblage (Kostenki 12/II). The stone industry of Kostenki 17/II, containing about ten thousand items, is very distinctive against the background of contemporary Streletskian sites. At the same time, it has no peculiar tool types (*fossiles directeurs*), which would allow us to put the search for analogies on firmer ground. As a consequence, it is difficult to demonstrate convincingly that any other assemblage should be considered Spitsynian. Unlike the Streletskian, the Spitsynian at Kostenki 17/II lacks any "archaic" features. Despite its very early age, it looks to be a full-fledged Upper Paleolithic, with prismatic cores being the only form of nuclei and blades dominating among the blanks. The tools consist primarily of retouched blades, end scrapers on blades with subparallel, unretouched edges (figure 6.2: 23–26, 32), and burins (figure 6.2: 27–31, 33–35). The latter are especially numerous, comprising about half of the 330 objects with secondary retouch. Characteristic of the assemblage is a type of burin on oblique retouched truncations. There are also isolated retouched microblades (figure 6.2: 36–38). The collection includes a few bone tools (figure 6.2: 47) and about fifty pendants with perforated holes made from arctic fox canines ($n = 37$), belemnites, stone, fossil shells, and corals (figure 6.2: 39–44, 46). It has recently been proposed that the Spitsynian may be considered one of the oldest Aurignacoid industries in Europe (Anikovich 1999). We are inclined to agree with Sinitsyn (2000), however, who argues that use of the term "Aurignacian" (in any form) to describe Kostenki 17/II is unwarranted.

Beyond the Kostenki area, there are very few archaeologically representative assemblages that could be placed definitely within the initial Upper Paleolithic. Most significant of those excavated and published before 2000 is probably the industry of layer III at Koulichivka in the upper Dnieper basin (Savich 1975: 15–36, 1987; Cohen and Stepanchuk 2000; Meignen et al., this volume). The lithic assemblage consists of about 6,500 specimens, including nearly one hundred cores (both flat and prismatic) and more than two hundred tools made primarily on blades. The tool kit is dominated by various end scrapers (including carinated and nosed forms), as well as burins, retouched blades, and blades with retouched truncations. The combination of end scrapers of Aurignacian aspect with numerous Levallois points allows us to link the industry with the Bohunician (Cohen and Stepanchuk 1999, 2000; Geneste et al. 1999; Meignen et al., this volume; Svoboda, this volume), whereas its position beneath a fossil soil attributed to Stillfried B may be indicative of an age not younger than early MVS 5. This age assignment is partly corroborated by a radiocarbon date of about 31 ka reported for layer III (Savich 1987), although there are some doubts about the provenance of the sample used for dating (Anikovich 2000; Meignen et al., this volume).

Assemblages such as Molodova 5/Xa,b and Korman 4/X (in the Dniester basin), although undoubtedly dating to MVS 3, are extremely small and difficult to classify (Chernysch 1977: 21, 1987: 25–26). In fact, it is impossible to say whether they are Middle or Upper Paleolithic. More tractable is the assemblage from Biryuchia Balka 1v/VII (the Seversky Donets River mouth), which occurs below a fossil soil of presumed MVS 5 age. This site yielded a number of unfinished, bifacially worked triangular points resembling Streletskian specimens (Matioukhine 1998). The assemblage may be as old as the earliest Kostenki sites, but more data are needed—absolute dates, palynological and paleomagnetic analyses—to substantiate this hypothesis. The same applies to the lower artifact-bearing levels at the site of Nepryakhino. This site, located just north of the lower Volga, is known for its numerous leaf-shaped bifacial tools of Szeletian appearance. It is regarded by the excavator as "final Mousterian-early Upper Paleolithic" (Zakharikov 1999). Another possible candidate to be included in the initial Upper Paleolithic sites is Mira, located in the lower Dnieper area (Cohen and Stepanchuk 2000). The lower level is thought to be older than 30 ka and has yielded a small collection of stone artifacts with several points of Gravettian aspect (V. Cohen and V. Stepanchuk, pers. comm.). Finally, a very early age has been suggested for the site of Zaozerie, on the Chusovaya River in the northeastern part of the Russian Plain near the western foothills of the Ural Mountains (58° N). A small Upper Paleolithic assemblage with end scrapers and retouched blades was found here in the upper part of a buried soil dated to 34 ka (Pavlov et al. in press). Equally old or even older finds come from Mamontovaya Kurya on the Pechora River (66° N), where the number of radiocarbon dates ranging from 34 to 38 ka exceeds the number of artifacts, represented by a bifacial fragment and a mammoth tusk preserving supposed stone tool cutmarks (Pavlov and Indrelid 2000).

Late Early Upper Paleolithic

Of the two Kostenki cultures noted above, only the Streletskian transcends the boundary separating initial and late early Upper Paleolithic. The Streletskian also transcends the geographic borders of Kostenki village during the late early Upper Paleolithic, being found not only at Kostenki 11/V and

12/Ia, but also at a number of localities to the south and north. In the south, the late early Upper Paleolithic Streletskian is represented by level III at Biryuchia Balka 2 (at the Seversky Donets River mouth), which contains a rich collection of both partially and fully finished triangular bifacial points with concave or straight bases, and short subtriangular, ventrally thinned end scrapers. However, the dating of this assemblage remains problematic; a post-MVS 5 age cannot be excluded (Matioukhine 1998: 491). Strange as it may seem, the same applies to the site of Sungir (Bader 1978), in the center of the Russian Plain, famous for its numerous ornaments and art objects and widely believed to be as old as 27–28 ka (e.g., White 1993a,b). Recent direct AMS radiocarbon dates on human bones from three burials associated with the cultural layer at the site suggest an age less than 25 ka (Pettitt and Bader 2000). Possibly coeval with Sungir is the site of Rusanikha, situated 8 km to the west in an identical geological context (Mikhailova 1985). The stone inventories of Sungir and Rusanikha are very similar, although Rusanikha contains none of the bifacial points found at Sungir (figure 6.2: 11, 13, 20) and considered a hallmark of the Streletskian. To the northeast, bifacial points and Streletskian short, subtriangular end scrapers were found at the site of Garchi 1 in the Kama basin (59° N) and are reliably dated to 28–29 ka (Pavlov and Indrelid 2000; Pavlov et al. in press). The contemporaneous assemblage from Byzovaya Cave on the Pechora River (65° N) used to be classified as Streletskian (Kanivets 1976), but subsequent work has rejected this affiliation (Anikovich 1986). The stone inventories from late early Upper Paleolithic Streletskian assemblages do not differ substantially from initial Upper Paleolithic examples, although both technologically and typologically Upper Paleolithic elements become somewhat more common. A late early Upper Paleolithic Streletskian bone industry is known only from Sungir, where it consists of diverse utilitarian (e.g., points, hoes, lances from straightened mammoth tusks), decorative (e.g., more than ten thousand beads, pendants, bracelets), and art objects (e.g., animal figurines).

Another late early Upper Paleolithic entity distinguished at Kostenki is the Gorodtsovian, or Gorodtsov culture (Rogachev and Anikovich 1984: 183–85; Sinitsyn 1996), which seems to have appeared later than the Spitsynian and Streletskian. Nonetheless, the oldest Gorodtsovian assemblages should be placed at the boundary between the initial and late early Upper Paleolithic, as is indicated by stratigraphic positions at the base of the upper humic bed (see above) and new radiocarbon dates of $30{,}080 \pm ^{590}_{550}$ BP (GrN-21802) and $31{,}760 \pm ^{430}_{410}$ BP (GrA-13288) obtained for Kostenki 14/III (Sinitsyn 2000). Although the affiliation of the Kostenki 14/III industry with the Gorodtsov culture is unlikely, layer III must have formed not much earlier than the overlying layer II containing a typical Gorodtsovian inventory. Despite their relatively late age, the Gorodtsovian, like the Streletskian, is characterized by a flake-oriented technology and contains many tools that would look more natural in the Middle Paleolithic. For example, Kostenki 14/II contains many retouched artifacts of Mousterian appearance, including diverse side scrapers (figure 6.3: 16), points (figure 6.3: 15), limaces (figure 6.3: 1, 17), and knives, which altogether comprise about half of all tools (Sinitsyn 1996: 282). Such tools are also well represented at Kostenki 15 and are still recognized at Kostenki 16, which is probably the latest known Gorodtsovian assemblage. In addition, all of the abovementioned sites contain diverse collections of scaled pieces (figure 6.3: 2–8) and end scrapers (figure 6.3: 11–14), whereas burins and bifacially worked tools are either rare or absent. The Gorodtsov culture is famous for its bone inventory, consisting of many utilitarian and decorative objects, such as points (including one with a zoomorphic head), needles, pendants, and beads. Particularly characteristic are the so-called shovels with ornamented handles made on mammoth long bones or scapulae (figure 6.3: 18).

In addition to the appearance of the Gorodtsovian at Kostenki, the beginning of MVS 5 seems to have marked the spread of the Aurignacian assemblages onto different parts of the Russian Plain and neighboring areas. These assemblages, however, are few in number and isolated. One of the most representative industries is that of Kostenki 1/III. The collection consists of more than 4,500 stone and bone items. The technology is clearly blade-oriented. Tools (about two hundred) are dominated by retouched microblades (figure 6.3: 21–23), including those with alternate retouch (i.e., dorsal retouch on one edge and ventral on the opposite edge). There are also thick (carinated) end scrapers of typical Aurignacian appearance (figure 6.3: 19), end scrapers on large blades with retouched edges (figure 6.3: 25), various burins and scaled pieces, single perforators, and small side scrapers. Split-base bone points, characteristic of many Aurignacian industries, are absent; a surprising feature, given the rich bone inventory. It includes awls, polishers, a perforated pendant made from a fox canine, and engraved ivory rods and points. Of the thirteen radiocarbon dates obtained from different labs, eight are indicative of an age around 25–26 ka, whereas two dates suggest the assemblage may be as old as 32 ka. For the time being, it is impossible to choose between these two alternative age estimates, although palynological and stratigraphic data are thought to be more consistent with the earlier date (Sinitsyn et al. 1997: 29). A similar industry from Siuren 1 in the Crimea has two radiocarbon dates pointing to an age of 28–30 ka. Another late early Upper Paleolithic assemblage that can be more or less confidently identified as Aurignacian is from Ivanychi, in the western end of the Russian Plain (Pyasetsky 1988). The archaeological materials come from the upper part of what may be a buried MVS 5 soil, roughly coeval with layer IIa at the site of Zhornov dated to 27–28 ka. The collection is very small (about 150 artifacts), but the presence of a dozen of high carinated and nosed end scrapers (figure 6.3: 44–48), combined with at least one

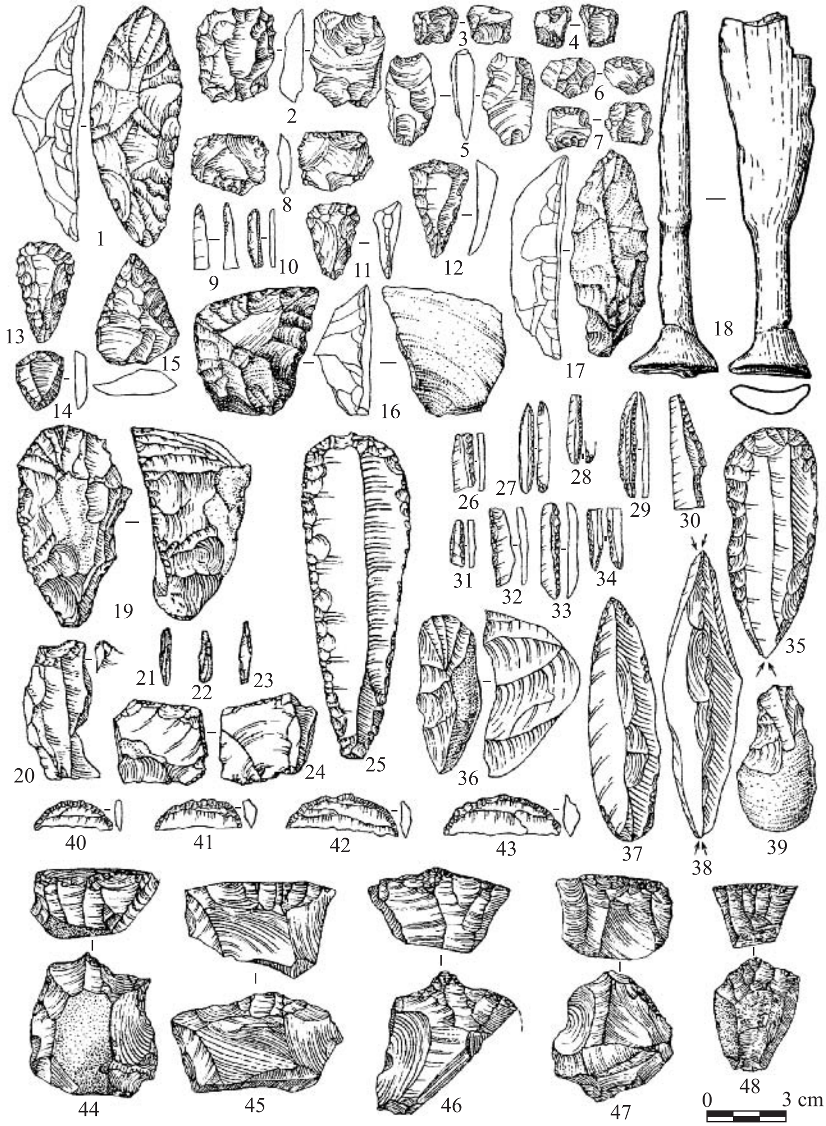

Figure 6.3. Artifacts associated with the Gorodtsov (1–18), Aurignacian (19–25, 44–48), and Molodovan cultures (26–39). Kostenki 14/II (1, 2, 8, 11, 13, 15–17); Kostenki 12/I (3, 4, 9, 10); Kostenki 15 (5–7, 12, 14, 18); Kostenki 1/III (19–25); Ivanychi (44–47); Molodova 5/VIII (26, 30, 31, 35, 36); Molodova 5/IX (27–29, 37, 38); Molodova 5/X (32–34 and 39); Korpatch, layer IV (40–43). After Rogachev and Anikovich (1984), Chernysh (1982, 1987), Pyasetsky (1988).

busked burin, makes its attribution to the Aurignacian rather plausible. The nearby site of Chervony Kamen also contains a number of Aurignacian artifact forms and is described as "developed Aurignacian" (Pyasetsky 1995). However, this site consists of surface finds only and may be mixed. Several other assemblages known from the northwestern Black Sea area are often described as early Upper Paleolithic, or Aurignacian, but consist mostly (or completely) of surface finds. These are Vorona 3 (Nuzhnyi 1994), Peremoga 1 (Olenkovsky 1991), Zeleny Khutor (Sapozhnikov 1994), Nenasytets (Smirnov 1973), and Klimautsy 1 (Borziak 1981).

A number of industrial traditions that existed in different parts of the Russian Plain during MVS 5 is often referred to as Gravettoid. The earliest of these is possibly the Molodovan culture represented primarily by materials from the multilevel site of Molodova 5 (Rogachev and Anikovich 1984: 173–74; Anikovich 1987, 1992: 214–19). The culture has a distinctive tool kit, which includes symmetrical dihedral burins on blades (figure 6.3: 38), end scrapers on large blades sometimes with thinning at the proximal end (figure 6.3: 35), single and double-tipped points on large blades (figure 6.3: 37), and various forms of backed bladelets (figure 6.3: 26–34). Bifacially worked tools are absent (with only one exception). All these characteristics appear for the first time in layer X at Molodova 5, which is confidently dated to the beginning of MVS 5. These characteristics are equally well expressed in the overlying layers IX–VII, the lowermost of which has two radiocarbon dates of 28–29 ka. The uppermost layer—the only one yielding a rich bone inventory—is believed to have formed after 24 ka. In a somewhat modified form, the Molodovan traditions continued to exist in post-Megainterstadial times.

Another putatively Gravettoid culture is Telmanskaya in the Kostenki area. This culture is represented by materials from Kostenki 8/II, which is dated to the middle of MVS 5. In contrast to the contemporary Gorodtsovian, the rich stone industry of Kostenki 8/II (about 23,000 stone artifacts including over two thousand tools) is completely blade-based and consists of typical Upper Paleolithic forms (various burins and end scrapers, backed microblades, perforators, truncated and notched blades). At the same time, the bone inventory resembles that from Kostenki 14/II, manifested most clearly in the types of engraved decorative patterns (e.g., parallel rows of notches and zigzags).

Two additional late early Upper Paleolithic assemblages described as Gravettoid are Zhornov IIa in the upper Dnieper basin (Pyasetsky 1991), and Khotylevo 2 in the Desna basin (Zavernyaev 1991). The former includes only fifteen tools (burins, knives, a broken point) and, judging by a radiocarbon date of about 28 ka, may be roughly coeval with the Telmanskaya and early Molodovan cultures. Khotylevo 2 is famous for its extremely rich and original stone and bone inventory, but its chronological position at the upper boundary of MSV 5 puts it beyond the scope of this chapter.

Of particular interest among the latest early Upper Paleolithic sites are layer III at Brynzeny 1 (a cave) and layer IV at Korpatch (both in the Prut basin). Brynzeny 1/III yielded a rich stone industry (some 7,500 objects, including over five hundred tools) combining Middle and Upper Paleolithic tool types (Ketraru 1973). There are numerous end and side scrapers, some burins, points on blades, Mousterian points on typical Levallois flakes, backed points, and archaic-looking oval and triangular bifaces. Nine radiocarbon determinations obtained for layer III range from about 14 to 26 ka. Only the character of the archaeological materials forces us to consider the earlier dates as more plausible. Somewhat similar assemblages come from a number of sites postdating the Megainterstadial (e.g., Chuntu, Bobuleshty). They have been united into the Brynzeny culture (Borziak 1983). The inventory from Korpatch, layer IV, dated to about 25 ka, is also remarkable for its unique combination of tools (Grigorieva 1983b). In addition to various end scraper types, burins, and retouched blades, it includes side scrapers, bifacially worked leaf-shaped points, and a series of typical segments (figure 6.3: 40–43). The segments, together with similar artifacts from Krakow-Zwierzyniec in Poland (Kozłowski 2000b; Kozłowski, this volume) and trapezoids from Buran-Kaya 3 in Crimea (Marks 1998; Marks and Monigal, this volume), represent the oldest geometric tools known in eastern Europe. A number of peculiar segments may also be represented at Kostenki 8/II.

There are several other sites in the southwestern Russian Plain and, particularly, in the northwestern Black Sea area that have been described as early Upper Paleolithic (e.g., Leski, Osokorovka 1/VI, Anetovka 13). However, the available absolute dates, geological data, and the character of the archaeological materials do not give sufficient grounds to place these assemblages within the late early Upper Paleolithic.

THE LATE MIDDLE PALEOLITHIC AND GENESIS OF THE EARLY UPPER PALEOLITHIC

Many hypotheses have been put forward to explain the genesis of the early Upper Paleolithic on the Russian Plain (Rogachev 1957: 132; Chmielewski 1972: 176; Anikovich 1983, 1992; Gladilin and Demidenko 1989c; Amirkhanov et al. 1993). Especially well known is the idea linking the Streletskian with Middle Paleolithic industries of the Crimea (e.g., Zaskalnaya, Chokurcha) and the southwestern Russian Plain (e.g., Trinka 3/III) where similar forms of bifacial points have been found (Anikovich 1999: figure 3). Most of these hypotheses hang in mid-air, however, because of the near absence of representative and reliably dated late Middle Paleolithic assemblages in the region. Although there are a number of very important and well-known Middle Paleolithic sites in the southern and southwestern parts of the Russian Plain, nearly all of them are too early to have much bearing on the genesis problem. The Mousterian at Ketrosy, Korman 4, and Molodova 1 and 5, as well as the Eastern Micoquian at Khotylevo 1 and Sukhaya Mechetka, clearly predate the Megainterstadial period (e.g., Hoffecker 1999: figure 5) and cannot have direct links with the early Upper Paleolithic. Regarding the putative late Middle Paleolithic industries at Zhornov (lower layer) (Pyasetsky 1992), Tochilnitsa (Pyasetsky 1990), Belokuzminovka (Gerasimenko and Kolesnik 1992), Betovo (Tarasov 1999), Biryuchia Balka and Kalitvenka (Matioukhine 1987), their assignments to the end of the Middle Paleolithic, although possible, are mainly based on rather ambiguous stratigraphic observations. We agree that all, or most of these assemblages may be of Megainterstadial age, but it is obvious that the available evidence is far from conclusive.

The only Middle Paleolithic assemblage from the Russian Plain that can be assigned with confidence to the period directly preceding the appearance of the first Upper Paleolithic industries is Shlyakh, layer VIII (Nehoroshev and Vishnyatsky 2000). Shlyakh is an open-air, multilevel Middle-Upper Paleolithic site in the southern part of the middle Don basin. Layer VIII, occurring at a depth of 4.5 m, directly below a buried soil, was found to be the richest archeological level. Two AMS radiocarbon dates obtained for this level point to an age of around 45 ka. This date is corroborated by palynological and paleomagnetic studies, which suggest that the main cultural level directly postdates the Kargopolovo paleomagnetic excursion (43–45 ka). Retouched tools from layer VIII consist of side scrapers, proto-Kostenki and backed knives (figure 6.4: 1), Mousterian points (figure 6.4: 3, 10), some retouched blades (figure 6.4: 8), end scrapers (figure 6.4: 2, 6, 9), and burins (figure 6.4: 5). Bifaces characteristic of many of eastern European Middle Paleolithic assemblages are absent. It is particularly significant that the industry contains a protoprismatic technology (figure 6.4: 4) aimed at the production of blades from wedge-shaped cores (figure 6.4: 7). Although the character of the industry by no means establishes a direct "phylogenetic" link with any of the early Upper Paleolithic cultures known in the Russian Plain, it clearly shows that a trend toward greater use of laminar technologies existed in the local Mousterian and became very pronounced by the end of the Middle Paleolithic.

WHO WERE THE CREATORS OF THE EARLY UPPER PALEOLITHIC ON THE RUSSIAN PLAIN?

Human fossil materials from the Russian Plain are very rare (for an exhaustive review, see Kharitonov and Batsevich [1997]). No human remains as yet have been reported in association with late Middle Paleolithic assemblages, and only single finds can be assigned to the initial Upper Paleolithic. It is widely believed that all of the Upper Paleolithic cultures of the region were

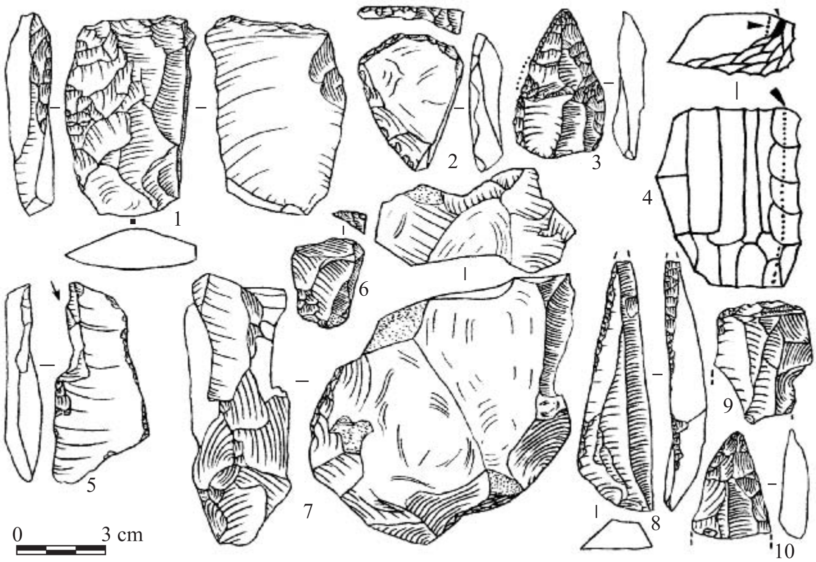

Figure 6.4. Artifacts from Shlyakh: retouched tools (1–3, 5, 6, 8–10); core (7); generalized technological scheme (4).

associated with anatomically modern humans (but see Anikovich 1999: 121–22). However, for the Spitsynian culture, this conclusion is based only on a single molar found in layer II at Kostenki 17. The presumed association between anatomically modern humans and the Streletskian is based on the rich but chronologically very late skeletal materials from Sungir. Interestingly, the fossil materials from Sungir are thought to show a number of archaic ("Neanderthaloid") traits. Less ambiguous are the fossil remains associated with the Gorodtsovian: modern human remains from the burial at Kostenki 14 must be either coeval with, or older than layer III, suggesting a minimum age of 31 ka. The child burial found at Kostenki 15 is probably the same age as cultural layer at the site, around 27–32 ka.

ON THE CAUSES OF THE MIDDLE-UPPER PALEOLITHIC TRANSITION

According to a very popular view, the Middle-Upper Paleolithic transition in Europe was caused by the arrival of anatomically modern people with an advanced culture. Some local Neanderthal populations are thought to have borrowed aspects of this advanced modern culture, a process of acculturation supposedly represented in the Châtelperronian, Szeletian, and Uluzzian. Intended first to explain the many incongruities between old theories and new data appearing in western and central Europe, this scenario of migration and acculturation has recently been invoked to explain the Middle-Upper Paleolithic transition on the Russian Plain (Anikovich 1999: 74; Cohen and Stepanchuk 1999).

In our opinion, however, the acculturation model leaves much to be desired. In most of Europe, the so-called Neanderthal early Upper Paleolithic cultures seem to have appeared well before those associated with anatomically modern humans (Zilhão and d'Errico 1999). Moreover, there are no reliably dated modern human remains in Europe older than 36–37 ka. If we exclude the morphologically ambiguous partial cranium from Hannofersand and the isolated molar from Kostenki 17/II, the maximum established age for the arrival of anatomically modern humans in Europe is 32 ka. The absence of fossil evidence aside, we still do not know who was responsible for the Aurignacian, where it originated, or even whether its origin was mono- or polyphyletic. Thus the presence of the Aurignacian on the Russian Plain, or anywhere for that matter, is of ambiguous significance. But, most importantly, all the Neanderthal early Upper Paleolithic cultures seem too original to have been simply borrowed. These observations necessarily exclude acculturation as a viable mechanism of culture change for the Neanderthal early Upper Paleolithic in Europe. On the Russian Plain, not only is there no reason to associate the "advanced" Spitsynian early Upper Paleolithic with anatomically modern humans and the "archaic" Streletskian early Upper Paleolithic with archaic humans, but there is also little evidence to suggest that the Spitsynian predates the Streletskian. As in western Europe, acculturation is thus a nonviable explanation for the genesis of the early Upper Paleolithic on the Russian Plain.

As one of us has recently tried to show (Vishnyatsky 2000), neither the available chronological data nor what we know about the association between different early Upper Paleolithic industries and hominin morphotypes give firm enough ground to believe that Upper Paleolithic culture(s) were brought to Europe, the Near East, or southern Siberia from elsewhere. Rather, there appear to have been a series of broadly synchronous local transitions prompted by the need to intensify resource procurement when escaping to open territory became impossible. So understood, the "Upper Paleolithic revolution" signifies the end of a "generalist" phase in the evolution of culture and transition to an "specialist" mode of development.

7

Emergence of the Levantine Upper Paleolithic

Evidence from the Wadi al-Hasa

J. R. Fox and N. R. Coinman

The Levant has long been recognized as an important region for archaeologists interested in the earliest development of the Upper Paleolithic (Neuville 1934; Garrod 1951, 1955; Marks 1993; Bar-Yosef 1999). The emergence of the Upper Paleolithic in the Levant and Near East in general has been the subject of extensive discussion in the archaeological literature of the past three decades (see Marks [1983a] for a thorough review of transitional studies in the Levant during the earlier part of the twentieth century). Although a number of scenarios and explanations have been offered to account for the replacement of Mousterian with Upper Paleolithic technologies, the general paucity of sites and reliable dates from the hypothetical transitional period and the preceding late Mousterian have made testing alternative theoretical models difficult. Several key issues related to this important period of human cultural evolution remain subjects of marked disagreement.

First, and perhaps most importantly, due to different theoretical orientations of researchers and the lack of well-dated assemblages from the interval of about 38–60 ka, there is a general disagreement concerning whether the Upper Paleolithic evolved directly from a Levantine Mousterian technological variant (e.g., Marks 1983a), or if it appeared as the result of importation into the area from another locale (e.g., Bar-Yosef 1999). Historically, this issue is closely related to the modern human origins debate, with argument centered on the question of continuity versus replacement (Clark and Lindly 1989; Bar-Yosef 1999). Contributing to a lack of consensus is the difficulty of defining, recognizing, and classifying assemblages that combine classic Middle and Upper Paleolithic technological and typological attributes. Although several assemblages from Lebanon, southern Jordan, and Israel have been suggested as technologically transitional, detailed analyses are largely restricted to two sites: Boker Tachtit in the central Negev Desert (Marks 1983a; Marks and Kaufman 1983; Marks and Volkman 1983) and the site of Ksar 'Akil in Lebanon (Bergman 1987; Ohnuma and Bergman 1990). At both of these sites, assemblages were recovered that indicate the presence of a technological stage intermediate between the late Levantine Mousterian and early Ahmarian.

Following recent investigations in the Wadi al-Hasa, we are now in a position to incorporate a new body of data into the discussion. Below we introduce the site of Tor Sadaf, a small rock shelter excavated during 1997 and 1998 by the Eastern Hasa Late Pleistocene Project (EHLPP), directed by D. I. Olszewski and N. R. Coinman (Olszewski et al. 1998; Coinman et al. 1999). Analysis of the lithic materials from the deeper levels at the site strongly suggest the presence of a technology related to that seen at Boker Tachtit and Ksar 'Akil. At Tor Sadaf, these materials are overlain by a clearly defined early Ahmarian component, making the site particularly rare in the Levant. Following a description of the site and the lithic materials recovered, we present a number of comparisons with assemblages from Israel and Lebanon. Finally, we discuss some of the implications for the major issues associated with the Levantine Middle-Upper Paleolithic transition in light of the new evidence presented here.

Tor Sadaf is a small rock shelter, located on a tributary drainage of the Wadi al-Hasa (figure 7.1). Discovered during Clark's 1992 survey of the Hasa (Clark et al. 1992), subsurface testing at Tor Sadaf took place during 1997 and 1998 by the EHLPP (Olszewski et al. 1998; Coinman et al. 1999). In all, eight 1 m × 1 m test units were excavated at the site, revealing more than 1 m of in situ cultural deposits across much of the site area. More than 25,000 lithic artifacts and a highly fragmented assemblage of faunal remains were recovered from these tests. Artifacts and faunal remains were distributed continuously throughout the vertical levels at the site, suggesting long periods of fairly sustained occupation. Excavation strategies included sampling sediments for macro- and microbotanics. Unfortunately, efforts to obtain radiocarbon dates from bone, especially from the lowermost levels, have been unsuccessful.

Preliminary analyses suggest that the faunal assemblage is dominated by medium-sized artiodactyls (particularly gazelle) and other mammals. Phytolith remains indicate occupations at the site occurred during a relatively dry period,[1] although a lack of radiocarbon dates has made it difficult to tie Tor Sadaf into the larger Hasa landscape chronology. In general, the faunal and environmental data suggest that Tor Sadaf differs from later Upper Paleolithic sites in the main Hasa lake basin, although whether these differences

1. Based on data presented in a preliminary report on phytolith analysis results for the EHLPP by Arlene Miller Rosen, Institute of Archaeology, University College of London.

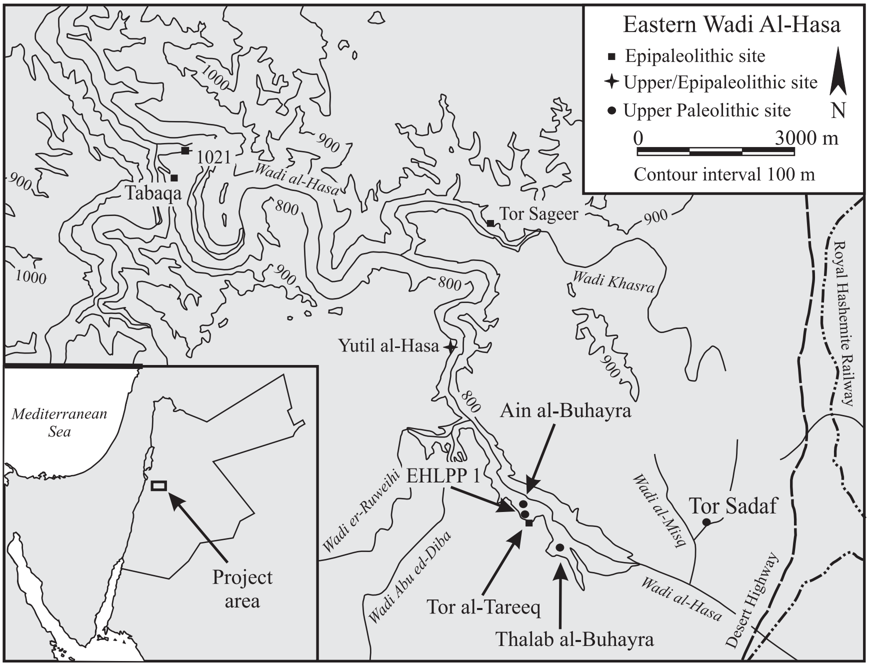

Figure 7.1. Map of the eastern Wadi al-Hasa showing the distribution of Upper Paleolithic and Epipaleolithic sites.

are a function of long-term environmental changes or simply site functional differences remains unclear. Given that the rock shelter faces directly south, we suspect that the site was occupied during winter months, although this has not yet been confirmed by any evidence of seasonality.

Technological analyses of the assemblage focused on cores, tools, and a sample of more than 1500 blades, bladelets, and flakes (Coinman and Fox 2000; Fox 2000). The analyses performed sought to collect information that would reveal aspects of core reduction strategies employed at the site over time. Because the depositional sequence at Tor Sadaf appears to be continuous, with no clear natural breaks, the lithic materials were divided into three stratigraphically continuous units or "occupation periods" (Coinman and Fox 2000). From stratigraphically earliest to latest, we have labeled these occupation periods "Tor Sadaf A," "Tor Sadaf B" and "early Upper Paleolithic."[2] These were defined on the basis of changes in lithic technol-

2. In a previous publication (Coinman and Fox 2000), Tor Sadaf A and B were referred to as Transitional A and B.

ogy and typology (see Coinman and Fox 2000). As we show here, most of the differences between the three occupation periods are matters of degree; all three show continuous variation in nearly all attributes. On the basis of excavations to date, we have found no evidence to suggest that any of the levels represent a discrete or stratigraphically abrupt change, but rather a stratigraphic sequence of continuous change that we have subdivided into three successive analytical units for comparisons. Thus the occupational periods discussed here should be seen as a heuristic device used to illustrate significant technological and typological change over time in the Tor Sadaf lithic materials.

THE TOR SADAF LITHIC ASSEMBLAGES

Changes in lithic reduction strategies across the three occupation periods at Tor Sadaf show a general trend toward more standardized, typically Upper Paleolithic blade/bladelet technology. The Tor Sadaf A assemblage is dominated by a unidirectional reduction strategy geared toward the production of elongated blades and points (table 7.1). Evidence for this method is preserved in an abundance of blades and cores showing unidirectional scar patterns (figure 7.2: 1). Cores were prepared and maintained by removal of large overpassed blades that generated convex lateral flaking surfaces. Overpassed blades make up the great majority (55%) of core trimming elements (CTE). Platforms of cores and blades show high frequencies of faceting, both dihedral and complex. Platform faceting was both formal and ad hoc, producing blades and points with classic convex platforms as well as more random faceting patterns. Platform characteristics of the debitage sample show relatively high frequencies of blades with large, pronounced bulbs of percussion and eraillure scars, indicating that blades were removed using direct, hard hammer percussion. The tool assemblage is dominated by Levallois-like points (51%) (figure 7.3: 12, 13, 18, 19), nearly all of which show unidirectional dorsal scars (88%). Other important tool categories include scrapers (predominately end scrapers on blades) and retouched blades. Burins are quite rare.

The Tor Sadaf B assemblage is typologically similar to Tor Sadaf A, but important technological changes are evident. The reduction strategy continues to be a unidirectional method (figure 7.2: 4), producing abundant blades and points. A high proportion of CTE are overpassed blades (32%) showing that these pieces continued to play an important role in maintaining core face convexity. There is a sharp reduction in the frequency of platform faceting on cores, debitage, and points, along with a corresponding increase in the frequency of core tablets. Most blades and points exhibit large, flat platforms with pronounced bulbs of percussion and large numbers of eraillure scars. These data suggest that direct, hard hammer percus-

TABLE 7.1 Frequencies of Selected Artifact Categories from Three Occupation Periods at Tor Sadaf

	Tor Sadaf A		*Tor Sadaf B*		*Early Upper Paleolithic*	
	n	Percentage	*n*	Percentage	*n*	Percentage
Core platforms						
Unfaceted	22	40.0	29	53.7	68	78.2
Dihehral	8	14.5	7	13.0	9	10.3
Multifaceted	25	45.5	13	24.1	6	6.9
Other	0	0.0	5	9.3	4	4.6
Core trimming elements						
Core tablet	2	9.1	11	35.5	46	51.7
Platform blade	4	18.2	9	29.0	20	22.5
Crested	0	0.0	0	0.0	14	15.7
Overpass	12	54.5	10	32.3	3	3.4
Other						
Blade/bladelet debitage tools	675	19.1	797	18.4	3325	29.5
Scrapers	19	15.7	34	17.5	45	13.4
Burins	1	0.8	6	3.1	9	2.7
Elongated Levallois-like points	62	51.2	60	30.9	8	2.4
Levallois flake points	4	3.3	15	7.7	1	0.3
Retouched blades	13	10.7	29	15.0	20	6.0
Retouched bladelets	3	2.5	10	15.2	63	18.8
el-Wad points	0	0.0	3	1.6	150	44.6

sion remained the dominant flaking mode during the Tor Sadaf B period. There are, however, increasing frequencies of bladelets and small blades with small, linear platforms, abraded platform edges, and diffuse bulbs of percussion during the Tor Sadaf B period. The tool kit from the Tor Sadaf B assemblage is nearly identical to that of the Tor Sadaf A, being dominated by Levallois-like points (figure 7.3: 14–17, 20) with the addition of a growing frequency of retouched blades and bladelets. The Levallois-like points in Tor Sadaf B, like the blade debitage sample, show increasing frequencies of large, unmodified platforms. In general, the Tor Sadaf B assemblage appears technologically and typologically very similar to Boker Tachtit level 4 and descriptions of the transitional levels at Ksar 'Akil XXIII–XXI (Marks 1983a; Ohnuma and Bergman 1990).

The early Upper Paleolithic assemblage from Tor Sadaf shows both a technological and typological shift from the previous levels. Most cores

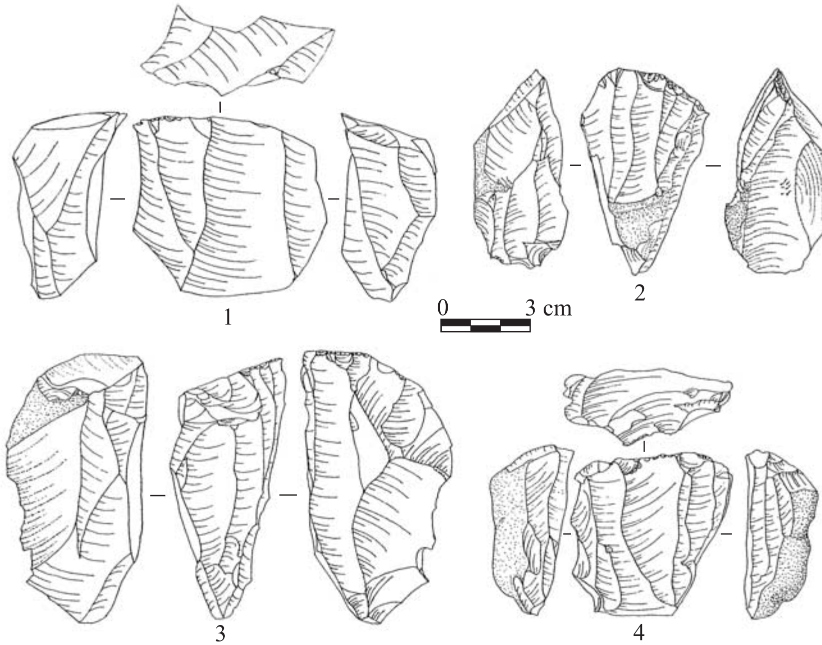

Figure 7.2. Cores from Tor Sadaf: point core with faceted platform from Tor Sadaf A (1); single platform blade/bladelet cores from the early Upper Paleolithic layers at Tor Sadaf (2, 3); point core with faceted platform from Tor Sadaf B (4).

(70%) in the assemblage are single-platform, unidirectional blade/bladelet cores (figure 7.2: 2, 3). Less frequent are changed-orientation cores (about 20%). Although they possess two or more platforms, changed-orientation cores are nonetheless consistent with the single-platform reduction strategy that dominates the assemblage. Blades and bladelets make up the overwhelming majority of both the debitage and tools in the early Upper Paleolithic assemblage (see table 7.1). Platforms on cores and blades show a great deal of abrasion and microchipping as a means of platform edge regularization. This regularization is linked to a change in flaking mode, which focused on the very marginal aspects of core platforms. Blade and bladelet platforms show very high frequencies of lipping (77%) and diffuse bulbs of percussion (94%), suggesting that soft hammer and indirect percussion techniques produced the great majority of the assemblage. Cores were maintained by means of the core tablet technique, reflected in the abundance of these pieces as a proportion of core trimming elements (52%).

The tool kit from the early Upper Paleolithic occupation is dominated by small blades and large bladelets retouched into points (figure 7.3: 1–11).

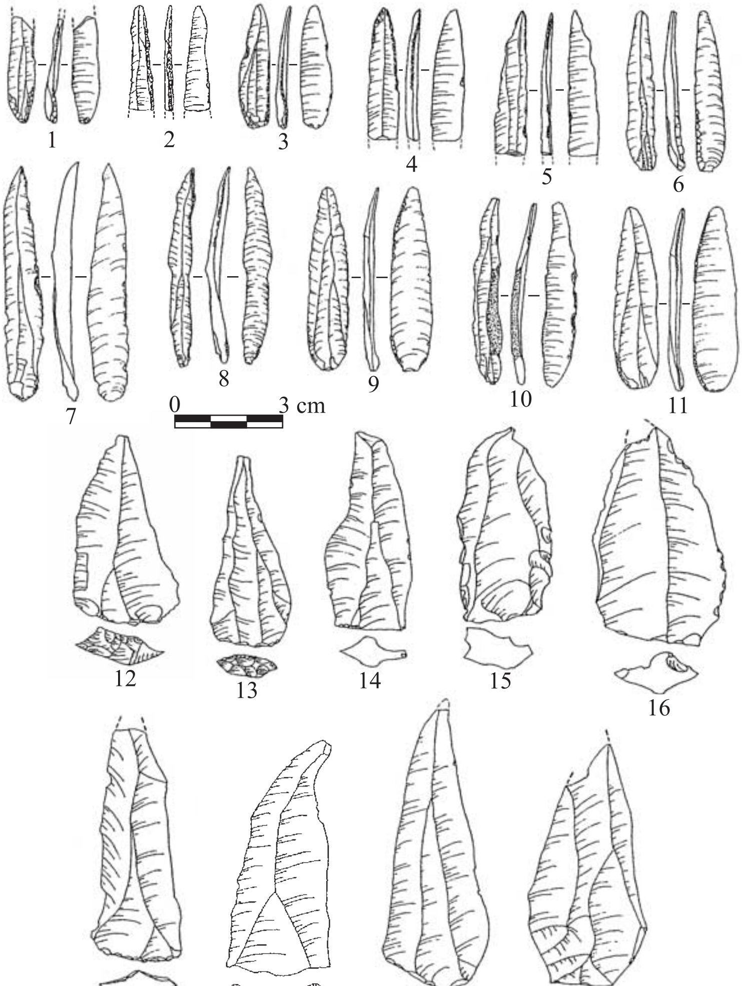

Figure 7.3. Blanks and tools from Tor Sadaf: el-Wad points from the early Upper Paleolithic layers at Tor Sadaf (1–11); Levallois-like points with faceted platforms from Tor Sadaf A (12, 13, 18, 19); Levallois-like points with unfaceted platforms from Tor Sadaf B (14–17, 20).

These el-Wad points represent over 40% of the tool kit, with another 25% represented by other retouched blades and bladelets. The only other important class of tools is end scrapers, which make up about 13% of the tool kit. Typologically and technologically, the early Upper Paleolithic assemblage from Tor Sadaf appears to represent an example of the early Ahmarian, an assemblage type common throughout the southern Levant (Gilead 1981, 1991; Marks 1981; Marks and Ferring 1988).

NATURE OF THE TRANSITION

Debate over the origin of the Levantine Upper Paleolithic has closely paralleled the issues surrounding modern human origins, especially the question of continuity or replacement. Although the two issues are strikingly similar and historically related, there is a general consensus among researchers that the evolution of modern *Homo sapiens* and the Upper Paleolithic were not coincident and must be studied as phenomena separated in both time and space (Clark and Lindly 1989; Marks 1993; Clark 2000). In the Levant, the best evidence yet recorded in support of a continuous evolution from Middle-Upper Paleolithic technologies has come from the site of Boker Tachtit, where Marks (1983a) and colleagues (Marks and Kaufman 1983; Volkman 1983) identified four occupation surfaces beginning perhaps 47 ka (Marks 1983a: 68, 1993). Through extensive debitage analysis and core reconstructions, they documented a gradual shift from a Levallois technique involving the production of elongated points from bidirectionally worked cores in level 1 to a non-Levallois, predominately single platform reduction strategy that produced numerous blades and elongated Levallois-like points in level 4 (Marks 1983a; Volkman 1983). Marks has called level 1 at Boker Tachtit a "specialized" late Mousterian assemblage, and level 4 the initial Upper Paleolithic (Marks and Ferring 1988; Marks 1993). In addition, based on stratigraphic relationships and radiocarbon dates of sites and terraces, Marks argued that the initial Upper Paleolithic assemblage from level 4 was the antecedent of early Ahmarian technology seen at later sites such as Boker A (Marks 1983; Marks and Ferring 1988).

In the late 1970s and early 1980s, Boker Tachtit revived the notion of an evolutionary continuum from the Middle to the Upper Paleolithic. Prior to that time, Garrod had posited the existence of the Emiran industry, a Middle-Upper Paleolithic transitional lithic assemblage type based on evidence from Lebanese cave sites (Garrod 1951, 1955). However, acceptance of the Emiran industry was undermined in the 1970s when serious concerns about the stratigraphic integrity of the relevant cave sites were raised (Bar-Yosef and Vandermeersch 1972). No such difficulties were raised for Boker Tachtit. Not only did investigations at Boker Tachtit reveal an assemblage combining technological attributes of the Middle and Upper Paleolithic, but several Emireh points were recovered, suggesting that Garrod's original type-fossil might, in fact, be valid (Marks 1983a; Marks and Kaufman 1983). Subsequent reanalysis of materials from Ksar 'Akil during the 1980s suggested that this site may have been the locus of a transitional occupation as well. Ksar 'Akil levels XXIII–XXI appear very similar to, and roughly the technological equivalent of, Boker Tachtit level 4 (Marks 1983a; Ohnuma and Bergman 1990). Ksar 'Akil levels XXIII–XXI lie stratigraphically above a Mousterian component and beneath an early Ahmarian Upper Paleolithic component (Ohnuma and Bergman 1990). The stratigraphic continuity of these levels has never been demonstrated, however, leaving the question of Middle-Upper Paleolithic continuity unresolved. There seems to be some consensus that Marks's connection between the assemblages at Boker Tachtit and the subsequent early Ahmarian at Boker A was accurate. More problematic has been drawing a connection between the late Levantine Mousterian and the early occupation at Boker Tachtit.

Marks has argued that the roots of the Boker Tachtit level 1 technology can be seen in the Mousterian assemblages of Tabun D type (Marks 1983a). Tabun D type Mousterian assemblages have been documented in Jordan (Henry 1982; Lindly and Clark 2000) and Israel (Jelinek 1981; Marks 1993) and are characterized by numerous elongated points and blades produced through uni- and bidirectional reduction strategies, in contrast to other centripetally oriented Mousterian industries. However, many of these assemblages date to very early parts of the Mousterian (>100 ka) (see Bar-Yosef 1994: 36–38). The significant gap in reliable dates between Tabun D assemblages and level 1 at Boker Tachtit has led some to argue that the two are in fact unrelated, despite their superficial similarities (Bar-Yosef 1994, 1999).

Contrasting with the evolutionary or transitional formula is a "revolutionary" model. Using the Neolithic revolution as an analog, Bar-Yosef (1999) reaches beyond the Levant, seeking to explain the emergence of the Upper Paleolithic throughout Africa and Eurasia. Where the Levant is concerned, Bar-Yosef suggests that the transitional assemblages of the region, as documented at Boker Tachtit, Ksar 'Akil, and the handful of other Lebanese sites, are in fact fully Upper Paleolithic in terms of technology and typology (Bar-Yosef 1999:154). This revolutionary model suggests the presence of a core area, in which the Upper Paleolithic originated. Subsequently, technological innovations would have spread, through either cultural diffusion or displacement of groups. East Africa stands out as a candidate for this core area (Ambrose 1998, cited in Bar-Yosef 1999), although secure dating of a truly Upper Paleolithic assemblage in this region remains difficult. This model suggests no relationship between the late Levantine Mousterian and all so-called transitional assemblages in the Levant, as the latter are actually the earliest manifestations of the Upper Paleolithic, which presumably eventually leads to the early Ahmarian.

Perhaps the strongest evidence supporting the revolutionary model for the origin of the Levantine Upper Paleolithic is the lack of evidence from sites dating to 40–60 ka. If Upper Paleolithic technologies emerged as a revolutionary development in a core area followed by rapid diffusion or displacement of populations, then a general lack of transitional forms is a logical outcome. However, this model fails to explain the sequence observed at Boker Tachtit, where the development of a blade technology from a true Levallois technology has, in our opinion, been clearly demonstrated. This problem could be accommodated if the central Negev is viewed as the core area from which Upper Paleolithic technologies subsequently spread. This possibility is not explored by Bar-Yosef (1999), who argues for an east African origin of the Upper Paleolithic.

Tor Sadaf and the Transition

At this point, it seems clear that the Tor Sadaf A and B assemblages are broadly similar to other transitional, or initial Upper Paleolithic assemblages in the Levant, particularly those from Boker Tachtit. Tables 7.2 and 7.3 compare a number of attributes from blade debitage and points from Tor Sadaf, Boker Tachtit, and Ksar 'Akil. At Tor Sadaf, evidence of the bidirectional Levallois technique described by Marks (1983a) for Boker Tachtit levels 1–2 is nearly completely absent. In terms of platform preparation, Tor Sadaf A appears very similar to Boker Tachtit, whereas Tor Sadaf B appears to represent a move toward less platform preparation. However, Tor Sadaf A varies from Boker Tachtit levels 2–4 in that there is little evidence of use of the core tablet technique until the Tor Sadaf B levels. Thus, at Tor Sadaf, it appears that the core tablet technique replaces core platform faceting as a means of maintaining platform shape and angle. This contrasts with the evidence from Boker Tachtit, where these two platform preparation techniques coexist within levels.

Differences in metric attributes in blades and points from Tor Sadaf and Boker Tachtit are small, showing large overlap in standard deviations. This suggests that these differences may be due purely to sampling vagaries and/or raw material factors (table 7.3). In general, the similarity in dimensions of blades and points from the two sites is striking, emphasizing that assemblages with considerable technological differences can still show remarkable typological homogeneity.

It is worth noting that no Emireh points, a possible type fossil of the Middle-Upper Paleolithic transition, were recovered from Tor Sadaf. The strongest support for the Emireh point as a type fossil has come from Boker Tachtit levels 1–2, where these pieces were recovered in some numbers. Although Emireh points have been recovered from a number of other sites (see Marks 1983a: 86–87), only one such point was recovered from Ksar

TABLE 7.2 Technological Features of Blades from Tor Sadaf A and B, Boker Tachtit Levels 1–4, and Ksar 'Akil Levels XXIII–XXI

Site/Levels	*Total n*	*Blade/Bladelet (%)*	*Unidirectional Scarring (%)*	*Unfaceted Platforms (%)*	*Faceted Platforms (%)*	*Core Tablet Technique*
Tor Sadaf B	2590	33.1[1]	91.5	76.4	13.2	Yes
Tor Sadaf A	2184	33.7[1]	87.6	49.0	44.8	No
Boker Tachtit[2]						
Level 4	4465	49.8	76.3	52.3	43.3	Yes
Level 3	2156	34.5	49.7	46.3	42.8	?
Level 2	9390	27.6	38.7	46.9	49.1	Yes
Level 1	4243	39.0	38.8	57.9	38.0	No
Ksar 'Akil[3]						
XXI	256	71.2	49.2	—[4]	—	—
XXII	871	73.4	56.4	—	—	—
XXIII	296	65.2	40.7	—	—	—

[1]Percentages of blades/bladelets from Tor Sadaf were calculated by removing trimming flakes from the debitage. This made the data comparable with that of Marks (1976: 374) and colleagues.

[2]Data from Marks (1983a: 80–81) and Marks and Kaufman (1983: 103–25).

[3]Data from Ohnuma and Bergman (1990: 100–110).

[4]—, Data not available.

TABLE 7.3 Metric Attributes of Blades/Bladelets and Points (Levallois and Non-Levallois) from Tor Sadaf A and B and Boker Tachtit Levels 1–4

	Length (mm)		*Width (mm)*		*Thickness (mm)*	
Site/Levels	Mean	SD	Mean	SD	Mean	SD
Blades						
Tor Sadaf B	57.9	19.2	20.5	7.3	7.1	3.1
Tor Sadaf A	58.2	18.6	20.6	7.4	7.3	3.1
Boker Tachtit[1]						
Level 4	63.4	24.0	22.3	9.1	6.8	3.9
Level 3	51.7	22.3	19.8	7.3	6.6	3.2
Level 2	51.5	21.2	19.8	8.7	6.5	3.6
Level 1	52.5	23.2	19.2	9.2	5.8	3.4
Points						
Tor Sadaf B	59.1	16.0	22.3	5.1	7.3	2.3
Tor Sadaf A	57.8	14.1	22.9	6.2	7.3	2.3
Boker Tachtit[2]						
Level 4	68.0	20.0	22.0	7.0	6.0	3.0
Level 3[3]	—	—	—	—	—	—
Level 2	59.0	21.0	26.0	6.0	7.0	4.0
Level 1	50.0	20.0	24.0	8.0	5.6	6.0

[1]Data from Marks (1983a: 81).
[2]Estimated from Marks and Kaufman (1983: figure 5-28).
[3]No points found at this level.

ʾAkil. The very limited contexts in which these points are found support the notion that if these pieces represent a true type fossil, then they are indicative of the early aspects of the Middle-Upper Paleolithic transition. Based on the evidence from Boker Tachtit, these points appear discretely associated with the early bidirectional Levallois technique seen in levels 1–2 (Marks and Kaufman 1983). At this point, no stratified Upper Paleolithic sites in the Wadi al-Hasa have been shown to contain the bidirectional Levallois technology seen in Boker Tachtit levels 1–2 (although there are broad similarities with the Tabun D occupation at Ain Difla). However, at least one Emireh point has been recovered from deflated surfaces at the site of Ain al-Buhayra (WHS 618), an extensive multicomponent lakeshore site (Coinman 1993, 1998, 2000).

Given the technological and typological comparisons made here, we suggest that Tor Sadaf A and B are technologically equivalent to Boker Tachtit level 4 and Ksar ʾAkil levels XXIII–XXI. This implies that Tor Sadaf A is somewhat younger than 45–46 ka, based on the dates from Boker Tachtit (Marks

1983a). Differences observed in the core reduction strategies employed in Tor Sadaf A and B, and Boker Tachtit level 4 (e.g., changes in the core tablet technique seen at Tor Sadaf, limited use of bidirectional reduction strategies at Boker Tachtit) likely represent regional and/or temporal variability within a given lithic industry. It is clear that Tor Sadaf A and B have far more in common with the assemblages recovered from Ksar 'Akil XXIII–XXI and Boker Tachtit level 4 than they do with either the late Mousterian or the early Ahmarian.

As Marks (1993: 7–9) and others (e.g., Clark 2000) have noted, the most likely Levantine Mousterian forerunner to the transitional assemblages is the Tabun D industry (Jelinek 1981). Tabun D assemblages are characterized by numerous elongated Levallois points and an abundance of Upper Paleolithic tool types, in contrast to other Tabun industries (Henry 1988; Marks 1993; Lindly and Clark 2000). In the Wadi al-Hasa area, a Tabun D type industry is represented at the site of Ain Difla (Clark 2000; Lindly and Clark 2000). Although it appears likely on the basis of technological attributes that the transitional industry emerged from a long-term developmental sequence rooted in the Tabun D Levantine Mousterian (Marks 1993; Hovers 1998; Clark 2000), dating problems have made such a proposition equivocal (Bar-Yosef 1994). Clark (2000) has argued that these problems may stem largely from systematic variation in dating methods, which are amplified at the early boundary for radiocarbon dating and obscure continuity between the Levantine Mousterian sequence and the transitional assemblages at Boker Tachtit. Marks (1983a, 1993) has suggested that some Tabun D assemblages are probably quite young on the basis of environmental data. Hovers (1998) has framed the emergence of the Upper Paleolithic as a set of innovations that are based on existing pre-adaptations that can be found in the Levantine Mousterian (e.g., soft hammer and indirect percussion, blade technology, single-platform core reduction strategies). At this point, the connection between the Levantine Mousterian and subsequent transitional (and/or initial Upper Paleolithic) industries remains hypothetical, although in our opinion, strongly supported on the basis of technological features.

At the other end of the chronological continuum, Tor Sadaf offers some of the strongest evidence yet recovered that the transitional assemblages documented at Boker Tachtit and Ksar 'Akil were in fact the direct forerunners of the early Ahmarian. Although it is virtually impossible to prove in any absolute sense, we think that the directional change in lithic technology at Tor Sadaf provides very strong support for the notion put forth by Marks (1983a) nearly twenty years ago that the early Ahmarian industry common to the Levant (especially in the south), developed directly from the initial Upper Paleolithic industry seen at Boker Tachtit level 4.

Identification and Classification

Classification remains another persistent problem in studies of the Middle-Upper Paleolithic transition. For those who favor Marks's interpretation of the transition based on the sequences at Boker Tachtit and Boker A, classification of assemblages is least problematic. As Marks has pointed out, once an evolutionary continuum between two entities has been demonstrated, the question of where to segment this continuum into units is, to some degree, arbitrary (Marks 1983a: 83–84). However, issues of classification are more important if it is posited that the Levantine Upper Paleolithic did not develop directly from the local Mousterian. Since the very notion of a transitional assemblage may presume evolutionary continuity, the use of this term can be problematic. Kuhn et al. (1999: 506) have suggested that the presumption of a "phylogenetic" relationship between the Middle and Upper Paleolithic should be avoided by classifying so-called transitional assemblages as initial Upper Paleolithic. For those favoring a foreign origin of the Upper Paleolithic, the assemblages from Boker Tachtit and other sites must lie clearly within *either* the Middle or Upper Paleolithic. Bar-Yosef (1999: 154) has suggested that all of the assemblages from Boker Tachtit are in fact both technologically and typologically Upper Paleolithic in character, suggesting that the origin of the Upper Paleolithic lies in some earlier migration of groups or diffusion of ideas into the Levant from east Africa.

Marks has classified Boker Tachtit level 4 as initial Upper Paleolithic (Marks 1983a, 1993; Marks and Ferring 1988). For Marks, who argues for a continuum of technological evolution, the issue of classification remains somewhat arbitrary. However, he has proposed that the most meaningful distinction is to be made between Levallois and non-Levallois reduction strategies (Marks 1983a). Such a classification scheme depends on a clear and reliable definition of Levallois technique, which can be a problematic issue in its own right. In recent years, a great deal of variability has been noted within Levallois reduction strategies (e.g., Dibble and Bar-Yosef 1995), suggesting a good deal of flexibility in reduction strategies of Levallois type. Marks's distinction between the bidirectional Levallois technique at Boker Tachtit, with its emphasis on point production as the end-point of reduction, as opposed to subsequent unidirectional strategies that produced elongated Levallois-like points, has been a useful one. For Marks, the classification of assemblages that are part of a technological continuum was best made by noting distinctions of kind rather than degree (Marks 1983a: 84).

Tor Sadaf and Lithic Taxonomies

Because we agree with Marks's argument that the lithic materials from Boker Tachtit levels 1–2 are Mousterian in character, we also agree that the assemblages from Boker Tachtit represent a true technological transition from the Middle-Upper Paleolithic. Given this continuum, we also concur that distinguishing between what is Middle, Upper, and transitional is a somewhat arbitrary affair. However, given the new evidence presented here for Tor Sadaf, we suggest that we now have a clearer means of distinguishing between the Middle and Upper Paleolithic.

Given the need to draw a boundary for the earliest Upper Paleolithic, the evidence from Tor Sadaf shows that this line can be drawn most unambiguously at the emergence of the early Ahmarian. The early Ahmarian appears at Tor Sadaf as a clear technological and typological shift to an emphasis on soft hammer and indirect percussion flaking modes used primarily for the production of smaller blades and bladelets. We argue that the contrast between the early Ahmarian and the earlier Tor Sadaf A–B is much more distinct than that between Tor Sadaf A–B and Boker Tachtit levels 1–2. This suggests that the most meaningful place to make a distinction of kind in this technological continuum is between assemblages that appear transitional (Boker Tachtit levels 1–4, Ksar 'Akil levels XXIII–XXI, Tor Sadaf A and B) and those that are early Ahmarian Upper Paleolithic (Boker A, Tor Sadaf early Upper Paleolithic). The sequence at Tor Sadaf illustrates, in our opinion, that even in a site with an apparently continuous sequence of assemblages, the technological and typological shift that results in the appearance of the early Ahmarian is discernible.

We also recognize that the use of the word "transitional" may raise objections from those who favor a replacement/revolutionary model of cultural change from the Middle to Upper Paleolithic. We acknowledge the bias inherent in the term "transitional" for those who consider this issue, at the very least, unresolved. Perhaps this problem could be avoided by using a new Middle Paleolithic/Upper Paleolithic neutral taxonomic designation that would allow the issue to remain unresolved until further evidence can be discerned. Unfortunately, we suspect that the introduction of new taxonomic designations into the discussion is likely to obscure rather than clarify the issue.

CONCLUSION

The results of these analyses hold implications for our understanding of the emergence of the Levantine Upper Paleolithic. First, Tor Sadaf provides strong evidence of a developmental sequence leading from an assemblage strikingly similar to Boker Tachtit level 4 to the early Ahmarian. This provides important support for Marks's hypothesis that the early Ahmarian in the Negev arose directly from the sequence of assemblages at Boker Tachtit (Marks 1983a; Marks and Ferring 1988). However, these analyses have also shown that the Tor Sadaf A and B assemblages also vary in important ways from what Marks and his colleagues have documented at Boker Tachtit level 4. Some of the differences between the assemblages from the two sites may relate to stratigraphic issues; whereas Tor Sadaf shows a long sequence of occupation, the Boker Tachtit level 4 assemblage comes from a relatively discrete occupation surface. Thus, one might expect a greater degree of variability in the Tor Sadaf materials.

Beyond issues of occupation duration, differences between the two sites can be seen broadly as either spatial or temporal variability within a lithic industry (whether we call it transitional, Emiran, or initial Upper Paleolithic). In this context, we view the Tor Sadaf A and B assemblages as representing the continued directional change that Marks documented at Boker Tachtit. In short, the Tor Sadaf A and B appear to fit what we would expect in an assemblage that lies between the Boker Tachtit level 4 assemblage and the subsequent early Ahmarian. The Tor Sadaf A and B show remarkably similar technology and typology to Boker Tachtit level 4, but with growing emphasis on unidirectional reduction strategies and blade/bladelet manufacture. Although we expect Tor Sadaf A and B to fall in the interval 39–42 ka, we also lack the necessary radiometric dates to verify this hypothesis. We argue, however, that the technological features of the assemblages do support this conclusion.

Continued excavations at Tor Sadaf are planned, and we hope to be able to refine further the nature of the important behavioral changes that are implied by the significant shifts in lithic technology discussed here. Specifically, future studies will attempt to put the environmental context of the site's occupations into finer resolution. Clearly, the recovery of suitably preserved organic materials for radiometric dating must be a high priority, given the implications discussed in this chapter.

ACKNOWLEDGMENTS

Investigations at the site of Tor Sadaf took place in 1997 and 1998 as part of the EHLPP, directed by N. R. Coinman (Iowa State University, Ames) and D. I. Olszewski (University of Pennsylvania, Museum of Archaeology and Anthropology, Philadelphia). The EHLPP has been funded by the National Science Foundation (grant SBR 9618766), the Wenner Gren Foundation for Anthropological Research (grant 6278), the National Geographic Society (grant 6695-00), the U.S. Information Agency, the American Centers for Oriental Research, and the Joukowsky Family Foundation. Financial and logistical support has also been provided by the Department of Anthropology and the Graduate College at Iowa State University. Artifact illustrations are the work of Antena Bryne (Iowa State University). This is EHLPP contribution 20.

8

New Perspectives on the Initial Upper Paleolithic

The View from Üçağızlı Cave, Turkey

S. L. Kuhn, M. C. Stiner, and E. Güleç

The initial Upper Paleolithic industries of the Levant are pivotal to accounts of the origins of the Upper Paleolithic in Eurasia and that complex of archaeological traits thought to represent "modern human behavior." Technologically, initial Upper Paleolithic assemblages seem to manifest a combination of Mousterian (Levallois) and Upper Paleolithic features. Elongated flakes, blades, and points were produced from flat cores with faceted striking platforms, usually by hard hammer percussion. Typologically, the initial Upper Paleolithic falls more securely into the Upper Paleolithic, sometimes—although not always—containing distinctive type fossils (Emireh points, *chanfreins*) (Marks and Ferring 1988; Gilead 1991). However, little is known of the greater part of human behavior—from foraging to art—associated with these industries. It is therefore not obvious whether the initial Upper Paleolithic should be seen basically as a kind of evolved Middle Paleolithic with a few new tool forms, or whether it manifests other characteristics of what is often referred to as modern human behavior.

Recent work at a number of sites in Europe and Asia has greatly enriched our knowledge of the initial Upper Paleolithic. This chapter summarizes the results of two seasons of excavation at Üçağızlı Cave in south-central Turkey. In addition to data on lithic technology, Üçağızlı has produced information on foraging and the use of ornaments in the initial Upper Paleolithic, phenomena about which comparatively little is known for this region and time period.

THE SITE AND ITS STRATIGRAPHY

Üçağızlı Cave is located on the Mediterranean coast of the Hatay region of southern Turkey. Centered on the city of Antakya (ancient Antioch), the

Hatay occupies the extreme northeast corner of the Mediterranean basin (figure 8.1). The Hatay is part of the modern nation of Turkey, but topographically and ecologically it resembles the coastal Levant much more closely than it does either central Anatolia or the southern Mediterranean coast of Turkey. The area should probably be considered the most northerly extension of the Mediterranean Levant.

The site of Üçağızlı is situated on the coast about 15 km south of the mouth of the Asi (Orontes) River (figure 8.1). The surface of deposits within the cave lies at an elevation of about 17 m above current sea level. The site cave was discovered and first investigated by A. Minzoni-Deroche (1992). The current project, a joint effort of the University of Arizona and Ankara University, began with test excavations in 1997 (Kuhn et al. 1999), followed by full-scale excavation in 1999 and 2000. Üçağızlı is the remnant of a larger collapsed cave. Pleistocene sediments are preserved in two main areas: a tunnel-like chamber to the southwest and an area in front of two smaller cavities to the northeast, along what was once the back wall of the cave. Minzoni-Deroche excavated primarily in the southwestern chamber. The more recent excavations have focused on the areas to the north. Cemented deposits with Epipaleolithic artifacts are preserved high on the back wall, showing that at least 3 m of deposits were lost to erosion subsequent to the cave's collapse. Even so, around 3 m of intact early Upper Paleolithic deposits remain in the northern area. One advantage of the collapse is that Üçağızlı saw little or no post-Pleistocene occupation.

Recent excavations have exposed a north-south stratigraphic section 9.5 m long at the north end of the site (figure 8.2). The width of the trench varies from 1 to 3 m, encompassing between half and a third of the surface of intact archaeological deposits at the site. Intact deposits end just west of the excavation trench, truncated by erosion just outside the current dripline.

The archaeological sequence at Üçağızlı has been divided into eight layers (B–I), each of which has one or more subdivisions. The dominant bedding plane slopes down from south to north, and the upper layers are more steeply inclined than the lower ones. The sediments are principally geogenic red clays *(terra rosa)* mixed with varying amounts of anthropogenic sediments, especially calcite ash. Boundaries between layers are not marked by changes in sediment mineralogy but instead by sharp fluctuations in the amount of anthropogenic sediment. Layers B, C, E, and G are relatively pure red clay, containing little ash but varying quantities of artifacts and bone: layers C and G are fairly poor in archaeological material; layers B and E are richer. Layers B1–B4, D, F, and H are extremely rich in artifacts and bone and contain numerous features, such as hearths and ash dumps. Underlying the Upper Paleolithic sequence is a relatively pure clay stratum (J) and a thick layer of limestone *éboulis* (layer K), both nearly sterile. Layer I contains a very low-density Middle Paleolithic deposit.

Figure 8.1. Map of the northeast Mediterranean region, showing the location of Üçağızlı Cave.

Broadly speaking, Upper Paleolithic artifact assemblages can be divided into three main groups.[1] The most recent Upper Paleolithic component is found in layers B–B4, exposed mainly at the north end of the excavated area: it was also present in the area excavated by Minzoni-Deroche in the south chamber. The materials from these layers bear a striking resemblance to artifact assemblages from layer XVI and XVII at Ksar 'Akil (Azoury

1. There are remnant Epipaleolithic deposits within the covered chamber on the south end of the site, but these do not figure into the current discussion, and they are not stratigraphically linked to the sequence in the northern excavation trench.

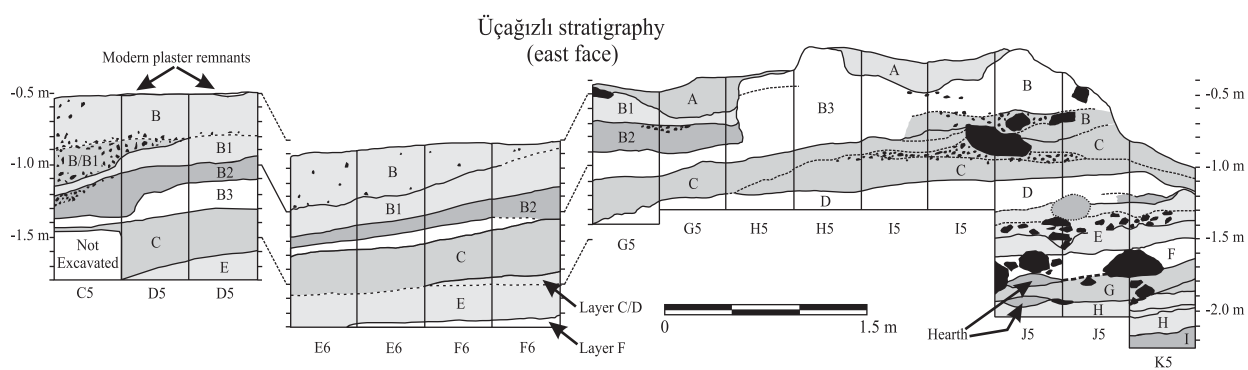

Figure 8.2. Stratigraphy of Üçağızlı Cave. Shading is schematic to illustrate stratigraphic correlations across the three excavated sections.

1986; Ohnuma 1988). They are characterized by well-developed prismatic blade technology utilizing soft hammer or indirect percussion. Common retouched tool forms include end scrapers and retouched and pointed blades; burins are extremely scarce. Layers G–I contain the earliest assemblages, which resemble the initial Upper Paleolithic of such sites as Ksar 'Akil layer XXI and Boker Tachit level 4. The intervening strata (F–C) yield materials intermediate in character between the earlier and later components. This chapter deals mainly with materials from the lowest layers, F–I.

Strata F and H are more correctly characterized as sedimentary cycles than as sedimentologically or mineralogically distinct layers. They appear to be made up of a large number of closely spaced, discrete, small-scale episodes of cultural deposition, interfingering with smaller lenses or "stringers" of red clay. Each contains numerous superimposed and partially overlapping ash lenses. Some of these show evidence of in situ burning and are probably small hearths. In other cases, the sediments, artifacts, and bones underlying the ash deposits show no evidence of heating: the latter features appear to be ash dumps rather than fireplaces. Layer G differs from F and H in that the frequency of anthropogenic depositional events is much lower. Layer I does not contain ash lenses, although there are hearths directly on top of it.

LITHIC ASSEMBLAGES

Collections from the first two excavation seasons are presented separately in the analyses and descriptions below. The 1999 sample has been studied in detail and results are essentially complete. Observations on the 2000 sample reported here should be considered preliminary.[2] In some of the tables that follow, samples from G and H have are combined: the great majority of artifacts and other material come from layer H, which is both thicker and richer.

Dorsal cortex preserved on artifacts shows that two general classes of raw materials were used at Üçağızlı. Some flints and quartzites have a very smooth, pitted, and frosted cortex typical of pebbles from high-energy fluvial contexts. There are no siliceous rocks in either primary or secondary context on the coastline around Üçağızlı today. The closest sources of pebble materials are ancient fluvial terraces located 10–15 km inland. The second group of materials consists of flints with a soft, white, chalky cortex typical of nodules derived directly from limestone or chalk bedrock. We have

2. Many of the stone artifacts from Üçağızlı Cave are coated with a calcium carbonate crust, which must be removed using a weak acid. The 1999 sample had been completely cleaned as of this writing, but the 2000 samples had not. Because some artifact edges are obscured by the encrustation, certain tool types, particularly burins and retouched flakes and blades, are likely to be under-represented in the 2000 sample as reported here.

TABLE 8.1 Typological Composition of Retouched Tool Assemblages from Üçağızlı Cave

Typological Category	Layer (1999 sample) F (n)	G (n)	H (n)	Layer (2000 sample) F (n)	G (n)	H (n)
A1 Levallois	**1**	—	**3**	**1**	—	**5**
A2 side scrapers and points	**6**	**2**	**7**	**5**	**1**	**1**
B end scrapers (all types)	**68**	**18**	**25**	**56**	**3**	**14**
b (indet.)	17	4	8	9	—	2
b1	20	9	10	25	1	6
b2	20	5	6	13	1	2
b4	1	—	—	3	—	—
b5	2	—	—	—	—	—

not yet succeeded in locating the original sources of these nodular flints, but it is certain that they do not occur in the immediate vicinity of the site.

In layers F–H, around half of the cortical tool blanks have pebble cortex. The percentage having pebble cortex rises to 60–75% for debitage. This suggests that the majority of in situ flint working involved pebble raw materials, but that a slightly greater proportion of flints from primary sources were used in the production of tool blanks. For comparison, in the upper layers (B–B4), more than 80% of the cortex on tools and debitage is of the nonpebble or nodular variety. The contrasts between the upper and lower layers probably reflect somewhat different raw material provisioning strategies associated with different patterns of mobility and site use (see Kuhn 1992, 1995). The representation of different kinds of cortex on tools and debitage from layers F–H may indicate that a substantial proportion of the tools were brought to the site in finished form, perhaps as part of mobile tool kits.

Table 8.1 shows a basic typological breakdown of retouched artifacts from layers F through I. The type categories are taken from Hours's (1974) typology for the Upper Paleolithic of Lebanon. Simple end scrapers, especially short forms (type B1) are the most abundant retouched tool forms. The characteristic artifact form in these layers consists of short, heavily modified end scrapers made on thick flakes or flake/blades, often with faceted platforms (figure 8.3: 6, 7, 14). Other, less abundant types include retouched blades (figure 8.3: 9), burins, and retouched pointed blades (figure 8.3: 2), although the latter are much less abundant than in the more recent layers at the site. Slightly fewer than 10% of the tools from layer H can be charac-

TABLE 8.1 (*continued*)

Typological Category	Layer (1999 sample) F (n)	G (n)	H (n)	Layer (2000 sample) F (n)	G (n)	H (n)
b6	3	—	—	1	—	1
b7	3	—	1	3	—	2
b8	1	—	—	—	—	—
b10	1	—	—	2	1	1
D burins (all types)	**4**	**1**	**7**	**6**	**—**	**2**
d1	1	—	2	—	—	—
d3a	—	—	—	1	—	1
d3b/c	—	1	1	2	—	—
d7	2	—	4	3	—	1
d8	1	—	—	—	—	—
d9	—	—	—	—	—	—
E perçoirs	**2**	**—**	**—**	**1**	**—**	**1**
F backed pieces	**4**	**3**	**—**	**1**	**—**	**—**
G truncations	**3**	**1**	**2**	**5**	**—**	**—**
H notches and denticulates (all types)	**6**	**2**	**4**	**1**	**—**	**3**
h1, h2	2	1	2	1	—	1
h3	4	1	2	—	—	2
I pointed blades (all types)	**9**	**3**	**1**	**6**	**3**	**3**
i2	8	3	1	6	3	3
i3	1	—	—	—	—	—
Blades with Aurignacian retouch	—	—	—	—	—	—
i4	1	—	—	—	—	—
J retouched pieces and pièces esquillé (all types)	**32**	**12**	**14**	**20**	**1**	**3**
j1 + j6[1]	25	9	11	15	1	2
j2	—	—	—	—	—	—
j3	1	—	—	—	—	—
j5	6	3	3	5	—	1
K multiple tools	**5**	**4**	**1**	**2**	**—**	**—**
M nongeometric microliths	**2**	**—**	**2**	**—**	**—**	**—**
Tool fragments	**2**	**4**	**1**	**—**	**—**	**—**
Total	**145**	**50**	**67**	**104**	**8**	**32**

NOTE: Category totals shown in bold. —, No types found.
[1]Type J6, representing blades and flakes with partial retouch on one or both edges, was added to the type list for this study.

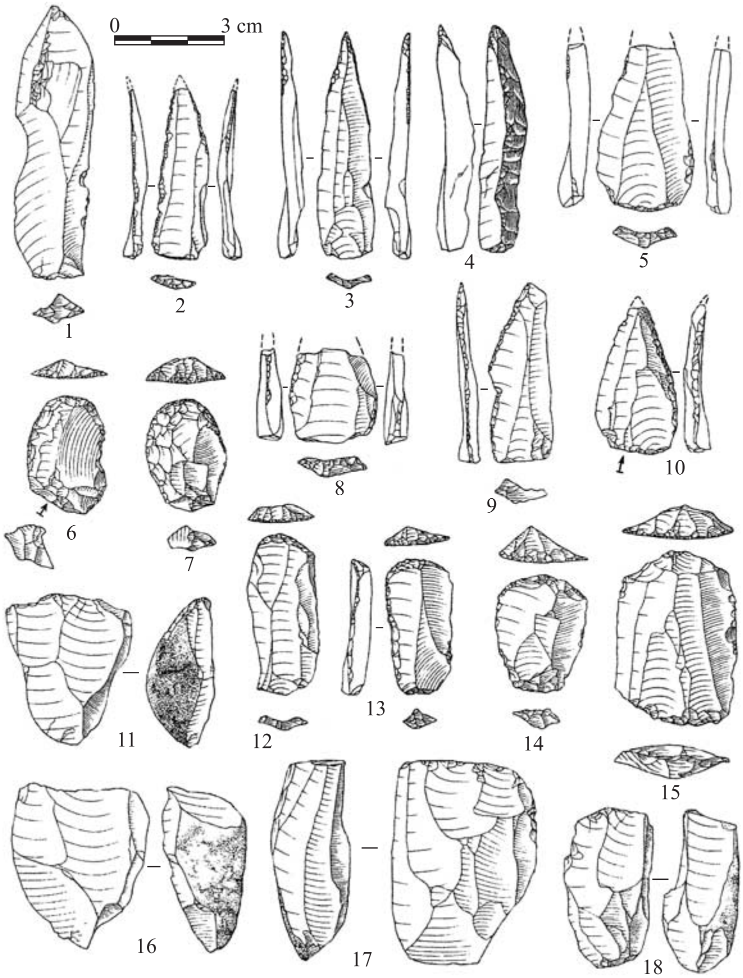

Figure 8.3. Artifacts from layers F–H at Üçağızlı Cave. Drawn by Kristopher Kerry.

terized as Levallois points and blades (figure 8.3: 5, 8). The “type fossils” of the earlier initial Upper Paleolithic—*chanfreins* and Emireh points—are not present at Üçağızlı. A few specimens (figure 8.3: 3) could be classified as Um el Tlel points (Boëda and Muhesen 1993): elongated Levallois points or blades thinned at the base by dorsal removals prior to detachment from the core.

Even the earliest assemblages at Üçağızlı show an appreciable laminarity. In layer F, blades outnumber flakes in both tool blanks and the larger deb-

TABLE 8.2 Tool Blank and Debitage Counts from Üçağızlı Cave

Artifact	Layer (1999 sample) F (n)	G (n)	H (n)	Layer (2000 sample) F (n)	G (n)	H (n)
Tool blanks						
Flakes	29	11	13	26	4	13
Blades and bladelets	54	12	19	21	0	12
Other forms	13	5	4	5	1	1
Indeterminate	51	22	33	12	0	3
Unretouched (> 2.5 cm)						
Flakes	106	24	139	—	—	—
Blades and bladelets	126	23	111	—	—	—
Other forms	62	10	73	—	—	—
Indeterminate	59	11	88	—	—	—
Unretouched (> 2.5 cm)						
Flakes	431	41	532	—	—	—
Blades and bladelets	92	8	115	—	—	—
Other forms	61	14	166	—	—	—
Indeterminate	384	101	965	—	—	—

NOTE: —, No data.

itage. In layers G and H, there is a more even mix between flakes and blades (table 8.2). As would be expected for an initial Upper Paleolithic assemblage, platform faceting is common. Of the unretouched pieces and tool blanks from layer F, roughly 43% have faceted or dihedral butts: the proportion of faceted and dihedral platforms is even higher among the tool blanks in layers G and H (69% and 54%, respectively) (table 8.3). Technological indicators suggest that most blank production was by hard hammer percussion. Platforms, whether plain or faceted, tend to be large and deep, and most flakes and blades have well-developed bulbs of percussion. However, a small but significant number of specimens possess punctiform or linear butts, contracting butts, and relatively flat bulbs of percussion, often considered indicative of soft hammer or indirect percussion. The crested blade technique was used, and most crested blades are unidirectional (e.g., figure 8.3: 4).

Core forms are surprisingly varied (table 8.4), although most have only one striking platform (figure 8.3: 11, 16, 17). The majority of cores would have yielded elongated products, either Levallois points or blades, elongated flakes, or true blades. Nonetheless, core forms range from flat, uni- or bidirectional specimens with faceted striking platforms, resembling Levallois blade or point cores, to true prismatic cores. The variety of core forms and platform types in layers F–H at Üçağızlı may indicate that more than

TABLE 8.3 Counts of Platform Types on Tool Blanks and Debitage from Üçağızlı Cave

Platform Type	*Layer (Retouched Tools)* F (*n*)	G (*n*)	H (*n*)	*Layer (Unretouched > 2.5 cm)* F (*n*)	G (*n*)	H (*n*)
Cortical	3	0	0	18	2	16
Plain	27	8	13	98	22	132
Dihedral	8	6	6	39	5	35
Faceted	22	12	13	59	18	97
Punctiform/linear	9	3	3	38	2	19

NOTE: Based on 1999 sample only.

one basic method of blank production was used. This would be consistent with Azoury's (1986) assertion that two distinct approaches to blade manufacture were used in the earliest layers at Ksar ʻAkil. However, it is also possible that the minority of blades that appear to have been produced by soft hammer or indirect percussion in fact represent one end of a range of variability in products of a single basic *chaîne opératoire.* Additional technological analysis and artifact refitting should help to resolve this question.

Although the technological differences between layers F, G, and H are subtle, there is some indication that a different suite of activities is represented in layer H. The tool:debitage ratio in layer H is roughly 0.03:1, much lower than for any other layer at the site. By way of comparison, the ratio for layers F and G are 0.11:1 and 0.23:1, respectively. Proportions of retouched pieces in the uppermost layers are even higher. The unusually large proportion of unretouched pieces and debris suggests that the layer H assemblage was characterized by more in situ manufacture than was true of other stratigraphic units at the site.

Technologically, the assemblages from layers F–H at Üçağızlı most closely resemble later manifestations of the initial Upper Paleolithic. The single closest match is Ksar ʻAkil layer XXI (Azoury 1986; Ohnuma 1988), which preserves the Levallois-like blade technology of the lower levels but contains few if any *chanfreins.* Azoury (1986) reports much higher frequencies of Levallois blanks for Ksar ʻAkil layer XXI, but this probably reflects somewhat different analytical criteria. The *Paléolithique intermédiaire* of Umm el Tlel (Boëda and Muhesen 1993; Bourguignon 1998) is another possible match, although a detailed description of the assemblage has yet to be published. Looking farther afield, Bohunician assemblages from central Europe present similar technological features with an essentially generic inventory of Upper Paleolithic tools forms (Svoboda and Škrdla 1995), although in the

TABLE 8.4 Counts of Core Forms from Üçağızlı Cave

	Layer (1999 Sample)			*Layer (2000 Sample)*		
Core Form	F (*n*)	G (*n*)	H (*n*)	F (*n*)	G (*n*)	H (*n*)
Tested	0	0	0	0	0	0
Disc-unifacial	0	0	1	0	0	0
Unidirectional Levallois	3	1	1	0	1	0
Bidirectional Levallois	0	1	1	0	0	0
Single platform flake/ blade core	6	2	6	2	1	0
Opposed platform flake/ blade core	3	0	0	0	0	0
Single platform prismatic blade core	1	1	2	1	0	0
Opposed platform prismatic blade core	0	1	1	2	0	0
Bipolar core	0	0	1	0	0	0
Amorphous core	0	0	4	3	0	0

Bohunician, cores tend to be bidirectional rather than having a single platform as at Üçağızlı.

FAUNA

Faunal remains from layers F, G, and H are extremely well preserved, although the cemented, clay-rich matrix makes it difficult to extract the bones in their original conditions. Large terrestrial herbivores were the dominant prey both in terms of numbers of specimens (NISP) and amount of meat represented. The most abundant taxon is *Capra* (probably *Capra aegagrus*), followed by fallow and roe deer *(Dama dama, Capreolus capreolus)*. Both wild cattle *(Bos aurochs)* and pig *(Sus scrofa)* are also present, although in much smaller numbers. Remains of terrestrial small game, such as birds, tortoises *(Testudo graeca)* and small carnivores (e.g., *Vulpes* sp.) are much less common. The earliest layers at Üçağızlı contain very little evidence for the use of marine foods. Shellfish of the types most often used for food in the more recent deposits (*Monodonta* sp., *Patella* sp.) are very rare in layers F–H.

The predominance of terrestrial game in such close proximity to the sea may simply be testament to a very rich terrestrial environment. Local topography could also have made Üçağızlı a particularly suitable base for the hunting of terrestrial herbivores. The drainages closest to the site are short and extremely steep, with high, nearly vertical walls. With such a box canyon-like configuration, the valleys would have been well suited for ambushing or corralling prey. Even so, shellfish and other marine resources are much more common in the later Upper Paleolithic layers (B, B1–B4, C) at the site. The scarcity of shellfish and marine resources, along with the predominance of caprids, suggest that layers F–H may have formed when conditions were relatively cold and dry and sea levels correspondingly low.

ORNAMENTS

Perhaps the most remarkable finding to date from layers F–H at Üçağızlı Cave concerns the association of ornaments with initial Upper Paleolithic stone tool assemblages. More than one hundred perforated shell beads or small pendants were recovered from these layers in the 1999 and 2000 excavation seasons (table 8.5). The most common ornamental species, *Nassarius gibbosula* and *Columbella rustica,* are typical omnivorous or predatory gastropods of the Mediterranean littoral zone. Another gastropod species, *Theodoxus jodani,* inhabits fresh or brackish waters, such as the mouth of the nearby Asi (Orontes) River. The great majority of these specimens were perforated by punching a small, irregular hole near the rim or lip of the shell. Beach wear (abrasion) is not uncommon on ornamental shells, but evidence for perforation by predatory mollusks is rare (table 8.5).

Ornaments are part of that suite of derived Upper Paleolithic features that are sometimes described as representing modern human behavior (Mellars 1989; Klein 1995). In general, ornaments are scarce in the early Upper Paleolithic of the Levant. Moreover, they have not been widely reported in association with initial Upper Paleolithic industries, although they are present throughout the sequence at Ksar 'Akil (Altena and von Regtern 1962; Kuhn et al. 2001). Thus the question naturally arises: Do these ornaments actually belong in the layers where they were found, or have they migrated down through the sediment column from more recent layers?

Several facts convince us that the shell beads found in layers F–H were deposited at the same time as the rest of the archaeological contents of these levels. As table 8.5 shows, the species composition of the ornament assemblage from layers F–H differs from more recent strata. *Nassarius* dominates the earliest ornament assemblages, whereas *Columbella* is more common in layers C–E, the next highest strata in the sequence. The two taxa are quite similar in size and shape, and there is no reason to think that *Nassarius* shells would have more readily migrated through the sediments. Likewise, the extreme scarcity of typical food species *(Patella* and *Monodonta)* in layers F–H argues against massive intrusion of shell ornaments from overlying deposits, as it is unlikely that beads would have moved around while fragments of food shells remained stationary.

TABLE 8.5 Distribution of Ornamental and Food Shells at Üçağızlı Cave

	Layer						
Taxon	B	B1–4	C	D	E	F	G/H
Ornamental taxa (%)							
Marine gastropods							
Columbella rustica	33	44	41	50	63	22	7
Nassarius gibbosula	50	44	29	50	25	64	88
Other species	6	4	6	10	2	5	0
Marine bivalves							
Glycymeris sp.	3	3	0	0	2	0	
Other species	5	2	0	0	—	0	
Fresh/brackish water gastropods							
Theodoxus jordani	3	3	21	2	10	0	0
Other species	<1	0	0	0	0	—	0
Total NISP	385	481	70	6	48	50	58
Damage incidence (%)							
Perforated	74	77	81	68	90	74	0
Mollusk-predated	6	3	3	0	0	0	3
Food taxa (%)							
Patella sp.	87	80	87	68	77	100	75
Monodonta sp.	13	20	12	32	23	0	25
Cerastoderma sp.	<1	<1	1	0	0	0	0
Total NISP	2255	2092	117	22	31	3	4

NOTE: All values except total number of identified specimens (NISP) are percentage NISP. —, No data.

RADIOMETRIC DATES

AMS radiocarbon dates from layers F–H are presented in table 8.6. Layers G and H yielded six determinations. Four of these range from around 39,000 to 41,000 BP, overlapping at just over one standard deviation. These earlier dates would seem to provide the most reliable age estimates and are probably equivalent to roughly 41,000–43,000 calendar years BP (see Kitagawa and van der Plicht 1998a). The two more recent dates from layer H, ranging from 33,000 to 35,600, are likely to have resulted from sample contamination or else to have been made on fragments of charcoal that had filtered down from overlying layers. Layer F has yielded two AMS radiocarbon dates, between 34,000 and 35,000 BP. Because no earlier determinations have been obtained from layer F, we cannot rule out the possibility that these determinations reflect the actual age of the deposits. Given the stratigraphic sequence at the site, it would be surprising to find that layers F–H spanned more than 5000 years, however.

TABLE 8.6 AMS Radiocarbon Dates from Layers F–H at Üçağızlı Cave

Layer	*Age (BP)*	*Lab Number*
F	34,000 ± 690	AA 35260
	35,020 ± 740	AA 37624
G	39,100 ± 1500	AA 37626
H	35,670 ± 730	AA 35261
	33,040 ± 1400	AA 37623
	38,900 ± 1100	AA 27995
	39,400 ± 1200	AA 27994
	41,400 ± 1100	AA 37625

NOTE: In all cases, material dated was charcoal.

The earlier set of AMS radiocarbon dates from layers G and H at Üçağızlı Cave fit reasonably well with standard estimates for the age of the initial Upper Paleolithic and transitional industries in the Levant and with the few available radiometric dates (Mellars and Tixier 1989; Bar-Yosef 2000). Because the difficulties of calibration and sample contamination are compounded as radiocarbon determinations approach the limits of the technique, it is unwise to place too much importance on differences between dates in the range of 40,000 radiocarbon years BP. Nonetheless, the age estimates for layers G and H at Üçağızlı are consistent with the idea that this is a relatively late manifestation of the initial Upper Paleolithic. The dates from layer F are more problematic. They seem too recent, but there are currently no grounds for rejecting them. If they prove to be correct, they would greatly extend the temporal range for the initial Upper Paleolithic, implying considerable temporal overlap with more classic Upper Paleolithic industries (Ahmarian, Aurignacian) in the Levant (see Phillips 1994; Bar-Yosef 2000).

DISCUSSION

At one time it appeared that the Levantine initial Upper Paleolithic represented a short-lived hybrid transitional interval between the local Mousterian and more classic Upper Paleolithic industries such as Ahmarian and Aurignacian. It now appears that similar kinds of assemblages have a very wide geographic distribution. Early Upper Paleolithic assemblages with Levallois-like methods of blade production dating to approximately the same time range (about 45–36 ka) are now known to be distributed from central Europe to the Altai Mountains (Demidenko 1989a; Svoboda and Škrdla 1995; Ginter et al. 1996; Derevianko et al. 2000c; Gladilin and

Kozłowski 2000a), perhaps extending even to Mongolia and northern China (Brantingham et al. 2001). Either very similar kinds of hybrid technologies developed independently over a vast portion of Eurasia, or the technological phenomenon that unites these diverse archaeological occurrences (a form of blade production with many features of the Levallois method) propagated widely from a single source (Tostevin 2000). If all of these occurrences represent parallel in situ developments out of an indigenous Middle Paleolithic base, their synchronous appearance over such a broad spatial scale is remarkable. If, on the other hand, they represent the spread of a specific population or set of technological procedures, current archaeological knowledge does not provide an obvious answer as to what advantage the initial Upper Paleolithic way of doing things might have afforded.

Radiocarbon results from excavations at Üçağızlı, although preliminary, bear on the questions of the evolutionary significance of the initial Upper Paleolithic. To date, there has been very little direct evidence for the ages of initial Upper Paleolithic deposits in the Levant. In combination with near-infinite dates from Boker Tachtit (Marks 1983b), AMS radiocarbon dates from layer H at Üçağızlı indicate that the initial Upper Paleolithic lasted at least 5000 (radiocarbon) years. If the assemblage from layer F can indeed be considered to fall within the definition of initial Upper Paleolithic, and if the current dates hold up, then it may have lasted twice as long. This is not what we expect of a short-lived transitional phase. The picture of the initial Upper Paleolithic that emerges is that of a discrete and long-lived entity showing a remarkable degree of technological, if not typological, continuity and a broad distribution.

Another puzzling aspect of the initial Upper Paleolithic derives from the lack of information about aspects of behavior other than those associated with lithic technology. For the most part, such assemblages lack features, such as bone or antler tools, ornaments, and art objects that differentiate the Upper Paleolithic sensu lato from the Mousterian. However, it is has never been entirely clear whether the absence of these features from the archaeological record indicates that they were absent in the past as well. The best-known sites were either excavated in earlier eras, when recovery techniques were not up to today's standards (e.g., Ksar 'Akil, Antelias), or are open-air localities, where organic preservation is poor (e.g., Boker Tachtit). The scarcity of art, ornaments, and bone tools could be genuine, but taphonomic factors and recovery techniques could play a major role in their deficit as well.

It is now clear that at least one of the features of so-called modern human behavior was indeed in place with the initial Upper Paleolithic. At Üçağızlı and Ksar 'Akil, shell beads are abundant in even the earliest layers (Kuhn et al. 2001). In the northern Levant, at least the initial Upper Paleolithic is more than just a kind of late Mousterian assemblage with blades, end scrapers, burins, and Emireh points or *chanfreins*. In this part of the Mediterranean basin at least, the practice of using material culture as a medium of communication was well established by 40,000 years ago, perhaps considerably earlier. Whether similar artifacts will be found in other regions, and whether the Levantine initial Upper Paleolithic will eventually be shown to include other distinctive features of the Upper Paleolithic remains to be seen.

ACKNOWLEDGMENTS

This chapter is based on work supported by the National Science Foundation (grant SBR 9804722), Ankara University, and the Office of the Vice President for Research at the University of Arizona. We thank these institutions for their economic and material support of this project. The generous cooperation of the Hatay Museum and the Turkish Directorate of Monuments and Museums has also been instrumental in the successful execution of the research reported here. Paul Goldberg, project geologist, is responsible for the insights into the formation of deposits at Üçağızlı Cave.

9

The Upper Paleolithic in Western Georgia

T. Meshveliani, O. Bar-Yosef, and A. Belfer-Cohen

Genetic studies indicating a recent origin for modern humans have reinvigorated interest in the archaeology of the Middle-Upper Paleolithic transition and how it is related to the emergence and dispersals of modern populations. Some researchers have correlated the extensive movements of modern human groups into or across Eurasia with concrete archaeological entities (Semino et al. 2000). The most significant population movement is considered as marking the advent of the Upper Paleolithic revolution. The search for the causes and origin of this major cultural change has resulted in divergent perspectives. Some authorities suggest that this revolution was no more than a continuation of a process of local cultural change through time within each region. They surmise that the local populations responsible for Middle Paleolithic Mousterian tool kits independently transformed them into characteristic Upper Paleolithic industries. Such an explanation does not require any appeal to population replacements (Wolpoff 1998). Other researchers accept the idea of prehistoric migrations, but nonetheless consider that endemic Neanderthal populations were capable of acquiring new technological skills, such as lithic reduction techniques for the standard production of blades, shaping of bone, and the production of body decorations (e.g., Zilhão and d'Errico 1999). Yet a different approach proposes that the Upper Paleolithic transformation was a major revolutionary event that took place in one particular region and from there eventually spread out to the rest of the Old World. While moving across Eurasia, the bearers of this new set of tools, often known as Cro-Magnons, influenced and replaced local populations (Mellars 1999; Bar-Yosef 2000). Dating the end of the Middle Paleolithic and onset of the Upper Paleolithic is crucial, at least in part, for testing these various models. Moreover, if the model of diffusion and migration from a core area is correct, then searching for geographic location of this core area is of great importance (Bar-Yosef 2000).

Although genetic evidence indicates that modern humans spread from Africa to Eurasia, further testing is required to locate the actual geographic source of these modern populations, in East Africa (Klein 1995, 1999), the Levant (Stringer 1989, 1996; Sherratt 1997), or somewhere else in Asia (Kozłowski and Otte 2000). The current view that modern humans came to Europe from East Africa or the Levant draws attention to a number of intermediate geographic regions, especially those bordering the Levant, such as Turkey and Georgia. These countries lie at the African-Eurasian crossroads (Kozłowski 1998; Otte 1998; Nioradze and Otte 2000)

We do not consider it necessary to explain the Middle-Upper Paleolithic transition in terms of a biological change, be it a speciation event (Stringer 1989) or a sudden neural modification within a single species (Klein 1995, 1999). It seems to us, first and foremost, that the Upper Paleolithic is manifested in technological innovations (e.g., the use of bone and antler), a realignment of the social organization, new ways of intergroup communication, major changes in the expression of group or clan identity (through the introduction of body decorations), and probably improved hunting devices.

Assuming an east-west migration route of Upper Paleolithic populations within the circum-Mediterranean region, we present what is known about the chronology and archaeological sequence from the Caucasus, an area located north of the Zagros, Taurus, and the Levant. Although incomplete, this information contributes greatly to our knowledge concerning the social geography of the last Mousterians and the pioneering Upper Paleolithic groups in western Asia. Most of the data presented here derives from western Georgia (or Imereti), a region lying between the Likhi mountain range and the Black Sea (figure 9.1). Unfortunately, past excavations of Upper Paleolithic caves and rock shelters in western Georgia have suffered from several problems (see Liubin 1989). Here we list some of the problems inherent in the available data:

1. Stratigraphic observations were not systematic and excavation units were thick. The admixture of archaeological horizons and/or reliance on postdepositionally mixed deposits led to the false impression that there are lithic assemblages displaying “transitional” Middle-Upper Paleolithic characteristics.
2. Faunal remains were studied from a paleontological viewpoint, resulting in presence/absence lists of species without any of the anthropological analyses common today. Bone fragments, for example, were commonly discarded as unidentifiable. As a consequence, available collections cannot serve as a sound foundation for taphonomic studies of butchering patterns, cut and gnaw marks, or frequencies of bone burning.

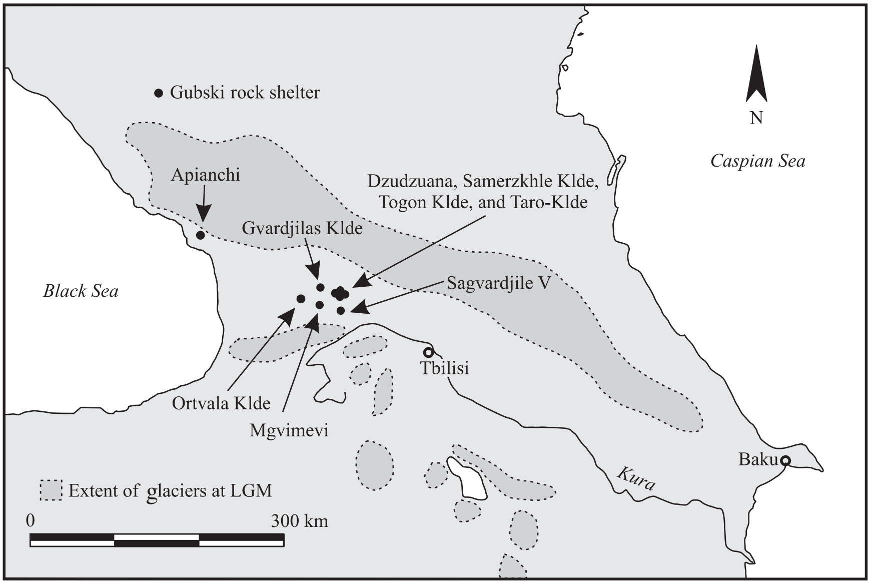

Figure 9.1. Map of the Caucasus region, indicating the expanse of glaciers at the Last Glacial Maximum (LGM) and the location of sites mentioned in the text. The primary area of reconstructed glaciation, extending from northwest to southeast, corresponds to the Likhi mountain range. After Liubin (1989).

3. Most of the cave sites containing presumed evidence for a stratigraphic continuum from the Middle to Upper Paleolithic were completely emptied during the course of excavations. It is therefore impossible to verify this supposition of stratigraphic continuity in most cases.
4. Until recently, radiocarbon dates were scarce and inconsistently reported.

A BRIEF HISTORY OF GEORGIAN UPPER PALEOLITHIC RESEARCH

Several cave sites and rock shelters in western Georgia containing Upper Paleolithic remains have been excavated over the past century (Liubin 1989), and numerous efforts have been made to reconstruct the local Upper Paleolithic sequence. Zamiatnin (1957) was the first to propose a chronostratigraphic sequence based on typological comparisons of various assemblages. His tripartite scheme for the Georgian Upper Paleolithic has been generally accepted, with only a few minor modifications introduced by Berdzeneshvili (1972), Tushabramishvili and Vekua (1982), and Liubin (1989). The main typological considerations in this scheme were: (1) the presence of Mousterian tool types, reflecting the gradualist assumption that assemblages occurring earlier in the sequence would contain higher percentages of Mousterian tool types; and (2) the presence or absence of microlithic tools, especially those of geometric forms, which were recognized as representing late Upper Paleolithic and Mesolithic entities.

Originally, the sites of Togon Klde and Khergulis Klde were considered to represent the earliest Upper Paleolithic in Georgia. Consensus later shifted to the assemblage from Sagvardjila V. Samerzkhle Klde, Savante-Savana, and Dzudzuana Cave were also accepted as examples of the early Upper Paleolithic. A middle Upper Paleolithic phase included assemblages from Sakajia, Devis-Khvreli, and Mgvimevi. The latest phase was represented by assemblages rich in geometric microliths uncovered at Gvardjilas Klde and Apianchi. Most researchers agreed that the chronological positions of the majority of the assemblages, except the earliest and the latest of them, were difficult to assess.

Kozłowski was the first to cast doubt on the ages assigned to many of these assemblages and thereby question the validity of the tripartite scheme for the Georgian Upper Paleolithic. He suggested that the Georgian sequence would benefit from comparisons with assemblages much farther afield, especially those of the Near East. Accordingly, comparisons with the Baradostian lithic assemblages from Shanidar Cave led Kozłowski (1972) to propose an age of 30–34 ka for Sagvardjila V, considered by him to represent the earliest Upper Paleolithic.

Meshveliani (1989) subsequently sought to revise the Georgian Upper Paleolithic sequence based on reexaminations of collections from most of the Upper Paleolithic sites in the regional sequence. Significantly, his study tried to incorporate data obtained through geological, palynological, and paleontological investigations. Meshveliani's study revealed that none of the sites—with the possible exception of Sagvardjila V, for which material was not available for restudy—fit within existing definitions of either the European or Near Eastern early Upper Paleolithic. Detailed reexaminations of the collections and geological data also established that admixture between Middle Paleolithic and Upper Paleolithic layers had occurred in many instances. Meshveliani thus rejected the accepted wisdom of the day that the western Georgian Upper Paleolithic evolved from the local late Mousterian, primarily because the supposed typological continuity lacked solid stratigraphic evidence. In his final conclusions, he proposed that most of the Upper Paleolithic occurrences in western Georgia belonged to the final stages of the Pleistocene and perhaps lasted well into the Holocene. Meshveliani also suggested that there was no congruency between the techno-typological seriation established for the Upper Paleolithic sequence and the few available radiocarbon dates, most of which were obtained from bone samples lacking specified stratigraphic provenances.

RECENT STUDIES OF THE GEORGIAN UPPER PALEOLITHIC

The only way to resolve the chronological issues surrounding the Upper Paleolithic sequence in western Georgia is to initiate new excavations employing modern archaeological methods. Such excavations will provide new data and facilitate radiometric dating; avoiding the significant problems associated with attempts to date samples derived from old excavations and collected using obsolete field techniques. The incorporation of information derived from systematic studies of sediment micromorphology, geochemistry, zooarchaeology, and palynology will provide a basis for reconstructing paleoenvironmental conditions and provide insights concerning the contextual integrity of given archaeological assemblages. New investigations should also aid, to some extent, the reinterpretation of observable technotypological variability recorded in previously studied collections.

Before beginning our research efforts, we formulated three major questions to be answered in renewed field and laboratory investigations. First, granting that there is no genuine early Upper Paleolithic in western Georgia, is it possible that the Middle Paleolithic persisted into later times, as is the case in Crimea, Croatia, Italy, and the Iberian Peninsula (Chabai and Marks 1998; Smith et al. 1999; Carbonell et al. 2000; Kuhn and Bietti 2000; Raposo 2000)? Without better control over the ages for the latest Middle Paleolithic and the "earliest" Upper Paleolithic manifestations in the Caucasus, this question cannot be answered.

Second, do the observable stratigraphic gaps in the Upper Paleolithic sequence seen in caves and rock shelters reflect the impact of climatic changes in a region affected both by the mountain glaciers of the Caucasus and the ameliorating effects of the Black Sea? Needless to say, without radiometric dates, any correlations between paleoclimatic events and their possible impact on human occupations cannot be established.

Finally, how do we interpret the final stages of the Upper Paleolithic? When the origin and development of agricultural systems across western Asia is taken into account, it is quite possible that Neolithic farmer-pastoralists arrived in the hilly region of Imereti during the early Holocene. Contact with an entirely different subsistence system could have initiated a process of acculturation among the last Upper Paleolithic foragers, or the invading populations could simply have replaced them. If cultural contact resulted in the adoption of herding systems by groups of foragers, the archaeological markers for such a process are expected to differ from those attributed to total replacement. Establishing the nature of the socio-economic changes during the first millennia of the Holocene should facilitate reconstruction of the cultural history of this region and the unknown fate of the last Upper Paleolithic hunter-gatherers.

Our new project is focused on excavation at two sites in western Georgia, Dzudzuana Cave and the Ortvale Klde rock shelter. Both excavations were initiated in 1996 by a joint team of Georgian, American, and Israeli researchers from various institutions (Meshveliani et al. 1999; Tushabramishvili et al. 1999). Ortvale Klde, where excavations are being conducted by N. Tushabramishvili and D. Adler, contains a thick late Mousterian sequence capped by much thinner Upper Paleolithic horizons (Tushabramishvili et al. 2002). Previous excavations in Dzudzuana Cave, conducted by D. Tushabramishvili and later by T. Meshveliani, exposed approximately 3.5 m of Upper Paleolithic deposits above bedrock. The Upper Paleolithic layers were capped by deposits representing an "Eneolithic" (or Chalcolithic) to early Bronze Age occupation. We are conducting new excavations in Dzudzuana Cave.

In this chapter, we use the results of the first five excavation seasons at Dzudzuana Cave, as well as AMS radiocarbon dates from Dzudzuana Cave and the upper Paleolithic deposits in Ortvale Klde, to reexamine the Upper Paleolithic sequence of western Georgia. We do not provide a full survey of previously known Upper Paleolithic sites, but rather demonstrate how new information may illuminate unresolved issues. The advantages of the new excavations include the practice of water screening, which immediately demonstrated that the percentage of microlithic materials is much higher than reported in previous publications. AMS radiocarbon dates on bone and charcoal from both Ortvale Klde and Dzudzuana Cave facilitate the building of a lithic sequence based on the stratigraphic order. Importantly, the available dates from Dzudzuana Cave reveal two occupational gaps in the Upper Paleolithic sequence, only one of which was observed in studies of the lithic assemblages. Following the appearance of a presently unclassified blade and bladelet industry dated to around 30,000 BP, there is clear technotypological continuity from around 27,000 BP to at least 20,000 BP. From 13,000 BP on, we observe a different variant of an Upper Paleolithic industry. These industries are described below.

Detailed studies of the lithic assemblages from Dzudzuana Cave and numerous other collections stored in the Georgian State Museum, Tbilisi, make it clear that the Aurignacian sensu stricto is not represented at any known site in the region. We are aware that carinated items once taken to indicate the presence of Aurignacian affinities in western Georgia are actually cores for the production of bladelets. We describe this particular technique in detail later in the chapter.

While comparing the old collections to those retrieved from our new excavations, we made a series of observations concerning the Upper Paleolithic industrial sequence. The information we present here is only an interim report, and with the acquisition of additional dates, the scheme for the regional Upper Paleolithic will undergo further modification. With the accumulation of new data, it may be possible to discern more than one contemporaneous geographical lithic facies.

UPPER PALEOLITHIC ASSEMBLAGES IN DZUDZUANA CAVE

The lower layers at Dzudzuana Cave have been considered to represent early Upper Paleolithic occurrences. The lowermost lithic assemblage, recovered during the earlier excavations and also encountered in 2001, is characterized by unidirectional blade/bladelet cores and the production of short blades and small bladelets. Many of the cores are exhausted, and their final morphology prevents formal classification. Among the retouched pieces, there are burins and typical end scrapers on flakes and blades, which appear consistently throughout the Dzudzuana Cave sequence. The most distinctive tool type is a very small, finely retouched bladelet, often less than 4 mm wide (figure 9.2). The following radiocarbon measurements, in stratigraphic order, provide a first indication of the age of this industry: 30,350 ± 400 BP (RTA 3438); 27,400 ± 300 BP (RTA 3437); and 27,150 ± 300 BP (RTA 3436). The earliest level is yet not dated.

The second industry in the Dzudzuana Cave sequence was recovered from several stratigraphic units. It is dominated by the production of small blades and bladelets (figure 9.3) detached predominantly from carinated narrow cores (figure 9.4). This type of core represents a specialized technique for obtaining narrow, long bladelets. Such cores were recognized almost a century ago by Bourlon and Bouyssonie (1912), who coined the term “rabot” based on the general morphological similarity with a woodworking push-plane. The intuition was that rabots were used for scraping and, subsequently, they have been classified along with other scrapers. At the time, this “tool” was seen to occur in Aurignacian contexts alongside carinated “scrapers” on flakes, and has thus come to be considered diagnostic of the Aurignacian.

It is now recognized that carinated cores represent the last stage of reduction of raw material nodules or thick flakes, a distinctive strategy previously described in the Near East under the classification “narrow cores” (Bar-Yosef 1970, 1991). Others have referred to these artifacts as “grattoires carénés surélevés.” We suggest adopting the term “carinated cores,” as it closely corresponds to the form of the object when discarded (Belfer-Cohen and Grosman in press). The production of bladelets from carinated cores began with bifacially shaping the nodule. The next step involved the removal of a ridge blade to establish the primary striking platform. A second ridge blade was then removed from the narrow end of the nose-shaped platform. To maintain a standard bladelet length, while also keeping the bladelets straight and flat, a notch was established by retouch or bifacial flaking on the edge opposite the platform, forming the keel of

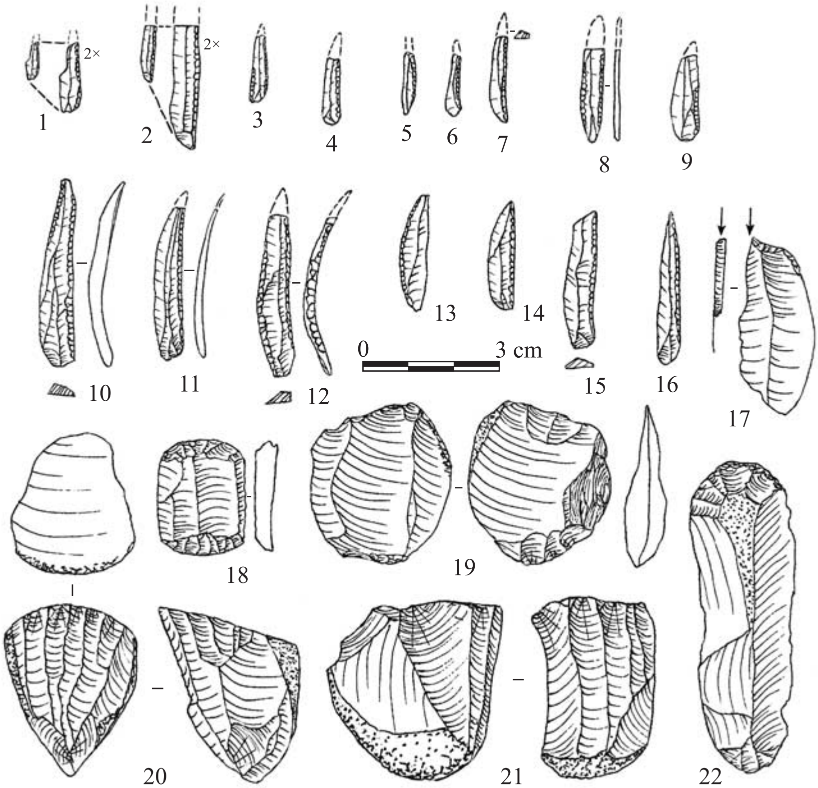

Figure 9.2. Artifacts from the Dzudzuana lower complex. Note the bladelets with fine retouch. Numbers 1 and 2 include actual size and 2× views.

the core. Bladelets were then removed in succession, with intermittent reshaping of the core along the keel and the two sides of the platform. Rejuvenation of the platform produced a typical core tablet that is relatively narrow and elongated. Selected bladelets were modified into tools by fine to semiabrupt retouch.

Other lithic tool types of this industry include simple end scrapers on flakes and blades, burins, and, rarely, borers (see figure 9.3). The stratigraphic units containing this industry yielded the following series of AMS radiocarbon dates, all on bone: 21,220 ± 200 BP (RTA 3433); 20,980 ± 150 BP (RTA 3434); 21,930 ± 190 BP (RTA 3435); and 23,240 ± 200 BP (RTA 3823).The upper assemblages from Dzudzuana Cave are rich in blades and bladelets from bipolar cores, which differ considerably from the carinated cores of the underlying industry. They are larger—although the same range

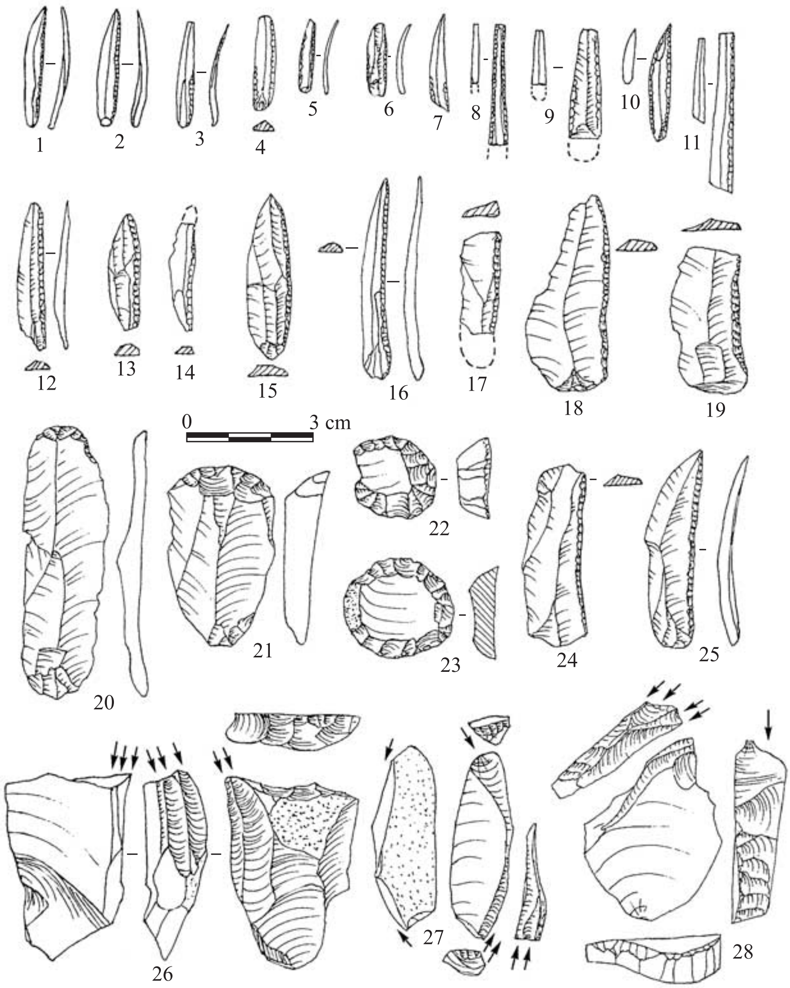

Figure 9.3. Artifacts from the Dzudzuana lower complex. Note the bladelets with fine retouch.

of primarily local raw material was used—and often have flaked backs (figure 9.5). Core trimming elements include many core-side ridge blades and some core tablets. Unretouched blades may reach a length of 8–9 cm. The most common tools are end scrapers, many of the "thumbnail" variety (figure 9.5). The dominant microlithic types are microgravettes and elongated straight-backed bladelets. The former are generally blades or bladelets, 11–16 mm wide, shaped by bipolar retouch. Modified bone items,

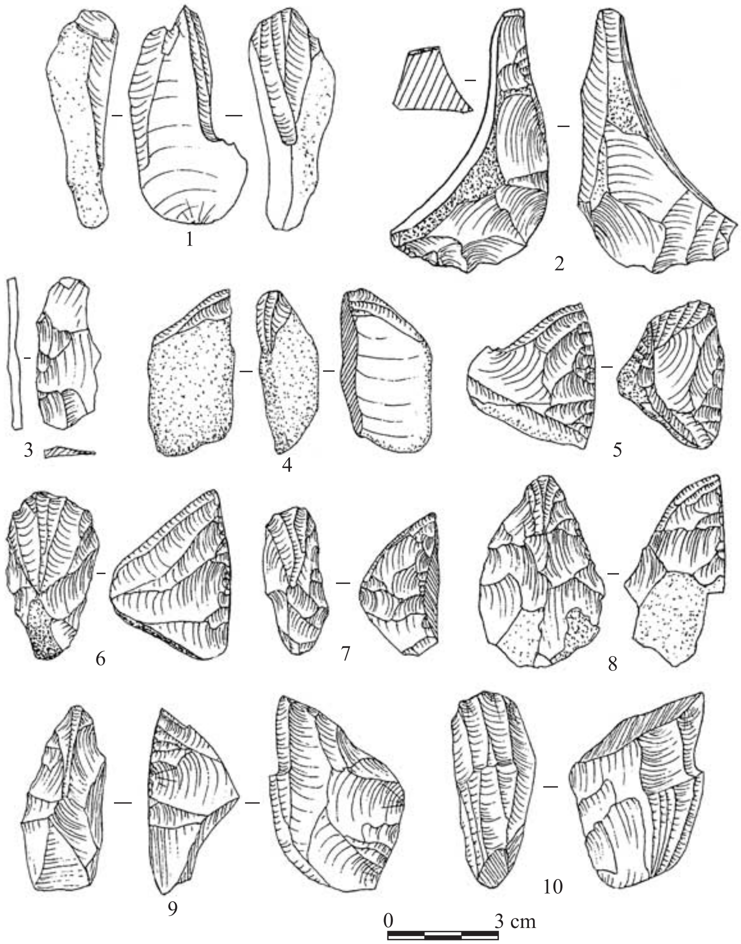

Figure 9.4. Carinated cores from the lower complex at Dzudzuana.

including simple points, awls, and some decorated items were recovered from both the upper microgravette and lower carinated core industries. The upper assemblages are currently dated to 13,830 ± 100 BP (RTA 3278) and 11,500 ± 75 BP (RTA 3282), but may have first appeared somewhat earlier.

Note that the available radiocarbon dates from Dzudzuana Cave reveal two chronological gaps in the sequence, one following 27 ka and the other following 23 ka. One may suppose either that different industry types will eventually be found to occupy these empty blocks of time (the later interval corresponding in part to the Last Glacial Maximum), or that each of the two known industries lasted longer regionally than the available data suggest. It

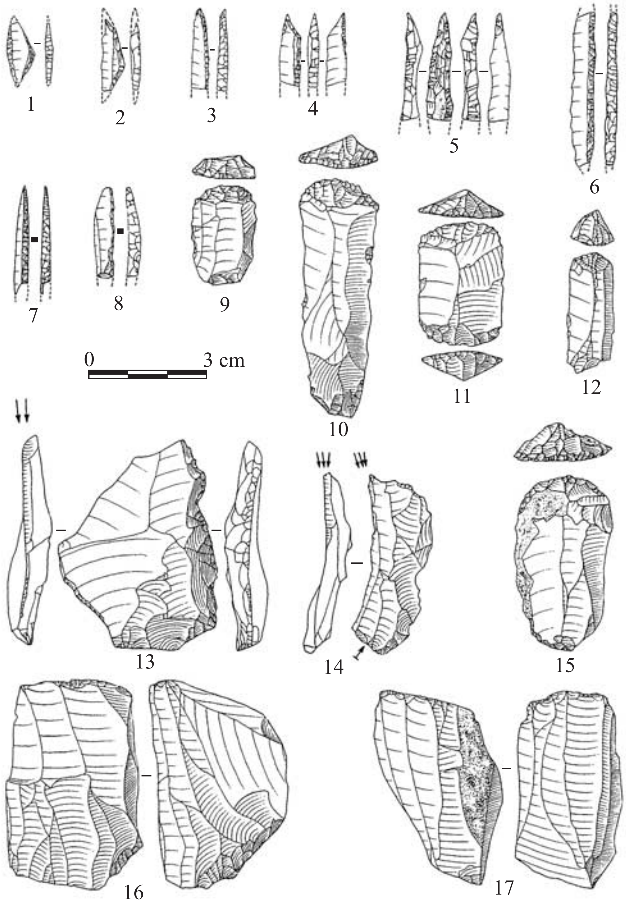

Figure 9.5. Artifacts from the Dzudzuana upper complex.

is possible, for example, that the carinated core industry ended around 16–17 ka and the microgravette industry started immediately thereafter.

OTHER UPPER PALEOLITHIC ASSEMBLAGES

In this section, we comment on several other Upper Paleolithic assemblages in the region. We believe that our results from Dzudzuana Cave, the new radiometric dates, and those recently published (Nioradze and Otte 2000) from other sites may help in constructing a revised Upper Paleolithic sequence for western Georgia. Although we could not study the original collections from Sagvardjila V, we accept the observations of various scholars who have studied the materials, including Kozłowski (1972), who noted the resemblance between the original Sagvardjila V assemblages and the Baradostian, and on this basis, suggested assigning the former to the same time period as the latter (30–34 ka). The notion that the Upper Paleolithic began at a later time in the Caucasus region has found support in dates obtained for late Mousterian layers at sites such as Mezmaiskaya Cave (Golovanova et al. 1999), located on the northern flanks of the Caucasus, and Ortvale Klde (Tushabramishvili et al. 2002), on the southern side. The four dates (two from each site) fall between 34 and 37 ka. If a local cultural transition is reflected in the lithic industries, it occurred much later than in the Levant. Moreover, the late Mousterian flake assemblages of the Caucasus are often Charentian in character, and the core reduction strategies are not well suited to a rapid shift to the production of blades and bladelets. Although we have not as yet obtained a date earlier than 30 ka for an Upper Paleolithic in western Georgia, an occurrence dated to around 32,000 BP was reported from Mezmaiskaya Cave (Golovanova et al. 1999). The lithic components from Mezmaiskaya differ from the lowermost assemblage from Dzudzuana Cave, primarily in the predominance of backed items. Given the location of the two sites—separated geographically by the peaks of the Caucasus—their apparent contemporaneity raises the possibility that they represent different industries produced in each region by local foragers. Another site older than 32,800 BP (KN 4501) is Apianchi Cave, situated near the shore of the Black Sea (Tsereteli 1988). However, detailed comparisons between the lithic assemblages from Apianchi, Dzudzuana, and Mezmaskaya Caves are currently not available.

A site traditionally considered to represent the early Upper Paleolithic is Samerzkhle Klde rock shelter. Its assignment to the early Upper Paleolithic was based on the observation that the lithic assemblage comprises numerous long blades, blade cores, and rarely, bladelet cores (e.g., Nioradze and Otte 2000: figures 13–18). Other components include simple end scrapers on blades, dihedral burins, and several carinated cores (rabots). Liubin (1989: 124) noted that the detailed sections published by the original excavators, as well as their field observations, indicate that there were at least two (if not more) Upper Paleolithic occupations separated by a sterile deposit. The total thickness of the Upper Paleolithic layers was around 1.2 m. A recently published radiocarbon date (on bone) from this site of 20,160 ± 160 BP (OxA 7854) (Nioradze and Otte 2000) and the reported presence of carinated cores indicates a general contemporaneity with the carinated core industry at Dzudzuana Cave (compare figure 13 in Nioradze and Otte [2000] with our figure 9.4). A similar industry with carinated cores was reported from the site of Gubs, located on the northern slopes of the Caucasus (Amirkhanov 1986; Cohen and Stepanchuck 1999). The Samerzkhle Klde industry, which contains long blades and bidirectional blade cores, resembles the late Upper

Paleolithic. Hence, the assignment of Samerzkhle Klde to an early Upper Paleolithic cannot be substantiated on the basis of current knowledge.

Many of the undated Upper Paleolithic assemblages in western Georgia are difficult to accommodate within a linear chronological sequence. The industry from Togon Klde rock shelter, for example, contains some bone (but not antler) tools, scrapers with scalariform retouch (resembling the Aurignacian style), dihedral and polyhedral burins, and only a few backed bladelets compared with the abundance of these items at Dzudzuana Cave. This difference in abundances may be linked to the omission of water screening at the Togon Klde excavation.

Another example of what may be interpreted as territorial variability is the assemblage from Savante Savana, a site in the lowlands, rich in scrapers with scalariform retouch and very high frequencies of burins on truncations. This assemblage resembles industries reported from such Levantine sites as Ksar ʹAkil VI, Fazael IX, and Nahal Ein Gev I, all dating to around 20–25 ka. Savante Savana may correlate with a later assemblage from Apianchi Cave, radiocarbon dated to 26 ka (Tsereteli 1988). However, the tempo of local changes in material culture and the degree of interregional interactions between the coastal region and the hilly hinterlands, some 100 km away, could have been more complicated than presently described.

The carinated cores in these assemblages have been considered Aurignacian markers. As explained above, however, there is no justification—either technological or typological—for linking Dzudzuana Cave, Savante Savana, Togon Klde, or any other site in western Georgia, with the Aurignacian tradition. Bone implements were recovered from almost every site, but none of these represent typical Aurignacian items, such as split-base points. Moreover, bear in mind that various types of bone tools, such as points, awls, and needles, were recovered from diverse Upper Paleolithic contexts from western Europe to south Africa and Tasmania.

There are as yet no dates for human occupations in western Georgia during the Last Glacial Maximum, although continuity in certain industries and known paleoclimatic conditions suggest that the region may not have been abandoned. Under the coldest glacial conditions, vegetation belts moved down from the Caucasus and fauna that typically occupy higher altitudes, such as the Caucasian wild goat, moved to lower elevations. Western Georgia, with its varied terrain and climate, might have served as a refugium for hunter-gatherer populations during the Last Glacial Maximum.

From about 15,000 BP on, various types and combinations of microgravette tools and backed bladelets are common at some sites. These assemblages also contain a standard inventory of simple end scrapers, thumbnail scrapers, burins, and awls. In certain cases, there is a marked increase in the percentage of geometric microliths. The cave site of Gvardjilas Klde, located 5 km from Ortvale Klde, is also known for its rich microlithic component incorporating, in addition to microgravettes, large numbers of such geometric microliths as triangles and lunates. The site also yielded small delicate awls, long borers, high frequencies of small end scrapers (including the thumbnail type), and a rich bone industry containing several ornaments and decorated items. Unfortunately, it is obvious from descriptions of the excavations that several Upper Paleolithic occupations were lumped together. Stratigraphic observations reveal that there were sterile layers interspersed between archaeological deposits, reaching a total thickness of 3.5 m (see Liubin [1989] and detailed references therein). We therefore expect that the two radiocarbon dates of 15,960 ± 120 BP (OxA 7855) and 15,010 ± 110 BP (OxA 7856) obtained from bone artifacts (Nioradze and Otte 2000) correspond to an early Epi-Gravettian occupation like that described from Dzudzuana Cave. The upper assemblages from Gvardjilas Klde, characterized by the clear-cut appearance of geometric microliths, are most probably of early Holocene age.

To the west, Sakajia Cave has been excavated by several archaeologists. Whereas the original excavators (Schmidt and Kozłowski) identified three separate Upper Paleolithic occurrences, later excavators (G. Nioradze and M. Nioradze) considered the entire Upper Paleolithic sequence as one unit (Zamiatnin 1957; Liubin 1989; Nioradze and Otte 2000). The industry contains prismatic and pyramidal cores, burins, scrapers, backed bladelets, a few shouldered points, and very few microgravettes. A particular tool type, represented by more than sixty items, is the so-called Azilian point (curved, backed short blade). The site has recently yielded a radiocarbon date of 11,700 ± 80 BP (OxA 7853) (Nioradze and Otte 2000), which may represent the later phase of the Upper Paleolithic sequence at the site.

Two final sites may also be included in this group. The uppermost layers in Apianchi Cave contain an industry of backed bladelets with a local variant of small, shouldered points. Two radiocarbon dates of around 14,500 BP have been reported, although the exact provenances of the dated samples are not known (Tsereteli 1988). Devis-Khvreli, situated 30 km southwest of Dzudzuana Cave in the Dzerula River gorge, contains an assemblage dominated by geometric microliths. Recovered from a depositional unit 0.5 m thick, this assemblage is accepted as representing the final stage of the Upper Paleolithic (Liubin 1989), a view in accordance with the recent radiocarbon date of 10,025 ± 55 BP (OxA 8020) obtained from a bone artifact (Nioradze and Otte 2000).

CONCLUSIONS

We note that the late Middle Paleolithic of the southern flanks of the Caucasus differs from the Levantine Middle Paleolithic. It resembles more closely sites on the northern side of the Caucasus, the Taurus (e.g., Karain

Cave) and, to a certain extent, the Zagros (Baumler and Speth 1993; Dibble and Holdaway 1993; Yalçinkaya et al. 1993; Golovanova et al. 1999; Bar-Yosef 2000). The Caucasus late Mousterian is currently dated to around 35 ka and thus provides the terminus ante quem for the earliest Upper Paleolithic (see Tushabramishvili et al. 2002).

The earliest manifestations of the Upper Paleolithic in western Georgia are dominated by the production of blades and bladelets. However, the importance of bladelets in these assemblages went unnoticed by many excavators because of the omission of water screening when working a site. In presenting such features, these early assemblages are indeed "advanced" when compared with the earliest Upper Paleolithic in the Near East and southeastern Europe. The blade-dominated character of the western Georgian assemblages does resemble the Ahmarian industries of the Levant. It would be presumptuous, however, to claim that the Levant was the source area of these western Georgian populations.

We stress that none of the Georgian assemblages were found to represent a true Aurignacian, be it a western European or Levantine variant. The suggested Aurignacian affinities of some of the Georgian assemblages, as interpreted from the appearance of carinated cores, is rejected. Carinated cores are shown to be simply a particular core reduction strategy for the production of bladelets and could have been invented independently in many different regions, as is apparently the case at Ein Gev I in Israel.

Further investigations are crucial to resolving outstanding questions regarding the Upper Paleolithic period of this region. In particular, we emphasize the need to gather information concerning site size and distribution, the activities carried out at the time of site occupation, and subsistence patterns.

ACKNOWLEDGMENTS

We are grateful to the American School of Prehistoric Research (Peabody Museum, Harvard University), the National Geographic Society (Washington, D.C.), the L. S. B. Leakey Foundation (San Francisco), and the Wenner-Gren Foundation for Anthropological Research (New York) for funding our field research and collaborative investigations. We thank D. Lordkipanidze, head of the Department of Geology and Paleontology of the Georgian State Museum (Tbilisi), for his help and participation in the field work, M. Tvalchrelidze for his geological observations, A. Vekua for supervising research on the faunal remains, and N. Dejakeli for her help in recording lithics. We thank E. Buaretto and S. Weiner (Wiezmann Institute of Science, Rehovot, Israel) for providing radiocarbon dates. A. Krauz, K. Kerry, D. Berikashvili, G. Bar-Oz, and Z. Matskevich were instrumental in carrying out field work at Dzudzuana Cave.

10

The Aurignacian in Asia

M. Otte

New discoveries in central Asia permit the distribution of the Aurignacian to be extended far beyond Europe, which brings into question the hypothesis of a direct African origin for modern humans. In Europe, modern human populations arrived with new technology, new values, and a new way of life. As archaeologists, we call this new behavioral complex the "Aurignacian." This model of modern behavior cannot be applied as such outside Europe, although it is clear that new people and new technologies were migrating from east to west beginning around 40,000 to 35,000 BP (Djindjian 1993). In my view, this movement of modern populations provoked various responses among indigenous Middle Paleolithic populations. Indeed, contact between modern and indigenous Middle Paleolithic populations appears to have initiated the development of leaf point industries in the north, bifacial foliate industries in the east, the Uluzzian industries in Italy, and the Châtelperronian in the west (Kozłowski and Otte 2000; Mellars 2000).

There is no clear earlier evidence to indicate a specific regional origin for modern human behavior. All the available dates for the Aurignacian in Anatolia (e.g., 28,000 BP at Karain B) (Yalçinkaya and Otte 2000), Georgia (e.g., 32,800 BP at Apianchi layer VII; figure 10.1) (Tsereteli 1998; Nioradze and Otte 2000; Meshveliani et al., this volume), and the Levant are all much younger than the oldest Balkan dates (e.g., greater than 43,000–37,000 BP at Bacho Kiro, and between 45,000 and 37,000 BP at Temnata layer 4) (Ginter et al. 1996; Kozłowski 1982). There is thus absolutely no archaeological evidence for an Aurignacian migration from Africa through the Near East to Europe; not a single Aurignacian-like tool has ever been found on the African continent. There may have been an earlier dispersal of modern humans out of Africa, limited to the southern Levant around

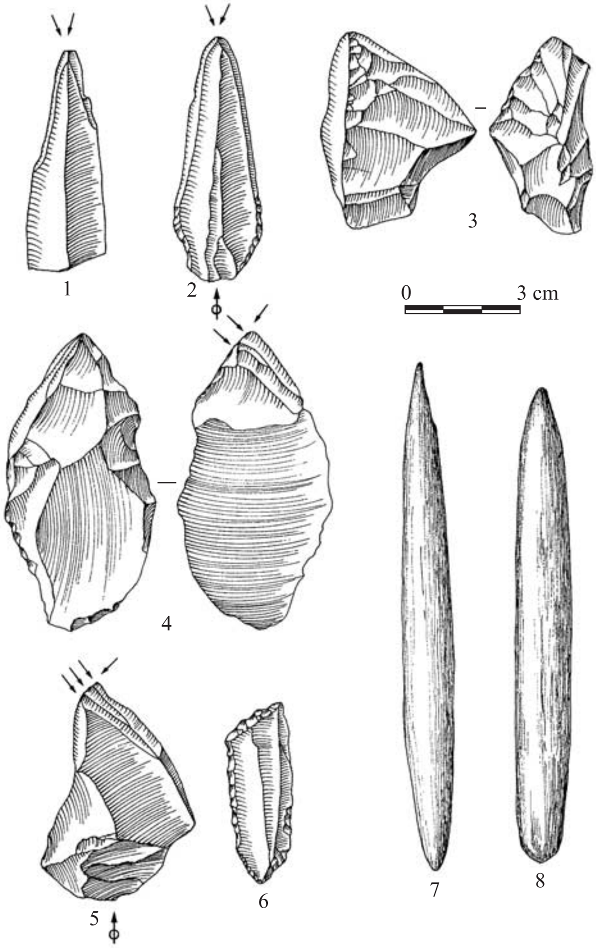

Figure 10.1. Georgian Aurignacian (Samerzkhle Klde): dihedral burins (1, 2); carinated burins (3–5); truncated blade (6); bone spear heads (7, 8). After Nioradze and Otte (2000).

100,000–90,000 BP (e.g., Zuttiyeh, Qafzeh), but this event should not be confused with later processes occurring in Europe or central Asia about 50,000 years later.

A series of alternative sites, described below, should be seriously considered as a possible source for the Aurignacian expansion into Europe. Aurignacian sites are found from the Altai to the Zagros Mountains. Although poorly dated up to now, the wide geographic area represented by these sites suggests that the Near East and central Asia could hold the origin of the Aurignacian. Regardless of the biological point of origin of modern human populations—either Africa or Asia—they converged upon a common cultural tradition, which was well adapted to open landscapes and represented by a specific lithic and bone technology. Subsequent population expansion would have been more or less along the same latitude as Europe, lateral movements that would have transported new ideas as well as new genes to Europe. From an anatomical point of view, there seems to be no reason to suggest that these migrating populations came directly from Africa at the beginning of the Upper Paleolithic.

ANUY

On the flanks of the Altai Mountains, the valley of the Anuy River passes in front of Denisova Cave. At the base of extremely thick slope deposits, traces of paleosols are found associated with diverse industries of Aurignacian character (figure 10.2). These include retouched blades and tools on thick flakes, retouched by bladelet removals. By comparing them with local sequences, the industries of Anuy have been attributed to the beginning of the Upper Paleolithic (Otte and Derevianko 2001).

UST KARAKOL

The site of Ust Karakol, also located in the Anuy River basin, contains a complex of paleosols dated by both radiocarbon and thermoluminescence methods to between 35,000 and 50,000 BP (Derevianko and Markin 1998a). Distributed among several successive levels, the tools demonstrate an evolutionary tendency based on the development of blades and the appearance of Aurignacian tools. A pendant made of bone material (possibly ivory) also evokes traditions from the beginning of the Upper Paleolithic (Otte and Derevianko 2001).

ZAGROS

Long archaeological sequences in Iran such as that at Warwasi (Olszewski and Dibble 1994) show the great importance of Aurignacian installations (figure 10.3). Radiocarbon dates were obtained for Baradostian industries at Yafteh Cave (nine dates between greater than 40,000 and 29,400 BP and one isolated result of 21,000 BP) and Shanidar (ten dates between 35,400 and 24,500 BP), which may hint at the deep roots of this tradition (Hole and Flannery 1967; Bar-Yosef and Pilbeam 2000).

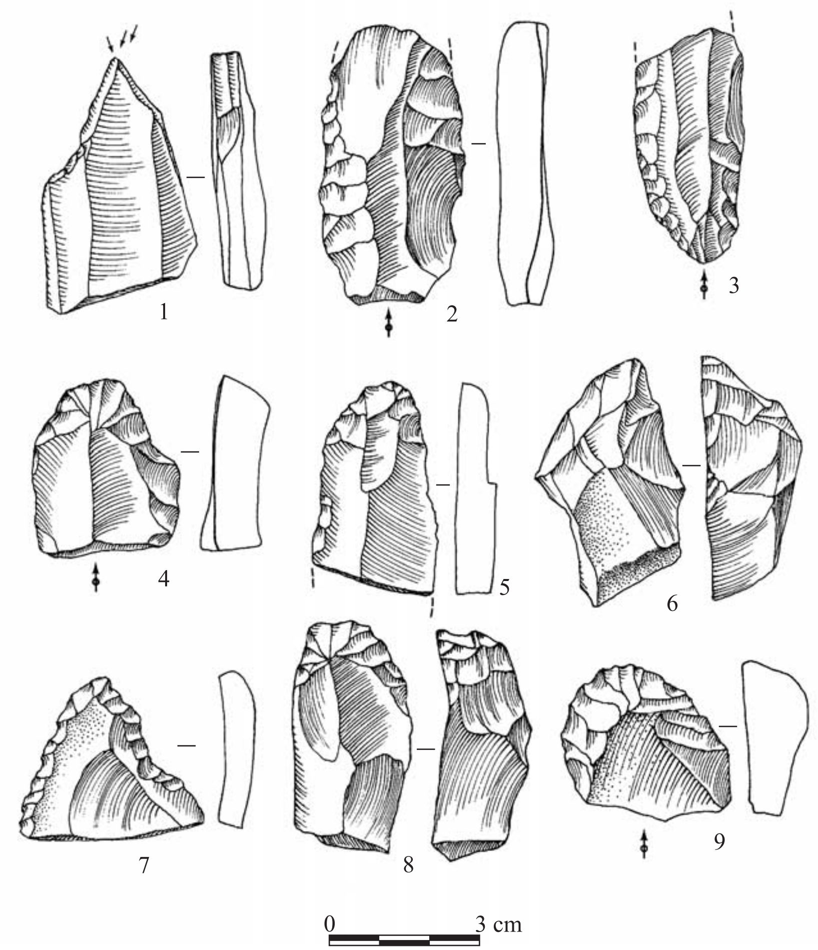

Figure 10.2. Altaic Aurignacian, Siberia (Anuy 2 layer 13B): dihedral burin (1); retouched blades (2, 3); carinated end scrapers (4, 6, 8, 9); end scrapers (5, 7). After Otte and Derevianko (2001).

REGIONAL CONTEXT

Numerous Upper Paleolithic sites are found on the eastern steppes of Asia, but they do not always present characteristics associated with the Aurignacian. For the most part, these sites contain laminar industries lacking unique identifying characteristics. By contrast, pure Aurignacian sites are found along the mountainous contours bordering this immense plain. From the

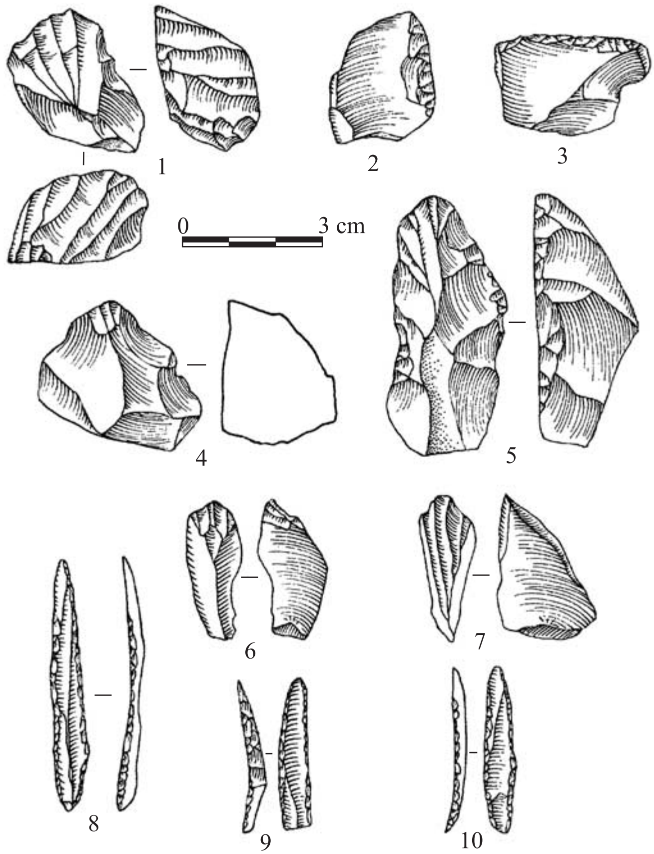

Figure 10.3. Zagros Aurignacian (Warwasi layer Z): carinated end scrapers (1, 4, 5); side scrapers on flakes (2, 3); carinated burins (6, 7); Krems-Dufour retouched bladelets (8–10). After Kozłowski and Otte (2000).

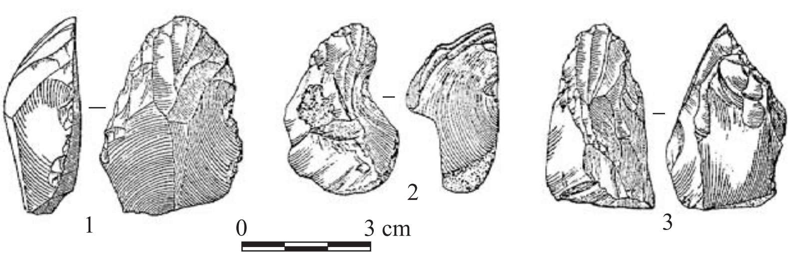

Figure 10.4. Afghan Aurignacian (Kara Kamar): carinated end scrapers (1, 2); carinated burin (3). After Davis (1978).

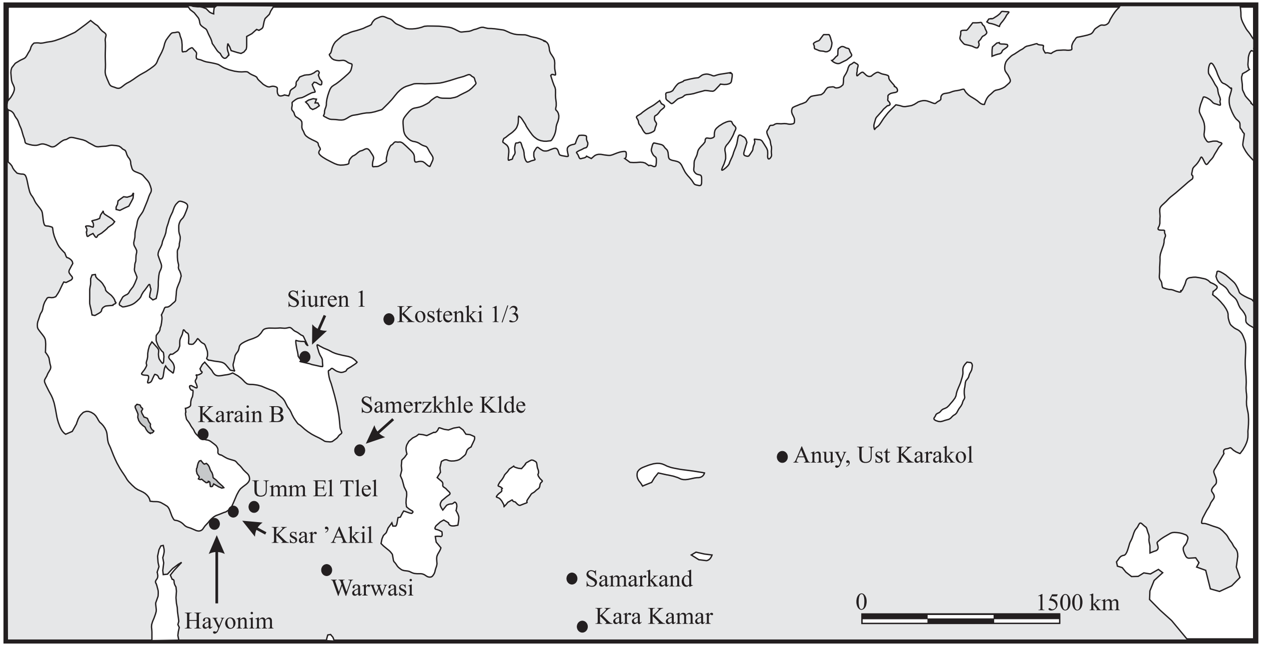

Figure 10.5. Distribution of Aurignacian sites in central Asia.

Altai to the Zagros, sites are found in Afghanistan (e.g., Kara Kamar, dated to 25,000 BP) (Coon and Ralph 1955; Coon 1957) (figure 10.4) and Uzbekistan (e.g., Samarkand). Other possible sites may be found on the broad steppe underlying thick aeolian deposits. This regional distribution is connected to the Levant by the southern Caucasus and Taurus Mountains. Europe could also have been reached by migrations along the northern coast of the Black Sea and Crimea (e.g., Siuren I) (Demidenko et al. 1998).

CONCLUSION

In Europe, the Aurignacian is found in association with modern humans. However, on the margins of Europe (in Anatolia and the Levant), the Aurignacian is more recent than in Europe. It does not correspond to the theory of an African migration along a Levantine corridor. By contrast, sites in central Asia suggest a diffusion of the Aurignacian simultaneously toward the Near East and Europe (figure 10.5). Identification of this region as a cultural center seems to be particularly promising because a series of sites have already yielded traces of Aurignacian passage. As a result, if modern humans were truly associated with the Aurignacian, they would have had an Asian rather than African origin (Otte 1994). It is also reasonable to posit that modern humans, originally from Africa, could have inhabited central Asia for an extended period before migrating to Europe with Aurignacian technology. Finally, it remains possible that the movement of the Aurignacian had no link whatsoever with Africa (where the Aurignacian is absent). Central Asia thus seems to have been a reservoir of modern humanity and served as a source for lateral displacements of Aurignacian populations.

11

The Middle-Upper Paleolithic Interface in Former Soviet Central Asia

L. B. Vishnyatsky

GEOGRAPHICAL DISTRIBUTION AND PALEOGEOGRAPHICAL BACKGROUND

The region containing the sites of interest in this chapter stretches from the Caspian Sea in the west to the Pamirs and Tian Shan in the east. This is a vast area with highly variable natural conditions. Different sections of this region have experienced different geological and environmental histories. The arid plains and mountains lying in the west, between the Caspian Sea and the Aral Sea, are of minor significance for this chapter, because no early Upper Paleolithic sites—nor any later Upper Paleolithic sites, for that matter—have as yet been discovered there. Much more important is eastern central Asia, where two great mountain systems—the Pamirs and Tian Shan—form a single mountainous country. A considerable part of this country lies above 5000 m in elevation, and the highest ridges exceed 7000 m. There are also many depressions and large valleys where sedimentary deposits accumulated during the Pleistocene. Among the dozens of sealed Paleolithic sites known in the region, there are several that can be more or less confidently assigned to the late Middle and/or early Upper Paleolithic (figure 11.1).

According to a widely held view, the climate of the Pamirs/Tian Shan area during the Late Cenozoic became increasingly arid, which led to significant changes in faunal and floral communities. Palynological data indicate that each succeeding stage of the Cenozoic was characterized by decreasing biological productivity and diversity (Pakhomov 1973), so that by the late Pleistocene, no more than ten or fifteen floral genera have been reported (even for the most humid periods), whereas in the middle Pleistocene, the number of genera reached twenty-six (Nikonov et al. 1989). A great deal of controversy exists regarding the correlation of mountain glaciations with cli-

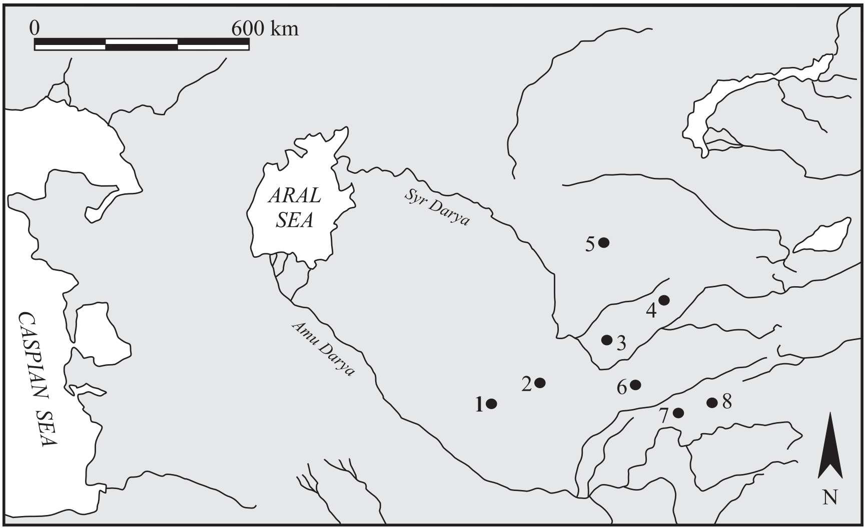

Figure 11.1. Distribution of the central Asian sites referred to in text. *Key:* 1, Zirabulak; 2, Samarkandskaya; 3, Kulbulak; 4, Obi Rakhmat; 5, Karasu (Valikhanov's site); 6, Khudji; 7, Shugnou; 8, Khonako 3.

matic events. One group of researchers believes that high-mountain glaciations were accompanied by cooling and increasing humidity in low-lying periglacial areas (Nikonov et al. 1989; Pakhomov 1991). Another group bases paleogeographical reconstructions on the assumption that glacial stages were characterized by more arid continental climates, and interglacials were characterized by increased precipitation and temperatures (Dodonov 1986). In any case, it is beyond doubt, despite increasing aridity, that the region witnessed several relatively humid stages during the late Pleistocene (Serebrianyi et al. 1980; Nikonov et al. 1989).

ARCHAEOLOGICAL MATERIALS

Over the entire region of central Asia, no more than a half-dozen sites have yielded assemblages that can be reasonably assigned to the early stages of the Upper Paleolithic. Note, however, that these assignments are based primarily on typological considerations, and only very rarely are they supported by stratigraphic observations or absolute age determinations. The number of the sites with reliably dated late Middle Paleolithic assemblages is still fewer, although it cannot be ruled out that most (if not all) of the Mousterian sites known in the region are very young (Vishnyatsky 1999: 105). Of primary interest for the problem of the Middle-Upper Paleolithic transition are the sites of Khudji and Obi Rakhmat, which have been dated to the period directly preceding the beginning of the Upper Paleolithic, as recognized in most regions of western Eurasia.

The open-air site of Khudji, Tajikistan (Ranov and Amosova 1984; Ranov and Laukhin 2000), is 40 km west of Dushanbe at 1200 m above sea level. The 1978 and 1997 excavation units, set on the right bank of Khudji Brook, exposed an area of about 300 m^2. Cultural remains were found in loess loams of the so-called Dushanbe complex (late Pleistocene). Unfortunately, only a part of the cultural layer is preserved, with most of it destroyed by road construction before archaeological work had begun. The faunal assemblage (3667 specimens) has not yet been described in detail, but according to preliminary reports, it is dominated by wild goat and wild sheep *(Capra* and *Ovis),* followed by deer (*Cervus* sp.), horse (*Equus* sp.), and tortoise (*Testudo* sp.). Single bones of porcupine (*Histrix* sp.), ox (*Bos* sp.), bear (*Ursus* sp.), wolf (*Canis* sp.), and red deer *(Cervus elaphus)* were also found. In 1997, a human mandibular deciduous incisor was discovered in the cultural layer (Trinkaus et al. 2000). Its taxonomic affiliation is unclear. Palynological data suggest that the cultural layer was formed under rather cold conditions. A radiocarbon date of 38,900 ± 700 BP (GIN-2905), obtained from a charcoal sample in the late 1970s, has recently been corroborated by a series of five new determinations ranging from 36 to 42 ka (Ranov and Laukhin 2000).

The collection of stone artifacts includes about 10,400 items made primarily of fine-grained quartz sandstone and aleurolite, both of which are available at the bottom of the neighboring gorge. A few objects are made of flint and silicified slate, which are not present in the immediate environment. Cores are often amorphous, without clear signs of special preparation. Most do not fit readily into conventional types, although there are typical narrow, wedge-shaped cores (figure 11.2: 7) and flat cores with parallel flaking (figure 11.2: 8, 9). Intact blades (figure 11.2: 1–6) are almost as numerous as intact flakes and display more regular morphologies. Based on this, combined with the observation that more than half of the total number of retouched tools are on blades (figure 11.2: 10–16), I conclude that the technology was aimed primarily at the production of elongated blade blanks. Most of the retouched blades are described as side scrapers (single, double, and convergent) and points. The rest of the tools are retouched flakes, notches, denticulates, single burins, and putative end scrapers. Based on these observed typological and technological characteristics, there is little doubt that the industry from Khudji should be considered Middle Paleolithic.

More controversial is the question of how to define the industry from Obi Rakhmat, Uzbekistan (Suleimanov 1972; Derevianko et al. 1998b), which is located 100 km northeast of Tashkent, close to the confluence of the Chatkal and Pskem Rivers at 1250 m above sea level. This cave, on the fourth terrace of the Chatkal, is said by geologists to have formed during the first half of the

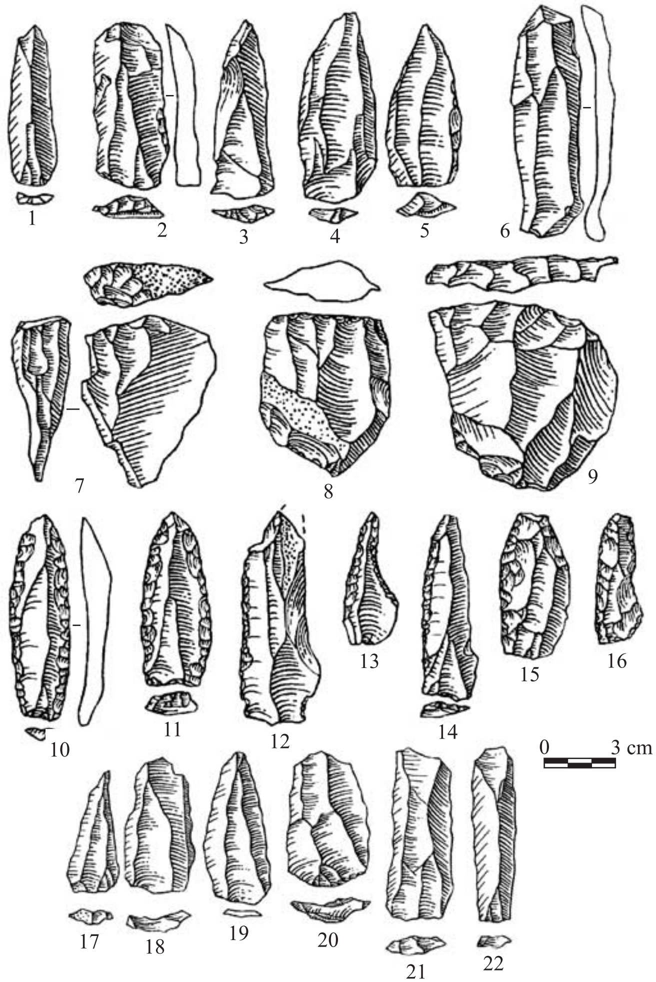

Figure 11.2. Stone artifacts from Khudji (1–16) and horizons 3–4 of Shugnou (17–22). After Ranov and Amosova (1984).

late Pleistocene, and to have filled with loam and detritus (around 10 m thick) during the second half. Excavations conducted in the mid-1960s exposed an area of about 60 m^2 at the surface, but only in 2 m^2 at the base of the deposits. The materials have been described according to lithological units, as neither true cultural layers, nor sterile layers separating cultural units were identified. The faunal assemblage is dominated by wild goat *(Capra sibirica)* (60% of identifiable specimens), followed by red deer *(Cervus* *elaphus* cf. *bactrianus)* (30% of identifiable specimens). It also includes rare bones of sheep (*Ovis* sp.), marmot (*Marmota* sp.), boar *(Sus scrofa),* and, supposedly, cave lion *(Panthera leo spelea).* Two U-series dates of 125 ± 16 and 44 ± 1 ka (calendric) were obtained on bone (Cherdyntsev 1969: 290), but the provenances of the samples are unclear. Nonetheless, the younger age is in good accordance with new radiocarbon dates for the upper layers of the site, which range from 40 to 46 ka (Derevianko et al. 1998b).

The Paleolithic inhabitants of Obi Rakhmat made their tools from raw materials available in vicinity of the cave. Most of the approximately thirty thousand stone artifacts are made from silicified limestone, which could have been obtained from nearby outcrops. The remainder are made from quartz and quartz-sandstone pebbles. The bulk of the materials comes from the middle part of the cave deposits, whereas the lowermost and uppermost layers yielded very rare (if any) finds. The industry is characterized by an abundance of long blades with even, sharp edges—according to Suleimanov, Ilam is 60. These blades were struck from single-platform or bidirectional cores with convex flaking surfaces (figure 11.3: 15). True prismatic cores are absent. Discoidal cores are rare and heavily reduced (figure 11.3: 12). Tools are represented mainly by blades retouched along one or both edges (figure 11.3: 1–11, 13, 14, 16, 17). A number of the latter can be considered elongated points, and one is indistinguishable from a Châtelperronian knife. Side scrapers on flakes are relatively rare, and usually have one straight or slightly convex working edge. There are also some burin spalls and burins, as well as end scrapers, but both tool types are atypical by Upper Paleolithic standards. Some authors regard the entire industry, or minimally the materials from the upper levels, as exemplifying the process of the Middle-Upper Paleolithic transition (Suleimanov 1972; Derevianko et al. 1998b). Others see no substantial differences in the cores and tools from different levels (Abramova 1984: 142). Based on a study of a considerable part of the collection, I consider the entire sequence to be Middle Paleolithic (Vishnyatsky 1996: 124–26; cf. Schäfer and Ranov 1998: 794).

In addition to Khudji and Obi Rakhmat, one has to take into account the materials from the two lowest layers at Shugnou, Tajikistan. Shugnou is situated in the upper reaches of the Yakhsu River, 55–70 m above the river surface, at an elevation of about 2000 m above sea level. The materials are associated with loess sediments of the third (late Pleistocene) terrace. More than 5000 m^2 were exposed during excavation. The sequence contains five cultural horizons (each 20–40 cm thick) occurring at depths between 3 and 11.5 m and separated by sterile strata (the upper layer, or horizon 0, is believed to date to the Mesolithic). Identifiable bones are rare throughout the sequence, but include horse, ox, wild goat or sheep, marmot, and turtle. Palynological data suggest that the beginning of human occupation (horizon 4) coincided with an expansion of boreal vegetation and a general

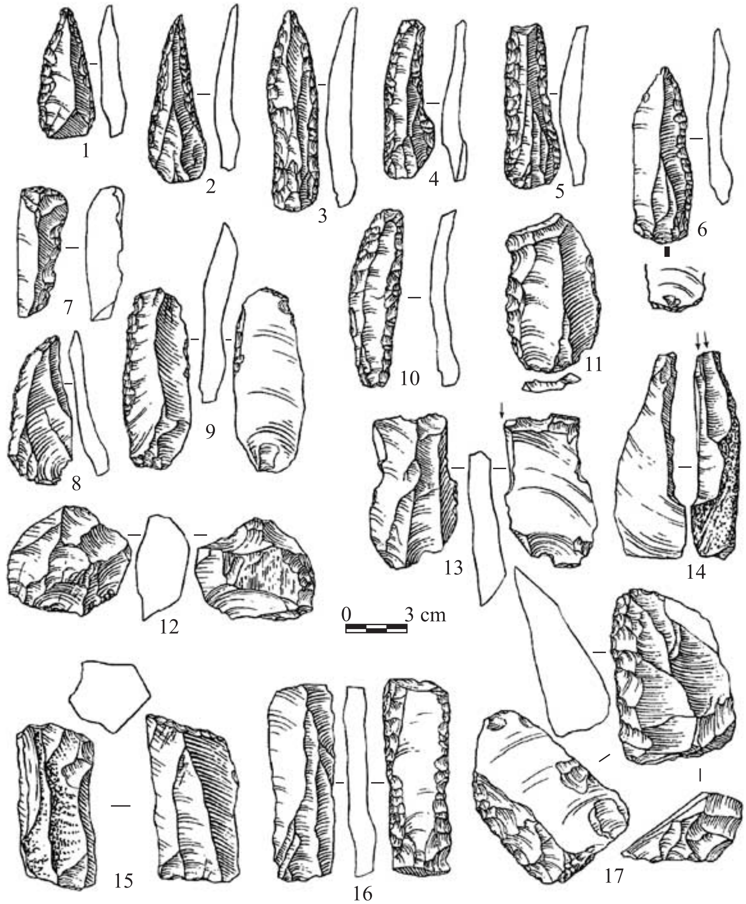

Figure 11.3. Stone artifacts from Obi Rakhmat. After Suleimanov (1972).

fall in temperature, and the later Paleolithic levels were also deposited under rather cool conditions. A radiocarbon date 10,700 ± 500 BP (GIN-590) was obtained for horizon 1. Most stone objects are made from porphyrite, but slate, silicified limestone, and less frequently, flint, were also used. The assemblages from horizons 1 (>1700 lithics) and 2 (>1800 lithics) are dominated by artifacts characteristic of the Upper Paleolithic—bladelets and large blades, various end scrapers, various types of points (including some similar to Gravettian points), perforators, and retouched blades. A few discoidal and Levallois cores were recovered from horizon 2. The collections from horizons 3 and 4 (about three hundred and two hundred items, respectively) are dominated by large flakes and flake blades (see figure 11.2: 17–22) and also contain single notches (retouched) and side scrapers. Although the materials from horizons 3 and 4 were originally considered to be Upper Paleolithic (Ranov et al. 1976), I have tried to show elsewhere that they are more consistent with a Middle Paleolithic designation (Vishnyatsky 1996: 100–101). Schäfer and Ranov recently expressed a similar view (1998: 795). In all likelihood, both layers occurring in the lowest part of the loess deposits, associated with cold palynological spectra, may be correlated roughly with the cultural layer at Khudji and dated to a time older than 35,000 BP. Only layer 2 at Shugnou is reasonably classified as early Upper Paleolithic.

Lithic assemblages somewhat similar to those from Khudji, Obi Rakhmat, and horizons 3–4 at Shugnou were reported from the open-air sites of Khonako 3, Tajikistan (Schäfer and Ranov 1998), and Zirabulak, Uzbekistan (Tashkenbaev and Suleimanov 1980: 61–66). Khonako 3 is associated with a massive loess outcrop located 10 km northeast of Shugnou. The industry is remarkable for the presence of numerous blades, including retouched specimens, and some true prismatic cores. This material, however, comes from a soil complex correlated with Oxygen Isotope Stage 7 and, if the correlation is correct, is beyond the scope of this chapter. Unfortunately, the site of Zirabulak, located 100 km west of Samarkand, was seriously disturbed by building works in historic times, and the Paleolithic artifacts found both on the present surface and at a depth of over 2 m were mixed with medieval ceramics.

As can be concluded from the above observations, late Middle Paleolithic assemblages of central Asia share a common set of technological and typological characteristics and probably can be considered to represent the same cultural entity. In contrast, stone industries of the early Upper Paleolithic sites are very diverse and differ sharply both from each other and from sites in adjacent regions.

A number of Upper Paleolithic sites are known in the Zeravshan basin. The most important, Samarkandskaya, is located within the limits of the city of Samarkand in Uzbekistan (Nesmeyanov 1980; Djurakulov 1987; Korobkova and Djurakulov 2000). The site has been under investigation since 1939, and the total area exposed in excavations is around 1000 m^2. Cultural remains are confined to deposits of two terraces on the right bank of the Chashmasiab ravine. Initial excavations were carried out on the lower terrace (10 m above the ravine bottom), where three cultural layers were thought to occur in dark loams. Subsequently, cultural remains have also been found in sediments of the upper terrace (15–17 m). The stratigraphy of the site is extremely complicated. Geological investigations conducted by Nesmeyanov have shown that the traditional treatment of the site as composed of three layers is an oversimplification resulting partly from inadequate excavation and recording techniques. In fact, archaeological materials do not occur in true cultural layers, but rather in levels of intensive habitation. Each habitation level includes several lenses saturated with lithics, bone fragments, pieces of charcoal, and ocher. Nesmeyanov (1980) distinguished four such levels within the lower terrace and three in the upper terrace, and considered the two sequences to be partially contemporaneous.

More than three thousand bones and bone fragments proved to be identifiable. Half of these are horse *(Equus* cf. *przewalskii);* the next most commonly found are from the Pleistocene ass *(Equus hydruntinus)* and aurochs *(Bos primigenius).* Remains of camel *(Camelus knoblochi),* red deer *(Cervus elaphus bactrianus),* steppe sheep *(Ovis arcal),* gazelle *(Gazella subgutturosa),* wild boar *(Sus scrofa),* wolf *(Canis lupus),* and wild ass *(Equus hemionus)* were found in lower frequencies. There are also barely identifiable long bone fragments that can be attributed to either elephant or rhinoceros. The human bones found at Samarkandskaya and ascribed to anatomically modern humans are of unclear provenance, and their association with the Paleolithic sediments is questioned (Nesmeyanov 1980: 43).

The stone inventory is very rich, diverse, and original, although no data regarding the number and composition of artifacts or their distribution have ever been published. Raw materials, dominated by flint, chalcedony, diorite, quartz, quartzite, and siliceous limestone are of relatively poor quality. Most cores are split pebbles and have usually one or two striking platforms and unidirectional or bidirectional parallel scar patterns, respectively. Unifacial discoidal cores are also present. True prismatic cores are absent, although some forms similar to wedge-shaped cores occur. Blades are not numerous and most are heavily retouched (figure 11.4: 7–16). Some of these retouched blades can be defined as elongated points. End scrapers of various types are the most numerous kind of tool found (figure 11.4: 1–6). Side scrapers on small flakes with slightly convex working edges (see figure 11.2: 17, 18), angular *(déjeté)* scrapers (figure 11.4: 19, 20), and chisel-like tools are also common. In addition, the tool kit includes perforators, retouched bladelets, objects with burin facets, pebble (chopper/chopping) tools, and objects defined as indentors and anvils. Both the cultural affinities of the site and its chronological position have yet to be ascertained. Traditionally, the archaeological assemblage has been considered unitary and homogeneous, although this assumption may be wrong. In my view, it cannot be ruled out that Samarkandskaya represents a palimpsest of occupational episodes widely spaced in time (from the Middle to the final late Pleistocene) and associated with different cultural traditions (see also Davis and Ranov 1999: 191). At least part of the materials from the upper terrace may well date to the first half and even the very beginning of the Upper Paleolithic, but much more reliable data are needed to substantiate this supposition.

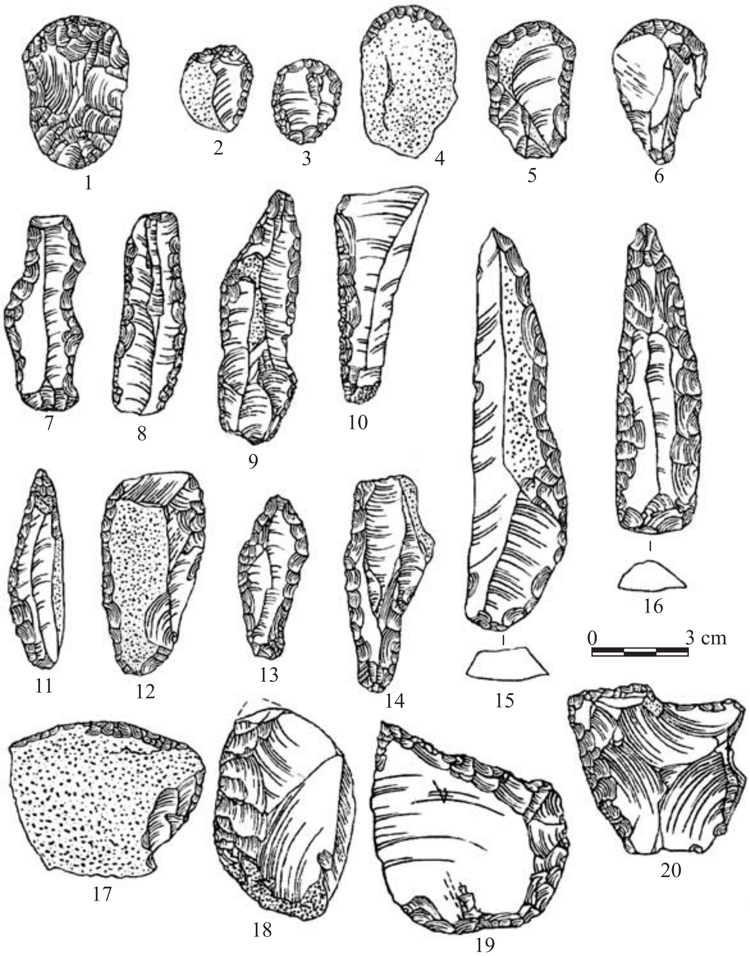

Figure 11.4. Stone artifacts from Samarkandskaya. After Djurakulov (1987).

Another site with presumed early Upper Paleolithic layers is known from the northwestern Tian Shan to the north of the Fergana depression (Uzbekistan). This site, Kulbulak, is situated on the southeastern slope of the Chatkal range (6 km west of the town of Angren) at an elevation of 1042 m above sea level (Kasymov 1972; Kasymov and Grechkina 1994). The Upper Paleolithic is represented by materials from the top part of sequence (layers 1–3). Prismatic cores and various end scrapers coexist with tool types characteristic of the underlying Middle Paleolithic levels, such as notches and denticulates, which continue to predominate numerically, and side scrapers.

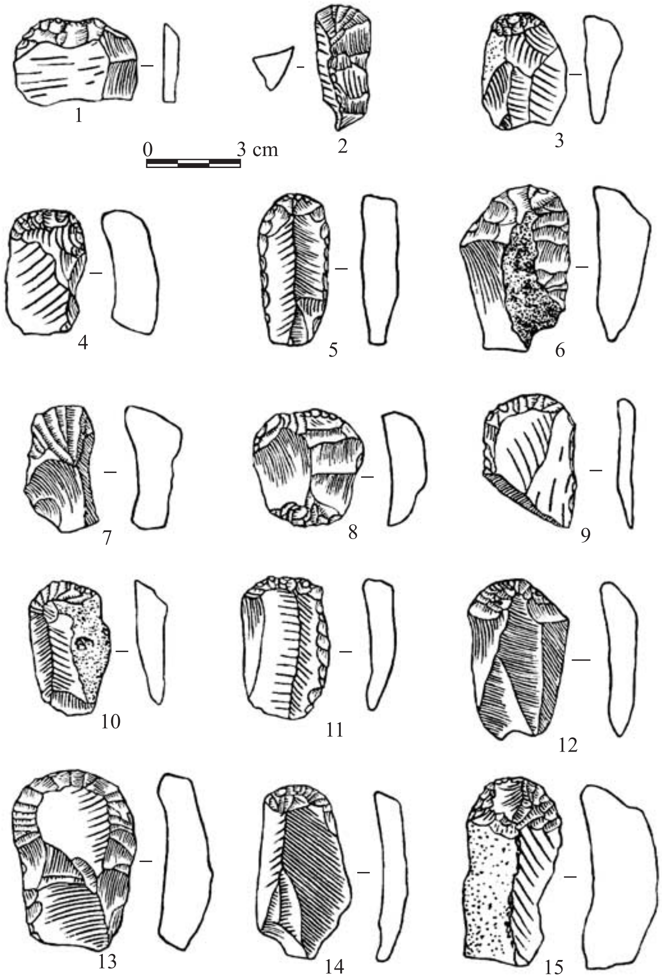

Figure 11.5. Stone artifacts from Karasu (Valikhanov's site). After Taimagambetov (1990).

The Karasu (Valikhanov's) site is situated on the right bank of the upper reaches of the Arystandy River, about 140 km north of Chimkent in Kazakhstan (Taimagambetov 1990). The cultural layers of the site are associated with the loams of the third river terrace and contain lithics, faunal remains, and traces of fireplaces. The faunal remains are dominated by horse, followed by bison, saiga (Saiga sp.), and red deer. The available palynological data also indicate steppe conditions for the period during which the cultural deposits were formed. Recently, a radiocarbon date of 24,800 ± 1100 BP was reported for the upper cultural layer (Taimagambetov and Aubekerov 1996: 24). In the original reports, the site was mentioned as consisting of three layers; the same section is now treated as containing five cultural layers and the material has been described as five distinct assemblages. The lithics include about six thousand items made of chalcedony (the source of chalcedony nodules is about 1 km from the site). The cores and flakes from all five layers could be considered Middle Paleolithic (i.e., there are very few blades, very few or no prismatic cores), but the character of the retouched tools, at least for the four upper layers, leaves no doubt that this is an Upper Paleolithic industry. End scrapers make up more than half of the tools and are primarily symmetrical, carefully retouched forms made on blades and elongated flakes (figure 11.5). The rest of the tool kit consists of burins, retouched flakes, and rare side scrapers and points.

CONCLUSIONS

The paucity of data makes it impossible to construct even a rough scenario for the Middle-Upper Paleolithic transition in central Asia. As noted in this chapter, the few known Upper Paleolithic industries are very diverse. It appears that no two sites can be classified together on the basis of typology. Nonetheless, there is one noteworthy feature common to Karasu, layer 2 of Shugnou, the Samarkandskaya site, and the Upper Paleolithic layers of Kulbulak: all of these assemblages show a marked retention of Middle Paleolithic elements both technologically and typologically, whereas Upper Paleolithic elements remain somewhat underdeveloped. The persistence of Middle Paleolithic elements in these industries might indicate local evolutionary roots and the absence of any sharp discontinuity in their development. However, there is insufficient evidence to assess this possibility. Despite the diversity of the industries, none seems to have a direct analogy in adjacent regions. For example, neither the Baradostian, with its Aurignacian features (Olszewski and Dibble 1994), nor layer 3 of Kara-Kamar (northern Afghanistan), characterized by a blade-oriented technology and dominated by carinated end scrapers and retouched blades (Davis 1978: 53), is similar to the industries described here. A recent paper by Otte and Derevianko (2001) does include Kara Kamar and Samarkandskaya in a larger group of supposed Aurignacian sites. The empirical foundation for this claim, however, leaves much to be desired.

12

The Early Upper Paleolithic of Siberia

T. Goebel

Few topics in anthropology have generated controversy like the origins and dispersal of modern humans (Mellars and Stringer 1989; Bräuer and Smith 1992; Aitken et al. 1993; Stringer and Gamble 1993; Nitecki and Nitecki 1994). The bulk of the evidence currently available from western Eurasia and Africa supports the "spread-and-replacement" model of modern human origins (Howell 1994; Klein 1994, 1999; Mellars 1996; Stringer 1996), which asserts that modern humans evolved in Africa during the late middle Pleistocene and later spread throughout the globe, replacing autochthonous populations of premodern hominins. This scenario is not unanimously agreed on, however, especially among a circle of paleoanthropologists and Paleolithic archaeologists investigating the hominin record of East and Southeast Asia (Frayer et al. 1993; Wolpoff et al. 1994). Their view is that modern humans gradually evolved in multiple regional centers—not just in Africa, but also in Europe, southwest Asia, East Asia, and Southeast Asia. Although I disagree with much of the multiregional theory of modern human origins, I concur that resolution of this debate can only be achieved by broadening our perspective to consider evidence from all regions of the Old World, not just Europe and Africa.

In this regard, the Paleolithic record of Siberia is critical to the modern human origins debate. Stretching across northern and central Asia from the Ural Mountains in the west to the Amur basin in the east (figure 12.1), Siberia is a natural bridge that for eons has connected Europe and East Asia. Siberia has a rich Paleolithic archaeological past, not the least of which is the record for the middle late Pleistocene, 40,000–30,000 BP, the time when it is thought that modern humans emerged in this part of the world. Dozens of stratified sites assigned to the early Upper Paleolithic have been found that appear to document the appearance of modern human behavior. Many of these sites contain rich artifact and faunal assemblages, as well as intact archaeological features. My goal in this chapter is to review what we know about these sites and to synthesize this information to interpret technological organization, subsistence pursuits, and settlement strategies of the period. Through this synthesis, I attempt to characterize modern human adaptations during the early Upper Paleolithic, about 43,000–30,000 BP, and to place the Siberian record within the broader context of the origins and dispersal of modern humans.

SIBERIAN ENVIRONMENTS DURING THE MIDDLE LATE PLEISTOCENE

Russian Quaternary geologists and palynologists conventionally divide the late Pleistocene of Siberia into four stages: the Kazantsev Interglacial (128,000–118,000 BP), Zyrian Glacial (118,000–60,000 BP), Karga Interglacial (60,000–25,000 BP), and Sartan Glacial (25,000–10,000 BP). This time scale is comparable with those generated for the late Pleistocene of western Eurasia and North America, as well as the deep sea oxygen isotope record, except that in Siberia the middle late Pleistocene warm interval (Oxygen Isotope Stage 3) maintains interglacial status (Kind 1974). This partitioning of the Siberian late Pleistocene into two interglacial/glacial cycles (i.e., the Kazantsev-Zyrian and Karga-Sartan) is based on a series of paleoenvironmental records from throughout northern Asia that suggest temperatures during the Karga were as warm as or warmer than today (Kind 1974; Abramova et al. 1991: 25). In northern Siberia, the Arctic Ocean transgressed southward to a point nearly as far as in the Holocene (Danilov 1982; Hopkins 1982; Arkhipov 1989), and the arctic tree line encroached northward at least 100 km farther than where it currently stands (Andreeva 1980). In southern Siberia, a series of soils formed: the Isitkim Pedocomplex on the Ob River (Volkov and Zykina 1982, 1984), the Kurtak Pedocomplex on the Yenisei (Zykina 1992), and the Osin Pedocomplex on the Angara (Vorobieva and Medvedev 1984; Medvedev et al. 1990: 14; Vorobieva 1992). During the height of the Karga, southwest Siberia was covered with a pine-birch forest-steppe and grass-wormwood steppe (Volkova and Nikolaeva 1982), while nearly all of southeast Siberia was covered by a pine-birch forest or forest-steppe (Belova 1985; Rezanov 1986). Pollen of deciduous trees today exotic to the region has been encountered in pollen cores from all regions of southern Siberia (Belova 1985). All of this suggests that during the Karga Interglacial, average annual temperatures were as much as 2–3°C warmer than in the Holocene.

The paleoenvironmental records also indicate that the Karga Interglacial was a period of oscillating climate. On the basis of conventional radiocarbon dating of middle late Pleistocene sediments throughout the Yenisei and Lena

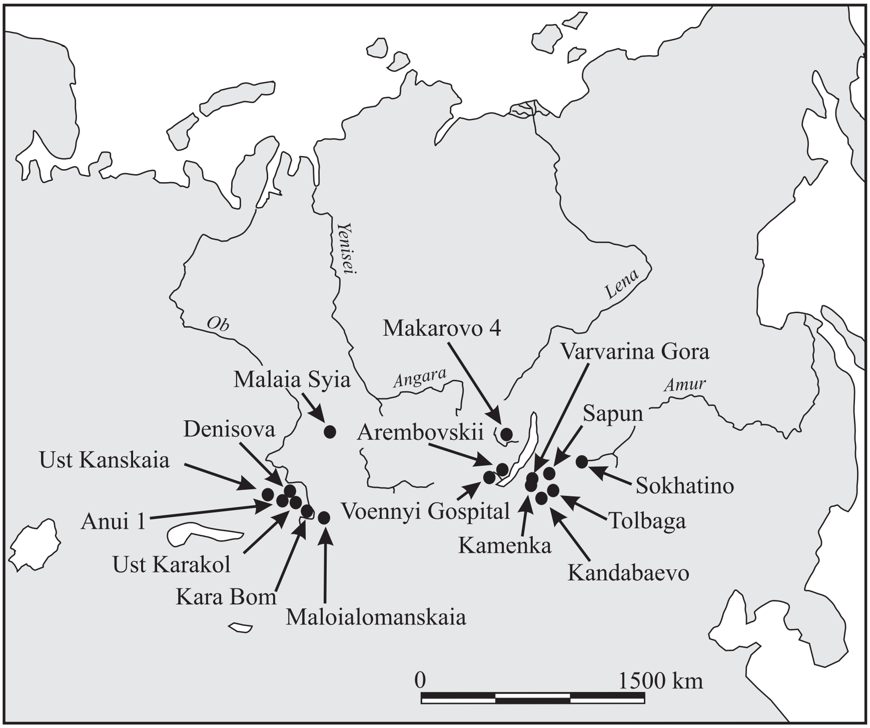

Figure 12.1. Map of eastern Eurasia showing locations of the early Upper Paleolithic sites discussed in the text.

basins, Kind (1974) divides the Karga into the following set of stades and interstades: The Karga began with an Early Interstade just before 45,000 BP, followed by a brief cold episode, the Early Stade, from 45,000 to 43,000 BP. The Malokheta Interstade, a warm period considered the optimum of the Karga Interglacial, spanned from 43,000 to 33,000 BP, and the Konoshchelye Stade, a brief episode of cooler climate, followed from 33,000 to 29,000 BP. The final warm interval of the Karga Interglacial, the Lipovsko-Novoselovo Interstade, occurred from 29,000 to 24,000 BP (Kind 1974). This five part division of the Karga Interglacial has been confirmed by numerous proxy records from throughout Siberia (Tseitlin 1979: 14). Thus, during the time that the early Upper Paleolithic existed across southern Siberia, the climate oscillated between a series of interstades and stades, with landscapes characterized by forest, forest-steppe, and/or steppe vegetation communities. These biomes supported diverse faunal complexes that consisted of a variety of large- and medium-sized mammal species, including woolly rhinoceros, bison, horse, wild ass, antelope, and argali sheep, to name a few.

EARLY UPPER PALEOLITHIC SITES

There are at least seventeen archaeological sites in Siberia that contain early Upper Paleolithic cultural occupations thought to date to about 45,000–30,000 BP (see figure 12.1). Some of these sites lack chronometric dates, and their assignment to this period is based on either geology and/or lithic typology. Most of the information available on these sites is from the published Russian literature. Detailed reports are available for some sites, whereas others have never been fully described. Still others have only been preliminarily tested or are currently under field investigation. All of this makes for an uneven record for the early Upper Paleolithic. With this caveat in mind, my first objective in this chapter is to present a brief description of each early Upper Paleolithic site (from west to east), focusing on archaeological inventories. For details on geomorphology and stratigraphy of these sites, I refer readers to the primary Russian literature (English-language synopses can also be found in Goebel [1993]). Radiocarbon determinations are presented in uncalibrated years BP.

Ust Kanskaia Cave

Ust Kanskaia Cave is located on the right bank of the Charysh River, 3.5 km east of the town of Ust Kan, Gorno-Altai Autonomous Oblast. The cave is situated in a steep limestone escarpment 52 m above the Charysh River (Derevianko and Markin 1990: 74). Rudenko discovered and excavated the cave in 1954, exposing an area of about 21 m^2 at the cave entrance (Rudenko 1960: 108; Rudenko 1961). Paleolithic cultural remains were recovered throughout the cave's 1.75-m-thick stratigraphic profile (Rudenko 1960: 108; Anisiutkin and Astakhov 1970: 28), but Rudenko (1960) grouped all finds into a single component and did not describe the cave's geological stratigraphy.

Tseitlin (1979: 79) conducted geoarchaeological tests at Ust Kanskaia years after Rudenko worked there. He described six distinct geological layers and observed that artifacts were densely concentrated in two separate cultural components (Tseitlin 1979: 79). Vereshchagin's study of the faunal remains from Rudenko's excavations (Rudenko 1960: 108–9) (table 12.1) led to the identification of both cold steppe and warm forest species, again suggesting to Tseitlin (1979) that Rudenko inadvertently combined two Paleolithic occupations.

Anisiutkin and Astakhov (1970) and Shun'kov (1990) conducted detailed analyses of Rudenko's lithic artifact assemblage. The assemblage consists of 520 artifacts, including twenty-four cores and forty-one tools. Cores are predominantly Levallois, discoidal, and spheroidal. Platforms are frequently faceted. The tool assemblage includes side scrapers, Levallois points, retouched Levallois flakes, retouched blades, denticulates, and

TABLE 12.1 Fauna Represented in Siberian Early Upper Paleolithic Sites

Species by Ecotone	*Common Name*	*KAN*[1]	*DEN*	*ANU*	*BOM*	*MAL*	*MSY*	*VAR*	*KAM*	*TOL*
Alpine										
Ochotona alpina	Altai pika					•				
Ochotona sp.	Pika		•							
Marmota baibacina	Gray marmot					•	•			
Alticola sp.	Vole					•				
Arvicola terrestris	Water vole					•				
Panthera uncia	Snow leopard					•				
Poephagus gruniens[2]	Yak	•				•		•		•
Ovis ammon	Argali sheep	•	•				•	•		•
Ovis sp.	Sheep					•				
Capra sibirica	Siberian mountain goat					•	•	•		
Capra sp.	Mountain goat			•	•					
Steppe										
Lepus tolai	Tolai hare					•		•		
Marmota sibirica	Siberian marmot							•		
Marmota sp.	Marmot		•		•					
Citellus sp.	Souslik (ground squirrel)		•				•			•
Microtus brandti	Brandt's vole									•
Lagurus lagurus	Steppe lemming		•			•				
Ellobius sp.	Mole-vole		•							
Allactaga sp.	Jerboa		•							
Vulpes corsac	Corsac fox		•					•		
Felis manul	Pallas's cat (manul)					•				
Equus caballus	Horse	•		•			•			
E. hemionus	Asiatic wild ass	•		•		•	•	•		•
Coelodonta antiquitatis	Woolly rhinoceros	•[3]	•	•	•	•	•	•		•

Bison priscus	Steppe bison						•			
Spirocerus kiakhtensis	Kiakhta antelope	•						•		•
Procapra gutturosa	Mongolian gazelle	•						•		•
Forest-steppe										
Cricetus cricetus	Common hamster					•				
Myospalax myospalax	West Siberian zokor					•				
Myospalax sp.	Zokor		•							
M. arvalis-agrestis	Zokor					•				
M. gregalis	Zokor		•							
Cuon sp.	Dhole (Asiatic wild dog)		•							
Mustela nivalis	Common (least) weasel		•							
Cervus elaphus	Red deer		•			•	•			•
Capreolus capreolus	Roe deer		•			•				
Forest										
Sorex sp.	Long-tailed shrew		•			•				
Crocidura sp.	White-toothed shrew					•				
Talpa europea	European mole					•				
Talpa sp.	Mole		•							
Pteromys volans	Siberian flying squirrel					•				
Clethrionomys sp.	Vole					•				
Microtus agrestis	Field vole					•				
Ursus arctos	Brown bear	•					•	•		
Mutsela erminea	Ermine (stoat)	•	•							
Martes zibellina	Sable		•							
Meles meles	Badger	•								
Alces alces	Moose		•							

(continued)

TABLE 12.1 *(continued)*

Species by Ecotone	*Common Name*	*KAN*[1]	*DEN*	*ANU*	*BOM*	*MAL*	*MSY*	*VAR*	*KAM*	*TOL*
Tundra										
Citellus undulatus	Arctic ground squirrel					•				
Rangifer tarandus	Reindeer		•				•	•		•
Multiple ecotones										
Chiroptera gen. sp.	Bat					•				
Lepus timidus	Arctic hare		•			•	•	•		
Lepus sp.	Hare				•					
Cricetinae gen. sp.	Vole or hamster		•							
Microtus sp.	Vole		•			•				
Apodemus sp.	Field mouse					•				
Canis lupus	Gray wolf	•	•		•	•		•		•
Vulpes vulpes	Red fox	•	•			•		•		
Ursus sp.	Bear		•			•				
Mustela sp.	Weasel		•							
Crocuta spelaea	Cave hyena	•			•	•				
Crocuta sp.	Hyena		•							
Mammuthus primigenius	Woolly mammoth						•			
Equus sp.	Horse or ass		•		•	•		•		•
Bison sp.	Bison		•	•	•	•	•			•

[1]KAN, Ust Kanskaia Cave; DEN, Denisova Cave; ANU, Anui 1; BOM, Kara Bom; MAL, Maloialomanskaia Cave; MSY, Malaia Syia; VAR, Varvarina Gora; KAM, Kamenka; TOL, Tolbaga.

[2]Also known as *Bos gruniens* and *Poephagus baikalensis* (Baikal yak).

[3]Rudenko (1960: 108) reports *Rhinocerus tichorinus*, presumably woolly rhinoceros; Tseitlin (1979: 81) recovered a single tooth of *Coelodonta antiquitatis*.

notches, as well as end scrapers on blades, angle burins on blades, wedges, a graver, a bifacial knife, and a small bone pendant with a drilled hole (Anisiutkin and Astakhov 1970: 31–32; Shun'kov 1990: 44, 55). The presence of early Upper Paleolithic artifacts (end scrapers, burins, graver, bone pendant) in an otherwise typical Levallois-Mousterian context has been thought by some to represent a "transitional" Middle-to-Upper Paleolithic industry (Kuzmin and Orlova 1998); however, it is more likely that this "mixed" industry is the result of Rudenko combining stratigraphically separate Middle and early Upper Paleolithic occupations, as Anisiutkin and Astakhov (1970: 33), Tseitlin (1979: 83), and Derevianko and Markin (1990: 99–100) have pointed out.

Denisova Cave

Denisova Cave is located 6 km northwest of the village of Chernyi Anui, on the right bank of the Anui River, near the northwestern border of the Gorno-Altai Autonomous Oblast. This cave is situated 28 m above the right bank of the river, in the southwest face of a steep limestone escarpment (Derevianko et al. 1985a: 8; Markin 1987: 11; Derevianko and Markin 1998b: 88). The cave has been known historically for over a century (Derevianko et al. 1985a: 3; Derevianko and Molodin 1994), but as a Paleolithic site, it was not discovered until 1977 (Okladnikov and Ovodov 1978: 266). In 1984, a 9-m^2 block was excavated in the main chamber of the cave, leading to the discovery of a series of late Upper and Middle Paleolithic components (Derevianko et al. 1985b–f; Markin 1987; Derevianko and Markin 1998b: 88–94). Since 1986, excavations have concentrated on an area at the cave entrance (Derevianko et al. 1990b, 1992a,c; Shun'kov and Agadjanian 2000).

Much has been written on the geological stratigraphy and dating of the cave (Derevianko et al. 1990b: 34, 1992a: 75–76; Shun'kov and Agadjanian 2000). In the more recent excavations of the cave entrance, an early Upper Paleolithic component has been exposed. This occupation has not been radiocarbon dated; however, it is sandwiched between a late Upper Paleolithic component radiocarbon dated to about 14,000 BP and a Middle Paleolithic component radiocarbon dated to about 46,000 BP (Derevianko et al. 1992c: 84; Goebel 1993).

Early Upper Paleolithic artifacts include parallel (flat-faced) blade cores, points on blades, end scrapers, side scrapers, retouched blades, gravers, denticulates, notches, and Levallois spalls (figure 12.2) (Derevianko et al. 1990b: 38–39, 1992c: 84; Goebel 1993). Lithic raw materials were almost exclusively procured from local alluvium on the Anui River (Postnov et al. 2000). Faunal remains from Denisova Cave have been analyzed by Germonpré (1993), but unfortunately not by geological layer.

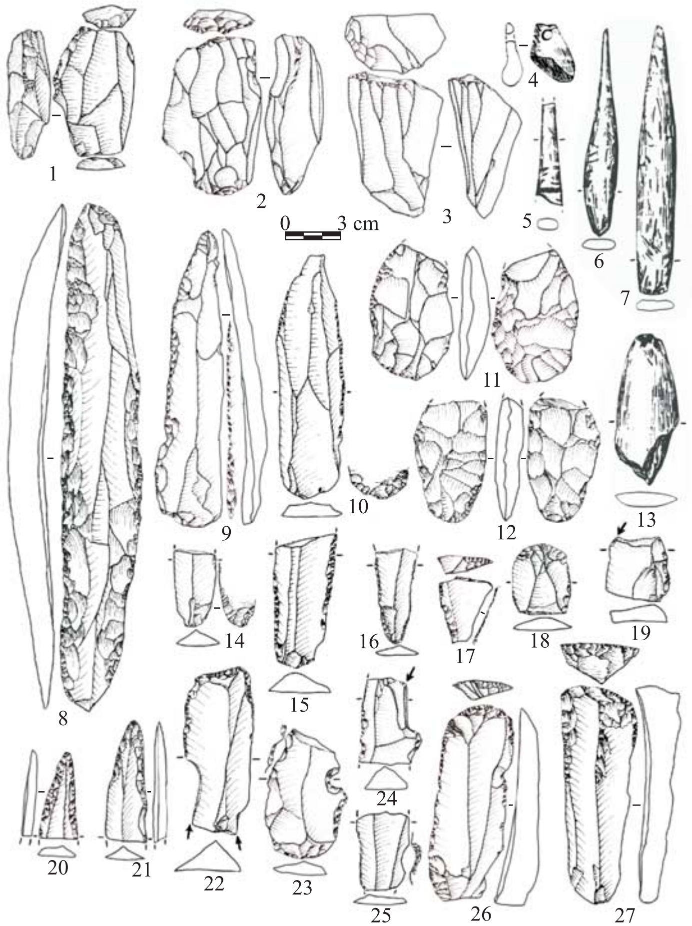

Figure 12.2. Artifacts from Denisova Cave (16, 18, 19, 25), Ust Karakol (1, 8, 12, 14, 21, 22), Kara Bom (2, 3, 9, 11, 17, 20, 23, 24, 26), Maloialomanskaia Cave (4, 10), and Malaia Syia (5–7, 13, 15, 27). Blade cores (1–3); tooth pendant (4); bone points/awls (5–7); retouched blades (8–10, 14–16); bifaces (11, 12); ivory retoucher (13); end scrapers (17, 18, 26, 27); burins (19, 22, 24); points on blades (20, 21); notches (23, 25).

Anui 1

This open-air site is located on the left bank of the Anui River, 0.5 km south of Denisova Cave, 6 km north of the village of Chernyi Anui, Gorno-Altai Autonomous Oblast. Anui 1 lies on the 10 m terrace of the Anui River. Derevianko and Molodin discovered the site in 1983 (Derevianko and Zenin

1990). An area of 204 m^2 was excavated between 1986 and 1988 (Derevianko and Zenin 1990; Derevianko et al. 1990b: 49–58); however, Paleolithic cultural remains were restricted to a 70 m^2 portion of the excavated area (Derevianko 1990b: 49).

One possible, yet undated, early Upper Paleolithic occupation has been identified. It occurs within colluvial deposits and is likely redeposited (Derevianko and Markin 1998b: 100; Derevianko and Zenin 1990: 32–33; Derevianko et al. 1990b: 50–51). Cultural remains include 279 lithic artifacts and eighty-six faunal remains (Derevianko and Zenin 1990: 34). This assemblage is made up of 191 flakes (sixty-five cortical spalls), eleven blades, nineteen cores and core-like fragments, fourteen cobbles (unworked and initially flaked), and forty-four tools. Primary reduction technology is characterized by parallel and subprismatic blade cores and their removals. The tool assemblage includes side scrapers, cobble tools (choppers and cobble scrapers), retouched flakes, burins, end scrapers, notches, denticulates, bifaces, wedges, a retouched blade, a hammer stone, and a retoucher (Derevianko and Zenin 1990: 34–35; Derevianko et al. 1990b: 53–55). Faunal remains are chiefly cold steppe and forest-steppe taxa (see table 12.1) (Derevianko et al. 1990b: 53).

Ust Karakol

Ust Karakol is an open-air site located 4 km northwest of the village of Chernyi Anui, at the confluence of the Karakol and Anui Rivers in Gornyi-Altai Autonomous Oblast. The site is situated on a northeast-facing terrace-like knoll 25 m above the left bank of the Anui River. Derevianko discovered Ust Karakol in 1984, and Markin excavated a 120 m^2 area in 1986 (Derevianko et al. 1987, 1990b; Maloletko and Panychev 1990; Derevianko and Markin 1998b: 97).

One of the site's four cultural components has been assigned to the early Upper Paleolithic. It occurs in a cryoturbated deposit of loess and has been consistently radiocarbon dated to about 30,000 BP. Two samples of cultural charcoal from two different hearths yielded determinations of 31,410 ± 1160 (SOAN-2515) and 29,900 ± 2070 BP (IGAN-837) (Derevianko et al. 1987, 1990b). Furthermore, two charcoal samples of unreported provenance have yielded determinations of 31,345 ± 1275 (SOAN-2869) (Orlova 1995a) and 30,460 ± 2035 BP (SOAN-3260) (Orlova 1998). These radiocarbon determinations suggest that the early Upper Paleolithic component can be assigned to the Konoshchelye Stade (33,000–30,000 BP) of the Karga Interglacial (Derevianko et al. 1987).

The early Upper Paleolithic assemblage consists of 637 lithic artifacts, including 142 blades, fifty-two cores, and fifty-two tools. All of the lithic artifacts were made on fine-grained cryptocrystalline silicates (Goebel 1993) procured from local alluvium on the Anui River (Postnov et al. 2000). Primary reduction technology is characterized by the production of blades from parallel (flat-faced) blade cores. Secondary reduction technology is marked by unifacial, bifacial, and edge (burin) retouching. The tool assemblage includes side scrapers, unifacial points on blades, unifacial knives, bifaces, burins, denticulates, retouched blades, and retouched flakes (see figure 12.2). Three unlined oval hearths 0.7–0.8 m in diameter were found in this component (Derevianko et al. 1987). Lithic artifacts and isolated bone fragments are clustered in and around these hearth features. The associated faunal assemblage consists of only eight unidentifiable bone fragments.

Kara Bom

Kara Bom is an open-air site located 4 km south of the village of Elo, Gorno-Altai Autonomous Oblast. It is situated on a colluvial talus cone at the base of a steep bedrock cliff overlooking the confluence of the Semisart and Kaerlyk Rivers, tributaries of the Ursul River. The site was discovered by Okladnikov (1983), who excavated there in 1980–81. Petrin intensively excavated the site from 1987 through 1993 (Derevianko and Petrin 1988; Petrin and Chevalkov 1992; Derevianko et al. 2000c), exposing seven stratigraphically separate Paleolithic components.

Sediments reach 5 m in thickness and are thought to be for the most part colluvial in origin (although lower strata have been reworked by spring activity) (Goebel et al. 1993; Derevianko et al. 2000c). Four cultural components (IIa, IIb, IIc, and IId) are assigned to the early Upper Paleolithic. AMS radiocarbon determinations indicate that they range in age from about 43,000 to 30,000 BP (Goebel et al. 1993). Small samples of cultural charcoal from two hearth features in components IIa and IIb (the two basal early Upper Paleolithic components) have produced AMS radiocarbon dates of 43,200 ± 1500 (GX-17597) and 43,300 ± 1600 BP (GX-17596), respectively. Charcoal samples from component IIc have been AMS radiocarbon dated to 34,180 ± 640 (GX-17595) and 33,780 ± 570 BP (GX-17593), and charcoal from component IId, the uppermost early Upper Paleolithic occupation, has been AMS radiocarbon dated to 30,990 ± 460 BP (GX-17594) (Goebel et al. 1993). An AMS date of 38,080 ± 910 BP (GX-17592) was also obtained from charcoal recovered from above these early Upper Paleolithic components, but it was not associated with cultural remains and likely was re-deposited (Goebel et al. 1993).

Nearly all lithic artifacts from the early Upper Paleolithic components at Kara Bom were manufactured on a dark gray cryptocrystalline silicate found in alluvium of the nearby Semisart River and Altairy Creek (Goebel 1993). Primary reduction technology focused on the production of blades; blade cores include parallel (flat-faced) and subprismatic forms. Most tools were retouched unifacially, although sixteen tools have been burinated and three are bifacial. Tool assemblages include retouched blades, unifacial points on blades, end scrapers, burins, side scrapers, unifacial knives, denticulates, notches, bifaces, and a graver (see figure 12.2) (Derevianko et al. 1987; Goebel et al. 1993; Derevianko et al. 2000c).

Maloialomanskaia Cave

This cave site is located on the Malyi Ialoman River, 10 km west of the village of Inia, Gorno-Altai Autonomous Oblast. The cave has two openings that occur on a steep limestone escarpment about 27 m above the left bank of the river (Derevianko and Petrin 1989: 16). The first archaeological materials from the cave were found in 1983, when Maloletko and Ovodov excavated a small test pit in each grotto (Alekseeva and Maloletko 1984: 26). In 1988 Petrin conducted full-scale archaeological research, excavating a 45-m^2 area (Derevianko and Petrin 1989; Derevianko et al. 1990b: 149–56).

Sediments within the cave measure less than 1 m thick (Derevianko et al. 1990b: 150–52). Paleolithic cultural remains have been combined into a single cultural component, even though they originate from two geological layers (153). A single conventional radiocarbon determination of 33,350 ± 1145 BP (SOAN-2500) was obtained on wood charcoal collected from near the top of this Paleolithic component (153).

The Paleolithic component consists of fifty-seven artifacts, including four unworked cobbles, one split cobble, two preforms, one spall, one large flake, seventeen small flakes, five blades and blade fragments, and eighteen tools (Derevianko and Petrin 1989: 17; Derevianko et al. 1990b: 154). The tool assemblage includes retouched blades and blade fragments, retouched flakes (one Levallois), denticulates, and a Levallois point. In addition, a small pendant made on a red deer canine was also recovered (see figure 12.2). It bears a biconically drilled hole and eleven incised lines. On one wall of the cave, there is a vertical line of red ochre 3 cm long and 1 cm wide. Whether this line was drawn during the Paleolithic, however, is indeterminable, but Derevianko et al. (1990b: 155–56) report that a cobble with traces of ochre was found in the Paleolithic component. Overall, the character of this assemblage is Mousterian (Levallois point and spall), as well as early Upper Paleolithic (blades, some ventrally-proximally retouched); it probably incorporates multiple Paleolithic occupations. Faunal remains have been recovered but only preliminarily analyzed (see table 12.1). Steppe, forest-steppe, and forest species are represented, but it is not clear how they relate to the archaeological occupation(s). Alekseeva and Maloletko (1984: 27) also report the discovery of a human tooth, but neither its provenance nor its morphology has been described.

Malaia Syia

Malaia Syia is located in the northeastern Kuznetsk Alatau, on the left bank of the Belyi Iyus River, a tributary of the Chulym River, in the Shirinsk region, Krasnoyarsk Krai. The site is situated on heavily weathered Pliocene alluvium (Muratov et al. 1982), 38 m above the floodplain of the river. Ovodov discovered Malaia Syia in 1974, when he noticed Paleolithic artifacts eroding from the wall of a quarry (Muratov et al. 1982). In 1975, Ovodov and Okladnikov conducted test excavations and preliminary geological research (Muratov et al. 1982). Larichev (1978a; Larichev et al. 1988) later excavated extensively at the site. The description of Malaia Syia presented here is based largely on the results of Muratov et al. (1982), because materials excavated by Larichev remain, for the most part, undocumented.

The Malaia Syia stratigraphic profile contains a 3 m thick set of cryoturbated loesses. An early Upper Paleolithic component occurs within a reworked paleosol built on clay-loam sediments. Radiocarbon determinations for this component are problematic. A combined sample of natural charcoal yielded a conventional radiocarbon determination of 20,370 ± 340 BP (SOAN-1124), whereas conventionally radiocarbon-dated bone from component I produced determinations of 34,500 ± 450 BP (SOAN-1286) and 34,420 ± 360 BP (SOAN-1287) (Muratov et al. 1982).[1] In addition to these conventional determinations, Goebel (1993) reports one AMS radiocarbon date of 29,450 ± 420 BP (AA-8876). This date was run on a sample of bone that Ovodov collected in 1975 and gave to me in 1991. Although thought by many to date to 35,000 BP (Muratov et al. 1982), the single AMS date of 29,000 BP, plus the cold-adapted faunal and floral remains, suggest a somewhat younger, Konoshchelye age of about 30,000–29,000 BP for the early Upper Paleolithic occupation.

In 1975, Ovodov collected an assemblage of 583 lithic artifacts (fifty-one cores, eighty-nine cobbles, 374 flakes, twenty-nine blades, and forty tools). These were made on argillites (at least three varieties are represented), quartzites (four varieties), and cryptocrystalline silicates (two varieties) (Goebel 1993). Sources of these lithic raw materials have not been reported, but high proportions of cortex on cores and tools suggest that toolstones were procured in nearby alluvium (Goebel 1993). Primary reduction technology is characterized by the production of blades from large parallel (flat-faced) cores, as well as flakes from large, variably reduced flake cores. Among the Malaia Syia tools, 98% are worked unifacially and 2% bifacially (Goebel 1993). The tool assemblage includes cobble choppers and trans-

1. For SOAN-1287, although Muratov et al. (1982) reported this determination as 34,420 ± 360 BP, Larichev (1978a; Larichev et al. 1988) and Kuzmin and Orlova (1998) present a radiocarbon age of 33,360 ± 300 BP. Given that the analyzed bone came from field studies carried out by Muratov et al. (1982), I give their determination priority over Larichev's.

verse scrapers on choppers, end scrapers, retouched blades, notches, denticulates, and unifacial knives (see figure 12.2) (Muratov et al. 1982; Larichev et al. 1988). Bone and antler tools also occur (see figure 12.2); they include four complete or nearly complete antler points ranging from 90 to 180 mm long. These are wide (1–4 cm) and thin (less than 1 cm). None are slotted or split based. Also present are two thick antler billets apparently used to retouch stone tools. Larichev (1978a,b, 1979, 1980, 1984; Larichev et al. 1988) has written much on the putative portable art from Malaia Syia. He presents a series of lithic flakes, cortical spalls, and tools that appear to have been shaped into animal forms (tortoises, eagles, horses, mammoths). All of these, however, are equivocal. In addition, proposed etchings of wild animals (horse, bison, lion, wolf) are neither clear nor indisputable.

The faunal assemblage is extensive (4779 pieces) but has been only preliminarily studied (Muratov et al. 1982). Steppe, tundra, and alpine species are well represented, whereas forest species are absent (see table 12.1). The pollen spectrum from layer 4 is dominated by grasses, composites, goosefoots, and caryophylles, whereas arboreal pollen is absent (Muratov et al. 1982). Considered together, this information suggests cold and arid conditions at the time of the early Upper Paleolithic occupation.

Voennyi Gospital

The Voennyi Gospital ("Military Hospital") site is located on the right bank of the Ushakovka River, near its confluence with the Angara River, Irkutsk Oblast. The site was discovered in 1871 during the building of a military hospital in what was then the northeastern outskirts of the city of Irkutsk. A laborer uncovered several stone and bone artifacts, which were given to Bel'tsov, Cherskii, and Chekanovskii of the Siberian branch of the Russian Geographical Society (Larichev 1969: 30). Cherskii, a geologist and paleontologist, identified them immediately as prehistoric stone and bone artifacts. The controlled excavation of a 6 m^2 area soon followed, to establish the geological context and ascertain whether the cultural remains were associated with bones of extinct fauna (Cherskii 1872; Larichev 1969: 30). Cherskii's excavations reached a depth of nearly 2 m and recovered numerous cultural remains in situ. These he assigned to the "Old Stone Age," based on the character of the artifacts and their association with remains of woolly mammoth and giant elk. The cultural remains from Cherskii's 1871 excavations were only cursorily described (Medvedev et al. 1990: 30–31). Apparently the lithic industry was blade based, with a tool assemblage containing leaf-shaped bifaces, end scrapers, side scrapers, and a cobble chopper. Cherskii (1872) also described a series of ivory and bone artifacts, including an incised mammoth ivory spheroid (or ball), a pointed ivory rod, several ivory and bone cylindrical pendants with biconically drilled holes and transverse linear incisions, a ring (or bracelet) manufactured on bison horn, a red deer canine bearing a biconically drilled hole, and a "chisel" (or perhaps awl) manufactured on a reindeer metacarpal. Faunal remains recovered in 1871 included isolated elements of red deer, giant elk, reindeer, woolly mammoth, Kovalevskii's horse, and bison (Larichev 1969: 31–32; Medvedev et al. 1990: 66). These finds were curated at the headquarters of the Russian Geographical Society. In 1879, this building burned to the ground, and the artifacts from Cherskii's excavations were lost (Larichev 1969: 32–33; Aksenov et al. 1986).

In 1983, excavations were resumed in an attempt to relocate the original Voennyi Gospital archaeological locality (Aksenov et al. 1986; Medvedev 1998: 124). In 1988, Sëmin recovered in situ several isolated stone artifacts and faunal remains (Medvedev et al. 1990: 64–67). These few remains are thought to mark the location of Cherskii's original excavations, although some controversy still exists about the precise location of the site (Kozyrev 2000). Medvedev et al. (1990: 64–67) describe the site as lying on a low bedrock rise about 45 m above the modern Angara floodplain. Late Pleistocene/Holocene sediments are 2–3 m thick and consist of a series of unconsolidated loams and sandy loams. The Voennyi Gospital cultural remains recovered by Sëmin were situated in a deposit of clay loam in association with a heavily weathered paleosol thought to have formed during the Karga Interglacial (Medvedev et al. 1990: 65). A horse bone from this stratum yielded a conventional radiocarbon determination of 29,700 ± 500 BP (GIN-4440), further suggesting assignment of the site to the Konoshchelye Stade. The 1988 tests produced the following lithic inventory: one quartz cobble chopper, two cores, two side scraper fragments on quartzite flakes, one end scraper on a jasper blade, one blade, one flake, and one flake fragment (Medvedev 1998: 124; Medvedev et al. 1990: 65). Isolated remains of horse and reindeer were also recovered.

Arembovskii

Arembovskii is located at the head of Pshenichnyi ravine, on the outskirts of the city of Irkutsk (Medvedev et al. 1990: 67–71; Sëmin et al. 1990: 114–15). The site is situated on the south-facing side of a watershed divide. It was discovered in 1938 by Arembovskii, an instructor at Irkutsk University. He made surface collections in 1947–49 (Arembovskii and Ivan'ev 1953; Arembovskii 1958). In 1989, Sëmin directed full scale salvage excavations; to date, nearly 1000 m^2 have been excavated (Sëmin et al. 1990).

Late Pleistocene/Holocene sediments at Arembovskii measure only 1 m thick. Cultural remains assigned to the early Upper Paleolithic for the most part occur within a massively bedded loam that contains a paleosol thought to date to the Karga Interglacial (Medvedev et al. 1990; Sëmin et al. 1990: 114). AMS radiocarbon dating has been unsuccessful; a sample of bone analyzed at the University of Arizona AMS facility (AA-8881) yielded insufficient collagen for analysis (Austin Long, pers. comm., 1992).

The full scale excavations in 1989 also failed to produce any archaeological features. The lithic assemblage contains more than ten thousand artifacts (Sëmin et al. 1990: 115), including numerous cores and tools. Nearly all of the lithic artifacts were manufactured on tan argillite that was procured from an outcrop less than 200 m from the site. Cores are dominated by parallel (flat-faced) blade cores, but some radial ("tortoise") cores also occur. Secondary reduction is characterized by unifacial retouching (94%) and bifacial retouching (6%) (Goebel 1993). The tool assemblage is characterized by retouched blades, end scrapers on blades, side scrapers, points on blades, bifaces, unifacial knives, notches, gravers, retouched flakes, and hammer stones (figure 12.3). A meager assemblage of faunal remains was recovered, although none have been identified. Sëmin et al. (1990: 114) have characterized Arembovskii as a workshop.

Makarovo 4

Makarovo 4 is one of six Makarovo sites located on the upper Lena River, 8 km northwest of the village of Kachug, Irkutsk Oblast. The site is situated on the south-facing bluff of a side valley alluvial fan (called the fourth terrace by Tseitlin [1979: 199]), 40 m above the right bank of the Lena River (Vorobieva 1987: 19; Aksenov 1989b). Aksenov (1989b) discovered Makarovo 4 in 1975. Excavations in 1975–82 exposed an 1100-m^2 area (Aksenov 1989a,b).

Quaternary stratigraphy is broadly described as a series of colluvial and aeolian loams and sandy loams (Tseitlin 1979: 197–98; Vorobieva 1987: 20–21; Aksenov 1989b). Early Upper Paleolithic materials occur on the surface of a thin band of sand and scree that appears to be a wind-deflated lag deposit. Lithic artifacts are markedly sandblasted, and the cultural component has been further deformed by ice wedge pseudomorphs (Aksenov 1989a: 125; Aksenov and Naidentskaia 1979). The complex context of the Makarovo 4 cultural component makes dating difficult. Nonetheless, three bone fragments recovered in situ during excavations in 1979 and 1980 yielded AMS radiocarbon dates of greater than 38,000 BP (AA-8878), greater than 38,000 BP (AA-8879), and greater than 39,000 BP (AA-8880) (Goebel and Aksenov 1995).

The lithic assemblage consists of 4119 pieces, produced chiefly from cryptocrystalline silicates (94%), but quartzites (6%) also occur. These were procured in alluvium in the vicinity of the site (Aksenov 1989b). The 113 cores include parallel (flat-faced), subparallel, and radial forms; nearly 75% of all tool blanks are blades. Secondary reduction techniques are chiefly uni-

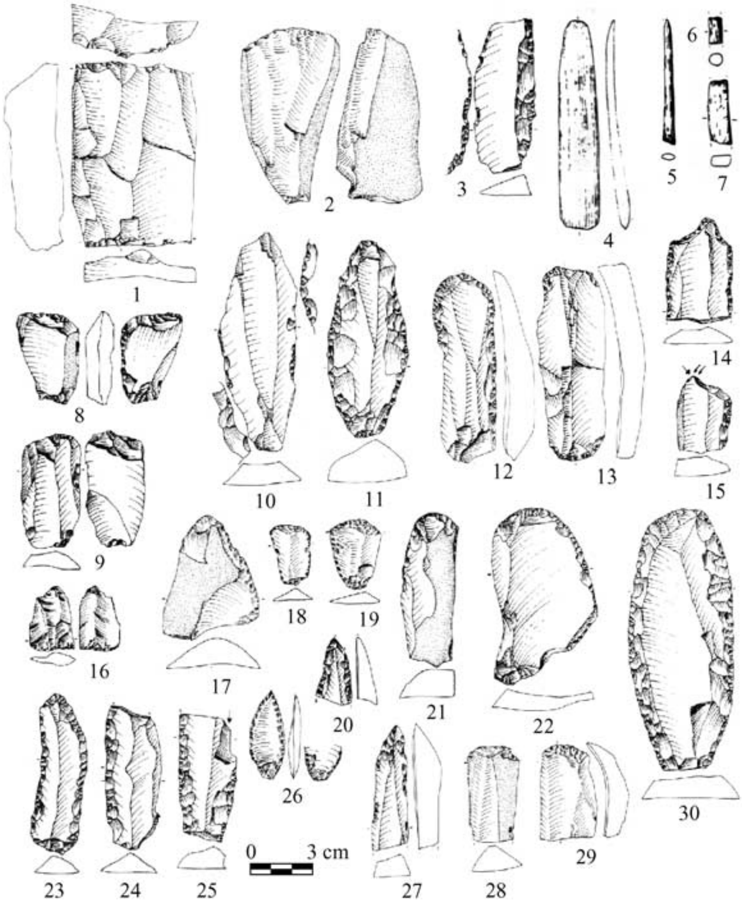

Figure 12.3. Artifacts from Arembovskii (1, 8, 12, 13, 22, 30), Makarovo 4 (2, 16–19, 26, 28, 29), Varvarina Gora (3, 4, 9, 20, 23, 24), and Tolbaga (5–7, 10, 11, 14, 15, 21, 25, 27). Blade cores (1, 2); backed blade (3); antler retoucher (4); bone awls (5–7); bipolar cores (8, 9, 16); retouched blades (10, 11, 23, 24); end scrapers (12–14, 18, 19, 21,22, 28, 29); burins (15, 25); side scrapers (17, 30); points on blades (20, 27).

facial (93%), but bifacial retouch also occurs in low frequencies (Goebel 1993). The tool assemblage is characterized by retouched blades and flakes, end scrapers, side scrapers, and cobble choppers, and, less frequently, unifacial points, unifacial knives, gravers, bifaces, and hammer stones (figure 12.3) (Aksenov 1989b; Aksenov et al. 1987). This blade industry is the type assemblage for the Makarovo Stratum, which in eastern Siberia is considered to mark the beginning of the Upper Paleolithic. Faunal remains include 502 fragments of bone; however, only five bones have been identified taxonomically. Species represented include woolly rhinoceros, red deer, and roe deer (Aksenov 1989a).

Varvarina Gora

The early Upper Paleolithic site Varvarina Gora is located 12 km south of the village of Novaia Brian, Buriat Republic, on the left bank of the Brianka River, a tributary of the Uda River. The site is situated on a high fan of colluvium overlooking the Brianka valley, nearly 40 m above and 600 m west of the river. The site was discovered in 1964 by Bazarov and Khamzina (Bazarov 1968), and excavated in 1973–75 by Okladnikov (1974; Okladnikov and Kirillov 1980: 31–34, 91, 212–14; Bazarov et al. 1982: 87–90).

Early Upper Paleolithic cultural remains occur about 1.5 m below the modern surface in a carbonated loam, sandwiched between reworked colluvial deposits (Bazarov 1968; Tseitlin 1979: 212–14; Bazarov et al. 1982: 87–89; Lbova 1992: 164). Two samples of bone from the early Upper Paleolithic component were conventionally radiocarbon dated to 30,600 ± 500 (SOAN-850) and 34,900 ± 780 BP (SOAN-1524) (Okladnikov and Kirillov 1980: 34; Bazarov et al. 1982: 89). In addition, two bones (from Okladnikov's excavation of the early Upper Paleolithic component) were AMS radiocarbon dated to greater than 34,050 BP (AA-8875) and greater than 35,300 BP (AA-8893).

The Varvarina Gora lithic industry from layer 3 has been ascribed to the early Upper Paleolithic (Okladnikov 1974; Okladnikov and Kirillov 1980; Lbova 1992; Goebel 1993; Goebel and Aksenov 1995; Kirillov and Derevianko 1998:139). The assemblage consists of 1451 artifacts, including 226 tools (Lbova 1992: 165). Lithic raw materials include cryptocrystalline silicates (ten varieties), basalt and other aphanitic igneous rocks, and quartzite. There is also one artifact made on obsidian (Goebel 1993). Sources of these materials have not been identified, but the observation that cortex occurs on very few of the artifacts suggests that toolstones were collected some distance from the site (Goebel 1993). Most cores are parallel or subprismatic, and nearly 35% of all tools were manufactured on blades (Lbova 1992: 165). Tools were secondarily worked through unifacial retouch (86%), bifacial retouch (12%), edge (burin) retouch (1%), and backing retouch (1%) (Goebel 1993). The tool assemblage consists of end scrapers and side scrapers (several worked bifacially), unifacial knives, gravers, unifacial points on blades, burins, notches, denticulates, retouched blades and flakes, cobble tools (choppers, chopping tools, hammer stones, and small anvil stones related to bipolar core reduction), and a single backed blade (figure 12.3) (Okladnikov and Kirillov 1980: 32; Lbova 1992: 165; Goebel 1993). Also present in the assemblage are two small incised and polished bone "awl-like points," a flat spatulate-shaped rod made on bone that appears to have served as a retoucher (figure 12.3), a "cut and sharpened" ivory tusk fragment, and a flat stone "semi-disk" (possibly a fragment of a pendant), (Okladnikov and Kirillov 1980: 33–34; Kirillov 1987: 71). Faunal remains are predominantly steppe and alpine forms (see table 12.1) and include numerous specimens of horse, woolly rhinoceros, Siberian mountain goat, argali sheep, Siberian marmot, and gray wolf (Ovodov 1987).

Excavations revealed a series of pit features (Okladnikov and Kirillov 1980). One pit had stone walls and a stone floor, and contained a wolf's skull and a set of complete horse bones (Ovodov 1987). Okladnikov and Kirillov (1980: 32) interpret this feature as "the ritual burial of a predator's head, accompanied by the sacrificial offering of an entire horse." Possibly these pits are part of a larger 80-m^2 surface dwelling structure, the remnants of which include occasional blocks of stone reportedly forming a circle (Okladnikov and Kirillov 1980: 32; Lbova 1992: 165).

Kamenka

The Kamenka site is located 3.5 km northeast of the village of Novaia Brian, Buriat Republic, on the left bank of the Brianka River, about 15 km from Varvarina Gora. The site lies in colluvial hill slope deposits that reach 12 m in thickness (Lbova and Volkov 1993; Germonpré and Lbova 1996: 35; Lbova 1996: 24). Lbova (1996) excavated there from 1990 to 1995.

Lbova (1996) identified three distinct Upper Paleolithic components that are referred to as complexes A, B, and C. Complexes A and B were found in the 1991 excavation block, and complexes B and C were found in the 1992 excavation block. In both excavations, complex B is tied stratigraphically to a dark brown humified band in a deposit of sand and angular rock debris. Bone samples from this complex have yielded conventional radiocarbon determinations of 28,815 ± 150 BP (SOAN-3032) and 28,060 ± 475 BP (SOAN-2904) (Lbova 1996: 32). Complex A is tied stratigraphically to carbonated sands underlying complex B in the main excavation profile. Four samples of bone (?) from complex A yielded conventional radiocarbon determinations of 35,845 ± 695 BP (SOAN-2903), 31,060 ± 530 BP (SOAN-3133), 30,460 ± 430 BP (SOAN-3354), and 26,760 ± 265 BP (SOAN-3353) (Lbova 1996: 30). Complex C occurs only in the more recent 1993 excavation block and is in the same stratigraphic position as complex A, although in a facies of sand with lenses of humified material (Lbova 1996: 32). A single conventional radiocarbon determination run on bone for complex C is 30,220 ± 270 BP (SOAN-3052).

Lbova (1996; Germonpré and Lbova 1996) assigns complexes A and C to the early Upper Paleolithic. The lithic assemblage from Kamenka complex A consists of 1328 artifacts, including twenty cores and 365 tools (Lbova 1996: 28). Raw material sources have not been described. The majority of cores are parallel blade cores with single fronts and opposing platforms, although subprismatic blade cores and a single Levallois flake core are included. Nearly all tools are made on blades and secondarily worked only on their dorsal faces. Tools include retouched blades and flakes, points on blades, notches, denticulates, burins, gravers, wedges, end scrapers, and side scrapers (Lbova 1996: 29; Lbova and Volkov 1993). Also present in complex A are a number of bone tools that appear to have been used as awls or chisels, a bracelet made of mammoth ivory, several amulets made on tubular bird bone, and several small stone beads with drilled holes (Lbova 1996: 29). Excavation of complex A uncovered several features, including two hearths, a 25-cm-deep and 50-cm-diameter pit, and a semicircular stone structure (Germonpré and Lbova 1996). Faunal remains from complex A have been analyzed in detail; the faunal assemblage is dominated Mongolian gazelle and horse; bison, woolly rhinoceros, argali sheep, camel, giant elk, Kiakhta antelope, Asian wild ass, and lion are also present (Germonpré and Lbova 1996).

The lithic assemblage from Kamenka complex C consists of 294 artifacts, including two cores and sixty-nine tools. Both cores are parallel blade cores with single fronts and opposing platforms (Lbova 1996: 32). The majority of tools are made on blades, and are retouched only on their dorsal faces. Tools include retouched blades, notches, denticulates, end scrapers, side scrapers, and burins (Lbova 1996: 33). Three bone tools have also been found. Faunal remains from complex C include a few bones of horse and single examples of woolly rhinoceros, bison, and Mongolian gazelle (Germonpré and Lbova 1996).

Kandabaevo

The Kandabaevo site is located on the right bank of the Khilok River, 2 km east of the village of Kandabaevo. The site lies on a hill slope 8–10 m above the modern floodplain of the river (Bazarov et al. 1982: 83). It was discovered in 1971; in 1972–73, Kirillov and Konstantinov excavated an area of 159 m^2 (Konstantinov 1975). A small assemblage of cultural remains was found in redeposited fluvial sediments of the second terrace of the Khilok River, which Bazarov et al. (1982: 83) provisionally ascribed to the early Sartan Glacial (25,000–13,000 BP). Orlova (1995b) reported a conventional radiocarbon determination on bone of 38,460 ± 1100 BP (SOAN-1625) for this site; however, she does not report the provenance of this sample or its relationship to the redeposited artifacts. Archaeological materials recovered during Kirillov's and Konstantinov's excavation include two flakes and a worked cobble, as well as a large number of Pleistocene-age faunal remains.

Identified taxa include bison, hyena, Asiatic wild ass, horse, woolly rhinoceros, saiga, deer, bear, vintorogaia antelope, surok, and mammoth. These cultural remains are undiagnostic and apparently in a secondary context.

Sapun

Sapun is located on the right bank of the Ona River 6 km north of its confluence with the Uda River, near the town of Khorinsk. The site was discovered and tested by Aseev in 1980 during a cultural resource survey of a planned irrigation system (Aseev and Kholiushkin 1981, 1985). Only cursory descriptions of the site have been published. It occurs in an unstratified colluvial context and is undated (Aseev and Kholiushkin 1985: 7).

The lithic assemblage consists of 1074 artifacts, 464 of which are tools, and fifteen of which are cores. Primary reduction technology is characterized by the production of blades from parallel and triangular cores. The tool assemblage consists of notches and denticulates, retouched blades and flake-blades, retouched flakes, end scrapers, burins, beaked tools, points, gravers, side scrapers, and wedges (Aseev and Kholiushkin 1985: 9–10). The overall character of the assemblage suggests affinities with early Upper Paleolithic sites in the Transbaikal (Aseev and Kholiushkin 1985: 8). No faunal remains or features have been reported.

Tolbaga

The Tolbaga site is located on the right bank of the Khilok River, 10 km east of the town of Novopavlovka, Chita Oblast. The site lies near the top of a high hill slope, 35 m above and 200 m north of the modern river floodplain (Bazarov et al. 1982: 21). Konstantinov (1973, 1975: 40) discovered the site in 1971 and conducted excavations there from 1972 to 1979, exposing an area of 624 m^2 (Konstantinov 1980: 16–20, 1994: 46; Okladnikov and Kirillov 1980: 35–39; Bazarov et al. 1982: 20–35; Bazarova 1985). In 1985–86, Vasil'ev resumed work at Tolbaga, excavating an additional 340 m^2 (Vasil'ev et al. 1986, 1987). These excavations have revealed an extensive collection of faunal materials and lithic artifacts assigned to the early Upper Paleolithic (Kirillov 1984, 1987).

Colluvial, hill slope sediments overlying bedrock measure 2.5 m thick. Early Upper Paleolithic cultural remains lie less than 0.8 m below the modern surface, in colluvial sands and sandy loams with varying amounts of scree (Bazarov et al. 1982: 20–22; Konstantinov 1994: 46–47; Goebel and Waters 2000). Vasil'ev's excavations revealed that most artifacts are oriented along the same axis as the slope (8–12°) (Vasil'ev et al. 1986: 80, 1987:109–10), suggesting considerable slope deformation of the original Paleolithic living floor.

Four conventional radiocarbon dates have been obtained from bone samples: 34,860 ± 2100 BP (SOAN-1522), 27,210 ± 300 BP (SOAN-1523), 26,900 ± 225 BP (SOAN-3078), and 15,100 ± 520 BP (SOAN-810) (Okladnikov and Kirillov 1980; Bazarov et al. 1982; Orlova 1998). In addition to these, Goebel and Waters (2000) report two AMS radiocarbon determinations on bone of 29,200 ± 1000 (AA-26740) and 25,200 ± 260 BP (AA-8874). Discounting the aberrantly young 15,000 BP age, the five radiocarbon bone determinations from the early Upper Paleolithic component range from nearly 35,000 to 25,000 BP. Goebel and Waters (2000) suggest that the long span of time represented by this series of radiocarbon determinations may indicate that Tolbaga saw repeated occupations between 35,000 and 25,000 BP, thus leading to the vast array of lithic artifacts, faunal remains, and features preserved at the site.

The Tolbaga lithic industry has been described in detail by several researchers (Bazarov et al. 1982; Kirillov 1987; Vasil'ev et al. 1987; Konstantinov and Konstantinov 1991; Goebel 1993; Konstantinov 1994: 50–59; Kirillov and Derevianko 1998: 142). The assemblage consists of nearly ten thousand artifacts. Lithic raw materials include high proportions of cryptocrystalline silicates (at least nine varieties), as well as argillites, quartzites, and basalts (Goebel 1993). Sourcing studies have not been conducted, but high frequencies of flakes with cortex suggest that most were collected in nearby alluvium, perhaps on the Khilok River. Primary reduction technology is characterized by the production of blades, flake-blades, and flakes, removed chiefly from flat-faced blade cores or variably reduced, simply prepared flake cores. Retouching is almost exclusively unifacial, but bifacial, burin, and backing retouch also occur (Goebel 1993). The tool assemblage consists of retouched blades and flakes, unifacial points on blades, burins, side scrapers, notches, denticulates, unifacial knives, choppers, chopping tools, hammer stones, end scrapers, backed blades, and a graver (see figure 12.3) (Bazarov et al. 1982: 27; Vasil'ev et al. 1987: 117–20). A few bone artifacts have also been recovered, including a mammoth rib fragment bearing traces of polishing, a slotted horse rib apparently utilized as a scraper or knife handle, three polished bone needle fragments made on small mammal and bird bones (one with a partially preserved "eye": see figure 12.3), and two possible bone pendants. Also present is a woolly rhinoceros vertebra carved into the form of a bear's head (Vasil'ev et al. 1987: 114). According to Konstantinov et al. (1983) and Avdeev (1986), this artifact bears unmistakable microscopic traces of cutting and polishing from a chert knife and burin. Faunal remains from Tolbaga have been analyzed by Ovodov (1987). Megafauna are predominantly steppe species (horse, woolly rhinoceros, Kiakhta antelope, Mongolian gazelle, and argali sheep); however, at least one cold-adapted species is represented (reindeer) (see table 12.1).

Although the Paleolithic living surface has been disturbed by the downhill movement of sediments, the Tolbaga excavations revealed the remains of seven possible dwelling structures. These features were oval in shape, up to 6–12 m in diameter, and outlined by rings of large gneiss plates (Bazarov et al. 1982: 25–26; Meshcherin 1985; Vasil'ev et al. 1987: 112–14). These are interpreted as surface structures with single living floors (Konstantinov and Konstantinov 1991: 13–14). The number of hearths found within each dwelling ranged from one to twelve; some of these were lined with stones; others were smears of charcoal and ash (Bazarov et al. 1982: 25–26; Vasil'ev et al. 1987: 112–14). Konstantinov's excavations also uncovered the remains of three storage pits. The most substantial of these (0.75 m in diameter, 0.35 m deep) was dug into the floor of one of the dwellings, and contained a mandible and other bones of horse (Bazarov et al. 1982: 26).

Sokhatino

The well-known group of Sokhatino sites are located on the left bank of the Ingoda River, on the southeastern slope of Titovskaia Mountain in the western suburbs of the city of Chita, Chita Oblast. The localities of Sokhatino 1 and Sokhatino 6 contain early Upper Paleolithic components that are not chronometrically dated (Okladnikov and Kirillov 1980; Kirillov and Kasparov 1990).

Sokhatino 1 is situated on the third (18–20 m) terrace of the Ingoda River (Okladnikov and Kirillov 1980: 40). Paleolithic artifacts were found in a shallow and unstratified deposit of aeolian loess, 15–30 cm below the modern surface (Okladnikov and Kirillov 1968: 111, 1980: 40). Faunal remains and features are absent. Primary reduction technology is based on the manufacture of wide blades removed from unidirectional, subtriangular "Levallois" cores (seventeen) and subprismatic cores (two) (Okladnikov and Kirillov 1980: 40–41). Among the debitage are forty-eight blades (Okladnikov and Kirillov 1968: 112), and among the tools are notches, points, side scrapers, knives, and gravers (Okladnikov and Kirillov 1980: 113).

Sokhatino 6 was discovered in 1988 (Kirillov and Kasparov 1990: 195). The site is situated at a height of 56 m above the modern river floodplain. Sediments overlaying bedrock are 2.5 m thick and are described as a series of alternating bands of loam and scree. To date, only 12 m^2 have been excavated. Cultural remains are reported to occur in two stratigraphic layers (Kirillov and Kasparov 1990: 195). The upper layer (component I) is characterized by a small lithic assemblage of subprismatic and parallel blade cores, and a tool assemblage including end scrapers, gravers, notches, denticulates, and side scrapers. The lower cultural layer (component II) contains three "Levallois" blade cores, and several notches, denticulates, side scrapers, end scrapers, and gravers (Kirillov and Kasparov 1990: 195). Many of these artifacts bear traces of sandblasting.

Summary

As indicated by this review, there are seventeen known sites in Siberia that have been ascribed to the early Upper Paleolithic. Constructing a chronology of these sites, though, is difficult, given various problems. Seven sites (Ust Kanskaia Cave, Denisova Cave, Anui 1, Arembovskii, Sapun, Sokhatino 1, and Sokhatino 6) have not been or cannot be radiocarbon dated. Although ten sites have radiocarbon determinations, three (Maloialomanskaia Cave, Voennyi Gospital, and Kandabaevo) have radiocarbon determinations that cannot be reliably associated with early Upper Paleolithic cultural remains. This leaves only seven undisputed Siberian early Upper Paleolithic sites (Ust Karakol, Kara Bom, Malaia Syia, Makarovo 4, Varvarina Gora, Kamenka, and Tolbaga).

Based on the radiocarbon evidence from these seven sites, a provisional site chronology is shown in figure 12.4. This ordering illustrates that early Upper Paleolithic industries emerged in Siberia prior to 40,000 BP. Earliest occupations occur in southwest Siberia at Kara Bom (components IIa and IIb), and in southeast Siberia at Makarovo 4. The precise ages of these occupations, however, are unknown, due to shortcomings in the present range of AMS radiocarbon dating. Other sites appear younger in age. Kara Bom (component IIc) and Varvarina Gora were probably occupied during the Malokheta Interstade, between about 40,000 and 33,000 BP, whereas Kara Bom (component IId), Ust Karakol, Malaia Syia, and Kamenka (complexes A and C) were probably occupied during the Konoshchelye Stade, between about 33,000 and 30,000 BP. The Tolbaga site may span the entire period, from about 35,000 BP to as late as 25,000 BP.

LITHIC TECHNOLOGICAL ORGANIZATION

My review of early Upper Paleolithic technology draws upon data presented above in the site descriptions, as well as results of my analysis of lithic assemblages from these sites (Goebel 1993). I have organized this discussion according to three aspects of lithic technology: (1) primary reduction technology (i.e., raw material procurement, core preparation, blank manufacture), (2) secondary reduction technology (blank retouching, tool resharpening), and (3) finished tool forms.

Early Upper Paleolithic flintknappers relied exclusively on local raw materials, collected either from nearby outcrops or alluvium. By “local,” I mean within 5 km of the site where found. This exclusive use of local tool-

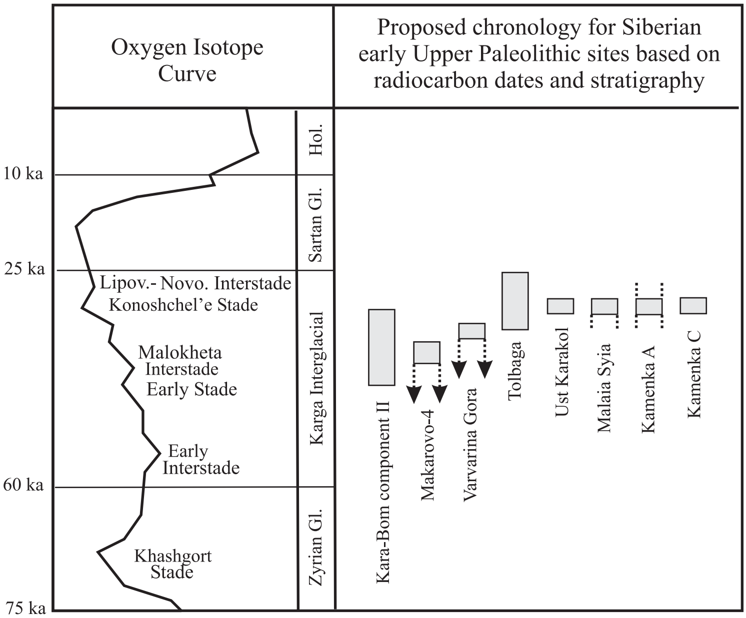

Fig 12.4. Chronology for Siberian early Upper Paleolithic sites. Dotted lines indicate a range of available radiocarbon dates. Arrows indicate the presence of infinite radiocarbon ages. *Abbreviations:* Gl., Glacial; Hol., Holocene; Lipov.-Novo., Lipovsko-Novoselovo Interstade.

stones has been documented at Ust Karakol, Denisova Cave, Kara Bom, Arembovskii, and Makarovo 4, where lithic raw materials were being gathered from alluvium (or, in the case of Arembovskii, from outcrops) in the immediate vicinities of the sites. At Tolbaga, raw materials also appear to have come from local alluvium, but toolstone may have been scarcer in the vicinity of the site. Varvarina Gora may contain exotic toolstone (i.e., obsidian), but other than this, no exotic raw materials (from distances of greater than 20 km) have been documented at any of the Siberian early Upper Paleolithic sites.

Primary reduction technology focused on the manufacture of blades and flake-blades for use as tools. Blade cores were typically manufactured on flat, long cobbles. Initial preparation of a typical blade core occurred through a series of simple steps (figure 12.5). The platform was prepared by driving a flake from one of the ends of the cobble (sometimes natural cortical surfaces were used as platforms). Elongate cortical spalls were then removed serially from this platform, resulting in the formation of a series of flat, not prismatic, parallel facets on the front of the core (figure 12.5: step A, spalls 1, 2). Blades

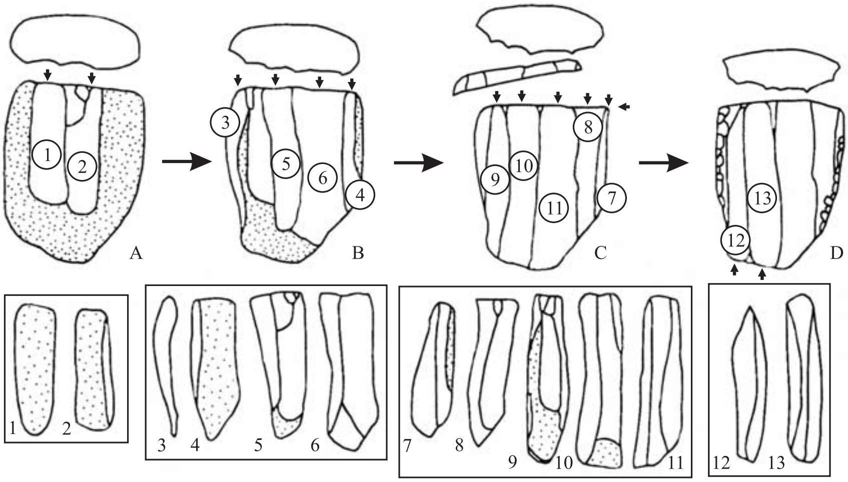

Figure 12.5. Schematic representation of blade core reduction in Siberian early Upper Paleolithic assemblages. After Goebel (1993).

were systematically removed after decortication, as long as the core's platform was workable (figure 12.5: step B, blades 3–6). The platform was rejuvenated by either faceting its surface, or trimming its perimeter, or both (figure 12.5: step C, blades 7–11). Rarely was a core tablet detached. Often the primary platform was abandoned, and a secondary platform was prepared at the opposite end of the core. Blades were then detached from this opposing platform (figure 12.5: step D). Often it appears that blades were sequentially detached from both platforms, forming blades with bidirectional facets on their dorsal faces (figure 12.5: blades 12, 13). As a result of this method of core preparation and flaking, Siberian early Upper Paleolithic blade cores are typically referred to as "flat-faced" blade cores. Heavily reduced cores often evolved into subprismatic forms. True prismatic blade cores are not common in most of these industries, but do occur in relatively higher frequencies at Ust Karakol (Goebel 1993) and the post–35,000 BP components at Kara Bom (Derevianko et al. 1998e). Thus, prismatic blade technologies may have developed in southwest Siberia late in the early Upper Paleolithic, during the Konoshchelye Stade (after 33,000 BP).

There are other methods of blank manufacture evident in early Upper Paleolithic industries. A few sites (Malaia Syia, Tolbaga) have rather high frequencies of expedient flake cores, some of them heavily reduced and occurring in the form of rotated cores (Goebel 1993). Radial cores, however, occur in low frequencies, and Levallois flake cores are almost entirely absent. Another common technology, especially in the southeast Siberian assemblages from Varvarina Gora and Tolbaga, is bipolar core reduction. Varvarina Gora has a relatively large sample of bipolar cores that are typically made on thick blades. These are associated with a series of small anvil stones that have pitted flat surfaces. Interestingly, Varvarina Gora (and Tolbaga) has far fewer typical blade and flake cores preserved in its assemblage than the other early Upper Paleolithic assemblages that I have analyzed, suggesting that the bipolar cores are evidence of some reduction extravagance resulting from raw material shortages at the site.

Secondary reduction technology is characterized by the following forms of retouching and resharpening (in order of occurrence): (1) unifacial retouch, (2) burin retouch, (3) bifacial retouch, and (4) backing retouch. Most tools were retouched unifacially, some marginally and others quite invasively. Sites such as Makarovo 4 and Kara Bom, for example, are predominantly made up of marginally retouched pieces, whereas Arembovskii, Tolbaga, and Varvarina Gora have higher frequencies of invasive, scalar retouch (Goebel 1993). Early Upper Paleolithic points were typically unifacially retouched, but some have invasive ventral retouch to remove thick bulbs of percussion or distal curving. Burin technology occurs to varying degrees in some of the early Upper Paleolithic assemblages (Ust Karakol, Kara Bom, Varvarina Gora, Tolbaga). Most burins were manufactured by the removal of a burin facet on the lateral margin of a blade, with a transverse break serving as the burin spall platform. Bifacial technology is rare in the early Upper Paleolithic; typically there are only one to three artifacts in each assemblage that display bifacial working (with the exception of Ust Karakol, which has nine bifaces [Goebel 1993]). Backing occurs infrequently; it shows up only in the Transbaikal assemblages.

Tool forms include high frequencies of retouched blades and flakes, as well as formal tools such as end scrapers, side scrapers, angle burins, gravers, points on blades, denticulates, notches, unifacial knives (sometimes backed), and oval-shaped bifaces. The Kara Bom, Varvarina Gora, and Tolbaga lithic assemblages contain all of these tool forms, whereas Ust Karakol lacks notches, end scrapers, and gravers; Malaia Syia lacks unifacial points, gravers, and burins; Arembovskii lacks denticulates and burins; and Makarovo 4 lacks burins. Backed blades, finally, occur in very low frequencies (less than 1%) in the Varvarina Gora and Tolbaga assemblages (Goebel 1993).

Thus, the organization of technology during the early Upper Paleolithic can be summed up as follows. Only local raw materials gathered from alluvial sources were utilized at most sites. In every assemblage, for nearly every raw material present, either cores or cortical elements (or both) are preserved. This indicates that (1) raw material packages (i.e., cobbles) were typically carried to sites for primary reduction; and (2) finished tools were almost never transported to sites from some other location. Furthermore, all sites show signs of secondary reduction, including tool retouching and resharpening. Blades and flakes saw more intensive secondary reduction at some sites, leading to apparent high frequencies of side scrapers and other formal tools. This is probably a factor of raw material economizing in places where toolstone was scarce. No matter how far the site seems to have been from local sources of raw material, early Upper Paleolithic hunter-gatherers were provisioning their camps with toolstones, and they were carrying out all stages of lithic reduction, primary as well as secondary, at these camps. Finally, the same basic set of lithic tools recurs at all sites; however, larger assemblages characteristically have more diversity in tool classes.

OSSEOUS TECHNOLOGIES AND NONUTILITARIAN ARTIFACTS

Every early Upper Paleolithic site with well-preserved faunal remains (with the exception of Kara Bom component II) contains a handful of carefully worked nonlithic implements. Recurring forms include small points made on cervid antler, bone awls and needles, and cut and polished ivory and bone retouchers. At Tolbaga, there is also a horse rib with an incised longitudinal slot; perhaps this served as a handle for a stone blade or scraper. Osseous technology, therefore, is clearly present in the early Upper Paleolithic.

Jewelry and other items of personal adornment are also present in the Siberian early Upper Paleolithic, although in just a few sites. There are cervid tooth pendants from Maloialomanskaia Cave and Voennyi Gospital (although these are not clearly tied to early Upper Paleolithic industries), a softstone "semi-disk" colored with red ochre at Varvarina Gora, and small bone fragments with what appear to be intentionally drilled holes at Tolbaga. The cervid tooth pendants are reminiscent of those described for the European Aurignacian (White 1989).

Early Upper Paleolithic artwork is problematic and controversial. Red ochre has been found at Maloialomanskaia Cave and Malaia Syia. At Maloialomanskaia Cave, it was used to draw a small line on the wall of the cave; however, this cannot be clearly tied to the early Upper Paleolithic occupation there. The putative portable stone art from Malaia Syia (Larichev 1978a,b; Larichev et al. 1988) is equivocal; the pieces that I have examined were unconvincing. Perhaps the "bear's head" carved on a woolly rhinoceros vertebra found at Tolbaga is a true example of early Upper Paleolithic art, but it was found together with a jumble of other woolly rhinoceros bones, an unusual context for a work of art. Perhaps the only unequivocal work of art for the Siberian early Upper Paleolithic is the mammoth ivory spheroid found over a hundred years ago at Voennyi Gospital. Unfortunately, this piece is lost and we have only an illustration provided by Cherskii (1872). Thus, the evidence for artwork in the Siberian early Upper Paleolithic is meager.

SUBSISTENCE

Faunal analyses of Siberian Paleolithic assemblages are scarce, especially for the early Upper Paleolithic. Most sites have preserved fauna, but so far only a few sites have been subjected to detailed zooarchaeological analysis. As shown in table 12.1, though, "kitchen-lists" of fauna have been presented for all of the early Upper Paleolithic sites with well-preserved faunal remains. One striking feature of these data is that many faunal species are represented. To me, this suggests that early Upper Paleolithic hunter-gatherers were generalists who preyed on different species as opportunities arose. For the three sites that have number of individual specimen (NISP) and minimum number of individual (MNI) data reported, Malaia Syia has at least thirteen economically important fauna present, Varvarina Gora has at least fifteen, and Kamenka has at least nine. In all three assemblages, no single species dominates, again reinforcing the interpretation that subsistence in the early Upper Paleolithic was based on generalized, perhaps opportunistic hunting. Given the lack of more specific data concerning the faunal assemblages from these sites, little else can be said about early Upper Paleolithic prey choice and hunting organization. Clearly more detailed taphonomic and zooarchaeological analyses are needed to test these and other hypotheses of early Upper Paleolithic foraging, planning, and seasonality.

SITE STRUCTURE AND SETTLEMENT

Early Upper Paleolithic sites are characterized by clear intrasite as well as intersite heterogeneity. Nearly all are open-air sites. There is little indication that, during this period, hominins used caves, although ephemeral occupations occur at Ust Kanskaia Cave, Denisova Cave, and Maloialomanskaia Cave.

Open sites are typically situated on high terrace-like colluvial landforms overlooking broad floodplains (e.g., Ust Karakol, Kara Bom, Arembovskii, Makarovo 4, Varvarina Gora, Tolbaga, Sapun, Sokhatino). Some sites are also situated adjacent to confluences of side valley streams and rivers (Ust Karakol, Kara Bom, Malaia Syia). One site, Arembovskii, appears to be a workshop located adjacent to a high quality raw material source.

Early Upper Paleolithic sites also show clear internal organization. Features are common, and activity areas are definable in most cases. Hearths have been identified at Ust Karakol, Kara Bom, Makarovo 4, Varvarina Gora, Kamenka, and Tolbaga. Many of these are stone-lined, whereas others are smears of charcoal, ash, charred bone, and lithics. Structural remains of dwellings are also common. Larichev (1978a: 105; Larichev et al. 1988: 369) reports the discovery of a series of "dwelling complexes" at Malaia Syia (although no feature maps have been reported), and nearly all of the Transbaikal sites have revealed remnants of structures. At Varvarina Gora and Tolbaga, these are defined by roughly circular rings of large stone plates, and sometimes centrally located hearths. These dwellings appear to have been surficial and 3–6 m in diameter. “Outdoor work areas” have also been defined at some of these sites, as have trash heaps. At Varvarina Gora and Tolbaga, there are features considered to be storage pits. One such pit at Varvarina Gora contained a large bird skull and an articulated partial skeleton of a horse, and another pit at Tolbaga contained a horse mandible and other horse bones. The repeated occurrence of dwellings, hearths, and storage pits and large accumulations of lithic artifacts, debitage, and faunal remains at these early Upper Paleolithic sites suggest to some researchers (i.e., Meshcherin 1985; Kirillov 1987: 71; Goebel 1999) that they were repeatedly occupied for relatively long periods. Many of these sites, however, have been shown to be disturbed by colluvial processes (Goebel and Aksenov 1995; Goebel and Waters 2000; Goebel et al. 2001), so that these reconstructions need to be carefully evaluated with detailed geoarchaeological studies.

Thus, among the open early Upper Paleolithic sites, three site types can be distinguished:

1. Large camps with features including dwellings, pits, hearths, and/or large accumulations of lithics and faunal remains (Kara Bom, Makarovo 4, Varvarina Gora, Kamenka complex A, Tolbaga, perhaps Malaia Syia);
2. Small camps with unlined hearths and clearly defined activity areas (Ust Karakol, Kamenka complex C); and
3. Lithic workshops with associated camps (Arembovskii).

The large sites with extensive concentrations of lithic and faunal debris probably represent base camps (some of which were repeatedly occupied), whereas the smaller sites represent short-term camps occupied only once or on several occasions (Goebel 1999). These patterns suggest some degree of logistical mobility among early Upper Paleolithic hunter-gatherers, what Guthrie (1983) referred to as a northern base-camp and spike-camp settlement strategy (Goebel 1999).

This pattern of logistical mobility in the early Upper Paleolithic is further seen in the relative proportions of formal and informal tools in the lithic assemblages. Kelly (1988, 2001), Andrefsky (1998), and others have noted that in some situations, high frequencies of formal tools in lithic assemblages reflect relatively high mobility, whereas high frequencies of informal tools reflect relatively low mobility. Proportions of formal and informal tools for the early Upper Paleolithic are presented in figure 12.6. Clearly, early Upper Paleolithic sites have relatively high proportions of informal, expedient tools. These occur primarily in the form of retouched blades and flakes, as well as notches and denticulates. Formal tools (i.e., end scrapers, side scrapers, burins, and bifaces) that were made in advance of use and/or were more

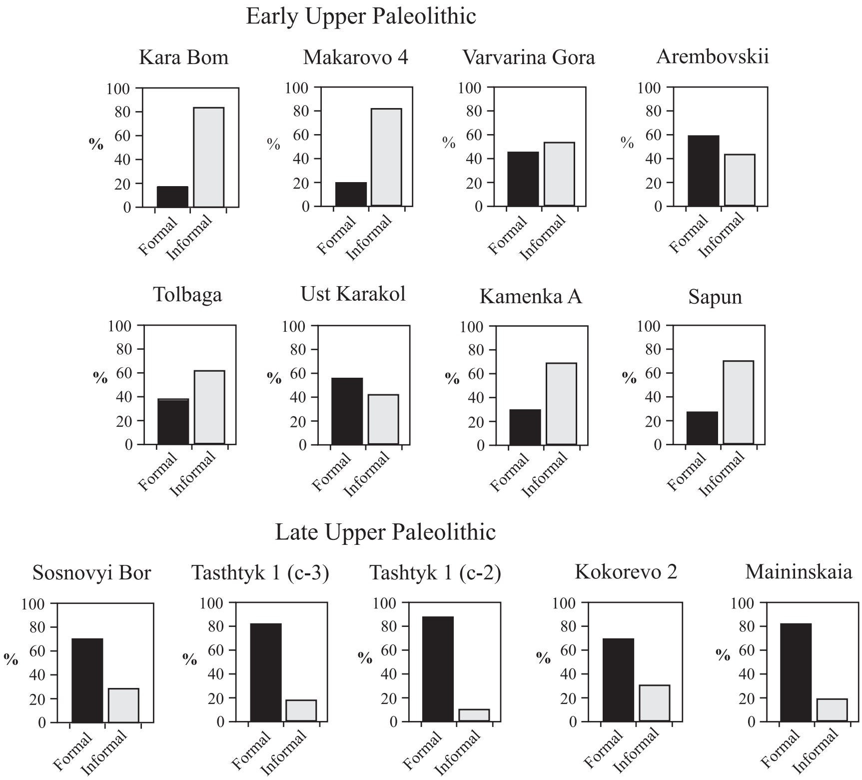

Figure 12.6. Comparison of formal and informal tool production in early and late Upper Paleolithic assemblages.

carefully curated are far less common in most assemblages. Furthermore, among the early Upper Paleolithic assemblages for which data are available, relative frequencies of formal and informal tools fall into two discrete clusters. The first cluster includes Kara Bom, Makarovo 4, Varvarina Gora, Kamenka A, Sapun, and Tolbaga, which have relatively high frequencies of informal tools, and the second includes Ust Karakol and Arembovskii, which have relatively low frequencies of informal tools. In addition, the assemblages with high proportions of informal tools are relatively large (more than 130 artifacts), whereas those with low proportions of informal tools are relatively small (less than fifty artifacts). This dichotomy may be a reflection of site function, with the large sites again representing long-term base camps and the small sites representing spike camps that were occupied for shorter periods.

That early Upper Paleolithic assemblages are rich in informal tools is clearly shown when these proportions are compared with similar statistics from Siberian late Upper Paleolithic assemblages thought to represent residentially, as opposed to logistically mobile hunter-gatherers (Goebel 2002). Frequencies of formal tools in six late Upper Paleolithic assemblages range from 67.1% to 87.2% and average 74.0%. As presented here, frequencies of formal tools in seven early Upper Paleolithic assemblages range from 16.5% to 58.7% and average 37.7% (figure 12.6). This difference suggests some fundamental differences in tool provisioning and settlement strategies between the early and late Upper Paleolithic. Early Upper Paleolithic hunter-gatherers occupied camps for longer periods of time and were less mobile than their late Upper Paleolithic counterparts.

DISCUSSION AND CONCLUSIONS

This paper focuses on issues related to chronology and cultural history; however, I have also made an attempt to synthesize what we know about technological organization, subsistence pursuits, and settlement behavior in the early Upper Paleolithic. Based on this review, I draw the following conclusions.

1. The early Upper Paleolithic in Siberia emerged by 40,000 BP, and possibly earlier. It does not appear to have been coincident with the Siberian Mousterian, except perhaps in the Altai Mountains, where the two complexes may have coexisted for some time between 42,000 and 38,000 BP.
2. In terms of raw material procurement and organization of technology, early Upper Paleolithic hunter-gatherers provisioned places. This is based on three observations: (1) an almost exclusive reliance on local lithic resources, which were carried in cobble form to campsites where primary as well as secondary reduction activities took place; (2) the lack of any unequivocal evidence of finished tools being transported to sites; and (3) the relatively high frequency of expedient, informal tools.
3. Early Upper Paleolithic lithic industries were centered on flat-faced core and blade industries. These differ from blade core technologies in the European Aurignacian, but are similar to initial Upper Paleolithic core technologies from southwestern and central Asia (e.g., Kebara Cave, Israel [45,000 BP]; Yafteh Cave, Iran [greater than 40,000 BP]; Obi Rakhmat, Uzbekistan [undated]) (Hole and Flannery 1967: 153; Suleimanov 1972; Bar-Yosef et al. 1992). The Siberian early Upper Paleolithic may be part of a more widespread inner Asian complex that existed from southwestern Asia to Inner Mongolia during the middle late Pleistocene (Goebel 1993).
4. Early Upper Paleolithic stone tools were almost exclusively unifacially worked. Bifacial, burin, and backing techniques were used infrequently.

Major tool forms include retouched blades and flakes, end scrapers, side scrapers, notches, denticulates, burins, unifacial points on blades, unifacial knives, gravers, bifaces, and cobble tools.

5. Faunal assemblages reflect generalized hunting of prey species found in diverse habitats close to the sites. This suggests that early Upper Paleolithic hunting strategies were opportunistic, not residentially organized or specialized, as in the late Upper Paleolithic (Goebel 1999). Although no single prey species seems to dominate any one assemblage, a small set of economically important fauna recur in most sites: woolly rhinoceros, wild ass, argali sheep, bison, and reindeer. Woolly mammoth, incidentally, are absent from all but one site (Malaia Syia).
6. Early Upper Paleolithic sites are variable in size and internal organization and represent a logistically mobile settlement scheme that consisted of short-term, special-purpose spike camps connected to large, stable base camps. Large base camps have hearths, storage pits, and remains of dwellings, as well as high proportions of expedient tools.

Thus, early Upper Paleolithic hominin adaptations were locally based, with little evidence of high residential mobility or long-distance transport of resources. This was an adaptation that fit well with the heterogeneous forest-steppe environments that existed in southern Siberia during the interstades of the middle late Pleistocene.

Is the Siberian early Upper Paleolithic the result of local evolution of Neanderthals into anatomically modern humans, or is it the result of migration of early modern humans from southwest Asia? Currently, we have no clear answer to this question. Besides a few isolated teeth, no Neanderthal or anatomically modern human fossils have been found from any of these early Upper Paleolithic sites or the immediately preceding Siberian Middle Paleolithic sites. Thus, we do not know whether the Siberian early Upper Paleolithic was the product of modern humans, Neanderthals, or both. Given occurrences of anatomically modern human fossils in Middle Paleolithic contexts in Israel, as well as Neanderthals in seemingly Upper Paleolithic contexts in France, fossil evidence is clearly needed from Siberia to identify which hominins were the main players in the transition to the Upper Paleolithic. Nevertheless, on the grounds that early Upper Paleolithic industries are fundamentally different from earlier Siberian Mousterian industries, but very similar to contemporaneous initial Upper Paleolithic industries in Uzebekistan, Iran, and Israel, I have argued that the transition to the Upper Paleolithic around 42,000 BP reflects rapid replacement of authochthonous Middle Paleolithic populations by an intrusive Upper Paleolithic population that presumably migrated from central Asia and ultimately southwestern Asia (Goebel 1993, 1999). More detailed studies comparing the adaptations of Siberian Middle Paleolithic and early Upper Paleolithic hominins, however, are needed to test this hypothesis.

Did early Upper Paleolithic hominins further colonize the Siberian subarctic and arctic? So far, no sites clearly dated to between 40,000 and 30,000 BP have been found above 55° N. Subarctic Siberia is relatively flat and featureless, especially compared with southern Siberia, and paleobotanical records suggest that during the Karga Interglacial, this area was blanketed by an extensive boreal forest not too different from that of today. This environment would have required a radically different hunter-gatherer adaptation than the one described here for the early Upper Paleolithic. Technological provisioning of individuals and transport of lithic raw materials over great distances, hunting of a small set of prey species, fishing, and relatively high mobility levels would be required. Such behaviors do not appear in the archaeological record of Siberia until much later in the Upper Paleolithic (Goebel 1993). Thus, it is reasonable to conclude that the hominin range during the early Upper Paleolithic may have been restricted to below 55° N, and that it was not until the succeeding phase of the Upper Paleolithic, between 25,000 and 20,000 BP, that the north was "conquered." This has important implications not only for our interpretations of how early modern humans peopled the Old World, but also for modeling the timing and process of the colonization of the New World.

13

Origin of the Upper Paleolithic in Siberia

A Geoarchaeological Perspective

Y. V. Kuzmin

The transition from the Middle-Upper Paleolithic is of great importance for Old World archaeology and physical anthropology (J. D. Clark 1992; Nitecki and Nitecki 1994; Foley and Lahr 1997). It is now possible to clarify the main features of the transition in Siberia, which covers approximately 12,000,000 km^2, because of the recent publication of several comprehensive summaries of the archaeology and radiocarbon chronology of the Siberian Paleolithic (West 1996; Lisitsyn and Svezhentsev 1997; Derevianko et al. 1998f; Kuzmin and Orlova 1998; see also Goebel, this volume). In this overview, I present an updated geoarchaeological picture (see Kuzmin and Orlova 1998: 30–34; Orlova et al. 1998). Emphasis is given to radiocarbon dated sites because they are usually the best studied.

The primary chronological and paleoenvironmental features of the Middle-Upper Paleolithic transition in Siberia have been established using stratigraphic, radiocarbon, and pollen methods. There are only nine Mousterian sites with representative geoarchaeological records. Four of these are located in the Altai Mountains, including Okladnikov, Strashnaya, and Denisova Caves, which sit at elevations ranging from 250 m to 670 m above sea level, and the Kara Bom open-air site, which lies at an elevation of 1240 m. The Mokhovo 2 site is located in the western part of the Sayan Mountain foothills, in the Kuznetsky Coal Basin. Dvuglazka Cave is located in the eastern part of the Sayan Mountain foothills, in the Yenisei River basin. Both the Kurtak 4 and Ust Izhul sites are located on the left bank of the Krasnoyarsk Reservoir, also in the Yenisei River basin. The single Mousterian site east of the Yenisei River is Arta 2, located in the Transbaikal (figure 13.1).

Early Upper Paleolithic sites are much more widely distributed in Siberia, being known from the Altai Mountains (Kara Bom, Kara Tenesh, Malyi Yaloman, Ust Karakol 1 and 2, and Anuy 2), the Sayan Mountains (Dvuglazka

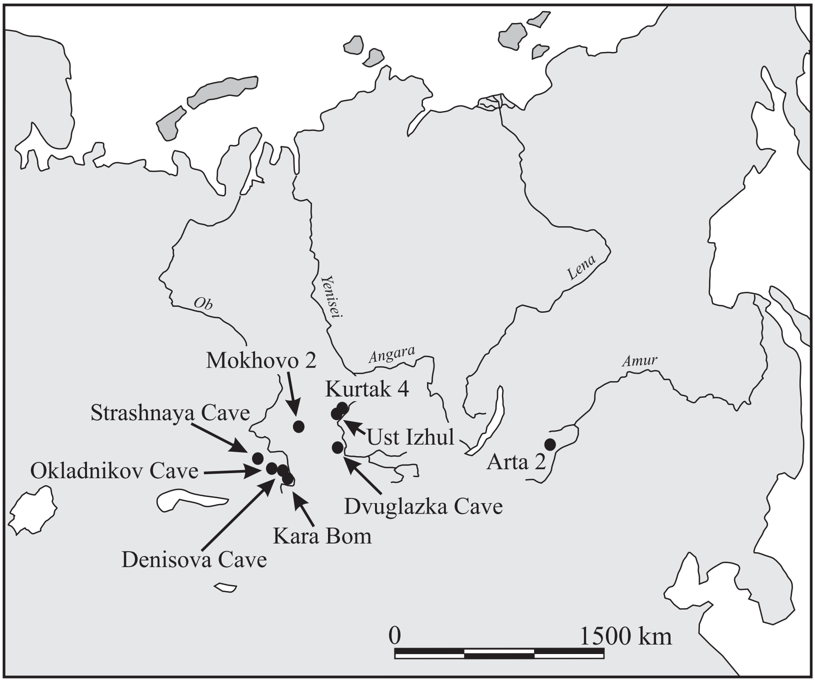

Figure 13.1. Locations of Middle Paleolithic sites in Siberia.

Cave), the Yenisei River basin (Brazhnoye and Kurtak 4), the Angara River basin (Malta, Ust Kova, Mamony 2, and Voenny Gospital 2), the Lena River headwaters (Makarovo 4), Transbaikal (Kandabaevo, Tolbaga, Kamenka, and Varvarina Gora), and in the Russian Far East (Geographical Society Cave; figure 13.2). In total, twenty sites correspond to the earliest Upper Paleolithic containing macroblade assemblages. Some early Upper Paleolithic sites may also show the first well-documented evidence of microblade manufacture as early as 33,000–27,000 BP (e.g., Ust Karakol 1, Anuy 2) (Derevianko et al. 1998a: 51–68; Postnov 1998).

Thus far, only two sites with both Mousterian and early Upper Paleolithic cultural complexes in stratigraphic order are known, Kara Bom and Ust Karakol 1. Both have now been studied in sufficient detail, allowing them to serve as reference points for other single-component sites.

THE MOUSTERIAN

The most representative region in Siberia for understanding the Middle-Upper Paleolithic is the Altai Mountains (Derevianko and Markin 1998c;

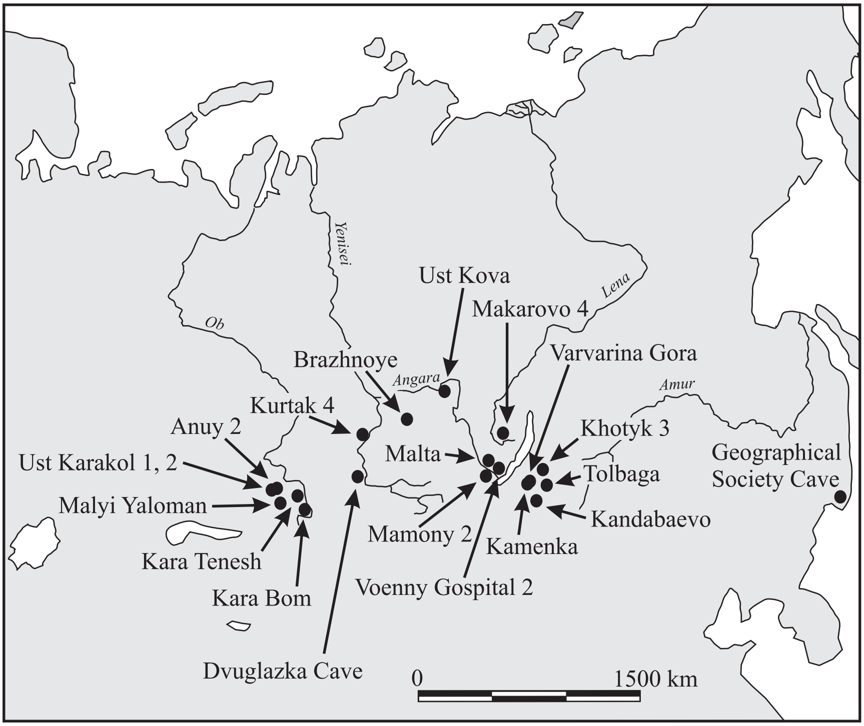

Figure 13.2. Locations of early Upper Paleolithic sites in Siberia.

Derevianko et al. 1998a,e, 1999; Postnov 1998). Extensive excavations conducted in the 1980s and 1990s have established a Mousterian chronology. At the key site of Kara Bom, Mousterian cultural layer 1 is radiocarbon dated to greater than 44,400 BP. At Okladnikov Cave, the radiocarbon series exhibits wide variation. The radiocarbon values from layer 3 range from 43,300 to 28,500 BP. Radiocarbon dates from Denisova Cave, layer 21, are from greater than 37,235 BP to around 35,100 BP (table 13.1).

Palynological data show that the Mousterian culture at Kara Bom existed under at least two different sets of conditions. The earlier phase corresponds to a birch-dominated forest-steppe, whereas the later phase is associated with dark coniferous forest, mostly pine (*Pinus* sp.) and spruce (*Picea* sp.), with a small component of broadleaved species such as elm (*Ulmus* sp.) and walnut tree (*Juglans* sp.). In the Denisova Cave section, a similar situation is observed (Derevianko et al. 1998a; Derevianko, Petrin, Nikolaev et al. 1999). Pollen spectra from the Mousterian layer at Okladnikov Cave are indicative of grass steppe vegetation around the site (Derevianko et al. 1998a).

In the Sayan Mountain foothills, Mousterian radiocarbon dates are from 30,300 to 27,200 BP (table 13.1). The typical Mousterian assemblage from layer 7 at Dvuglazka Cave is associated with a surprisingly young radiocarbon value (about 27,200 BP), which is, so far, the youngest radiocarbon date for any known Siberian Mousterian complex (Lisitsyn and Svezhentsev 1997).

In the Yenisei River basin, the Ust Izhul site has been excavated and dated (Davis 1998; Drozdov et al. 1999). The age of the Mousterian layer is apparently beyond the limit of radiocarbon dating; all of the radiocarbon values are greater than around 40,000 BP. The faunal assemblage, including an early type of woolly mammoth (*Mammuthus primigenius* Blumenbach), may support a pre-Karginian age for Ust Izhul, perhaps 65–125 ka (calendric). Layer 17 at Kurtak 4 also may be associated with the Mousterian; the radiocarbon dates range from 32,400 BP to 31,700 BP. In the Transbaikal, the single radiocarbon date associated with Mousterian, around 37,400 BP, comes from the Arta 2 site (table 13.1).

THE EARLY UPPER PALEOLITHIC

In the Altai Mountains, the earliest Upper Paleolithic component at Kara Bom (layer 6) is radiocarbon dated to 43,200 BP. At the Kara Tenesh site, radiocarbon dates are from 42,200 BP to 26,900 BP. The Malyi Yaloman site assemblage is radiocarbon dated to 33,400 BP.

At the key site of Ust Karakol 1, the earliest Upper Paleolithic is not radiocarbon dated. The age determination for layer 10, overlying the earliest Upper Paleolithic occurrences in layer 11A, is 35,000 BP. Importantly, the early Upper Paleolithic layers 11A, 10, and 9A contain a few definite microblades and microcores (Derevianko et al. 1998a: 66–67). Thus, Ust Karakol 1 contains the earliest in situ evidence of microblade manufacture in all of northern Asia, and we can assume that this microtechnique started in southern Siberia by at least 35,000 BP.

Anuy 2 (layer 12), radiocarbon dated to 27,900–26,800 BP, also contains definite microblades. Layer 9 is dated to 27,100 BP. Anuy 2 thus provides further evidence for early microblade manufacture in northern Asia before the appearance of a formally recognized Dyuktai culture, which is not older than 24,600 BP (Kuzmin and Orlova 1998: 35–37).

Palynological data from several sites, such as Denisova Cave, Anuy 2, and Ust Karakol 1, show that the earliest phase of the Upper Paleolithic in the Altai correlates with dark coniferous forests (Derevianko et al. 1998a). At the Kara Bom site, the earliest Upper Paleolithic layer corresponds to a transition from dark coniferous forest to forest-steppe (Derevianko et al. 1999).

In the Sayan Mountains, the early Upper Paleolithic at the Dvuglazka Cave is radiocarbon dated to 26,600 BP. In the Yenisei River basin, the radiocarbon dates from Brazhnoye and Kurtak 4 (layers 11–12) are between 31,000

TABLE 13.1 Radiocarbon Dates Associated with Mousterian and Early Upper Paleolithic Complexes in Siberia

Site Name, Layer	*Age (BP)*	*Material Dated*	*Lab Number*	*References*
Mousterian				
Altai Mountains				
Kara Bom, layer 1	>42,000	Bone	AA-8873A	Goebel (1993)
	>44,400	Bone	AA-8894A	Goebel (1993)
Okladnikov Cave, layer 3	43,300 ± 1500	Bone	RIDDL-722	Goebel (1993)
	40,700 ± 1100	Bone	RIDDL-720	Goebel (1993)
	32,400 ± 500	Bone	RIDDL-721	Goebel (1993)
	28,470 ± 1250	Bone	SOAN-2459	Goebel (1993)
	>16,210	Bone	SOAN-2458	Orlova (1995b)
Okladnikov Cave, layer 2	37,750 ± 750	Bone	RIDDL-719	Orlova (1995b)
Okladnikov Cave, layer 1	33,500 ± 700	Bone	RIDDL-718	Orlova (1995b)
Strashnaya Cave	>25,000	Bone	SOAN-785	Orlova (1995b)
Denisova Cave, layer 21	35,140 ± 670	Charcoal	GX-17599	Goebel (1993)
	>34,700	Humates	SOAN-2488	Orlova (1995b)
	39,390 ± 1310	Humates	SOAN-2489	Orlova (1995b)
Denisova Cave, layer 11	>37,235	Bone	SOAN-2504	Orlova (1995b)
Denisova Cave entrance, layer 9	46,000 ± 2300	Charcoal	GX-17602	Goebel (1993)
Sayan Mountains				
Mokhovo 2	30,330 ± 445	Bone	SOAN-2861	Orlova (1995b)
Dvuglazka, layer 7	27,200 ± 800	Bone	LE-4811	Lisitsyn and Svezhentsev (1997)
Yenisei River basin				
Ust Izhul	>42,100	Bone	AECV-1939C	Drozdov et al. (1999)
	>42,190	Charcoal	AECV-2034C	Drozdov et al. (1999)

	>41,810	Charcoal	AECV-2032C	Drozdov et al. (1999)
	>40,050	Charcoal	AECV-2033C	Drozdov et al. (1999)
Kurtak 4, layer 17 (?)	32,380 ± 280	Charcoal	LE-3638	Lisitsyn and Svezhentsev (1997)
	31,650 ± 520	Charcoal	LE-3352	Lisitsyn and Svezhentsev (1997)
Transbaikal				
Arta 2, layer 4	37,360 ± 2000	Charcoal	LE-2967	Kuzmin (1994)
Early Upper Paleolithic				
Altai Mountains				
Kara Bom, layer 6	43,200 ± 1500	Charcoal	GX-17597	Goebel (1993)
Kara Bom, layer 5	43,300 ± 1600	Charcoal	GX-17596	Goebel (1993)
Kara Tenesh	42,165 ± 4170	Bone	SOAN-2485	Orlova (1995b)
	34,760 ± 1240	Bone	SOAN-2135	Derevianko et al. (1998a)
	31,400 ± 410	Bone	SOAN-2486	Orlova (1995b)
	26,875 ± 625	Bone	SOAN-2134	Derevianko et al. (1998a)
Malyi Yaloman, layer 3	33,350 ± 1145	Charcoal	SOAN-2500	Derevianko et al. (1998a)
Ust Karakol 1, layer 10	35,100 ± 2850	Charcoal	SOAN-3259	Derevianko et al. (1998a)
Ust Karakol 1, layer 9	33,400 ± 1285	Charcoal	SOAN-3257	Derevianko et al. (1998a)
	29,860 ± 355	Charcoal	SOAN-3358	Derevianko et al. (1998a)
	29,720 ± 360	Charcoal	SOAN-3359	Derevianko et al. (1998a)
Ust Karakol 1, layer 5	30,460 ± 2035	Charcoal	SOAN-3260	Orlova (1998)
	27,020 ± 435	Charcoal	SOAN-3356	Orlova (1998)
	26,305 ± 280	Charcoal	SOAN-3261	Orlova (1998)
	26,920 ± 310	Humates	SOAN-3356G	Orlova (1998)
Ust Karakol 1, layer 3	31,410 ± 1160	Charcoal	SOAN-2515	Orlova (1995b)
	31,345 ± 1275	Charcoal	SOAN-2869	Orlova (1995b)
	29,900 ± 2070	Charcoal	IGAN-837	Derevianko et al. (1998a)

(*continued*)

TABLE 13.1 (*continued*)

Site Name, Layer	*Age (BP)*	*Material Dated*	*Lab Number*	*References*
Ust Karakol 1, layer 2	28,700 ± 850	Bone	SOAN-2614	Orlova (1995b)
Ust Karakol 2, layer 2	31,430 ± 1180	Bone	IGAN-1077	Derevianko et al. (1998a)
Anuy 2, layer 12	27,930 ± 1590	Humates	IGAN-1425	Derevianko et al. (1998a)
	26,810 ± 290	Charcoal	SOAN-3005	Orlova (1995b)
Sayan Mountains				
Dvuglazka, layer 4	26,580 ± 520	Bone	LE-4808	Lisitsyn and Svezhentsev (1997)
Yenisei River basin				
Brazhnoye	>31,000	Bone	GIN-8481	Vorobieva et al. (1998)
Kurtak 4, layers 11–12	27,470 ± 200	Charcoal	LE-2833	Drozdov et al. (1999)
Angara River basin				
Malta, layer 6	43,100 ± 2400	Bone	OxA-6189	Hedges et al. (1999)
Malta, (?)	41,100 ± 1500	Bone	GIN-7707	Medvedev et al. (1996)
Ust Kova, layer 7	>32,865	Charcoal	SOAN-1874	Kuzmin (1994)
	30,100 ± 150	Charcoal	GIN-1741	Kuzmin (1994)
	28,050 ± 670	Charcoal	SOAN-1875	Orlova (1995b)
Mamony 2	31,400 ± 150	Bone	GIN-8480	Vorobieva et al. (1998)
Voenny Gospital 2	29,700 ± 500	Bone	GIN-4440	Kuzmin (1994)
Lena River headwaters				
Makarovo 4, layer 3a	>39,000	Bone	AA-8880	Goebel and Aksenov (1995)
	>38,000	Bone	AA-8878	Goebel and Aksenov (1995)

	>38,000	Bone	AA-8879	Goebel and Aksenov (1995)
Transbaikal				
Kandabaevo	38,460 ± 1100	Bone	SOAN-1625	Orlova (1995b)
Tolbaga, layer 4	34,860 ± 2100	Bone	SOAN-1522	Konstantinov (1994)
	27,210 ± 300	Bone	SOAN-1523	Konstantinov (1994)
	26,900 ± 225	Bone	SOAN-3078	Orlova (1998)
	25,200 ± 260	Bone	AA-8874	Goebel (1993)
Kamenka, unit A	31,060 ± 530	Bone	SOAN-3133	Orlova (1998)
	30,460 ± 430	Bone	SOAN-3354	Orlova (1998)
	28,060 ± 475	Bone	SOAN-2903	Orlova (1995b)
	26,760 ± 265	Bone	SOAN-3353	Orlova (1998)
	25,540 ± 300	Bone	SOAN-3355	Orlova (1998)
	24,625 ± (190	Bone	SOAN-3031	Orlova (1998)
Kamenka, unit B	35,845 ± 695	Bone	SOAN-2904	Orlova (1995b)
	28,815 ± 150	Bone	SOAN-3032	Orlova (1998)
Kamenka, unit C	30,220 ± 270	Bone	SOAN-3052	Orlova (1998)
Varvarina Gora, layer 2	>35,300	Bone	AA-8893A	Goebel (1993)
	>34,050	Bone	AA-8875A	Goebel (1993)
	34,900 ± 780	Bone	SOAN-1524	Orlova (1995b)
	30,600 ± 500	Bone	SOAN-850	Orlova (1995b)
	29,895 ± 1790	Bone	SOAN-3054	Orlova (1998)
Russian Far East				
Geographical Society Cave	32,570 ± 1510	Bone	IGAN-341	Kuzmin (1994)

and 27,500 BP. In the Angara River basin, Malta (layer 6) has recently been dated to 43,100–41,100 BP (table 13.1). Interestingly, no Mousterian-like artifacts were reported from this cultural unit (Medvedev et al. 1996). Other early Upper Paleolithic sites in the Angara River basin, such as Ust Kova (layer 7), Mamony 2, and Voenny Gospital 2, are radiocarbon dated between 32,900 and 29,700 BP. At the Lena River headwaters, the early Upper Paleolithic at Makarovo 4 is greater than 39,000 BP (Goebel and Aksenov 1995).

Several early Upper Paleolithic sites in the Transbaikal have been excavated and radiocarbon dated during the past decade (Konstantinov 1994, 1996; Kuzmin and Orlova 1998; Lbova 1999). At Kandabaevo, the early Upper Paleolithic is radiocarbon dated to 38,500 BP; at Tolbaga (layer 4), dates are between 34,900 and 25,200 BP; at Kamenka (Unit A), radiocarbon dates vary from 31,100 to 24,600 BP; at Kamenka (Unit B), radiocarbon values are from 28,800 to 25,900 BP; and at Varvarina Gora (layer 2), the radiocarbon dates are from 35,300 to 29,900 BP (table 13.1). The single early Upper Paleolithic site in the Russian Far East, Geographic Society Cave, yielded a radiocarbon value of 32,600 BP.

During the past few years, one more site with both Mousterian and Upper Paleolithic cultural layers in situ, Khotyk 3, was excavated in the Transbaikal (Lbova 1999). The colluvial deposits at Khotyk 2 also contain abundant mammalian fauna remains. The radiothermoluminescence (RTL) method was applied to date sediments at this site (Perevalov and Rezanov 1997), yielding ages for the latest Mousterian (layers 3 and 4) of 49–56 ka (calendric) and the earliest Upper Paleolithic (layer 2) of 32 ka (calendric) (Lbova 1999). Recently, a radiocarbon value of 26,220 ± 550 BP (AA-32669) was obtained on charcoal from layer 2 at Khotyk 3 (L. V. Lbova, pers. comm., 2000). According to the latest information on late Pleistocene radiocarbon calibration (Bard 1998; Kitagawa and van der Plicht 1998a,b), radiocarbon ages may be as much as 4000–5000 years too young at around 25,000 BP. Thus, the radiocarbon value of 26,000 BP from Khotyk 3 (layer 2) may correspond to a calendar age of 30,000–31,000 BP, very close to the reported RTL age. Thus, Khotyk 3 is of great potential for establishing the timing of the Middle-Upper Paleolithic transition east of the Yenisei River.

PALEOENVIRONMENT OF THE MIDDLE-UPPER PALEOLITHIC TRANSITION IN SIBERIA

The time interval for the Middle-Upper Paleolithic transition, about 43,000–27,000 BP, corresponds to the Karginian Interglacial (Oxygen Isotope Stage 3) of Siberia (Arkhipov and Volkova 1994; Kind 1974; Orlova et al. 1998). In general, climates of the Karginian Interglacial were cooler than now, but still favorable enough for prehistoric populations to occupy the southern part of Siberia. Within Karginian time, the cold Konoshchelye event has been radio-

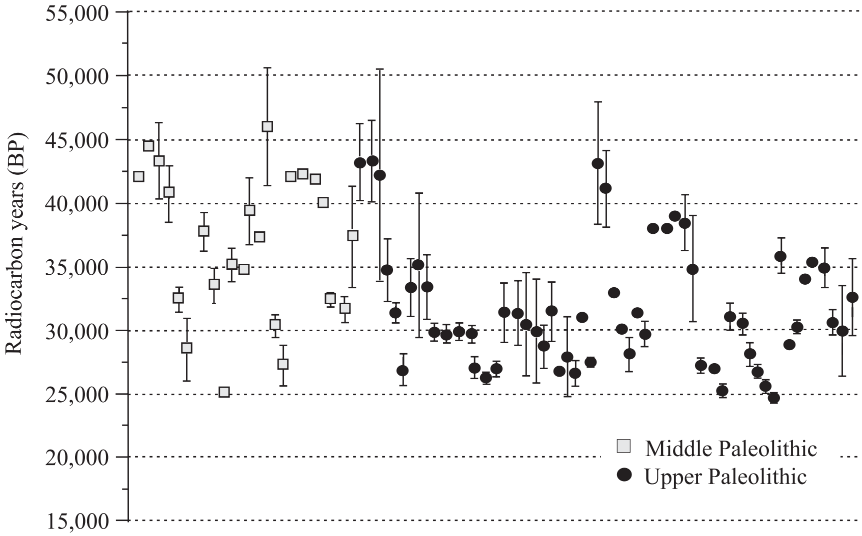

Figure 13.3. Radiocarbon dates associated with Middle and early Upper Paleolithic sites in Siberia.

carbon dated to 33,000–30,000 BP. During this time, landscapes of southwestern Siberia were represented by forest-tundra (Orlova et al. 1998). Using radiocarbon data from Paleolithic sites, we can correlate this event with occupations at Okladnikov Cave, Kara Tenesh, Kara Bom, and Ust Karakol 1 and 2 (Kuzmin and Orlova 1998). This shows that the degree of adaptation to cold environments during this time was quite high.

During most of the Karginian, the climate was milder. Not surprisingly, the largest number of sites corresponding to the Middle-Upper Paleolithic transition occur at this time. The environment was represented by forest-steppe and steppe landscapes in the southwestern Siberian Plain and the Altai Mountain piedmonts, and by dark coniferous forests in the Altai Mountains (Orlova et al. 1998).

CONCLUSIONS

At present, there are approximately eighty-five radiocarbon dates from Mousterian and early Upper Paleolithic complexes in Siberia. The most representative records are available for the Altai Mountains. The Mousterian radiocarbon chronology for Siberia covers quite a long period, from greater than 44,000 BP to around 27,200 BP. This time interval corresponds in general to the Karginian Interglacial, characterized by generally favorable environmental conditions. In Siberia, Mousterian cultural complexes persisted into more recent times than in other regions in Eurasia. For example, in the Near East, the Middle-Upper Paleolithic transition occurred as early as 47,000 BP, and in most of Europe between 45,000 and 38,000 BP (Bar-Yosef 1999). The earliest Upper Paleolithic assemblages in Siberia have associated radiocarbon ages ranging from at least 43,200 BP to around 25,000 BP. These data allow us to infer that the chronological "boundary" between the latest Mousterian and earliest Upper Paleolithic cultural complexes is quite wide. It may be placed broadly within the time interval 43,000–27,000 BP, primarily in the Altai and Sayan Mountain regions. It is also clear that we have definite evidence for the temporal coexistence of Mousterian and early Upper Paleolithic sites within this broad time interval (figure 13.3). This is a very distinctive feature of the Siberian Paleolithic sequence and consequently, more research is needed to understand the temporal-spatial peculiarities of the Middle-Upper Paleolithic transition process. The most promising areas to address these questions include the Altai and Sayan Mountains and the Transbaikal.

ACKNOWLEDGMENTS

This research was partly supported by several foundations, including the Russian Foundation for the Humanities (RGNF, grant 99-01-12010), the Fulbright Program (grant 21230), and the Russian Foundation for Fundamental Investigations (RFFI, grant 99-06-80348). I am grateful to colleagues who have provided important information about the geoarchaeology of the Siberian Paleolithic, especially Ludmila V. Lbova, Lyobov A. Orlova, and Alexander V. Postnov. I am also grateful to Stephen L. Zegura for editorial assistance.

14

Initial Upper Paleolithic Blade Industries from the North-Central Gobi Desert, Mongolia

A. P. Derevianko, P. J. Brantingham, J. W. Olsen, and D. Tseveendorj

There is ample evidence to suggest that distinctive initial Upper Paleolithic assemblages are found in southern Siberia and portions of northwest China (Derevianko et al. 1998f; Brantingham et al. 2001, chapter 15, this volume; Goebel, this volume; Kuzmin, this volume). Two recently excavated cave sites in the Mongolian Gobi, Tsagaan Agui (White Cave) and Chikhen Agui (Ear Cave), extend the known geographical range of the initial Upper Paleolithic into the cold desert regions of northeast Asia. Late Middle Paleolithic assemblages from Tsagaan Agui, which may date to the early (Zyrian) glacial, contain Levallois-like core technologies specialized for dealing with poor quality stone raw material (Brantingham et al. 2000). Initial Upper Paleolithic assemblages from both Tsagaan Agui and Chikhen Agui are focused on blade production from flat-faced, Levallois-like cores. Radiometric age determinations from both cave sites indicate that initial Upper Paleolithic blade technologies first appeared in the Gobi between 27 and 33 ka, during the last half of the Kargan interstadial (Brantingham et al. 2001; Derevianko et al. 2001, 2000b). Despite continuity in the general character of core technologies across the Mongolian Middle-Upper Paleolithic boundary, it is difficult to support a model of continuous occupation of the Gobi and in situ evolution of the Upper Paleolithic.

TSAGAAN AGUI

Tsagaan Agui (White Cave) is located at approximately 44°42′43.3″ N, 101°10′13.4″ E, in Bayan Hongor aimag (province), Mongolia (figure 14.1). The cave is situated in a limestone outlier, Tsagaan Tsakhir, on the southern piedmont of the Gobi Altai massif, southwest of the Zuun Bogd Uul range. Initial, small-scale excavations at Tsagaan Agui were conducted

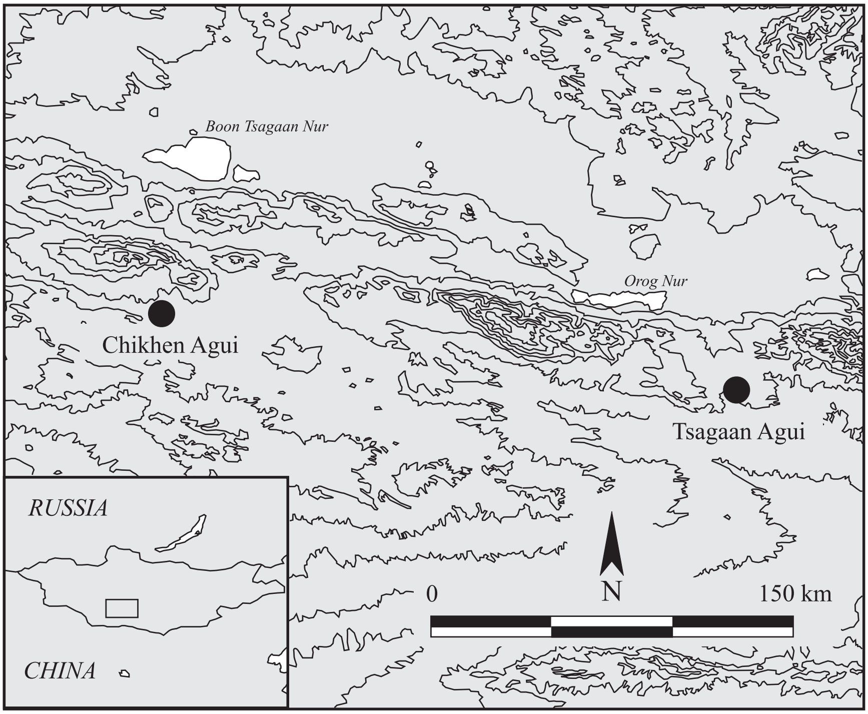

Figure 14.1. Map of the north-central Gobi Desert showing the locations of Tsagaan Agui and Chikhen Agui. Boon Tsagaan Nur (lake) is at about 1300 m elevation. The contour interval is 300 m. The inset shows the location of the detail.

by the Soviet-Mongol Archaeological Expedition between 1987 and 1989 (Derevianko and Petrin 1995b). Excavations resumed in 1995 under the direction of the Joint Mongolian-Russian-American Archaeological Expedition (Derevianko et al. 1996, 1998c, 2000b; Brantingham 1999).

Four main depositional basins have been identified in the cave system, the largest of which (the main chamber) preserves a total of fourteen distinct strata divided into two major depositional regimes (figure 14.2). Strata 6–13 in the main chamber are predominantly fluvial in origin, whereas strata 2a and 2b are primarily aeolian. Strata 4 and 5 appear to be transitional between the two regimes. Stratum 6 is a matrix-supported limestone *éboulis* possibly indicating cold, humid environmental conditions (see Brantingham et al. 2000). Stratum 3 is a thin (2–4 cm) anthropogenic ("occupational") horizon formed on stratum 4. It is dark in color, and greasy and rich in organic material. Strata 0 and 1 are recent historical deposits formed

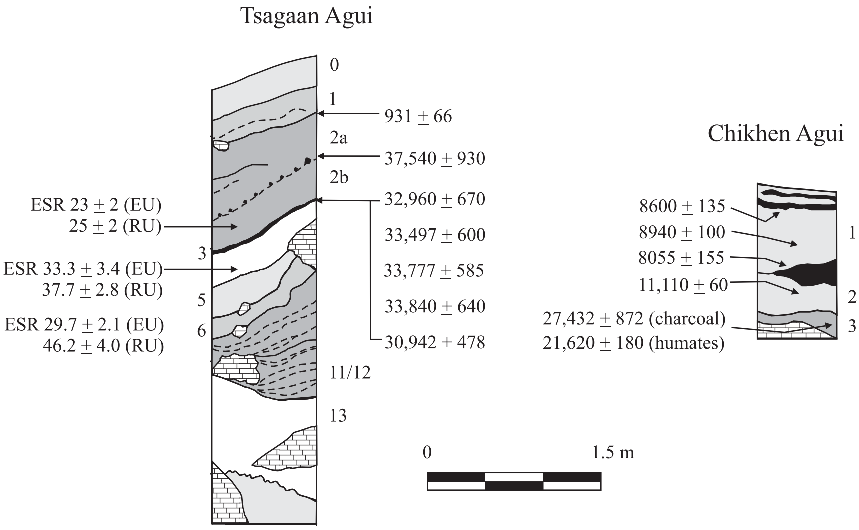

Figure 14.2. Stratigraphic sections and radiometric dates from Tsagaan Agui and Chikhen Agui. Electron spin resonance (ESR) dates are given as thousands of years before present (ka calendric). All remaining dates are radiocarbon years before present (BP). Hearth and hearth-like features in the Chikhen Agui sequence are indicated in black. *Abbreviations:* EU, early uranium uptake model; RU, recent uranium uptake model.

by a variety of anthropogenic and aeolian processes (see Derevianko et al. 2000b).

Ages of the main chamber deposits are constrained by seven AMS radiocarbon dates and three ESR determinations (table 14.1). Four of the five AMS radiocarbon dates from stratum 3 average to 33,541 ± 311 BP and provide a chronological benchmark for the sequence. The one statistically aberrant date of 30,942 ± 478 (AA-26589) may indicate that stratum 3 formed over the course of several thousand years, but may also be the result of bioturbation. The single bone collagen date from a gravel deflational horizon separating strata 2a and 2b produced an inversion. Given the consistency of the dates from stratum 3, it may be that this bone had been redeposited from older units farther back in the cave system. It is also possible that the date inversion is related to extreme irregularities in atmosphereric radiocarbon production during the late Pleistocene (Beck et al. 2001; Kitagawa and van der Plicht 1998a). Nonetheless, three ESR dates, all on equid teeth (Bonnie Blackwell, pers. comm.), are consistent with the available dates from stratum 3. The age of the base of stratum 4 is constrained by two separate dates. Specimen QT40 (one subsample) yielded an Early Uptake (EU)

TABLE 14.1 Radiometric Dates from Tsagaan Agui and Chikhen Agui

Site	*Stratum*	*Method*	*Age (BP)*[1]	*Standard Deviation*	*Material*	*Lab Number*
Tsagaan Agui	1	AMS radiocarbon	931	66	Charcoal	AA-26586
	2a	AMS radiocarbon	37,540	930	Bone collagen	AA-31869
	2b	ESR (Early Uptake)	23,000	2000	Equid tooth	
	2b	ESR (Recent Uptake)	25,000	2000	Equid tooth	
	3	AMS radiocarbon	32,960	670	Charcoal	AA-23159
	3	AMS radiocarbon	33,497	600	Charcoal	AA-26588
	3	AMS radiocarbon	33,777	585	Charcoal	AA-26587
	3	AMS radiocarbon	33,840	640	Charcoal	AA-23158
	3	AMS radiocarbon	30,942	478	Charcoal	AA-26589
	4	ESR (Early Uptake)	29,700	2100	Equid tooth	QT40
	4	ESR (Recent Uptake)	46,200	4000	Equid tooth	QT40
	4	ESR (Early Uptake)	33,300	3400	Equid tooth	QT41
	4	ESR (Recent Uptake)	37,700	2800	Equid tooth	QT41
	5	RTL	227,000	57,000	Sediment	RTL-804
	6	RTL	450,000	123,000	Sediment	RTL-803
	12	RTL	520,000	130,000	Sediment	RTL-805
Chikhen Agui	3	AMS radiocarbon	27,432	872	Charcoal	AA-26580
	3	AMS radiocarbon	21,620	180	Humates	AA-32207
Chikhen Agui, locality 2	3	AMS radiocarbon	30,550	410	Bone collagen	AA-31870

[1]ESR and RTL (radiothermoluminescence) dates are reported in calendar years. Two ESR dates, using different uranium uptake models, are reported for each sample. The different uptake models represent minimum (Early Uptake) and maximum (Recent Uptake) estimated ages.

age of 29.7 ± 2.1 ka and Recent Uptake (RU) age of 46.2 ± 4.0 ka (calendric). Specimen QT41 (six subsamples) yielded ages of 33.3 ± 3.4 (EU) and 37.7 ± 0.8 ka (RU) (calendric). Stratum 2b is dated between 23 ± 2 (EU) and 25 ± 2 ka (RU) (calendric) by ESR. Radiothermoluminescence dates on sediments from stratum 5 (227 ± 57 ka), stratum 6 (450 ± 123 ka), and stratum 12 (520 ± 130 ka) (Derevianko et al. 2000b) are much too old as a result of long transport times of sediments through the cave system.

Pollen assemblages recovered from strata 6–13 are generally indicative of cool, humid climatic conditions (Derevianko et al. 1998c). Arboreal taxa dominate and include fir *(Abies),* pine *(Pinus),* birch *(Betula),* alder *(Alnus),* hornbeam *(Carpinus),* and lime *(Tilia).* Nonarboreal grass and shrub species dominate the pollen assemblages from strata 2–5, indicating much drier climatic conditions and widespread steppe environments. Common taxa in strata 2–5 include grasses (Poaceae [Graminae]), asters (Compositae), and goosefoots (Chenopodiaceae) and ephedra (*Ephedra* sp.). Given the available radiocarbon and ESR dates, stratum 2a appears to correspond to the last (Sartan) glaciation (Oxygen Isotope Stage 2), whereas strata 2b–5 correspond to the Kargan interstadial (Oxygen Isotope Stage 3). Strata 6–13 may correspond to the early (Zyrian) glacial (Oxygen Isotope Stage 4) and perhaps the last part of the last (Kazanstev) interglacial (Oxygen Isotope Stage 5). The lack of reliable radiometric age determinations from the lower stratigraphic units remains a concern in assigning these ages. Faunal remains were not recovered from the lower stratigraphic units (stratum 6 and below). The large mammal species recovered from strata 2–5, including two extinct Pleistocene forms *(Crocuta spelaea* and *Coelodonta antiquitatis)* and several ungulates *(Equus hemionus, E. przewalskii, Procapra gutturosa, Pantholops hodgsoni, Capra sibirca,* and *Ovis ammon),* are consistent with the radiometric age determinations.

An excavated sample of 549 lithic specimens was analyzed from the main chamber at Tsagaan Agui as part of a larger study of the early Upper Paleolithic in northeast Asia (Brantingham 1999; Brantingham et al. 2001). Of this sample, nearly 33% ($n = 181$) consists of undiagnostic flake and core shatter. The diagnostic specimens ($n = 368$) are unevenly distributed between the lower fluvial (strata 6–13; $n = 152$), transitional (strata 4–5; $n = 83$), and upper aeolian (strata 2–3; $n = 88$) units. Only those specimens from stratum 3 ($n = 24$) clearly derive from an occupational horizon dated to approximately 33 ka. The remainder ($n = 299$; 81%) is from dispersed contexts within the vertical sediment column and cannot be related to any discrete occupational events. Rather, these specimens are time-averaged samples from occupations spanning the bulk of the late Pleistocene, which may have been both highly intermittent and ephemeral.

These caveats aside, the Tsagaan Agui sequence can be divided into three primary phases on the basis of recovered diagnostics. The earliest phase, represented by strata 5–13, may be classified as late Middle Paleolithic and is characterized by broad-faced prepared cores, a unique Levallois-like core technology based on large flake blanks (Brantingham et al. 2000). The ESR dates from the base of stratum 4 (33–46 ka, calendric) provide a tentative minimum age for this phase. Stratum 3 marks the appearance of initial Upper Paleolithic technologies, characterized by the production of both parallel and pointed blades from Levallois-like flat-faced cores. The radiocarbon evidence places this event at approximately 33 ka. Finally, the initiation of a third phase may be indicated by the recovery of two microblade segments and a single biface thinning flake from stratum 2a, overlying the gravel deflational horizon that may correspond to the Last Glacial Maximum. Although stratum 2a is currently undated, it is clearly younger than 23–25 ka (calendric) (ESR stratum 2b) and possibly younger than 18 ka. Our analyses are concerned with characteristics of the initial Upper Paleolithic blade technology appearing in stratum 3 and its relationship to the broad-faced Levallois-like core technologies from the underlying stratigraphic units.

The stone raw material environment at Tsagaan Agui is centered on an outcrop of heavily weathered chert located above the cave. This material is of relatively poor quality, containing numerous voids and inclusions (Brantingham et al. 2000). It is the dominant raw material used in core reduction and tool manufacturing throughout the sequence. More than 92% of all artifacts in strata 4–13 is made on this local raw material. The remainder is made on two types of agate (distinguished on the basis of color) that occur as very small, irregular nodules and derive from isolated outcrops on the limestone ridge opposite the cave. A dramatic change in raw material procurement patterns occurs in stratum 3 and accelerates through stratum 2. A few artifacts of high quality cryptocrystalline raw materials were recovered in stratum 3; in stratum 2, such materials make up nearly 20% of the entire assemblage. The sources of these raw materials are unknown. However, all of the "exotic" raw materials are represented by blanks and retouched tools only, suggesting that the sources are some distance from the site.

Core technology throughout the sequence at Tsagaan Agui is dominated by generalized core forms, including polyhedrons (globular cores), choppers, discoids, and tested pebbles (table 14.2). This predominance is explained in part by the poor quality of the raw material and resulting difficulty in executing formal designs. However, a unique prepared core technology for flake and point production is represented in certain frequencies in the lower strata, despite the evident raw material constraints (Brantingham et al. 2000). In many respects, these broad-faced prepared cores are reminiscent of Levallois technology. Such cores generally limit reduction to a single face of the raw material blank, are predominantly unidirectional, and commonly exhibit platform faceting. They are unique in being based fre-

TABLE 14.2 Counts of Core Types from Tsagaan Agui and Chikhen Agui

	Tsagaan Agui Stratigraphic Unit						*Chikhen Agui Stratigraphic Unit*
Core Type	1	2	3	4–5	6–8	9–13	3
Tested pebble	3	2		4	5	1	1
Chopper						2	
Polyhedron	6	4		5	3	3	
Discoid		1		2	1		
Levallois-like flake core			1		1	1	1
Levallois-like point core							1
Levallois-like blade core			1				7
Pyramidal blade core							1
Change-of-orientation				1		1	3
Pebble microblade core[1]							1
Narrow-faced core					2	1	2
Broad-faced core						5	2
Other					2		2
Total	9	7	2	12	14	14	21

[1]Intrusive from overlying stratigraphic units.

quently on large flake blanks, the ventral surfaces of which provide a ready-made Levallois-like core geometry that does not require much additional preparatory shaping. This specialized core design, which reduces the probability of generating serious reduction errors by minimizing the amount of preparation, appears to have been developed in response to the poor quality of stone raw material available at the site (Brantingham et al. 2000).

Formal, Levallois-like blade technologies appear in stratum 3, represented by a single core, debitage, and blade-based tools. The core has a moderate distal convexity with some distal trimming (figure 14.3: 1). The core platform displays some minor faceting, forming an acute angle of approximately 45° with the primary reduction face. One edge is prepared with a lateral crest, which appears to be a generalized design feature for transferring reduction from the primary face to the narrow face during later stages of core utilization. Cores with lateral crests and associated debitage (i.e., *lames à crêtes, lames débordants*) are common at surface localities in the Arts Bogd range in Mongolia and at Shuidonggou in northwest China (Krivoshapkin 1998; Brantingham et al., chapter 15, this volume), and resemble core technologies seen in certain Bohunician sites (Svoboda and Svoboda 1985: 511; Svoboda, this volume).

A small collection of blanks ($n = 5$) in strata 3 and 2 at Tsagaan Agui clearly derive from prepared blade cores (table 14.3). Prismatic or sub-

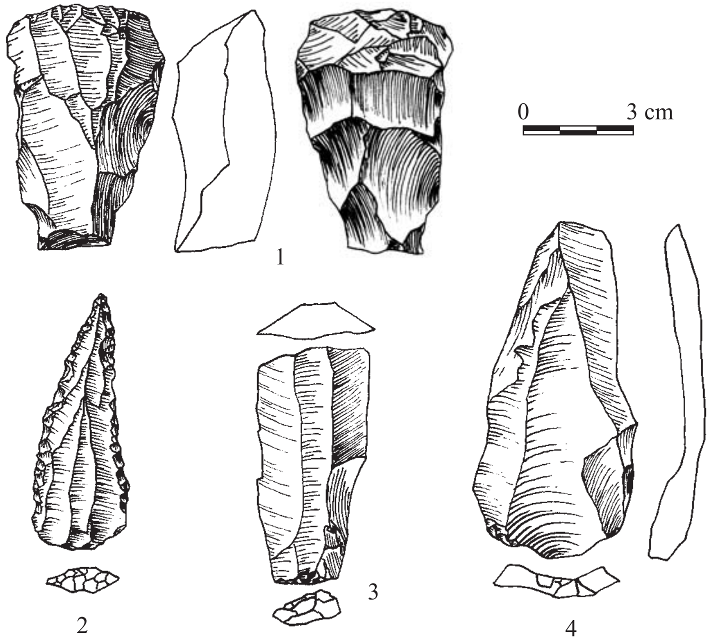

Figure 14.3. Tsagaan Agui stratum 3 lithics: flat-faced blade core (1); elongate Levallois points (2, 4); subprismatic blade (3).

prismatic blades display parallel edges, parallel to subparallel dorsal scars, and strongly triangular or trapezoidal cross sections (figure 14.3: 3). In contrast, Levallois blades display subparallel to irregular edges, subparallel to convergent dorsal scars, and generally flat cross sections. Note that that these criteria are insufficient to completely distinguish between true prismatic blade technologies, where blades are removed in continuous series from all or part of the core's perimeter (Boëda 1995a; Bar-Yosef and Kuhn 1999: 323), and Levallois blade production strategies, which limit reduction to a single plane of removal. This distinction can be made unequivocally only on the basis of the recovered cores. The only blade core recovered from the main chamber falls well within the Levallois definition. Both the Levallois and subprismatic blades recognized at Tsagaan Agui most likely derive from similar Levallois-like flat-faced blade cores. The same conclusion reasonably applies to large Levallois-like points recovered from stratum 2 (figure 14.3: 2, 4).

Significantly, all of the technical elements recovered from both the lower and upper strata at Tsagaan Agui are strongly suggestive of a Levallois-like prepared core technology. The consistent occurrence of edge elements is

TABLE 14.3 Counts of Flake Types from Tsagaan Agui and Chikhen Agui

	Tsagaan Agui Stratigraphic Unit						*Chikhen Agui Stratigraphic Unit*
Flake Type	1	2	3	4–5	6–8	9–13	3
Generalized flake	21	33	9	47	24	44	40
Levallois flake	1	1				2	
Levallois point		1					4
Levallois blade			2				28
Pointed blade							3
Bladelet							9
Pointed bladelet							1
Subprismatic blade			1	1			
Microblade		2					
Biface thinning flake	1						
Core tablet	1		1		1		1
Edge element	2	1		2	1	1	
Crested blade							5
Other technical element		3	2			7	
Bipolar flake				1	1		
Kombewa flake	2			3			
Total	27	39	16	56	27	47	98

particularly important. Edge elements are rejuvenation spalls that remove part or all of the edge of a core and serve to control the lateral convexity of the primary core surface. The technical elements designated as core tablets are irregular, or partial tablets. Although commonly associated with prismatic blade and bladelet technologies, here they are consistent with the removal of platforms from Levallois-like cores. In one case, the tablet was apparently aimed at removing a large raw material impurity that could potentially interfere with primary reduction. In the other case, it is uncertain whether tab removal was intentional or accidental. The remaining artifacts designated as "other technical elements" in table 14.3 are primarily *outrepassé* flakes removing the distal ends of prepared cores. Although these are also consistent with a Levallois-like core technology, it is unclear whether they are intentional technical elements (for core rejuvenation) or reduction errors.

The retouched tool inventory from the main chamber at Tsagaan Agui contains a number of diagnostic tool forms, although the most common types—combination tools possessing more than one functional edge, generalized retouched flakes, denticulates, and side scrapers—are arguably less diagnostic (table 14.4). The retouched elongate Levallois point recovered

TABLE 14.4 Counts of Retouched Tool Types from Tsagaan Agui and Chikhen Agui

	Tsagaan Agui Stratigraphic Unit						*Chikhen Agui Stratigraphic Unit*
Tool Type	1	2	3	4–5	6–8	9–13	3
Single side scraper		2		2	1	4	
Double side scraper		1					2
Convergent scraper	1						
Transverse scraper		1					
Single end scraper		2		1	2	3	1
End scraper on retouched blade		1					1
Thumbnail end scraper	1	1		1			1
Carinated end scraper			1		1	1	
Nosed end scraper	1						
Core scraper (rabot)					1		
Simple burin	1	1	1	1	2		2
Dihedral burin	1			2	2	2	
Burin on truncation					1		
Irregularly backed knife						1	
Backed fragment					1		
Clactonian notch		1			1		
Single retouched notch				2		1	1
Multiple notches					1		
Denticulate		1		1	4	3	
Combination tool	1	3		5	5	6	1
Retouched flake		4	2		2	3	1
Flake retouched into point					1		
Blade one edge retouched							5
Blade two edges retouched							3
Blade retouched into point	2		1				
Bladelet with abrupt retouch							1
Other	1				1		1
Total	9	18	5	15	26	24	20

from stratum 3 is typologically distinctive of initial Upper Paleolithic industries (figure 14.3: 1, 2) (Kuhn et al. 1999). There are a number of specialized end scraper types in the upper strata. However, the sample sizes are too small to provide any definitive typological classification of the assemblage as a whole.

CHIKHEN AGUI

Excavated concurrently with Tsagaan Agui, Chikhen Agui is a small rock shelter located in an isolated limestone outcrop 200 km to the west (44°46′22.3″ N, 99°04′08.7″ E; see figure 14.1) (Derevianko et al. 2001). Deposits at Chikhen Agui reach a maximum thickness of about 75 cm, and the site lacks the earlier archaeological sequence present in strata 5–13 at Tsagaan Agui. The sequence is divided into three archaeological zones on the basis of stratigraphy, recovered artifacts, and available radiocarbon dates (see figure 14.2). The upper two archaeological zones are microlithic and have fifteen associated radiocarbon dates ranging between about 11,200 and 5600 BP. These archaeological horizons are not discussed here (see Derevianko et al. 1998c, 2000a). The lower archaeological zone (stratum 3) contained several hearth or hearth-like features and a large blade industry resembling that recovered from stratum 3 at Tsagaan Agui. Unlike Tsagaan Agui, these features may mark a relatively intensive occupational episode at the rock shelter. The stratum 3 deposits at Chikhen Agui are maximally 30 cm thick and lie along the contact with limestone bedrock outside the drip line of the rock shelter. A single AMS radiocarbon date on hearth charcoal places this stratigraphic unit at 27,432 ± 872 BP (AA-26580), with the humate fraction dating to 21,620 ± 180 BP (AA-32207) (see table 14.1). A bone collagen date from an associated open-air component (locus 2) yielded an age of 30,550 ± 410 (AA-31870), providing broad confirmation for the age of this industry (Brantingham et al. 2001). Faunal remains are fragmentary and mostly confined to the terminal Pleistocene and Holocene strata (Derevianko et al. 2001). Pollen from stratum 3 is dominated by grass and shrub taxa, including goosefoots (Chenopodiaceae), asters (Asteraceae), and carrots (Apiaceae), as well as sage *(Artemesia)* and ephedra. This evidence is consistent with steppe, or desert-steppe environments in the vicinity of the site.

We examined all of the 169 artifacts from the 1996–97 excavations of stratum 3. The raw material environment at Chikhen Agui differs dramatically from that at Tsagaan Agui. There are no immediate sources of fine-grained lithic raw material surrounding Chikhen Agui, save for rare pebbles (<5 cm) of jasper-like and chert materials that occur on nearby *gobi* pavements and in local washes. The abundance of workable stone materials occurring in the immediate vicinity at Tsagaan Agui is not matched. Not surprisingly, therefore, the majority of stone raw materials are imported from nonlocal sources that have yet to be identified. There are three broad types of stone represented. Approximately 94% of the entire assemblage consists of high quality, opaque cherts. Quartzites, one potential local material, make up only 3.6% of the assemblage. Translucent chalcedonies occur in even lower frequencies, comprising only 2.4% of the assemblage. There are four raw materials groups within the opaque cherts, distinguished on the basis of color. In order of decreasing frequency, these groups are dark gray, olive gray, grayish brown, and dark reddish gray varieties. Whether these color varieties represent discrete sources remains to be established, as does the reason for their differing frequencies in the assemblage.

Cores represent nearly 12% ($n = 20$) of the total lithic assemblage (see table 14.2). Of these, fourteen are prepared cores dedicated to the production of elongate blanks. The remainder consists of a single tested pebble, one formal and one casual microblade core (both likely introduced from the overlying deposits through bioturbation), a flake preform for a broad-faced flake core, and two opportunistic narrow-faced cores. The prepared cores are flat-faced, restricting reduction to a single plane, and exhibit complex patterns of platform preparation and faceting. The majority of the prepared cores are Levallois-like bidirectional blade cores with opposed striking platforms situated at the ends of slightly elongate cobble blanks (figure 14.4: 1, 2). Only two specimens are classified as Levallois flake and point cores, based on the character of the final removal before core discard. Two cores are classified as simple broad-faced blade cores. Both are bidirectional, and one shows an attempt to develop a lateral crest along one side. Broad-faced cores are not intensively reduced and are likely part of a reduction continuum that includes bidirectional flat-faced blade cores.

Generalized flakes ($n = 41$) form the single largest category of debitage at Chikhen Agui (see table 14.3). All of the blade and bladelet products combined ($n = 42$), however, match the frequency of generalized flakes in the assemblage. Levallois-like, flat-faced specimens make up the majority of the blade products followed by bladelets, pointed blades, and pointed bladelets (figure 14.4: 3, 6). There is no evidence at present to suggest that the blade and bladelet blanks from Chikhen Agui were produced by different reduction strategies. They are morphologically similar in all respects, save for metric dimensions, and the core population is metrically consistent with the production of both blades and bladelets. A similar conclusion may also apply to the series of elements resembling Levantine Levallois points (figure 14.4: 7–9). Flat-faced blade cores at Chikhen Agui display a tendency to evolve gradually toward convergent reduction. Over its entire use life, a flat-faced core may thus generate products that are parallel, subparallel, and convergent in plan form, as well as metric blades and bladelets.

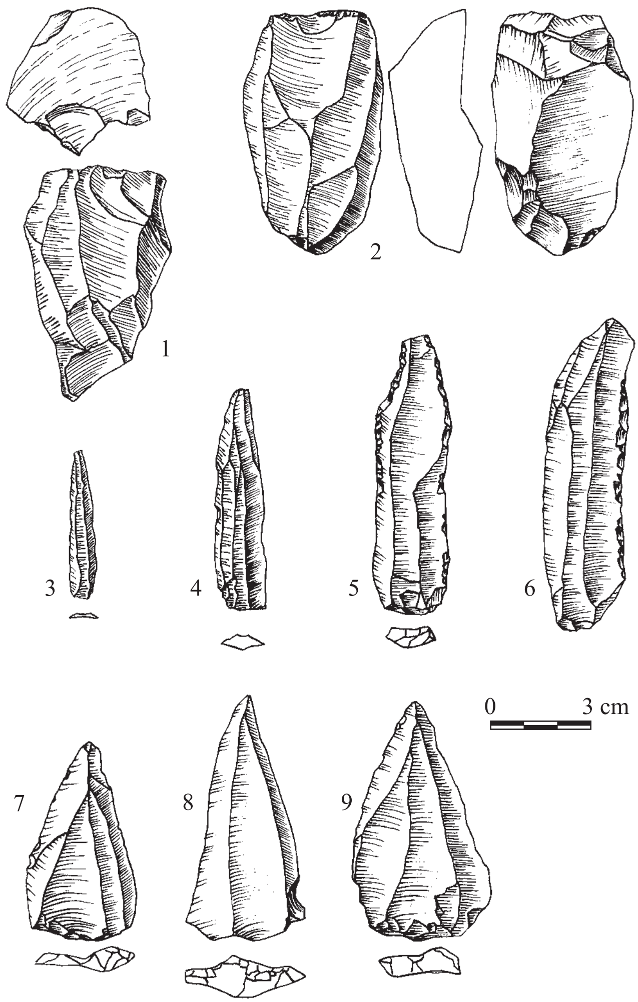

Figure 14.4. Chikhen Agui stratum 3 lithics: flat-faced blade cores (1, 2); blades and bladelets (3–6); classic Levallois points (7–9).

The technical elements from Chikhen Agui reinforce this impression. The relatively high frequencies of crested and overpassed blades (the latter classified under "other technical elements" in table 14.3) are consistent with a blade-focused assemblage. Another series of technical elements are morphologically indistinguishable from classic Upper Paleolithic crested blades *(lames à crêtes)* (Inizan et al. 1992). As at Tsagaan Agui and other sites in the region, these elements were employed in shifting reduction from the primary face to the edge of the core. It is not certain whether the single core tablet is actually a platform rejuvenation spall or a reduction error. The tablet is within the size range of a large microblade, or bladelet core.

The tool assemblage from Chikhen Agui comprises nearly 12% ($n = 20$) of the total recovered artifacts (table 14.4). Although a wide array of tool types is represented, including a number of burin and end scrapers types, no single tool form occurs in excessive frequencies. Tools classified as blades with one or two edges retouched are the only exception. However, the elevated frequency of this tool type likely reflects the predominance of blade blanks in the assemblage.

DISCUSSION

It is clear that Tsagaan Agui and Chikhen Agui give evidence of some of the technological trends accepted for the initial Upper Paleolithic in western Eurasia (Bar-Yosef and Kuhn 1999; Kuhn et al. 1999; Bar-Yosef 2000). Core technologies at these sites are specialized for blade production. Core morphologies generally fall within the Levallois definition, and blade blanks tend to display faceted platforms (see Brantingham et al. 2001). Platform tablets are uncommon, further emphasizing the importance of platform faceting in core preparation and maintenance. Crested blades are common, but were used within the Levallois method as lateral rather than initial preparations. Levallois-like points, pointed blades, and retouched blade tools are also represented in the collections. The remainder of the retouched tool inventory is rather generic in character.

Perhaps unique is the marked diversification of stone raw material exploitation patterns at the beginning of the Upper Paleolithic in Mongolia (see also Postnov et al. 2000). The transport and specialized use of high quality cryptocrystalline stone raw materials is conspicuous following the appearance of initial Upper Paleolithic technologies at roughly 27–33 ka. At Tsagaan Agui, this pattern is particularly striking, given the complete absence of any nonlocal stone raw materials through the entire Middle Paleolithic sequence. Such evidence would seem to imply dramatic changes in land use patterns, conceivably involving increased mobility and/or more structured seasonal foraging rounds. We can speculate that land use changes of this nature may have allowed initial Upper Paleolithic foraging groups to colonize extreme environments that were previously uninhabitable because of a lack of toolstone in close proximity to food and water resources. This appears to describe the situation at Chikhen Agui, where there is as yet no evidence for Middle Paleolithic occupation prior to the appearance of the initial Upper Paleolithic at around 30 ka. At Tsagaan Agui, the first occupations may reach back as far as 70–90 ka, during the early (Zyrian) glacial. The abundance of raw material at the site, despite its poor quality, appears to have been main attractor for these early occupations.

The Levallois-like blade cores from both Tsagaan Agui and Chikhen Agui are strikingly similar to the "flat cores" and "cores with lateral crests" identified by Svoboda and Svoboda (1985: 511) as characteristic of the Bohunican in central Europe. Such core technologies are often described as transitional, in that they show a mixture of Middle and Upper Paleolithic characteristics. We conclude that the initial Upper Paleolithic blade technologies in Mongolia are similarly transitional in character. Indeed, it is easy to see the strong degree of technological continuity with Middle Paleolithic Levallois core technologies at Tsagaan Agui, Chikhen Agui, and other locations in the Gobi (e.g., Okladnikov 1965, 1978, 1981; Kozłowski 1971; Derevianko et al. 1990a; Derevianko and Petrin 1995a; Jaubert et al. 1997; Krivoshapkin 1998). What is problematic is the interpretation of "transitional" technologies, or technological "continuity" in terms of population histories and human behavioral evolution. The greatest interpretive hazards are in assuming that the identified trends in lithic technologies are directly related to hominin cladistics.

It is clear to us that the development of Levallois-like blade technologies has more to do with foraging strategies in local ecological contexts than with any form of modern behavioral revolution or biological shift in cognitive capacities (Brantingham and Kuhn 2001). There is abundant evidence that blade technologies emerged repeatedly during both the late middle and late Pleistocene (Révillion and Tuffreau 1994; Révillion 1995; Bar-Yosef and Kuhn 1999), indicating that the ecological conditions driving the emergence of these technological behaviors were localized and cyclical in nature. A similar pattern of repeated, independent origins may apply to other archaeological traits, such as ornamental objects, frequently assumed to signal the emergence of modern human behavior (McBrearty and Brooks 2000; Kuhn et al. 2001). Rather than assuming that each of these events represents cladogenesis of anatomically modern humans, we must conclude that hominin populations, widely distributed during the late middle and late Pleistocene, slipped in and out of "behavioral modernity" with great ease. We do not deny that there is a relationship between the appearance of novel technologies and human population dynamics, but we insist that the relationship is complex and not yet well understood. We see no possibility simply equating the on-again–off-again character of various technologies with the origin of one hominin group or the demise of another.

How then do we characterize the apparent technological continuity between the Mongolian Middle and Upper Paleolithic? Is this simply another localized transition involving an archaic Middle Paleolithic population slipping over the precipice into behavioral modernity (d'Errico et al. 1998)? Unfortunately, it is difficult to prove direct continuity across the

Middle-Upper Paleolithic boundary. Regarding strict technological continuity, we argue that Levallois core designs are not sufficiently derived in character to demonstrate a direct "phylogenetic" relationship, even where they occur in stratigraphic order at a single site, as at Tsagaan Agui. There is always a possibility of convergence on similar generic technological designs, and in the case of Levallois core technologies, this possibility is particularly strong (Brantingham and Kuhn 2001).

It is even more difficult to establish occupational or population continuity, even at a regional level. In Mongolia, it is clear that Middle Paleolithic populations using various forms of Levallois-like core technologies were present as early as 70–90 ka (Okladnikov 1965, 1978, 1981; Derevianko et al. 1992b, 1998f, 2000b; Jaubert et al. 1997; Brantingham et al. 2000). However, many of these sites are poorly dated and are placed in sequence only within very broad chronological boundaries. Even at sites such as Tsagaan Agui, where initial Upper Paleolithic materials occur stratigraphically above Middle Paleolithic assemblages, it is difficult (if not impossible) to demonstrate occupational continuity. Indeed, it is abundantly clear that occupations throughout the Tsagaan Agui sequence were often ephemeral and always intermittent, with unspecified blocks of time seeing no human occupation whatsoever. It may be impossible to know whether this sequence represents a single population lineage (with a derived technological adaptation) or multiple unrelated lineages (with similar generic adaptations) repeatedly occupying the cave as their populations expanded and contracted under changing ecological conditions. It is misleading to think of the Tsagaan Agui sequence—or any sequence of individual sites—as reflecting direct population continuity.

CONCLUSIONS

We include the assemblages from Tsagaan Agui stratum 3 and Chikhen Agui stratum 3 within the initial Upper Paleolithic, emphasizing the coherence between these assemblages and technological parallels with accepted initial Upper Paleolithic assemblages from western Eurasia. The primary technological features of the Mongolian initial Upper Paleolithic include (1) expanded patterns of raw material exploitation and transport; (2) emphasis on blade production from Levallois-like prepared cores; (3) high frequencies of retouched blades; (4) occasional classic and elongate Levallois points; and (5) a persistence of Middle Paleolithic retouched tool types, especially side scrapers, notches, and denticulates. Note that the assemblages discussed here also fit the general chronological profile for the origin and elaboration of the initial Upper Paleolithic, all appearing after 45 ka. However, the ages for the initial Upper Paleolithic in Mongolia (27–33 ka) are younger than most documented assemblages in western Eurasia.

15

The Initial Upper Paleolithic at Shuidonggou, Northwestern China

P. J. Brantingham, X. Gao, D. B. Madsen, R. L. Bettinger, and R. G. Elston

Shuidonggou has long been recognized as unique within the north Chinese Paleolithic sequence (Licent and Teilhard de Chardin 1925; Boule et al. 1928; Jia et al. 1964; Bordes 1968; Kozłowski 1971; Li 1993; Yamanaka 1995; Lin 1996). It is one of only a few archaeological sites in northern China known to contain a formal blade technology. The initial excavators, Licent and Teilhard de Chardin (1925: 210), classified the lithic industry from Shuidonggou as evolved Mousterian, or emergent Aurignacian (see also Boule et al. 1928: 120–21). They observed that core forms from Shuidonggou closely resembled those found at western Mousterian sites and retouched tools were reminiscent of western Upper Paleolithic types. Bordes (1968: 130) reaffirmed this seemingly paradoxical classification some years later, adding: "The impression given [by the Shuidonggou industry] is in fact that of a very evolved Mousterian in the process of transition to an Upper Paleolithic stage, but of a type which, taken all round, has not much connection with western forms." Chinese researchers, beginning with Pei (1937: 226), have noted typological connections between Shuidonggou and western Middle Paleolithic industries. However, later studies have favored an Upper Paleolithic designation, based on the substantial differences seen between Shuidonggou and the Chinese Middle Paleolithic type site of Dingcun (Jia et al. 1964: 80). More recently, Shuidonggou has been placed squarely within the Upper Paleolithic solely on technological grounds (Li 1993; Lin 1996). These researchers emphasize the abundance of blades and retouched blade tools in the assemblage. Lin (1996: 12) considers Shuidonggou to be the only known site in China possessing a Mode IV Upper Paleolithic blade technology, adding that Mode III Middle Paleolithic prepared core technologies are entirely absent. Although these researchers have consistently described a suite of traits present at Shuidonggou, there has been little consensus on where this site fits in the archaeological sequences of China, east Asia, and greater Eurasia as a whole.

We are now in a much better position to answer some of these difficult questions. Recent field studies of the Shuidonggou area and a reanalysis of the 1980 excavated materials from locality 1 provide new insights into the technological character of the Shuidonggou stone industry and its geochronological position in the regional Upper Paleolithic. It is now clear that the Shuidonggou industry is essentially a Middle Paleolithic core technology dedicated to the production of large blades. In northeastern Asia, such core technologies are frequently termed "Levallois-like," or "flat-faced." The Shuidonggou industry may be technologically allied with similar assemblages from Mongolia, southern Siberia, and locations much farther to the west (see Brantingham et al. 2001; Derevianko et al., this volume; Goebel, this volume; Kuzmin, this volume). Collectively, these specialized blade technologies based on Middle Paleolithic core forms are now being referred to as the "initial Upper Paleolithic" (Bar-Yosef and Kuhn 1999; Kuhn et al. 1999).

New AMS radiocarbon dates from Shuidonggou 2 resolve some long-standing questions surrounding the age of the Shuidonggou industry. In particular, it is clear that the Shuidonggou industry appears fully developed around 25–27 ka (Madsen et al. 2001) and is significantly younger than similar assemblages from Mongolia (27–33 ka) and southern Siberia (39–45 ka) (Brantingham et al. 2001). Shuidonggou 2, although less well known, may actually preserve a longer sedimentary and archaeological sequence than is present at locality 1. Within this sequence, we also find evidence for the use of a bipolar bladelet technology not evident at locality 1 (Madsen et al. 2001). These materials show some important similarities with later northeastern Asian microblade industries and may indeed shed light on the origins of such technologies.

In contrast with other early Upper Paleolithic industries in greater Eurasia, Shuidonggou lacks other features considered diagnostic of the appearance of modern behavior. Expedient bone tools are present at locality 2, but there is no evidence for the use of either bone projectiles or complex bone-based composite tools. Similarly, there is no evidence for the use of personal ornaments, such as bone, tooth, or stone pendants. Such ornaments are rare at best in the north Chinese archaeological sequence until perhaps the terminal Pleistocene.

SHUIDONGGOU STRATIGRAPHY AND GEOCHRONOLOGY

Shuidonggou is located on the margins of the Ordos Desert in Ningxia Hui Autonomous Region, China (38°17′55.0″ N, 106°30′6.2″ E) (figure 15.1). Despite repeated field investigations at locality 1, several serious

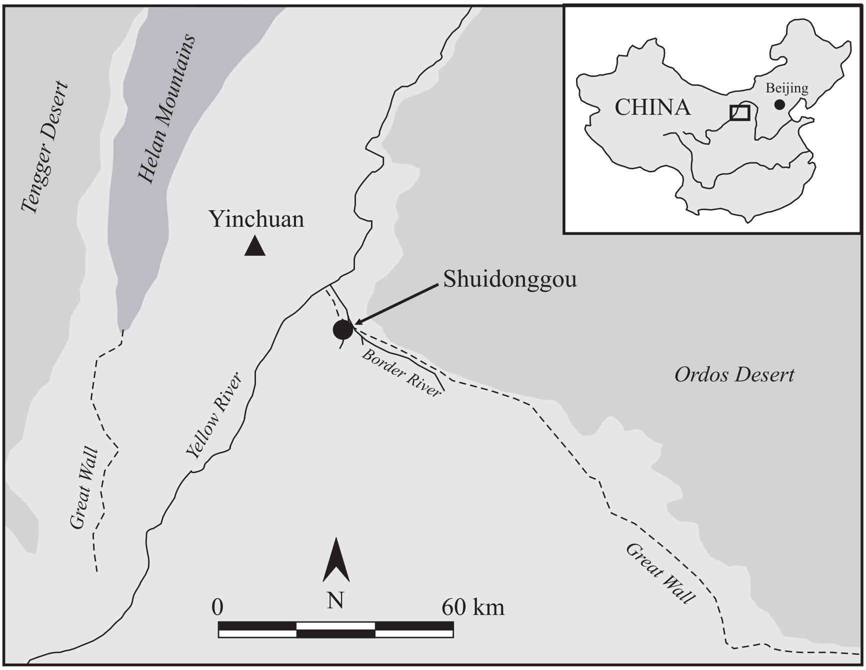

Figure 15.1. Location of Shuidonggou on the margins of the Ordos Desert. The inset shows the location of the detail.

questions still surround the stratigraphy and dating of the Shuidonggou industry (Zhou and Hu 1988; Sun et al. 1991). Shuidonggou is located on a tributary drainage system dominated by the Border River, approximately 10 km east of the modern channel of the Yellow River. The site occupies an ecotonal boundary dividing the semiarid desert steppe, associated with the Yellow River and foothills of the Helan Mountains, from the significantly more arid Ordos Desert. Quaternary sediments reflect this boundary situation. The region is dominated by a thick (10–40 m) sandy-loess platform that is increasingly intercalated with alluvial sediments as one approaches the floodplain of the Yellow River. Sandy-loess deposits in the immediate vicinity of Shuidonggou appear to correspond to the late Pleistocene–early Malan Loess (L1), but middle Pleistocene sandy-loess deposits (L2–L7) also may be present in similar contexts regionally (see Kukla and An 1989; Geng and Dan 1992). The Quaternary sequence is set in a thick Tertiary red clay that is found extensively throughout the region. At Shuidonggou, the Border River has dissected the sandy-loess platform and underlying Tertiary red clay producing steep exposure faces 10–20 m deep.

Four archaeological localities have been formally designated at Shuidonggou. Localities 3 and 4 are terminal Pleistocene and Holocene in age; we do not discuss them further here (see Zhou and Hu 1988; Zhang 1999). In this chapter, we concentrate on localities 1 and 2, which face one another across the small channel of the Border River (figure 15.2). Late Pleistocene sediments at locality 1 occur within a fluvial cut-and-fill sequence. The base of the late Pleistocene section is represented by finely bedded medium sands (stratum 8c) lying unconformably on the Tertiary red clay unit (figure 15.3). The overlying unit (stratum 8b) is a massive, fine silt with abundant carbonate. The middle portion of stratum 8b contains a well-defined zone of hard carbonate nodules (5–10 cm each), possibly of pedogenic origin. These nodules may correlate with a broadly recognized, carbonate-rich soil dividing the early (>25 ka) and late (13–18 ka) Malan Loess (Sun and Zhao 1991: 6). Stratum 8a represents a sequence of channel gravels and cross-bedded medium sands of fluvial or possibly mixed fluvial and aeolian origin. Strata 8c and 8a contain no significant detrital or pedogenic carbonate. Strata 5–7 represent a continuation of fluvial sedimentation, composed mainly of interbedded gravels and medium sands. The Shuidonggou stone industry derives from strata 6, 7, and 8b. Archaeological material from the former two units may be redeposited. An unconformity marks the transition to Holocene sediments (strata 1–4), represented by low-energy water-deposited silts and sands containing abundant organic matter and aquatic snail shells. These sediments are distinctive in showing alternating, laterally discontinuous bands of dark organics and gleyed clays.

The deposits at locality 2 are generally similar, although there are some differences in the early and later partitions of the sedimentary sequence. The Border River and the smaller stream tributary have isolated a stack of alluvial and aeolian sediments 10–15 m high in a long peninsula bounded by sheer to steeply sloping bluffs. There are two primary sedimentological units visible in exposed sections at locality 2: a basal unit consisting of finely bedded medium sands, and an overlying unit of loess-like fined sands and silts that shows localized horizontal and cross bedding (figure 15.3). These units are tentatively correlated with strata 8c and 8b at locality 1, respectively. Significantly, stratum 8b at locality 2 is at least twice as thick as its counterpart at locality 1. Locality 2 is apparently missing the coarse-grained fluvial sequence corresponding to strata 5–8a at locality 1, as well as the Holocene sequence corresponding to strata 1–4. Sun et al. (1991) also suggest that the Tertiary red clay and associated gravel, present at locality 1, is absent at locality 2. However, this clay is found in contact with locality 2 sediments several hundred meters upstream from the primary archaeological locality. Overall, it appears that locality 2 at Shuidonggou preserves a much thicker, continuous block of late Pleistocene sediments than does locality 1, but lacks a Holocene component.

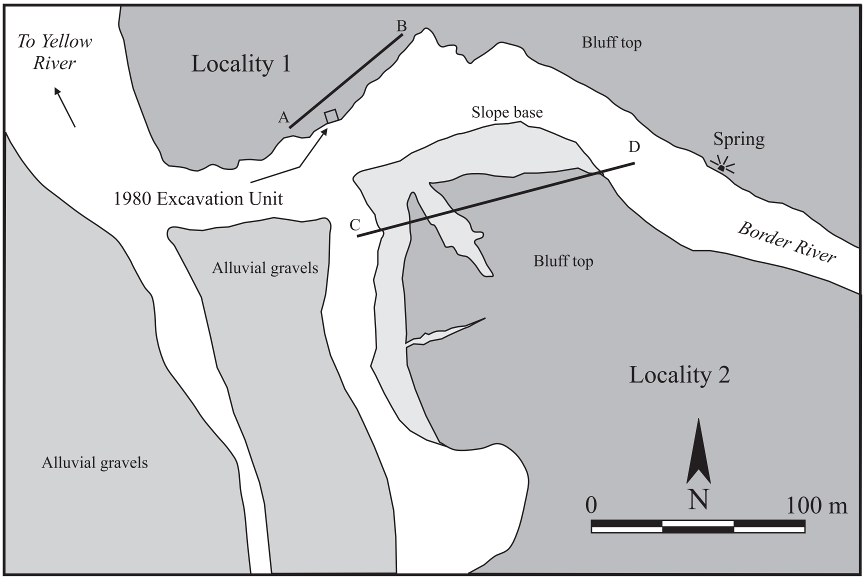

Figure 15.2. Map of the Shuidonggou area showing the location of the locality 1 (line AB) and locality 2 (line CD) stratigraphic profiles.

The correlations suggested here are confirmed both in available dates and preliminary comparisons of archaeological materials from the two localities. Stratum 4, the lowest Holocene unit at locality 1, appears securely dated with two radiocarbon assays on pond organic matter of 5940 ± 100 BP and 6505 ± 95 BP (Ningxia Museum 1987; Geng and Dan 1992: 48; see also Sun et al. 1991). There are two finite radiocarbon dates from the late Pleistocene strata, 17,250 ± 210 BP and 25,450 ± 800 BP from strata 7 and 8b, respectively (Chinese Quaternary Research Association 1987: 37). The first of these is a collagen date from what is likely a redeposited bone, and the second is taken from a carbonate nodule. Although potentially accurate, these dates are more safely assumed to be minimum ages because of problems with radiocarbon assays of bone collagen and carbonate (Stafford et al. 1991; Pendall et al. 1994). A third, infinite, radiocarbon date on unknown material (Geng and Dan 1992: 49) that underlies the archaeological horizons is difficult to evaluate. Chen et al. (1984) report on bone-derived U-Th ages from the "Lower Cultural Level" at Shuidonggou. These ages are given as 32–40 ka (calendric) (see also Chen and Yuan 1988). Although not unreasonable, given the character of the Shuidonggou industry, U-Th dating of bone has to be treated with extreme caution because of the uncertainty surrounding the mechanisms of uranium uptake and loss from bone tissues

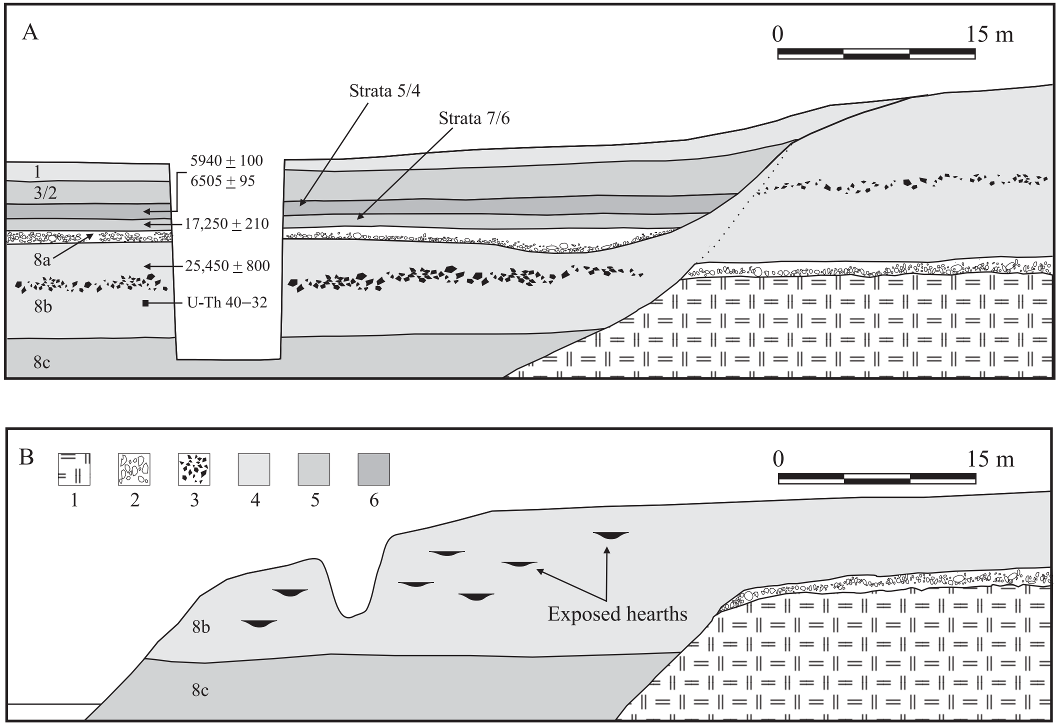

Figure 15.3. Shuidonggou stratigraphic sections at (A) locality 1 and (B) locality 2. Profile locations are indicated in figure 15.2. All locality 1 dates are conventional radiocarbon except where indicated. Radiocarbon results from locality 2 hearths are reported in table 15.1. *Sediments:* 1, Tertiary red clay; 2, alluvial gravels; 3, carbonate nodules; 4, sandy-loess; 5, bedded sands; 6, gleyed, organic-rich sands.

(Bischoff et al. 1988). In contrast, palynological evidence suggests that the late Pleistocene deposits at Shuidonggou accumulated under generally cold and dry conditions (Zhou and Hu 1988: 268). For this reason, Zhou and Hu favor a literal interpretation of the radiocarbon evidence and suggest that the Shuidonggou industry dates to the Last Glacial Maximum, around 20,000 BP. Fauna recovered from locality 1 include woolly rhinoceros *(Coelodonta antiquitatis),* horse *(Equus przwalskyi),* and ass *(E. hemionus),* and an extinct antelope *(Spiroceros kiahktensis)* has been identified at locality 2 (Ningxia Museum 1987; Madsen et al. 2001). Unfortunately, these species do not provide much additional chronological resolution.

Recent radiocarbon dates from Shuidonggou 2 support the conclusion that the Shuidonggou industry dates to 25–27 ka. Discrete, well-preserved hearths and hearth-related features are distributed throughout a 1.5- to 2-m-thick band of stratum 8b at locality 2 (figure 15.3). AMS radiocarbon ages obtained for seven of these hearths range from about 29,500 BP to about 23,800 BP, but cluster more tightly between 27,000 BP and 25,000 BP (table 15.1). The exact stratigraphic relationships among the hearths is difficult to establish without full-scale excavations. Nevertheless, the available age determinations appear consistent with relative stratigraphic positions (Madsen et al. 2001). Hearths present stratigraphically above and below those already dated suggest an even longer archaeological sequence may eventually be obtained. Significantly, the AMS dates from locality 2 indicate that the previously determined age from a carbonate nodule at locality 1 may indeed be accurate, despite known dating problems with such materials. This observation is further strengthened by the recovery of cores diagnostic of the locality 1 industry associated with locality 2 hearths. In particular, hearth 1 (26,350 ± 190 BP) yielded a flat-faced, flake-blade core matching locality 1 examples in all features but raw material type.

THE SHUIDONGGOU STONE INDUSTRY

Among the numerous archaeological occurrences in the Shuidonggou area, only locality 1 has been studied in considerable detail (Jia et al. 1964; Yamanaka 1995; Brantingham 1999; Brantingham et al. 2001). Our presentation here focuses on the locality 1 materials excavated in 1980 (Ningxia Museum 1987). Archaeological materials from locality 2, which in many respects promise to be richer than at locality 1, are just now beginning to be studied in detail. We discuss these materials only insofar as they highlight differences with locality 1. In particular, we draw attention to the presence of a bipolar bladelet technology at locality 2 that is not present at locality 1 to any significant degree.

All of the Shuidonggou localities occur in an area abundant in alluvial gravels. The primary deposit is a thick gravel lag capping local exposures of

TABLE 15.1 Radiometric Dates from Shuidonggou Localities 1 and 2

Locality	*Stratum or Feature*	*Method*	*Age (BP)*[1]	*Standard Deviation*	*Material*	*Lab Number*	*Reference*
1	4	Radiocarbon	5940	100	Pond organics		CQRC (1989)
1	4	Radiocarbon	6505	95	Pond organics		CQRC (1989)
1	7	Radiocarbon	17,250	210	Bone collagen		CQRC (1989)
1	8b	Radiocarbon	25,450	800	Carbonate nodule		CQRC (1989)
1	8c	Radiocarbon	>40,000		Not specified		Geng and Dan (1992)
1	8b	U-Th	32,000–38,000		Bone mineral		Chen and Yuan (1984)
2	Hearth 1	AMS radiocarbon	26,350	190	Charcoal	Beta 132982	Madsen et al. (2001)
2	Hearth 2	AMS radiocarbon	25,670	140	Charcoal	Beta 132983	Madsen et al. (2001)
2	Hearth 2	AMS radiocarbon	26,930	120	Eggshell	Beta 132984	Madsen et al. (2001)
2	Hearth 3	AMS radiocarbon	26,830	200	Charcoal	Beta 134824	Madsen et al. (2001)
2	Hearth 4	AMS radiocarbon	25,650	160	Charcoal	Beta 134825	Madsen et al. (2001)
2	Hearth 5	AMS radiocarbon	26,310	170	Charcoal	Beta 146355	Madsen et al. (2001)
2	Hearth 7	AMS radiocarbon	29,520	230	Charcoal	Beta 146357	Madsen et al. (2001)
2	Heath 10A	AMS radiocarbon	23,790	180	Charcoal	Beta 146358	Madsen et al. (2001)

[1]U-Th dates on bone reported in calendar years.

the Tertiary red clay. These materials also occur as secondary alluvial gravels in various channel fills, such as that seen in stratum 8a at locality 1. Accordingly, nearly 94% of the raw materials used in stone tool production at locality 1 are observed in the local gravels. Specific materials include gray and red quartzites, a fine-grained metamorphic green stone, silicified limestone, limestone, and sandstone. The two most abundant raw materials types represented in the stone assemblage are silicified limestone and quartzite, comprising 66.7% (n = 2540) and 18.3% (n = 698) of the sample, respectively. Cryptocrystalline stone raw materials, including a variety of cherts and chalcedonies, occur at very low frequencies in the lithic assemblage. These materials may also derive from alluvial gravels near the site.

Shuidonggou 1 Lithic Assemblage

The sample of late Pleistocene materials from locality 1 excavated in 1980 contained 3806 specimens. The materials recovered from strata 6, 7, and 8b are identical in composition and are treated together in our discussion of this material (Brantingham 1999). The assemblage is dominated by flat-faced blade cores, blade blanks, and an array of retouched tool types. The sample of cores consists of 176 specimens (table 15.2). Generalized flake cores (n = 69) include tested pebbles, unifacial chopping tools, bifacial choppers, polyhedrons (i.e., globular cores), and discoids. Prepared cores are numerically dominant (n = 94) in the collections, and Levallois-like cores make up the majority of these (n = 86). Only six of the latter are classified as Levallois flake and point cores. The remainder (n = 80) are Levallois-like, flat-faced blade cores (figure 15.4).

Technologically, these Levallois-like cores are both unidirectional and bidirectional recurrent forms dedicated to the production of blade blanks (Brantingham 1999; Brantingham et al. 2001). Significantly, uni- and bidirectional blade cores appear to represent two separate reduction trajectories, adopted perhaps in response to initial raw material package size. There are no statistical differences in the frequencies of whole uni- and bidirectional blades that retain intermediate and low levels of either dorsal cortex (χ^2 = 1.73; p = 0.552; n = 40), or platform cortex (χ^2 = 0.048; p = 0.826; n = 40). This suggests that both blade types were produced in roughly equal numbers during early decortification and later stages of core reduction. There is no evidence to suggest that cores were first reduced following a unidirectional, single platform strategy and were transformed into bidirectional, opposed platform cores only during the later stages of reduction.

Other prepared core forms are represented in low frequencies, including a single subprismatic blade core that displays continuous working around approximately 200° of the core's perimeter and two unfinished pyramidal bladelet cores (included in the category "Other" in table 15.2).

TABLE 15.2 Core Types from Shuidonggou Locality 1

Core Type	n
Tested pebble	7
Chopping tool	9
Chopper	10
Polyhedron	38
Discoid	11
Levallois flake core	5
Levallois point core	1
Levallois blade core	80
Subprismatic blade core	1
Change of orientation core	5
Bipolar pebble core	4
Narrow-faced core	3
Other	2
Total	176

Three change-of-orientation cores are combination flat- and narrow-faced cores and are not intensively reduced. The remaining two change-of-orientation cores appear to be responses to dwindling raw material package size in the later stages of reduction (see Baumler 1988, 1995). Only two examples of small bipolar core technology were identified in the locality 1 collections, a situation that contrasts sharply with Shuidonggou 2 (see below).

At locality 1, generalized flakes constitute more than half ($n = 1507$) of all blanks that retain striking platforms (figure 15.4; table 15.3). Some of the generalized flakes are undoubtedly related to the initial working of prepared cores, although there are no clear attributes to distinguish these flakes from others devoted to a core-and-flake strategy. Those blanks that are unequivocally related to prepared core reduction comprise 27.8% ($n = 620$) of the debitage assemblage; formal blades alone comprise 21.6% ($n = 482$). The great majority of blades are classified as Levallois products ($n = 402$). The subprismatic blades ($n = 7$) are primarily distinguished by distinctly trapezoidal or triangular cross-sections, parallel dorsal scars, and parallel sides. It is likely that these blades do not represent a separate reduction strategy, but are one extreme of a continuum of Levallois-like blade morphologies. The other end of this continuum is represented by flake-blades ($n = 112$). These products satisfy the metric definition of blades, but tend to possess one or more unstandardized attributes, such as substantial dorsal cortex, irregular dorsal scar patterns, or irregular sides. Flake-blades were produced primarily in the early stages of blade core preparation and reduction.

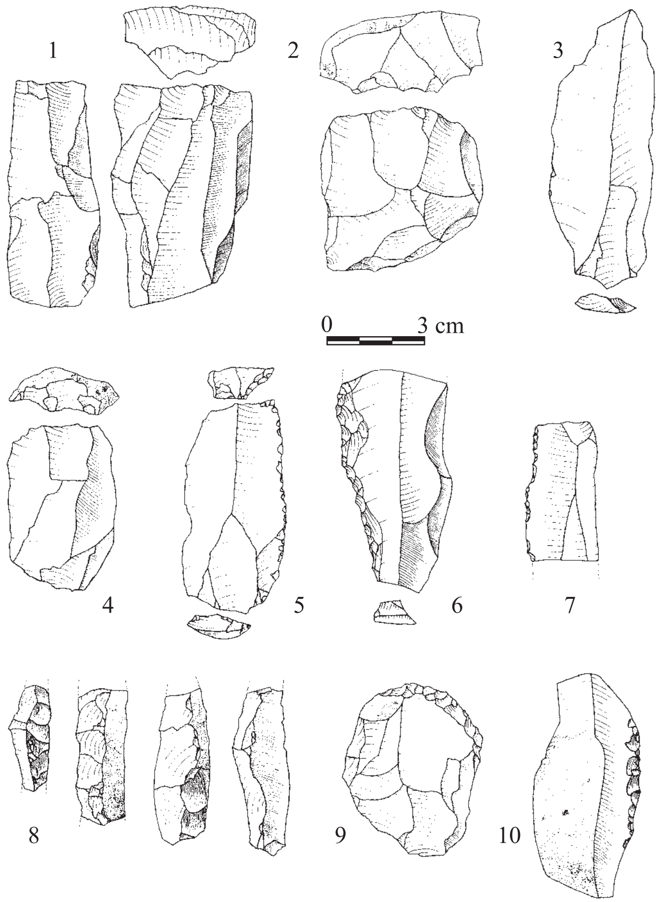

Figure 15.4. Cores, blanks, and tools from Shuidonggou locality 1: flat-faced ("Levallois") cores (1, 2, 4); Levallois blades (3, 5, 6, 7); crested blades (8); retouched flake end scraper (9); side scraper (10).

The limited number of platform tablets identified in the Shuidonggou collections recalls a standardized Upper Paleolithic approach to platform maintenance and rejuvenation. Because these tablets are all somewhat irregular in morphology, however, it is difficult to determine whether they were intentional rejuvenation spalls or simply accidental removals. Heavy faceting is clearly the primary means of establishing and maintaining striking platforms employed at Shuidonggou (Brantingham et al. 2001), in keeping with the Levallois-like character of core reduction: approximately

TABLE 15.3 Blank Types from Shuidonggou Locality 1

Blank Type	n
Generalized flake	1507
Levallois flake	11
Levallois point	15
Levallois blade	402
Prismatic blade	7
Pointed blade	7
Bladelet	66
Microblade	1
Core tab	7
Edge element	24
Other technical element	23
Bipolar flake	3
Crested blade	46
Flake blade	112
Total	2231

56% of the standardized blanks exhibit intensive platform faceting. The abundance of technical elements morphologically resembling crested blades also seems to suggest Upper Paleolithic blade core reduction strategies (figure 15.4). However, these technical elements appear to have been employed to extend core use life by transferring reduction to the edge of the core after the primary face was judged exhausted or had developed serious errors. Such cores tend to exhibit blade removals along the same percussion axis, but in two adjoining planes oriented at 90° to one another. There is no evidence to suggest that crested blades were used to initiate reduction on the primary core face.

The tool assemblage from Shuidonggou is diverse and comprises nearly 15% ($n = 544$) of the excavated sample (figure 15.4; table 15.4). Flake tools constitute 58.6% ($n = 319$), whereas 26.1% of the tools ($n = 142$) are based on blades. Including flake-blades, nearly 37% ($n = 200$) of the retouched tool assemblage is based on elongate end products. The four most abundant blade-based tool types are blades with one edge retouched ($n = 47$), notched blades ($n = 24$), blades with two edges retouched ($n = 15$), and single end scrapers ($n = 15$). The four most abundant flake-based tools include irregularly retouched flakes ($n = 64$), single side scrapers ($n = 63$), retouched notches ($n = 45$), and combination tools ($n = 34$). Ignoring blank type, the six most frequent tool types are single side scrapers ($n = 86$), retouched notches ($n = 76$), retouched flakes ($n = 71$), combination tools ($n = 59$), blades with one edge retouched ($n = 55$), and single end scrapers ($n = 43$).

TABLE 15.4 Tool Types from Shuidonggou Locality 1

Tool Type	n
Single side scraper	86
Double side scraper	22
Convergent scraper	16
Transverse scraper	28
Single end scraper	43
Double end scraper	1
End scraper on retouched blade	2
Fan-shaped end scraper	1
Circular scraper	5
Thumbnail end scraper	2
Carinated end scraper	9
Nosed end scraper	1
Simple burin	5
Dihedral burin	2
Multiple burin	1
Backed knife	7
Single notch	76
Multiple notches	18
Denticulate	18
Combination tool	59
Blade one edge retouched	55
Blade two edges retouched	17
Blade retouched into point	3
Retouched flake	71
Other	3
Total	551

Shuidonggou 2 Lithic Assemblage

Archaeological materials at locality 2 occur in two very different contexts. Mixed surface assemblages are prevalent at the top of the locality 2 bluff, whereas stratified materials occur in varying densities throughout the sedimentary stack identified with stratum 8b. Lithic artifacts were observed in situ both in close proximity to and at greater distances from hearths and charcoal lenses exposed on the bluff face. Other artifacts were recovered directly from soil and charcoal samples removed from hearth fill. Although the present sample of artifacts from stratified contexts at locality 2 remains small and absolute spatial and chronological relationships among recovered materials is uncertain, there are some significant patterns that require brief mention.

Lithic artifacts on the peninsula surface at locality 2 include (1) microblades, microblade cores, and debitage from microblade core maintenance; (2) bipolar cores and debitage; (3) a variety of generalized core-and-flake technologies; and (4) a small component of Helan point technology (see Elston et al. 1997; Zhang 1999). Silicified limestone accounts for most of the lithic items on the surface, but quartzite is also present. In the surface assemblage, two strategies of lithic reduction employ bipolar technology. In one strategy, which is more classically "bipolar," small pebbles of silicified limestone undergo bipolar reduction, using a percussor and stationary anvil, to generate flakes and sharp pieces. Some of the bipolar flakes are linear and blade-like, falling within the small end of the true microblade size range. Some of these blade-like flakes have platforms, but often the platform has collapsed; bulbs are frequently sheared, and the flakes are often split longitudinally. Bipolar flakes, cores, and shatter are very abundant in the peninsular surface assemblage. In the second strategy, the bipolar technique is employed as an early critical stage in microblade production from small cortical pebbles. Specifically, bipolar percussion is used to split and/or remove one or both ends of elongate pebble core blanks as initial steps in shaping the core before microblades are removed. Such cores and failed core blanks are common on the peninsula surface.

Materials recovered in situ from locality 2 provide strong evidence for the use of a bipolar pebble reduction strategy of the first type, but nothing that is unequivocally diagnostic of a formal microblade strategy (figure 15.5). In particular, both the fill and the sediments surrounding hearth 2, dated to about 26,000 BP, contained multiple lithic specimens clearly derived from a bipolar pebble strategy. Such cores are very small (2–4 cm in length), show severe crushing at one or both ends, and display subparallel, bladelet-like removals. Recovered debitage specimens are often very short and usually have only single, subparallel arises and crushed or sheared bulbs of percussion. One of these short, bipolar bladelets is retouched and could be easily confused with a true microblade, if given only a cursory examination.

In addition to bipolar pebble reduction debris, cores recovered from near hearths 1 and 7 provide direct correlations with the locality 1 stone industry (figure 15.5). The flat-faced core from hearth 1 (26,350 ± 190 BP) is a bidirectional convergent core with the final removals suggestive of flake-blade production. The primary striking platform is faceted, as is the case with the majority of flat-faced cores from locality 1. The core is somewhat unique in being based on gray quartzite. In contrast, the majority of flat-faced cores from locality 1 are based on silicified limestone. Nevertheless, technologically this specimen is diagnostic of the locality 1 industry and provides a point of direct correlation between the localities. The gray quartzite flake-blade core found in association with hearth 7 (29,520 ± 230 BP) is based on the ventral surface of a large flake blank and shows removals from

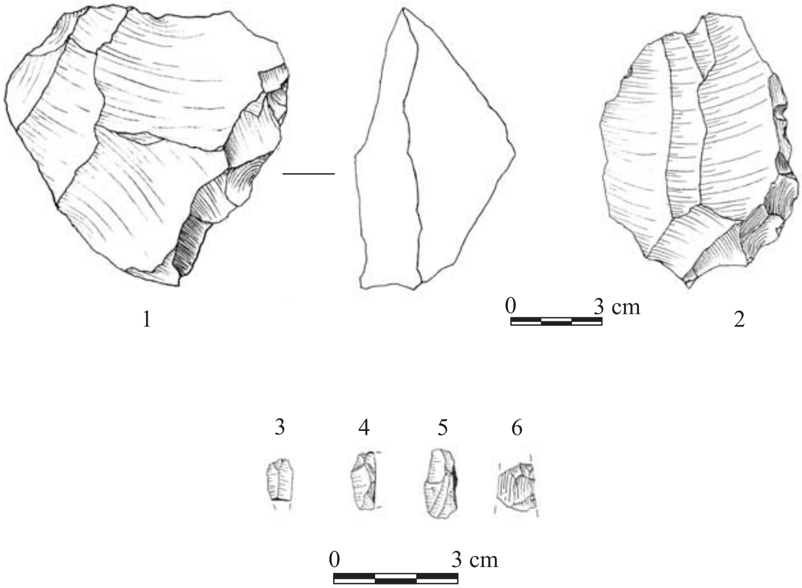

Figure 15.5. Selected Shuidonggou locality 2 artifacts: flat-faced ("Levallois") core from hearth 1 (1); atypical flat-faced core from hearth 7 (2); unretouched bipolar bladelets (3, 4, 5); retouched bipolar bladelet segment (6).

both opposed (proximal-distal) and unopposed (lateral) directions. The core resembles the flat-faced blade technology characteristic of locality 1, but is also irregular in a number of respects. It is more informal than most locality 1 flat-faced cores because it is based on a large flake blank, requiring minimal preparation (see Brantingham et al. 2000; Derevianko et al., this volume) and because it is based on a coarse-grained quartzite. Other lithic materials found in situ at locality 2 consist primarily of flake debitage and debris. Although consistent with the locality 1 assemblage, these specimens are not technologically diagnostic.

A single charred bone tool, made from the split mid-shaft of a large mammalian long bone, was recovered from hearth 4 (25,650 ± 170 BP) (Madsen et al. 2001). One end is bifacially flaked to form a crescent-shaped cutting or scraping edge. A portion of the edge is ground, apparently through use, and both the interior and exterior surfaces exhibit evidence of polish. Two tool manufacturing episodes are evident: the initial production phase and a second, resharpening phase, following extensive use. The tool appears to have splintered during this resharpening episode and was discarded. Similar bone tools were recovered at Salawasu, an earlier Upper Paleolithic site in the Ordos Desert (e.g., Miller-Antonio 1992), but have not been previously reported for Shuidonggou and generally are not common in the Paleolithic of northern China.

DISCUSSION

Since its initial discovery, Shuidonggou has garnered much attention from both Chinese and Western archaeologists. The blade-dominated character of the Shuidonggou assemblage is strikingly different from the great majority of Chinese Paleolithic assemblages, which exhibit relatively simple core-and-flake technologies through much of the Pleistocene. The late middle Pleistocene site of Dingcun (70–90 ka), for example, is best known for its large trihedral picks, but also contains spheroids, choppers, and discoids, as well as coarsely retouched scrapers (Wang et al. 1994). Dingcun is considered the type site for the Chinese Middle Paleolithic, although it bears little technological resemblance to Middle Paleolithic assemblages of western Eurasia. Other late middle Pleistocene sites, such as Xujiayao (about 100 ka), which contains a large collection of stone spheroids but also many small retouched flakes classified as informal scrapers and points (Li 1994; Qiu 1985), and Salawusu (75–130 ka), which is dominated by unstandardized small-flake technology (Miller-Antonio 1992), are similarly generic in character. Many late Pleistocene assemblages, such as that from Xiaonanhai (24 ka), are characterized by a persistence of small, irregular flakes and casually retouched tools. A somewhat greater degree of core preparation may be represented at Shiyu (28–29 ka), as judged by the proportion of flakes exhibiting prepared striking platforms and the occurrence of blades and flake-blades within the assemblage (Miller-Antonio 1992). As Gao (1999) points out, however, the use of the terms "Middle" and "Upper Paleolithic" within China generally describes broad chronostratigraphic boundaries not necessarily reflected in major technological or behavioral transitions. Gao argues, quite controversially, that if any division of the Chinese Paleolithic is warranted, it is between an early period, represented by relatively simple core-and-flake technologies, and a late period, represented by the explosion of microblade technologies following the Last Glacial Maximum. Shuidonggou is clearly an outlier in this general sequence (Lin 1996; Gao 1999). What are the evolutionary implications of this conclusion, and what bearing does it have on our understanding of the emergence of the Upper Paleolithic?

The unique technological and typological features seen at Shuidonggou 1 suggest that Shuidonggou blade technologies did not emerge from the north Chinese "Middle Paleolithic." Rather, Shuidonggou must represent an intrusive phenomenon from some adjacent region (Lin 1996; Zhang 1999). This position differs from that of Jia et al. (1964), who look to Dingcun as a possible source for the Shuidonggou industry.

Some characteristics of the Shuidonggou 2 are not as clearly intrusive. In particular, the prevalence of a bipolar pebble technology at this locality is consistent with the general character of the north Chinese Paleolithic sequence. Bipolar core technologies played a large role in the Chinese Paleolithic from its inception (Jia and Huang 1985). These technologies form a significant component of early and middle Pleistocene assemblages such as that from Chenjiawo (about 1.1 ma) in the Nihewan basin, and Zhoukoudian locality 1 (300–500 ka). They continued to play an important role in late Pleistocene stone industries as well. We are skeptical, however, of the diagnostic significance of bipolar core technologies. Bipolar reduction is common in many archaeological contexts around the world and is frequently used to reduce small, difficult to manipulate pieces of raw material, or intractable raw material types such as quartzite (Andrefsky 1998: 149). At Chinese sites such as Chenjiawo (early Pleistocene) and Salawusu (late Pleistocene), the availability of only small packages of stone raw material may have been driving the use of a bipolar reduction strategy (see Schick et al. 1991; Miller-Antonio 1992). At Zhoukoudian, in contrast, the availability of intractable quartzites and sandstones may have been the most important determinant in adopting this reduction technique (Pei and Zhang 1985). The use of a bipolar reduction strategy at Shuidonggou 2 appears to fall within the former category: it was used primarily to work small pebbles of high quality chert and chalcedony. We think that the broad similarity between Shuidonggou 2 and other Chinese Paleolithic sites in the use of bipolar core reduction reflects shared geological contexts rather than shared phylogeny. Raw material package size and quality are universal constraints impacting all lithic technological systems to some degree.

Nevertheless, the bipolar pebble reduction strategy in evidence at Shuidonggou 2 may have provided a substrate from which later microblade technologies developed. At a general level, the use of bipolar percussion to work small chalcedony pebbles presages pebble-based microblade core technologies, which were commonly initiated with bipolar reduction before entering a trajectory of more organized microblade production (Elston and Brantingham 2002). Such pebble-based microblade core technologies appear sometime around the Last Glacial Maximum, immediately following the peak of occupations at Shuidonggou, and come to dominate the Siberian, Mongolian, and north Chinese sequences by the Pleistocene-Holocene transition (Derevianko et al. 1998f; Lie 1998). More specifically, that some of the bipolar bladelets from Shuidonggou 2 were retouched in a manner similar to later microblades may suggest that they were used in similar ways, perhaps as insets in simple composite tools.

The observations presented here suggest, on the whole, that Shuidonggou is unlike many other Chinese Paleolithic occurrences both preceding and contemporaneous with it. However, Shuidonggou is not a complete outlier in the greater northeast Asian Paleolithic sequence. On the contrary, blade-based technologies such as that from Shuidonggou 1 are found widely distributed throughout Mongolia and southern Siberia between 27 and 45 ka and may be classified as part of the initial Upper Paleolithic (Brantingham et al. 2001; see also Derevianko et al., this volume; Goebel, this volume; Kuzmin, this volume). The Shuidonggou 1 assemblage differs from many initial Upper Paleolithic assemblages in western Eurasia primarily in the character of the tool assemblage. Retouched tools from Shuidonggou are typologically reminiscent of the Middle Paleolithic. Classical Upper Paleolithic tool types, such as end scrapers, burins, and truncations, are comparatively rare in the collections. The behavioral significance of this patterning is unclear. We also note that Shuidonggou differs from its western counterparts in another important way: with the peak of occupation at Shuidonggou falling around 25–27 ka, it is substantially younger than initial Upper Paleolithic examples from west Asia and central Europe. The proposed dating of Shuidonggou, however, is consistent with the broader regional sequence, which shows progressively older ages as one moves from south to north (Brantingham et al. 2001).

Shuidonggou also lacks some of the other features commonly associated with the emergence of the Upper Paleolithic and modern human behavior. The single bone tool from hearth 4 at Shuidonggou 2 is expedient and difficult to link to any formal bone and antler technology. Moreover, there is no evidence for the use of personal ornamentation or portable art, though in truth such remains are extremely rare in early Upper Paleolithic assemblages from Eurasia as a whole (Kuhn et al. 2001). In the absence of this evidence, many researchers will ask whether Shuidonggou is truly an example of the initial Upper Paleolithic, or merely a blade-based ("lepto-Levallois") Middle Paleolithic. Ultimately, we think that such classifications hinder our ability to investigate and understand the evolution of human behavior. Shuidonggou certainly marks an innovation in stone raw material economy in the Chinese Paleolithic. It also likely represents intensification of foraging activities and the emergence of novel patterns of land use (Brantingham et al. 2001). To classify Shuidonggou in the domain of the Middle Paleolithic creates an implicit link to archaic hominins and "archaic" behavior, whereas the alternative classification as Upper Paleolithic creates an implicit link to anatomically modern humans and the spread of modern behavior. Presently, there is neither theoretical nor empirical justification for either conclusion.

CONCLUSIONS

The lithic industry from Shuidonggou 1 falls squarely in the range of variability defined for the initial Upper Paleolithic when compared with western Eurasian examples. It is a specialized blade technology based almost exclusively on a Middle Paleolithic, Levallois-like core reduction strategy. New AMS radiocarbon dates from locality 2 provide strong evidence that this blade-based industry appeared around 25–27 ka and is closely related to similar assemblages from the Mongolian Gobi and southern Siberia dated to 27–33 ka and 39–43 ka, respectively. Shuidonggou 1 is thus possibly the latest initial Upper Paleolithic assemblage yet known in all of Eurasia.

Locality 2 at Shuidonggou differs from locality 1 in preserving a small but significant sample of what may be termed a “bipolar bladelet” technology. This technology was apparently employed alongside the large blade component, and may reflect constraints imposed by the use of small chalcedony pebbles. The use of this bipolar pebble technology may have provided an important foundation for the development of formal microblade technologies, which emerged rapidly in northeastern Asia shortly after the peak of occupation at Shuidonggou.

16

The Early Upper Paleolithic and the Origins of Modern Human Behavior

S. L. Kuhn, P. J. Brantingham, and K. W. Kerry

The ideas and data presented in this volume urge us to reconsider the complexity inherent in the origins of the Upper Paleolithic. A striking theme throughout the volume is the diversity of Middle-Upper Paleolithic transitions detected even on local or intraregional scales. In most of the areas covered, at least one variety of the early Upper Paleolithic appears to show strong continuity with the local late Middle Paleolithic (see figures 1.1, 1.2). In central and eastern Europe, for example, the various early Upper Paleolithic industries with leaf points (e.g., Szeletian, Streletskayan) appear to have evolved in situ out of the late Middle Paleolithic (Micoquian) with bifacial points (Kozłowski; Svoboda; Vishnyatsky and Nehoroshev; all in this volume). In the Levant (Fox and Coinman; Kuhn et al., chapter 8; both in this volume), central Asia (Vishnyatsky, this volume), and perhaps also portions of northeastern Asia (Kuzmin, this volume), the so-called "lepto-Levalloisian," or initial Upper Paleolithic, is the best candidate for a locally evolved variety of Upper Paleolithic (Kuhn et al. 1999; see also Bar-Yosef 2000). In some cases, the local origins of the Upper Paleolithic complexes are open to question: given the near ubiquity of Levallois technology in the Mousterian, the lepto-Levalloisian complexes could have come from almost anywhere. What is important is that in these areas, it seems that genuine Upper Paleolithic industries were derived independently from very different starting points in the Middle Paleolithic.

In many areas, other early Upper Paleolithic industries appear suddenly and without local precedent. These may even coexist with early Upper Paleolithic variants apparently derived from Mousterian antecedents. In central Europe, there are three apparently intrusive complexes: the Bohunician (a variant of the lepto-Levalloisian industries) (Svoboda, this volume), the so-called "arched backed blade" industries (Kozłowski, this volume), and the more widespread Aurignacian. In eastern Europe, the blade/bladelet-dominated Spitsynian (Vishnyatsky and Nehoroshev, this volume) appears unexpectedly; something similar occurred, albeit much later, in Georgia (Meshvilliani et al., this volume). In the Crimea (Marks and Monigal, this volume) and the Levant (Fox and Coinman, this volume), as in western Europe, it is the Aurignacian that appears intrusive (see below). In northwestern China, lepto-Levalloisian industries appear without any apparent local technological predecessors (Brantingham et al., chapter 15, this volume).

At first glance, the abrupt appearance of the early Upper Paleolithic in these regions would seem to imply a radical and unexpected reorganization of cultural and behavioral adaptations. In many instances, however, the origins of these locally unique early Upper Paleolithic industries can be traced to adjacent regions, where the ties to local Middle Paleolithic variants are more transparent. Kozłowski (this volume) sees the development of arched backed blade assemblages centered in the Balkans or southeastern Europe. The lepto-Levalloisian industries, intrusive to central and eastern Europe, may have originated in Ukraine (Meignen et al., this volume), or perhaps simultaneously in the Levant and central Asia, a pattern suggested by the available radiometric dates (Tostevin 2000). None of the authors suggests a point of origins for the intrusive blade/bladelet complexes of eastern Europe and the Caucuses, though the Levantine early Ahmarian is one likely ancestor. Brantingham et al. (chapter 15, this volume) suggest that the north Chinese early Upper Paleolithic, which has no likely Middle Paleolithic antecedents, is intrusive from Mongolia and, ultimately, from southern Siberia.

The intrusive character of the Aurignacian in several regions deserves special attention. In standard textbook accounts, the arrival of the Aurignacian in Europe marked the appearance of the full range of "modern" behavioral traits, including art, ornamentation, and elaborate bone and antler artifacts (Mellars 1996, 1999; Klein 1999, 2001; see also Bar-Yosef 2002). The Aurignacian continues to be of concern to researchers in some areas—particularly as regards the issue (or nonissue) of acculturation between archaic and modern populations as an explanation for the development of "transitional" industries such as the Châtelperronian (d'Errico et al. 1998; Mellars 1999; Zilhão and d'Errico 1999). However, in many of the regions discussed in this volume, the Aurignacian plays a much less important role in trajectories of Upper Paleolithic culture change. In eastern Europe, the Caucuses, and central and northeastern Asia, the Aurignacian sensu stricto is poorly represented, if it is present at all. Where it does appear elsewhere (central Europe, the Crimea, the Levant), the Aurignacian is both a relatively late arrival, appearing well after the development of other early Upper Paleolithic complexes, and is typologically variable. Moreover, the Aurignacian does not always appear to truncate or replace other technocomplexes, such as in the case of the "indigenous" leaf point industries of central Europe. The situation in the Levant, not discussed explicitly in this volume, remains in question. Appearing comparatively late—after 34,000 BP (Phillips 1994)—it is unclear whether the Aurignacian displaced the early Ahmarian or coexisted with it (compare Goring-Morris 1987; Gilead 1991; Schyle 1992; Bar-Yosef 2000).

Perhaps more importantly, it is clear from many areas that the appearance of key Upper Paleolithic characteristics is not linked to the arrival of the Aurignacian. In eastern Europe, Crimea, and the Levant, the earliest examples of ornaments and bone tools are associated with earlier, non-Aurignacian complexes such as the initial Upper Paleolithic/lepto-Levalloisian, the Spitsynian, and the remarkable industry from Buran-Kaya III (Marks and Monigal, this volume). Wherever they came from, and whenever they got there, the Aurignacian was clearly not the vehicle that carried these features of "modern human behavior." This volume makes it clear that we should abandon the Aurignacian as a typological marker for modern human behavior.

Typological issues aside, is there support for a more general model claiming that the early Upper Paleolithic spread from a single "homeland" to outright replace local Middle Paleolithic industries? At present, the answer to this question appears to be negative (but see Bar-Yosef 2002; Otte, this volume). The picture that emerges from the contributions to this volume is one of substantial interregional differentiation in the origins of the early Upper Paleolithic and its constituent elements. Many specific features (ornaments, prismatic blades, bone tools) often considered diagnostic of modern behavior are first manifested at different times and in association with different cultural complexes. Models that posit a single spatiotemporal origin for the Upper Paleolithic and modern human behavior are becoming increasingly difficult to support. As stressed in the chapter by Kozłowski, for example, the controversial acculturation model, which links the appearance of Upper Paleolithic features in the Châtelperronian to contact between indigenous Middle Paleolithic hominins and invading anatomically modern humans, is simply not a plausible explanation for the early Upper Paleolithic in most areas outside of western Europe. To be certain, there is reason to be cautious in drawing final conclusions in this matter, given the limitations of current geochronological techniques (Beck et al. 2001; Marks and Monigal, this volume) and the possibility that many so-called Middle-Upper Paleolithic "transitional" assemblages were discrete entities mixed postdepositionally or through substandard archaeological recovery (see Meshvilliani et al., this volume). Nevertheless, patterns of cultural and behavioral evolution during the early Upper Paleolithic are turning out to be much more of a mosaic than most of us previously imagined, and are more complex than is commonly presented to the public and readers of introductory textbooks.

What, then, are the implications of these diverse transitions for scenarios describing the origins of anatomically modern humans? Although individual authors have their own biases, none of the regional archaeological records described in this volume provides unambiguous support for either of the simple scenarios for the spread of modern humans into Eurasia—universal regional continuity or a catastrophic wave of population advance out of Africa. Except for the Caucasus, in each region there is at least one early Upper Paleolithic industry or group of assemblages that arguably demonstrates gradual in situ behavioral evolution. At the same time, every region also contains what are clearly intrusive early Upper Paleolithic archaeological cultures. Although none of these as yet can be traced back to sub-Saharan Africa, that may be more a reflection of the absence of appropriate data for comparisons. If one chooses to equate hominin populations with specific industries, what the archeological data suggest is a complex history involving a series of population movements among and within major regions. Interestingly, recent reevaluations of the genetic evidence reject simplistic early scenarios of catastrophic replacement of resident archaic hominins by African anatomically modern populations in favor of a series of smaller scale population segmentations, bottlenecks, expansions, and migrations among various regions (Hay 1997; Watson et al. 1997; Hawks et al. 2000; Jorde et al. 2000; Maca-Meyer et al. 2001; Relethford 2001).

Obviously, it would be desirable to know who (in a biological sense) produced the various archaeological assemblages described here. Many authors are willing to propose that a particular hominin type (Neanderthals or modern *Homo sapiens*) was responsible for a particular industry or archaeological culture. Such propositions are made both safer and less reliable by the scarcity of human fossils. In fact, except for the French Châtelperronian (e.g., Lévêque et al. 1993), there are remarkably few secure associations between early Upper Paleolithic assemblages and anatomically diagnostic skeletal materials (but see also Smith et al. 1999). For the most part, the fossils that do exist are associated with relatively late versions of the early Upper Paleolithic. Globally, the scarcity of human remains dating to the period between 45,000 and 35,000 years ago is both interesting and frustrating.

However, if one rejects the equation of a biological population with an archaeological culture—and there is more than sufficient reason to be wary of this equation—the data presented in this volume can be seen to demonstrate a complex and discontinuous development of Upper Paleolithic behavioral repertoires. Archaeological data from points beyond western Europe strongly indicate that the Upper Paleolithic, or the manifestation of "modern human behavior," was not a unitary phenomenon, but an amalgam of contextually and historically contingent behavioral tendencies.

Returning to the themes and models described in the opening chapter, assessing the difficulty of the so-called Middle-Upper Paleolithic "transition" remains somewhat problematic. It is clear that different, but apparently genuine, Upper Paleolithic adaptations were derived independently from very different starting points in the Middle Paleolithic and/or Middle Stone Age and that these transitions occurred over vast geographical areas. This empirical pattern may suggest that certain portions of Upper Paleolithic phenotypic space were easily accessed and, indeed, that there were many pathways to modern human behavior. Unfortunately, the bulk of this evidence for a relatively easy transition is restricted to lithic technology. Some may agree that a transition to Upper Paleolithic lithic technology was a relatively easy thing to accomplish, although many researchers contend that such "transitional" lithic technologies are simply terminal Middle Paleolithic industries and are therefore of no great relevance to the origins of modern behavior (see the discussion in Marks and Mongial, this volume). The evolutionary hurdle remains in place in this case. Whether this holds true, it is worth considering the possibility that transitions in other domains, such as in the emergence of complex social and symbolic behavior, were far more difficult than those involving lithic technology. This volume adds to a growing mass of evidence that the origins of complex symbolic behavior were spatially independent, even if they occurred at roughly the same time (Kuhn et al. 2001). The earliest forms of symbolic material culture appear in connection with very different early Upper Paleolithic stone industries, in very different environmental settings, and with very different degrees of connection with local Middle Paleolithic entities (Goebel, Marks and Monigal, Vishnyatsky and Nehoroshev, all in this volume). The implication is that even these highly unique features of modern behavior were derived from different starting points. If there is a common evolutionary cause, phylogentic or otherwise, it is rooted much deeper in evolutionary time and is largely independent of the events tracked in the Middle-Upper Paleolithic transition (Kuhn et al. 2001).

The simple empirical observation that Upper Paleolithic phenotypic space was accessed from many different starting points in Middle Paleolithic space suggests that the transition itself was not at all improbable. Theoretically, the greater the number of potential pathways between the Middle and Upper Paleolithic, the greater the chance that local ecological contexts would foster behavioral changes along one of them. Furthermore, there is some indication that the pathways between Middle and Upper Paleolithic phenotypic spaces were not newly opened sometime after 50,000 BP. The sporadic appearance of strikingly modern behavioral attributes—blade technologies, ground and polished bone tools, specialized hunting, and even the use of pigments and ornaments—earlier in the Middle Paleolithic (and much earlier in the African Middle Stone Age) implies that small portions of Upper Paleolithic phenotypic space have been accessible since at least 250 ka (see Révillion and Tuffreau 1994; Bar-Yosef and Kuhn 1999;

1 2

Figure 16.1. General topological models describing changes in the relative sizes of Middle Paleolithic (light gray) and Upper Paleolithic (dark gray) phenotypic spaces (see Brantingham et al., chapter 1, this volume). (1) Upper Paleolithic space is small enough to temporarily absorb some transitions from the Middle Paleolithic space. These transitions are expected to be restricted to a few features and generally will be short lived, because of the much larger basin of attraction represented by the Middle Paleolithic. (2) An increase in the relative size of Upper Paleolithic phenotypic space increases the probability of transition to the Upper Paleolithic. Such transitions should involve a more diverse set of behavioral and cultural attributes and also should be less prone to reverse transitions, because of the comparatively small basin represented by the remaining portion of Middle Paleolithic space. Such quantitative shifts in the relative sizes of Middle and Upper Paleolithic phenotypic spaces may underlie the Middle-Upper Paleolithic transitions.

McBrearty and Brooks 2000; Bar-Yosef 2002; Grayson and Delpeche 2002; Meignen et al., this volume). We are not endorsing the idea that the true transition to modernity occurred at these much earlier times. Rather, we are suggesting that brief, early excursions into “Upper Paleolithic-like” behavioral organizations indicate that the Upper Paleolithic, as it ultimately came to be, was not a complete break from the Middle Paleolithic/Middle Stone Age, but rather an extension and an expansion of some subset of it.

The scope and persistence of the most recent transitions (those occurring between 30 and 50 ka) is perhaps best seen as an indication of changes in the relative sizes of Middle and Upper Paleolithic phenotypic spaces (see figure 1.1). Early in the process, Middle Paleolithic/Middle Stone Age cultural phenotypic space was large and Upper Paleolithic space small (figure 16.1: 1). Only a small window connected them. This allowed occasional movement from Middle Paleolithic/Middle Stone Age to Upper Paleolithic, but it also permitted movement in the opposite direction, something that actually appears to have occurred more than once in sub-Saharan Africa

(McBrearty and Brooks 2000). Over time, Upper Paleolithic phenotypic space grew much larger and Middle Paleolithic space shrank, leaving a similar-sized window of access (figure 16.1: 2). Interestingly, this shifting balance would have lessened the probability of movement from the Upper Paleolithic back to the Middle Paleolithic/Middle Stone Age space, an implication consistent with the general lack of stratigraphic alternation between Middle and Upper Paleolithic industries in Eurasia. What caused the relative sizes of the two spaces to change is another question. We suggest that it was probably the result of a complex interplay between regionally variable environmental factors, human demography, and genetically determined capacities for certain forms of complex behavior, such as language. A unique insight from this model shifts focus from the relative superiority of Upper Paleolithic over Middle Paleolithic/Middle Stone Age to factors that would reduce the viability of one set of adaptive options while simultaneously increasing the viability of others. It also decouples the archaeological issues from questions of biological barriers between hominin taxa.

The great diversity of early Upper Paleolithic sequences described in this volume may be discouraging to those who prefer simple narratives. We—and we hope many readers of this volume—find it extremely encouraging. Increasingly, the community of scholars engaged in paleoanthropological research has the opportunity to approach the global question of modern human origins using a truly global database. It is almost inevitable that, as our knowledge base has expanded, models formulated using data from a few regions will be undermined. The early Upper Paleolithic world now seems to be a more complicated place than it did fifty, or even fifteen, years ago, but the door is now also open for a deeper and more comprehensive understanding of cognitive evolution, cultural change, and population movements during the late Pleistocene.

REFERENCES

Abramova, Z. A. 1984. The Early Paleolithic of the Asian part of the USSR. In *Paleolit SSSR.* P. I. Boriskovsky, editor. pp. 135–160. Moscow: Nauka.

Abramova, Z. A., S. N. Astakhov, S. A. Vasil'ev, N. M. Ermolova, and N. F. Lisitsyn. 1991. *Paleolit Eniseia.* Leningrad: Nauka.

Aitken, M. J., C. B. Stringer, and P. A. Mellars, editors. 1993. *The Origin of Modern Humans and the Impact of Chronometric Dating.* Princeton: Princeton University Press.

Aksenov, M. P. 1989a. *Paleolit i Mezolit vekhnei Leny.* Ph.D. dissertation. Novosibirsk: Institute of History, Philosophy and Philology, Siberian Branch, Soviet Academy of Sciences.

Aksenov, M. P. 1989b. *Paleolit i Mezolit vehknei Leny: Aftoreferat.* Novosibirsk: Nauka.

Aksenov, M. P., and I. S. Naidentskaia. 1979. K voprosu o stratigraficheskoi i planimetricheskoi situatsii na Makarovo IV. In *Otchetnaia Nauchno-Teoreticheskaia Konferentsiia Arkehelogiia Etnografiia Istochenikovedenie.* pp. 74–75. Irkutsk: Irkutskii Gosudarstvennyi Universitet.

Aksenov, M. P., V. I. Bazaliiskii, and E. M. Ineshin. 1986. Iz arkheologii G. Irkutska (drevneishie sledy osvoeniia chelovekom territorrii sovremennogo goroda). In *Arkheologicheski i Etnograficheskie issledovaniia v Vostochnoi Sibiri: Itogi i Perspektivy.* pp. 3–6. Irkutsk: Irkutskii Gosudarstvennyi Universitet.

Aksenov, M. P., M. A. Berdnikov, G. I. Medvedev, O. N. Perzhakov, and A. B. Fedorenko. 1987. Morfologiia i arkheologicheskii vozrast kamennogo inventar'ia Makarovskogo Paleoliticheskogo plasta. In *Problemy Antropologii i Arkheologii Kamennogo Veka Evrazii.* pp. 24–28. Irkutsk: Irkutskii Gosudarstvennyi Universitet.

Alekseeva, E. V., and A. M. Maloletko. 1984. Novyi peshchernyi Paleolita na Altae. In *Problemy Issledovaniia Kamennogo Veka Evrazii.* pp. 26–28. Krasnoiarsk: Krasnoiarskii Gosudarstvennyi Pedagogicheskii Institut.

Allsworth-Jones, P. 1986. *The Szeletian and the Transition from Middle to Upper Paleolithic in Central Europe.* Oxford: Clarendon.

Allsworth-Jones, P. 1990. The Szeletian and the stratigraphic succession in central Europe and adjacent areas: Main trends, recent results, and problems for resolution. In *The Emergence of Modern Humans: An Archaeological Perspective.* P. Mellars, editor. pp. 160–242. Ithaca: Cornell University Press.

Allsworth-Jones, P. 2000. Dating the transition between Middle and Upper Palaeolithic in Eastern Europe. In *Neanderthals and Modern Humans-Discussing the Transition: Central and Eastern Europe from 50,000–30,000 B.P.* J. Orschiedt and G. C. Weniger, editors. pp. 20–29. Mettmann, Germany: Neanderthal Museum.

Altena, C., and O. van Regtern. 1962. Molluscs and echinoderms from Paleolithic deposits in the rock shelter of Ksar 'Akil, Lebanon. *Zoologische Mededelingen* 38: 87–99.

Ambrose, S. H. 1998. Chronology of the Later Stone Age and food production in East Africa. *Journal of Archaeological Science* 25: 377–392.

Amick, D. S., editor. 1999. *Folsom Lithic Technology: Explorations in Structure and Variation.* Archaeological Series 12. Ann Arbor: International Monographs in Prehistory.

Amirkhanov, H. A. 1986. *Verhniy paleolit Prikubanya.* Moscow: Nauka.

Amirkhanov, H. A., M. V. Anikovich, and I. A. Borziak. 1993. Sur le problème de la transition du Moustérien au Paléolithique supérieur de la Plaine Russe et du Caucase. *L'Anthropologie* 97: 311–330.

Andreeva, S. M. 1980. Severo-Sibirskaia nizmennost' v Karginskoe Vremia: Paleogeografiia, radiouglerodnaia khronologiia. In *Geokhronologiia Chetvertichnogo Perioda.* pp. 183–191. Moscow: Nauka.

Andrefsky, W. Jr. 1998. *Lithics: Macroscopic Approaches to Analysis.* Cambridge: Cambridge University Press.

Anikovich, M. V. 1983. On possible south-western roots of the Kostenki-Streletskaya culture. In *Pervobytnye Drevnosti Moldavii.* V. P. Liubin, editor. pp. 193–202. Kishinev: Shtiintsa.

Anikovich, M. V. 1986. On some disputable questions in the study of the Paleolithic of the Pechora basin. In *Paleolit i Neolit.* V. P. Liubin, editor. pp. 39–45. Leningrad: Nauka.

Anikovich, M. V. 1987. On the validity of the "Babin phase" in the Upper Paleolithic of the Dniester region. In *Moldavskoe Podnestrovie v Pervobytnuyu Epokhu.* I. A. Borziyak, editor. pp. 42–63. Kishinev: Shtiintsa.

Anikovich, M. V. 1992. Early Upper Paleolithic industries of Eastern Europe. *Journal of World Prehistory* 6: 205–246.

Anikovich, M. V. 1999. The formation of Upper Paleolithic cultures and anatomically modern humans: The East European perspective. *Anthropologie* 37: 115–123.

Anikovich, M. V. 2000. The initial stage of the Upper Paleolithic in East Europe. *Stratum* 1: 11–30.

Anisiutkin, N. K., and S. N. Astakhov. 1970. K voprosu o drevneishikh pamiatnikakh Altaia. In *Sibir' i Eë Sosedi v Drevnosti.* pp. 27–33. Novosibirsk: Nauka.

Arembovskii, I. V. 1958. Stratigrafiia chetvertichnykh otlozhenii iuga vostochnoi Sibiri. *Trudy Irkutskogo Universiteta, Seriia Geologii* 14: 9–55.

Arembovskii, I. V., and L. N. Ivan'ev. 1953. Novoe obsledovanie Irkutskoi Paleoliticheskoi Stoianki. *Kratkie Soobshcheniia Instituta Istorii Material'noi Kul'tury* 49: 51–55.

Arkhipov, S. A. 1989. Khronostratigraficheskaia shkala lednikovogo Pleistotsena severa zapadnoi Sibiri. In *Pleistotsen Sibiri: Stratigrafiia i Mezhregional'nye Korreliatsii.* pp. 20–30. Novosibirsk: Nauka.

Arkhipov, S. A., and V. S. Volkova. 1994. *Geological History, Pleistocene Landscapes and Climate in Western Siberia*. Novosibirsk: United Institute of Geology, Geophysics and Mineralogy Press.

Arnold, J., editor. 2001. *The Origins of a Pacific Coast Chiefdom: The Chumash of the Channel Islands*. Salt Lake City: University of Utah Press.

Arslanov, Kh. A. 1992. The Late Pleistocene geochronological scale of the Russian Plain. In *Geokhronologia Chetvertichnogo Perioda*. pp. 10–19. Moscow: Nauka.

Aseev, I. V., and I. P. Kholiushkin. 1981. Novoe mestonakhozhdenie epokhi Paleolita v Raione Khorinska. In *Sibir' v Proshlom, Nastoiashem i Budushchem 3*. pp. 40–41. Novosibirsk: Nauka.

Aseev, I. V., and I. P. Kholiushkin. 1985. Paleoliticheskie mestonakhozhdeniia v Raione Knorinska (BSSR). In *Arkheologicheskie Issledovaniia v Rianakh Novostroek Sibiri*. pp. 7–11. Novosibirsk: Nauka.

Avdeev, S. M. 1986. Tobaginskaia skul'ptura kak obrazets provobutnogo iskusstva. In *Chetvertichnaia i Pervobytnaia Arkheologiia Iuzhnoi Sibiri*. pp. 80–83. Ulan-Ude: Nauka.

Azoury, I. 1986. *Ksar-'Akil, Lebanon. Vol. 1: Levels XXV–XII.* British Archaeological Reports International Series 289. Oxford: Archaeopress.

Bader, O. N. 1978. *The Upper Paleolithic Site of Sungir.* Moscow: Nauka.

Bar-Yosef, O. 1970. *The Epi-Paleolithic Cultures of Palestine*. Ph.D. dissertation. Jerusalem: Hebrew University.

Bar-Yosef, O. 1991. The search for lithic variability among Levantine Epi-Paleolithic industries. In *25 Ans d' études technologiques en Préhistoire. Bilan et perspectives. XIe Rencontres Internationales d'Archéologie et d'Histoire d'Antibes*. pp. 319–336. Antibes: APDCA.

Bar-Yosef, O. 1994. The contributions of southwest Asia to the study of the origin of modern humans. In *Origins of Anatomically Modern Humans*. M. H. Nitecki and D. V. Nitecki, editors. pp. 23–66. New York: Plenum.

Bar-Yosef, O. 1999. On the nature of transitions: The Middle to Upper Paleolithic and the Neolithic revolution. *Cambridge Archaeological Journal* 8: 141–163.

Bar-Yosef, O. 2000. The Middle and early Upper Paleolithic in southwest Asia and neighboring regions. In *The Geography of Neandertals and Modern Humans in Europe and the Greater Mediterranean*. O. Bar-Yosef and D. Pilbeam, editors. pp. 107–156. Cambridge, Massachusetts: Peabody Museum of Archaeology and Ethnology.

Bar-Yosef, O. 2002. The Upper Paleolithic revolution. *Annual Review of Anthropology* 31: 363–393.

Bar-Yosef, O., and A. Belfer-Cohen. 1996. Another look at the Levantine Aurignacian. In *The Late Aurignacian, Colloquium XI*. A. P. di Cesnola and A. Montet-White, editors. pp. 139–150. Forli: Proceedings of the XIIIe Congress of the Union Internationale des Sciences Préhistoriques et Protohistoriques.

Bar-Yosef, O., and S. L. Kuhn. 1999. The big deal about blades: Laminar technologies and human evolution. *American Anthropologist* 101: 322–338.

Bar-Yosef, O., and D. Pilbeam, editors. 2000. *The Geography of Neandertals and Modern Humans in Europe and the Greater Mediterranean*. Cambridge, Massachusetts: Peabody Museum of Archaeology and Ethnology.

Bar-Yosef, O., and B. Vandermeersch. 1972. The stratigraphical and cultural problems of the passage from Middle to Upper Paleolithic in Palestinian caves. In *The Origin of Homo Sapiens*. F. Bordes, editor. pp. 221–226. Paris: UNESCO.

Bar-Yosef, O., B. Vandermeersch, B. Arensburg, A. Belfer-Cohen, P. Goldberg, H. Laville, L. Meignen, Y. Rak, J. D. Speth, E. Tchernov, A. M. Tillier, and S. Weiner. 1992. The excavations in Kebara Cave, Mt. Carmel. *Current Anthropology* 33: 497–550.

Bärbel, M., R. Stadler, P. F. Stadler, G. P. Wagner, and W. Fontana. 2001. The topology of the possible: Formal spaces underlying patterns of evolutionary change. *Journal of Theoretical Biology* 213: 241–274.

Bard, E. 1998. Geochimical and geophysical implications of the radiocarbon calibration. *Geochimica et Cosmochimica Acta* 62: 2025–2038.

Bárta, J. 1962. *Slovensko v starsšej strednej dobe kamennej.* Bratislava: Slovenská Akademie Ved.

Bárta, J. 1986. Trenêianské Bohunslavice un habitat gravettien en Slovaquie occidentale. *L'Anthropologie* 93(1): 173–182.

Baumler, M. F. 1988. Core reduction, flake production, and the Middle Paleolithic industry of Zobiste (Yugoslavia). In *Upper Pleistocene Prehistory of Western Eurasia.* H. L. Dibble and A. Montet-White, editors. pp. 255–274. Philadelphia: The University Museum, University of Pennsylvania.

Baumler, M. F. 1995. Principles and properties of lithic core reduction: Implications for Levallois technology. In *The Definition and Interpretation of Levallois Technology.* H. L. Dibble and O. Bar-Yosef, editors. pp. 11–23. Madison: Prehistory.

Baumler, M. F., and J. D. Speth. 1993. A Middle Paleolithic assemblage from Kunji Cave, Iran. *The Paleolithic Prehistory of the Zagros-Taurus.* D. I. Olszewski and H. L. Dibble, editors. pp. 1–74. University Museum Monographs 83. Philadelphia: University of Pennsylvania.

Bazarov, D.-D. B. 1968. *Chetvertichnye Otlozheniia i Osnovnye Etapy Razvitiia Rel'efa Seleginskogo Srednoegor'ia.* Ulan-Ude: Buriatskoe Knizhnoe Izdatel'stvo.

Bazarov, D.-D. B., M. V. Konstantinov, A. B. Imetkhenov, L. D. Bazarova, and V. V. Savinova. 1982. *Geologiia i Kul'tura Drevnikh Poslelenii Zapadnogo Zabaikal'ia.* Novosibirisk: Nauka.

Bazarova, L. D. 1985. Drevnee Poselenie Tolbaga. In *Voprosu Geologii i Paleogeografii Sibiri i Dal'nego Vostoka.* pp. 157–163. Irkutsk: Irkutskii Gosudarstvennyi Universitet.

Beck, J. W., D. A. Richards, R. L. Edwards, B. W. Silverman, P. L. Smart, D. J. Donahue, S. Hererra-Osterheld, G. S. Burr, L. Calsoyas, A. J. T. Jull, and D. Biddulph. 2001. Extremely large variations of atmospheric ^{14}C concentrations during the last glacial period. *Science* 292: 2453–2458.

Belfer-Cohen, A. and L. Grosman. In press. Tools or cores? And why does it matter: Carinated artifacts in Levantine Upper Paleolithic assemblages. In *Tools or Cores: The Identification and Study of Alternative Core Technologies.* S. McPherron and J. Lindly, editors. Philadelphia: University of Pennsylvania Press.

Belova, V. A. 1985. *Rastitel'nost' i Klimat Pozdnego Kainozoia Iuga Vostochnoi Sibiri.* Novosibirsk: Nauka.

Berdzeneshvili, N. Z. 1972. The question of the Upper Paleolithic beginnings in Georgia. *The Stone Age in Central Asia and Kazakhstan.* Tashkent: FAN Press.

Bergman, C. A. 1987. *Ksar Akil, Lebanon: A Technological and Typological Analysis of Ksar Akil. Vol. II.* British Archaeological Reports International Series 329. Oxford: Archaeopress.

Bischoff, J. L., R. J. Rosenbauer, A. Tavoso, and H. de Lumley. 1988. A test of uranium-series dating of fossil tooth enamel: Results from Tournal Cave, France. *Applied Geochemistry* 3: 145–151.

Bluscz, A., J. K. Kozłowski, and E. Foltyn. 1994. A new sequence of EUP leaf point industries in southern Poland. *Préhistoire Européenne* 6: 197–222.

Bodu, P. 1990. L'application de la méthode des remontages á l'étude du matériel lithique des premiers niveaux châtelperroniens d'Arcy-sur-Cure. In *Paléolithique Moyen Récent et Paléolithique Supérieur Ancien en Europe, Ruptures et Transitions: Examen critique des documents archéologiques.* C. Farizy, editor. pp. 309–312. Nemours: CNRS.

Boëda, E. 1995a. Levallois: A volumetric construction, methods, a technique. In *The Definition and Interpretation of Levallois Technology.* H. L. Dibble and O. Bar-Yosef, editors. pp. 41–68. Madison: Prehistory.

Boëda, E. 1995b. Caractéristiques techniques des chaînes opératoires lithiques des niveaux micoquiens de Kulna (Tchécoslovaquie). In *Les industries à pointes foliacées d'Europe centrale.* Actes du Colloque commémoratif international "Les premières découvertes de Paléolithique à Miskolc et la question des industries à pièces foliacées de l'Europe centrale dans leur cadre chronologique, paléoécologique, paléontologique." pp. 57–72. Miskolc: Paléo Supplément 1.

Boëda, E., and S. Muhesen. 1993. Umm El Tlel (El Kowm, Syrie): Étude préliminaire des industries lithiques du Paléolithique Moyen et Supérieur. *Cahiers de l'Euphrate* 7: 47–91.

Bogutskij, A. B., A. S. Sytnik, and M. Yamada. 1997. Nouvelles perspectives de recherches sur le Paléolithique ancien et moyen dans la plaine russe occidentale. *Préhistoire Européenne* 11: 69–84.

Bolikhovskaya, N. S. 1995. *Evolution of the loess-soil formation of northern Eurasia.* Moscow: Moscow University Press.

Bonch-Osmolowski, G. A. 1925. Neanderthal remains in the Crimea. *American Journal of Physical Anthropology* 8: 114–115.

Bordes, F. 1958. Le passage du Paléolithique moyen au Paléolithique supérieur. In *Hundert Jahre Neanderthaler.* G. von Koenigswald, editor. pp. 175–181. Utrecht: Kemink en Zoon.

Bordes, F. 1968. *The Old Stone Age.* New York: McGraw-Hill.

Borziak, I. A. 1981. The Upper Paleolithic site of Klimautsy 1 in the middle Dniester. In *Arkheologicheskie Issledovania v Moldavii (1974–1976).* pp. 3–24. Kishinev: Shtiintsa.

Borziak I. A. 1983. Late Paleolithic of the Dniester-Carpathian region. In *Pervobytnye drevnosti Moldavii.* N. A. Ketraru, editor. pp. 33–64. Kishinev: Shtiintsa.

Borziak, I. A., G. V. Grigorieva, and N. A. Ketraru. 1981. *Poselenia Dreviekamennogo Veka na Sevro-Zapade Moldavii.* Kishinev: Shtiintsa.

Boule, M., H. Breuil, E. Licent, and P. Teilhard de Chardin. 1928. *Le Paléolithique de la Chine.* Paris: Archives de l'Institut de Paléontologie Humaine.

Bourguignon, L. 1998. Les industries du Paléolithique intermédiaire d'Umm el Tlel: nouveaux éléments pour le passage entre le Paléolithique moyen et supérieur dans le bassin d'El Khown. In *Préhistoire d'Anatolie, Genèse de deux mondes.* M. Otte, editor. pp. 709–730. Études et Recherches Archéologiques de l'Université de Liège (ERAUL) No. 85. Liège: Université de Liège.

Bourlon, J., and A. Bouyssonie. 1912. Grattoirs carénés: rabots et grattoirs nucléiformes: Essai de classification des grattoirs. *Revue Anthropologique 22° Année* 12: 475–486.

Bradley, B. A., M. Anikovich, and E. Giria. 1995. Early Upper Paleolithic in the Russian Plain: Streletskayan flaked stone artifacts and technology. *Antiquity* 69: 989–998.

Brantingham, P. J. 1999. *Astride the Movius Line: Late Pleistocene Lithic Technological Variability in Northeast Asia.* Ph.D. dissertation. Tucson: University of Arizona.

Brantingham, P. J., and S. L. Kuhn. 2001. Constraints on Levallois core technology: A mathematical model. *Journal of Archaeological Science* 28: 747–761.

Brantingham, P. J., J. W. Olsen, J. A. Rech, and A. I. Krivoshapkin. 2000. Raw material quality and prepared core technologies in northeast Asia. *Journal of Archaeological Science* 27: 255–271.

Brantingham, P. J., A. I. Krivoshapkin, J. Li., and Ya. Tserendagva. 2001. The Initial Upper Paleolithic in northeast Asia. *Current Anthropology* 42: 735–746.

Bräuer, G., and F. H. Smith. 1992. *Continuity or Replacement: Controversies in* Homo sapiens *Evolution.* Rotterdam: A. A. Balkema.

Buzy, D. 1929. Une station magdalénienne dans le Negev (Ain el Qedeirat). *Revue Biblique* 38: 364–381.

Camazine, S., J.-L. Deneubourg, N. R. Franks, J. Sneyd, G. Theraulaz, and E. Bonabeau. 2001. *Self-Organization in Biological Systems.* Princeton: Princeton University Press.

Cambell, J. B. 1980. Le problème des subdivisions du Paléolithique supérieur britannique dans le cadre européen. *Bulletin de la Société Royale Belge d' Anthropologie et de Préhistoire* 91: 39–77.

Cann, R. L., M. Stoneking, and A. C. Wilson. 1987. Mitochondrial DNA and human evolution. *Nature* 325:31–36.

Carbonell, E., M. Vaquero, J. Maroto, J. M. Rando, and C. Mallol. 2000. A geographic perspective on the Middle to Upper Paleolithic transition in the Iberian Peninsula. In *The Geography of Neandertals and Modern Humans in Europe and the Greater Mediterranean.* O. Bar-Yosef and D. Pilbeam, editors. pp. 5–34. Cambridge, Massachusetts: Peabody Museum of Archaeology and Ethnology.

Chabai, V. P., and A. E. Marks. 1998. Preliminary synthesis: Middle Paleolithic assemblage variability in western Crimea. In *The Middle Paleolithic of Western Crimea. Vol. 1.* A. E. Marks and V. P. Chabai, editors. pp. 355–368. Études et Recherches Archéologiques de l'Université de Liège (ERAUL) No. 84. Liège: Université de Liège.

Chabai, V. P., and K. Monigal, editors. 1999. *The Middle Paleolithic of Western Crimea. Vol. 2.* Études et Recherches Archéologiques de l'Université de Liège (ERAUL) No. 87. Liège: Université de Liège.

Chabai, V. P., Yu. E. Demidenko, and A. I. Yevtushenko. 2000. *Paleolit Krima: Metodi issledovani i kontseptualni podkhodi.* Simferopol-Kiev: Instituta Arkheologi, Krimski Filial.

Chebotareva, N. S., and I. A. Makarycheva. 1982. Geochronology of the environmental change in the glacial areas of East Europe during the Valdai time. In *Paleogeographia Evropy za Poslednie Sto Tysyach Let.* I. P. Gerasimov and A. A. Velichko, editors. pp. 16–27. Moscow: Nauka.

Chen T., and S. Yuan. 1988. Uranium-series dating of bones and teeth from Chinese Paleolithic sites. *Archaeometry* 30: 59–76.

Chen T., S. Yuan, and S. Gao. 1984. The study of uranium-series dating of fossil bones and an absolute age sequence for the main Paleolithic sites of North China. *Acta Anthropologica Sinica* 3: 259–269.

Cherdyntsev, V. V. 1969. *Uran-243*. Moscow: Nauka.

Chernysch, A. P. 1965. *Sur la date absolute des monuments paléolithiques de la région du Dniestr: Stratigraphie et périodisation*. Moscow: Nauka.

Chernysch, A. P. 1977. Multilevel Paleolithic site of Korman IV and its place in the Paleolithic. In *Mnogosloinaya Paleoliticheskaya Stoyanka Korman IV*. I. K. Ivanova, editor. pp. 7–77. Moscow: Nauka.

Chernysch, A. P. 1982. Mnogosloinaya palaeoliticheskaya stoyanka Molodova I. In *Molodova I: Unikal'noe Must'erskoe Poselenie na Srednem Dnestre*. G. I. Goretskij and I. K. Ivanova, editors. pp. 6–102. Moscow: Nauka.

Chernysch, A. P. 1987. Etalonnaya mnogosloinaya palaeoliticheskaya Molodova V: Arkheologia. In *Mnogosloinaya Palaeoliticheskaya Stoyanka Molodova V. Lyudi Kammennogo Veka: Okrozhayushchaya Sreda*. I. K. Ivanova and S. M. Tsejtlin, editors. pp. 7–93. Moscow: Nauka.

Cherskii, I. D. 1872. Noskol'ko sloev o Vyrytykh v Irkutske izdeliiakh Kamennogo Perioda. *Izvestiia Vostochno-Sibirskogo Otdela Russkogo Geograficheskogo Obschchestva* 3: 167–192.

Chinese Quaternary Research Association (CQRC). 1987. *Contributions to Quaternary Glaciology and Geology (Special Issue on ^{14}C Dating)*. Beijing: Geological Press.

Chmielewski, W. 1961. *La Civilisation de Jerzmanowice*. Wroclaw: Panstwowe Wydawnictwo Naukowe.

Chmielewski, W. 1972. The continuity and discontinuity of the evolution of the archaeological cultures in central and eastern Europe between the 55th and 25th millenaries B.C. In *The Origin of* Homo sapiens. F. Bordes, editor. pp. 173–179. Paris: UNESCO.

Clark, G. A. 1999. Modern human origins: Highly visible, curiously intangible. *Science* 283: 2029–2032.

Clark, G. A. 2000. The Middle Paleolithic in the Wadi al-Hasa: An overview. In *The Archaeology of the Wadi al-Hassa, West-Central Jordan. Vol. 2: Excavations and Research at Middle, Upper and Epipaleolithic Sites*. N. R. Coinman, editor. pp. 67–94. Anthropological Research Papers No. 52. Tempe: Arizona State University.

Clark, G. A., and J. M. Lindly. 1989. Modern human origins in the Levant and western Asia: The fossil and archaeological evidence. *American Anthropologist* 91: 962–985.

Clark, G. A., M. P. Neely, B. MacDonald, J. Schuldenrein, and K. 'Amr. 1992. Wadi al-Hasa Project–1992: Preliminary report. *Annual of the Department of Antiquities of Jordan* 36: 13–23.

Clark, G. A., J. Schuldenrein, M. Donaldson, H. Schwarcz, W. Rink, and S. Fish. 1997. Chronostratigraphic contexts of Middle Paleolithic at the 'Ain Difla rockshelter (WHS 634), west central Jordan. In *Studies in Early Near Eastern Production, Subsistence and Environment*. H. Gebel, Z. Kazafi, and G. Rollefson, editors. pp. 77–100. Berlin: Ex Oriente.

Clark, J. D. 1992. African and Asian perspectives on the origins of modern humans. *Philosophical Transactions of the Royal Society of London* B 337(1280): 201–215.

Cohen, V. Y., and V. N. Stepanchuk. 1999. Late Middle and early Upper Paleolithic evidence from the East European Plain and Caucasus: A new look at variability, interactions and transitions. *Journal of World Prehistory* 13: 265–319.

Cohen, V. Y., and V. N. Stepanchuk. 2000. Variability of Middle to Upper Paleolithic transition: New data from Eastern Europe. *Stratum* 1: 31–53.

Coinman, N. R. 1993. WHS 618–Ain el-Buhira: An Upper Paleolithic site in the Wadi Hasa, west-central Jordan. *Paléorient* 19: 17–37.

Coinman, N. R. 1998. The Upper Paleolithic of Jordan. In *The Prehistoric Archaeology of Jordan*. D. O. Henry, editor. pp. 39–63. British Archaeological Reports International Series 705. Oxford: Archaeopress.

Coinman, N. R. 2000. The Upper Paleolithic in the Wadi al-Hasa. In *The Archaeology of the Wadi al-Hasa, West-Central Jordan. Vol. 2: Excavations and Research at Middle, Upper and Epipaleolithic Sites*. N. R. Coinman, editor. pp. 143–160. Anthropological Research Papers No. 52. Tempe: Arizona State University.

Coinman, N. R., and J. R. Fox. 2000. Tor Sadaf (WHNBS 8): Transition to the Upper Paleolithic. In *The Archaeology of the Wadi al-Hasa, West-Central Jordan. Vol. 2: Excavations and Research at Middle, Upper na Epipaleolithic Sites*. Anthropological Research Papers No. 52. N. R. Coinman, editor. pp. 123–142. Tempe: Arizona State University.

Coinman, N. R., D. I. Olszewski, K. Abdo, T. Clausen, J. Cooper, J. Fox, M. al-Nahar, E. Richey, and L. Saele. 1999. Eastern Hasa Late Pleistocene Project: Preliminary report on the 1998 field season. *Annual of the Department of Antiquities of Jordan* 43: 9–25.

Coon, C. S. 1957. *The Seven Caves: Archaeological Explorations in the Middle East*. New York: Alfred Knopf.

Coon, C. S., and E. K. Ralph. 1955. Radiocarbon dates from Kara Kamar, Afghanistan. *Science* 122: 921–922.

Danilov, I. D. 1982. Pleistocene transgressions in northern west Siberia and the Pechora lowland. In *The Arctic Ocean and its Coast in the Cenozoic Era*. A. I. Tomachev, editor. pp. 368–372. New Delhi: Amerind Publishing.

Davis, R. S. 1978. The Palaeolithic. *The Archaeology of Afganistan*. F. R. Allchin and N. Hammond, editors. pp. 37–70. London: Academic.

Davis, R. S. 1998. The Enisei River of central Siberia in the Late Pleistocene. *Journal of Archaeological Research* 6: 169–194.

Davis, R. S., and V. A. Ranov. 1999. Recent work on the Paleolithic of central Asia. *Evolutionary Anthropology* 7: 186–193.

Demidenko, Y. E., editor. In press. *The Paleolithic of Crimea. Vol. 3: Siuren I*. Études et Recherches Archéologiques de l'Université de Liège (ERAUL). Liège: Université de Liège.

Demidenko, Y. E., and V. I. Usik. 1993a. The problem of changes in Levallois technique during the technological transition from the Middle to Upper Paleolithic. *Paléorient* 19(2): 5–15.

Demidenko, Y. E., and V. I. Usik. 1993b. On the Levallois technique in the Upper Paleolithic. In *UISPP, XIIe Congress. Vol. 2*. pp. 239–242. Bratislava: Institut Archéologique.

Demidenko, Y. E., and V. I. Usik. 1995. Establishing the potential evolutionary technological possibilities of the "Point" Levallois-Mousterian: Korolevo I site–

complex 2B in the Ukrainian Transcarpathians. In *The Definition and Interpretation of Levallois Technology.* H. L. Dibble and O. Bar-Yosef, editors. pp. 439–454. Madison: Prehistory.

Demidenko, Y. E., V. P. Chabai, M. Otte, A. I. Yevtushenk, and S. V. Tatartsev. 1998. Siuren I, an Aurignacian site in the Crimea (the investigations of the 1994–1996 field seasons). In *Préhistoire d'Anatolie, Genèse de deux mondes.* M. Otte, editor. pp. 367–414. Études et Recherches Archéologiques de l'Université de Liège (ERAUL) No. 85. Liège: Université de Liège.

Derevianko, A. P., and S. V. Markin. 1990. Predvaritel'nye itogi izucheniia Must'e Altaia. In *Arkheologicheskie, Etnograficheski i Antropologicheskie Issledovaniia v Mongolii.* pp. 73–102. Novosibirsk: Nauka.

Derevianko, A. P., and S. V. Markin, editors. 1998a. *Archaeology, Geology and Palaeography of the Pleistocene and Holocene of the Altai: Excursion Guide for the Congress of Novosibirsk (24 July–10 August 1998).* Novosibirsk: Institute of Archaeology and Ethnology Press.

Derevianko, A. P., and S. V. Markin. 1998b. II. The Paleolithic of the western Siberian Plain. In *The Paleolithic of Siberia: New Discoveries and Interpretations.* A. P. Derevianko, A. B. Shimkin, and W. R. Powers, editors. pp. 79–106. Chicago: University of Illinois Press.

Derevianko, A. P., and S. V. Markin, editors. 1998c. *The Problems of Paleoecology, Geology and Archaeology of the Paleolithic of the Altai.* Novosibirsk: Institute of Archaeology and Ethnography Press.

Derevianko, A. P., and V. I. Molodin. 1994. *Denisova Peschera: Chat I.* Novosibirsk: Rossiiskaia Akademiia Nauk.

Derevianko, A. P., and V. T. Petrin. 1988. Prostranstvennyi i vremennoi aspekty sushchestvovaniia kompleksova kamennogo tipa Kara-Bom. *Khronologiia i Kul'turnaia Prinadlezhnost' Pamiatnikov Kamennogo i Bronzogo Vekov Iuzhnoi Sibiri.* pp. 8–11. Barnaul: Nauka.

Derevianko, A. P., and V. T. Petrin. 1989. Arkheologiia Maloialomanskoi Peshchery. In *Karst Altae-Saianskoi Gornoi Oblasti i Sopredel'nykh Gornykh Stran.* pp. 16–19. Barnaul: Nauka.

Derevianko, A. P., and V. T. Petrin. 1995a. The Levallois of Mongolia. In *The Definition and Interpretation of Levallois Technology.* H. L. Dibble and O. Bar-Yosef, editors. pp. 455–471. Madison: Prehistory.

Derevianko, A. P., and V. T. Petrin. 1995b. *Investigations of the Tsagan-Agui Cave Site on the Southern Face of the Gobian Altai in Mongolia.* Novosibirsk: Institute of Archaeology and Ethnography, Siberian Branch of the Russian Academy of Sciences.

Derevianko, A. P., and A. N. Zenin. 1990. Paleoliticheskoe Mestonakhozhdenie Anui-1. In *Kompleksnye Issledovaniia Paleoliticheskikh Ob'esktov Basseina R. Anui.* pp. 31–42. Novosibirsk: Nauka.

Derevianko, A. P., R. S. Vasil'evskii, V. I. Molodin, and S. V. Markin. 1985a. *Arkheologicheskie Issledovaniia Denisovoi Peschery: Obshchie Svedeniia.* Novosibirsk: Nauka.

Derevianko, A. P., R. S. Vasil'evskii, V. I. Molodin, and S. V. Markin. 1985b. *Issledovanie Denisovoi Peschery: Opisanie Pleistotsenovykh Osadkov. Sloi 21–22.* Novosibirsk: Nauka.

Derevianko, A. P., R. S. Vasil'evskii, V. I. Molodin, and S. V. Markin. 1985c. *Issle-*

dovanie Denisovoi Peschery: Karakteristika Pleistotsenovykh Osadkov. Sloi 9. Novosibirsk: Nauka.

Derevianko, A. P., R. S. Vasil'evskii, V. I. Molodin, and S. V. Markin. 1985d. *Issledovanie Denisovoi Peschery: Opisanie Pleistotsenovykh Osadkov. Sloi 11–12*. Novosibirsk: Nauka.

Derevianko, A. P., R. S. Vasil'evskii, V. I. Molodin, and S. V. Markin. 1985e. *Issledovanie Denisovoi Peschery: Opisanie Pleistotsenovykh Osadkov. Sloi 13–18*. Novosibirsk: Nauka.

Derevianko, A. P., R. S. Vasil'evskii, V. I. Molodin, and S. V. Markin. 1985f. *Issledovanie Denisovoi Peschery: Opisanie Pleistotsenovykh Osadkov. Sloi 19–20*. Novosibirsk: Nauka.

Derevianko, A. P., V. I. Molodin, and S. V. Markin. 1987. *Arkheologicheskie Issledovaniia na Altae v 1986 G. (Predvaritel'nye Itogi Sovetsko-Iaponskoi Ekspeditsii)*. Novosibirsk: Nauka.

Derevianko, A. P., D. Dorzh, R. S. Vasil'evskii, V. E. Larichev, V. T. Petrin, E. V. Deviatkin, and E. M. Malaeva. 1990a. *Paleolit i Neolit Mongol'skogo Altaia*. Novosibirsk: Nauka.

Derevianko, A. P., I. V. Grichan, M. I. Dergacheva, A. N. Zenin, S. A. Laukhin, G. M. Levkovskaia, A. M. Maloletko, S. V. Markin, V. I. Molodin, N. D. Ovodov, V. T. Petrin, and M. V. Sun'kov. 1990b. *Arkheologii i Paleoekologiia Paleolita Gornogo Altaia*. Novosibirsk: Nauka.

Derevianko, A. P., G. M. Levkovskaia, S. A. Laukhin, and M. V. Shun'kov. 1992a. Klimatostratigrafiia Nizhnego Paleoliticheskogo sloia na Privkhodovoi Chasti razreza mnogosloinoi stoianki Denisova Peshchera. In *Paleoekologiia i Rasselenie Drevnego Cheloveka v Severnoi Azii i Amerike*. pp. 75–77. Krasnoiarsk: Nauka.

Derevianko, A. P., S. V. Nikolaev, and V. T. Petrin. 1992b. *Geology, Sratigraphy and Paleogeography of the Southern Hangai*. Novosibirsk: Institute of Archaeology and Ethnography.

Derevianko, A. P., M. V. Shun'kov, S. A. Laukhin, Z. N. Gnibidenko, G. M. Levkovskaia, and L. A. Orlova. 1992c. Vozrast Altaiskogo Must'e v svete noveishikh dannykh. In *Paleoekologiia i Rasselenie Drevnego Cheloveka v Severnoi Azii i Amerike*. pp. 83–86. Krasnoiarsk: Nauka.

Derevianko, A. P., J. W. Olsen, and D. Tseveendorj, editors. 1996. *A Preliminary Report on Archaeological Studies Carried Out by the Joint Mongolian-Russian-American Expedition to Mongolia in 1995*. Novosibirsk: Institute of Archaeology and Ethnology Press, Siberian Branch of the Russian Academy of Sciences.

Derevianko, A. P., A. K. Agadjanian, G. F. Baryshnikov, M. I. Dergacheva, E. M. Malaeva, S. V. Markin, V. I. Molodin, S. V. Nikolaev, L. A. Orlova, V. T. Petrin, A. V. Postnov, V. A. Ulanov, I. K. Fedeneva, I. V. Foronova, and M. V. Shunkov. 1998a. *Archaeology, Geology, and the Pleistocene and Holocene Paleogeography of the Mountainous Altai*. Novosibirsk: Institute of Archaeology and Ethnology Press.

Derevianko, A. P., U. I. Islamov, V. T. Petrin, R. H. Suleimanov, K. Alimov, K. A. Krahmal', I. N. Fedeneva, A. N. Zenin, A. I. Krivoshapkin, and A. A. Anoikin. 1998b. Works in the Obi-Rakhmat shelter (the Republic of Uzbekistan) in 1998. In *Problems of the Archaeology, Ethnography and Anthropology of Siberia and Adjacent Regions*. pp. 37–45. Novosibirsk: Institute of Archaeology and Ethnography, Siberian Branch of the Russian Academy of Sciences.

Derevianko, A. P., J. W. Olsen, and D. Tseveendorj, editors. 1998c. *Archaeological Studies Carried out by the Joint Russian-Mongolian-American Expedition in Mongolia in 1996*. Novosibirsk: Institute of Archaeology and Ethnology Press, Siberian Branch of the Russian Academy of Sciences.

Derevianko, A. P., V. T. Petrin, and M. Otte. 1998d. Variante de la transition du Moustérien au Paléolithique tardif à l'Altai. In *Préhistoire d'Anatolie, Genèse de deux mondes*. M. Otte, editor. pp. 815–843. Études et Recherches Archéologiques de l'Université de Liège (ERAUL) No. 85. Liège: Université de Liège.

Derevianko, A. P., V. T. Petrin, E. P. Rybin, and L. M. Chevalkov. 1998e. *Paleoliticheskie Kompleksy Stratifitsirovannoi Chasti Stoianki Kara Bom*. Novosibirsk: Institute of Archaeology and Ethnology Press.

Derevianko, A. P., D. B. Shimkin, and W. R. Powers, editors. 1998f. *The Paleolithic of Siberia: New Discoveries and Interpretations*. Chicago: University of Illinois Press.

Derevianko, A. P., V. T. Petrin, S. V. Nikolaev, and E. P. Rybin. 1999. The Kara Bom site: Mousterian to Late Paleolithic evolution of the lithic industry in the Altai. In *Quaternary of Siberia: Quaternary Geology, Palaeontology, and Palaeolithic Archaeology*. J. Chlachula, R. A. Kemp, and J. Tyrácek, editors. pp. 167–180. Prague: Czech Geological Survey.

Derevianko, A. P., J. W. Olsen, and D. Tseveendorj, editors. 2000a. *Archaeological Studies Carried out by the Joint Russian-Mongolian-American Expedition in Mongolia in 1997–1998*. Novosibirsk: Institute of Archaeology and Ethnology Press, Siberian Branch of the Russian Academy of Sciences.

Derevianko, A. P., J. W. Olsen, D. Tseveendorj, A. I. Krivoshapkin, V. T. Petrin, and P. J. Brantingham. 2000b. The stratified cave site of Tsagaan Agui in the Gobi Altai (Mongolia). *Archaeology, Ethnology and Anthropology of Eurasia* 1(1): 23–36.

Derevianko, A. P., V. T. Petrin, and E. P. Rybin. 2000c. The Kara Bom site and the characteristics of the Middle-Upper Paleolithic transition in the Altai. *Archaeology, Ethnology and Anthropology of Eurasia* 2(2): 33–52.

Derevianko, A. P., S. A. Gladyshev, J. W. Olsen, V. T. Petrin, and Ya. Tserendagva. 2001. Characteristic features of the Chikhen Agui Lithic assemblage (Gobi Altai). *Archaeology, Ethnology and Anthropology of Eurasia* 1(5): 25–39.

d'Errico, F., and V. Laroulandie. 2000. Bone technology at the Middle-Upper Paleolithic transition: The case of the worked bones from Buran-Kaya III Level C. In *Neanderthals and Modern Humans–Discussing the Transition: Central and Eastern Europe from 50,000–30,000 B.P.* J. Orschiedt and G. C. Weniger, editors. Mettmann, Germany: Neanderthal Museum.

d'Errico, F., J. Zilhão, M. Julien, D. Baffier, and J. Pelegrin. 1998. Neandertal acculturation in western Europe? A critical review of the evidence and its interpretation. *Current Anthropology* 39: S1–S44.

Dibble, H. L. 1995. Middle Paleolithic scraper reduction: Background, clarification, and review of the evidence to date. *Journal of Archaeological Method and Theory* 2: 299–368.

Dibble, H. L., and S. J. Holdaway. 1993. The Middle Paleolithic industries of Warwasi. In *The Paleolithic Prehistory of the Zaros-Taurus*. D. I. Olszewski and H. L. Dibble, editors. pp. 75–100. University Museum Monographs 83. Philadelphia: University of Pennsylvania.

Dibble, H. L., and O. Bar-Yosef. 1995. In *The Definition and Interpretation of Levallois Technology.* H. L. Dibble and O. Bar-Yosef, editors. Madison: Prehistory.

Djindjian, F. 1993. Les origines du peuplement aurignacian en Euorpe. In *Aurignacien en Europe et au Proche Orient.* L. Bánesz and J. K. Kozłowski, editors. pp. 136–154. Bratislava: Actes du XIIe Congrês International des Sciences Préhistoriques et Protohistoriques.

Djurakulov, M. D. 1987. *The Samarkandskaya Site.* Tashkent: FAN Press.

Dodonov, A. E. 1986. *The Anthropogene in Southern Tadjikistan.* Moscow: Nauka.

Drozdov, N. I., J. Chlachula, and V. P. Chekha. 1999. Pleistocene environments and Paleolithic occupation of the northern Minusinsk Basin, southern Krasnoiarsk Region. In *Quaternary of Siberia: Quaternary Geology, Palaeontology, and Palaeolithic Archaeology.* J. Chlachula, R. A. Kemp, and J. Tyrácek, editors. pp. 141–155. Prague: Czech Geological Survey.

Duffy, J. E., C. L. Morrison, and R. Rios. 2000. Multiple origins of eusociality among sponge-dwelling shrimps *(Synalpheus). Evolution* 54: 503–516.

Efimenko, P. P. 1956. Something new in the problem of the origin of the culture of the Late Paleolithic of Central and Eastern Europe. (Novye problemi proishozdeniya cultur pozdnego paleolita v Centralnoi i Vostochnoi Europe). *Acta Archeologica 7 (Hungarian Academy of Science).*

Elston, R. G., and P. J. Brantingham. 2002. Microlithic technology in northeast Asia: A risk minimizing strategy of the Late Paleolithic and Early Holocene. In *Thinking Small: Global Perspectives on Microlithization.* R.G. Elston and S.L. Kuhn, editors. pp. 103–116. Archaeological Papers of the American Anthropological Association No. 12. Arlington: American Anthropological Association.

Elston, R. G., C. Xu, D. B. Madsen, K. Zhong, R. L. Bettinger, J. Li, P. J. Brantingham, H. Wang, and J. Yu. 1997. New dates for the Chinese Mesolithic. *Antiquity* 71: 985–993.

Floss, H., and L. Niven. 2000. Der Vogelherd. In *Hugo Obermaier Gesellscaft, 42.* pp. 25–33. Tagung, Exkursionen. Tübingen, April 25–29, 2000.

Foley, R., and M. M. Lahr. 1997. Mode 3 technologies and the evolution of modern humans. *Cambridge Archaeological Journal* 7(1): 3–36.

Fox, J. R. 2000. *The Rockshelter of Tor Sadaf: A Middle to Upper Paleolithic Transitional Site in the Wadi al-Hasa, West-Central Jordan.* Master's thesis. Ames: Iowa State University.

Frayer, D. W., M. H. Wolpoff, A. G. Thorne, F. H. Smith, and G. G. Pope. 1993. Theories of modern human origins: The paleontological test. *American Anthroplogist* 95: 14–50.

Gábori, M. 1976. *Les civilisations du Paléolithique moyen entre les Alpes et l'Oural.* Budapest: Akadémiai kaidó.

Gábori-Csánk, V. 1994. *Le Jankovichein.* Études et Recherches Archéologiques de l'Université de Liège (ERAUL) No. 53. Liège: Université de Liège.

Gambassini, P. 1997. *Il Paleolitico di Cestelcivita: Culture e ambiente.* Napoli: Electa.

Gambier, D. 1989. Fossil hominids from the Early Upper Paleolithic (Aurignacian) of France. In *The Human Revolution: Behavioural and Biological Perspectives on the Origins of Modern Humans.* C. Stringer and P. Mellars, editors. pp. 194–211. Princeton: Princeton University Press.

Gao Xing. 1999. A discussion of the "Chinese Middle Paleolithic." *Acta Anthropologica Sinica* 18: 1–16.

Garrod, D. A. E. 1929. Excavations in the Mugharet el-Wad, near Athlit. April–June, 1929. *Palestine Exploration Fund Quarterly Statement* October 1929: 220–222.

Garrod, D. A. E. 1951. A transitional industry from the base of the Upper Paleolithic in Palestine. *Journal of the Royal Anthropological Institute* 80: 121–130.

Garrod, D. A. E. 1955. The Mugharet el-Emireh in lower Galilee: The type station of the Emiran industry. *Journal of the Royal Anthropological Institute* 85: 141–162.

Garrod, D. A. E., and D. M. A. Bate. 1937. *The Stone Age of Mount Carmel. Vol. 1*. Oxford: Clarendon.

Geneste, J.-M., L. Meignen, H. Plisson, L. Koulakovskaya, and A. Sytnik. 1999. L'industrie lithique des niveaux inférieurs de Koulytchivka (Krzemieniec), Ykraine. In *Sovremennye Eksperimentalno-Trasologicheskie i Techniko Tipologicheskie Razrabotki v Arkheologii*. G. F. Korobkova, editor. pp. 153–154. St. Petersburg: Institute for the History of Material Culture.

Geng, K. and P. Dan. 1992. *The Yinchuan Area: Past, Present and Future: Processes of Late Quaternary Environmental Evolution*. Beijing: Cartographic Publishing House.

Gerasimenko, N. P., and A. V. Kolesnik. 1992. Archaeological and stratigraphic study of the site of Belokuzminovka (Dondas) in 1986. *Rossijskaya Arkheologia* 3: 127–135.

Germonpré, M. 1993. Preliminary results on the taphonomy of Denisova Cave 1992 excavations. *Altaica* 2: 11–16.

Germonpré, M., and L. Lbova. 1996. Mammalian remains from the Upper Palaeolithic site of Kamenka, Buryatia (Siberia). *Journal of Archaeological Science* 23: 35–57.

Gilead, I. 1981. Upper Palaeolithic tool assemblages from The Negev and Sinai. In *Préhistoire du Levant. Chronologie et organisation de l'espace depuis les origines jusau'au VI millénaire*. J. Cauvin and P. Sanlaville, editors. pp. 331–342. Paris: CNRS.

Gilead, I. 1991. The Upper Paleolithic period in the Levant. *Journal of World Prehistory* 5: 105–153.

Ginter, B., J. K. Kozłowski, H. Laville, N. Sirakov, and R. E. M. Hedges. 1996. The transition in the Balkans: news from Temnata Cave, Bulgaria. In *The Last Neandertals, the First Anatomically Modern Humans: A Tale about Human Diversity, Cultural Change and Human Evolution: The Crisis at 40,000 BP*. E. Carbonell and M. Vaquero, editors. pp. 169–200. Tarragona: Universitat de Rovira i Virgili.

Ginter, B., J. K. Kozłowski, J. L. Guadelli, and H. Laville, editors. 2000. *Temnata Cave: Excavation in Karlukovo Karst Area, Bulgaria. Vol.* 2. Kraków: Jagellonian University.

Gioia, P. 1988. Problems related to the origins of Italian Upper Paleolithic: Uluzzian and Aurignacian. In *L'Homme de Néandertal 8, La Mutation*. J. K. Kozłoski, editor. pp. 71–101. Études et Recherches Archéologiques de l'Université de Liège (ERAUL). Liège: Université de Liège.

Gladilin, V. N. 1970. Les variantes techniques et les types d'industries dans le Moustérien de la Plaine Russe et de la Crimée. Prague: Proceedings of the VIIth Congress of the Union Internationale des Sciences Préhistoriques et Protohistoriques.

Gladilin, V. N., and J. Demidenko. 1989a. The Korolevo Paleolithic site. *Anthropologie* 27: 93–103.

Gladilin, V. N., and J. Demidenko. 1989b. Upper Paleolithic stone tool complexes from Korolevo. *Anthropologie* 27: 143–178.

Gladilin, V. N., and Y. E. Demidenko. 1989c. On the origin of the Kostenki-Streletskaya culture: Europe or Asia? In *Chetvertichnyi Period. Paleontologia i arkheologia.* A. L. Yanshin editor. pp. 187–194. Kishinev: Shtiintsa.

Glen, E., and N. I. Kaczanowski. 1982. Human remains. *Excavation in the Bacho Kiro Cave (Bulgaria): Final Report.* J. K. Kozłowski, editor. pp. 75–80. Warsaw: Panstowe Wudawinictwo Naukowe.

Goebel, T. 1993. *The Middle to Upper Paleolithic Transition in Siberia.* Ph.D. dissertation. Fairbanks: University of Alaska.

Goebel, T. 1999. Pleistocene human colonizatin of Siberia and peopling of the Americas: An ecological approach. *Evolutionary Anthropology* 8: 208–227.

Goebel, T. 2002. The "microblade adaptation" and re-colonization of Siberia during the late Upper Pleistocene. In *Thinking Small: A Global Perspective on Microlithic Technology.* R. G. Elston and S. L. Kuhn, editors. pp. 117–131. Archaeological Papers of the American Anthropological Association No. 12. Arlington: American Anthropological Association.

Goebel, T., and M. Aksenov. 1995. Accelerator radiocarbon dating of the initial Upper Paleolithic in southeast Siberia. *Antiquity* 69: 349–357.

Goebel, T., and M. R. Waters. 2000. New AMS ^{14}C ages for the Tolbaga Upper Paleolithic site, Transbaikal, Siberia. *Current Research in the Pleistocene* 17: 32–33.

Goebel, T., A. P. Derevianko, and V. T. Petrin. 1993. Dating the Middle-to-Upper-Paleolithic transition at Kara-Bom. *Current Anthropology* 34: 452–458.

Goebel, T., M. R. Waters, and M. N. Meshcherin. 2001. Masterov Kliuch and the early Upper Paleolithic of the Transbaikal, Siberia. *Asian Perspectives* 39: 47–70.

Golovanova, L. V., J. F. Hoffecker, V. M. Kharatonov, and G. P. Romanova. 1999. Mezmaiskaya Cave: A Neanderthal occupation in the northern Caucasus. *Current Anthropology* 40: 70–86.

Goring-Morris, N. 1987. *At the Edge: Terminal Pleistocene Hunter-Gatherers in the Negev and Sinai.* British Archaeologial Reports, International Series 362i and ii. Oxford: Archaeopress.

Grayson, D. K., and F. Delpech. 2002. Specialized early Upper Palaeolithic hunters in southwestern France? *Journal of Archaeological Science* 29: 1439–1449.

Grigorieva, G. V. 1983a. Korpatch, un gisement stratifié du Paléolithic supérieur en Moldavie. *L'Anthropologie* 87: 215–220.

Grigorieva, G. V. 1983b. Palynological and radiocarbon data for the multilevel site of Korpatch. In *Pervobytnye drevnosti Moldavii.* N. A. Ketraru, editor. pp. 202–206. Kisinev: Shtiintsa.

Grün, R., and C. Stringer. 1991. Electron spin resonance dating and the evolution of modern humans. *Archaeometry* 33: 153–199.

Guilbaud, M. 1987. Elaboration d'un cadre morphotechnique pour l'étude de débitage en typologie analytique de quelques industries des gisements de St.-Césaire (Charente Maritime) et de Quiçay (Vienne). In *Préhistoire de Poitou-Charente: Problêmes actuels.* pp. 101–113. Paris: Comité des Travaux Historiques et Scientifiques.

Guilbaud, M. 1996. Psychotechnic analysis and culture change: Origins of the Upper Paleolithic as seen through the example of Saint Césaire. In *The Last Neandertals, the First Anatomically Modern Humans: A Tale about Human Diversity. Cultural Change and Human Evolution: The Crisis at 40,000 BP.* E. Carbonell and M. Vaquero, editors. pp. 335–354. Tarragona: Universitat de Rovira i Virgili.

Guthrie, R. D. 1983. Paleocology of the site and its implications for early hunters. In *Archaeology and Paleoecology of a Late Pleistocene Alaskan Hunting Camp*. W. R. Powers, R. D. Guthrie, and J. F. Hoffecker, editors. pp. 209–287. Report submitted to the U.S. National Park Service, Anchorage. Contract CX-9000-7-0047.

Haesaerts, P., F. Damblon, M. Bachner, and G. Trnka. 1996. Revised stratigraphy and chronology of the Willendorf II sequence, Lower Austria. *Archaeologia Austriaca* 80: 25–42.

Hahn, J. 1977. *Aurignacien-Das ältere Jungpaläolithikum in Mittel- und Osteuropa.* Cologne-Graz: Bohlaus.

Hahn, J. 1993. L'origine du Paléolithique supérieur en Europe centrale: les datation C14. In *El origen del hombre moderno en el suroeste de Europa.* V. Cabrera, editor. pp. 61–80. Madrid: Universidad Nacional de Educación a Distancia.

Hahn, J. 1995. Neue Beschleuniger-14C-Daten zum Jungpaläolithikums in Südwestdeutschland. *Eiszeitalter Und Gegenwart* 45: 86–92.

Hardy, B. L., M. Kay, A. E. Marks, and K. Monigal. 2001. Stone tool function at the paleolithic sites of Starosele and Buran Kaya III, Cirmea: Behavioral implications. *Proceedings of the National Academy of Sciences* 98: 10972–10977.

Harrold, F. B. 1989. Mousterian, Châtelperronian and Early Aurignacian in Western Europe: Continuity or discontinuity? In *The Human Revolution: Behavioural and Biological Perspectives on the Origins of Modern Humans.* C. Stringer and P. Mellars, editors. pp. 677–713. Princeton: Princeton University Press.

Harrold, F. B. 2000. The Chatelperronian in historical context. *Journal of Anthropological Research* 56: 59–75.

Hawks, J., K. Hunley, Lee S.-H., and M. Wolpoff. 2000. Population bottlenecks and Pleistocene human evolution. *Molecular Biology and Evolution* 17: 2–22.

Hay, J. 1997. Mitochondrial and nuclear genes present conflicting portraits of human origins. *Molecular Biology and Evolution* 16: 166–172.

Henry, D. O. 1982. The prehistory of Jordan and relationships with the Levant. *Journal of Field Archaeology* 9: 417–444.

Henry, D. O. 1988. Summary of prehistoric and paleoenvrionmental research in the northern Hisma. In *The Prehistory of Jordan: The State of Research in 1986. Part 1*. A. Garrard and H. Gebel, editors. pp. 7–37. British Archaeological Reports International Series 396. Oxford: Archaeopress.

Hoffecker, J. F. 1999. Neandertals and modern humans in Eastern Europe. *Evolutionary Anthropology* 7: 129–141.

Hole, F., and K. V. Flannery. 1967. The prehistory of southwestern Iran: A preliminary report. *Proceedings of the Prehistoric Society* 33: 147–206.

Hopkins, D. M. 1982. Aspects of the paleogeograhy of Beringia during the Late Pleistocene. In *Paleoecoogy of Beringia.* D. M. Hopkins, J. V. Matthews, C. E. Schweger, and S. B. Young, editors. pp. 3–28. New York: Academic.

Hours, F. 1974. Remarques sur l'utilisation de liste-types pur l'etude du Paléolithique Supérieur et l'Épipaléolithique du Levant. *Paléorient* 2: 3–19.

Hovers, E. 1998. The lithic assemblages of Amud Cave: Implications for understanding the end of the Mousterian in the Levant. In *Neandertals and Modern Humans in Western Asia* T. Akazawa, K. Aoki, and O. Bar-Yosef, editors. pp. 143–163. New York: Plenum.

Howell, F. C. 1994. A chronostratigraphic and taxonomic framework of the origins of modern humans. In *Origins of Anatomically Modern Humans.* M. H. Nitecki and D. V. Nitecki, editors. pp. 253–320. New York: Plenum.

Inizan, M. L., H. Roche, and J. Tixier. 1992. *Technology of knapped Stone.* Meudon: Cercle de Recherches et d'Etudes Préhistoriques.

Ivanova, I. K. 1969. Etude géologique des gisements paléolithiques de l'URSS. *L'Anthropologie* 73: 5–48.

Ivanova, I. K. 1987. Paleogeographiya i paleoekologiyasredi obitaniya ludey kamennogo veka na srednem Dnestre. *Mnogoslojnaya Palaeoliticheksaya Stoyanka Moldova V. Lyudi Kammennogo Veka: Okruzhayushchaya Sreda.* I. K. Ivanova and S. M. Tsejtin, editors. Moscow: Nauka.

Janevič, A. A. 1998. Buran-Kaya 3–Neue Angaben zur Kulturgleiderung des Jungpaläolithikums der Krim. *Préhistoire Européenne* 13: 133–148.

Jaubert, J., Giscard P.-H., Z. Batsaikhan, D. Erdenebaatar, and Ch. Servelle. 1997. Contribution à la Connaissance du Paléolithique de Mongolie: Étude de Sites de L'Aïmak de Hovd (Altaï Mongol). *L'Anthropologie* 101: 419–447.

Jelinek, A. J. 1981. The Middle Paleolithic in the southern Levant from the perspective of the Tabun Cave, Mount Carmel (Israel). In *Préhistoire du Levant. Chronologie et organization de l'espace depuis les origines jusau'au VI millénaire.* J. Cauvin and P. Sanlaville, editors. pp. 265–280. Paris: CNRS.

Jelínek, J. 1983. The Mladec finds and their evolutionary importance. *Anthropologie* 21: 57–64.

Jia, L., and W. Huang. 1985. The Late Paleolithic of China. In *Paleoanthropology and Paleolithic Archaeology in the People's Republic of China.* R. Wu and J. W. Olsen, editors. pp. 211–223. Orlando: Academic.

Jia, L., P. Gai, and Y. Li. 1964. New materials from the Paleolithic site of Shuidonggou. *Vertebrata Palasiatica* 8: 75–86.

Jorde, L., W. Watkins, B. Bamshad, M. Dixon, C. Rocker, M. Sielstad, and M. Batzer. 2000. The distribution of human genetic diversity: A comparison of mitochondrial, autosomal and Y-chromosome data. *American Journal of Human Genetics* 66: 979–988.

Jöris, O., and B. Weninger. 1996. Calendric age-conversion of glacial radiocarbon data at the transition from the Middle to Upper Paleolithic in Europe. *Bulletin de la Société Préhistorique Luxembourgeoise* 18: 43–55.

Kanivets, V. I. 1976. *The Paleolithic of the Extreme North-East of Europe.* Moscow: Nauka.

Karavanič, I. 1995. Upper Paleolithic occupation levels and late-occuring Neandertal at Vindija Cave (Croatia) in the context of central Europe and the Balkans. *Journal of Anthropolgical Research* 51: 9–35.

Karavanič, I., and F. H. Smith. 1998. The Middle/Upper Paleolithic interface and the relationship of Neanderthals and early modern humans in the Hrvatsko Zagorje, Croatia. *Journal of Human Evolution* 34: 223–248.

Kasymov, M. R. 1972. The multi-layered Paleolithic site of Kulbulak in Uzbekistan. *Materialy i Issledovania po Arkheologii* 185: 111–119.

Kasymov, M. R., and T. Yu. Grechkina. 1994. Kul'bulak (Uzbekistan) and its significance for the Paleolithic of Central Asia. In *New Archaeological Discoveries in Asiatic Russia and Central Asia.* V. M. Masson, editor. pp. 5–13. St. Petersburg: Institute for the History of Material Culture.

Kelly, R. L. 1988. The three sides of a biface. *American Antiquity* 53: 717–734.

Kelly, R. L. 2001. *Prehistory of the Carson Desert and Stillwater Mountains: Environment, Mobility, and Subsistence in a Great Basin Wetland.* University of Utah Anthropological Papers No. 123. Salt Lake City: University of Utah Press.

Ketraru, N. A. 1973. *Paleolithic and Mesolithic Sites: Archaeological Map of Moldavian SSR.* Kishinev: Shtiintsa.

Kharitonov, V. M., and V. A. Batsevich. 1997. Finds of fossil hominids on the territory of East Europe and in adjacent regions of Asia. *Vestnik Antropologii* 3: 48–72.

Kind, N. V. 1974. *Geokhronologiia Pozdnego Antropogena po Izotopnym Dannym. Trudy 257.* Moscow: Geologicheski Institute, Nauka.

Kirillov, I. I. 1984. Zabaikal'skii Paleolit v svete novykh otkrytii. In *Problemy Issledovaniia Kamennogo Veka Evrazii.* pp. 46–49. Krasnoiarsk: Krasnoiarsk Gosudarstvennyi Pedoagogicheskii Institut.

Kirillov, I. I. 1987. Tolbaginskaia Paleoliticheskaia kul'tura Zabaikal'ia i eë korreliatsiia s kul'turami Sopredel'nykh Territorii. In *Drevnosti Sibiri i Dal'nego Vostoka.* pp. 68–73. Novosibirisk: Nauka.

Kirillov, I., and A. Derevianko. 1998. XII. The Paleolithic of the Trans-Baikal area. In *The Paleolithic of Siberia: New Discoveries and Interpretations.* A. P. Derevianko, A. B. Shimkin, and W. R. Powers, editors. pp. 137–150. Chicago: University of Illinois Press.

Kirillov, I. I., and A. K. Kasparov. 1990. Arkheologiia Zabaikal'ia: Problemy i perspectivy (epokha Paleolita). In *Khronostratigrafiia Paleolita Severnoi, Tsentral'noi, i Vostochnoi Azii i Amerike.* pp. 194–198. Novosibirsk: Nauka.

Kitagawa, H., and J. van der Picht. 1998a. Atmospheric radiocarbon calibration to 45,000 yr BP: Late glacial fluctuations and cosmogenic isotope production. *Science* 279: 1187–1190.

Kitagawa, H., and J. van der Picht. 1998b. A 40,000 Year varve chronology from Lake Suigetsu, Japan: Extension of the ^{14}C calibration curve. *Radiocarbon* 40(1): 505–515.

Klein, R. G. 1994. The problem of modern human origins. In *Origins of Anatomically Modern Humans.* M. H. Nitecki and D. V. Nitecki, editors. pp. 3–17. New York: Plenum.

Klein, R. G. 1995. Anatomy, behavior and modern human origins. *Journal of World Prehistory* 9: 167–198.

Klein, R. G. 1998. Why anatomically modern people did not disperse from Africa 100,000 years ago. In *Neandertals and Modern Humans in Western Asia.* T. Akazawa, K. Aoki, and O. Bar-Yosef, editors. pp. 509–521. New York: Plenum.

Klein, R. G. 1999. *The Human Career: Human Biological and Cultural Origins.* 2nd ed. Chicago: University of Chicago Press.

Klein, R. G. 2001. Fully modern humans. In *Archaeology at the Millenium: A Sourcebook.* G. M. Feinman and T. D. Price, editors. pp. 109–135. New York: Kluwer.

Knecht, H. 1993. Splits and wedges: The techniques and technology of early Aurignacian antler working. In *Before Lascaux: The Complex Record of the Early Upper Paleolithic.* H. Knecht, A. Pike-Tay, and R. White, editors. pp. 137–162. Boca Raton: CRC Press.

Konstantinov, M. V. 1973. Tolbaga—Novoe Paleoliticheskoe poselenie v Doline R. Khilok (zapadnoe Zabaikal'e). In *Problemy Etnogeneza Narodov Sibiri i Dal'nego Vostoka.* Novosibirisk: Nauka.

Konstantinov, M. V. 1975. Paleoliticheskie pamiatniki v Doline R. Khilok (zapadnoe Zabaikal'e). In *Arkheologiia Severnoi i Tsentral'noi Azii.* pp. 40–48. Novosibirsk: Nauka.

Konstantinov, M. V. 1980. Kul'turno-istoricheskie etapy drevneishei istorii iugozapada Zabaikal'ia. In *Arkheologicheskii Poisk (Severnaia Azii).* pp. 16–24. Novosibirsk: Nauka.

Konstantinov, M. V. 1994. *Kamennyi Vek Vostochnogo Regiona Baikal'skoi Azii.* Ulan-Ude and Chita: Chita Pedagogical University Press.

Konstantinov, M. V., editor. 1996. *New Paleolithic Sites in the Transbaikal.* Chita: Chita Pedagogical University Press.

Konstantinov, M. V., and A. V. Konstantinov. 1991. Nachalo Pozdnego Paleolita v Zaibaikal'e. In *Problemy Khronologii i Periodizatsii Arkheologicheskikh Pamiantnikov Iuzhnyi Sibiri.* pp. 13–15. Barnaul: Nauka.

Konstantinov, M. V., V. B. Sumarokov, A. K. Filippov, and N. M. Ermolova. 1983. Drevneishaia skul'ptura Sibiri. *Kratkie Soobshcheniia Instituta Arkheologii Akademii Nauk SSSR* 92: 78–81.

Korobkova, G. F., and M. D. Djurakulov. 2000. The Samarkandskaya site as the model of the Upper Paleolithic in Central Asia. *Stratum* 1: 385–462.

Koumouzelis, M., B. Ginter, J. K. Kozłowski, M. Pawlikowski, O. Bar-Yosef, R. M. Albert, M. Litynska-Zajac, E. Stworzewicz, P. Wojtal, G. Lipecki, T. Tomek, Z. M. Bochenski, and A. Pazdur. 2001. The Early Upper Paleolithic in Greece. *Journal of Archaeological Science* 28: 515–539.

Kozłowski, J. K. 1971. The problem of the so-called Ordos culture in the light of the Palaeolithic finds from northern China and southern Mongolia. *Folia Quaternaria* 39: 63–99.

Kozłowski, J. K., editor. 1982. *Excavation in the Bacho Kiro Cave (Bulgaria). Final Report.* Warsaw: Panstwowe Wydawnictwo Naukowe.

Kozłowski, J. K. 1988. L'apparition du Paléolithique supérieur. In *L'Homme de Néandertal 8, La Mutation.* J. K. Kozłoski, editor. pp. 11–21. Études et Recherches Archéologiques de l'Université de Liège (ERAUL) No. 25. Liège: Université de Liège.

Kozłowski, J. K. 1990. A multiaspectual approach to the origins of the Upper Paleolithic. In *The Emergence of Modern Humans: An Archaeological Perspective.* P. Mellars, editor. pp. 419–437. Edinburgh: Edinburgh University Press.

Kozłowski, J. K. 1992. The Balkans in the Middle and Upper Paleolithic: The gate to Europe or a cul-de-sac? *Proceedings of the Prehistoric Society* 58: 1–20.

Kozłowski, J. K. 1993. L'Aurignacien en Europe et au Proche Orient. In *Aurignacien en Europe et au Proche Orient.* L. Bánesz and J. K. Kozłowski, editors. pp. 283–291. Bratislava: Actes du XIIe Congrês International des Sciences Préhistoriques et Protohistoriques.

Kozłowski, J. K. 1996. Cultural context of the last Neandertals and early modern humans in Central-Eastern Europe. In *The Lower and Middle Palaeolithic.* O. Bar-Yosef, L. L. Cavalli-Sforza, R. J. March, and M. Piperno, editors. pp. 205–218. Forli: Proceedings of the XIIIe Congress of the Union Internationale des Sciences Préhistoriques et Protohistoriques.

Kozłowski, J. K. 1998. The Middle and Early Upper Paleolithic around the Black Sea. In *Neandertals and Modern Humans in Western Asia.* T. Akazawa, K. Aoki, and O. Bar-Yosef, editors. pp. 461–482. New York: Plenum.

Kozłowski, J. K. 2000a. The problem of cultural continuity between the Middle and the Upper Paleolithic in Central and Eastern Europe. In *The Geography of Neandertals and Modern Humans in Europe and the Greater Mediterranean.* O. Bar-Yosef and D. Pilbeam, editors. pp. 91–119. Cambridge, Massachusetts: Peabody Museum of Archaeology and Ethnology.

Kozłowski, J. K. 2000b. Southern Poland between 50 and 30 kyr B. P. Environment and archaeology. In *Neanderthals and Modern Humans-~~D~~iscussing the Transition: Central and Eastern Europe from 50,000–30,000 B.P.* J. Orschiedt and G. C. Weniger, editors. pp. 76–91. Mettmann, Germany: Neanderthal Museum.

Kozłowski, J. K., and S. K. Kozłowski. 1996. *Le Paléolithique en Pologne.* Grenoble: Millon.

Kozłowski, J. K., and M. Otte. 2000. La formation de l'Aurignacian en Europe. *L'Anthropologie* 104: 3–15.

Kozłowski, S. K., and E. Sachse-Kozłowska. 1975. Nowa kultura górnopaleolityczna w Europie oerodkowej. *Archeologia Polski* 21: 215–313.

Kozyrev, A. S. 2000. The Military Hospital Paleolithic site: New data concerning the location. *Archaeology, Ethnology and Anthropology of Eurasia* 4: 61–65.

Krivoshapkin A. 1998. *Paleolithic Complexes from North-Eastern Slope of Arts-Bogd (Southern Mongolia).* Novosibirsk: Institute of Archaeology and Ethnology Press, Siberian Branch of the Russian Academy of Sciences.

Kuhn, S. L. 1992. On planning and curated technologies in the Middle Paleolithic. *Journal of Anthropological Research* 48: 185–214.

Kuhn, S. L. 1995. *Mousterian Lithic Technology: An Ecological Perspective.* Princeton: Princeton University Press.

Kuhn, S. L., and A. Bietti. 2000. The late Middle and early Upper Paleolithic in Italy. In *The Geography of Neandertals and Modern Humans in Europe and the Greater Mediterranean.* O. Bar-Yosef and D. Pilbeam, editors. pp. 49–76. Cambridge, Massachusetts: Peabody Museum of Archaeology and Ethnology.

Kuhn, S. L., M. C. Stiner, and E. Güleç. 1999. Initial Upper Paleolithic in south-central Turkey and its regional context: A preliminary report. *Antiquity* 73: 505–517.

Kuhn, S. L., M. C. Stiner, D. S. Reese, and Erksin Güleç. 2001. Ornaments of the earliest Upper Paleolithic: New insights from the Levant. *Proceedings of the National Academy of Sciences* 98(13): 7641–7646.

Kukla, G., and Z. An. 1989. Loess stratigraphy in central China. *Palaeogeography, Palaeoclimatology, Palaeoecology* 72: 203–225.

Kuzmin, Y. V., and L. A. Orlova. 1998. Radiocarbon chronology of the Siberian Paleolithic. *Journal of World Prehistory* 12: 1–53.

Larichev, V. E. 1969. *Paleolit Svernoi, Tsentral'noi i Vostochnoi Azii.* Novosibirisk: Nauka.

Larichev, V. E. 1978a. Iskusstvo Verkhnepaleoliticheskogo poseleniia Malaia Syia: Datirovka, vidy ego i obrazy, ikh khudozhestvennyi stil' i problema interpretatsii. *Izvestiia Sibirskogo Otdeleniia Akademii Nauk SSSR: Seriia Obshchestvennykh Nauk* 11: 104–119.

Larichev, V. E. 1978b. Skul'ptura Cherepakhi s poseleniia Malaia Syia i problema kosmogonoicheskikh predstavlenyy Verkhnepaleoliticheskogo cheloveka. In *U Istokov Tvorchestva.* pp. 32–69. Novosibirsk: Nauka.

Larichev, V. E. 1979. Zooantropomorfnaia skul'ptura rozhaiushchego sushchestva

Verkhnepaleoliticheskogo poseleniia Malaia Syia i Vlikaia Bogin'a Mat' Indiyskoi mifologii. In *Rerikhovskie Chteniia–1979 God.* pp. 13–40. Novosibirsk: Nauka.

Larichev, V. E. 1980. Mamont v iskusstve poseleniia Malaia Syia i opit rekonstruktsii predstavlenyi Verkhnepaleoliticheskogo cheloveka Sibiri o vozniknovenii vselennoi. In *Zveri v Kamne.* pp. 159–198. Novosibirsk: Nauka.

Larichev, V. E. 1984. Skul'pturnoe izobrazhenie Zhenshchini i lunno-sonechnyi kalendar' poseleniia Malaia Syia (semantika obraza i rekonstruktsiia sposoba Schisleniia vremeni na rannem etape Verkhnego Paleolita Sibiri). *Izvestiia Sibirskogo Otdeleniia Akademii Nauk SSSR: Seriia Istorii Filologii i Filosofii* 1: 20–31.

Larichev, V. E., U. Khol'ushkin, and I. Laricheva. 1988. The Upper Paleolithic of northern Asia: Achievements, problems and perspectives. I. Western Siberia. *Journal of World Prehistory* 2: 359–396.

Lbova, L. B. 1992. Brianksii Paleoliticheskii kompleks (k obosnovaniiu arkheologicheskogo rainoa). In *Paleoekologiia i Rasselenie Drevnego Cheloveka v Severnoi Azii i Amerike.* pp. 162–164. Krasnoiarsk: Nauka.

Lbova, L. B. 1996. Paleoliticheskoe mestonakhozhdenie kamenka. In *Novye Paleoliticheskie Pamiatniki Zabaikal'ia.* pp. 24–47. Chita: Chita Pedagogical University Press.

Lbova, L. B., editor. 1999. *Human Paleoecology in the Baikal Asia: Field Excursion Guide.* Ulan-Ude: Buryat Scientific Center, Siberian Branch of the Russian Academy of Sciences.

Lbova, L. B., and P. V. Volkov. 1993. Instrumentarii Paleoliticheskogo mestanakhozhdeniia Kemenka-1: Tipologiia i funktsia. *Kul'tury i Pamiatniki Epokhi Kamnia i Rannego Metalla Zabaikal'ia.* pp. 3–20. Novosibirsk: Nauka.

Leroy-Prost, C. 1975. L'industrie osseuse aurignacienne. Essai régional de classification: Poitou, Charentes, Périgord. *Gallia Préhistoire* 18: 65–155.

Lévêque, F., and B. Vandermeersch. 1980. Découverte des restes humains dans un niveau castelperronien a Saint Césaire (Charente-Maritime). *Comptes-Rendus De L'Académie Des Sciences De Paris* 291: 187–189.

Lévêque, F., A. M. Backer, and M. Guilbaud, editors. 1993. *Context of a Late Neandertal: Implications of Multidisciplinary Research for the Transition to Upper Paleolithic Adaptations at Saint-Césaire, Charent-Maritime, France.* Monographs in World Archaeology No. 16. Madison: Prehistory.

Levkovskaya G. M. 1999. The bank of paleobotanical data for the Paleolithic sites of the former USSR and its significance for the problem of the Middle to Upper Paleolithic transition. In *Osobennosti Razvitia Verhnego Paleolita Vostochnoi Evropy.* M. V. Anikovich and N. D. Praslov, editors. St. Petersburg: Institute for the History of Material Culture.

Li, C. 1994. The study of stone spheroids. *Journal of Chinese Antiquity* 3: 103–108.

Li, Y. 1993. A discussion of the Upper Paleolithic industries of China. *Acta Anthropologica Sinica* 12(3): 214–223.

Licent, E., and P. Teilhard de Chardin. 1925. Le Paléolithique de la Chine. *L'Anthropologie* 25: 201–234.

Lie, D. 1998. The microblade tradition in China: Regional chronologies and significance in the transition to Neolithic. *Asian Perspectives* 37: 84–112.

Lin, S. 1996. Comparisons of Chinese and Western Paleolithic technological modes. *Acta Anthropologica Sinica* 15: 1–20.

Lindly, J. M., and G. A. Clark. 2000. A preliminary lithic analysis of the Mousterian site of ʹAin Difla (WHS 634) in the Wadi Ali, west-central Jordan. In *The Archaeology of the Wadi al-Hassa, West-Central Jordan. Vol. 2: Excavations and Research at Middle, Upper and Epipaleolithic Sites.* N. R. Coinman, editor. pp. 95–110. Anthropological Research Papers No. 52. Tempe: Arizona State University.

Lindner, L., editor. 1992. *Czwartorzed: Osady, Metody Badan, Stratigrafia.* Warsaw: Wydawnictwo Polska Agencija Ekologiczna.

Lisitsyn, N. F., and Y. S. Svezhentsev. 1997. Radiocarbon chronology of the Upper Paleolithic of northern Asia. In *Radiouglerodnaya Chronologia Paleolita Vostochnoi Evropy i Severnoi Azii: Problemy i Perspectivy.* A. A. Sinitsyn and N. D. Praslov, editors. pp. 67–100. St. Petersburg: Institute for the History of Material Culture.

Liubin, V. P. 1989. *Palaeolithic of Caucasus.* Leningrad: Nauka.

Maca-Meyer, N., A. M. González, J. M. Larruga, C. Flores, and V. M. Cabrera. 2001. Major genomic mitochondiral lineages delineate early human expansions. *BMC Genetics* 2: 13.

Madeyska, T. 1981. Srodowisko czlowieka w srodkowym i górnym paleolicie na ziemiach plskich. *Studia Geologica Polonica* 69: 7–125.

Madsen, D. B., J. Li, P. J. Brantingham, X. Gao, R. G. Elston, and R. L. Bettinger. 2001. Dating Shuidonggou and the Upper Paleolithic blade industry in north China. *Antiquity* 75: 706–716.

Maloletko, A. M., and V. A. Panychev. 1990. Arkheologicheskii pamiatnik Ust-Karakol: Stratigrafiia i usloviia osadkonakoplenniia. In *Khronostratigrafiia Paleolita Severnoi, Tsentral'noi, i Vostochnoi Azii i Amerike (Doklady Mezhdunarodnogo Simposiuma).* pp. 223–225. Novosibirsk: Nauka.

Markin, S. V. 1987. Mnogosloinyi arkheologicheskii razrez Denisovoi Peshchery. In *Drevnosti Sibiri i Dal'nego Vostoka.* pp. 11–20. Novosibirsk: Nauka.

Marks, A. E., editor. 1976. *Prehistory and Paleoenvironments in the Central Negev, Israel. Vol. 1: The Avdat/Aqev Area, Part 1.* Dallas: Southern Methodist University Press.

Marks, A. E. 1981. The Upper Paleolithic of the Negev. In *Préhistoire du Levant. Chronologie et organization de l'espace depuis les origines jusau'au VI millénaire.* J. Cauvin and P. Sanlaville, editors. pp. 344–352. Paris: CNRS.

Marks, A. E. 1983a. The Middle to Upper Paleolithic transition in the Levant. In *Advances in World Archaeology. Vol. II.* F. Wendorf and A. E. Close, editors. pp. 51–98. New York: Academic.

Marks, A. E., editor. 1983b. *Prehistory and Paleoenvironment in the Central Negev, Israel. Vol. 3.* Dallas: Southern Methodist University Press.

Marks, A. E. 1990. The Middle and Upper Palaeolithic of the Near East and the Nile Valley: The problem of cultural transformations. In *The Emergence of Modern Humans: An Archaeological Perspective.* P. Mellars, editor. pp. 56–80. Edinburgh: Edinburgh University Press.

Marks, A. E. 1993. The Early Upper Paleolithic: The view from the Levant. In *Before Lascaux: The Complex Record of the Early Upper Paleolithic.* H. Knecht, A. Pike-Tay, and R. White, editors. pp. 5–22. Boca Raton: CRC Press.

Marks, A. E. 1998. A new Midlle to Upper Paleolithic "transitional" assemblage from Buran-Kaya III, Level C, Eastern Crimea: A preliminary report. In *Préhistoire d'Anatolie, Genèse de deux mondes.* M. Otte, editor. pp. 353–366. Études et Recherches

Archéologiques de l'Université de Liège (ERAUL) No. 85. Liège: Université de Liège.

Marks, A. E., and V. P. Chabai. 1998. *The Middle Paleolithic of Western Crimea. Vol. 1.* Études et Recherches Archéologiques de l'Université de Liège (ERAUL) No. 84. Liège: Université de Liège.

Marks, A. E., and C. R. Ferring. 1988. The early Upper Paleolithic of the Levant. In *The Early Upper Paleolithic: Evidence from Europe and the Near East.* J. Hoffecker and C. Wolf, editors. pp. 43–66. British Archaeological Reports International Series 437. Oxford: Archaeopress.

Marks, A. E., and D. Kaufman. 1983. Boker Tachtit: The artifacts. In *Prehistory and Paleoenvironment in the Central Negev, Israel, Vol. 3.* A. Marks, editor. pp. 69–126. Dallas: Southern Methodist University Press.

Marks, A. E., and M.-B. Mishoe. 1997. The Magdalenian of Portuguese Estremadura. In *El Món Mediterrani després del Pleniglacial (18,000–12,000 B.P.).* J. M. Fullola and N. Soler, editors. pp. 225–232. Sêrie Monográfica 17. Girona: Museau d'Aqueologia de Catalunya-Girona.

Marks, A. E., and K. Monigal. 2000. The Middle Paleolithic/Upper Paleolithic interface at Buran Kaya III. In *Neanderthals and Modern Humans–Discussing the Transition: Central and Eastern Europe from 50,000–30,000 B.P.* J. Orschiedt and G. C. Weniger, editors. pp. 210–224. Mettmann, Germany: Neanderthal Museum.

Marks, A. E., and P. Volkman. 1983. Changing core reduction strategies: A technological shift from the Middle to Upper Paleolithic in the southern Levant. In *The Mousterian Legacy: Human Biocultural Change in the Upper Pleistocene.* E. Trinkaus, editor. pp. 13–34. British Archaeological Reports International Series 164. Oxford: Archaeopress.

Matioukhine, A. E. 1987. Paleolithic workshop of Kalitvenka 1. *Kratkie Soobshchenia Instituta Arkheologii* 189: 83–88.

Matioukhine, A. E. 1998. Les atelier du Paléolithique supérieurr de la vallée du Donets-Severski (région de Rostov, Russie). *Anthropologie* 102: 467–494.

Maynard Smith, J., and E. Szathmáry. 1995. *The Major Transitions in Evolution.* Oxford: W. H. Freeman.

McBrearty, S., and A. S. Brooks. 2000. The revolution that wasn't: A new interpretation of the origin of modern human behavior. *Journal of Human Evolution* 39: 453–563.

McGhee, G. R. Jr. 1999. *Theoretical Morphology: The Concept and Its Applications.* New York: Columbia University Press.

Medvedev, G. 1998. X. Upper Paleolithic sites in south-central Siberia. In *The Paleolithic of Siberia: New Discoveries and Interpretations.* A. P. Derevianko, A. B. Shimkin, and W. R. Powers, editors. pp. 122–132. Chicago: University of Illinois Press.

Medvedev, G. I., N. A. Savel'ev, and V. V. Svinin. 1990. *Stratigrafiia, Paleogeografiia, i Arkheologiia Iuga Srednei Sibiri: K XIII Kongressu INQUA 1990.* Irkutsk: Nauka.

Medvedev, G., N. Cauwe, G. Vorobieva, D. Coup, L. Claes, E. Lipnina, S. Modri, S. Mukharramov, S. Osadchy, P. Pettitt, P. Rebrikov, E. Rogovsky, V. Sitlivy, L. Sulerzhitsky, and F. Khenzykhenova. 1996. *The Malta Paleolithic Locality (According to the 1995 Fieldseason).* Irkutsk: Arcon.

Meignen, L. 1994. Paléolithique moyen au Proche-Orient: le phénomène laminaire. In *Les industries laminaires au Paléolithique moyen.* S. Révillion and A. Tuffreau, editors. pp. 125–159. Paris: CNRS.

Meignen, L. 1996. Les prémices du Paléolithique supérieur au Proche Oriente. In *The Last Neandertals, the First Anatomically Modern Humans: A Tale about Human Diversity. Cultural Change and Human Evolution: The Crisis at 40,000 BP.* E. Carbonell and M. Vaquero, editors. pp. 107–128. Tarragona: Universitat Rovira i Virgili.

Meignen, L. 2000. Early Middle Palaeolithic blade technology in southwestern Asia. *Acta Anthropologica Sinica (Supplemental)* 19: 158–168.

Mellars, P. A. 1973. The character of the Middle-Upper Paleolithic transition in south-west France. *The Explanation of Culture Change: Models in Prehistory.* C. Renfrew, editor. pp. 255–276. London: Duckworth.

Mellars, P. A. 1989. Major issues in the emergence of modern humans. *Current Anthropology* 30: 349–385.

Mellars, P. A. 1992. Archaeology and the population-dispersal hypothesis of modern human origins in Europe. In *The Origins of Modern Humans and the Impact of Chronometric Dating.* M. J. Aitken, C. B. Stringer, and P. A. Mellars, editors. *Philosophical Transations of the Royal Society, London* B 337: 225–234.

Mellars, P. A. 1996. *The Neandertal Legacy: An Archaeological Perspective from Western Europe.* Princeton: Princeton University Press.

Mellars, P. A. 1999. The Neanderthal problem continued. *Current Anthropology* 40: 341–364.

Mellars, P. A. 2000. The archaeological records of the Neandertal-modern human transition in France. In *The Geography of Neandertals and Modern Humans in Europe and the Greater Mediterranean.* O. Bar-Yosef and D. Pilbeam, editors. pp. 35–47. Cambridge, Massachusetts: Peabody Museum of Archaeology and Ethnology.

Mellars, P. A., and K. Gibson, editors. 1996. *Modeling the early human mind.* Cambridge, Massachusetts: McDonald Institute for Archaeological Research.

Mellars, P. A., and C. B. Stringer, editors. 1989. *The Human Revolution: Behavioural and Biological Perspectives on the Origins of Modern Humans.* Princeton: Princeton University Press.

Mellars, P. A., and J. Tixier. 1989. Radiocarbon accelerator dating of Ksar 'Aquil (Lebanon) and the chronology of the Upper Paleolithic sequence in the Middle East. *Antiquity* 63: 761–768.

Mercier, N., H. Valladas, L. Froget, J.-L. Joron, J.-L. Reyss, S. Balescu, C. Escutenaire, J. Kozłowski, V. Sitlivy, K. Sobczyk, and A. Zieba. 2003. Luminescence dates for the palaeolithic site of Piekary IIa (Poland): Comparison between TL of burnt flints and OSL of a loess-like deposit. *Quaternary Science Reviews* 22:1245–1249.

Merejkowski, C. S. 1884. Station Moustérienne en Crimée. *L'Homme* 10: 300–302.

Meshcherin, M. N. 1985. Paleoliticheskie Zhilishcha Zabaikal'ia. In *Problemy Arkheologii Sibiri i Dal'nego Vostoka.* pp. 20–22. Irkutsk: Irkutskii Gosudarstvennyi Universitet.

Meshveliani, T. 1989. About the early stages of the Upper Paleolithic cultures in western Georgia. *Newsletter of the State Museum of Georgia* 40B: 13–31.

Meshveliani, T., O. Bar-Yosef, A. Belfer-Cohen, N. Djakeli, A. Kraus, D. Lordkipanidze, and A. Vekua. 1999. Excavations at Dzudzuana Cave, Western Georgia (1996–1998): Preliminary results. *Préhistoire Européenne* 15: 79–86.

Michod, R. E. 1999. *Darwinian Dynamics: Evolutionary Transitions in Fitness and Individuality.* Princeton: Princeton University Press.

Mikhailova, L. A. 1985. Rusanikha—A new Paleolithic site near Sungir. *Sovetskaya Arkheolgia* 4: 107–117.

Miller-Antonio, S. 1992. *Lithic Variability and the Cultural Elaboration of Upper Pleistocene North China.* Ph.D. dissertation. Tucson: University of Arizona.

Minzoni-Deroche, A. 1992 . Üçagizli magara, un site aurignacien dans le Hatay (Anatolie). Premier résultats. *Paléorient* 18: 89–96.

Miracle, P. 1998. The spread of modernity in Paleolithic Europe. In *The Origins and Past of Modern Humans: Towards Reconciliation.* K. Omoto and P. V. Tobias, editors. pp. 117–187. Singapore: World Scientific.

Mithen, S. 1996. *The Prehistory of the Mind.* London: Thames and Hudson.

Monigal, K. 2001. Lower and Middle Paleolithic blade industries and the dawn of the Upper Paleolithic in the Levant. *Archaeology, Anthropology, and Ethnology of Eurasia* 1(5): 11–24.

Morawski, W. 1975. Middle Palaeolithic flint assemblages from Piekary IIa site. *Swiatowit* 39: 139–146.

Morawski, W. 1992. Kompleks stanowisk paleolitycznych w Piekarach. *Pradnik-Prace i Materialy Muzeum Imeni Profesor W. Szafera* 6: 163–172.

Muratov, V. M., N. D. Ovodov, V. A. Panychev, and S. A. Safrova. 1982. Obshchaia kharakteristika Paleolitichekoi stoianki Malaia Syia v Khakasii. In *Arkheologiia Svernoi Azii.* pp. 33–48. Novosibirsk: Nauka.

Nehoroshev, P. E., and L. B. Vishnyatsky. 2000. Shlyakh—A new late Middle Paleolithic site in the South Russian Plain. In *Neanderthals and Modern Humans—Discussing the Transition: Central and Eastern Europe from 50,000–30,000 B.P.* J. Orschiedt and G. C. Weniger, editors. pp. 256–266. Mettmann, Germany: Neanderthal Museum.

Nesmeyanov, S. A. 1980. Geological structure of the Samarkandskaya Upper Paleolithic site. In *Paleolit Srednei i Vostochnoi Azii.* V. E. Larichev, editor. pp. 30–46. Novosibirsk: Nauka.

Neugebauer-Maresch, Ch. 1999. *Le paléolithique en Autriche.* Grenoble: J. Millen.

Neuville, R. 1934. Le Préhistoire de Palestine. *Revue Biblique* 43: 237–259.

Nikonov, A. A., M. M. Pakhomov, E. A. Romanova, L. D. Sulerzhitsky, and G. M. Shumova. 1989. New data on the paleogeography of the Pamir-Alai. In *Paleoklimaty i Oledeneiya v Pleistotsene.* A. A. Velichko, editor. pp. 117–125. Moscow: Nauka.

Ningxia Museum. 1987. A report on the 1980 excavations at Shuidonggou. *Kaogu Xue Bao* 4: 439–449.

Nioradze, M. G., and M. Otte. 2000. Paleolithique supérieur de Géorgie. *L'Anthropologie* 104: 265–300.

Nitecki, M. H., and D. V. Nitecki, editors. 1994. *Origins of Anatomically Modern Humans.* New York: Plenum.

Nobel, W., and I. Davidson. 1996. *Human Evolution, Language and Mind: A Psychological and Archaeological Inquiry.* Cambridge: Cambridge University Press.

Nuzhnyi, D. Y. 1994. Late Paleolithic site of Vorona 3 on the Dnieper rapids and its place among the Aurignacian of East Europe. *Arkheologichesky Almanach (Donetsk)* 3: 204–216.

Oakley, K. 1964. *Frameworks for Dating Fossil Man.* London: Weinfeld and Nicolson.

Ohnuma, K. 1988. *Ksar-'Akil, Lebanon: A Technological Study of the Earlier Upper Paleolithic Levels of Ksar 'Akil.* Vol. III. Levels XXV–XIV. British Archaeological Reports International Series 426. Oxford: Archaeopress.

Ohnuma, K., and C. A. Bergman. 1990. A technological analysis of the Upper Paleolithic levels (XXV–VI) of Ksar Akil, Lebanon. In *The Emergence of Modern Humans: An Archaeological Perspective.* P. Mellars, editor. pp. 91–138. Edinburgh: Edinburgh University Press.

Okladnikov, A. P. 1965. Paleolithic finds in the region of Lake Orok-Nor. *Arctic Anthropology* 3(1): 142–145.

Okladnikov, A. P. 1974. Varvarina Gora—Novyi pamiatnik Levalluazkogo etapa Paleolita za Baikalom. In *Arkheologicheskie Otkrytiia 1973 Goda.* pp. 215–216. Moscow: Nauka.

Okladnikov, A. P. 1978. The Paleolithic of Mongolia. In *Early Paleolithic in South and East Asia.* F. Ikawa-Smith, editor. pp. 317–325. The Hague: Mouton.

Okladnikov, A. P. 1981. *The Paleolithic of Central Asia: Moil'tyn am (Mongolia).* Novosibirsk: Nauka.

Okladnikov, A. P. 1983. Paleoliticheskaia stoianka Kara-Bom v Gornom Altae (po materialam raskopok 1980 goda). In *Paleolit Sibiri.* pp. 5–20. Novosibirsk: Nauka.

Okladnikov, A. P., and I. I. Kirillov. 1968. Paleoliticheskoe Poselenie v Skhatino (Titovskaia Sopka). *Izvestiia Sibirskogo Otdeleniia Akademii Nauk SSSR: Seriia Obshchestvennykh Nauk* 6: 111–114.

Okladnikov, A. P., and I. I. Kirillov. 1980. *Iugo-Vostochnoe Zabaikal'e v Epolhu Kamnia i Rannei Bronzy.* Novosibirsk: Nauka.

Okladnikov, A. P., and N. D. Ovodov. 1978. Paleoliticheskaia stoinka v Denisovoi Peshchere na Altae. In *Arkheologicheskie Otkrytiia 1977 Goda.* pp. 266–268. Moscow: Nauka.

Olenkovsky, N. P. 1991. *Late Paleolithic and Mesolithic of the Lower Dnieper.* Kherson: Ukrainian Foundation of Culture.

Oliva, M. 1984. Le Bohnicien, un nouveau groupe culturel en Moravie: quelques aspectes psycho-technologiques du développement des industries paléolithiques. *L'Anthropologie* 88: 209–220.

Oliva, M. 1991. The Szeletian in Czechoslovakia. *Antiquity* 65: 133–194.

Olszewski, D., and H. Dibble. 1994. The Zagros Aurignacian. *Current Anthropology* 35: 68–75.

Olszewski, D. I., N. R. Coinman, J. Schuldenrein, T. Clausen, J. Cooper, J. Fox, J. B. Hill, M. al-Nahar, and J. William. 1998. The eastern al-Hasa Late Pleistocene Project: A preliminary report on the 1997 season. *Annual of the Department of Antiquities of Jordan* 41: 1–21.

Orlova, L. A. 1995a. Radiouglerodnaia khronologiia arkheologicheskikh pamiatnikov Zabaikal'ia. In *Kul'turnye Traditsii Narodov Sibiri i Ameriki: Preemstvennost' i Ekologiia (Gorizonty Kompleksnogo Izucheniia).* p. 99. Chita: Administratsiia Chitinskoi Oblast.

Orlova, L. A. 1995b. Radiouglerodnoye datirovanie arkheologichesikh pamiatnikov Sibiri i Dalnego Vostoka. In *Metody Estestvennykh Nauk v Arkheologicheskikh Rekonstruktsiyakh,* A. P. Derevianko and Y. P. Kholushkin editors. pp. 207–232. Novosibirsk: Izdatelstvo Instituta Arheologii i Etnografii SORAN.

Orlova, L. A. 1998. Radiocarbon dating of archaeology sites in Siberia and the Russian Far East: List 2. In *Statistical Analysis of the Upper Paleolithic Complexes of Northern Asia, Supplement.* A. P. Derevianko, Y. P. Kholushkin, P. S. Rostovtsev, and V. T. Voronin, editors. pp. 74–88. Novosibirsk: Institute of of Archaeology and Ethnology Press.

Orlova, L. A., Y. V. Kuzmin, and I. D. Zolnikov. 1998. ^{14}C database and geographic information system for western Siberia. *Radiocarbon* 40: 319–329.

Otte, M. 1990. From the Middle to the Upper Paleolithic: The nature of the transition. In *The Emergence of Modern Humans: An Archaeological Perspective.* P. Mellars, editor. pp. 438–456. Edinburgh: University of Edinburgh Press.

Otte, M. 1994. Origine de l'homme moderne: approche comportementale. *Comptes-Rendus De L'Académie Des Sciences De Paris* 318: 267–273.

Otte, M. 1998. Turkey as a key. In *Neandertals and Modern Humans in Western Asia* T. Akazawa, K. Aoki, and O. Bar-Yosef, editors. pp. 483–492. New York: Plenum.

Otte, M., and A. P. Derevianko. 2001. The Aurignacian in Altai. *Antiquity* 75: 44–48.

Otte, M., I. Lopez-Bayon, P. Noiret, I. Borziac, and V. Chirica. 1996. Recherches sure le Paléolithique supérieur de la Moldavie. *Anthropologie Et Préhistoire* 107: 45–80.

Otte, M., P. Noiret, S. Tattartsev, and I. Lopéz-Bayón. 1996. L'Aurignacian de Siuren I (Crimée, Ukraine). *Anthropologie Et Préhistoire* 107: 81–92.

Ovodov, N. D. 1987. Fauna Paleoliticheskikh poselenii Tolbaga i Varvarina Gora v zapadnom Zabaikal'e. In *Prirodnaia Sreda i Drevnii Chelovek v Pozdnem Antropogene.* pp. 122–140. Ulan-Ude: Nauka.

Pakhomov, M. M. 1973. The change in the structure of mountain vegetation in the east of Central Asia as a basis for divisions of the Pleistocene. In *Palinologia Pleistotsena i Pliotsena,* V. P. Grichuk editor. pp. 153–160. Moscow: Nauka.

Pakhomov, M. M. 1991. The correlation of the Pleistocene events in central Asia and the dynamics of mountain zonality. *Izvestiya Akademii Nauk SSSR, Seriia Geograficheskaya* 6: 94–103.

Palma di Cesnola, P. 1989. L'Uluzzien: faciês italien du Leptolithique archaïque. *L'Athropologie* 93(4): 783–812.

Palma di Cesnola, P. 1993. *Il Paleolitica superiore in Italia.* Florence: Garlatti e Razzzai.

Paunescu, A. 1993. *Ripiceni-Izvor paleolitic si mezolitic.* Bucharest: Editura Academei Romane.

Pavlov, P. Y., and S. Indrelid. 2000. Human occupation in Northeastern Europe during the period 35,000–18,000 BP. In *Hunters of the Golden Age: The Mid Upper Paleolithic of Eurasia 30,000–20,000 BP.* W. Roebroeks, M. Mussi, J. Svoboda, and K. Fenema, editors. pp. 165–172. Leiden: University of Leiden.

Pavlov P. Yu., A. A. Velichko, Yu. N. Gribchenko, Yu. Yu. Tsyganov. In press. Zaozerie: An early Upper Paleolithic site in the north-east of Europe (Zaozerie: Pamiatnik rannei pory verhnego paliolita na severo-vostoke Evropy). *Rossijskaya Arkheologia.*

Pei, W. 1937. Paleolithic industries of China. In *Early Man.* pp. 221–232. Philadelphia: J. B. Lippincott.

Pei, W., and S. Zhang. 1985. *A Study of the Lithic Artifacts of Sinanthropus.* Beijing: Sciences.

Pelegrin, J. 1995. *Technologie lithique: Le Châtelperronien de Roc de Combe (Lot) et de la Côte (Dordogne).* Paris: CNRS.

Pendall, E. G., J. W. Harden, S. E. Trumbore, and O. A. Chadwick. 1994. Isotopic approach to soil carbonate dynamics and implications for Paleoclimatic interpretations. *Quaternary Research* 42: 60–71.

Perevalov, A. V., and I. N. Rezanov. 1997. First attempt of radiothermoluminescent dating of anthropogene deposits in southwestern Transbaikalia. *Russian Geology and Geophysics* 38: 1282–1288.

Petrin, V. T., and L. M. Chevalkov. 1992. O Vozniknovenii mikroliticheskoi tortsovoi tekhniki skalyvaniia na primere Paleoliticheskoi stoianki Kara-Bom. In *Paleoekologiia i Rasselenie Drevnego Cheloveka v Severnoi Azii i Amerike*. pp. 206–209. Krasnoiarsk: Nauka.

Pettitt, P. B. 1998. Middle and early Upper Paleolithic Crimea: The radiocarbon chronology. In *Préhistoire d'Anatolie, Genèse de deux mondes*. M. Otte, editor. pp. 329–338. Études et Recherches Archéologiques de l'Université de Liège (ERAUL) No. 85. Liège: Université de Liège.

Pettitt, P. B., and N. O. Bader. 2000. Direct AMS radiocarbon dates for the Sungir mid Upper Paleolithic burials. *Antiquity* 74: 269–270.

Phillips, J. 1994. The Upper Paleolithic chronology of the Levant and the Nile Valley. In *Late Quaternary Chronology and Paleoclimates in the Eastern Mediterranean*. O. Bar-Yosef and R. Kra, editors. pp. 169–176. Cambridge, Massachusetts: American School of Prehistoric Research.

Ponce de León, M. S., and C. P. E. Zollikofer. 2001. Neanderthal cranial ontogeny and its implications for late hominid diversity. *Nature* 412: 534–538.

Postnov, A. V. 1998. *Late Paleolithic of the Anuy River Basin (Altai Mountians)*. Ph.D. dissertation. Novosibirsk: Institute of Archaeology and Ethnology Press, Siberian Branch of the Russian Academy of Sciences.

Postnov, A. V., A. A. Anoykin, and N. A. Kulik. 2000. Criteria for the selection of raw materials in Paleolithic industries of the Anui River basin (Gorny Altai). *Archaeology, Ethnology and Anthropology of Eurasia* 1(3): 18–30.

Proček, F. 1953. Szeletien na Slovensku. *Slovenská Archeológia* 1: 133–194.

Pyasetsky, V. K. 1988. The Aurignacian site of Ivanychi in Volyn. *Arkheologia* 64: 49–56.

Pyasetsky, V. K. 1990. Geology of the Mousterian site of Tochilnitsa. *Bulleten Komissii po Izucheniyu Cyetveertichnogog Perioda* 59: 102–110.

Pyasetsky, V. K. 1991. The middle cultural layer of the Paleolithic site of Zhornov. *Sovetskaya Arkheologia* 4: 182–191.

Pyasetsky, V. K. 1992. The Mousterian cultural layer of the Paleolithic site of Zhornov 1 and some questions of the Paleolithic stratigraphy. *Rossijskaya Arkheologia* 3: 112–126.

Pyasetsky, V. K. 1995. The Aurignacian site of Chervony Kamen in the Rovno region. *Rossijskaya Arkheologia* 2: 123–134.

Qiu, Z. 1985. The Middle Paleolithic of China. In *Paleoanthropology and Paleolithic Archaeology in the People's Republic of China*. R. Wu and J. W. Olsen, editors. pp. 187–210. Orlando: Academic.

Ranov, V. A., and A. G. Amosova. 1984. Excavations of the Mousterian site of Kuhdji in 1978. *Arkheologicheskie Raboty v Tadjikistane* 18: 11–47.

Ranov, V. A., and S. A. Laukhin. 2000. A site on the Paleolithic Man migration route from the Levant to Siberia. *Priroda* 9: 52–60.

Ranov, V. A., A. A. Nikonov, and M. M. Pakhomov. 1976. Stone Age humans on the approaches to Pamir. *Acta Archaeologica Carpathica* 16: 5–20.

Raposo, L. 2000. The Middle-Upper Paleolithic transition in Portugal. In *Neanderthals on the Edge: Papers from a Conference Marking the 150th Anniversary of the Forbes' Quarry Discovery, Gibraltar.* C. B. Stringer, R. N. E. Barton, and J. C. Finlayson, editors. pp. 95–109. Oxford: Oxbow.

Raup, D. M. 1966. Geometric analysis of shell coiling: General problems. *Journal of Paleontology* 40: 1178–90.

Relethford, J. H. 2001. *Genetics and the Search for Modern Human Origins.* New York: Wiley.

Révillion, S. 1994. *Les industries laminaires du Paléolithique moyen en Europe septentrionale: L'example des gisements de Saint-Germain-des-Vaux/Port Racine (Manche), de Seclin (Nord) et de Riencourt-les-Bapaume (Pas-de-Calais).* Lille: CERP, Université des Sciences et Technologies de Lille.

Révillion, S. 1995. Technologie du Débitage Laminaire au Paléolithique Moyen en Europe Septentrionale: État de la Question. *Bulletin De La Société Préhistorique Française* 92(4): 425–441.

Révillion, S., and A. Tuffreau, editors. 1994. *Les industries laminaires au Paléolithique moyen.* Paris: CNRS.

Rezanov, I. N. 1986. Paleolandshafnye usloviia Vnelednikovoi Zony iuzhnogo Pribaikal'ia v Verkhnem Pleistotsene. In *Chetvertichnaia i Pervobytnaia Arkheologiia Iuzhnoi Sibiri.* pp. 8–9. Ulan-Ude: Nauka.

Richter, D., J. Waiblinger, W. J. Rink, and G. A. Wagner. 2000. Thermoluminescence, electron spin resonance and 14-C dating of the Late Middle and Early Upper Paleolithic site of Geissenklösterle Cave in southern Germany. *Journal of Archaeological Science* 27: 71–89.

Ringer, A., L. Kordos, and E. Krolopp. 1995. Le complexe babonyein-szeletien en Hongrie du nord-est dans son cadre chronologique et environnemental. In *Les industries a pointes foliaceés d'Europe centrale.* Actes du Colloque commémoratif international "Les premières découvertes de Paléolithique à Miskolc et la question des industries à pièces foliacées de l'Europe centrale dans leur cadre chronologique, paléoécologique, paléontologique." pp. 27–30. Miskolc: Paléo Supplément 1.

Rink, W. J., H. P. Schwarcz, K. Valoch, L. Seitl, and C. B. Stringer. 1996. ESR dating of Micoquian industry and Neanderthal remains at Kulna Cave, Czech Republic. *Journal of Archaeological Science* 23: 889–901.

Rogachev, A. N. 1957. Multilevel sites of the Kostenki-Borshchevo area on the Don River and the problem of the development of culture in the Upper Paleolithic of the Russian Plain. In *Paleolit i Neolit SSSR. Vol. 3.* pp. 9–134. Moscow-Leningrad: Academy of Sciences of the USSR.

Rogachev, A. N., and M. V. Anikovich. 1984. Late Paleolithic of the Russian Plain and Crimea. In *Paleolit SSSR.* P. I. Boriskovsky, editor. pp. 162–271. Moscow: Nauka.

Rudenko, S. I. 1960. Ust'-Kanskaia Peshchernaia Paleoliticheskaia stoianka. *Materialy i Issledovaniia po Arkheologii SSSR* 79: 104–125.

Rudenko, S. I. 1961. The Ust'-Kanskaia Cave Paleolithic site. *American Antiquity* 27: 203–215.

Sapozhnikov, I.V. 1994. *The Paleolithic in the Steppes of the Lower Dnieper Region.* Odessa: Institute of Archaeology.

Savich, V. P. 1975. *Pozn'opaleolitichne Naselennya Pivdenno-Zakhidnoj Volyni.* Kiev: Naukova Dumka.

Savich, V. P. 1987. Pozdnij Paleolit Volyni. In *Archeologia Prikarpat'ya, Volyni i Zakarpat'ya.* A. P. Chernysh, editor. pp. 43–65. Kiev: Naukova Dumka.

Schäfer, J., and V. A. Ranov. 1998. Middle Paleolithic blade industries in the Upper Paleolithic of central Aisa. In *Préhistoire d'Anatolie, Genèse de deux mondes.* M. Otte, editor. pp. 785–814. Études et Recherches Archéologiques de l'Université de Liège (ERAUL) No. 85. Liège: Université de Liège.

Schick, K., N. Toth, Q. Wei, J. D. Clark, and D. Etler. 1991. Archaeological perspective in the Nihewan Basin, China. *Journal of Human Evolution* 21: 13–26.

Schyle, D. 1992. *Near Eastern Upper Paleolithic Cultural Stratigraphy: An Evaluation of Evidence.* Beihefte zum Tübinger Atlas des Vorderen Orients, Reihe B (Geisteswissenschaften) Nr. 59. Wiesbaden, Germany: Ludwig Reichert.

Sëmin, M., S. O. Shelkovaia, and A. A. Chebotarev. 1990. Novoe Paleoliticheskoe mestonakhozhdenie v G. Irkutske (Imeni I. V. Arembovskogo). In *Paleoetnologiia Sibiri.* pp. 114–115. Irkutsk: Irkutskii Gosudarstvennyi Universitet.

Semino, O., G. Passarino, P. J. Oefner, A. A. Lin, S. Arbuzova, L. E. Beckman, G. DeBenedicis, P. Francalacci, A. Kouvatsi, S. Limborska, M. Marcikiae, A. Mika, B. Mika, D. Primorac, A. S. Santachirara-Benerecitti, L. L. Cavalli-Sforza, and P. A. Underhill. 2000. The genetic legacy of Paleolithic *Homo sapiens sapiens* in extant Europeans: A Y chromosome perspective. *Science* 290: 1155–1159.

Serebryanyi, L. R., G. M. Pshenin, and Ya. Punning. 1980. A stage-by-stage analysis of the events in the Late Quaternary history of Central Asia. *Izvestia AN SSSR, Seriya Geograficheskaya* 2: 52–70.

Sherman, P. W., J. U. M. Jarvis, and R. D. Alexander, editors. 1991. *The Biology of the Naked Mole-Rat.* Princeton: Princeton University Press.

Sherratt, A. 1997. Climatic cycles and behavioural revolutions: The emergence of modern humans and the beginning of farming. *Antiquity* 71: 271–287.

Shun'kov, M. V. 1990. *Must'erskie pamiatniki mezhgornykh kotlovin tsentral'nogo Altaia.* Novosibirsk: Nauka.

Shun'kov, M. V., and A. K. Agadjanian. 2000. Paleoenvironmental reconstruction of the Paleolithic period at Denisova Cave (Gorny Altai, Siberia). *Archaeology, Ethnology and Anthropology of Eurasia* 2(2): 2–19.

Sinitsyn, A. A. 1996. Kostenki 14 (Markina Gora): Data, problems and perspectives. *Préhistoire Européenne* 9: 273–313.

Sinitsyn, A. A. 2000. The lower cultural layers of Kostenki 14 (Markina Gora) and their significance for the problems of the earliest Upper Paleolithic. *Stratum* 1: 125–146.

Sinitsyn, A. A., N. D. Praslov, Y. S. Svezhentsev, and L. D. Sulerzhitsky. 1997. The radiocarbon chronology of the Upper Paleolithic in East Europe. In *Radiouglerodnaya Khronologia Paleolita Vostochnoi Evropy i Severnoi Azii: Problemy i Perspectivy.* A. A. Sinitsyn and N. D. Prsalov, editors. pp. 21–66. St. Petersburg: Institute for the History of Material Culture.

Sitlivy, V., K. Sobczyk, C. Escutenaire, T. Kalicki, K. Zieba, and K. Kaczor. 2000a. The new Palaeolithic site of Ksiecia Józefa (Cracow, Poland) with blade and flake reduction. *Préhistoire Européenne* 15: 87–111.

Sitlivy, V., K. Sobczyk, W. Morawski, A. Zieba, and C. Escutenaire. 2000b. Piekary IIa

Palaeolithic industries: Preliminary results of a new multidisciplinary investigations. *Préhistoire Européenne* 15: 45–64.

Škrdla, P. 1996. The Bohunician reduction strategy. *Quaternaria Nova* 6: 93–107.

Smirnov, S. V. 1973. *Paleolithic of the Dnieper rapids area.* Kiev: Naokova Jumka.

Smith, F. H., E. Trinkaus, P. B. Pettitt, I. Karavanic, and M. Paunovic. 1999. Direct radiocarbon dates for Vindija G_1 and Velika Pecina Late Pleistocene hominid remains. *Proceedings of the National Academy of Sciences* 96: 12281–12286.

Smith, M., editor. 2003. *The Social Construction of Ancient Cities.* Washington, D.C.: Smithsonian Institution Press.

Spiridonova, E. A. 1991. *Evolution of the Vegetational Cover in the Don Basin during the Upper Pleistocene and Holocene.* Moscow: Nauka.

Stafford, T. W., P. E. Hare, L. Currie, A. J. T. Jull, and D. J. Donahue. 1991. Accelerator radiocarbon dating at the molecular level. *Journal of Archaeological Science* 18: 35–72.

Stepanchuk, V. 1998. The Crimean Paleolithic: Genesis and evolution between 140–30 kyr BP. In *Préhistoire d'Anatolie, Genèse de deux mondes.* M. Otte, editor. pp. 261–300. Études et Recherches Archéologiques de l'Université de Liège (ERAUL) No. 85. Liège: Université de Liège.

Stiner, M. C. 2001. Thirty years on the "Broad Spectrum Revolution" and paleolithic demography. *Proceedings of the National Academy of Sciences* 98: 6993–6996.

Stiner, Mary C. 2002. Carnivory, coevolution, and the geographic spread of the genus *Homo. Journal of Archaeological Research* 10: 1–63.

Strauss, L. G. 1997. The Iberian situation between 40,000 and 30,000 B. P. in light of European models of migration and convergence. In *Conceptual Issues in Modern Human Origins Research.* G. A. Clark and C. M. Willermet, editors. pp. 235–252. New York: Aldine de Gruyter.

Stringer, C. B. 1989. Documenting the origins of modern humans. In *The Emergence of Modern Humans: Biocultural Adaptations in the Later Pleistocene.* E. Trinkaus, editor. pp. 47–96. Cambridge: Cambridge University Press.

Stringer, C. B. 1996. Current issues in modern human origins. In *Contemporary Issues in Human Evolution.* W. E. Meickle, F. C. Howell, and N. G. Jablonski, editors. pp. 115–134. San Fransisco: California Academy of Sciences.

Stringer, C. B., and C. Gamble. 1993. *In Search of the Neanderthals: Solving the Puzzle of Modern Human Origins.* New York: Thames and Hudson.

Suleimanov, R. Kh. 1972. *A Statistical Study of the Culture of Obi-Rakhmat Shelter (Statisticheskoe Izuchenie Kul'tury Grota Obi-Rakhmat).* Tashkent: FAN Press.

Sun, J., M. Ke, X. Sun, J. Zhao, M. Wei, and B. Li. 1991. Locality III stratigraphic profile, Shuidonggou, Ningxia. In *The Quaternary Loess Plateau.* J. Sun and J. Zhao, editors. pp. 195–201. Beijing: Sciences.

Sun, J., and J. Zhao, editors. 1991. *The Quaternary Loess Plateau.* Beijing: Sciences.

Svoboda, J. 1980. Ondratice I: Early Upper paleolithic technologies of quartzite working. In *Colloque International l'Aurignacien et le Gravettien (périgordien) dans leur Cadre Ecologique.* pp. 275–281. Nitra: Institute of Archaeology.

Svoboda, J. 1987. *Stránská skála: Bohunický typ v brneské kotline.* Prague: Academia.

Svoboda, J. 1988. Early Upper Paleolithic industries in Moravia: A review of recent evidence. In *L'Homme de Néandertal 4.* M. Otte, editor. pp. 169–192. Études et

Recherches Archéologiques de l'Université de Liège (ERAUL). Liège: Université de Liège.

Svoboda, J. 1990. The Bohunician. In *Les feuilles de pierre.* J. K. Kozłowski, editor. pp. 199–211. Études et Recherches Archéologiques de l'Université de Liège (ERAUL) No. 42. Liège: Université de Liège.

Svoboda, J. 1991. Stránská skála: Výsledky výzkumu v letech 1985–1987. *Památky Archeologické* 82: 5–47.

Svoboda, J. 1993. The complex origin of the Upper Paleolithic in the Czech and Slovak Republics. In *Before Lascaux: The Complex Record of the Early Upper Paleolithic.* H. Knecht, A. Pike-Tay, and R. White, editors. pp. 23–36. Boca Raton: CRC Press.

Svoboda, J. 1997. Note on a Palaeolithic industry from Wadi Buzna, Gezzan. *Anthropologie* 35: 11–15.

Svoboda, J. 2000. Cas, prostor, príbeh a identitia: Poznámky ke sruckture paleolitického myšlení. *Archeologické Rozhledy* 52: 183–208.

Svoboda, J. 2001a. Mladec and other caves in the Middle Danube region: Early modern humans, late Neandertals and projectiles. In *Les premiers hommes modernes de la péninsule ibérique.* J. Zilhão, T. Aubry, and A. F. Carvalho, editors. pp. 45–60. Actes du Colloque de la Commission VIII, Union Internationale des Sciences Préhistoriques et Protohistoriques. Lisbon: Portugese Institute of Archaeology Press.

Svoboda, J. 2001b. La question szélétienne. In *Les industries aux outils bifaciaux du Paléolithique moyen d'Europe occidentale.* D. Cliquet, editor. pp. 221–230. Études et Recherches Archéologiques de l'Université de Liège (ERAUL) No. 98. Liège: Université de Liège.

Svoboda, J., and O. Bar-Yosef. 2003. *Stránská Skála: Origins of the Upper Paleolithic in the Brno Basin, Czech Republic.* American School of Prehistoric Research Bulletin 47–Dolní Vstonice Studies 10. Cambridge, Massachusetts: Harvard University Press.

Svoboda, J., and K. Simán. 1989. The Middle-Upper Paleolithic transition in Southeastern Central Europe (Czechoslovakia, Hungary). *Journal of World Prehistory* 3: 283–322.

Svoboda, J., and P. Škrdla. 1995. The Bohunician technology. In *The Definition and Interpretation of Levallois Technology.* H. L. Dibble and O. Bar-Yosef, editors. pp. 429–438. Madison: Prehistory.

Svoboda, J., and H. Svoboda. 1985. Les Industries de type Bohunice dans leurs cadre stratigraphique et écologique. *L'Anthropologie* 89: 505–514.

Svoboda, J., V. Lozek, and E. Vlcek. 1996. Hunters between East and West: The Paleolithic of Moravia. New York: Plenum.

Svoboda, J., H. van der Plicht, and V. Kuželka. 2002. Upper Palaeolithic and Mesolithic human fossils from Moravia and Bohemia (Czech Republic): Some new ^{14}C dates. *Antiquity* 76:957–962.

Szombathy, J. 1925. Die Diluvialen Menschenreste aus der Furst-Johanns Höhle bei Lautsch in Mähren. *Die Eiszeitung* 2: 73–95.

Taimagambetov, Zh. K. 1990. *Ch. Valikhanov Paleolithic Site.* Alma-Ata: Nauka.

Taimagambetov, Zh. K., and B. Zh. Aubekerov. 1996. The Upper Paleolithic of Kazakhstan. In *Voprosy Arkheologii Zapadnogo Kazakhstana.* pp. 23–29. Samara: University of Samara.

Tarasov, L. M. 1999. Periodization of the Paleolithic in the upper Desna basin. *Chetvertichnyi Period: Paleontologia i Arkheologia.* A. L. Yanshin, editor. pp. 166–175. Kishinev: Shtiintsa.

Tashkenbaev, N. Kh., and R. Kh. Suleimanov. 1980. *The Old Stone Age Culture of the Zeravshan Valley.* Tashkent: FAN Press.

Tavoso, A. 1988. L'outillage du gisement de San Francesco San Remo (Ligurie, Italie). Nouvel examen. In *L'Homme de Néandertal 8, La Mutation.* J. K. Kozłowski, editor. pp. 193–210. Études et Recherches Archéologiques de l'Université de Liège (ERAUL). Liège: Université de Liège.

Tostevin, G. 2000. *Behavioral Change and Regional Variation across the Middle to Upper Paleolithic Transition in Central Europe, Eastern Europe and the Levant.* Ph.D. dissertation. Cambridge, Massachusetts: Harvard University.

Trinkaus, E., V. A. Ranov, and S. Laukhin. 2000. Middle Paleolithic human deciduous incisor from Kudji, Tajikistan. *Journal of Human Evolution* 38: 575–583.

Tseitlin, S. M. 1979. *Geologiia Paleolita Svernoi Azii.* Moscow: Nauka.

Tsereteli, L. D. 1988. Le peuplement ancien dans la vallée de Kodori. In *L'Homme de Néandertal 8, La Mutation.* J. K. Kozłoski, editor. pp. 211–224. Études et Recherches Archéologiques de l'Université de Liège (ERAUL). Liège: Université de Liège.

Tsereteli, L. D. 1998. *The Cultures of the Upper Paleolithic in Georgia, Close to the Black Sea.* Tbilisi: Matserba.

Tushabramishvili, N., and A. K. Vekua. 1982. *The Paleolithic of Georgia the Quaternary of Georgia.* Tbilisi: Matserba.

Tushabramishvili, N., D. Lordkipanidze, A. Vekua, M. Tvalcherlidze, A. Muskhelishvili, and D. S. Adler. 1999. The Paleolithic rockshelter of Ortvale Klde, Imereti region, the Georgian Republic. *Préhistoire Européenne* 15: 65–77.

Tushabramishvili, N., D. S. Adler, O. Bar-Yosef, A. Belfer-Cohen. 2002. Current Middle & Upper Paleolithic research in the southern Caucasus. *Antiquity* 76: 927–928.

Valde-Nowak, P. 1991. Studies in Pleistocene settlement in the Polish Carpathians. *Antiquity* 65: 593–606.

Valladas, H., N. Mercier, C. Escutenaire, T. Kalicki, J. Kozłowski, V. Sitlivy, K. Sobczyk, A. Zieba, B. Van Vliet-Lanöe, B., 2003. The late middle Palaeolithic blade technologies and the transition to the Upper Palaeolithic in Southern Poland: TL dating contribution. *Eurasian Prehistory* 1(1): 57–82.

Valoch, K., editor. 1965. *Jeskyne Špka a Certova díra u Šramberku, Anthropos 17.* Brno: Moravské Muzeum.

Valoch, K., editor. 1976. *Die altsteinzeitliche Fundstelle in Brno-Bohunice.* Prague: Academia.

Valoch, K. 1980. L'origine de différentes technocomplexes du Paléolithique supérieur morave. In *Colloque International l'Aurignacien et le Gravettien (Périgordien) dans leur Cadre Ecologique.* pp. 283–289. Nitra: Institute of Archaeology.

Valoch, K., editor. 1988. *Die Erforschung der Külna Höhle 1961–1976, Anthropos 24.* Brno: Moravské Muzeum.

Valoch, K. 1990a. Le széletien en Moravie. In *Les feuilles de pierre.* J. K. Kozłowski, editor. pp. 213–221. Études et Recherches Archéologiques de l'Université de Liège (ERAUL) No. 42. Liège: Université de Liège.

Valoch, K. 1990b. La Moravie il y a 40,000 ans. In *Paléolithique Moyen Récent et Paléolithique Supérieur Ancien en Europe.* C. Farizy, editor. pp. 115–124. Nemours: Musée de Préhistoire d'Ile de France.

Valoch, K. 1993. Vedrovice V, eine Siedlund des Szeletiens in Sudmähren. *Quartär* 43/44: 7–93.

Valoch, K., Z. Nerudová, and P. Neruda. 2000. Stránská skála III: Ateliers des Bohunicien. *Památky Archeologické* 91: 5–113.

Vandermeersch, B. 1981. *Les Hommes Fossiles de Qafzeh (Israel).* Paris: CNRS.

Vasil'ev, S. G., O. V. Kuznetsov, and M. N. Meshcherin. 1986. Novye dannye o Paleoliticheskom poselenii Tolbaga. In *Chetvertichnaia i Pervobytnaia Arkheologiia Iuzhnoi Sibiri.* pp. 78–80. Ulan-Ude: Nauka.

Vasil'ev, S. G., O. V. Kuznetsov, and M. N. Meshcherin. 1987. Poselene Tolbaga (novyi etap issledovanii). In *Prirodnaia Sreda i Drevnii Chelovek v Pozdnem Antropogene.* pp. 109–121. Ulan-Ude: Nauka.

Vencl, S. 1977. Aurignacké osídlení v Hradsku, okr. Melník. *Archeologické Rozhledy* 29: 3–44.

Vignard, E. 1928. Une nouvelle industrie lithique: le Sébilien. *Bulletin De La Société Préhistorique Française* 25: 200–220.

Vishnyatsky, L. B. 1996. *The Paleolithic of Central Asia and Kazakhstan.* St. Petersburg: Evropeisky Dom.

Vishnyatsky, L. B. 1999. The Paleolithic of Central Asia. *Journal of World Prehistory* 13: 69–122.

Vishnyatsky, L. B. 2000. The Upper Paleolithic revolution: Its geography, chronology and causes. *Stratum* 1: 245–271.

Vlček, E. 1969. *Neandertaler de Tschechoslowakei.* Prague: Academia.

Volkman, P. 1983. Boker Tachtit: Core reconstruction. In *Prehistory and Paleoenvironment in the Central Negev, Israel.* A. Marks, editor. pp. 127–190. Dallas: Southern Methodist University Press.

Volkov, I. A., and V. S. Zykina. 1982. Stratigrafiia chetvertichnoi Lëssovoi tolshchi Novosibirskogo Priob'ia. In *Problemy Stratigrafii i Paleogeografii Pleistotsena Sibiri.* pp. 17–28. Novosibirsk: Nauka.

Volkov, I. A., and V. S. Zykina. 1984. Loess stratigraphy in southwestern Siberia. *Late Quaternary Environments of the Soviet Union.* A. A. Velichko, editor. pp. 119–124. Minneapolis: University of Minnesota Press.

Volkova, V. S., and N. I. Nikolaeva. 1982. Palinologicheskaia kharakteristika otlozhenii vtoroi terrasu Ishimkskogo Priirtysh'ia. In *Problemy Stratigrafii i Paleogeografii Pleistotsena Sibiri.* pp. 82–87. Novosibirsk: Nauka.

Vorobieva, G. A. 1987. Stroenie razreza otlozhennyi na Paleoliticheskom mestonakhozhdenii Makarovo-IV. In *Problemy Stratigrafii i Paleogeografii Pleistotsena Sibiri.* pp. 82–87. Novosibirsk: Nauka.

Vorobieva, G. A. 1992. Paleogeografiia Pozdnego Pleistotsena Baikal-Eniseiskoi Sibiri. In *Paleoekologiia i Rasselenie Drevnego Cheloveka v Severnoi Azii i Amerike.* pp. 44–48. Krasnoiarsk: Nauka.

Vorobieva, G. A., and G. I. Medvedev. 1984. *Pleistotsen-Golotsenovye Otlozheniia i Pochvy Arkheologicheskikh Pamiatnikov Iuga Srednei Sibiri.* Irkutsk: Irkutskii Gosudarstvennyi Universitet.

Wang, J., F. Tao, and Y. Wang. 1994. A report on the investigations and excavations at the Dingcun Paleolithic site. *Wen Wu Ji Kan* 3: 1–73.

Watson, E., P. Forster, M. Richards, and H.-J. Bandelt. 1997. Mitochondrial footprints of human expansion in Africa. *American Journal of Human Genetics* 61: 691–704.

West, F. H., editor. 1996. *American Beginnings: The Prehistory and Palaeoecology of Beringia.* Chicago: University of Chicago Press.

White, R. 1982. Rethinking the Middle/Upper Paleolithic transition. *Current Anthropology* 23: 169–192.

White, R. 1989. Production complexity and standardization in early Aurignacian bead and pendant manufacture: Evolutionary implications. In *The Human Revolution: Behavioural and Biological Perspectives on the Origins of Modern Humans.* C. Stringer and P. Mellars, editors. pp. 336–390. Princeton: Princeton University Press.

White, R. 1993a. The dawn of adornment. *Natural History* 102(5): 61–66.

White, R. 1993b. Technological and social dimension of "Aurignacian-age" body ornaments across Europe. In *Before Lascaux: The Complex Record of the Early Upper Paleolithic.* H. Knecht, A. Pike-Tay, and R. White, editors. pp. 277–301. Boca Raton: CRC Press.

Wilson, E. O. 1971. *The Insect Societies.* Cambridge, Massachusetts: Belknap Press.

Wolpoff, M. H. 1998. Multiregional evolution and modern human origins. In *The Origins and Past of Modern Humans: Towards Reconciliation.* K. Omoto and P. V. Tobais, editors. pp. 91–105. Singapore: World Scientific.

Wolpoff, M. H. 1999. *Paleoanthropology.* 2nd edition. Boston: McGraw-Hill.

Wolpoff, M. H., A. G. Thorne, F. H. Smith, D. W. Frayer, and G. G. Pope. 1994. Multiregional evolution: A world-wide source for modern human populations. In *Origins of Anatomically Modern Humans.* M. H. Nitecki and D. V. Nitecki, editors. pp. 175–200. New York: Plenum.

Wu, R., X. Wu, and S. Zhang. 1989. *Early Humankind in China.* Beijing: Sciences.

Yalçinkaya, I., and M. Otte. 2000. Début du Paléolithique supérieur à karain (Turquie). *L'Anthropologie* 104: 51–62.

Yalçinkaya, I., M. Otte, O. Bar-Yosef, J. Kozłowski, J. M. Léotard, and H. Taskiran. 1993. The excavations at Karain cave, south-western Turkey: An interim report. In *The Paleolithic Prehistory of the Zaros-Taurus.* D. I. Olszewski and H. L. Dibble, editors. pp. 100–106. University Museum Monographs 83. Philadelphia: University of Pennsylvania.

Yamada, M. 1996. Étude préliminaire sur l'industrie lithique de la dernière phase du Paléolithique Moyen dans le site du Buran Kaya III en Crimée Orientale (Ukraine). *Préhistoire Européenne* 9: 11–30.

Yamada, M., and A. S. Sytnik. 1997. Novelle étude sur les modes de production lithique Levalloisienne dans le site de Molodova V en Ukraine. *Préhistoire Européenne* 11: 53–67.

Yamada, M., and A. A. Yanevich. 1997. Excavations at the site of Buran Kaya-3 in eastern Crimea (Raskopki stoyanki Buran Kaya-3 v vostochnoi Crimu). In *Archaeological Research in Crimea: 1994.* pp. 277–281. Simferopol: SONAT.

Yamanaka, I. 1995. L'Industrie Lithique Du Site de Shuidonggou (Choei-Tong-Keou) Dans L'Ordos en Chine. *Kyoto University College of Literature Research Summary* 32: 105–154.

Yanevich, A. A., V. N. Stepanchuk, and Y. Cohen. 1996. Buran Kaya III and Skalistiy rockshelter: Two new dated late Pleistocene sites in the Crimea. *Préhistoire Européenne* 9: 315–324.

Yanevich, A. A., A. E. Marks, and H.-P. Uerpman. 1997. A bone handle from Buran-Kaya III, the earliest known in Crimea. *Préhistoire Européenne* 11: 85–88.

Zakharikov, A. P. 1999. Industries with bifaces and the Middle to Upper Paleolithic transition in Europe. *Arkheologichesky Almanackh (Donetsk)* 8: 197–206.

Zamiatnin, S. N. 1957. Paleolit zapadnowo Zakawkazia. *Sbornik Museji Anthropologii Etnografi (Moscow)* 27: 423–499.

Zarrina, E. P. 1991. *Quaternary Deposits of the North-Western and Central Areas of the European Part of the USSR.* Leningrad: Nedra.

Zavernyaev, F. M. 1991. Flint inventroy of the Upper Paleolithic site of Khotylevo. *Sovetskaya Arkheolgia* 4: 164–181.

Žebera, K. 1958. *Ceskoslovensko ve starší dobe kamenné.* Prague: Nakladatelstvi Ceskoslovenske Akademie Ved.

Zhang, S. 1999. A study of stone artifacts found at the Xiaokouzi prehistoric site. *Acta Anthropologica Sinica* 18: 81–101.

Zhou, J., and J. Hu. 1988. Environment and stratigraphy at the Shuidonggou site. *Acta Anthropologica Sinica* 7: 263–269.

Zilhão, J., and F. d'Errico. 1999. The chronology and taphonomy of the earliest Aurignacian and its implications for the understanding of Neandertal extinction. *Journal of World Prehistory* 13(1): 3–68.

Zykina, V. S. 1992. Pozdnepleistotsenovye iskopaemye pochvy iuga srednei Sibiri (Prieniseiskaia chast'). In *Paleoekologiia i Rasselenie Drevnego Cheloveka v Severnoi Azii i Amerike.* pp. 102–106. Krasnoiarsk: Nauka.

CONTRIBUTORS

O. Bar-Yosef, Department of Anthropology, Peabody Museum, Harvard University, USA

A. Belfer-Cohen, Institute of Archaeology, Hebrew University, Israel

R. L. Bettinger, Department of Anthropology, University of California, Davis, USA

P. J. Brantingham, Department of Anthropology, University of California, Los Angeles, USA

N. R. Coinman, Department of Anthropology, Iowa State University, Ames, USA

A. P. Derevianko, Institute of Archaeology and Ethnology, Siberian Branch of the Russian Academy of Sciences, Novosibirsk, Russia

R. G. Elston, Silver City, Nevada, USA

J. R. Fox, Department of Anthropology, University of Pittsburgh, USA

X. Gao, Institute of Vertebrate Paleontology and Paleoanthropology, Chinese Academy of Sciences, Beijing, People's Republic of China

J.-M. Geneste, Regional Archaeological Service of Aquitaine, Ministry of Culture, Bordeaux, France

T. Goebel, Department of Anthropology, University of Nevada, Reno, USA

E. Güleç, Department of Physical Anthropology and Paleoanthropology, Ankara University, Turkey

K. W. Kerry, Department of Anthropology, University of Arizona, Tucson, USA

L. Koulakovskaia, Museum of Archaeology, Kiev, Ukraine

J. K. Kozłowski, Institute of Archaeology, Jagellonian University, Poland

S. L. Kuhn, Department of Anthropology, University of Arizona, Tucson, USA

Y. V. Kuzmin, Pacific Institute of Geography, Far Eastern Branch of the Russian Academy of Sciences, Vladivostok, Russia

D. B. Madsen, Texas Archaeological Research Institute, University of Texas at Austin, USA

A. E. Marks, Department of Anthropology, Southern Methodist University, Dallas, USA

L. Meignen, Center for the Study of Prehistory, Antiquity and the Middle Ages, National Center of Scientific Research, Valbonne, France

T. Meshveliani, Department of Archaeology, Georgian State Museum, Tbilisi, Republic of Georgia

K. Monigal, Department of Anthropology, Southern Methodist University, Dallas, USA

P. E. Nehoroshev, Institute for the History of Material Culture, Russian Academy of Sciences, St. Petersburg, Russia

J. W. Olsen, Department of Anthropology, University of Arizona, Tucson, USA

M. Otte, Department of Prehistory, University of Liege, Belgium

M. C. Stiner, Department of Anthropology, University of Arizona, Tucson, USA

J. A. Svoboda, Institute of Archaeology, Paleolithic and Paleoethnology Research Center, Academy of Sciences of the Czech Republic, Brno, Czech Republic

A. Sytnik, Department of Archaeology, National Institute of Science, Lviv, Ukraine

D. Tseveendorj, Institute of Archaeology, Mongolian Academy of Sciences, Ulaan Bataar, Mongolia

L. B. Vishnyatsky, Institute for the History of Material Culture, Russian Academy of Sciences, St. Petersburg, Russia

INDEX

Project management, copyediting,
and composition: Princeton Editorial Associates, Inc.
Text and display: Baskerville
Printer and binder: Maple-Vail Book Manufacturing Group