

THESIS

THE CULTURAL SIGNIFICANCE OF MODERN HUMAN MORPHOLOGY

Submitted by

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ABSTRACT

THE CULTURAL SIGNIFICANCE OF MODERN HUMAN MORPHOLOGY

The dominant opinion in paleoanthropology maintains that ‘modern’ behavior resulted from innovations made by anatomically modern humans without the development of this behavior in archaic hominin groups. To a large degree, the archaeological record supports this dogma since much of the evidence for ‘modern’ behavior is found associated with anatomically modern human fossils. However, other evidence is surfacing that suggests ‘modern’ behaviors to be associated with other hominin groups independently of modern humans. Through a comparative analysis of 15 Pleistocene Neanderthal and modern human sites from Africa, the Levant, and Eurasia, I test this longstanding assumption. While my results reveal that anatomically modern humans do in fact appear to be the dominant producers of ‘modern’ behavior, evidence for this behavior is also conclusively present in Neanderthals. Therefore we can declare that ‘modern’ behavior does not match modern morphology in the archaeological record and thus reject the dogma that anatomically modern humans were the sole producers of ‘modern’ behavior. Additionally I find that the evolution of these behaviors was not a straightforward progression, but a mosaic of developments that varied across region, period, and species.

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Table of Contents

Abstract of Thesis	ii
Acknowledgments	iii
List of Tables	vi
List of Figures	vii

<u>Chapter</u>	<u>Page</u>
I. INTRODUCTION	
Contextualizing the Research.....	2
Hypothesis Construction	3
Background	3
Analysis.....	5
Results	6
II. MORPHOLOGICAL BACKGROUND	
Modern vs. Archaic Morphology.....	8
Modern <i>Homo sapiens</i> Cranial Morphology and Etiology	8
Neanderthal Cranial Morphology and Etiology	13
Neanderthal Variation	20
Modern Human Transition.....	21
Neanderthal/Modern Human Overlap and Uniqueness	26
III. CULTURAL BACKGROUND	
‘Modern’ Behavior.....	29
Characteristics of ‘Modern’ Technology	29
Lithic Blades and Elongated Tools	30
Hafting and Lithic Projectile Points.....	31
Standardization and Retouching Design	33
Bone and Antler Tools	35
‘Modern’ Symbolic Behavior	40
Art	40
Jewelry	43
Non-Utilitarian Use of Pigment	45
Burial of the Dead	46
‘Modern’ Strategic Behavioral Patterns.....	48
Specialized Site Use	48
Organized Site Structure	49
Long Distance Procurement of Raw Materials	50
Strategic Hunting	51
Connection to the Research.....	52
IV. MATERIALS AND METHODS	
Sample.....	55
African and Levantine Sites.....	57
Eurasian Sites.....	58
Exclusion Criteria	58

	Methods of Analysis	60
	Hypothesis Testing	62
V.	SITE REPORTS	
	Herto	65
	Klasies River Mouth	71
	Border Cave	79
	Kebara	85
	Tabun	92
	Qafzeh	98
	Skhul	105
	St. Cesaire	111
	Grotte du Renne	117
	La Quina	123
	Krapina	128
	Vindija	134
	Mladec	140
	Buran Kaya III	147
	Kostenki 14	152
VI.	RESULTS	
	Behavioral Percentage	159
	Average Behavioral Percentage per Morphology	160
	Average Behavioral Percentage per Period	162
	Average Behavioral Percentage per Region	165
	Behavioral Indicators	168
	Number of Sites with 'Modern' Behavioral Indicator per Morphology	168
	Number of Sites with 'Modern' Behavioral Indicator per Period	169
	Number of Sites with 'Modern' Behavioral Indicator per Region	170
	Total Number of Sites Where Information on the Behavioral Indicators was Not Available	175
	Results	176
VII.	DISCUSSION AND CONCLUSION	
	Discussion	179
	'Modern' Moderns	181
	Modern Human Evolution Models	182
	Challenges to Paleoanthropology	183
	Problematic Issues	185
	Conclusion	190
	REFERENCES CITED	191
	IMAGES CITED	205

List of Tables

<u>Table</u>	<u>Page</u>
1. List of Sites	56
2. List of Excluded Sites	60
3. List of Variables.....	61
4. Herto Table of Evidence	65
5. Klasies River Mouth Table of Evidence	71
6. Border Cave Table of Evidence	79
7. Kebara Cave Table of Evidence.....	85
8. Tabun Cave Table of Evidence	92
9. Qafzeh Cave Table of Evidence.....	98
10. Skhul Table of Evidence	105
11. Saint-Cesaire Table of Evidence.....	111
12. Grotte du Renne Table of Evidence	117
13. La Quina Table of Evidence	123
14. Krapina Table of Evidence	128
15. Vindija Cave Table of Evidence	134
16. Mladec Cave Table of Evidence	140
17. Buran Kaya III Table of Evidence	147
18. Kostenki 14 Table of Evidence	152

List of Figures

<u>Figure</u>	<u>Page</u>
1. Anatomically Modern <i>Homo sapiens</i> Cranium (anterior view).....	11
2. Anatomically Modern <i>Homo sapiens</i> Cranium (lateral view)	12
3. Neanderthal Cranium (anterior view)	17
4. Neanderthal Cranium (lateral view).....	18
5. Archaic Human Cranium (rear view).....	19
6. Neanderthal Dentition	19
7. Jebel Irhoud 3 Mandible	23
8. Jebel Irhoud I (lateral view)	24
9. Jebel Irhoud I (anterior view).....	25
10. Magdalenian Stone Blades.....	30
11. Aurignacian End Scraper	31
12. Replicated Wood Hafted Flint Knife	32
13. Mousterian Point Showing Basal Thinning	33
14. Re-touched Aurignacian Blades.....	34
15. Geometric Microliths	35
16. Swartkrans Bone Tools	36
17. MSA Bone Points with Tangs for Hafting.....	37
18. MSA Bone Harpoon.....	37
19. Bone Awl from Blombos Cave.....	38
20. Bone Needles from Blombos Cave.....	38
21. Replicated Bone Hafted Knife	38
22. La Quina Bone Retoucher	39
23. Ochre Crayon from Blombos Cave.....	40
24. Cave Art from Chauvet Cave, Spain.....	41
25. Painted Rock Slab from Apollo 11	42
26. Engraved Rock from La Ferrassie	42
27. Venus Figurine from Willendorf	43
28. MSA and IUP African Shell Pendants.....	44
29. Ivory Rings from Grotte du Renne	45
30. Flexed Fetal Position Burial.....	46
31. Map of African and Levantine Sites	57
32. Map of Eurasian Sites	58
33. Herto Adult Cranium	67
34. Klasies River Mouth Cave	77
35. Border Cave	83
36. Engraved Bone Fragment from Kebara	87
37. Kebara 2 Burial	88
38. Kebara Cave.....	90
39. Tabun Cave	96
40. Qafzeh 8 and 9	101
41. Two Perforated Shell Beads from Es-Skhu1	107
42. Mount Carmel	109
43. Reconstruction of the St. Cesaire Skull	112
44. Grotte du Renne Personal Ornaments.....	120
45. Bone Retouch Tools.....	125
46. Cutmarks on the Krapina 3 Frontal.....	131

47. Vindija Cave	137
48. Mladec 5	142
49. Mladec 1	142
50. Buran Kaya III Ivory Beads	149
51. Kostenki 14 Skeleton	155
52. Behavioral Percentage and Modern Morphology	160
53. Behavioral Percentage and Neanderthal Morphology	160
54. Behavioral Percentage 200-100kya	162
55. Behavioral Percentage 100-45kya	162
56. Behavioral Percentage 50-21kya	162
57. Behavioral Percentage in Africa	165
58. Behavioral Percentage in the Levant.....	165
59. Behavioral Percentage in Eurasia.....	165
60. Behavioral Indicators and Modern Morphology.....	168
61. Behavioral Indicators and Neanderthal Morphology	168
62. Behavioral Indicators 200-100kya	169
63. Behavioral Indicators 100-45kya	169
64. Behavioral Indicators 50-21kya	169
65. Behavioral Indicators in Africa.....	170
66. Behavioral Indicators in the Levant.....	170
67. Behavioral Indicators in Eurasia	170
68. Behavioral Indicators N/A	175

Chapter 1

Introduction

Contextualizing the Research

Conventional wisdom in paleoanthropology currently suggests that anatomically modern humans have been the only hominin species capable of ‘modern’ cultural behavior. Until recently, the beginning of the Upper Paleolithic in Europe was identified as the time and place that ‘modern’ behaviors are first observed. Dubbed a ‘creative explosion’ by John Pfeiffer (1982), the European Upper Paleolithic was thought to uniquely possess symbolically laden artistic expression in the form of cave art as well as portable sculpted figurines. Taken as a whole, these non-utilitarian behaviors were seen as the first evidence of ritual behavior and increased social complexity. They were characterized as the result of a ‘cultural revolution’. In this sense, the revolution was understood to be an influx of ‘modern’ behavior brought to Europe by anatomically modern humans about 40kya (d’Errico 2003).

However, the characterization of the Upper Paleolithic as a cultural revolution of sorts is no longer supported (d’Errico 2003, Henshilwood 2003, Kaufman 1999, Trikaus 1989), primarily because of evidence of symbolic behavior occurring in Africa much earlier than the Upper Paleolithic (McBearty and Brooks 2000). In recent years, not only has the idea of a rapid transition to ‘modernity’ been questioned, but definitions of what constitutes ‘modern’ behavior have also expanded (Henshilwood 2003, Kaufman 1999, McBearty and Brooks 2000, Mellars 1989, Wadley 2001).

Within the archaeological record, evidence for ‘modern’ behavior has most often been associated with modern human morphology (Mellars 1989). Thus, even with new approaches to the origins of and what constitutes ‘modern’ behavior, most scholars implicitly assume that this behavior is only accredited to anatomically modern humans. The present research examines the validity of this dogma and tests whether a detailed comparative approach to the Paleolithic archaeological record falsifies this longstanding assumption.

Hypothesis Construction

My hypothesis is derived from this dominant opinion that ‘modern’ behavior resulted from innovations by anatomically modern humans, who developed the technologies in their African homeland and then through dispersals into Eurasia, were responsible for ‘modernity’ in that region. This hypothesis rejects the possibility for the development of this behavior in archaic hominin groups.

The hypothesis to be tested is as follows:

Only modern hominin morphologies are associated with ‘modern’ cultural remains; therefore anatomically modern humans are the sole innovators of ‘modern’ behavior.

Background

Prior to addressing the hypothesis in my research, two avenues of inquiry are explored, skeletal morphology and hominin behavior. Chapter 2 addresses skeletal morphology, where I examine modern versus archaic hominin cranial morphology and determine if the two types are strictly dichotomous. Modern, in the context of this study, consists of those features that identify anatomically modern *Homo sapiens*, while archaic is represented by Neanderthals.

Here I explore characteristics that are used to identify hominin fossils and categorize them in the archaeological record. I discuss differences in facial dimensions such as breadth, length, height, and degree of prognathism (Cartmill and Smith 2009). I look at differences in key features of the face such as nasal aperture (Cartmill and Smith 2009, Trinkaus 1989), mental eminence (Cartmill and Smith 2009, Schwartz 2000), supraorbital torus (Cartmill and Smith 2009, Vineyard and Smith 1997), and infraorbital area (Rak 1986). I also explore differences in dentition such as tooth size, positioning, and wear (Baily 2006, Cartmill and Smith 2009, Trinkaus 1984, Wallace 1975). In regards to overall skull shape I discuss

dimensions including frontal, parietal, and occipital shape, along with overall cranial capacity (Cartmill and Smith 2009, Kaufman 1999, Leiberman 2002, Trinkaus and LeMay 1982).

In this chapter I also explore issues indicating that a strict typological approach to past hominin groups is problematic. This discussion includes a review of the variation within Neanderthals as they change regionally throughout time (Cartmill and Smith 2009, Schwartz and Tattersall 2006). Also discussed, is transitional morphology within *Homo sapiens* as archaic humans transition into anatomically modern humans in Africa (Cartmill and Smith 2009, Hublin 1992). Additionally examined is the observation that Neanderthal and *Homo sapiens* morphologies overlap as they come into contact in Europe (Trinkaus 2003, 2006, 2007).

In chapter 3, I examine the characteristics that define ‘modern’ behavior and determine the analytical methods used to identify them in the archaeological record. Here I discuss three major categories of behavior; tool technology, symbolic behavior, and strategic behavioral patterns. The adaptations discussed in this chapter reveal evolution in past hominin cognition beyond day-to-day survival, showing increases in planning depth and abstract thinking.

In regards to tool technology I look at what signifies ‘modern’ innovation in lithic technology, specifically in blade tools, end scrapers, and projectile points (Andrefsky 2009, McBeary and Brooks 2000, Mellars 1989, Mellars 2006, Shea 2006, Trinkaus 1989). I also look at ‘modern’ characteristics of bone technology, specifically in points, awls, and harpoons (Backwell 2003, d’Errico 2007, Henshilwood and d’Errico 2001, Henshilwood and Marean 2003, Marshack 1990, McBearty and Brooks 2000, Villa and d’Errico 2001).

In regards to symbolic behavior, I explore various forms of artistic expression considered to be ‘modern’ in behavior such as paintings, engravings, figurines, and production of jewelry, or items of personal adornment (Marshak 1990, White 1989, Zilhã 2007). I also

explore the ‘modern’ practices of purposeful and symbolic human burial (Kaufman 1999, McBearty and Brooks 2000, Riel-Salvatore 2010).

I then discuss ‘modern’ strategic behavioral patterns such as site use (Binford 1989, Chase 1989, Clark 1989, Kaufman 1999) and site structure (Henry 2003, Vallverdu 2010), the sources for raw material used at the sites (Ambrose 2010, Kaufman 1999, McBearty and Brooks 2000), as well as various subsistence strategies like faunal species and size selection, seasonal hunting patterns, and the practice of fishing (Kaufman 1999, Klein 1989, McBearty and Brooks 2000).

Analysis

Chapter 4 explains my materials and methods. Here I explore how my data was chosen and analyzed in order to assess behavior at the sites and ultimately test the working hypothesis. I describe the reasoning behind each site/region analyzed along with a map showing approximate location of the sites. I also discuss the sample criteria and the requirements necessary to qualify a site as usable for the study. Then I give a brief description of each site with location, period, and its importance relative to the study. Finally, I introduce my variables and explain how these are used to make a behavioral assessment of each of my sites.

Chapter 5 contains the focal point of my study. Here I look at data sets from the current literature to analyze and compare various archaeological sites. The compilation of my data is derived from the literature on fifteen late Pleistocene sites ranging from 200-21kya in the regions of East and South Africa, the Levant, and western Eurasia. All of these contain fossil remains so that proper authorship of the hominin group responsible can be noted. Each site also contains signatures in the assemblage that show ‘modern’ behavior.

With this data I conduct a comparative qualitative analysis of these sites on the basis of designated variables that are indicators of ‘modern’ behavior. These include the categories discussed above: lithic blades, end scrapers, and projectile points; bone or antler points, awls, and harpoons; artistic expression through paintings, engravings, figurines, jewelry, and non-utilitarian uses of pigments; practices of purposeful and ritual human burial; site use and structure; raw material source; and hunting preferences in species, size, and season as well as fishing practices. Through the presence or absence of these indicators, I come up with a percentage assessment as to the degree that each site displays ‘modern’ behavior.

Results

Chapter 6 displays my results. I do this through various figures that help to better visualize the outcome of my data analysis and include a discussion of each. This provides me with answers as to whether archaic and modern morphology match with ‘archaic’ and ‘modern’ behavior in the archaeological record.

Then in chapter 7 is the discussion of my findings. Here, I discuss my results and then expand on my assessments in order to relate my findings to larger issues in paleoanthropology. I also touch on some problematic issues I ran into during my research and site analysis. Finally I answer the central question of my thesis; are anatomically modern humans the sole party responsible for ‘modern’ behavior?

Chapter 2

Morphological Background

Modern vs. Archaic Morphology

The following is a discussion of three cranial morphological forms found in hominins of the late Pleistocene; modern and archaic, as well as a specimen showing a mosaic of characteristics in order to display the variation that can occur in past hominin skeletal morphology. In this study, modern morphology is represented by anatomically modern *Homo sapiens*, both early and late. While archaic morphology is represented by Neanderthals, who are a derived form of archaic hominin and distinctly different from anatomically modern humans.

Anatomically Modern *Homo sapiens* Cranial Morphology and Etiology

Due to the range of variation in hominins during the early late Pleistocene, anatomically modern human morphology exists on a continuum. There is however a general acceptance of what constitutes the morphology and this is predominately defined through cranial features (figures 1-2). Cartmill and Smith (2009) effectively summarize these characteristics.

1. Modern *Homo sapiens* crania are nearly orthognathic (2a), with almost the entire face, except the tip of the nasal aperture, existing posterior to the anterior most point of the braincase. Unlike earlier archaic hominins, there exists little mid-face prognathism (2b) while alveolar prognathism (2c) remains.

2. The key modern autapomorphy is the projecting mental eminence (2d) on the mandible marked by a mental trigone (1a), which is bounded on either side by mental fossae (1b). These features combine to form a well-defined mandibular incurvature (2e). The most generally accepted reasoning behind the appearance of a chin in our evolution is the reduction of the dental arcade mainly due to a reduction in the size of the anterior teeth. This

left the boney protrusion. But it is more complicated because we don't have a chin at the anterior point of our maxilla like on the mandible even those these teeth also reduced in size. This remaining protruding bone has been proposed as being due to the demands of the tongue and larynx muscles that served to maintain mandibular length (Schwartz 2000).

3. The supraorbital torus (1c) is relatively weakly developed and not continuous, but divided into lateral and medial portions.

4. The nasal aperture (1d) is reduced when compared to earlier archaic hominins. This is subject to regional variation, often larger in colder dryer climates and smaller in warmer more humid climates.

5. Facial lengths are reduced 10-15% in both height and length relative to overall cranial size when compared to earlier archaic hominins, making for an overall smaller, shorter face (Leiberman 2002). This forces the angle of the zygomatic bone into the maxilla to produce another modern autapomorphy, a well-defined malar notch (1e).

6. A short, high and globular skull with smoothly arched cranial contours is defined by the combination of a high, vertical frontal bone (2f), a long, high parietal bone (2g) with narrow inferior dimensions and broad superior dimensions, and an occipital bone (2h) that is continuously curved rather than angulated. These alterations in facial and cranial form in modern humans seem to be mostly the result of developmental changes in the evolution of our brain, this being growth of the temporal lobe and slight growth of the frontal lobe (Leiberman 2002). Other epigenetic forces can also change facial structure. Degree of mastication due to diet or use of the teeth as tools can change the size of facial features and

bone structures due to necessary robustness and because of increased muscle attachments needed in order to perform daily functions. Forces such as sexual selection can influence the evolution of certain cranial features as well.

7. The presence of an external occipital protuberance (2i) lies just below the maximum rear cranial breadth.

8. A mastoid process (2j) projects below the cranial base.

9. The dentition in comparison to earlier archaic hominins, especially Neanderthals, is marked by the reduction and retraction of the anterior teeth. This came as tool technology advanced and the front teeth were not used for non-masticatory reasons to the same degree, which is seen in the reduced wear on fossil teeth (Trinkaus 1984). The middle and posterior teeth remained relatively constant in size when compared to earlier archaic hominins. Also due to the reduction in mid-face prognathism, there is no retromolar space (1f).

10. Overall hominin cranial capacity surprisingly, reached its peak in early modern humans and has actually since decreased. This is seen in the data that shows averages in recent humans are 60-200 cubic centimeters smaller than early modern human and late archaic *Homo* averages (Cartmill and Smith 2009). This decline does not correlate with a decline in intelligence, but reflects changes in body size due to climate since the Pleistocene. Because a higher body mass, which is an adaptation for cold, is accompanied by a larger brain; the declining temperatures in the Holocene could be responsible for this decline in hominin cranial capacity.

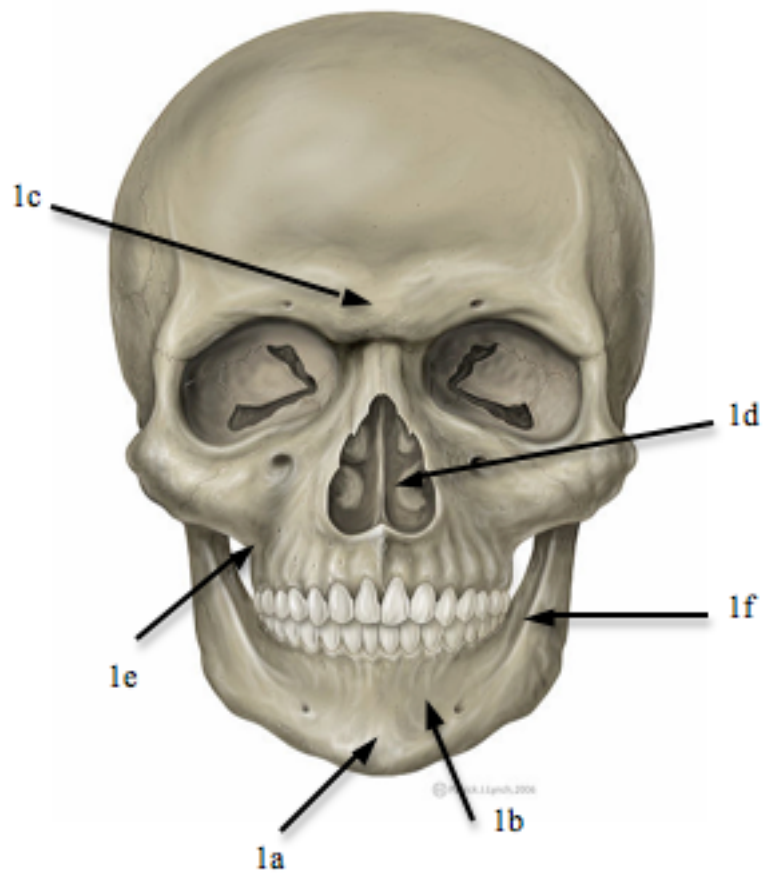


Figure 1: Anatomically Modern *Homo sapiens* Crania (anterior view)

Adapted from: http://commons.wikimedia.org/wiki/File:Head_skull_anterior_view.jpg

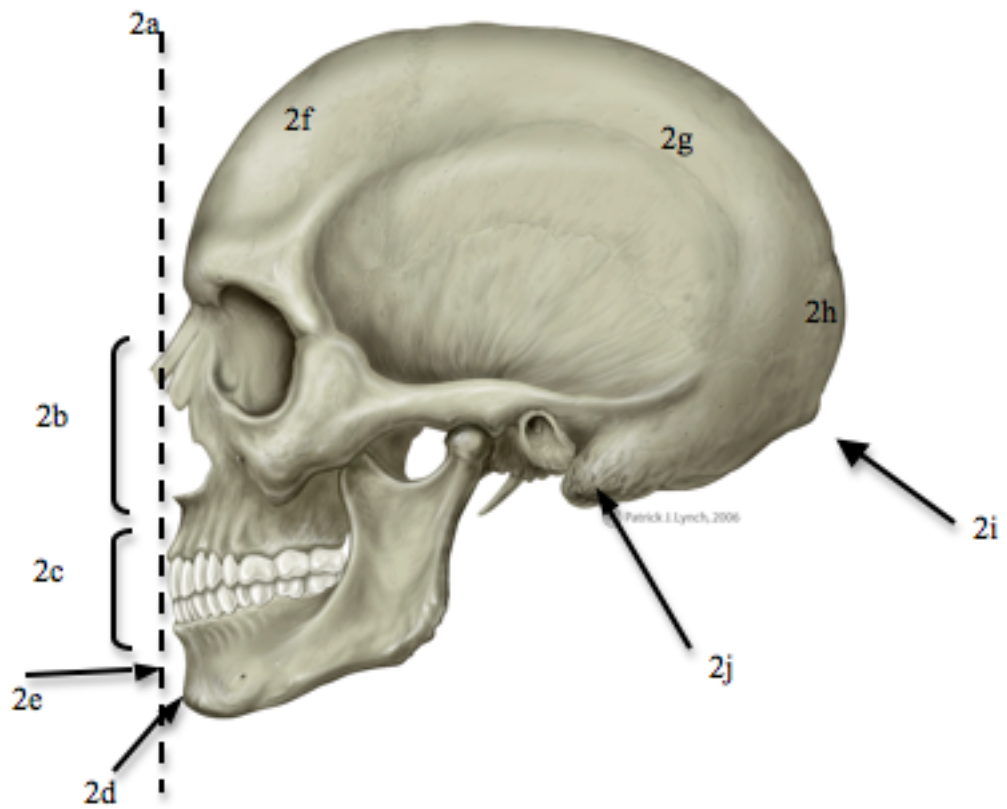


Figure 2: Anatomically Modern *Homo sapiens* Cranium (lateral view)
 Adapted from: http://commons.wikimedia.org/wiki/File:Human_skull_lateral_view.jpg

Neanderthal Cranial Morphology and Etiology

Neanderthal morphology (figures 3-6) also exists on a continuum and is composed of a suite of archaic and derived features, differing distinctly from anatomically modern humans. Cartmill and Smith (2009) effectively summarize the most salient of these characteristics.

1. Neanderthal faces have high breadth, length, and height values when compared to modern humans. With marked mid-facial (3a) and alveolar prognathism (3b), most of the face lies in front of the anterior most point of the braincase. However, the lateral face is distinguished by gracile cheekbones that sweep back to either side (3c), placing this portion further back. This combination of features is suggested to be due to large anterior teeth and a very large nasal area, making for a beak-like facial appearance.

2. The large nasal aperture in both height and width is a key autapomorphy of the face. This is suggested as an adaptation to an intensely physical life in a cold dry climate. The configuration of the nasal passage as such would serve to dissipate body heat while conserving moisture from exhaled air; an adaptation well suited for a hominin with endurance related foraging patterns in a cold arid environment (Trinkaus 1989).

3. Neanderthals lack a projecting mental eminence (3d).

4. The supraorbital torus (3e) is well defined, thick, and horizontally protuberant. It thins laterally and is pronounced by a dip in the middle that divides it into separate arches over large eye sockets. This characteristic is suggested to be in a mutual cause and effect relationship with the large frontal-sinus volume (Vineyard and Smith 1997). The supratoral

sulcus (3f) is minimal when compared to earlier erectine hominins, but is larger than in modern humans, where it is non-existent.

5. The infraorbital area on Neanderthals has an inflated or buttressing appearance. This puffiness removes any physical canine fossa, and the retraction of the cheekbones makes for a zygomaticalveolar margin that slopes down in a straight line, eliminating a malar notch (3g) as seen in modern humans (Rak 1986).

6. The cranial vault is long, low, and wide. The frontal braincase slopes back behind the brow ridge and the rear brain case protrudes backwards. The greatest width of the braincase is lower on the parietals than in modern humans, bulging out most just above the ears (3h).

7. A signature of European Neanderthals is an enlarged occipital bone projecting out of the rear braincase that makes for an occipital plane that is longest at the midsagittal level and a nuchal plane that is larger than in more recent humans. This makes for the flattening of the lambdoidal region and the presence of an infratoral shelf, which gives the skull a unique shape dubbed, an 'occipital bun' (4a). The feature has been associated with the enlarged occipital pole of the Neanderthal brain that produces this posterior bulge in the upper part of the occipital bone (Trinkaus and LeMay 1982). It has also been suggested that the bun developed to provide a more horizontal surface for the attachment of the nuchal muscles at the back of the neck (Brose and Wolpoff 1972). This would as well be an adaptation for a physically demanding existence.

8. Another Neanderthal autapomorphy is the minimal projection of the mastoid process (4b). This is not due to a decrease in the size of the bone, but to the more inferior positioning of the

adjacent occipitomastoid eminence (4c). On the surface of the eminence lies a distinct ridge (4c), which also helps mask the projection of the mastoid process below the cranial base.

9. Instead of an external occipital protuberance as in modern humans, a horizontally elongated suprainiac fossa (5a) exists on the underside of the nuchal torus. Characterized by pinprick like pitting, this area represents an attachment area for the nuchal ligament, just as in the area of the occipital protuberance in modern humans. However, this ligament is wider and more fan-like in Neanderthals. This has been suggested as being a result of more intense bending forces and larger muscle attachments in the Neanderthal occipital region due to an existence of more intense physical activity (Cartmill and Smith 2009).

10. The foramen magnum in Neanderthals is long anteroposteriorly when compared to most earlier hominins as well as anatomically modern humans. This could be due to circulatory demands required by a big face and large cranial capacity, but could also be due to the overall elongation of the Neanderthal cranial base (Trinkaus 1995).

11. Neanderthal dentition is marked by very large anterior teeth (6a), in both canines and incisors. It has mostly been agreed that this increased size was due to the heavy use of the front teeth for non-masticatory purposes, such as a tool for holding, pulling, and twisting materials being worked for other purposes than consumption. This is supported by evidence of extreme wear on Neanderthal incisors and canines in the archaeological record, namely in microrfractures, striations, and enamel chipping. For example remains from La Ferrassie and Shanidar show the crowns of the anterior teeth to be worn beyond capacity, all the way down to the roots (Wallace 1975). Neanderthal incisors and canines also exhibit shovel shaping. Although this is seen sporadically in earlier and later hominins species, it is consistently a

Neanderthal trait (Bailey 2006). This has also been suggested to be a characteristic of teeth that are enabled to exert more powerful bite forces (Cartmill and Smith 2009). The posterior teeth are less distinctive and reduced in size from earlier *Homo*, falling in the size range of more recent humans. This was probably a result of food procurement practices and a more favorable diet away from foods such as roots and tubers that required high levels of mastication. There does exist a retro molar space (6b).

12. Neanderthal cranial capacity is as big as living humans today. They existed on the trajectory of enlarging brains over time from earlier hominins, which reached a maximum during early modern humans and then actually decreased since then. These changes reflected more a shifting in body mass rather than in intelligence. The average Neanderthal cranial capacity lies at 1465cc (Kaufman 1999).

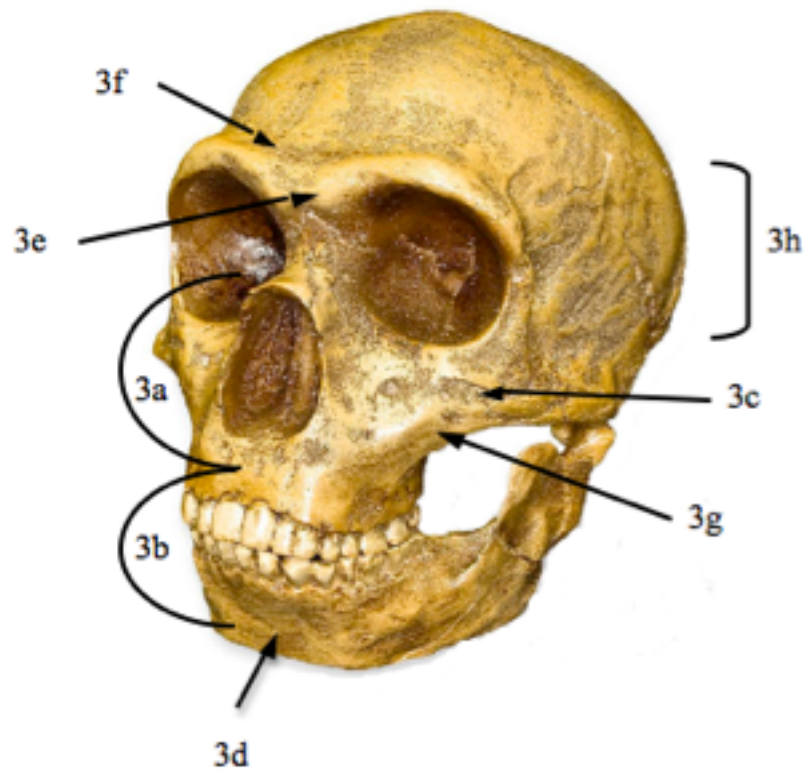


Figure 3: Neanderthal Cranium (anterior view)

Adapted from: <http://forums.skadi.net/showthread.php?p=858425>

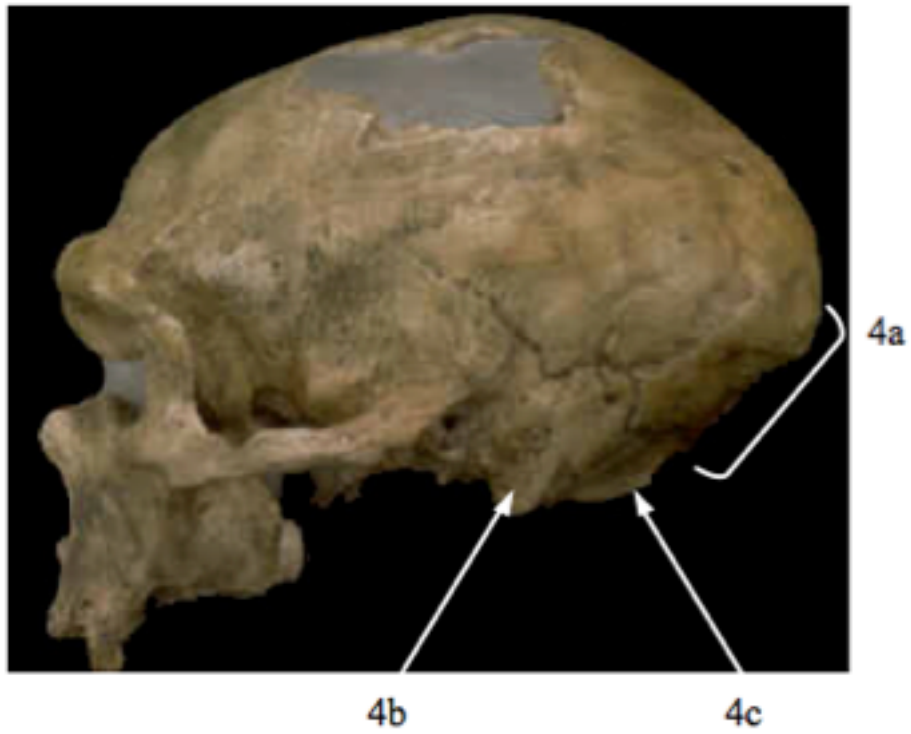
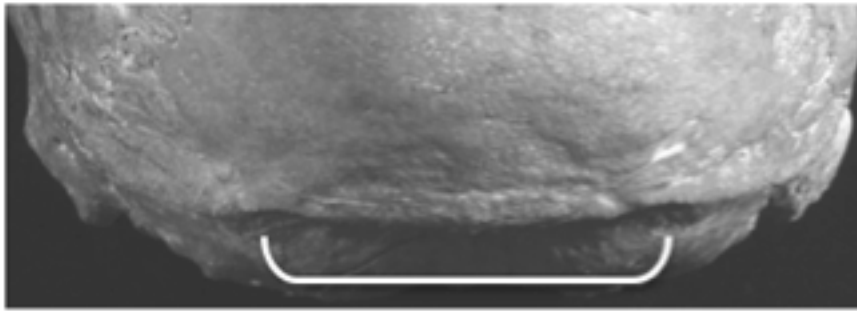


Figure 4: Neanderthal Cranium (lateral view)

Adapted from: <http://en.citizendium.org/wiki/Neanderthal>



5a

Figure 5: Archaic Human Cranium (rear view)
Adapted from: Trinkaus (2007)



6a

6b

Figure 6: Neanderthal Dentition
Adapted from: <http://en.citizendium.org/wiki/Neanderthal>

Neanderthal Variation

Neanderthals do not strictly adhere to the morphology described previously, but vary temporally as well as regionally, making it difficult to declare a set of qualifying Neanderthal features. They can however be assigned to a few major groups according to region and period. These include Wurm/Classic European Neanderthals, West and Central Asian Neanderthals, and late Neanderthals (Cartmill and Smith 2009).

The beginning of the Wurm Glaciation period, which took place during the early stages of the Upper Pleistocene, marks the onset of what Howell (1957) dubbed the ‘classic’ Neanderthals of Europe. These hominins fit the most distinctive traits for Neanderthals and appear to be the best adapted for cold glacial conditions. The well-known fossils from La Chapelle and La Ferrassie in France are amongst these displaying ‘classic’ features and give Neanderthals the stereotype as to having very large cranial capacities (Cartmill and Smith 2009).

Neanderthal like hominins however, actually began appearing in Europe before the onset of the Wurm Glaciation, around 200kya in transition from *Homo heidelbergensis*. Later pre-Wurm hominins displayed most of the ‘classic’ Neanderthal features, but did not quite make for the complete package. We see this in the fossils of several adult and juvenile individuals from Krapina in Croatia, c.130kya. With an array of features these hominins represent enough distinctive Neanderthal traits to be called Neanderthals, but show primitive retentions as well as modern human morphology (Schwartz and Tattersall 2006).

Neanderthals eventually spread out into Asia to regions such as Israel, Syria, Iraq, Uzbekistan, Ukraine, and into Russia. In some of these areas, they appear to have lost some of their ‘classic’ Neanderthal traits. This is apparent in the case of the complete Neanderthal skull from Shanidar, Iraq, which lacks an occipital bun (Stewart 1977). Some other Asian Neanderthal fossils show a trajectory towards modern human morphology. The mandible

recovered from the Tabun site in Israel displays large anterior teeth and a retromolar space as seen in Neanderthals, but also exhibits a projecting chin as in modern humans (Stefan and Trinkaus 1998).

Late Neanderthals existed in Europe past the point that modern humans had left Africa and spread into Eurasia, c.40kya. Some of these strongly show to be transitional to modern humans. The fragmentary skull from Saint-Cesaire, France exhibits Neanderthal infraorbital and mandibular morphology with similar facial prognathism, but the supraorbital torus, anterior teeth, and nasal aperture are significantly reduced as seen in modern humans (Cartmill and Smith 2009).

Modern Human Transition

Anatomically modern humans as well did not arise suddenly displaying a particular morphology, but came about over time transitionally while also varying regionally. Even currently they do not fit into a strict morphological type, as high variation exists around the world.

The transition to modern human morphology is highly apparent in the African fossil record starting around 200kya. One example that displays this is the North African site of Jebel Irhoud in Morocco, where the fossils show a mosaic of archaic and modern features. Recovered here are fossils from four individuals including a cranium, adult calvaria, a juvenile mandible, and a juvenile humeral diaphysis; dating between 130-190kya (Hublin 1992). They have been declared that of anatomically modern human, but at the same time show a suite of archaic features.

The juvenile mandible comes from Irhoud 3 (Figure 7). It as well shows an interesting mix of an archaically robust bone structure with large teeth, but a modern reduction in the size of

the retro molar space (7a) with, although not visible from this view, a chin displaying elements of modern morphology (Hublin 1992).

The cranium come from Irhoud 1 and consists of a complete face fully connected to the braincase (Figures 8-9). The face is wide and low and lies in between modern and archaic in the degree of prognathism (8a), showing remaining alveolar prognathism and decreased mid-facial prognathism (Hublin 1992). The eye orbits are large and somewhat rectangular in shape with well-defined supraorbital tori (9a) that are more consistently thick across the orbit than Neanderthals, thinning only slightly laterally (Hublin 1992). The nasal aperture is wide like in Neanderthals, but short at 52.5mm when compared to the 61-66mm of European Neanderthals (Hublin 1992). Angled zygomaticoalveolar margins bring the face the characteristic modern malar notch (9b) (Cartmill and Smith 2009).

The braincase also shows a mixture of modern and archaic traits. It is archaic in being long and low, but more modern in having a moderately steep forehead (8b). The frontal angles are closer to modern humans at 78 degrees rather than the 65.5 degrees seen in European Neanderthals (Hublin 1992). But the maximum breadth lies low on the parietals (9b) with angles at 150 degrees, larger than that of European Neanderthals who are at 139 degrees (Hublin 1992). Irhoud 1 does show to have an occipital bun (8c) like Neanderthals. And the mastoid process (8d) is reduced in size compared to modern humans, but similar in that it is well defined and projects downward. Overall cranial capacity comes to 1480cm³ (Hublin 1992).

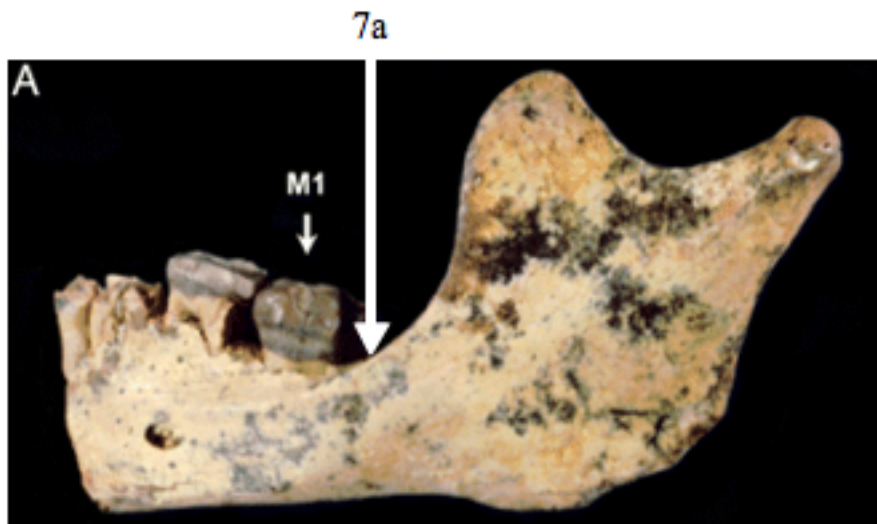


Figure 7: Jebel Irhoud 3 (mandible)
Adapted from: Smith and Toussaint (2007)

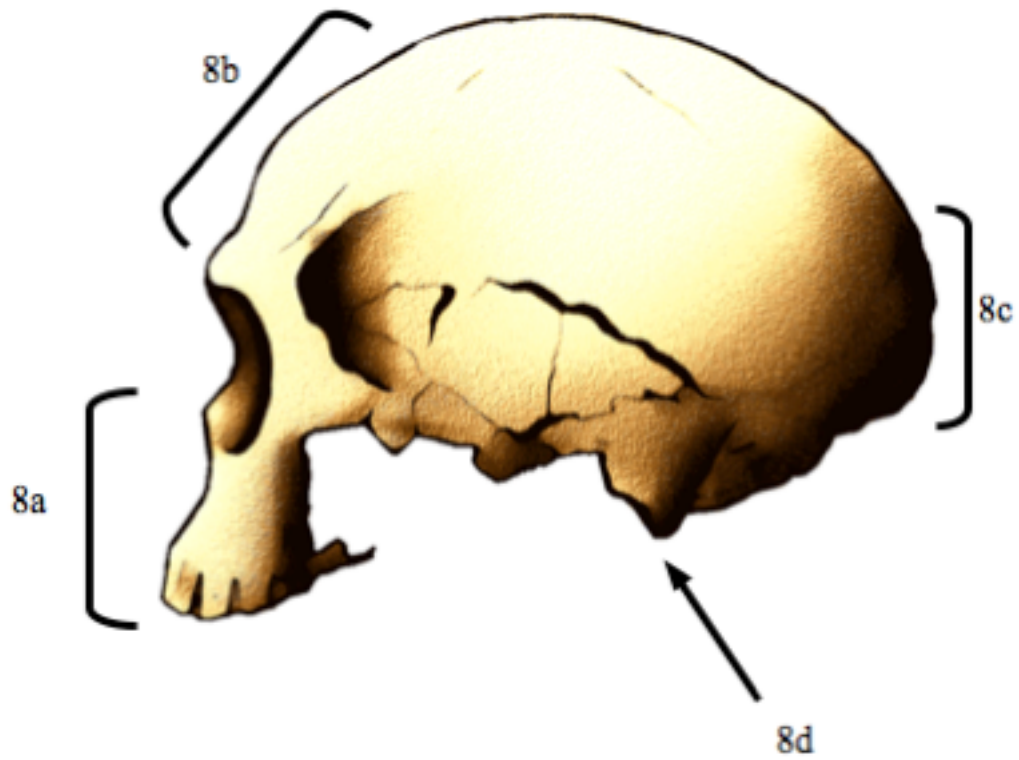


Figure 8: Jebel Irhoud 1 (lateral view)

Adapted from: <http://commons.wikimedia.org/wiki/File:Jebel-Irhoud.png>

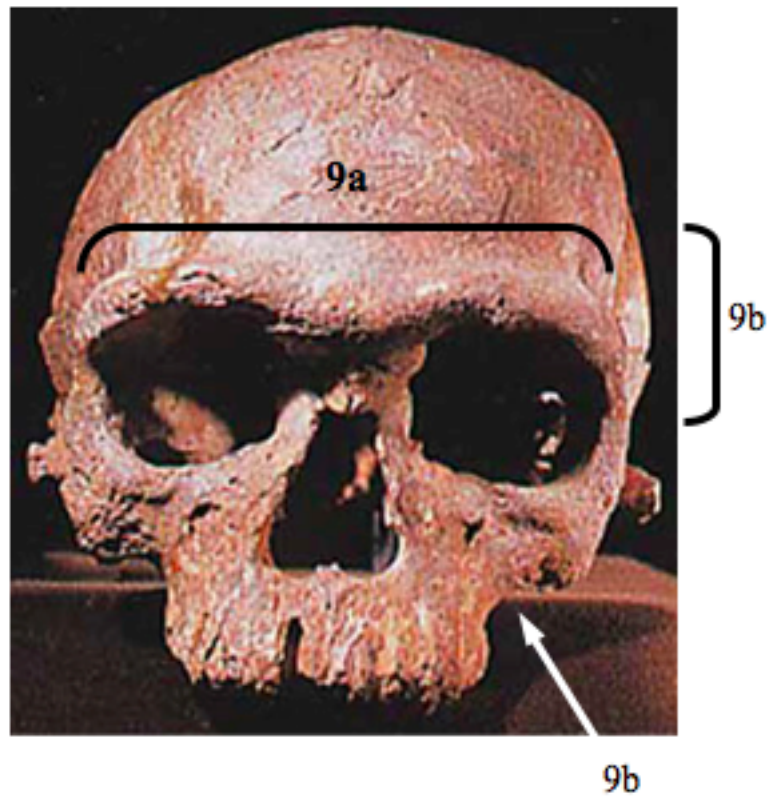


Figure 9: Jebel Irhoud 1 (anterior view)

Adapted from: <http://www.eva.mpg.de/evolution/files/irhoud.htm>

Neanderthal/Modern Human Overlap and Uniqueness

In the mapping of human ancestry, there has been an emphasis on cladistic analysis that makes for the separation of species due to differing morphological traits. The Neanderthals have fallen victim to this trend and been excluded from modern human ancestry due to their display of derived traits. More recently however, as in the Trinkaus (2007) study discussed below, there has been consideration of the degree that Neanderthals and modern humans overlap, and to the degree in which modern humans are actually uniquely derived themselves.

Trinkaus (2007) assesses the level to which both Neanderthals and modern humans exhibit shared or uniquely derived features relative to other archaic Pleistocene *Homo*. He finds that of 75 derived cranial, mandibular, dental, axial, and appendicular traits, about one-quarter are unique to Neanderthals, while one-half are largely unique to modern humans. This assessment is particularly apparent in facial length and facial projection in the two species. Neanderthals have been labeled as an outlier in regards to these characteristics, having noticeably long and projecting faces.

Trinkaus (2003) documents that these features appear to modestly decrease through the middle and late Pleistocene among archaic *Homo*, and that Neanderthals are actually similar to or even modestly reduced from that of their archaic predecessors. With the onset of modern humans however, facial length and projection show to sharply decrease (Trinkaus 2003). Therefore, he concludes that it is modern humans with the derived, short flat faces and Neanderthals that are more consistent with other archaic hominins. This tells us that Neanderthals often times are not the outliers as labeled, but it is actually modern humans who are more derived and unique.

The Trinkaus (2007) results also show that about one-quarter of the total traits are shared between Neanderthals and modern humans (Trinkaus 2007). This is apparent in the earliest modern humans to enter Neanderthal Europe. Although they possess a morphology

displaying anatomically modern human features, they also exhibit a suite of craniofacial, dental, and postcranial traits that are distinctively Neanderthal (Trinkaus 2007). This reveals that there is considerable overlap between the two groups and that separating them into distinct species can be quite problematic with the often fragmentary remains available.

Chapter 3

Cultural Background

‘Modern’ Behavior

Hominin behavior has evolved through time to a set of elements reached during the late Pleistocene that are the accepted criterion for indicating ‘modern’ behavior. These practices reveal evolution in past hominin cognition beyond day-to-day survival, showing increases in planning depth and abstract thinking through technological innovativeness and the manipulation of symbols (McBearty and Brooks 2000). The following is a discussion of what signifies these behavioral elements in the archaeological record and why they are considered ‘modern’.

Characteristics of ‘Modern’ Technology

Cultural technology during the period discussed in this study can be divided into two major categories based on level of ‘modernity’. These are that of the ‘archaic’ Middle Paleolithic technology, which is then said to transition into the ‘modern’ Upper Paleolithic technology. These can be distinguished based on a few generalities. Upper Paleolithic tool assemblages are blade based, contain more elongated tools such as end scrapers, show the production of projectile points, and contain higher frequencies of tools made of bone and antler. Middle Paleolithic tool assemblages are flake based dominated by side scraper tools, and show a lack of projectile points as well a lower frequency of bone and antler tools (Harrold 1989). It is difficult to find a clear dividing line as assemblages of both contain elements of the other. For purposes of this study, the most well known industries within these two categories are the Middle Paleolithic Mousterian and Upper Paleolithic Aurignacian (Harrold 1989).

Here I expand on these cultural elements and take a more detailed look at the characteristics that make for ‘modernity’ within the realm of past hominin technology. The two categories discussed here are lithic tools and bone or antler tools. I touch on the

materials and methods behind their production as well as their advantaged uses and some of the earliest places they are found.

Lithic Blades and Elongated Tools

A shift from flake-based industries to core reduction strategies typical of blade production is a hallmark of Upper Paleolithic tool industries (Figure 10). Thus, blades have become a key signature of ‘modern’ behavior. Blades can be described simply as long narrow flakes more than twice as long as they are wide. They normally possess one or more ridges running parallel to their axis, which gives them a triangular shape (Bar-Yosef and Kuhn 1999). Their consistent production requires deliberate technological steps, striking from elongated cores to purposefully create uniform blades with sufficient surface area to serve their use as a cutting device. A skilled knapper is able to exhaust an entire core through the removal of a long series of blades (McBearty and Brooks 2000).

Some of the earliest evidence of blade production actually dates back to the latter half of the Middle Pleistocene between 270-330kya. These early blades were recovered from the Amudian layers at Tabun cave in the Levant (Bar-Yosef and Kuhn 1999). Early Upper Pleistocene blades have been found abundantly in the Howiesons Poort industry of South Africa, such as at the coastal site of Klasies River mouth (Bar-Yosef and Kuhn 1999).



Figure 10: Magdalenian Stone Blades

Adapted from: <http://www.worldmuseumofman.org/display.php?item=634>

End scraper production (Figure 11) also dominantly replaced the side scrapers of earlier tool traditions and the production of burins become commonplace in the Upper Paleolithic. These major shifts suggest an emphasis on elongated tools that had greater mechanical advantages and required a reduced amount of muscular strength for tool utilization along with greater length of cutting edge per unit volume of stone (Trinkaus 1989). Elongated tools, due to their precise production requirements, also resulted in a much higher degree of standardization than flake tools. This was advantageous in Upper Paleolithic tool industries where composite and hafted tools requiring replaceable components were very common (Bar-Yosef and Kuhn 1999).



Figure 11: Aurignacian End Scraper

Adapted from: <http://www.worldmuseumofman.org/display.php?item=508>

Hafting and Lithic Projectile Points

The technological development of hafted tools is also considered a 'modern' advancement (Figure 12). This practice is apparent in bifaces that contain a hafting element such as basal thinning (Figure 13), the fabrication of a neck or tang, or the presence of notches, all of which would be used for attachment to some type of wooden component (Shea 2006). Evidence for hafting is also seen in the use of glue as an adhesive material. This has been found in remains of birch bark or bitumen that shows to have been heated to high temperatures and used to secure lithic elements to a wooden component (Villa 2010b).

Unfortunately, preservation of wood over time is a problem, so exact use of a biface can be difficult to determine. But speculation has been made as to hafting being used in tools for hide, bone, and woodworking as well as for projectile points (Mellars 1989).



Figure 12: Replicated Wood Hafted Flint Knife

Adapted from: <http://www.mesacc.edu/dept/d10/asb/iceman/iceman.html>

The increased production and use of stone projectile points is another feature of the ‘modern’ tool kit. Abundant evidence for use of this type of weaponry, which allows the user to inflict a lethal wound from a safe distance, exists after 40kya, but is less common prior to this (Shea 2006). The presence of impact scars and fractures is a good indicator of a point being used as a projectile (Villa 2010b). Most agree that larger projectile points were used on stabbing or throwing spears while smaller points that came about closer to the Holocene, would have been delivered by bow and arrow (McBearty and Brooks 2000).

An example of early projectile point use is at the Middle Paleolithic site of Oscurusciuto, a rockshelter in southern Italy. Here, six Mousterian points with impact scars were recovered dating to c.43kya (Villa 2010b). Blombos cave in South Africa also yielded several bifacial points with impact scars that date between 70-77kya (Villa 2010b).



Figure 13: Mousterian Point Showing Basal Thinning

Adapted from: <http://www.worldmuseumofman.org/display.php?item=505>

Standardization and Retouching Design

As lithic tool technologies transitioned into 'modernity', they showed an overall higher level of standardization. This is apparent across 'modern' archaeological assemblages for a few reasons as described by Mellars (1989). First, there appeared a greater redundancy in artifact forms. Second, a much clearer pattern of morphological separation between artifact categories developed. And third, a more distinct degree of imposed forms in the various stages of tool production was seen across tool traditions. The practice of hafting would also increase standardization in that it would impose tighter constraints on composite forms, especially in projectile points that also needed to meet aerodynamic capabilities (Mellars 1989).

Heavy retouching is also a sign of modernity in past tool assemblages (Figure 14). Retouching can be described as a process of an extensive overlapping removal of flakes around the edges that make for a refined, and sharper edge (Mellars 2006). Andrefsky (2009) describes various ways that retouching is measured. The retouch perimeter index is simply the ratio of the amount of retouched edge relative to the total tool edge. The retouch curvature index measures how the retouch makes for the concave or convex shape of the tool.

And the retouch index of invasiveness measures the extent to which flake scars invade the tool from the edge to the middle. All of these factors work together to influence the overall shape, use, and effectiveness of the tool.

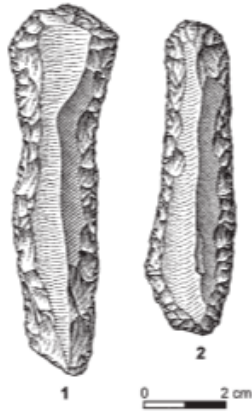


Figure 14: Re-touched Aurignacian Blades
Adapted from: Mellars (2006)

Backing or blunting of the edges is a form of retouch seen in geometric macroliths and microliths (Figure 15). Usually performed on blades, this type of retouching created geometric triangle or crescent-shaped pieces that would be mounted in multiple layers. This would prevent damage to the armature or allow replacement of damaged segments without overhauling the entire implement. Some of the most well known evidence for this sort of blade technology use comes from the Howiesons Poort industries of South Africa which dates between 69-59kya. Important sites showing this blade use are Klasies River Mouth, Rose Cottage, and Sibudu (Villa 2010b).



Figure 15: Geometric Microlith

Adapted from: <http://www.lithiccastinglab.com/gallery-pages/2002novembertransversepointspage2.htm>

Bone and Antler Tools

The shaping of bone and antler into specialized tools is a major element of ‘modern’ tool industries. Uses of manufactured bone and antler were multi-faceted including projectile points, harpoons, awls, needles, hafts, pegs, and perforated batons. Bone as a raw material was used at the highest frequency due to being more readily available, but antler was far superior because of its greater workability and higher resistance to breakage (Henshilwood and Marean 2003).

Since organic material is susceptible to decomposition and the preservation time much shorter than stone, it is difficult to determine when bone tools came into widespread use or when they advanced into ‘modernity’. Incidentally, the archaeological record shows that hominins have been using bone for utilitarian purposes since long before ‘modernity’. Micro-wear studies have shown us that bone pieces dating back 1.5-1.8mya were used as digging tools at the sites of Swartkrans and Sterkfontein in South Africa (Figure 16). The associated hominin remains here suggest that even the robust australopithecines were using bone as a tool (Backwell 2003).



Figure 16: Swartkrans Bone Tools

Adapted from: Backwell (2003)

However, the difference between early bone tools and ‘modern’ bone tools is extensive.

Henshilwood (2001b) describes this difference as informal tools versus formal tools.

Informal bone tools were expediently made or fractured naturally with little or no modification to the fractured edge being used as the tool bit. Such is the case with the early bone tools of South Africa that are suggested to have been long bone fragments used for digging termites. Formal bone tools however, are products of cultural manipulation and manufacturing, purposely shaped into specialized tools. This is the case with the bone tools seen in Upper Paleolithic tool kits.

Bone projectile points (Figure 17) were often a slender cone shape with sharp points and fairly straight to maximize their aerodynamic capabilities (Backwell 2008).

Early evidence for this is seen at Blombos Cave in South Africa where three bone points with evidence for hafting were found in layers dating between c.73-c.98kya (Henshilwood 2001b).



Figure 17: MSA Bone Points with Tangs for Hafting
Adapted from: d'Errico (2007)

Bone harpoons were used in hunting large fish and sea mammals (Figure 18). These were barbed points that had a series of basal grooves to facilitate hafting and often a backward facing notch that would have retained an attached line used to retrieve the element with or without its target. Point design such as this is seen at the South African site of Katanda dating to c.90kya (McBearty and Brooks 2000).



Figure 18: MSA Bone Harpoon, Katanda, SA
Adapted from: Mcbearty and Brooks (2000)

Bone awls were cylindrical objects with sharp points used to pierce material such as leather or other raw materials in the making of beads (Figure 19). These would have been used with bone needles (Figure 20) in the making of products such as animal hide clothing and accessories or housing materials (d'Errico 2007). Early bone awls and needles are seen

in the MSA layers at Blombos Cave, South Africa dating between c.73 – c.98kya (Henshilwood 2001b).



Figure 19: Bone Awl from Blombos Cave
Adapted from: d'Errico (2007)



Figure 20: Bone Needles from Blombos Cave
Adapted from: d'Errico (2007)

Bone hafts (Figure 21) would have been used with attached stone tools for digging implements, knives, or for more efficient hide scraping devices (Villa and d'Errico 2001). Bone pegs and perforated batons would have been used in the attachment to materials to the ground such as in the securing of hide housing materials (Marshack 1990).



Figure 21: Replicated Bone Hafted Flint Knife
Adapted from: <http://www.etsy.com/listing/16289817/primitive-stone-age-knife-replica-flint>

Bone was also used as a retoucher in the production of or the expedient refinishing of stone tools. Most often used from antlers or other faunal remains, use of bone as a retoucher (Figure 22) is seen in cut marks, scraping marks, and notches generally found close to the

bone ends (Verna and d'Errico 2010). Human bone retouchers have also been recovered as in the La Quina rockshelter site in France, where three human cranial bones were found with use wear consistent with that of a retouching tool (Verna and d'Errico 2010).



Figure 22: La Quina Bone Retoucher
Adapted from: Verna and d'Errico (2010)

‘Modern’ Symbolic Behavior

Perhaps the strongest signature of ‘modern’ cultural behavior in hominins is the onset of symbolic behavior. Kaufman (1999) suggests that abstract thinking and the ability to reason with concepts not limited by time or space, makes for expressions seen in these ‘modern’ cultural elements such as ritual belief systems and a deeper concept of the self. Here I discuss the making of and the presence of these symbolic expressions in the archeological record.

Art

Early human art is seen largely in rock paintings and engravings. Organic compounds, charcoal, and metal oxides from minerals such as ochre were used to stain the colors of ancient rock art. Remains of actual ochre crayons and pencils have been recovered from early cave art sites in both Africa showing actual tools of artistic expression. An example of this is in the discovery of ochre crayons (Figure 23) from the Mousterian layers dating between 73-99kya at Blombos cave in South Africa.

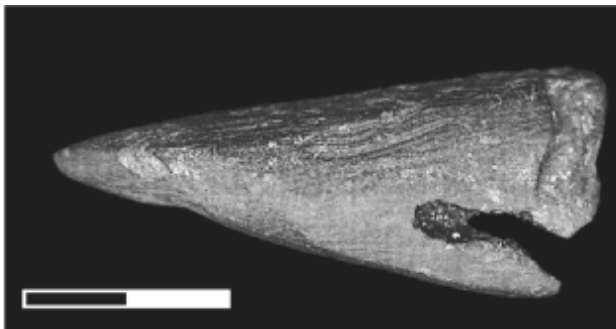


Figure 23: Ochre Crayon from Blombos Cave
Adapted from: Henshilwood (2001a)

The caves of Western Europe that contain some 10,000-15,000 paintings and engravings make for the largest display of early human rock art from the Upper Paleolithic. Mostly representations of animal figures (Figure 24), they capture what appears to be most important to the livelihood of these early people (Pfeiffer 1982).



Figure 24: Cave Art from Chauvet Cave, Spain

Adapted from: http://www.newyorker.com/reporting/2008/06/23/080623fa_fact_thurman

Mobile art has also been found in painted slabs from Apollo 11 Cave in Namibia (Figure 25). These portray figures of what appear to be a rhinoceros, a zebra, and some sort of feline with human-like hind legs. The radiocarbon dates for the levels where the slabs were found are between 26kya and 28kya (McBearty and Brooks 2001). These sorts of depictions show that humans were able to conceptualize concepts from the past and develop ideas of the future through art and storytelling, also making for the likely presence of complex language (Zilhã'o 2007).

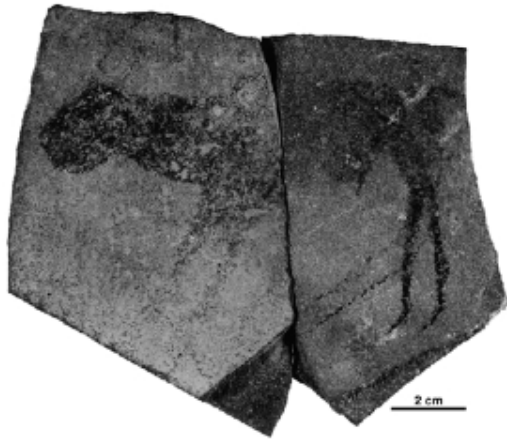


Figure 25: Painted Rock Slab from Apollo 11
Adapted from: Mcbearty and Brooks (2000)

Art in the form of engravings (Figure 26) is seen in non-utilitarian markings on teeth, bone, shell, wood, and rock. This is apparent in incised lines in shapes that would not occur naturally or from use as a cutting device, such as precise parallel or 90 degree angled lines, or in representational motifs (Zilhao 2007). Ochre pieces have also been found engraved at sites such as Blombos Cave in South Africa, where 15 ochre engravings were recovered in the Mousterian levels of 73-99kya (Henshilwood and d’Errico 2009). Non-utilitarian scraping is apparent here in incised lines that would be insubstantial for powder extraction or that reveal a purposeful design such as fan shaped or cross-hatched lines (Henshilwood and d’Errico 2009).



Figure 26: Engraved Rock from Aurignacian Levels at La Ferrassie, France
Adapted from: Zilhao (2007)

Rock engraving art is also seen in the sculpted rock figurines found throughout Europe dating to the Upper Paleolithic. These are known as Venus figurines (Figure 27), as they represent the female body (Pfeiffer 1982). Their highly standardized design of tapering legs, wide hips, and tapering shoulders and head shows a shared system of art across a stretch of more than 1000 miles from western France to central Russia. This can be inferred as shared belief systems across great distances as early as 30kya (Pfeiffer 1982).



Figure 27: Venus Figurine from Willendorf
Adapted from: <http://www.artlex.com/ArtLex/s/stoneage.html>

Jewelry

Personal ornaments have long been recognized as a key feature of 'modern' human behavior. These come in pierced bead-like pendants made from animal teeth, shells, bones, egg, and antler that appear to have been used for personal decoration (Zilha'o 2007). The site of Grotte du Renne in France is known for abundant findings of bone and tooth ornaments in the Chatelperronian levels dating between c.21kya-c.49kya (Zilha'o 2007).

The choice of raw material or animal used for these items of personal adornment was often very specific. As in the case of Aurignacian sites in Germany, the selection of fox teeth for pendants far outnumbers any other species, showing the special significance of this animal

(White 1989). The material was also often exotic and non-local as much of the earliest evidence for long-distance procurement of raw materials is linked to body ornaments (White 1989).

The making of personal items of decoration displays 'modern' behavior in both technological capabilities and social complexity (Figure 28, 29). In order to create such jewelry, tiny objects would need to be properly thinned and polished, and tiny holes bored in them. The jewelry would also need to include some sort of string for hanging, whether from strands of hair, gut, or strips of hide. Thus, these items involved labor-intensive techniques that would require complex multi-leveled planning and production (White 1989). This sort of complex non-utilitarian decorative behavior has been suggested to imply an increased awareness of the self along with more involved social displays (Marshak 1990).

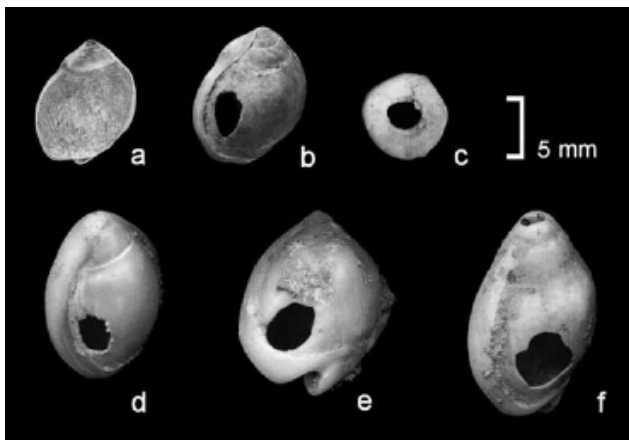


Figure 28: MSA and IUP African Shell Pendants
Adapted from: Zilhão (2007)



Figure 29: Ivory Rings from Grotte du Renne, France
Adapted from: Zilhão (2007)

Non-Utilitarian Use of Pigment

The systematic coloring of materials and objects is a widespread practice in the Upper Palaeolithic. Organic compounds such as charcoal and plant residues were used as pigments, but most often those detected in the archaeological record were metallic oxides such as manganese and hematite, otherwise known as ochre (McBearty and Brooks 2000). While these mineral objects do occur naturally, the evidence of their use by humans lies in them being broken, scraped, ground into powder on grindstones, or even shaped into crayons or pencils. Also in many cases, the minerals were imported over considerable distances, as they were often not available locally. This is apparent at Qafzeh cave where the outcroppings of ochre found at the site are located approximately 8km away (Hovers 2003).

Some argue for utilitarian domestic use of ochre such as in hide preparation, for medical reasons such as an antiseptic or an astringent, or to slow down putrefaction in burials (Riel-Salvatore 2010). While this explains some of the usage, the high number of non-utilitarian artistic objects of stone and other organic material that have been found with traces of applied ochre, have led to the conclusion of symbolic pigmentation. These symbolic uses are considered ‘modern’ in behavior. Qafzeh cave shows heavy non-utilitarian use of ochre in

the high numbers of ochre stained lithic artifacts and seashells that were used as items of personal adornment. Also recovered here were many ochre pieces associated with human burials (Hovers 2003). These findings date to c.92kya (Valladas 1988).

Burial of the Dead

Special treatment of the dead through deliberate burial is considered an aspect of ‘modern’ behavior as it displays a respect for the dead beyond simple discard of the body. In order to declare the burial of hominin remains as ‘modern’, intentional versus naturally occurring internment must first be deciphered.

Usually an articulated skeleton signifies an intentional internment, however this can occur through natural taphonomic processes as well. Therefore the total area in which the remains are found must be examined for features such as pits or mounds that would signify a purposeful burial (Riel-Salvatore 2010). A skeleton placed purposefully in positions such as a tightly or loosely flexed fetal position (Figure 30), a fully extended position, dorsally, or face down; also signify an intentional burial. Even the direction that the body is oriented can allude to a purposeful placement, however usually only in the context of multiple skeletons together aligned similarly (Riel-Salvatore 2010).



Figure 30: Flexed Fetal Position Burial

Adapted from: <http://www.cardiff.ac.uk/hisar/archaeology/reports/koros/>

An intentional burial can also be symbolic and therefore considered to show a higher degree of 'modern' behavior in that it shows a purposeful burial along with probable ritual ideas about life and death. The above indicators however, do not necessarily mean a symbolic burial, as the remains could have been put under ground for practical discard reasons such as hygienic purposes or to avoid attracting predators or scavengers (Riel-Salvatore 2010). Certain features such as stone casings or hearths at the head or foot of the burial more than likely show symbolic burial (Riel-Salvatore 2010). But these elements could still represent utilitarian behavior such as the use of simple place markers or the utilitarian burning of the body.

Ultimately, the agreed upon telltale sign of symbolic activity when found in human burial, is the presence of grave goods. These can include any number of items such as stone tools, animal bones or teeth, oddly shaped rocks, shells, pendants or other types of jewelry, and even the placement of flowers seen through pollen remains. The requirement here is that the object must have been deliberately placed, and is therefore distinguishable from those artifacts that happen to become incorporated into the sediments in which the graves were dug (Kaufman 1999). Whether or not these sorts of burial practices indicate actual religious ritual activity or beliefs about an after-life is unknown. What it does show is a different level of caring for the deceased than seen in prior hominins, or for that matter any other higher primate.

Qafzeh cave provides a good example of a site that displays purposeful burial as well as symbolic burial that date to c.92kya (Valladas 1988). Here, seven individuals are considered to be buried purposefully due to their flexed position. Another individual, that of a 10-year old boy was found lying on his back with his hands clasped to the antlers of a large deer (Vandermeersch 2001). This is considered to be a grave good, therefore a symbolic burial.

‘Modern’ Strategic Behavioral Patterns

‘Modernity’ in hominin behavior is also seen in behavior patterns that exhibit increases in planning depth and strategic use of the landscape and its resources. Here I discuss several ways this is seen in the archaeological record and how these prove to be advantageous over earlier, more ‘primitive’ behaviors.

Specialized Site Use

Rather than randomly roaming the landscape acquiring resources within an encounter based system and setting up camp wherever was suitable, ‘modern’ hominin settlement behavior became more structured and organized. Sites became specialized and re-used as part of a planned system of exploiting subsistence resources available on the landscape. According to Binford (1989) this behavior reveals patterns of aggregation and dispersal, logistical systems of procurement, and seasonal scheduling of subsistence activities.

Binford (1989) refers to specialized site use as involving a high level of “tactical depth”, or stored knowledge of environmental characteristics and opportunities. He also discusses the behavior as requiring a high level of “planning depth”, or the length of time between anticipatory actions of investment and the actions they facilitate.

Early ‘modern’ hominin sites can be categorized into three major groups: base camps, hunting/gathering camps, and workshops/quarry sites. There is extensive debate on what constitutes these categories in the archaeological record, but each varies in size, intensity of occupation, artifact density, and general assemblage characteristics. Some show evidence of being multi-seasonal while others show single-season occupation. But they are all linked and interdependent in the overall survival tactics of the group.

In comparison to the other site types, base camps generally show evidence of being larger, more intensely occupied, and tied to a predictable water source and plant resources. Lithic

evidence points to the largest number of finished and re-touched tools with the fewest frequency of cores (Kaufman 1999). Faunal evidence shows the highest rate of larger meat bearing bones suggesting they were brought to the locale post-processing (Chase 1989). Occupation was not necessarily for a long term uninterrupted period of use, as this was dictated by seasonal game movements and plant and water availability. Seasonality however, is difficult to prove, but can be inferred from the associated faunal and botanical remains (Clark 1989).

Hunting and gathering camps were generally smaller and less intensely occupied showing only short-term use. These sites would have been dependent upon game migrations and optimal hunting grounds, but not necessarily strategically located for other resources. The lithic evidence here reveals an assemblage containing finished tools and a higher number of prepared blanks than actual cores (Kaufman 1989). The faunal evidence shows an over-representation of the poorest meat bearing bones, meaning that game was butchered here and the high meat yielding sections were likely transported to a base camp (Chase 1989).

Workshops and quarry sites were usually the smallest and show repeated but also less intense occupations. These sites were linked to optimal flint outcrops for obtaining stone for working into tools, and were also not directly tied to other resources. While the faunal evidence was often minimal at these sites, the lithic evidence was of course abundant showing high frequencies of cores and debitage, with fewer finished tools (Kaufman 1999).

Organized Site Structure

Site structure can be referred to as the arrangement of the living floor in accordance to varying uses of space. In an archaeological assemblage, site structure consists of the spatial distributions and relationships of features, artifacts, and other evidence that bring behavioral meaning to different activity areas (Henry 2003).

‘Archaic’ hominin behavior shows a more simple site structure with seemingly random distribution of artifacts without evidence of arranged living surfaces; while ‘modern’ behavior brings a more complex site structure and organization to the immediate surroundings and habitation zone. Henry (2003) defines a ‘simple’ site structure as an intensive activity area tied to a central hearth or a few redundant activity areas tied to a small number of hearths. The evidence here would show temporally continuous and spatially overlapping activities. He describes a ‘complex’ site structure as discrete, non-redundant activity areas in which most but not all are tied to hearths. The evidence here would show temporarily segmented and spatially segregated activities.

Specifically designated living areas of ‘modern’ hominins are revealed to be that of work areas, food-processing areas, refuse dumping areas, and sleeping areas. Work areas are marked by high levels of debitage and tools and were usually used for lithic production or chores such as hide working (Henry 2003). Food-processing areas contain plant and animal remains and were often used for activities such as food preparation and consumption (Henry 2003). Sleeping areas can be seen in bivouac spaces, sometimes with pollen remains that suggest grass use for padding, strategically placed by hearths and containing few other artifacts (Vallverdu 2010). Refuse, or trash dumping areas, show a mixture of remains without logical stratigraphic organization and high levels of ash (Henry 2003).

Long Distance Procurement of Raw Materials

Procurement of non-local raw materials is a practice that dramatically increases in the late Middle to Upper Paleolithic period. Raw materials commonly considered non-local are those whose source is more than 10-20km from the site in which they are found. In the Middle Paleolithic, lithic source distances in Europe reach up to 300km, and in the Upper Paleolithic reach up to 1300km (McBearty and Brooks 2000). Throughout prehistory however, a

majority of the raw material from human sites remains local, but studies show that planned systems of local and non-local procurement are in place by the Middle Paleolithic. In European lithic assemblages, 65-95% of the raw material is local, but only 5% of this was actually shaped into formal tools for utilization. On the other hand, 75-100% of the remaining non-local material was utilized as a formal tool or at least found in the final stages of production (Kaufman 1999). This suggests a close relationship between raw material procurement and use with mobility on the landscape, making evident high levels of foresight and versatility in resource use.

The abandonment of lithic materials at greater distances from their geologic sources has been suggested to be due to increased curation of the artifacts (Ambrose 2010). This would make their use life longer, thus resulting in discard further from the source. However this has also been suggested to be due to an increase in human mobility (Ambrose 2010).

Long distance raw material exploitation also points to other important implications for ‘modern’ behavior. One implication is the practice of planned seasonal residential movements along with designated and repeated use of various sites. This purposeful movement would not only involve advanced planning, but in-depth knowledge of the landscape. Another implication is an increase in social interaction between hominin groups and the development of exchange networks that would make for connections between distant regions (Kaufman 1999).

Strategic Hunting

‘Modern’ hominin subsistence patterns are suggested to have moved beyond simple scavenging as well as beyond encounter based opportunistic hunting. This is seen in hunting practices that show evidence of systematic and highly organized as well as the onset of fishing, all of which require higher levels of foresight and planning depth. As discussed by

Binford (1980), these sorts of advanced organization patterns were key labor accommodations to varying distributions of critical resources.

The hominin processing of game is apparent in animal bones from the archaeological faunal record that show cut marks made from stone tools rather than from carnivore teeth. Structured and purposeful hunting practices are seen in a ‘modern’ assemblage through a preference for prime age adults of species-specific targets, more dangerous and difficult prey, seasonal hunting patterns often during breeding or migrations, and high frequencies in the remains of major meat bearing bones (Kaufman 1999). This contrasts an assemblage showing scavenging or opportunistic practices, which would contain mostly remains of non-species specific young and old individuals that would have been more susceptible to predation or natural death, less dangerous more docile prey, a lack of seasonal hunting, and higher frequency of minimal meat bearing bones such as cranial remains and distal limbs (Kaufman 1999).

Nearing the Upper Paleolithic, fish also become an increasing part of the hominin diet. ‘Modern’ fishing practices moved beyond the simple gathering of riparian species such as shellfish and moved into the calculated capture of deep-water fish. This is apparent in the archaeological record in fish remains associated with bone points that show signs of human capture such as deliberate damage to the spines. Fishing paraphernalia artifacts such as bone harpoons and fishhooks also reveal hominin aquatic resource exploitation (McBearty and Brooks 2000).

Connection to the Research

The indicators of modern behavior discussed above will be used to make my assessments as to the degree of ‘modernity’ at my selected sites. It is not possible to operationalize some of these elements in strict ‘modern’ or ‘archaic’ behavioral categories, therefore not all of

them will be used. However, enough of these have been discovered at my selected sites to make them reliable proxies for the occurrence of ‘modern’ behavior in past hominins during the period at hand.

Chapter 4

Materials and Methods

In order to test the significance of modern human morphology to ‘modern’ behavior I conduct a comparative analysis of fifteen late Pleistocene sites. This chapter describes my sample, explains why specific sites were used or not used, and my methods of analysis that allowed for a behavioral assessment on my sites and ultimately a test of the working hypothesis.

Sample

My analysis is conducted on the archaeological materials reported in the literature that serve as proxies for hominin behavior at these fifteen late Pleistocene African and Eurasian sites. The period examined ranges from 200kya-21kya and was chosen due to encompassing the appearance of anatomically modern humans, their arrival into Eurasia, and the accepted onset of ‘modern’ behavior. Each of the sites contains a signature in its assemblage that has been declared as showing ‘modern’ behavior. Also, the sites contain diagnostic fossil remains so that proper identification of the human group responsible can be noted as to being anatomically modern *Homo sapiens* or Neanderthal.

The fifteen sites that met my criteria come from three major regions: Africa (3), the Levant (4), and western Eurasia (8). Each of these is significant in past hominin evolution for different reasons. Africa is important in the evolution of archaic hominins as well as containing the first evidence of anatomically modern humans. And culturally, Africa is said to hold the origins of ‘modern’ behavior. The Levantine sites are located in the major pathway for past hominin migrations in and out of Africa into Eurasia. This location also makes for the possible contact between different various hominin species. The Eurasian sites are in a region important to Neanderthal evolution and their possible earliest contacts with anatomically modern humans, as well as representing the movement of hominins further to the east.

Table 1: List of Sites

Site	Country	Period/Date Source
Herto	Ethiopia	c160 – c154 kya (Clark 2003)
Klasies River Mouth	South Africa	c116 – c60 kya (Grun 1990)
Border Cave	South Africa	c84 – c57 kya (Grun 1990/Bird 2003)
Kebara	Israel	c60 – c48 kya (Valladas 1987/Schwarcz 1989)
Tabun	Israel	c195 – c102 kya (Grun and Stringer 2000)
Qafzeh	Israel	c92 kya (Valladas 1998)
Skhul	Israel	c130–c100kya (Grun and Stringer 2005/Mercier 1992)
St. Cesaire	France	c36 kya (Mercier 1991)
Grotte du Renne	France	c49 – c21kya (Higham 2010)
La Quina	France	c35 – c31kya (Vogel and Waterbolk 1963,1967)
Krapina	Croatia	c137 – c110kya (Rink 1995)
Vindija	Croatia	c42 – c18kya (Wild 2001)
Mladec	Czech Republic	c31kya (Wild 2006)
Buran Kaya III	Ukraine	c37 – 32kya (Prat 2011/Hardy 2001)
Kostenki 14/Markina Gora	Russia	c37 – c25kya (Sinitsyn 2006)

African and Levantine Sites



Figure 31: Map of African and the Levantine Sites

Adapted from: <http://climate-connections.org/2010/10/15/africa-and-the-climate-finance-controversy/>

Eurasian Sites



Figure 32: Map of European and Western Eurasian Sites

Adapted from: <http://www.zonu.com/fullsize-en/2009-12-22-11445/Europe-satellite-map-2002.html>

Exclusion Criteria

Overall, my sample size is relatively small in comparison to the numerous sites that show evidence of early ‘modern’ behavior. This is due to a few strong limitations which I imposed upon my sample. First, in order for me to use a site there must be diagnostic hominin fossils that are associated with an archaeological assemblage. Some sites contain many diagnostic fossils, others contain no fossils at all, and some contain an insufficient amount to detect the morphology. Unfortunately, a few isolated worn teeth are not enough for the determination of hominin species to be made, therefore giving reason for the exclusion of some sites. Other sites contained diagnostic fossils, but no archaeology accompanied them. This also deemed a site unusable.

If there is no reliable date for a site, it too was excluded. Typological correlation or stratigraphic location is not sufficient in determining when the behavior was occurring. This is my second limitation.

Third, I have set the minimum limit of sources for each site at three. Being that there is much literature that is not published in English, certain site data is unusable to me. This limitation led to the exclusion of the East Asian sites, which for the most part are published in Chinese.

Also, some sites simply have not been completely reported on. This led me to my fourth limitation of putting a minimum percentage of behavioral indicators (explained in more detail later in this chapter) reported on for each site, this being 80%. Therefore, if more than four of these indicators are missing on a site, there is not sufficient information and must be excluded.

Some of the sites that I could not use are displayed in the following table. This shows how a study on sites of such antiquity proves to be difficult.

Table 2: List of Excluded Sites

Site	Country	Reason
Bacho Kiro	Bulgaria	limited sources
Jebel Irhoud	Morocco	source language
La Ferrassie	France	source language
Chatelperron	France	source language
Blombos Cave	South Africa	inadequate fossil evidence
Nazlet Khater	Egypt	inadequate fossil evidence
Chauvet	France	inadequate fossil evidence
Apollo 11	Namibia	inadequate fossil evidence
Riparo Mochi	Italy	inadequate fossil evidence
Fuman	Iran	inadequate fossil evidence
Quneitra	Israel	inadequate fossil evidence
Oase	Romania	inadequate archaeology
Omo	Ethiopia	inadequate archaeology
Tianyuan	China	inadequate archaeology
Lake Mungo	Australia	unreliable dating

Methods of Analysis

The compilation of my data is derived from the current literature containing the archaeological findings at the fifteen qualified sites. With this data I conduct a comparative qualitative analysis of the sites on the basis of designated variables that are indicators of ‘modern’ behavior, which were reviewed in the cultural background chapter. For each site I indicate whether there is evidence for each of these indicators, or if the information is not available (N/A). Typically, the presence of the technology or behavior indicates ‘modern’

behavior, while absence indicates ‘archaic’ behavior. However, two of the variables are based on frequency levels as in the case of blades versus flake tools or end scrapers versus side scrapers. This analysis is followed by a written explanation of the evidence for each behavioral indicator. All of this information is contained in individual site reports in the next chapter.

Table 3: List of Variables - ‘Modern’ Behavioral Indicators

Behavior	Evidence	References
Stone Tools	Blades (>flake tools) End Scrapers (>side scrapers) Projectile Points	Andrefsky (2009), McBearty and Brooks (2000), Mellars (1989), Mellars (2006), Shea (2006), Trinkaus (1989)
Bone/Antler Tools	Points Awls Harpoons	Backwell (2003), d’Errico (2007), Henshilwood and d’Errico (2001), Henshilwood and Marean (2003), Marshack (1990), McBearty and Brooks (2000), Villa and d’Errico (2001)
Art	Paintings Engravings Figurines Other Artistic Use of Pigment	Kaufman (1999), McBearty and Brooks (2000), Riel-Salvatore (2010), Pfeiffer (1982), Zilha’o (2007)
Jewelry	Personal Ornaments	Marshak (1990), White (1989), Zilha’o (2007)
Human Burial	Purposeful Internment Symbolic Internment	Kaufman (1999), McBearty and Brooks (2000), Riel-Salvatore (2010)
Site Use	Specialized	Binford (1989), Chase (1989), Clark (1989), Kaufman (1999),
Site Structure	Complex	Henry (2003), Vallverdu (2010)
Raw Material Source	Non-Local	Ambrose (2010), Kaufman (1999), McBearty and Brooks (2000),
Subsistence Patterns (Faunal)	Species Preference Size Selection Seasonal Hunting Fishing	Kaufman (1999), Klein (1989), McBearty and Brooks (2000)

I then I come up with a behavioral assessment as to the degree to which the sites display ‘modern’ behavior. This is done through the overall percentage of ‘modern’ behavioral indicators for each site. The presence or absence of the ‘modern’ behavioral indicators is on a yes or no basis, except in the case of blades and scrapers, which are on a greater than/less than scale. Since there are 20 behavioral indicators, each is given a value of 5%. From this, and not including those indicators that were not available, a total percentage can be reached as to the degree of ‘modernity’ at the sites. The reasoning behind my assessments for each indicator and behavior seen at the sites is explained in the site reports in chapter 5.

Hypothesis Testing

My analysis and site classification provide me with answers as to how closely archaic and modern morphology match with ‘archaic’ and ‘modern’ behavior in the archaeological record. This ultimately leads me to answer my driving question as to if anatomically modern humans are the sole party responsible for ‘modern’ behavior.

Chapter 5

Site Reports

This chapter contains my fifteen site reports. These include basic site information, discussion of the recovered fossils, a chart displaying the presence or absence of the discussed ‘modern’ behavioral indicators, an explanation of the evidence for each, and an overall ‘modern’ behavioral percentage with an assessment of the behavioral patterns in the hominins present at the site.

Site: Herto, Ethiopia

Layers: Upper Herto

Dates: 160 +/- 2kya - 154 +/- 7kya
Ar/Ar dating of over/underlying volcanic tuff (Clark 2003)

Associated Hominin Morphology: Modern

'Modern' Behavioral Percentage: 12%

Table 4: **Herto Table of Evidence**

<u>Behavior</u>	<u>Evidence</u>	<u>Yes</u>	<u>No</u>	<u>N/A</u>
Stone Tools	Blades (>flake tools)		X	
	End Scrapers (>side scrapers)		X	
	Projectile Points		X	
Bone/Antler Tools	Points		X	
	Awls		X	
	Harpoons		X	
Art	Paintings		X	
	Engravings		X	
	Figurines		X	
	Non-Utilitarian Use of Pigment		X	
Jewelry	Personal Ornaments		X	
Human Burial	Purposeful Internment		X	
	Symbolic Internment		X	
Site Use	Specialized			X
Site Structure	Complex			X
Raw Material Source	Non-Local	X		
Subsistence Patterns (Faunal)	Species Preference	X		
	Size Selection			X
	Seasonal Hunting		X	
	Fishing		X	

Explanation of Evidence

The site of Herto is located in the Middle Awash Valley of current day Ethiopia. It is an open-air site, which during its human inhabitation was next to a fresh water lake. The hominin remains were found in the Upper Herto layers, which lie between two volcanic tuff layers, therefore accurate dating was possible. The fossils are that of very robust early *Homo sapiens* and are associated with Achulean and MSA technologies. Tim White conducted excavations here in the mid 1990's (Negash 2011).

Hominin Remains

The hominin remains from Herto are that of three crania, two represented by adults and one from an immature individual. One of the adult crania is interpreted as a large robust male, with a cranial capacity at 1,450cm³. The second adult is that of an even larger individual. The immature cranium is identified as an individual of 6-7 years old (White 2003).

The Herto hominids are classified as anatomically modern humans, but they contain archaic human features as well. As discussed by White (2003), they are modern human with a high cranial vault and relatively large frontal and parietal dimensions. Yet they are archaic in that the parietal bone is less curved and the occipital is more flexed.

Interestingly, all three crania bear cultural modification that appears to be of post-mortem mortuary practices. This is seen in bone modifications such as deep cut marks associated with defleshing and soft tissue removal as well as in evidence for repetitive scraping and polishing. The latter is not seen in consumption processing (Clark 2003). This sort of defleshing and decoration for mortuary rituals is seen ethnographically in New Guinea and suggests the Herto hominins also took part in such behavior (Clark 2003).



Figure 33: Herto Adult Cranium

Adapted from: White (2003)

Stone Tools

The lithics at Herto according to Clark (2003) appear to be technologically transitional from that of Achulean with handaxes and picks, to that of flake based MSA technologies. Blade technology is present, but rare, constituting only 1% of the assemblage. End scrapers are also present, but at half the frequency of side scrapers. There does show to be a number of bifaces in a wide size range, but these are not discussed as projectile points (Clark 2003).

Bone/Antler Tools

There is no evidence of bone tool production at Herto.

Art

One could suggest that the apparent post-mortem mortuary practices seen at Herto could be an artistic expression through burial rituals. However besides this, these hominins do not appear to be expressing themselves artistically.

Non-Utilitarian Use of Pigment

I found no evidence for pigmentation at the site.

Jewelry

There does not show evidence of the production and use of items of personal adornment at Herto.

Human Burial

The Herto hominin remains do not show evidence of being purposefully buried, mainly due to the lack of articulated skeletons. However, the evidence of post-mortem mortuary practices discussed above suggests that there did exist ritual behavior at the site when dealing with the deceased.

Site Use

I found no discussion of a specialized site use for Herto.

Site Structure

An organized site structure is not discussed in the literature on the site.

Raw Material Source

Most artifacts at Herto were made of basalt, but the points and blades were made almost exclusively of obsidian. The sources for the obsidian found at the site are between 28 and 289 kilometers away (Negash 2011). Therefore, long distant procurement of lithics is an apparent behavior in the Herto hominins.

Subsistence Patterns (Faunal)

Most of the faunal remains at Herto come from extinct bovine that inhabit both aquatic and grassland habitats. The preferred species of the Herto hominins appears to be that of hippopotamids. One occurrence shows abundant remains of several hippo calves of newborn or a few weeks of age, scattered together with butchered adults (Clark 2003). This appears to be a favorite species to consume, but size preference cannot be inferred from the evidence discussed. There does not show evidence of seasonal hunting practices or fishing at Herto.

Site Behavioral Assessment

Only a few elements of behavior can be considered 'modern' at Herto. This would be in the exploitation of non-local obsidian, the preference for hippo in the diet, and the post-mortem mortuary practices. The remainder shows almost a complete lack 'modernity'. This is seen in a tool kit without blades, minimal end scrapers, and a lack of projectile points or bone tools. Also there is seemingly no artistic expression, no evidence for burial, no report of organized site structure or specialized site use, and minimally structured subsistence patterns.

Therefore, the behavior of the Herto hominins is dominantly 'archaic'. Here the skeletal morphology matches the behavior.

Sources Cited

Clark, Desmond J.

2003 “Stratigraphic, Chronological and Behavioral Contexts of Pleistocene *Homo sapiens* from Middle Awash, Ethiopia” In Nature 423(6941):747-752.

Negash, Agazi

2011 “Varieties and Sources of Artefactual Obsidian in the Middle Stone Age of the Middle Awash, Ethiopia” In Archaeometry ():2-14.

White, Tim

2003 “Pleistocene *Homo sapiens* from Middle Awash, Ethiopia” In Nature 423(6941):742-747.

Site: Klasies River Mouth, South Africa

Layers: MSA I and II

Dates: c.116kya – c.60kya

ESR dating of tooth enamel from associated fauna (Grun 1990a)

Associated Hominin Morphology: Modern

‘Modern’ Behavioral Percentage: 33%

Table 5: **Klasies River Mouth Table of Evidence**

<u>Behavior</u>	<u>Evidence</u>	<u>Yes</u>	<u>No</u>	<u>N/A</u>
Stone Tools	Blades (>flake tools)	X		
	End Scrapers (>side scrapers)		X	
	Projectile Points		X	
Bone/Antler Tools	Points	X		
	Awls		X	
	Harpoons		X	
Art	Paintings		X	
	Engravings	X		
	Figurines		X	
	Non-Utilitarian Use of Pigment	X		
Jewelry	Personal Ornaments		X	
Human Burial	Purposeful Internment		X	
	Symbolic Internment		X	
Site Use	Specialized			X
Site Structure	Complex		X	
Raw Material Source	Non-Local			X
Subsistence Patterns (Faunal)	Species Preference	X		
	Size Selection	X		
	Seasonal Hunting		X	
	Fishing		X	

Explanation of Evidence

Klasies River Mouth is a complex of five caves on the coast of South Africa in the current day Eastern Cape Province. In total, the caves constitute three sites. The main site is discussed here and is made up of Caves 1 and 2, which is actually now an open-air site cut into a quartzite cliff. The site is well stratified with 20m of deposit, but also complex in its stratigraphy due to erosion and geological movement (Villa 2010).

The first excavations took place in 1967-68 by Ronald Singer and John Wymer. Hilary Deacon led the recent excavations from 1984-91 (Villa 2010). The fossil findings here are argued to be some of the earliest modern human fossils, but this remains controversial due to their diverse morphological nature (Pearson 1997). The site is also known for its cultural sequence of Howiensons Poort lithic technology (Villa 2010).

Hominin Remains

The hominin remains from Klasies River Mouth were found in the lower portion of the MSA layers and consist mainly of five partial mandibles with teeth, two partial maxillae, cranial fragments, and a few postcranial remains. There are no articulated skeletons at the site. Even though the remains have been argued to be of modern morphology, they actually appear quite mixed in their morphology. Singer and Wymer first suggested that two groups of moderns are represented at the site, a gracile group and a more primitive robust group. Others have argued that it was a single highly sexually dimorphic modern group (Rightmire 2006). And yet others go with the conclusion that the Klasies River Mouth hominins are a transitional archaic group on the way to a modern morphology (Pearson 1996).

Special note should be made that many of the human bones, especially the skull fragments, show cut and tear marks, percussion impacts, and burning. This had led to suggestions of some sort of ritual burials, interpersonal violence, or perhaps cannibalism (Deacon 2001).

Of the post-cranial remains, three foot bones were recovered in the MSA levels. A first metatarsal was found revealing similar size and anatomical features to recent Holocene burials in the Cape Province. However, a second and fifth metatarsal shows to be very long and heavy in comparison to recent South African hominins (Rightmire 2006). This suggests that some Klasies hominins are either sexually dimorphic or fall outside the range of anatomically modern humans.

A radial fragment was also found that shows to be a morphological mix of archaic and modern features. Although it possesses derived features in common with modern humans, it

also has a relatively thick cortical bone that is between the size of an early modern human and a Neanderthal (Pearson 1997).

A right temporal and a partial atlas were also discovered in similar stratigraphic levels. These are suggested to be of the same, comparatively small individual as it is morphologically and metrically indistinguishable from recent African homologues (Grine 1998).

Several teeth including two complete upper molars, a partial tooth crown, and an anterior tooth were found in these levels and can be matched with recent South African populations. However they range greatly in size. The molars are small in comparison to the recent Africans while the others are close to the upper limits of recent Africans (Rightmire 2001). This is more evidence for a sexually dimorphic population at Klasies.

The mosaic of skeletal features makes an exact classification of the Klasies River Mouth hominins problematic. Although they could represent an archaic transitional species, the overriding evidence argues that they are a highly variable anatomically modern population.

Stone Tools

The lithic tool industries at Klasies River Mouth go through various phases in the MSA levels. The lower horizons are characterized by blades and elongated points. The middle levels are similarly characterized but show a shortening and widening of these tools (Wurz 2002). And the upper horizons reveal the Howiesons Poort tradition, which is characterized by backed micro-lith tools as well as blades, burins, scrapers, and denticulates (Deacon 2001).

Blades dominate the assemblages at the site, especially in the upper Howiesons Poort sequence where they make up 85% of the formal tools (Villa 2010). Points taper off dramatically in numbers in the upper layers, perhaps replaced by HP backed blade hafted tools. In the scraper category, side scrapers appear to outnumber end scrapers throughout (Wurz 2002).

Although Howiesons Poort is a MSA tradition, the lithic technology exhibited by the Klasies River Mouth hominins appears quite 'modern'. This is most apparent in the high frequencies of blades and points and the production of complex backed blade tools as seen in the HP tradition. Although there does not show to be evidence that the points at the site were that of projectile points, evidence for hafting comes with the backed blades of the HP that would have been used as hand held chopping devices (Milo 1998).

Consideration must be taken of the extensive time span covered in these layers of the site. Since the hominins were recovered from the lower horizons and the Howiensons Poort technology was recovered from the upper horizons, the case may be that the recovered hominins were not actually the ones responsible for this technology. These changes through the horizons however, do not serve to alter the overall assessment of the lithic assemblage from the site for this particular study, as blade tools dominate over flake tools throughout the layers.

Bone/Antler Tools

Three bone tools were recovered from the MSA levels of Klasies River Mouth. One is an elongated point made from a bovid shaft fragment that shows to be shaped by scraping with a retouched lithic cutting edge. Resembling LSA points in South Africa, as well as ethnographic points from the South African San people, the point appears to be double sided (d'Errico 2007).

The other two bone tools are notched pieces of bone, one made from a large bovid midshaft bone and another from a rib. These items appear to have first been scraped on the edges in order to obtain a round section, then notches were carved into these edges in order to produce the cutting edge of the tools (d'Errico 2007).

Art

One piece of bone suggested to be symbolic art was found at Klasies River Mouth. This is an engraved midshaft fragment from a limb bone of a large bovid. It is highly polished with four parallel lines engraved by a sharp lithic point across the main surface and perpendicular to the main axis of the fragment (d'Errico 2007). The lack of more symbolic art at the site could either be due to low preservation of these items or that the Klasies hominins were simply not producing much of such work.

Non-Utilitarian Use of Pigment

Evidence of pigment use beyond utilitarian means is apparent in the findings of ochre crayons with grinding facets in the MSA levels at Klasies (Deacon 2001). Crayons are suggested to show that the ochre was for coloring in artistic activity rather than being used to for utilitarian purposes.

Jewelry

There is no evidence for items of personal adornment in the MSA levels of Klasies River Mouth.

Human Burial

The human bone remains are too few and not closely associated enough to suggest conventional burials. However, since they do occur in particular horizons and show burning along with cut and impact marks, Deacon (2001) suggests they may be a sort of secondary burial practice if not the result of interpersonal violence or cannibalism. But this remains an inconclusive interpretation.

Site Use

I found no argument for a specialized use of the site. However, due to the extensive layers and large amount of archaeological finds, the site appears to have been repeatedly and intensively used. With extensive faunal and lithic remains throughout the layers as well as evidence for hearths, Klasies River Mouth was at least a long-term seasonal base camp, if not a year round permanent settlement.

Site Structure

There appears to be no evidence of an organized site structure. This is most likely due to the complex stratigraphy resulting from erosion and geological movement.

Raw Material Source

In the lower layers of the Klasies MSA layers quartzite is virtually the only lithic material used. Being that the caves are cut into a quartzite cliff, this material is obviously local. However with the onset of the Howiensons Poort levels, non-local materials such as quartz, hornfels, silcrete, and chalcedony are used. These lithics are non-local and in one sample, account for 33% of the raw materials (Wurz 2002).

Considering the large time span occurring in the layers at hand, and that the hominin remains are from the lower horizons and the Howiensons Poort industry from the upper horizons, it is problematic to declare that these hominins were responsible for the long distant procurement of these lithics. As a result, the precise evidence for this behavioral indicator is unavailable in the literature.

Subsistence Patterns (Faunal)

The faunal record in the Klasies River Mouth MSA levels is extensive. It is suggested that the hominins here were practicing scavenging due to the nature and the placement of cut marks on the bovid bones. Deeper hack marks on the larger game suggest scavenging, while lighter hack marks on the smaller game suggest they were taken fresh (Thackeray 1988). Milo (1998) agrees that scavenging may have been occurring along with the taking of game through hand-held hunting weapons. This is due to the evidence for bovid carcass remains in all sizes, as would be seen in an assemblage showing scavenging or opportunistic hunting with no selection for size.

Interestingly, the Klasies hominins show a preference for eland, even though buffaloes were the more common bovids in the area. Klein (1996) suggests that this is because the Eland is a more docile species that are very amenable to driving. Therefore the hominins at Klasies with their lack of projectile points, could have conducted game drives over the local cliffs. The faunal remains reflect this as the eland shows an abundance of prime age adults while the buffalo remains show mostly that of the weaker individuals in that of the very young and the very mature (Klein 1975).

Shellfish was collected at the site in large enough amounts to produce midden heaps. The majority of these were that of the Brown mussel and the Turban shell (Decon 2001). There is also evidence that the Klasies hominins hunted seals along the coast. The remains here show selection for sub adult and mature seals with no seasonal preference (Klein 1996). No evidence for fishing and little evidence of fowling is seen at Klasies River Mouth.

Site Behavioral Assessment

The behavior of the hominins at Klasies River Mouth appears to reflect their morphology, which is highly variable. The lithic assemblages show ‘modernity’ in the high occurrence of blades, but archaic in the lack of projectile points and lower ratios of end scrapers. There are a few bone tools present, but very low in numbers. The same is true for artistic expression with only a few items reflecting this. There is also no evidence of purposeful burial. In regards to subsistence patterns, there is a preference for eland bovids, but this may be only that they were more easily attained. The faunal record shows behavior representative of scavenging and opportunistic hunting, but not well-structured habits. Overall percentage shows the behavior of the Klasies River hominins to be ‘archaic’. In this case, modern morphology accompanies ‘archaic’ behavior.



Figure 34: Klasies River Mouth Cave

Adapted from: <http://www.flickr.com/photos/gbaku/988626694/>

Sources Cited

Deacon, Hilary

2001 "Guide to Klasies River" Accessed March 15, 2010 from:
<http://academic.sun.ac.za/archaeology/KRguide2001.PDF>

Grine, Frederick

1998 "Additional Human Fossils from Klasies River Mouth, South Africa" In Journal of Human Evolution 35(1):95-107.

Grun, Rainer

1990a "Electron-Spin-Resonance Dating of Tooth Enamel from Klasies River Mouth Cave" In Current Anthropology 31(4):427-432.

Klein, Richard G.

1996 "Exploitation of Large Bovids and Seals at Middle and Later Stone Age Sites in South Africa" In Journal of Human Evolution 31(4):315-333.

Lam, Y.M.

1996 "Chin Morphology and Sexual Dimorphism in the Fossil Hominid Mandible Sample from Klasies River Mouth" In American Journal of Physical Anthropology 100(4):545-557.

Pearson, Osbjorn M.

1997 "Re-analysis of the Hominid Radii from Cave of Hearths and Klasies River Mouth, South Africa" In Journal of Human Evolution 32(6):577-591.

Rightmire, G.P.

2001 "New Human Teeth from Middle Age Deposits at Klasies River Mouth, South Africa" In Journal of Human Evolution 41(6):535-544.

Rightmire, G.P.

2006 "Human Foot Bones from Klasies River Main Site, South Africa" In Journal of Human Evolution 50(1):96-103.

Thackeray, JF

1988 "On Statistical Analyses of Faunal Data from Klasies River Mouth" In Current Anthropology 29(1):149-151.

Villa, Paola

2010a "The Howiesons Poort and MSA III at Klasies River Main Site, Cave 1A" In Journal of Archaeological Science 37(3):630-655.

Wurz, Sarah

2002 "Variability in the Middle Stone Age Lithic Sequence, 115,000-60,000 Years Ago at Klasies River, South Africa" In Journal of Archaeological Science 29(9):1001-1015.

Site: Border Cave, South Africa

Layers: 4BS – 2BS

Dates: 84,000 +/- 11,600kya – 56, 500 +/- 2,700kya
ESR dating of associated mammal tooth enamel (Grun 1990b)
Radiocarbon dating of charcoal (Bird 2003)

Associated Hominin Morphology: Modern

‘Modern’ Behavioral Percentage: 62.5%

Table 6: **Border Cave Table of Evidence**

<u>Behavior</u>	<u>Evidence</u>	<u>Yes</u>	<u>No</u>	<u>N/A</u>
Stone Tools	Blades (>flake tools)	X		
	End Scrapers (>side scrapers)	X		
	Projectile Points	X		
Bone/Antler Tools	Points	X		
	Awls		X	
	Harpoons		X	
Art	Paintings		X	
	Engravings		X	
	Figurines		X	
	Non-Utilitarian Use of Pigment	X		
Jewelry	Personal Ornaments	X		
Human Burial	Purposeful Internment	X		
	Symbolic Internment	X		
Site Use	Specialized			X
Site Structure	Complex			X
Raw Material Source	Non-Local			X
Subsistence Patterns (Faunal)	Species Preference	X		
	Size Selection	X		
	Seasonal Hunting			X
	Fishing		X	

Explanation of Evidence

Border cave is located on the western slope of the Lebombo mountain range in South Africa on the boundary of current day Zululand and Swaziland. Raymond Dart first investigated the site with an unpublished trial trench in 1934. Then in 1940, Guano diggers removed a number of human cranial and limb bone fragments. But it was in 1941 and 1942 that H.B.S. Cooke conducted the first actual excavations. Since then, Peter Beaumont carried out excavations throughout the 1970's (Beaumont 1978).

The cave is known for some of the oldest representative fossils of modern humans. However, the stratigraphy of the individuals has undergone serious debate right to their unprofessional removal and certain burials that are argued to be intrusive from higher layers. These issues are yet completely resolved, however relative and absolute dating of the fossils give them an antiquity of c.90kya-c.60kya (Grun 1990b). These mark the earliest findings of human fossils at the site and extend through time to the MSA/LSA transition.

Hominin Remains

The overall fossil collection from Border Cave is represented by an infant skeleton, a partial adult cranium, two partial adult mandibles, and a few post cranial remains of a humerus shaft, an ulna, and two metatarsals (Sillen 1996). Cooke (1945) reported on the earlier human fossil findings from Border Cave, that of the partial cranium and other adult skeletal fragments. Although their size being at the upper limit of modern Africans and nearing that of European Neanderthals, he stated them to be completely modern in appearance. In his excavations, they found a modern infant skeleton and reported it to be a clear deliberate burial in a shallow grave (Cooke 1945).

However, Cooke (1945) questioned the stratigraphy of the remains reported from the guano diggers and also his own burial find that could have been intrusive from higher layers. The main reason behind his questioning was the different state of the human bones which were well preserved and complete, with that of the associated animal bones which were poorly preserved and highly fragmented (Cooke 1954).

The human fossil remains have since been further examined and still uphold their original modern classification (Rightmire 1984). Through ESR dating of associated mammal teeth, the crania was found at c.84kya, the skeleton at c. 80kya, and a partial mandible at c.90kya (Grun 1990b). The nearly complete mandible with teeth (BC5) was directly dated through ESR dating of tooth enamel, obtaining an age of 74+/-5ky (Grun 2003). This absolute date

not only gives conclusive evidence of the antiquity of at least one of the fossils, but also serves to support the ages of the other fossils found through relative dating techniques.

Stone Tools

Displayed in the MSA levels at Border Cave is the Howiensoons Poort Industry. Blade tools are dominant, especial that of a wide variety of backed blade elements (Beaumont 1978). Cooke (1945) reported these as something not seen elsewhere at the time of discovery. The next most numerous tool shows to be that of the end scraper.

Of particular note in the lower layers are small pressure flaked triangular bifacial forms made from fine-grained chert and quartz. These were suggested by Cooke (1945) to be that of very specialized points, perhaps projectile points. Beaumont (1978) concurs with this opinion as these points continue into the upper layers where they show butt reduction, which is cause for a hafting conclusion.

Bone/Antler Tools

The bone tools of Border Cave consist of seven bone daggers of warthog or bushpig tusk fragments. They appear to be first ground and display split bases for hafting (Beaumont 1978). Although not of bone, but of particular interest due to their preservation, are the three acacia thorn pieces with damaged tips that appear to be used as awls (Beaumont 1978).

Art

There does not appear to be evidence of artistic expression in the literature on Border Cave.

Non-Utilitarian Use of Pigment

Some bones of the infant burial show reddish brown stains that appear to be the result of ochre use. Although this is not conclusive of symbolic coloring, artistic use of ochre is also apparent in the several ochre pencils occurring throughout the associated sequence (Beaumont 1978).

Jewelry

The infant burial was found directly associated with a perforated *Conus* shell that appears to be an ornament or amulet (Beaumont 1978). Being purposefully buried with the infant, this shows the symbolic use of jewelry at Border Cave.

Human Burial

Although it has been suggested that two burials exist at Border Cave, only the infant skeleton is conclusively a purposeful burial. The skeleton of the 4-6 month old was found by Cook (1945), disarticulated, but in situ. The grave was very shallow which led him to report that the remains belong to the MSA levels. The burial also appears to be symbolic in that it is directly associated with a personal ornament made of perforated *Conus* shell. Some of the bones also show reddish brown stains that could be from symbolic or utilitarian ochre coloring (Beaumont 1978).

Site Use

The faunal dental sample proves to be too small to show any sort of seasonal human occupation that would indicate specialized site use at Border Cave (Klein 1977).

Site Structure

There does not appear to be suggestion of an organized site structure at the site.

Raw Material Source

I found no report of the source for the lithic material at Border Cave. However, the *Conus* shell associated with the infant burial comes from the coast, which is about 82km to the east (Beaumont 1978). Therefore there did exist some sort of long distant procurement of raw materials.

Subsistence Patterns (Faunal)

The majority of the faunal remains from Border Cave are represented by various mammals such as hippopotamus, bush pig, buffalo, antelope, gnu, impala, zebra, hyrax, and various rodents (Cooke 1945). Klein (1977) discusses the frequencies of the fauna recovered at the site. It appears that buffalo, bush pig, antelope, and zebra are the most abundant in remains. Of these an overall preference for young buffalo is seen. However, the small sample size of all species besides buffalo is too limited to make age distributions claims.

I found no evidence for fishing at the site.

Site Behavioral Assessment

The hominins at Border Cave express 'modern' behavior in many aspects. Their stone tool technology shows to be advanced with the presence of blades, backed tools, end scrapers, and

projectile points. And although not extensive, the presence of bone tools is apparent through the recovery of seven points. The poor preservation of organic materials with such antiquity demands consideration that there was a larger bone tool kit that simply did not stand the test of time. Among the recovered faunal remains, there appears a preference for young buffalo in the diet of these hominins. Additionally, the existence of a burial with a grave good shows 'modern' care for the deceased.

There does however, appear to be a limited bone tool assemblage, little artistic expression, and no practice of fishing at the site. Thus, these hominins retain a large degree of 'archaicism' in their behavior. Therefore, even though the overall 'modern' behavioral percentage shows to be higher, modern hominin morphology comes with a good mix of 'modern' and 'archaic' behavior at Border Cave.



Figure 35: Border Cave

Adapted from: <http://swazinet.com/border-cave/border-cave-2/>

Sources Cited

Beaumont, PB

1978 "Modern Man in Sub-Saharan Africa Prior to 49000 Years BP - Review and Evaluation with Particular Reference to Border Cave" In South African Journal of Science 74(11):409-419.

Bird, M.I.

2003 "Radiocarbon Dating from 40-60 ka BP at Border Cave, South Africa" In Quaternary Science Review 22(8-9):943-947.

Cooke, H.B.S.

1945 "Fossil Man in the Lebombo Mountains, South Africa: the "Border Cave"" In Man 45:6-13.

Grun, Rainer

1990b "ESR Dating Evidence For Early Modern Humans At Border Cave In South Africa." Letters To Nature. April. Cambridge University.

Grun, Rainer

2003 "On the Age of Border Cave 5 Human Mandible" In Journal of Human Evolution 45(2):155-167.

Klein, Richard G.

1977 "The Mammalian Fauna from the Middle and Later Stone Age (Later Pleistocene) Levels at Border Cave, Natal Province, South Africa" In South African Archaeological Bulletin 32(125):14-27.

Rightmire, G.P.

1984 "Homo sapiens in Sub-Saharan Africa" In The Origin of Modern Humans: A World Survey of the Fossil Evidence Eds. Smith, Fred H. and Frank Spencer. New York: Alan R. Liss Inc.

Site: Kebara Cave, Israel

Layer: F (Units V-XIV)

Dates/Methods: 60,000 +/- 6,000kya - 48,300 +/- 3,500kya
TL dating of burnt flint (Valladas 1987)
ESR dating of mammal tooth samples (Schwarcz 1989)

Associated Hominin Morphology: Neanderthal

'Modern' Behavioral Percentage: 42%

Table 7: **Kebara Cave Table of Evidence**

<u>Behavior</u>	<u>Evidence</u>	<u>Yes</u>	<u>No</u>	<u>N/A</u>
Stone Tools	Blades (>flake tools)		X	
	End Scrapers (>side scrapers)		X	
	Projectile Points	X		
Bone/Antler Tools	Points		X	
	Awls		X	
	Harpoons		X	
Art	Paintings		X	
	Engravings	X		
	Figurines		X	
	Non-Utilitarian Use of Pigment			X
Jewelry	Personal Ornaments		X	
Human Burial	Purposeful Internment	X		
	Symbolic Internment		X	
Site Use	Specialized	X		
Site Structure	Complex	X		
Raw Material Source	Non-Local		X	
Subsistence Patterns (Faunal)	Species Preference	X		
	Size Selection	X		
	Seasonal Hunting	X		
	Fishing		X	

Explanation of Evidence

Kebara Cave is located on the western side of Mount Carmel in current day Israel. It rests 65m above sea level overlooking 2.5km of Mediterranean coastal plain. The cave is about 26m long and 20m wide with an overall funnel shape, and its ceiling consists of three vault-like domes and a chimney. A small terrace in the front was formed by a large rock collapse dated to post 30kya (Bar-Yosef 1996).

Discovered by Moche Stekelis in 1927, it was first excavated by Turville-Petre in 1932 and later by Stekelis from 1951-1965. Recent excavations were conducted by Bar-Yosef from 1982-1990. The site has revealed numerous hominin remains showing a mosaic of characteristics of Neanderthal, archaic, and modern features. The cultural traditions in the cave span from the Mousterian to the Natufian (Bar-Yosef 1996).

Hominin Remains

The total hominin remains discovered at Kebara Cave is substantial, coming to 29 fragments and two nearly complete individuals. From layer F, 17 hominin fossils were recovered including the two well-preserved burials. These are Kebara 1, which consists of the fragmentary skeleton of an infant about 7-9 months old; and Kebara 2, which is that of an adult male about 25-30 years old (Bar-Yosef 1992). The skeletal remains have not been directly dated, but the layer above the adult male burial was dated to 56 +/- 3,600kya (Bar-Yosef 1986).

Anatomical analysis by Arensburg (1989) of Kebara 2, which is missing the cranium and most of the lower limbs, reveals a mosaic of characteristics. Neanderthal traits are seen in the metacarpal bones and the pelvis, archaic traits are seen in the mandible, and modern traits in the vertebral column, the hyoid, ribs, and sternum. Bar-Yosef (1992) groups this individual with Neanderthal affinities because of the fact that it is the most robust individual known from the Levant. Therefore, despite the variety of features, the hominins at Kebara are classified as Neanderthal.

Stone Tools

The lithic tradition, as reported by Bar-Yosef (1992) in Kebara Layer F, is that of Mousterian classification. Throughout the sequence production of scrapers, blades, and points is seen, but the chief component throughout the sequence is that of flake tools. Side scrapers prove to be the dominant form of scraper tool while the presence of blades increases

in the lower levels even though their production remains significantly less than flake tools. Other Upper Paleolithic tool types such as burins are also present in the lower levels (Bar-Yosef 1992).

The points found in units IX-XII were analyzed and suggested by Shea (1988) to have been employed as projectile points. He finds evidence for this in traces of hafting on 43 of the 132 recovered points, and impact damage on 31 of these. The production of projectile points, blades, and burins in the Mousterian levels of Kebara suggest that the hominins there were in a transition towards Upper Paleolithic technology.

Bone/Antler Tools

I found no report for evidence of bone or antler tools in Mousterian level F of Kebara.

Art

Artistic expression is minimal in the layer of interest at Kebara. Davis (1974), in his analysis of the faunal remains from the site, found a shaft fragment of gazelle or Fallow deer long bone with incisions on it that appear to be engravings. They are significantly larger than scratch marks resulting from cutting tendons or meat removal, therefore he suggests this to be art. This is inconclusive however, as the incisions could have been used for grip on some sort of bone tool. But the lack of other bone tools works to uphold the Davis conclusion.



Figure 36: Engraved Bone Fragment from Kebara
Adapted from: Davis (1974)

Use of Pigment

There is no discussion that pigments were put to use in this layer of Kebara.

Jewelry

There are no signs of personal items of adornment in the Kebara Mousterian.

Human Burial

Kebara 1 and 2 are generally accepted to be purposeful burials. The pit of Kebara 2 appears to be strategically dug between two hearths with an additional hearth at its base. Numerous lithics and a few bones were discovered within the burial pit, however their distribution does not suggest them to be grave goods, rather just part of the refill (Bar-Yosef 1992).

The position of the upper limbs of Kebara 2 appear to be purposefully placed and flexed together across the body, suggesting immediate inhumation preceding rigor mortis. The skull was missing, but the positions of the mandible, the hyoid bone, and a third molar exclude the hypothesis that the skull was removed by animal activity. Bar-Yosef (1992) suggests that this is the first recorded human intervention of a burial from a Mousterian context.



Figure 37: Kebara 2 Burial
Adapted from: Bar-Yosef (1992)

Site Use

Kebara Cave appears to be specialized in its use as an intensely occupied single-season and multi-season base camp. Evidence for intensive and repeated occupations is seen in hearths with deep sequences, more than 3 meters thick (Shea 2001). And seasonality data derived from gazelle teeth show hominin presence to be strongest in winter, spring, and early summer (Shea 2001).

Site Structure

Spatial differences in the distribution of bones, ashes, and artifacts at Kebara were noted by Schick and Stekelis (1977), particularly a concentration of bones and lithic debris near the north wall that appear to be a dumping zone. In both the Middle and Upper Paleolithic levels, thousands of bones from larger mammals are densely concentrated in a single 4-meter wide strip against this wall. Bar-Yosef (1992) concluded that humans played an important role in these bone accumulations, as seen in the many cut-marked and burnt bones and the correlation in the stratigraphy of the bones with other cultural activity. The bones also show to have been gnawed and punctured by carnivores as well, suggesting that animals either also played a role in the accumulation or simply scavenged the remains later (Bar-Yosef 1992). Also notably, are the hearths that appear to be well organized as seen in Upper Paleolithic horizons. The difference here is the lack of stones for warmth banking (Bar-Yosef 1992).

The Kebara site structure appears to show characteristics of being 'complex'. Designation of living spaces for different purposes is seen at in a refuse area, hearth organization, and burial placement (Bar-Yosef 1992).

Raw Material Source

The sources for the lithics and raw materials found at Kebara are all within 10-20km of the site, most being in the immediate vicinity, less than 5km (Bar-Yosef 1992). Long distance procurement of lithics appears to be, if at all, minimally occurring at the cave.

Subsistence Patterns (Faunal)

Excavations in Kebara yielded large collections of medium to large mammal remains. The most abundant of these are the ungulate remains of gazelle and Fallow deer, which make for about 75% of the preferred game of Kebara hominins (Leiberman and Shea 1994). Over time, a preference from older female gazelles to prime-age male gazelles was seen to occur (Leiberman and Shea 1994). Seasonality data from gazelle teeth also shows a seasonal preference for this game during winter and summer months (Shea 2001). These patterns show hominin preference in species, size and sex, as well as season. There is however no evidence of fishing for subsistence at Kebara.

Site Behavioral Assessment

The hominins occupying Kebara cave in the Mousterian Level F show anatomical morphology as well as behavior of a mosaic type between 'archaic' and 'modern'. We see

‘modern’ behavior in site use, which appears to be seasonal, and site structure, which is organized. Also in the subsistence patterns showing species, size and sex, and seasonal preferences; we see ‘modern’ behavior. Human burial is practiced, although not proven to be symbolic. And the lithic assemblages, although overall of the Mousterian type, show ‘modern’ signatures in blades and projectile points.

However, there is no evidence of bone tools, little to no evidence of artistic expression or production of personal ornaments, no long distant procurement of raw materials, and no exploitation of marine animals. Although the overall percentage sides with ‘archaic’ behavior in the archaic hominins of Kebara, they show a definite trend towards ‘modernity’ that demands notice.



Figure 38: Kebara Cave
Adapted from: Shea (2001)

Sources Cited

Arensburg, B.

1989 "New Skeletal Evidence Concerning the Anatomy of Middle Palaeolithic Populations in the Middle East: the Kebara Skeleton" In The Human Revolution Eds. Paul Mellars and Chris Stringer, Princeton University Press.

Bar-Yosef, Ofer

1992 "The Excavations in Kebara Cave, Mt. Carmel" In Current Anthropology 33(5):497-550.

Bar-Yosef, Ofer

1996 "The Dating of the Upper Paleolithic Layers in Kebara Cave, Mt. Carmel" In Journal of Archaeological Science 23(2):297-306.

Davis, Simon

1974 "Incised Bones from the Mousterian of Kebara Cave (Mount Carmel) and the Aurignacian of Ha-Yonim Cave (Western Gallilee), Isreal" In Paleorient 2(1-2):182-182.

Leiberman, Daniel and John J. Shea

1994 "Behavioral-Differences Between Archaic and Modern Humans in the Levantine Mousterian" In American Anthropologist 96(2):300-322.

Schwarcz, Henry

1989 "ESR Dating of the Neanderthal Site, Kebara Cave, Israel" In Journal of Archaeological Science 16(6):653-659.

Shea, John J.

2001 "The Middle Paleolithic: Early Modern Humans and Neanderthals in the Levant" In Near Eastern Archaeology 64(1/2):38-64.

Shick, T and M. Sekelis

1977 "Mousterian Assemblages in Kebara Cave, Mount Carmel" In Eretz-Israel 13:97-150.

Valladas, Helene

1987 "Thermoluminescence Dates for the Neanderthal Burial Site at Kebara in Israel" In Nature 330(6144):159-160.

Site: Tabun Cave, Israel

Layers: B and C

Dates: **Layer B-** 122 +/- 16kya - 102 +/- 17kya
ESR of faunal dental enamel (Grun and Stringer 2000)

Layer C- 140+/-21kya - 120+/-16kya –
ESR of faunal dental enamel (Grun and Stringer 2000)

Associated Hominin Morphology: Neanderthal

‘Modern’ Behavioral Percentage: 31%

Table 8: **Tabun Cave Table of Evidence**

<u>Behavior</u>	<u>Evidence</u>	<u>Yes</u>	<u>No</u>	<u>N/A</u>
Stone Tools	Blades (>flake tools) End Scrapers (>side scrapers) Projectile Points		X X	X
Bone/Antler Tools	Points Awls Harpoons		X X X	
Art	Paintings Engravings Figurines Non-Utilitarian Use of Pigment		X X X	X
Jewelry	Personal Ornaments		X	
Human Burial	Purposeful Internment Symbolic Internment	X	X	
Site Use	Specialized	X		
Site Structure	Complex			X
Raw Material Source	Non-Local			X
Subsistence Patterns (Faunal)	Species Preference Size Selection Seasonal Hunting Fishing	X X X	X	

Explanation of Evidence

Tabun cave is a late Pleistocene southern Levant cave site located on Mount Carmel in current day Israel. It lies 63 meters above sea level and consists of 2 major chambers and 2 shafts with artifact remains dating from 300kya to recent times. The cave was excavated from 1929-1931 by D.A.E. Garrod, and again in 1967-1972 by Arthur Jelinek.

Hominin Remains

Garrod (1980) recorded 29 skull fragments, 9 milk teeth, maxilla fragments, and 7 isolated teeth in Layer B, of which he said to be a transitional morphology between Neanderthals and moderns. These fossils are now classified as Neanderthal and dated to 90kya by direct dating of tooth enamel through ESR dating (Coppa 2007).

Also, a burial of a Neanderthal woman called Tabun I was found in Layer C during the first excavations by Garrod. However, it was found so close to Layer B that Garrod (1980) left it an open question as to possibly being a burial from Layer B. Others say that it may have actually come from Layer D (Trinkaus 1984).

Grun and Stringer (2000) directly dated Tabun I through ESR dating of dentine from the tooth enamel to 47+/-3kya. Surprisingly, the mandible of this individual was directly dated through GRS dating to an age of 35kya +/- 5ky (Shwarcz 1998). These dates put the individual into a younger range than the dated material in both Layer B and C. Interestingly, the later date shows her to be much younger than any Neanderthal from the Levant, which is significant because it suggests that they existed here as long as they did in Europe (Shwarcz 1998).

Also a complete mandible, Tabun II, was found in Layer C. Being mixed morphologically with a retro molar space as well as a slight chin, Jelinek (1982) declared it to be a Neanderthal, but Stephan and Trinkaus (1998) consider it a late archaic. Tabun II dates between 50-60kya (Jelinek 1982). All of these fossils prove to be younger than the archeological material in which they are directly associated with.

Stone Tools

Layers B and C were found to be very typologically similar, characterized by relatively high frequencies of scrapers, broad flakes, and bifaces, with a low number of end scrapers. Blades were present, but also limited (Jelinek 1982). There were however many points along

with scrapers that were highly characterized by retouching manufacture (Garrod 1980). I saw no discussion of conclusive evidence that these were projectile points.

Overall the site is characterized by a continual steady progression in tool technology through time, but it is interesting to note that Layer D has a cultural sequence characterized by high frequencies of blades and flake tools rather than scrapers and bifaces (Jelinek 1982). This gives it a more ‘modern’ upper Paleolithic technological level at an earlier date than Level C. A situation like this has been argued to be evidence of Neanderthal presence after modern human presence, showing that that two species were living contemporaneously to each other. This has also been argued to be evidence that Neanderthals were copying ‘modern’ technology, or according to some, coming up with it themselves.

Bone/Antler Tools

No tools of this type show to be found in these layers of the cave.

Art

Artistic expression does not show to be occurring at Tabun.

Non-Utilitarian Use of Pigment

I found no discussion of the use of pigments at the site.

Jewelry

Personal ornaments are not in the assemblage.

Human Burial

Tabun I in Layer C is generally accepted to be of purposeful internment. However there are no signs such as grave markings or grave goods signaling the burial as symbolic (Shea 2001).

Site Use

The Tabun site shows to be intensely and repeatedly occupied. Seasonality data derived from the examination of gazelle bones leads Shea (2001) to the conclusion that Tabun was a multi-seasonal base camp. Layer B shows to be mainly a winter and summer camp while Layer C shows to be mainly a winter and spring camp.

Site Structure

I found no evidence telling that the site was organized spatially. This could however be due to the high amount of post depositional disturbances that occurred such as a collapse of the shaft sediments between layer C and D, or a seasonal spring that periodically was flowing through the site (Jelinek 1982).

Raw Material Source

I found no information on the source of the lithics at Tabun. This is similar to most Mousterian sites in the southern Levant which show to contain lithics from local sources of less than 10km away (Shea 2001).

Subsistence Patterns (Faunal)

The faunal subsistence patterns of the Tabun hominins shows to shift from smaller herbivore exploitation to a greater exploitation of large herbivores from Layer C to Layer B. Of the total faunal remains showing human processing, the percentage of large herbivores shifts from just below 40% in Layer C, to just over 90% in Layer B (Shea 2001).

Species preference is apparent in a shift from gazelle to deer as the main source of meat (Jelinek 1982). This is seen in the percentages of herbivores exploited at 39.5% gazelle and 15.8% deer in Layer C, to just 12.6% gazelle and up to 78.1% deer in Layer B (Shea 2001).

Seasonal hunting practices are apparent in the seasonal data from gazelle bones that show a higher exploitation in the winter and summer in Layer B, and a higher exploitation in the winter and spring in Layer C (Shea 2001).

There does not show to be evidence of fishing.

Site Behavioral Assessment

The Tabun hominins that were present in Layers B and C, show some behaviorally 'modern' characteristics in the occurrence of a human burial, specialized site use, and in organized hunting practices. But for the most part they were expressing 'archaic' behavior seen in the minimal amount of 'modern' technological elements, and the complete lack of artistic expression or symbolic behavior. Therefore archaic morphology accompanies 'archaic' behavior at this site.



Figure 39: Tabun Cave
Adapted from: Shea 2001

Sources Cited

Coppa, Alfredo

2007 “Evidence for New Neanderthal Teeth in Tabun Cave (Israel) by the Application of Self-Organizing Maps (SOMs)” In Journal of Human Evolution 52(6):601-613.

Garrod D.A.E.

1939 The Stone Age of Mount Carmel Clarendon Press, Oxford.

Grun, Rainer and Chris Stringer

2000 “Tabun revisited: revised ESR chronology and new ESR and U-series analyses of dental material from Tabun C1” In Journal of Human Evolution 39:601-612.

Jelinek, Arthur J.

1982 “The Tabun Cave and Paleolithic Man in the Levant” In Science 216(2553):1365-1375.

Schwarcz, Henry P.

1998 “Neanderthal Skeleton from Tabun: U-Series Data by Gamma-Ray Spectrometry” In Journal of Human Evolution 6:635-645.

Shea, John J.

2001 “The Middle Paleolithic: Early Modern Humans and Neanderthals in the Levant” In Near Eastern Archaeology 64(1/2):38-64.

Stefan, Vincent H. and Eric Trinkaus

1998 “Discrete Trait and Dental Morphometric Affinities of the Tabun 2 Mandible” In Journal of Human Evolution 34(5):443-468.

Trinkaus, Erik

1984 “Western Asia” In The Origins of Modern Humans: A World Survey of the Fossil Evidence Ed. Fred H. Smith and Frank Spencer, New York, Alan R Liss Inc.

Site: Qafzeh Cave, Isreal

Units: XV-XXII

Dates/Methods: 92 +/- 5kya
TL dating of burnt flint (Valladas 1988)

Associated Hominin Morphology: Modern

'Modern' Behavioral Percentage: 61%

Table 9: **Qafzeh Cave Table of Evidence**

<u>Behavior</u>	<u>Evidence</u>	<u>Yes</u>	<u>No</u>	<u>N/A</u>
Stone Tools	Blades (>flake tools %)		X	
	End Scrapers (>side scraper %)			X
	Projectile Points	X		
Bone/Antler Tools	Points		X	
	Awls		X	
	Harpoons		X	
Art	Paintings		X	
	Engravings	X		
	Figurines		X	
	Other Artistic Use of Pigment	X		
Jewelry	Personal Ornaments	X		
Human Burial	Purposeful Internment	X		
	Symbolic Internment	X		
Site Use	Specialized	X		
Site Structure	Complex			X
Raw Material Source	Non-Local	X		
Subsistence Patterns (Faunal)	Species Preference	X		
	Size Selection	X		
	Seasonal Hunting	X		
	Fishing		X	

Explanation of Evidence

Qafzeh Cave is a late Pleistocene site in the Levant about 2.5 km south of Nazareth in current day Israel. Its name means “precipice,” which means overhanging cliff or situation of great peril, and legend has it that Jesus was hurled off a nearby cliff that was called the “Lord’s Leap” in the Middle Ages (Vandermeersch 2002). Lying 220 meters above sea level, the cave was first excavated by Rene Neuville and Miriam Stekelis from 1933-1935, and later by Bernard Vandermeersch from 1965-1979. Much of the excavation work took place on the terrace of the cave (Vandermeersch 2002). The site is known for its findings of anatomically modern human remains found in the Mousterian levels.

Hominin Remains

The hominin remains from Qafzeh are agreed to be of anatomically modern human. The earlier excavations revealed four adults and two juveniles (Shea 2001), and the more recent excavations of units XV-XXII revealed 18 individuals, most of these being fragmentary. There were however, three articulated partial skeletons and two articulated, almost complete skeletons in these layers (Gargett 1999).

When the two almost complete skeletons were found in 1967, they were discovered in the Mousterian levels of the site. This negated the dogma that Neanderthals were the only hominins responsible for Mousterian technology. It was suggested that these were actually burials from more recent levels. But because of the depth of these remains in the Mousterian layer and the fact that the layers were covered by a period of intense breaching, this has proved not to be the case (Vandermeersch 2002).

Thermoluminescence dating of associated burnt flint provided proof for the antiquity of the remains giving a date of 92 +/- 5kya (Valladas 1988). This meant that the Mousterian of the Levant showed to be the work of modern humans as well as Neanderthals.

Stone Tools

The lithic assemblages associated with hominin remains at Qafzeh are that of the Mousterian characterized by a high percentage of flake tools and Levallois cores. In the upper layers, the frequencies of blades, points, and retouched flake tools show to increase (Leiberman and Shea 1994). Most of the lithic data is unavailable in English.

Bone/Antler Tools

There is no evidence of bone or antler tools at Qafzeh.

Art

Found in layer XVII was an engraved cortical flake that has been interpreted as having symbolic meaning (Mayer 2009).

Non-Utilitarian Use of Pigment

High amounts of ochre were found in the lower layers of Qafzeh Cave. Hovers (2003) conducted a study of 71 recovered pieces on which evidence for human utilization was found. Signs of human use come from markings on the pieces that indicate manipulation such as scrapings, striations, or signs of lithic reduction such as bulbs of percussion. Presence of ochre stained artifacts also show its use by humans, such as the various flakes and retouched tools from layers XXII-XVII that bear ochre around the edges or on the tips (Hovers 2003). The hominins here notably show a particular preference for red, which can either be collected from natural sources or produced by heating from other iron minerals. The high frequency of hearths in the layers of Qafzeh in which ochre was found led Hovers (2003) to suggest this heating technique was often employed there to attain red pigment.

Ochre was dominantly found in association with the human remains at Qafzeh. Especially in layer XVII, which yielded the largest number of intentional burials and contains the highest frequencies of large pieces of ochre. Notably in this layer, associated with Qafzeh individual 8, is a large intensively scraped piece of ochre (Hovers 2003).

Some suggest that the use of ochre is utilitarian as in an aid for hide tanning, hafting, medicinal purposes, or to slow purification in burials. Hovers (2003) rejects hafting with ochre at Qafzeh due to the lack of the mineral on the surfaces of the lithic artifacts where hafting would occur. He also states that the repeated selection for red hues of ochre seems unlikely for other practical purposes at the site. Additionally, the presence of ochre stained glycymeris seashells that show evidence of being items of personal adornment (Mayer 2009) combine with the above factors, arguing for a symbolic use of ochre at Qafzeh.

Jewelry

Personal ornaments in the form of glycymeris bivalve marine shells were recovered from the lower levels of Qafzeh. Although the shells were naturally perforated, a high number

show traces of grooves that appear to be the result of friction from stringing. Several shells also prove to be ochre stained (Mayer 2009). The source for these shells would have been 40-50km from the site being that the seashore would have been at that distance during the occupation. There is a lack of any geological formation containing these shells in the vicinity of the cave (Mayer 2009). These factors combine suggesting the marine shells were used as symbolic jewelry.

Human Burial

Of the Qafzeh individuals, 8-11 and 13-15 are accepted to be burials (Shea 2001). Particularly that of the near complete individuals, Qafzeh 8 and 9, who appear to be a double grave due to their close proximity (Vandermeersch 2001). Qafzeh 8, the skeleton of an adult woman was found in a flexed position with Qafzeh 9, an infant, lying at her feet also in a flexed position (Gargett 1999).

Also notably was the burial of Qafzeh 11, which were the remains of a 10-year-old boy. He was found lying on his back with legs bent to the side, and both hands clasped to his chest holding the antlers of a large deer (Vandermeersch 2001). This has been suggested to be a grave good placed purposely with the body. This signals not only intentional burial, but also symbolic.



Figure 40: Qafzeh 8 and 9

Adapted from: <http://www.sciencephoto.com/media/116067/enlarge>

Site Use

Qafzeh appears to be a repeatedly occupied multi-seasonal base camp. Seasonality data from incrementally deposited tissue on gazelle teeth, leads Leiberman and Shea (1994) to

conclude that the more recent layers of the site were occupied mainly in the spring and summer.

Site Structure

I found no evidence discussing that the site was organized spatially. This could however, be due to rockfall from the terrace destroying the evidence, as Gargett (1999) suggested to be the cause of the highly fragmented skeletal remains.

Raw Material Source

Long distance procurement of lithics and other raw materials is apparent at Qafzeh cave. The closest currently exposed lithic sources are located 10-12km to the northeast and the closest outcrops of ochre are located approximately 8km away (Hovers 2003). Notably, the recovered marine shells would have come from the coast, which was 45-50km from the site at the time of occupation (Mayer 2009). These distances show that the hominins here had established systems of attaining raw materials from long distances.

Subsistence Patterns (Faunal)

A diet with a preference for medium territorial species such as gazelle and red deer is seen at Qafzeh. These species make up for 60% of the faunal remains in levels V-XV and 75% in levels XVI-XXIV (Shea 2001). Other larger mammals are also present such as zebra, horse, and rhino. The upper levels have yielded some land snails and freshwater bivalves that are presumed to be food remains (Lieberman and Shea 1994).

The site also reveals seasonal hunting practices seen in gazelle remains that show to be killed during the dry season in the lower layers and in spring and summer in the upper layers. Besides the shells that appear to be items of personal adornment, there is no evidence of other marine resource exploitation or fishing (Mayer 2009).

Site Behavioral Assessment

The hominins from Qafzeh show to display both 'archaic' and 'modern' behavior. The tool tradition is 'archaic' in that the assemblages are dominated by flake tools and there is a complete lack of bone tools. Conversely, the other behavioral indicators from the site appear to be 'modern'. The presence of symbolic behavior seems to be strong in the burials, the items of personal adornment, and the use of pigments. The site use also appears to be specialized seasonally with long distance procurement of lithics and other raw materials.

And the subsistence patterns show game preferences in species and size as well as seasonal hunting practices. Ultimately, even with the presence of 'archaic' technology, the 'modern' behavioral percentage is larger. Therefore at the Qafzeh site, modern morphology accompanies 'modern' behavior.

Sources Cited

Gargett, Robert H.

1999 “Middle Palaeolithic Burial is Not a Dead Issue: The View from Qafzeh, Saint-Césaire, Kebara, Amud, and Dederiyeh” In Journal of Human Evolution 37(1):27-90.

Hovers, Erella

2003 “An Early Case of Color Symbolism - Ochre Use by Modern Humans in Qafzeh Cave” In Current Anthropology 44(4):491-522.

Leiberman, Daniel and John J. Shea

1994 “Behavioral-Differences Between Archaic and Modern Humans in the Levantine Mousterian” In American Anthropologist 96(2):300-322.

Mayer, Daniella E.

2009 “Shells and Ochre in Middle Paleolithic Qafzeh Cave, Israel: Indication for Modern Behavior” In Journal of Human Evolution 56(3):307-314.

Shea, John J.

2001 “The Middle Paleolithic: Early Modern Humans and Neanderthals in the Levant” In Near Eastern Archaeology 64(1/2):38-64.

Valladas, H

1988 “Thermoluminescence Dates for the Mousterian Proto-Cro Magnons from Qafzeh Cave (Israel)” In Nature 331:614-616.

Vandermeersch, Bernard

2002 “The Excavation of Qafzeh” In Bulletin du Centre de Recherche Francais a Jerusalem.

Site: Mugharet Es-Skhul, Israel

Level: B

Dates/Methods: c.130kya – c.100kya
U-Series and ESR dating of hominin teeth and bones (Grun and Stringer 2005)
Thermoluminescence dating of associated burnt flint (Mercier 1992)

Associated Hominin Morphology: Modern

‘Modern’ Behavioral Percentage: 44%

Table 10: **Skhul Table of Evidence**

<u>Behavior</u>	<u>Evidence</u>	<u>Yes</u>	<u>No</u>	<u>N/A</u>
Stone Tools	Blades (>flake tools)		X	
	End Scrapers (>side scrapers)	X		
	Projectile Points	X		
Bone/Antler Tools	Points		X	
	Awls		X	
	Harpoons		X	
Art	Paintings		X	
	Engravings		X	
	Figurines		X	
	Non-Utilitarian Use of Pigment	X		
Jewelry	Personal Ornaments	X		
Human Burial	Purposeful Internment	X		
	Symbolic Internment	X		
Site Use	Specialized			X
Site Structure	Complex		X	
Raw Material Source	Non-Local			X
Subsistence Patterns (Faunal)	Species Preference	X		
	Size Selection			X
	Seasonal Hunting			X
	Fishing		X	

Explanation of Evidence

Es-Skhul is a rockshelter site on Mount Carmel located 3.5km from the Mediterranean Sea in current day Israel. The shelter is of a relatively small size with only 6m into the back wall and a 5m terrace. The site is suggested to be a cemetery due to the 10 human individuals found here (Garrod 1939). It was excavated in 1928 by Dorothy Garrod and from 1931-1932 by T.D. McCown (d'Errico 2010). The hominin remains were found in level B and dated between c.100kya-c135kya (Grun and Stringer 2005).

Hominin Remains

Both cranial and post-cranial remains of at least 10 hominin individuals, 7 adults and 3 adolescents, were recovered from level B of the site. Two of these individuals were nearly complete (Garrod 1939). The majority of them were found in positions that appear to be from intentional burial, leading Garrod (1939) to call the site a cemetery. Direct U-Series and ESR dating of bones and teeth from Skhul II and IX date the fossils to between c.100kya – c.135kya (Grun and Stringer 2005).

High morphological variation exists among the remains, therefore the interpretations of the fossils differ. They have been called archaic human with a combination of Neanderthal and modern human traits (Garrod 1939), as well as an archaic form of modern human (Shea 2001). Trinkaus (1984) supports an early modern human classification in his comparison of the Skhul hominins to Neanderthals. He states that they have longer distal limbs, shorter and higher cranial vaults, non-prognathic mid-facial regions, relatively small brow ridges, and a chin. Here we see the variation present in many hominins from this period.

Stone Tools

Apparently much of the lithic assemblage from level B was discarded at the site, making reanalysis difficult. However, what was recorded by Garrod (1939) shows to be that of a Middle Palaeolithic Mousterian industry with flake tools dominating over blade tools. However, some Upper Palaeolithic elements are present. For example, Garrod (1939) reports that end scrapers outnumber side scrapers six to one. Also there a large amounts of points, some being on triangular Levallois flakes, others leaf shaped, some long and narrow, and many asymmetrical. It has been concluded that many of these points match the morphological pattern of projectile points (Leslie 2008).

Bone/Antler Tools

There is no evidence for the manipulation of bone or antler for tool use at Skhul.

Art

There does not appear to be artistic expression amongst the Skhul hominins.

Use of Pigment

Pigmentation practices are apparent at the Skhul site in four specimens of pigmental lithic material analyzed by (d'Errico 2010). These display various hues of yellow, orange, and red and show to be from various geological sources; meaning an intentional gathering of the pieces. The orange and red are of three pieces that prove to have been heated to at least 300 degrees Celsius. This is thought to have been deliberate heating in order to attain these colors (d'Errico 2010). It cannot be determined with the available evidence whether or not these specimens were used for functional or symbolic purposes. However in other African sites pigmentation is seen on lithic tools as well as on shell beads, which argues for both uses.

Jewelry

Two *Nassarius gibbosulus* gastropod shells that show perforations with patterns consistent with cultural use as suspended items of personal adornment were recovered from level B (Vanhaeren 2006). The site was 3-20km from the Mediterranean shore during the accumulations of level B, making them too far to arrive there naturally by water flows. Also there is no known animal predator of these gastropods that may have transported them to the cave. Therefore, they must have been selected and transported there by human agent, supporting the idea that they were symbolic or decorative items (Vanhaeren 2006).



Figure 41: Two Perforated Shell Beads from Es-Skhul
Adapted from: Vanhaeren (2006)

Human Burial

Garrod (1939) called the site a cemetery with deliberate internment of several hominin individuals. Due to skeletal position, at least three of these prove to be definitive burials. Skhul I is that of a 3-year-old female child buried in a kneeling position with a flexed left arm, with the forearm and hand placed under the head (Garrod 1939). Skhul IV was buried with legs tightly flexed, arms folded, hands placed in front of the face, and legs folded back upon the buttocks (Garrod 1939). Skhul V is that of a 45 year old male, lying on his back with head bent upon the chest, right arm flexed, left arm laying across the body, legs tightly flexed with feet up against the buttocks, and hips twisted so that the right one lay deepest in the grave (Garrod 1939). Although all these Skhul hominins appear to be intentionally buried, only one shows sure sign of symbolic burial. This is in a boar mandible that appears to be purposely placed between the right arm and the ribcage of Skhul V (Shea 2001).

Site Use

I found no discussion of specialized site use at Skhul.

Site Structure

There is no evidence that the site was organized spatially.

Raw Material Source

The source of the lithic material used at the site was not discussed in the literature.

Subsistence Patterns (Faunal)

Shea (2001) discusses the site faunal record to reveal a preference in the Skhul hominins for the consumption of cattle, comprising 88.4% of the large animal cultural remains. The remainder comprise of equids, which account for 9.6%, while deer account for 2%. The literature does not discuss a preference for size or seasonality. And there is no evidence for fishing.

Site Behavioral Assessment

The Skhul hominins display more 'archaic' behavioral indicators than 'modern' ones. This is seen mainly in that there is no use of bone or antler tools and there is no artistic expression. However, the lithic industry, the apparent burial practices including one with a grave good, the use of jewelry and pigmentation along with hunting species preferences; make the

behavior at the site to strongly show that of ‘modern’ hominins. But taken from the behavioral percentage, at Skhul, modern morphology accompanies ‘archaic’ behavior.



Figure 42: Mount Carmel

Adapted from: http://en.wikipedia.org/wiki/Mount_Carmel

Sources Cited

d'Errico, Francesco

2010 "Pigments from the Middle Palaeolithic Levels of Es-Skhul (Mount Carmel, Israel)" In Journal of Archaeological Science 37(12):3099-3100.

Garrod D.A.E.

1939 The Stone Age of Mount Carmel Clarendon Press, Oxford.

Grun, Rainer and Chris Stringer

2005 "U-series and ESR analyses of bones and teeth relating to the human burials from Skhul" In Journal of Human Evolution 49(3):316-334.

Leiberman, Daniel and John J. Shea

1994 "Behavioral-Differences Between Archaic and Modern Humans in the Levantine Mousterian" In American Anthropologist 96(2):300-322.

Leslie, David E.

2008 "Formal Variation in Lithic Projectile Armatures: Re-Interpreting Points from Tabun Cave, Israel" Masters Thesis, Florida Atlantic University.

Mercier, N.

1992 "Thermoluminescence Date for the Mousterian Burial Site of Es Skhul, Mt Carmel" In Journal of Archaeological Science 20(2):169-174.

Shea, John J.

2001 "The Middle Paleolithic: Early Modern Humans and Neanderthals in the Levant" In Near Eastern Archaeology 64(1/2):38-64.

Trinkaus, Eric

1984 "Western Asia" In The Origins of Modern Humans: A World Survey of the Fossil Evidence Eds. Fred H. Smith and Frank Specer. Alan R. Liss Inc., New York.

Vanhaeren, Marian

2006 "Middle Paleolithic Shell Beads in Israel and Algeria" In Science 312(5781):1785-1788.

Site: Saint-Cesaire, France

Level: 8

Dates/Methods: 36,300 +/- 27,000kya
Thermoluminescence dating of associated burnt flint (Mercier 1991)

Associated Hominin Morphology: Neanderthal

'Modern' Behavioral Percentage: 55.5%

Table 11: **Saint-Cesaire Table of Evidence**

<u>Behavior</u>	<u>Evidence</u>	<u>Yes</u>	<u>No</u>	<u>N/A</u>
Stone Tools	Blades (>flake tools)		X	
	End Scrapers (>side scrapers)		X	
	Projectile Points			X
Bone/Antler Tools	Points		X	
	Awls		X	
	Harpoons		X	
Art	Paintings		X	
	Engravings		X	
	Figurines		X	
	Non-Utilitarian Use of Pigment			X
Jewelry	Personal Ornaments	X		
Human Burial	Purposeful Internment	X		
	Symbolic Internment	X		
Site Use	Specialized	X		
Site Structure	Complex	X		
Raw Material Source	Non-Local	X		
Subsistence Patterns (Faunal)	Species Preference	X		
	Size Selection	X		
	Seasonal Hunting	X		
	Fishing	X		

Explanation of Evidence

The site of Saint-Cesaire, locally known as La Roche-a-Pierrot, is a rock shelter site located 10km northeast of Saintes in Charente-Maritimes, France. It was discovered in 1979 by French archaeologist Francois Leveque who continued excavations over the next 12 years. The site is known for the recovery of a nearly complete Neanderthal skeleton associated with a Chatelperronian tool kit with Upper Paleolithic technology, a technology that at the time was only thought to have been made by modern humans (Stringer 1984).

Hominin Remains

The hominin remains from the Chatelperronian level of Saint-Cesaire are that of a nearly complete skeleton of a very robust young adult individual. The cranial features are undoubtedly Neanderthal seen in an elongated skull, low supraorbital torus with frontal groove, receding forehead, elongate parietal, a large retromolar space, and no canine fossa or chin (Stringer 1984).

Interestingly the skull appears to have the bony scar of a healed fracture wound. Computer assisted reconstruction of the skull conducted by Zollikofer (2002) shows the fracture to have come from the impact of a sharp implement. This has been used to suggest interpersonal violence amongst Neanderthals.



Figure 43: Reconstruction of the St. Cesaire Skull
Adapted from: <http://www.donsmaps.com/stcesaire.html>

Stone Tools

From this level of the site Leveque (1993) plotted 767 pieces and categorized 305 tools. Scrapers number to 122 and make for the most abundant tool at 40% of the assemblage. Of these 84% are side scrapers and 16% end scrapers. Also, 8 points and 26 backed points were recovered, along with 14 backed blades, 14 burins, and 27 knives (Leveque 1993).

Studies have suggested that this assemblage has an 'archaic' character. Bar-Yosef (2010) indicates that more than 65% of the tools show to have a Mousterian component to their manufacture, while about 35% show an Upper Paleolithic component.

Bone/Antler Tools

There is no evidence of a bone tool industry in this level at Saint-Cesaire.

Art

There appears to be no artistic expression occurring during this period at the site.

Use of Pigment

I found no discussion of pigment use in level 8 the site.

Jewelry

Several *Dentalium* beads were found directly associated with the Neanderthal skeleton, showing use of ornaments by the Saint-Cesaire hominins (Zilha'o 2007).

Human Burial

The Neanderthal remains are mostly agreed upon to be a purposeful burial. Many of the skeletal parts were found 1m from the shelter wall, still articulated within a spatially confined area with a diameter of 70cm. There were however, no signs of a burial pit, leading some to doubt this assessment (Zollikofer 2002).

Evidence for a symbolic burial is seen in the several *Dentalium* beads found directly associated with the skeleton. Also, limestone blocks located close to the skeleton have been suggested to be placed there as grave markers. This evidence however remains skeptical (Gargett 1999).

Site Use

Saint-Cesaire shows to be an intensely occupied multi-seasonal site, mostly during the colder months. This is seen in the presence of shed antlers rather than stag antlers, which shows a stronger presence during winter and spring (Patou-Mathis 1993). Faunal remains from the site were studied by Patou-Mathis (1993) in regards to tooth wear, crown height, shed antlers and fetal remains. The results here also show evidence that a majority of the food procurement at the site took place in winter and spring. Animal parts were also obtained for food in summer and fall, but the data from these seasons shows to be less clear or limited to single taxon (Patou-Mathis 1993). Thus it appears that a majority of the site use here took place during specific times of the year.

Site Structure

The site shows organized use of space in several ways as discussed by Backer (1993). Deposition of tools and modified pieces show specified areas for lithic manufacture. Hearths were repeatedly used and placed in specific spots near the wall, in the alcove, near the dripline, and in the unsheltered area. Faunal remains distribution occurred mainly in the alcove. And there existed specific areas for refuse disposal. These lines of evidence show conscious organized spatial use by the occupying hominins.

Raw Material Source

It appears that most of the raw materials found at the site were procured locally, however about 5% of the lithic assemblage came from a non-local origin (Leveque 1993).

Subsistence Patterns (Faunal)

The Saint-Cesaire hominins appear to have had species and sex preference in their food choice. Reindeer show to make up 63% of the faunal record with 77% of these being of females (Patou-Mathis 1993). Then the next most common food sources are from bison and horse, in that order. There was also presence of rhinoceros and mammoth (Lavaud-Girard 1993). These results show to be similar to that of the Aurignacian levels of the site, thus we can infer that the diets of Neanderthals were similar to that of modern humans. There were also 3 fish vertebrae recovered from 2 different species, salmon and an unspecified cyprinid from this level (Grayson 2008). This suggests these hominins were capable of fishing.

Site Behavioral Assessment

The behavior expressed by the Saint-Cesaire hominins shows to be a combination of ‘modern’ and ‘archaic’. Technologically the behavior is dominantly ‘archaic’, with no bone tools and only some elements of Upper Paleolithic technology in the lithics. There is also no artistic expression seen at the site. However, many ‘modern’ elements are present as well. This is seen in the items of personal adornment found associated with the skeletal remains, evidence for purposeful and symbolic burial, seasonally specific use of the site, an organized site structure, non-local lithic exploitation, and preferred hunting practices in regards to species, game size, and seasonal selection as well as an element of fishing. Seeing as how the behavioral percentage shows to be ‘modern’, it appears that the Neanderthals from St. Cesaire were in a transition towards ‘modernity’. In this case, Neanderthal morphology accompanies ‘modern’ behavior.

Sources Cited

Backer, A.M.

1993 "Spatial Distribution at La Roche a Pierrot, Saint-Cesaire: Changing Uses of a Rockshelter" In Context of a Late Neandertal, Eds. F. Leveque, A. Backer, and M Guilbaud, pp. 105-127. Prehistory Press, Madison.

Gargett, Robert H.

1999 "Middle Palaeolithic Burial is Not a Dead Issue: The View from Qafzeh, Saint-Césaire, Kebara, Amud, and Dederiyeh" In Journal of Human Evolution 37(1):27-90.

Grayson, D.K.

2008 "The Large Mammals of Roc de Combe (Lot, France): The Chatelperronian and Aurignacian Assemblages" In Journal of Anthropological Archaeology 27(3):338-362.

Lavaud-Girard, Françoise

1993 "Macrofauna from Castelperronian Levels at Saint-Cesaire, Charente-Maritime" In Context of a Late Neandertal, Eds. F. Leveque, A. Backer, and M Guilbaud, pp. 73-77. Prehistory Press, Madison.

Leveque, François

1993 "The Castelperronian Industry of Saint-Cesaire: The Upper Level" In Context of a Late Neandertal, Eds. F. Leveque, A. Backer, and M Guilbaud, pp. 23-35. Prehistory Press, Madison.

Patou-Mathis, Marylene

1993 "Taphonomic and Paleoethnographic Study of the Fauna Associated with the Neandertal of Saint Cesaire" In Context of a Late Neandertal, Eds. F. Leveque, A. Backer, and M Guilbaud, pp. 79-102. Prehistory Press, Madison.

Stringer, Chris

1984 "The Origin of Anatomically Modern Humans in Western Europe" In The Origins of Modern Humans: A World Survey of the Fossil Evidence Eds. Fred H. Smith and Frank Spencer, pp. 51-136. Alan R. Liss Inc., New York.

Zollikofer, Christopher, P.E.

2002 "Evidence for Interpersonal Violence in the St. Cesaire Neanderthal" In Proceedings for the National Academy of Sciences of the United States of America 99(9):6444-6448.

Site: Grotte du Renne Cave, Arcy-sur-Cure, France

Level: X

Dates: 48,700 +/- 3,600ya - 21,150 +/- 160ya
AMS dating of associated bones, antlers, and teeth (Higham 2010)

Associated Hominin Morphology: Neanderthal

'Modern' Behavioral Percentage: 31%

Table 12: **Grotte du Renne Table of Evidence**

<u>Behavior</u>	<u>Evidence</u>	<u>Yes</u>	<u>No</u>	<u>N/A</u>
Stone Tools	Blades (>flake tools)	X		
	End Scrapers (>side scrapers)		X	
	Projectile Points		X	
Bone/Antler Tools	Points	X		
	Awls	X		
	Harpoons		X	
Art	Paintings		X	
	Engravings		X	
	Figurines		X	
	Non-Utilitarian Use of Pigment		X	
Jewelry	Personal Ornaments	X		
Human Burial	Purposeful Internment		X	
	Symbolic Internment		X	
Site Use	Specialized		X	
Site Structure	Complex		X	
Raw Material Source	Non-Local	X		
Subsistence Patterns (Faunal)	Species Preference			X
	Size Selection			X
	Seasonal Hunting			X
	Fishing			X

Explanation of Evidence

Grotte du Renne is one of several caves of the Arcy-sur-Cure area, located about 200km southeast of Paris, France. Excavated between 1949 and 1963 by Andre Leroi-Gourhan, the site provides persuasive evidence for behavioral ‘modernity’ amongst Neanderthals. This is seen in ornaments and tools normally associated with modern human industries that were found in the Chatelperronian levels and prove to be associated with Neanderthal remains. Level X, dating between c21kya-c49kya, yields most of the artifacts and hominin remains.

Hominin Remains

The hominin remains from Grotte du Renne consist of 29 teeth and a temporal bone fragment. Hublin (1996) assessed the bone to be that of an individual of about one year old. Normally taxonomic assignment of an individual of such young age is difficult, but since the bony labyrinth gains its adult morphology long before birth, Hublin was able to identify the specimen as Neanderthal based on a full suite of Neanderthal features. The bone fragment was found in Layer Xb, which has been dated to 33,820 +/- 720ya by C14 dating (Hublin 1996).

The teeth, found throughout the Chatelperronian levels, were studied by Bailey (2006). Almost equal in numbers between permanent and deciduous teeth, they represent a minimum of six individuals of all ages, with a majority belonging to sub-adults. Across the board, the teeth pervasively exhibit traits that show to be that of Neanderthal, making this a safe assessment as to the taxonomic assignment of the remains.

The integrity of the archaeological layers has been questioned leading some to suggest admixture with the Mousterian layers that would make these hominin remains out of context. However, the teeth do not come from the thinner sloping layers, but from the thick horizontal layers. They also are found in the upper most Chatelperronian layers as well as the lower most layers, making admixture an unlikely possibility (Baily 2006).

Stone Tools

Level X at Grotte du Renne is particularly rich in lithics with 35,000 pieces collected and about 4,000 of those being tools. This particular Chatelperronian industry has a more Upper Paleolithic character in that it is blade based rather than flake based and there is a dominance of burins over scrapers. Relevant percentages are from 13-18% points, 10-15% blades, and

11-20% side scrapers (Farizy 1990). It does not appear that the recovered points were projectiles.

The most common raw materials are flint and chert. Flint is the most abundant being used in the blades and burins, while chert is seen in side scrapers and denticulates. Points show to be made of both materials (Farizy 1990).

Bone/Antler Tools

The level at hand also reveals a rich bone and ivory industry. Among the 115 items of worked bone, are short and long awls made from long bone fragments, elongated projectile points, rods used as digging sticks, baguettes, burnishing tools, and bird-bone tubes (Zilhao 2006). It has been suggested that these ‘modern’ bone tools were actually intrusions from the upper Aurignacian layers. However, d’Errico (2003) rejects this hypothesis by observing that instead of the bone tools decreasing lower in the stratigraphy as one would expect if this were the case, they are actually most abundant in the lowest of the Chatelperronian layers.

Art

There is not evidence of artistic display at the rockshelter.

Non-Utilitarian Use of Pigment

No evidence of pigment use is apparent at Grotte du Renne.

Jewelry

This level of Grotte du Renne reveals a total of 24 bone and tooth personal ornaments. Some being perforated and some being grooved ornaments; they are made from the teeth of wolf, fox, bovid, bear, reindeer, marmot, rhinoceros, as well as ivory (Zilhao 2007). It has been suggested that the Chatelperronian ornaments at the site are actually intrusions from the overlying Aurignacian levels. But since a far majority of the total ornaments come from this level X, which is more than 70cm below the base of the Aurignacian that yielded only seven ornaments, this hypothesis can safely be rejected (Zilhao 2007).



Figure 44: Grotte du Renne Personal Ornaments of Fox Teeth (F,G) and Bovid Teeth (H)
Adapted from: Higham (2010)

Human Burial

The human remains are limited and do not show to be of intentional burial.

Site Use

There is no evidence of specialized site use at the site.

Site Structure

I found no evidence of organized spatial structure at Grotte du Renne.

Raw Material Source

Flint is the most abundant lithic material used in the Grotte du Renne tool industry. This stone type is not available locally, however an exact location of its source is still unknown (Farizy 1990).

Subsistence Patterns (Faunal)

I was unable to find a faunal record in English for the site in the available literature.

Site Behavioral Assessment

Grotte du Renne shows more characteristics of being ‘archaic’ rather than ‘modern’ in behavior. There does not appear to be artistic expression in the form of paintings, engravings, or figurines, and there is no evidence of purposeful burial, specialized site use, or organized site structure. However very important indicators show ‘modern’ behavior in the presence of a blade dominated stone tool industry, a rich bone tool industry, and numerous tooth and bone items of personal adornment. Therefore, even though the percentage of ‘modern’ behavior at 31% shows that archaic hominin morphology accompanies ‘archaic’

behavior, the ‘modern’ behavioral indicators present demand notice that the Neanderthals at Grotte du Renne were very well capable of ‘modern’ behavior.

Sources Cited

Bailey, Sarah

2006 “Dental Remains from the Grotte du Renne at Arcy-sur-Cure (Yonne)” In Journal of Human Evolution 50(5):485-508.

D’Errico, Francesco

2003 “Many Awls in our Argument: Bone Tool Manufacture and Use in the Chatelperronian and Aurignacian Levels of the Grotte du Renne at Arcy-sur-Cure” In The Chronology of the Aurignacian and the Transitional Technocomplexes: Dating, Stratigraphies, Cultural Implications Eds. Zilhao, J and Francesco d’Errico, Instituto Portugues de Arqueologia.

Farizy, C

1990 “The Transition from Middle to Upper Paleolithic at Arcy-sur-Cure (Yonne, France): Technological, Economic and Social Aspects” In The Emergence of Modern Humans: an Archaeological Perspective Ed. Paul Mellars. Edinburgh University Press.

Higham, T.

2010 “Chronology of the Grotte du Renne (France) and Implications for the Context of Ornaments and Human Remains within the Chatelperronian” In Proceedings of the National Academy of Sciences of the United States of America 107(47):20234-20239.

Hublin, JJ

1996 “A Late Neanderthal Associated with Upper Palaeolithic Artefacts” In Nature 361(6579):224-226.

Zilhao, Joao

2007 “The Emergence of Ornaments and Art: An Archaeological Perspective on the Origins of “Behavioral Modernity” In Journal of Archaeological Research 15(1):1-54.

Site: La Quina, France

Layers: 1-4

Dates: 35,250 +/- 530kya – 31,400 +/- 350kya
Radiocarbon dating of associated organic material in levels 1 and 4 (Vogel and Waterbolk 1963,1967)

Associated Hominin Morphology: Neanderthal

‘Modern’ Behavior Percentage: 28%

Table 13: **La Quina Table of Evidence**

<u>Behavior</u>	<u>Evidence</u>	<u>Yes</u>	<u>No</u>	<u>N/A</u>
Stone Tools	Blades (>flake tools) End Scrapers (>side scrapers) Projectile Points		X X X	
Bone/Antler Tools	Points Awls Harpoons	X	X X	
Art	Paintings Engravings Figurines Non-Utilitarian Use of Pigment		X X X	 X
Jewelry	Personal Ornaments	X		
Human Burial	Purposeful Internment Symbolic Internment		X X	
Site Use	Specialized	X		
Site Structure	Complex	X		
Raw Material Source	Non-Local			X
Subsistence Patterns (Faunal)	Species Preference Size Selection Seasonal Hunting Fishing	X	 X X X	

Explanation of Evidence

La Quina is a rockshelter site located in southwest France where numerous Neanderthal fossil remains were recovered. Extending more than 300 meters along the foot of a limestone cliff, the location of the site along with the rich faunal record is particularly interesting because it suggests its use as a cliff jump game drive (Chase 1994). Also, the use of bone, including human bone, as stone tool retouching implements (Chase 1990), makes the behavior here notably advanced for the generally accepted Neanderthal behavior.

The site was excavated during four main excavation periods; 1905-1936 by L. Henri-Martin, 1953-1972 by G. Henri-Martin, 1985-1994 by A. Debenath and A. Jelinek, and 1994-1998 by V. Dujardin (Verna and d'Errico 2010).

Hominin Remains

The hominin remains from La Quina consist of 53 specimens from four adult individuals and one juvenile (Verna and d'Errico 2010). Most of these that are not too fragmentary to identify have been attributed to Neanderthals. However, they do show variability in that they also possess early modern human features. For example, the La Quina 9 mandible has characteristics found in early modern humans, and H5 has an overall gracile cranium with thin walls and a high forehead (Stringer 1984).

Stone Tools

The lithic industry from these layers is considered to be unequivocally of the Mousterian style. This is seen mainly in the dominance of flake tools and the abundance of side scrapers (Verna and d'Errico 2010). The abundance of particularly thick asymmetric tools that appear to have been transformed several times, has given the site its own category in tool style, this being the La Quina Mousterian type (Verna and d'Errico 2010).

Bone/Antler Tools

Amongst the faunal remains of Layer 2, 67 bones were recovered with evidence of use wear that is consistent with their use as retouch tools. The context shows to be that of a game processing area, therefore the bone tools are suggested to be of on site, expedient use (Chase 1990). Notably, three hominin skull fragments were recovered showing use wear markings consistent with the other bone retouch tools. This reveals the not only the earliest use of

human bone as a tool, but the first evidence of this practice outside of modern humans (Verna and d'Errico 2010). These items are put under the behavioral indicator as awls.



Figure 45: Bone Retouch Tools
Adapted from: Verna and d'Errico (2010)

Art

There does not appear to evidence of artistic expression at La Quina.

Non-Utilitarian Use of Pigment

I found no discussion of the practice of pigmentation at the site.

Jewelry

In the uppermost layer of the Mousterian levels, two pierced fox canines were recovered showing production of items of personal adornment. These could possibly be intrusive from the overlying Aurignacian layer, but has yet to be proved as such (White 1984).

Human Burial

The hominin remains are not suggested to be of purposeful human burial.

Site Use

Being that there are heavy concentrations of animal bone directly under the highest part of the cliff with evidence for butchering, the site has been suggested to be a cliff jump game drive kill site (Jelinek 1989). Analysis by Chase (1994) concludes that the bone accumulation could not have been from other natural causes for the following reasons. The high number of bones would have been too great for only carnivore activity. The varying

species in the faunal remains excludes the possibility of a catastrophic event. And while the river could have modified the placement of the bones, it could not have been responsible for the entire accumulation.

Site Structure

Domestic camps and butchering stations were found near the kill site in the shelter of the cliff (Jelinek 1989). This shows an organized site structure at La Quina.

Raw Material Source

There is no discussion of the sources for the lithic raw material found at the site.

Subsistence Patterns (Faunal)

The faunal record at the site shows a preference for reindeer, bison, and horse. Reindeer dominate the assemblage with bones numbering to 584 (Chase 1984). There does not appear to be an age, size, or seasonal discrimination. However, lack of age and size discrimination could be the result of a cliff jump game drive, which would take highly organized hunting practices from the La Quina hominins. There is also no evidence for fishing at the site.

Site Behavioral Assessment

Although the behavioral percentage clearly points to ‘archaic’ behavior, namely in the lithics and virtual absence of artistic expression, a few key factors strongly show ‘modern’ behavior. This is in the presence of bone tools, the manufacture of jewelry, and the apparent structured hunting practices with the specified use of the site as a cliff jump game drive. Therefore, the La Quina Neanderthals prove to display a mix of ‘archaic’ and ‘modern’ behavior.

Sources Cited

- Chase, Phillip G.
1990 "Tool-Making Tools and Middle Paleolithic Behavior" In Current Anthropology 31(4):443-447.
- Chase, Phillip G.
1994 "Taphonomy and Zooarchaeology of a Mousterian Faunal Assemblage from La Quina, Charente, France" In Journal of Field Archaeology 21(3):289-305.
- Jelinek, A.J.
1989 "A Preliminary Report on Evidence Related to the Interpretation of Economic and Social Activities of Neanderthals at the Site of La Quina (Charente), France" In La Subsistance 6:99-106.
- Stringer, Chris
1984 "The Origin of Anatomically Modern Humans in Western Europe" In The Origins of Modern Humans: A World Survey of the Fossil Evidence Eds. Fred H. Smith and Frank Spencer, New York, Alan R. Liss Inc.
- Verna, C.
2010 "Two New Hominin Cranial Fragments from the Mousterian Levels at La Quina (Charente, France)" In Journal of Human Evolution 58:273-278.
- Verna, C. and Francesco d'Errico
2010 "The Earliest Evidence for the Use of Human Bone as a Tool" In Journal of Human Evolution 60(2):145-147.
- Vogel, J.C. and H.T. Waterbolk
1963 "Groningen Radiocarbon Dates IV" In Radiocarbon 5:163-202.
- Vogel, J.C. and H.T. Waterbolk
1967 "Groningen Radiocarbon Dates VII" In Radiocarbon 9:107-155.

Site: Krapina, Croatia

Levels: 1-8

Dates: c.137kya - c.110
ESR and U-Series dating of tooth enamel (Rink 1995)

Associated Hominin Morphology: Neanderthal

'Modern' Behavioral Percentage: 25%

Table 14: **Krapina Table of Evidence**

<u>Behavior</u>	<u>Evidence</u>	<u>Yes</u>	<u>No</u>	<u>N/A</u>
Stone Tools	Blades (>flake tools)		X	
	End Scrapers (>side scrapers)		X	
	Projectile Points		X	
Bone/Antler Tools	Points		X	
	Awls		X	
	Harpoons		X	
Art	Paintings		X	
	Engravings		X	
	Figurines		X	
	Non-Utilitarian Use of Pigment			X
Jewelry	Personal Ornaments		X	
Human Burial	Purposeful Internment	X		
	Symbolic Internment		X	
Site Use	Specialized			X
Site Structure	Complex			X
Raw Material Source	Non-Local	X		
Subsistence Patterns (Faunal)	Species Preference	X		
	Size Selection	X		
	Seasonal Hunting			X
	Fishing		X	

Explanation of Evidence

Krapina is a rockshelter site located in the Republic of Croatia. It is one of the most well-known early/late Pleistocene sites due to having a large assemblage of Mousterian tools along with the largest number of Neanderthal remains ever recovered from a single site. The site was excavated from 1899-1905 under the direction of Karl Gorjanovic and has since undergone various reanalysis on the recovered remains, namely by F.H. Smith in the 1970's (Minugh-Purvis 2000).

Hominin Remains

The Krapina fossil record is extensive, comprising of some 800 skeletal fragments from 43 individuals and over 280 teeth from about 80 individuals (Russell 1987). These remains yield a mean age of 130 +/- 10ky (Rink 1995) and were recovered from all the levels at hand, but a majority from levels 3-4.

Although there is high variation due to sex and age differences, the fossils clearly fall in the Neanderthal category. Smith (1984) provides a summary of the characteristics. The crania exhibit key Neanderthal features such as long, broad, low vaults with receding foreheads and broad occiputs, robust mandibular fossae and mastoid processes, large faces with wide interorbital areas, well developed supraorbital tori, large frontal sinuses, no canine fossae, retromolar spaces, mandibles without mental eminences, large anterior teeth, and an overall "beaked" face. The postcrania as well are comparable to other Neanderthals (Smith 1984).

There does prove to be a controversial specimen however. Krapina 1, an adolescent individual which due to a mosaic of features, has been argued to be a Neanderthal, a transitional species, as well as an early modern human. The more modern-like features include a wide cranium, high forehead, differentiated supraorbitals, and gracility in the browridge (Minugh-Purvis 2000). This has not changed the Krapina hominins from their Neanderthal classification, but has emphasized the non-homogeneity of Neanderthal morphology in general.

Stone Tools

All levels at Krapina are decidedly of Mousterian typology with flake tools dominating the assemblage and almost a complete lack of Upper Paleolithic tools. There are many tool types including notched and denticulated pieces as well as naturally-backed knives, but scrapers make for the majority of the tools, comprising more than half of the tools in every level (Simek and Smith 2000). The raw material used shows tools were made from cobbles in nearby river gravels and sectioned in order to produce flakes (Simek and Smith 2000).

Bone/Antler Tools

No production of bone or antler tools is apparent at Krapina.

Art

There does not appear to be artistic expression from the Krapina hominins.

Non-Utilitarian Use of Pigment

There is no discussion of pigment use at the site.

Jewelry

There are no remains of items of personal adornment at Krapina.

Human Burial

The Krapina hominin remains are mostly agreed to be that of purposeful burial as they show preservation patterns consistent with this when compared to other Neanderthal sites and recent burial sites of equivalent age (Russell 1987). However, the sample is primarily made up of isolated and incomplete bones. One explanation for this has been the practice of cannibalism. Signs explained by cannibalism include high fragmentation, disassociation of the bones from individual skeletons, disproportionate representation of certain bones, burnt bones, and the presence of cut marks (Trinkaus 1985).

Trinkaus (1985) negates the cannibalism theory saying that the damage done to the bones was most likely due to post-depositional processes or the primitive excavation methods used on the site with shovels, metal tools, and the use of dynamite. Also, only 6.8% of the skull pieces and 0.5% of the postcranial pieces show any evidence of burning, while it is the other mammal bones that show the high frequencies of burning (Trinkaus 1985).

The condition of the hominin remains is also argued to be due to secondary burial practices by the Krapina hominins. Russell (1987) concludes that the disarticulation and striations on the remains are consistent with postmortem processing of corpses with stone tools. Therefore the evidence seems to conclude that these bones were separated and cleaned in preparation for a secondary burial. There is a lack of evidence however, to say that this practice was of ritual significance.

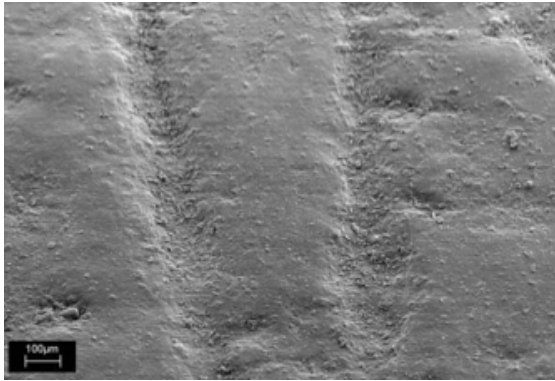


Figure 46: Cutmarks on the Krapina 3 Frontal
Adapted from: Frayer (2006b)

Site Use

The available literature does not discuss Krapina as to having any specialized site use.

Site Structure

Most likely due to the early primitive excavation practices and post-depositional disturbance there is no evidence for an organized site structure at the site.

Raw Material Source

Most of the material curated at Krapina came from the nearby Krapinica River in the form of cobbles, which were knapped into tools at the site. Included in these local materials were volcanic tuff, flint, and limestone (Simek and Smith 2000). A few exotic materials with sources at some distance from the site came in quartz, chalcedony, and other elusive rocks. For the most part, the hominins of Krapina were exploiting local lithic material. However, it appears there was a limited amount of tools that were curated elsewhere from non-local material (Simek and Smith 2000).

Subsistence Patterns (Faunal)

The rockshelter yielded a rich faunal record and is suggested to have served as a hyena den and a hibernation locale for cave bears. The fauna showing hominin exploitation is dominated by rhinoceros at 42 individuals, followed by bison at 26 individuals, cave bear at 22 individuals, and beaver at 14 (Gaudzinski-Windheuser 2001). Age preference is seen in the choice of adult bison, beaver, and cave bear, while a preference for young individuals is seen in the rhino selection (Gaudzinski-Windheuser 2001). There is no discussion of season hunting patterns and there is no sign of fishing at Krapina.

Site Behavioral Assessment

The Krapina hominins, which are decidedly Neanderthals, only display a limited amount of ‘modern’ behavior seen in their burial practices, use of non-local lithics, and signs of preferred hunting of certain species and sizes of game. The rest of the evidence shows ‘archaic’ behavior seen in the tool assemblage, which lacks Upper Paleolithic tools or bone tools, and in the complete lack of artistic expression. Therefore at Krapina, Neanderthal morphology accompanies ‘archaic’ behavior.

Sources Cited

Freyer, David W.

2006 "Krapina 3: Cut Marks and Ritual Behavior?" In Periodicum Biologorum 108(4):519-524.

Gaudzinski-Windheuser, Sabine

2011 "On Neanderthal Subsistence in Last Interglacial Forested Environments in Northern Europe" In Neanderthal Lifeways, Subsistence and Technology: One Hundred Fifty Years of Neanderthal Study Eds. N.J. Conrad and J. Richter. Springer Science and Business Media.

Minugh-Purvis, Nancy

2000 "Krapina 1: A juvenile Neandertal from the early late Pleistocene of Croatia" In American Journal of Physical Anthropology 111(3):392-424.

Rink, W.J.

1995 "ESR Ages for Krapina Hominids" In Nature 378(6552):24.

Russell, Mary D.

1987 "Mortuary Practices at the Krapina Neanderthal Site" In American Journal of Physical Anthropology 72(3):1987.

Simek, Jan F.

1987 "Chronological Changes in Stone Tool Assemblages from Krapina (Croatia)" In Journal of Human Evolution 32(6):561-575.

Smith, Fred H.

1984 "Fossil Hominids from the Upper Pleistocene of Central Europe and the Origin of Modern Humans" In The Origins of Modern Humans: A World Survey of the Fossil Evidence Eds. Fred H. Smith and Frank Spencer. New York, Alan R Liss Inc.

Trinkaus, Eric

1985 "Cannibalism and Burial at Krapina" In Journal of Human Evolution 14(2):1985.

Site: Vindija Cave, Croatia

Levels: G1 and G3

Dates: c42kya - c18kya
C14 dating of associated cave bear bones (Wild 2001)

Associated Hominin Morphology: Neanderthal

'Modern' Behavioral Percentage: 12.5%

Table 15: **Vindija Cave Table of Evidence**

<u>Behavior</u>	<u>Evidence</u>	<u>Yes</u>	<u>No</u>	<u>N/A</u>
Stone Tools	Blades (>flake tools)		X	
	End Scrapers (>side scrapers)		X	
	Projectile Points		X	
Bone/Antler Tools	Points	X		
	Awls		X	
	Harpoons		X	
Art	Paintings		X	
	Engravings		X	
	Figurines		X	
	Non-Utilitarian Use of Pigment		X	
Jewelry	Personal Ornaments		X	
Human Burial	Purposeful Internment		X	
	Symbolic Internment		X	
Site Use	Specialized			X
Site Structure	Complex		X	
Raw Material Source	Non-Local	X		
Subsistence Patterns (Faunal)	Species Preference			X
	Size Selection			X
	Seasonal Hunting			X
	Fishing		X	

Explanation of Evidence

Vindija is a cave site in the semi-mountainous region of Hrvatsko Zagorje in current day Croatia. It lies at 275 meters above sea level and is quite large measuring about 50m in length, 28m in width, and almost 20m in height (Jankovic 2006). The upper levels of the cave were first excavated by S. Vukovi over a 30 period starting in 1928. It was not until 1974 that large-scale excavations were undertaken which yielded great amounts of paleontological, archaeological, and human fossil remains. These were carried out by M. Malez and continued until 1986 (Jancovic 2006).

The importance of the site lies in its numerous human fossil remains that prove to be some of the youngest Neanderthal remains in Central/Eastern Europe (Smith 1999). Also, in that the fossils were found in association with Upper Paleolithic archaeological material, particularly bone tools said to reflect the modern human Aurignacian culture (Karavanic and Smith 1998). The stratigraphy of the site has been questioned however, with artificial mixing suggested as a reason behind the presence of Neanderthal fossils with modern type tools. Jankovic (2006) argues against admixture due to the reddish clay in level G1 that is easily distinguishable from the other levels. Since this clay is found embedded in the Neanderthal fossils of this layer, he argues that they would not have come from a different level.

Hominin Remains

Levels G3 and G1 of Vindija Cave yielded substantial numbers of hominin fossils. Those from lower level G3 consist of 40, dominantly cranial specimens, whose morphology has been identified as in the Neanderthal taxon. This is seen mostly in characteristics of the supraorbital region (Malez 1980). The fossils from level G1 consist of six cranial specimens that show to be Neanderthals also through certain salient features, namely in a true supraorbital torus, large shoveled incisors, and a retromolar space (Karavanic and Smith 1998).

However, all of these fossils have also been considered part of a transitional species showing a modern human-like trend towards gracility and overall facial reduction when compared to other Neanderthal specimens. This is apparent in reduced mid-facial prognathism, reduced nasal breadth, thinner cranial vaults, development of incipient chins, and reduction of the supraorbital torus (Ahern 2004). A broader braincase is also apparent that shows a higher vault with a more rounded forehead than most Neanderthals (Ahern 2004).

The most recent dates from these specimens were two direct radiocarbon dates taken by Higham (2006). The results yielded a date of 29,200 +/- 360kya from Vi-208, a parietal bone; and 32,400 +/- 1,800kya from Vi-207, a mandible. These prove to be some of the youngest Neanderthal dates from Central and Eastern Europe (Smith 1999).

Stone Tools

Level G3 represents a Mousterian tool tradition in that flake tools are dominant at 56.2%. There are however Upper Paleolithic elements in the presence of blades and bifacial tools, but these are only at 5.2% of the assemblage (Ahern 2004). Sidescrapers are also represent at 23.3% of the tools and dominate over endscrapers, which represent 6.7% of the tools from this level (Ahern 2004).

The tools from level G1 are also mostly of the Mousterian type due to the fact that flake technique debitage also dominates over blade technique debitage with similar ratios to level G3. However, there are also typical Upper Paleolithic tools in the presence of endscrapers, blades, burins, and a leaf-shaped bifacial point (Karavanic and Smith 1998). Most importantly, it is the presence of Aurignacian style bone tools, as discussed in the next section, that make for the categorization of this level as Upper Paleolithic (Karavanic 1998).

This assessment however, conflicts with the result seen in this study. The stone tool categories of blades and end scrapers were done on a greater than/less than basis. Therefore, even though there is significant presence of 'modern' tools in the assemblage, they are less in number than the archaic elements and thus do not meet the 'modern' requirement.

Bone/Antler Tools

Several Upper Paleolithic bone tools were found in level G1; that of an Aurignacian style split-base bone point, as well as three large-base bone points found in the same level (Jancovic 2006). T.D. White also identified nine possible bone retouchers from the faunal remains of these levels. Experimental reconstruction of their use by Ahern (2004), suggest they were used as pressure as well as percussion retouch tools.

Art

Artistic expression does not show to be part of the behavior of the Vindija hominins.

Non-Utilitarian Use of Pigment

There does not appear to be use of pigments at the site.

Jewelry

There is no evidence that items of personal adornment were manufactured in the cave.

Human Burial

The remains are too fragmented and dispersed to suggest intentional burial.

Site Use

There was no discussion of specialized site use in the literature on Vindija Cave.

Site Structure

The archaeology done at the site did not reveal any organized site structure.

Raw Material Source

The middle Paleolithic materials found at the site were made mainly of quartz, while the upper Paleolithic materials were made mainly of chert. Both of these are found locally (Karavanic 19995). However, one bifacial stone point made from non-local material was identified in level G1 (Jankovic 2006). The hominins here were dominantly exploiting local lithic material, however there does appear to be some acquiring of non-local material.

Subsistence Patterns (Faunal)

Tests on the bone content of the Vindija Neanderthal fossils were performed by Richards (2000) revealing that their diet predominantly relied on animal protein. This suggests a high level of meat consumption in these hominins. Unfortunately the insufficient faunal samples make it impossible to detect the preferred species and size consumed at the cave, or any seasonal hunting patterns (Richards 2000). There is also no evidence of fishing at the site.

Site Behavioral Assessment

Vindija Cave does provide an interesting case of Neanderthal fossils associated with 'modern' tools in the bone tools found in level G1 along with the 'modern' lithics found throughout Layer G. However, technology appears to be the only 'modern' behavior being performed by these hominins. Therefore at Vindija, archaic morphology accompanies 'archaic' behavior.



Figure 47: Vindija Cave
Adapted from: Jankovi (2006)

Sources Cited

Ahern, James C.M.

2004 "New Discoveries and Interpretations of Hominid Fossils and Artifacts from Vindija Cave, Croatia" In Journal of Human Evolution 46(1):27-67.

Jankovi, Ivor

2006 "Vindija Cave and the Modern Human Peopling of Europe" In Coll. Antropol. 30(3):457-466.

Karavanic, Ivor and Fred H. Smith

1998 "The Middle/Upper Paleolithic interface and the relationship of Neanderthals and early modern humans in the Hrvatsko Zagorje, Croatia" In Journal of Human Evolution 34(3):223-248.

Malez, Mirko

1980 "Upper Pleistocene Hominids From Vindija, Croatia, Yugoslavia" In Current Anthropology 21(3):365-367.

Smith, Fred H.

1999 "Direct Radiocarbon Dates for Vindija G1 and Velika Pecina Late Pleistocene Hominid Remains" In Proceedings of the National Academy of Sciences of the United States of America 96(22):12281-12286.

Wild, Eva Maria

2001 "Age Determination of Fossil Bones from the Vindija Neanderthal Site in Croatia" In Radiocarbon 43(2B):1021-1028.

Site: Mladec Cave, Czech Republic

Provenience: Space D and E

Dates: c.31kya
Radiocarbon dating of hominin teeth (Wild 2006)

Associated Hominin Morphology: Modern

‘Modern’ Behavior Percentage: 55.5%

Table 16: **Mladec Cave Table of Evidence**

<u>Behavior</u>	<u>Evidence</u>	<u>Yes</u>	<u>No</u>	<u>N/A</u>
Stone Tools	Blades (>flake tools)	X		
	End Scrapers (>side scrapers)	X		
	Projectile Points		X	
Bone/Antler Tools	Points	X		
	Awls	X		
	Harpoons		X	
Art	Paintings	X		
	Engravings		X	
	Figurines		X	
	Non-Utilitarian Use of Pigment	X		
Jewelry	Personal Ornaments	X		
Human Burial	Purposeful Internment	X		
	Symbolic Internment			X
Site Use	Specialized	X		
Site Structure	Complex	X		
Raw Material Source	Non-Local			X
Subsistence Patterns (Faunal)	Species Preference		X	
	Size Selection		X	
	Seasonal Hunting		X	
	Fishing		X	

Explanation of Evidence

The Mladec cave site is located in central Moravia in current day Czech Republic. The site was first excavated by Josef Szombathy in 1881-1882, and then again in 1882 by Jan Knies (Frayer 2006a). In space E and D of the “Dome of the Dead,” more than 100 specimens from multiple individuals were recovered along with perforated animal teeth, bone points, and associated hearths (Svoboda 2006). These findings have been accepted as the oldest modern human remains, at c. 31kya, in Europe that are associated with cultural artifacts (Wild 2006).

However, the site archaeological record is problematic for many reasons. The original excavations were more like a collecting of bones. They were done with little light and documented poorly as to the sequence of sedimentary deposits and exact coordinates of the fossils and artifacts (Wild 2006). Also many of the findings were lost from the Litovel Museum or destroyed from the Mikulov Castle at the end of WWII (Svoboda 2001). And in 1904 when the cave was opened to quarrying, sediments and other material were disposed of without informing archaeologists (Frayer 2006a).

The site is also problematic because it has been argued to be the result of cultural and fossil remains simply falling or being dropped into the cave via chimney entrances, therefore having no in situ provenience locations (Svoboda 2006). Additionally, the hominin remains themselves have been under debate as to their classification as modern human, since they show many archaic features as well (Wild 2006).

Despite these issues, the hominin remains and the archaeological material have been accepted as contemporaneously associated because of Szombathy’s address to the problems in 1925 when he reported that the human and animal remains he found were in situ and they are all of common age and provenience (Frayer 2006a). The layout of the cave has also been analyzed by Oliva (2006) who reported that space D and E are separated by bends in the corridor and who also found that the depth of the cave does not decrease in the direction away from the chimney entrance and that the cultural and fossil remains are actually found at a higher level, making their placement there only possible through human agent.

Hominin Remains

More than 100 specimens from multiple individuals, male/female as well as adult and immature, were recovered in the initial excavations of space D and E of the “Dome of the Dead” in Mladec cave. Radiocarbon dating of four tooth samples yielded an average of

about 31kya, making this the oldest assemblage of early modern humans in Europe to contain cranial, dental, and postcranial specimens (Wild 2005).

These fossils have been generally accepted as early modern humans, however there is ongoing debate as to whether they exhibit distinctive archaic features that may indicate a degree of Neanderthal ancestry. These features include aspects of certain individuals such as in the sagittal cranial profile, robust supraorbital regions, distinctive occipital bunning, large palatal and dental dimensions, as well as particularly robust post crania (Wild 2005).

Mladec 5, which is male, displays a supraorbital region that closer resembles an archaic or Neanderthal than a modern human. This is seen in its forward projection and the continuous bar of bone over the orbits (Frayer 2006a).



Figure 48: Mladec 5
Adapted from: Frayer (2006a)

Mladec 1, which is female, exhibits a more gracile face typical of a modern human, but at the same time, a low, broad skull with a well-developed occipital bun; which is more typical of an archaic or Neanderthal individual (Wolpoff 2006a).



Figure 49: Mladec 1
Adapted from: Wolpoff (2006b)

Overall, the Mladec hominin sample displays a high level of sexual dimorphism as the males show far more archaic features while the females show far more modern features (Wolpoff 2006a).

Stone Tools

Lithic material in Mladec cave is extremely limited, but has been classified as representing the Aurignacian tradition (Frayner 2006a). The assemblage consists of a bladelet, 2 burins, 2 blades, 3 pebbles, 3 hammerstones, an end scraper, and several flakes (Oliva 2006). The lithic material displays a variety of cherts and flints, suggesting that the tools were not manufactured locally. The tools also appear to have no functional relation (Oliva 2006). The above factors combined with the small number of lithics recovered, brings to question how often, and for what purpose the site was actually used by these hominins, as it appears not to be of domestic use.

Bone/Antler Tools

Contrasting the lithics, significant evidence of bone tool use was found at Mladec. The main component here is comprised of 14 bone points. These points have particularly broad bases and have been dubbed Mladec type points (Frayner 2006a). Also numerous awls made from deer metacarpals were found with evidence of scraping and polishing (Oliva 2006).

Art

Possible artistic expression, as analyzed by Oliva (2006), is seen in the cave in several ochre-colored marks on the walls of the “Dome of the Dead.” These come shapes such as lines, dots, and blotches. However, there are three drawings of the letter “D” on the wall of the stairs leading to the “Upper Floor” in the same ochre pigment, bringing suspicion to the Pleistocene age of the other drawings. Since these cannot be directly dated, the antiquity of the ochre drawings is questionable (Oliva 2006).

Non-Utilitarian Use of Pigment

Use of pigment for artistic expression is seen in the cave as discussed above in the “art” category.

Jewelry

Items of personal adornment are apparent at Mlaced in the 21 perforated teeth recovered from space D. The collection included a canine of a wolf, a horse incisor, ten reindeer incisors, and nine beaver incisors (Oliva 2006). A few of the bone points recovered were also perforated (Oliva 2006), showing that perhaps bone was worn as jewelry as well.

Human Burial

It was reported in Szomathy's original documentation that the cave contained the burial of three individuals. However, these remains seem to be amongst those that were lost or destroyed since the excavation (Wolpoff 2006c).

Site Use

Mladec cave yields little evidence of domestic use, which is seen in the low levels of lithic remains as well as no evidence of animal consumption in the cave. However, there were a relative abundance of decorative objects recovered here. This has led to the suggestion of the site as strictly a ritual site of non-utilitarian uses (Svoboda 2006).

Site Structure

Two factors lead to the inference that the site was organized spatially. Szombathy reported the finding of two hearths characterized by a layer of charcoal lined with a circle of stones (Oliva 2006). Within 2 meters of this location was a heap of fragmented animal bones, bone implements, and perhaps some human bones (Oliva 2006). This has been negated by Teschler-Nicola (2006) who argues that the charcoal colored layer actually reflects an input of manganese soil components into the cave. However the hearths, along with Szombathy's report of three human burials must be considered as evidence of an organized use of space in the cave.

Raw Material Source

Although there is mention of a variety of non-local cherts and flints in the lithic assemblage, there is no further discussion of their sources and distances from the site. Therefore the evidence is non-conclusive as to the long distant procurement of resources at Mladec.

Subsistence Patterns (Faunal)

There is a rich faunal record from Mladec, as analyzed by Pacher (2006), consisting of large mammals and small vertebrate remains. Bovidae are the main component followed by reindeer, horse, and wolf. Even though these remains show to be of a similar period as the hominin remains, the bones bear no evidence of human exploitation. However, there do exist know marks that show clear traces of hyena activity. It has been suggested that the cave was a natural trap, therefore causing this great accumulation of bones (Pacher 2006).

Site Behavioral Assessment

Despite the skeptical archaeological record at the site, Mladec cave shows many of the ‘modern’ behavioral indicators. The lithics, although few in number, show to be that of the Aurignacian tradition. Also, there is a high presence of bone tools as well as items of personal adornment in the form of perforated teeth. There is questionable evidence of cave art as well as reports from the original excavations as to the presence of human burials. The site also appears to be organized spatially and with a specialized purpose as a ritual cave. However, the ‘modern’ behavioral percentage is just barely over 50%, making the behavior here appear quite archaic. But due to the probable non-domestic uses for the site, some of these indicators, such as subsistence patterns, simply are not present. Overall at Mladec, modern morphology couples “modern” behavior.

Sources Cited

Frayer, David W.

2006a “Aurignacian Male Crania, Jaws, and Teeth from the Mladec Caves, Moravia, Czech Republic” In Early Modern Humans at the Moravian Gate: The Mladec Caves and their Remains Ed. Maria Teschler-Nicola. Springer Inc., New York.

Oliva, Martin

2006 “The Upper Paleolithic Finds from the Mladec Cave” In Early Modern Humans at the Moravian Gate: The Mladec Caves and their Remains Ed. Maria Teschler-Nicola. Springer Inc., New York.

Svoboda, Jiri A.

2001 “Mladec and Other Caves in the Middle Danube Region: Early Modern Humans, Late Neanderthals, and Projectiles” In Les Premiers Hommes Modernes de la Peninsule Iberique pg 45-60.

Svoboda, Jiri A.

2006 “The Structure of the Cave, Stratigraphy, and Depositional Context” In Early Modern Humans at the Moravian Gate: The Mladec Caves and their Remains Ed. Maria Teschler-Nicola. Springer Inc., New York.

Teschler-Nicola, Maria

2006 “Taphonomic Aspects of the Human Remains from the Mladec Cave” In Early Modern Humans at the Moravian Gate: The Mladec Caves and their Remains Ed. Maria Teschler-Nicola. Springer Inc., New York.

Wild, Eva M.

2005 “Direct Dating of Early Upper Palaeolithic Human Remains from Mladec” In Nature 435:332-335.

Wild, Eva M.

2006 “¹⁴C Dating of Early Upper Palaeolithic Human and Faunal Remains from Mladec” In Early Modern Humans at the Moravian Gate: The Mladec Caves and their Remains Ed. Maria Teschler-Nicola. Springer Inc., New York.

Wolpoff, Milford H.

2006a “Aurignacian Female Crania and Teeth from the Mladec Caves, Moravia, Czech Republic” In Early Modern Humans at the Moravian Gate: The Mladec Caves and their Remains Ed. Maria Teschler-Nicola. Springer Inc., New York.

Wolpoff, Milford H.

2006b “Inventory and Photo-Documentation of the Mladec Hominid Remains” In Early Modern Humans at the Moravian Gate: The Mladec Caves and their Remains Ed. Maria Teschler-Nicola. Springer Inc., New York.

Wolpoff, Milford H.

2006c “Lost, Destroyed or Misidentified Postcranial Specimens from Mladec” In Early Modern Humans at the Moravian Gate: The Mladec Caves and their Remains Ed. Maria Teschler-Nicola. Springer Inc., New York.

Site: Buran-Kaya III, Ukraine

Layers: C – 6-1

Dates: 36,700+/-1500kya - 31,900+/-240 kya
Radiocarbon dating of human bone (Prat 2011)
Radiocarbon dating of bone artifacts (Hardy 2001)

Associated Hominin Morphology: Modern

‘Modern’ Behavioral Percentage: 53%

Table 17: **Buran-Kaya III Table of Evidence**

<u>Behavior</u>	<u>Evidence</u>	<u>Yes</u>	<u>No</u>	<u>N/A</u>
Stone Tools	Blades (>flake tools)		X	
	End Scrapers (>side scrapers)	X		
	Projectile Points	X		
Bone/Antler Tools	Points	X		
	Awls	X		
	Harpoons		X	
Art	Paintings		X	
	Engravings	X		
	Figurines		X	
	Non-Utilitarian Use of Pigment			X
Jewelry	Personal Ornaments	X		
Human Burial	Purposeful Internment		X	
	Symbolic Internment		X	
Site Use	Specialized			X
Site Structure	Complex		X	
Raw Material Source	Non-Local			X
Subsistence Patterns (Faunal)	Species Preference	X		
	Size Selection	X		
	Seasonal Hunting		X	
	Fishing	X		

Explanation of Evidence

Burna Kaya III is a collapsed rockshelter site located on the bank of the Burulcha River in eastern Crimea, Ukraine. The site was discovered in 1990 by A. Yanevich who conducted excavations from then until 2001, and again since 2009 until the present. Yielding modern human remains associated with Upper Paleolithic technology, the site proves to be the oldest modern human presence in far southeastern Europe (Prat 2011).

Hominin Remains

A total of 162 human remains, represented mostly by fragmented cranial parts and teeth, were discovered in layer 6-1. The fossils make up at least five individuals including one juvenile, two sub-adults, and two adults (Prat 2011). Based on tooth and cranial morphology, namely a lack of an occipital bun or a suprainiac fossa, the fossils have been attributed to anatomically modern human. Of these, a parietal fragment was directly radiocarbon dated to 31,900+/-240kya, making these the oldest modern human remains in far southeastern Europe (Prat 2011).

Interestingly, the skeletal distribution shows a lack of anatomical parts from certain upper and lower limbs that are usually preserved. This, along with the presence of cut marks on 14 of the cranial remains, suggests some sort of post-mortem processing of the body parts (Prat 2011). The processing evidence, as analyzed by Prat (2011), does not match that of either dietary cannibalism or a utilitarian secondary disposal of the remains. This, along with the association of the bones with personal body ornaments, has led to suggestion of ritual mortuary practices.

Stone Tools

The lithic assemblage from layer C has been identified as Early Eastern Szeletian. It is represented by bifacial tools made from flakes, end-scrapers dominating over side scrapers, knives, backed pieces, and bifacially retouched microlithic trapezoids (Chabai 2001). Interestingly there was a total absence of blades. Bifacial points are also present, some showing to be projectile points through evidence of impact scars and hafting (Hardy 2001).

Bone/Antler Tools

Layer C has yielded a bone tool industry that consists of one bone haft made of horse metapodial and several bone tubes made of wolf and hare long bone. Also recovered were the fragments of bone projectile points, awls, and needles. Direct dating of these artifacts revealed dates between c32ky and c36kya (Villa and d'Errico 2001).

Art

Evidence of artistic expression exists in the engraved ivory plate that was perforated in order to make a personal ornament (Prat 2011).

Non-Utilitarian Use of Pigment

I found no discussion of the use of pigments at Buran Kaya III.

Jewelry

A large number of personal ornaments were found at the site. They came in the form of five ivory beads, one perforated engraved plate made of mammoth ivory, and 35 fresh water perforated shells (Prat 2011).

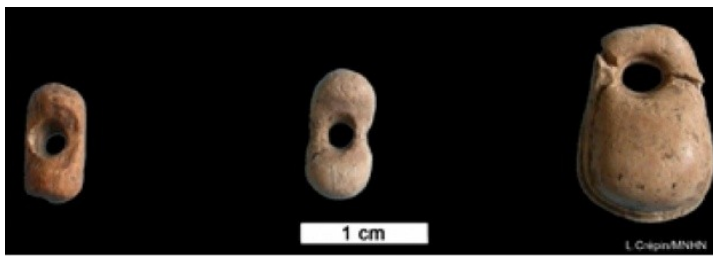


Figure 50: Buran Kaya III Ivory Beads

Adapted from: <http://actualite.nouvelobs.com/mammouth/>

Human Burial

The human remains from 6-1 are well documented but show no evidence of intentional burial. However, the evidence of human processing on the bones that seems to be non-utilitarian, suggest some sort of symbolic post-mortem practices (Prat 2011).

Site Use

There is no discussion of a specialized use for the site.

Site Structure

There is no evidence of an organized site structure at Buran Kaya III.

Raw Material Source

I found no discussion of the source of raw materials found at the rockshelter.

Subsistence Patterns (Faunal)

Layer 6-1 yielded abundant faunal remains. Adult antelopes dominated the assemblage at 42%, red and polar foxes numbered at 29.5%, and hares at 13%. Other mammals were horse, bison, elephants, and reindeer (Prat 2011).

Collagen from human bone was measured and tested proving to show that there was a high consumption of fish at Buran Kaya, reflecting more than 50% of the diet intake (Prat 2011).

Site Behavioral Assessment

The site shows a nearly equal distribution of ‘modern’ and ‘archaic’ behavioral indicators. ‘Modernity’ is seen in a lithics assemblage containing end scrapers and points, a substantial bone industry, artistic expression and jewelry, and hunting practices with preference for size and species as well as the consumption of fish. ‘Archaicness’ is seen the absence of lithic blades, minimal artistic expression, and the lack of human burial, organized site structure, and seasonal hunting. Even though the overall percentage of ‘modern’ behavior is slightly higher, it appears that modern hominin morphology accompanies an almost equal mix of ‘modern’ and ‘archaic’ behavior at Burn Kaya III.

Sources Cited

Chabai, Victor P.

2001 “The Late Middle and Early Upper Paleolithic in Crimea (Ukraine)” In Les Premiers Hommes Modernes de la Peninsule Iberique pp. 25-35, Ed. Joao Zilhao, Trabalhas de Arqueologia 17.

Hardy, Bruce L.

2001 “Stone Tool Function at the Paleolithic Sites of Starosele and Buran Kaya III, Crimea: Behavioral Implications” In Proceedings of the National Academy of Sciences of the United States of America 98(19):10972-10977.

Prat, Sandrine

2011 “The Oldest Anatomically Modern Humans from Far Southeast Europe: Direct Dating, Culture, and Behavior” In PLoS ONE 6(6):e20834.

Villa, Paola and Francesco D’errico

2001 “Bone and Ivory Points in the Lower and Middle Paleolithic of Europe” In Journal of Human Evolution 41(2):69-112.

Site: Kostenki 14 / Markina Gora, Russia

Layers: II-IVb

Dates: c37kya - c25kya

Radiocarbon dating of associated bone and charcoal (Sinitsyn 2006)

Associated Hominin Morphology: Modern

'Modern' Behavioral Percentage: 69%

Table 18: **Kostenki 14 Table of Evidence**

<u>Behavior</u>	<u>Evidence</u>	<u>Yes</u>	<u>No</u>	<u>N/A</u>
Stone Tools	Blades (>flake tools)	X		
	End Scrapers (>side scrapers)	X		
	Projectile Points			X
Bone/Antler Tools	Points	X		
	Awls			X
	Harpoons		X	
Art	Paintings		X	
	Engravings		X	
	Figurines	X		
	Non-Utilitarian Use of Pigment	X		
Jewelry	Personal Ornaments	X		
Human Burial	Purposeful Internment	X		
	Symbolic Internment		X	
Site Use	Specialized	X		
Site Structure	Complex			X
Raw Material Source	Non-Local	X		
Subsistence Patterns (Faunal)	Species Preference	X		
	Size Selection	X		
	Seasonal Hunting			X
	Fishing		X	

Explanation of Evidence

Kostenki 14, otherwise known as Markina Gora, is a Russian site located about 400km south of Moscow on the Don River. It is one of several open-air sites lying in the many ravines that branch out from the river flood plain (Anikovich 2007). The site was discovered in 1928 by P.P. Efimenko who at this time first excavated the uppermost layers. It was then again excavated in 1953 as well as at various points between 1958 and 1994. Excavations have then continued since 1998 (Hoffecker 2010).

Proving to be the oldest and most easterly Aurignacian site of Eastern Europe, the site represents the spread of modern humans into the central East European Plain several thousand years before their spread across Western and Eastern Europe (Anikovich 2007). Notably, the archaeological deposit contains a thick tephra layer suggesting the settlement was brought to end by a catastrophic volcanic event (Sinitsyn 2003a).

There still exist some unresolved issues concerning the chronology of the site. Radiocarbon dating of bone and charcoal has given the layers of interest an age of c25kya – c37kya (Sinitsyn 2006). However, two other lines of evidence have put the site into an older time frame. The volcanic ash layer has been established as deriving from the Campanian Ignimbrite eruption, which dates through argon/argon dating to 38.5 - 41kya. Yet ash from this same layer has been radiocarbon dated to c32kya (Sinitsyn 2006). Also, a paleomagnetic excursion has been identified in the sediments between layer IVa and IVb that is estimated at c42kya. But this same horizon is radiocarbon dated to c35kya (Sinitsyn 2006). This gives the site two separate periods for its hominin occupation. However, since the radiocarbon dates are direct dates that match the timeframe of the archaeological evidence, these make for the accepted period of the site.

* most of the literature from the site was in Russian, making more detailed descriptions for the behavioral indicators difficult

Hominin Remains

In the upper part of layer IV, a burial of a 25-year-old male was found. It may be intrusive from layer III, but the stratigraphic location of the skeleton puts it between 30-33kya. This has been established as modern human (Chabai 2003).

The only other human fossils recovered, is that of a tooth. It is diagnostic in that its morphology contains a deflective wrinkle that is only found on modern humans (Sinitsyn 2003b).

Stone Tools

The lithic assemblage from Kostenki 14 has been determined to be Aurignacian, representing an Upper Paleolithic industry with high amounts of blades, end scrapers, burins, and small bifaces. Although there are Middle Paleolithic artifacts present such as side scrapers, they are far fewer in number. Overall, blade technology dominates the assemblage (Anikovich 2007) and I found no discussion of points as part of the tool kit.

Bone/Antler Tools

An extensive bone tool industry was recovered from the site also meeting the classification as being that of Aurignacian. The raw materials used were that of bone, antler, and ivory. Of particular note were the several mattocks recovered that were made from antler, bone, and mammoth tusk (Anikovich 2007). These items are grouped in the behavior indicator as points.

Art

One piece of unfinished carved ivory representing the head of a human figurine was recovered from the site (Anikovich 2007). This appears to match other figurines found in neighboring sites of the area (Gvozdover 1989).

Non-Utilitarian Use of Pigment

There does appear to be use of pigments at Kostenki 14, as small pieces of red and yellow ochre were recovered from the layers at hand. Also, some of the bones of the human burial were found to be covered in red ochre, showing perhaps a non-utilitarian burial use for the pigments (Sinitsyn 2003a).

Jewelry

Several items of personal adornment were recovered from the site. Four elongated bone beads of polar fox long bone and bird bone were found engraved with criss-cross patterns and polished with smooth edges. Also five perforated shell pendants made from mollusks and polar fox, were recovered from the lowest layer of the site (Sinitsyn 2003a).

Human Burial

The almost complete skeleton of male aged 20-25 was found in the upper-most part of layer IV. It was buried in an oval pit lying in a crouched, tightly flexed position. The bones were also found to be covered in red ochre (Chabai 2003). These factors suggest not only a purposeful burial, but possibly one with symbolic meaning. However, based on this evidence symbolic burial cannot be declared.



Figure 51: Kostenki 14 Skeleton

Adapted from: <http://news.bbc.co.uk/2/hi/8435317.stm>

Site Use

Heavy concentrations of mammal bones, especially from horse, show to be evidence of animal butchery as a specific use for the site. Hoffecker (2010) examines several lines of evidence pointing to this conclusion. Virtually all skeletal parts from these concentrations were represented in multiple groups of bones in anatomical order, traces of carnivore damage is almost entirely absent whereas a high number of tool cut marks show multiple phases of a butchering process, and most of the bones show to have been fractured fresh rather than dry. There was also no evidence of direct human hunting such as spear points embedded in the bones, suggesting the site to be that of a butchery site rather than a kill site.

Site Structure

There is no discussion in the English literature on the site of any sort of organized site structure.

Raw Material Source

Long distance procurement of raw materials is apparent at Kostenki 14. A majority of the stone used for tool production was imported from a source 100-150km from the site. Also the closest possible source for the perforated shell pendants is that of the Black Sea, which is some 500km away (Anikovich 2007).

Subsistence Patterns (Faunal)

In layers II and III the large mammal faunal record is made up of remains mostly from horse, reindeer, rhinoceros, and mammoth. Horse, represents 95% of the remains and come in various ages and sizes, but prove to show a high percentage of females (Hoffecker 2010). A complete mammoth skeleton was also found, but the absence of cultural remains in association make the assessment of human agent impossible to declare (Sinitsyn 2003b). There is no discussion of seasonal hunting patterns and there appears to be no fishing activity at Kostenki 14.

Site Behavioral Assessment

Kostenki 14 shows a high percentage of 'modern' behavior. This is seen in the lithics and bone technology, the production of art and personal ornaments, a human burial, long distant procurement of lithic material, along with the practice of animal butchery as a specific use for the site. The 'archaic' behavior here is minimal. Therefore at Kostenki 14, modern morphology accompanies 'modern' behavior.

Sources Cited

Anikovich, M.V.

2007 “Early Upper Paleolithic in Eastern Europe and Implications for the Dispersal of Modern Humans” In Science 315(5809):223-226.

Chabai, Victor P.

2003 “The Chronology and Industrial Variability of the Middle Upper Paleolithic Transition in Eastern Europe” In The Chronology of the Aurignacian and of the Transitional Technocomplexes: Dating Stratigraphies, Cultural Implications pp.71-88, Eds. Joao Zilhao and Francesco d’Errico, *Trabalhos de Arqueologia* 33.

Gvozdover, M.D.

1989 “The Typology of Female Figurines of the Kostenki Paleolithic Culture” In Anthropology and Archaeology of Eurasia 27(4):32-94.

Hoffecker, John F.

2010 “Evidence for Kill-Butchery Events of Early Upper Paleolithic Age at Kostenki, Russia” In Journal of Archaeological Science 37(5):1073-1089.

Sinitsyn, Andrei A.

2003a “A Palaeolithic Pompeii at Kostenki, Russia” In Antiquity 77:9-14.

Sinitsyn, Andrei A.

2003b “The Most Ancient Sites of Kostenki in the Context of the Initial Upper Paleolithic of Northern Eurasia” In The Chronology of the Aurignacian and of the Transitional Technocomplexes: Dating Stratigraphies, Cultural Implications pp. 89-108, Eds. Joao Zilhao and Francesco d’Errico, *Trabalhos de Arqueologia* 33.

Sinitsyn, Andrei A.

2006 “Radiocarbon Dating and Chronology of the Early Upper Paleolithic at Kostenki” In Quaternary International 152:164-174.

Chapter 6

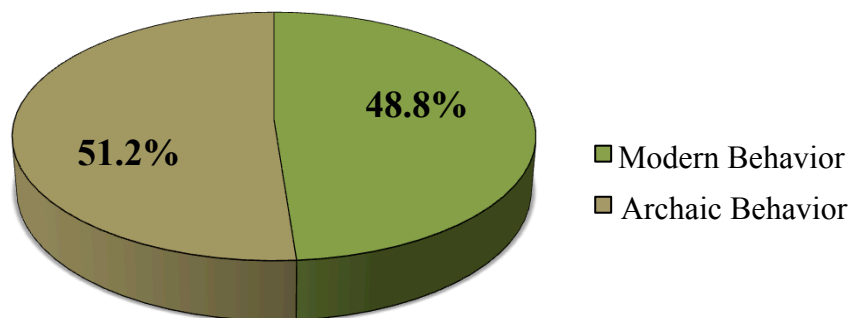
Results

In order to visualize the site descriptive categories, graphic representations are presented here so that patterns and possible correlations among the datasets can be identified. The figures are grouped in three ways; 1) according to hominin fossil morphology found at the site, 2) period of the site, and 3) region in which the site is located.

Behavioral Percentage

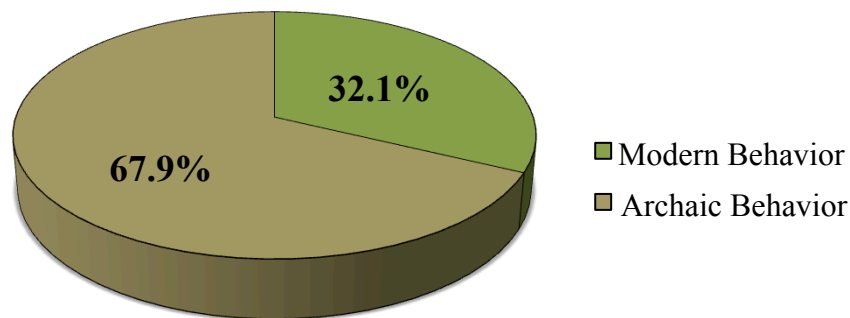
Figures 52-59 illustrate the average percentage of ‘modern’ behavior and the average percentage of ‘archaic’ behavior for all sites combined according to the three categories above. Morphology is divided between the two categories analyzed in this study; anatomically modern human and Neanderthal. Periods are divided between 200-100kya, 100-45kya, and 50-21kya. And region is split up between the three regions relevant in this study; Africa, the Levant, and Eurasia.

Average Behavioral Percentage per Morphology



Sites: Herto, Border Cave, Klasies River Mouth, Qafzeh, Skhul, Buran-Kaya III, Mladec, Kostenki 14

Figure 52: Modern Morphology (8 sites)



Sites: Grotte du Renne, Kebara, Krapina, La Quina, St. Cesaire, Tabun, Vindija

Figure 53: Neanderthal Morphology (7 sites)

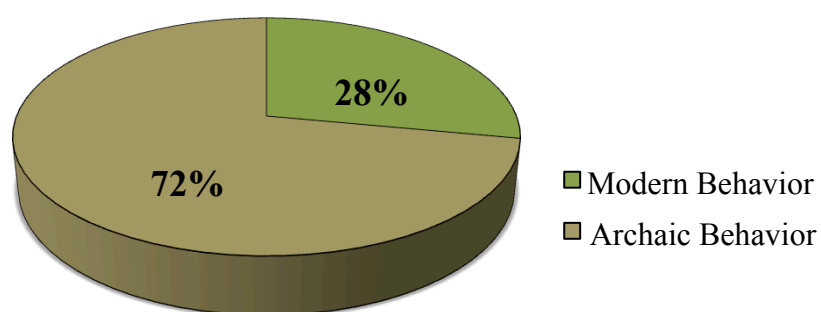
Fossils with modern human morphology were found at eight of the fifteen sites. These sites showed an aggregate percentage of ‘modern’ behavior at 48.8% (Figure 52). This seems to be relatively low for the species regarded as responsible for ‘modern’ behavior, suggesting that not all anatomically modern humans were actually performing these behaviors. The site of Herto, Ethiopia displays this occurrence as a modern human site showing a low ‘modern’ behavioral percentage of 12%. The site disproportionately lowers the modern behavior percentage for the modern morphology category. However, the overall low percentage in this category could also be due to the fact that only three out of eight

modern human sites were dated to post 50kya. Therefore a majority of them are from before when modern humans entered Eurasia post 40kya, and subsequently the supposed time when these behaviors were fully developed.

Fossils of Neanderthal morphology were found at seven sites. These show an average percentage of ‘modern’ behavior at 32.1% (Figure 53), which is substantially lower than the modern human sites. Notably, four of these sites are from the period post 50kya, suggesting that a low percentage of ‘modern’ behavior existed in Neanderthals even during the supposed time of full development of these behaviors. An example from this study of a post 50kya Neanderthal site is Saint-Cesaire in France. This site displays a ‘modern’ behavioral percentage of 55.5% seen in the production of personal ornaments, purposeful symbolic burial, specialized site use, complex site structure, exploitation of non-local raw materials, structured hunting practices, and fishing. This site shows that Neanderthals were performing ‘modern’ behaviors to a large enough degree to deserve credit for the behaviors.

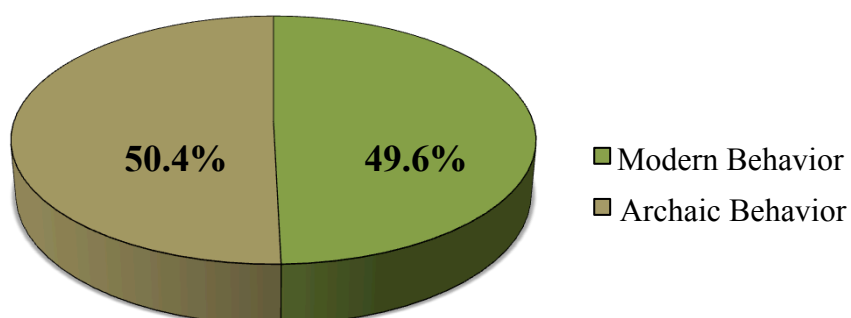
The results from this study in the case of correlations between behavior and fossil morphology tell us that behavioral categories cannot be strictly assigned to certain hominin morphologies. Instead, ‘modern’ and ‘archaic’ behaviors existed to different degrees in both morphological types.

Average Behavioral Percentage per Period



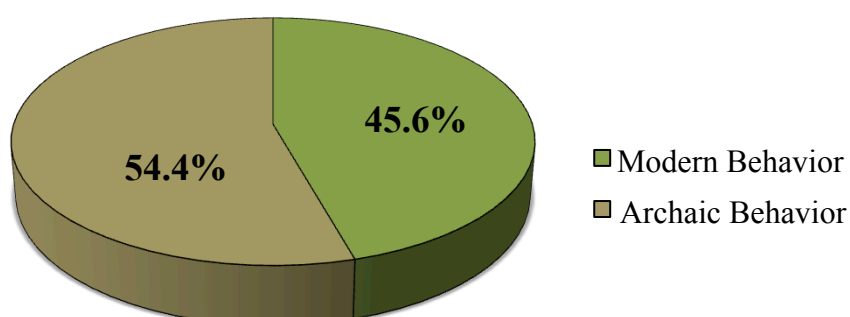
Sites: Herto, Krapina, Skhul, Tabun

Figure 54: 200-100kya (4 sites)



Sites: Border Cave, Kebara, Klasies River Mouth, Qafzeh

Figure 55: 100-45kya (4 sites)



Sites: Buran -Kaya III, Grotte du Renne, Kostenki 14,
La Quina, Mladec, St. Cesaire, Vindija

Figure 56: 50-21kya (7 sites)

Four sites from this study date to between 200-100kya. These sites yield an average ‘modern’ behavioral percentage of 28% (Figure 54). This is the lowest of the three periods selected in this study. Because this is the earliest period, the result is not surprising. The modern human site of Herto, Ethiopia with a ‘modern’ behavioral percentage of 12%, serves to lower this average, while the modern human site of Skhul, Israel with a percentage of 44%, serves to increase this average. It is important to note that these are modern human sites with a Middle Paleolithic industry that is typical of other archaic hominins (Clark 2004 and Garrod 1939).

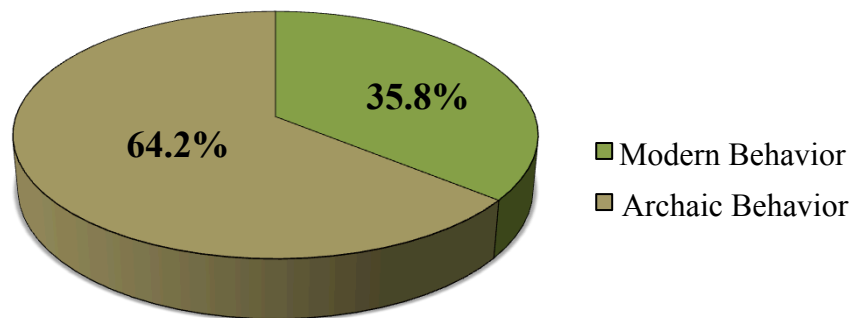
Four sites range from 100-45kya and prove to represent the highest average ‘modern’ behavioral percentage at 49.6% (Figure 55). This is somewhat surprising, as one would expect the highest percentage to be from the most recent period. It is also interesting that this percentage is the highest, but still lies below 50%. Here, the modern human site of Klasies River Mouth, South Africa with a ‘modern’ behavioral percentage of 33%, serves to lower this percentage. Also notably, three of these sites are modern human, but none from this period are from Eurasia. This reflects the fact that modern humans were not yet in the region.

Seven sites are from the most recent period ranging from 50-21kya and yield a slightly lower average ‘modern’ behavioral percentage of 45.6% (Figure 56). This is interesting because as the most recent period it is expected to be the most advanced behaviorally and therefore should show the highest percentage of modern attributes. Also, all of these sites are from Eurasia, which conventional wisdom says would serve to increase the percentage of ‘modern’ behavior. However, the fact that four of these sites were Neanderthal sites, could ultimately serve to lower this percentage.

The results from the period analysis indicate that ‘modern’ behavior is not a straightforward progression over time from ‘archaic’ to ‘modern’ behavior, but a process of

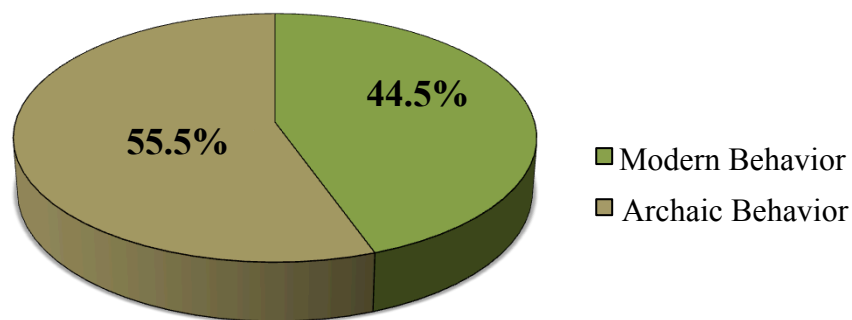
varying development temporally. The advancements toward 'modern' hominin behavior appear to fluctuate over time depending on the species and the region.

Average Behavioral Percentage per Region



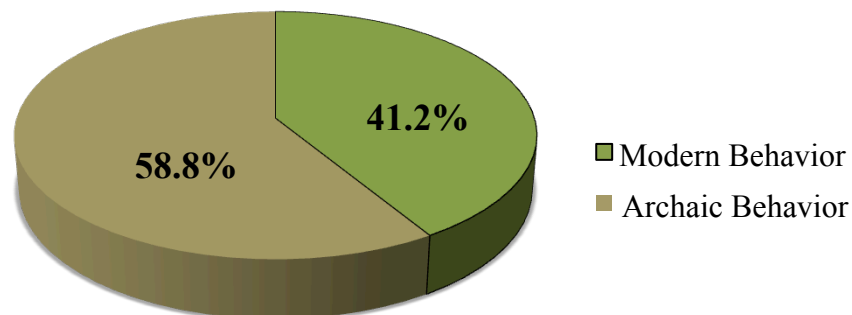
Sites: Border Cave, Herto, Klasies River Mouth

Figure 57: Africa (3 sites)



Sites: Kebara, Qafzeh, Skhul, Tabun

Figure 58: Levant (4 sites)



Sites: Buran-Kaya III, Grotte du Renne, Kostenki 14, Krapina, La Quina, Mladec, St. Cesaire, Vindija

Figure 59: Eurasia (8 sites)

The three African sites make for the lowest average ‘modern’ behavioral percentage of the three regions at 35.8% (Figure 57). Being that all of these sites are from before the 45kya period, this lower percentage is not necessarily surprising. However, all three of these sites are modern human sites, which one might expect to increase the percentage. Once again the modern human site of Herto, Ethiopia at 12% and the modern human Klasies River Mouth, South Africa at 33% serve to lower this percentage. The evidence here does in fact support conventional wisdom that while modern human morphology was developing in Africa, so too were ‘modern’ behaviors.

There are four Levantine sites that prove to bring the highest average ‘modern’ behavioral percentage at 44.5% (Figure 58). This is once again surprising since all of these sites are before the 45kya time mark, two being earlier than 100kya. The modern human site of Qafzeh Cave in Israel, with a ‘modern’ behavioral percentage of 61%, serves to increase this percentage. The high percentage in this region could be due to the fact that in past hominin migration patterns, the Levant was a path in and out of Africa. This would have made for the possible communication and trading of ideas between species which would subsequently serve to further advance cultural behavior.

Eight Eurasian sites bring a slightly lower average ‘modern’ behavioral percentage than the Levant at 41.2% (Figure 59). This lower percentage is interesting due to the fact that seven of these sites come from the post 50kya period and therefore should bring increased ‘modernity’. However, there are actually only three modern human sites from this region. The remaining are the Neanderthal sites of Grotte du Renne, France at 31%, Krapina, Croatia at 25%, La Quina, France at 28%, Saint-Cesaire, France at 55.5%, and Vindija, Croatia at 12.5% ‘modern’ behavioral percentage. These combine to lower the percentage. The results from the regional data suggest that behavioral advancement cannot be categorized by region,

but that it was a process varying within regions depending on the species and the period at hand.

Behavioral Indicators

The following set of figures (60-67) illustrates each particular ‘modern’ behavioral indicator and display the number of sites in which they are present. The figures are also grouped into the same categories as above; morphology, period, and region. This makes it possible to visualize the data from my study as to what species was performing individual ‘modern’ behaviors, and as to when and where they were taking place.

Number of Sites with ‘Modern’ Behavioral Indicator per Morphology

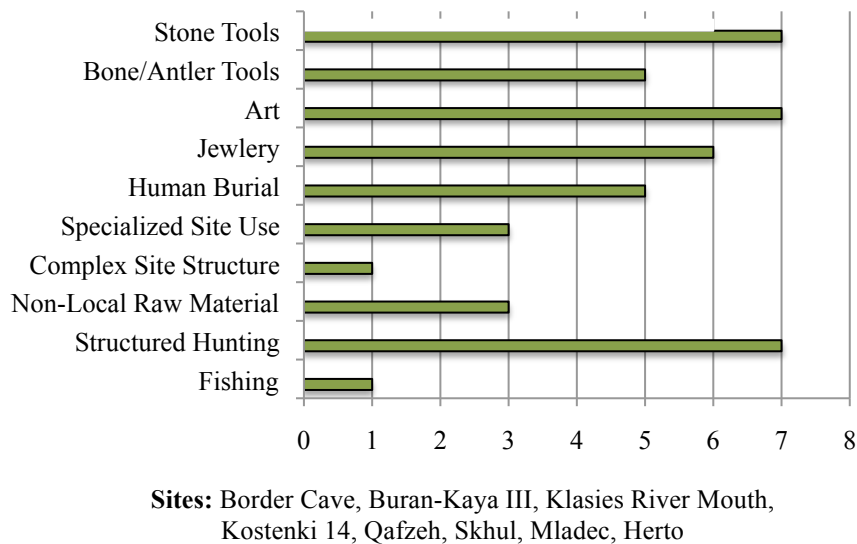


Figure 60: Modern Morphology (8 sites)

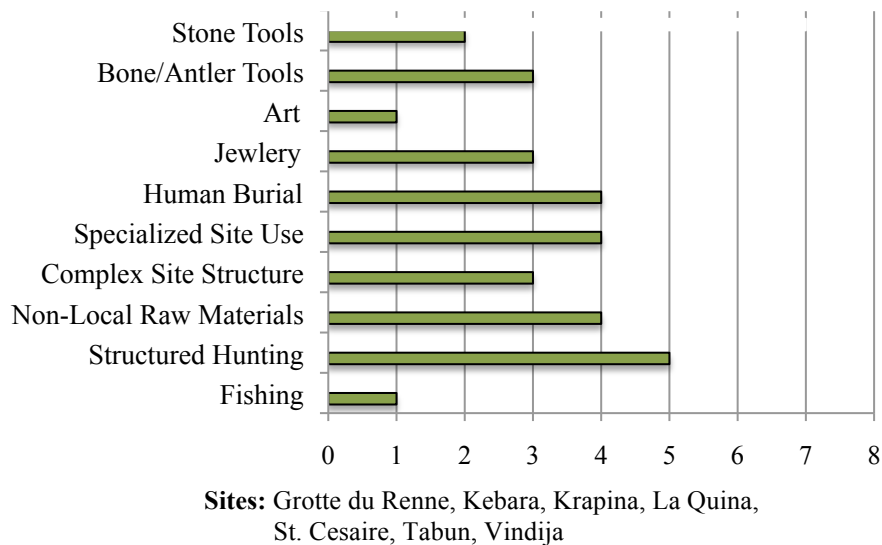


Figure 61: Neanderthal Morphology (7 sites)

Number of Sites with 'Modern' Behavioral Indicator per Period

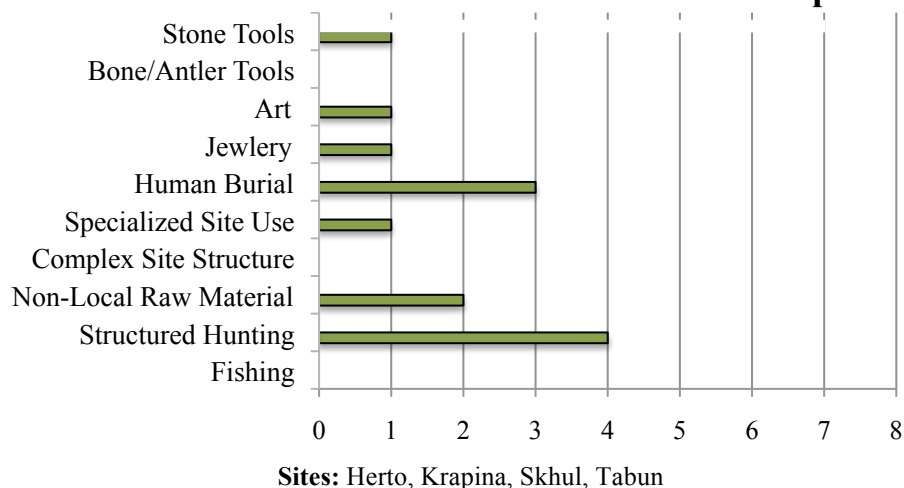


Figure 62: 200-100kya (4 sites)

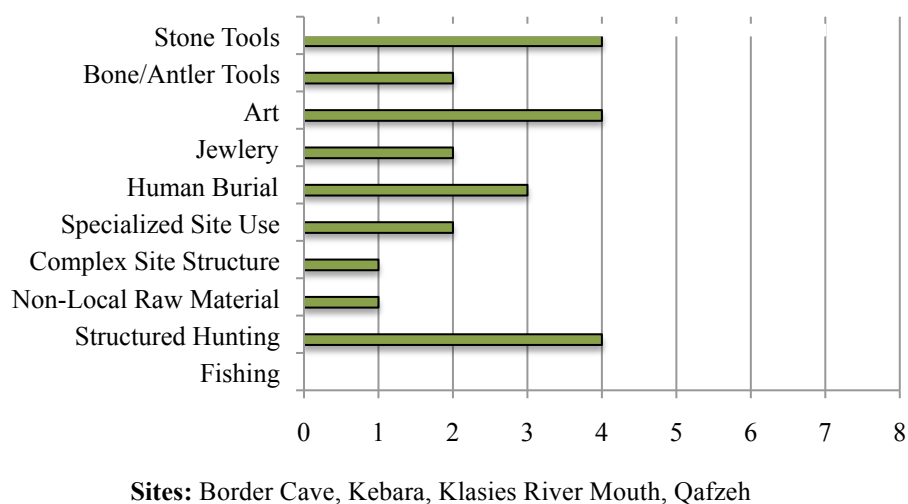


Figure 63: 100-45kya (4 sites)

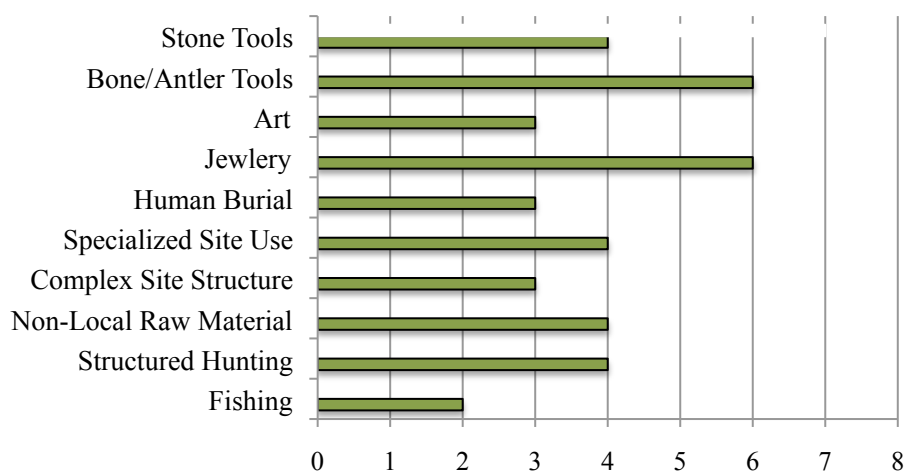


Figure 64: 50-21kya (7 sites)

Number of Sites with ‘Modern’ Behavioral Indicator per Region

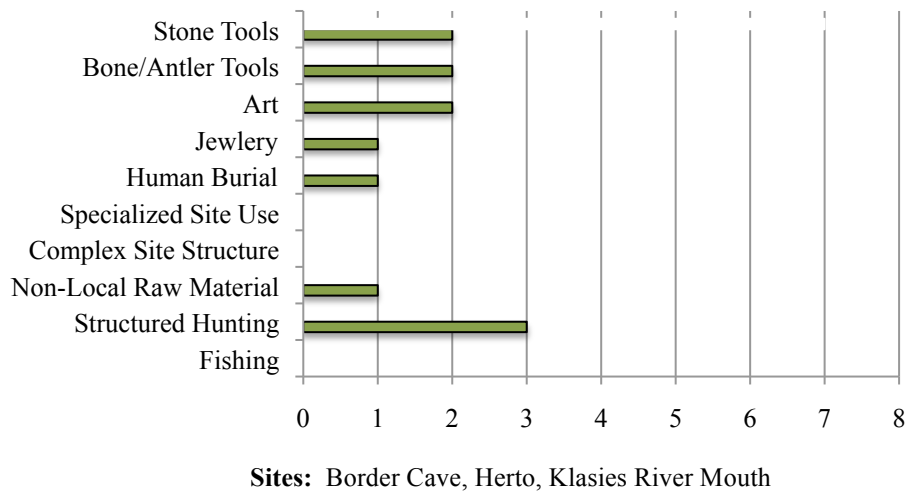


Figure 65: Africa (3 sites)

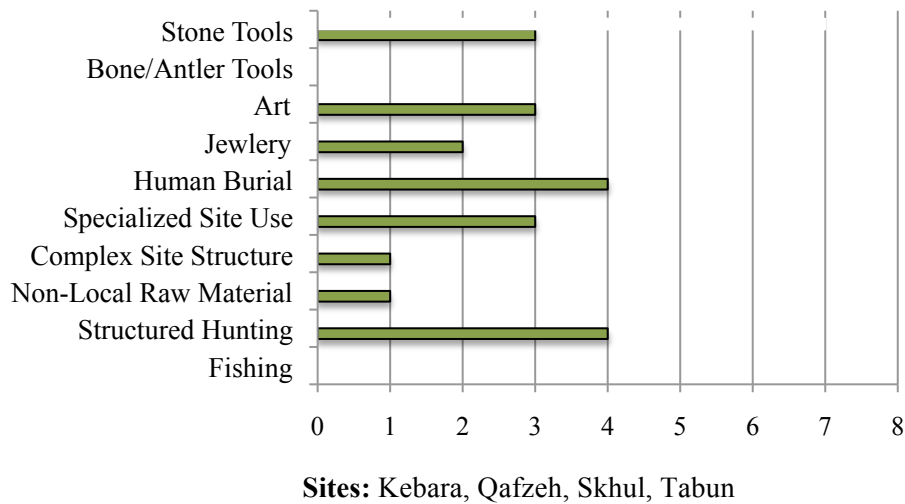


Figure 66: Levant (4 sites)

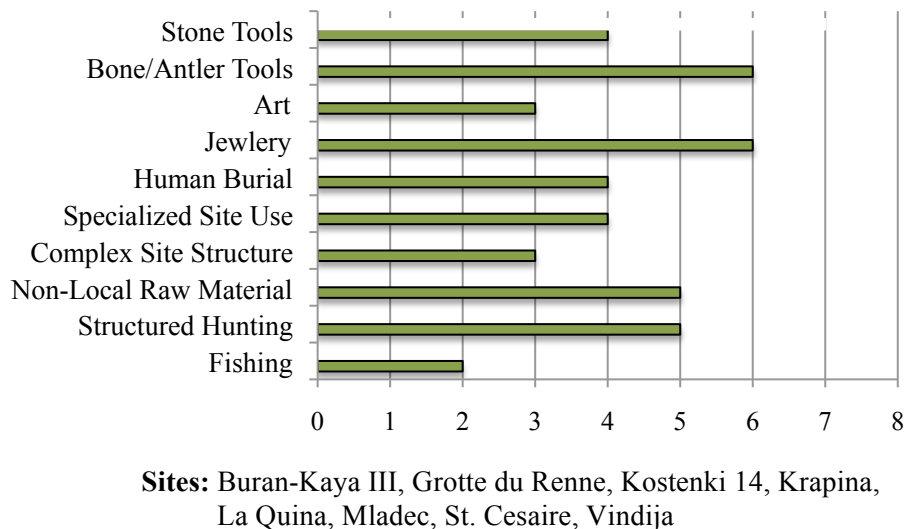


Figure 67: Eurasia (8 sites)

Lithic tools are the strongest signature of past behavior in the archaeological record due to the high preservation of stone. Evidence of ‘modern’ stone tool production was actually found at all sites in this study. However, the presence of this ‘modern’ indicator was set up as a greater than/less than value. So even though most the Neanderthal sites showed production of blade tools and end scrapers, the fact that these often did not outnumber flake tools and side scrapers, excluded many of these sites from qualifying as ‘modern’ in the stone tool category. Of the Neanderthal sites, only Grotte du Renne in France and Kebara in Israel showed a greater ‘modern’ stone tool frequency than ‘archaic’ in this category. On the other hand, all but one modern human site, Herto, had ‘modern’ stone tools at a greater value than ‘archaic’ stone tools. Thus, the results here show ‘modern’ stone tool production occurs dominantly in anatomically modern humans.

Temporally, only one site before 100kya had evidence of ‘modern’ stone tools and both of the other periods showed four sites each with this behavior. Regionally, ‘modern’ stone tools occur at highest frequency in Eurasia, being found at four sites. The Levant contained three sites and Africa two with this behavior. The trends here follow conventional wisdom suggesting that modern humans were the most responsible for ‘modern’ innovations of stone technology and were producing them mostly in Eurasia post 50kya. Being that only two Neanderthal sites and all but one modern human site qualify as having ‘modern’ stone tools, we see a reason why modern humans are credited with ‘modern’ behavior.

Bone and antler tools are less likely to preserve as well as stone due to being of organic material. Therefore the lack of this evidence in the archaeological record could be a preservation issue rather than an actual absence of the behavior. The results of this study show that modern humans were using bone and antler to make tools at five of the eight modern human sites. This is a higher frequency than Neanderthals, who were producing them at three of their seven sites. Over time, the frequency increases. There are no sites with

this signature before 100kya, two sites between 100-45kya, and six sites between 50-21kya. This could mean there was less bone tool production in the earlier periods, and/or less preservation. Eurasia is the region where this behavior is seen the most, being found at six sites. Africa follows this at two sites, and the Levant shows no sites with bone or antler tools. These trends follow conventional wisdom and again argue for modern humans as the main innovators of 'modern' behavior. But due to bone tool presence at three Neanderthal sites, they again cannot be excluded from the credit for bone and antler tool production.

Artistic expression also appears to be predominantly a modern human behavior, as it is present in some form at seven of the eight modern human sites. On the other hand, it is only found at one Neanderthal site from this study. Temporally, art does not occur at any sites before 100kya and it occurs at seven sites after this time. Eurasia and the Levant both show the same number of sites with artistic expression at three sites each, while Africa shows two sites. These trends as well follow dominant opinion of artistic expression as a modern human phenomenon, which started in Africa and then spread to Eurasia.

The production of jewelry shows as well to be dominantly performed by anatomically modern humans, being present at six modern human sites and only three Neanderthal sites. Temporally, jewelry shows a definite increase over time. Prior to 100kya there is only one site displaying this behavior, while 100-45kya shows two sites, and the 50-21kya period shows six sites. This behavior regionally appears to increase from Africa at one site, to two sites in the Levant, and then on to Eurasia with six sites. The dominant opinion is upheld here as well that modern humans were the major innovators of jewelry in Africa and continued to spread the behavior into Eurasia. But Neanderthals again cannot be excluded from credit of jewelry production, as they also show conclusive evidence of this behavior.

Purposeful or symbolic burial appears at five modern human sites, this being slightly higher than in Neanderthals, which show four sites with this behavior. Evidence for this does

not however, fluctuate over time. All three periods show equal evidence of this at three sites each. Regionally, Africa shows the lowest frequency of this behavior with one site while the Levant and Eurasia show to be equal at four sites. Although more modern human sites show evidence for purposeful burial, it is not dominated by this species, as it is also substantially present in Neanderthals.

The use of sites for specialized purposes was a difficult behavior to analyze, as the information was often not available in the literature. This was the case for seven sites of the total fifteen sites. Of the sites that showed this evidence, Neanderthals displayed this behavior at four sites while modern humans did at three. Temporally, the earliest period only showed one site, 100-45kya showed two sites, and the 50-21kya period showed four sites. Regionally, no sites in Africa showed evidence for this, three in the Levant, and four in Eurasia. The lack of information available for this indicator makes using it in a behavioral assessment problematic.

Complex site structure is another category where the information was often unavailable, this being the case at six sites of the fifteen sites. This could possibly be due to taphonomic processes that make spatial organization difficult to detect at sites of such great antiquity. From the available information, this behavior appeared at one modern human site and three Neanderthal sites. The earliest period showed no sites with this behavior, the middle period showed one, and the latter showed three. Africa had no sites with this behavior, the Levant had one, and Eurasia had three. Here as well, the lack of available information makes a behavioral assessment difficult.

A third indicator that was often not available was the use of non-local raw material, being absent from the literature for seven sites. From the available information, modern humans showed evidence for this at three sites and Neanderthals at four sites. Temporally, two sites prior to 100kya showed this behavior, one site from the 100-45kya period, and four sites from

the 50-21kya period. Regionally, one site from Africa, one from the Levant, and five from Eurasia show evidence for non-local exploitation of raw materials. As in the two prior cases, the lack of available information for this indicator is cause for making a behavioral assessment problematic.

Some form of structured hunting was the ‘modern’ behavioral indicator present at the most sites, showing at 13 of the 15 sites. Modern humans displayed this at seven of their eight sites while Neanderthals did at five of their seven sites. It was present at a consistent four sites per period. And regionally, Africa showed the lowest frequency of this at three sites, then came the Levant with four sites, and Eurasia with five. These trends argue that some form of structured hunting was occurring across species and region further back in time than this study extends. The evidence here suggests that this ‘modern’ behavior was occurring long before the presence of anatomically modern humans.

Fishing was the behavioral indicator found at the least number of sites, only two. One was the modern human site of Buran-Kaya III, Ukraine and one was the Neanderthal site of Saint-Cesaire, France. Both of these were from the most recent period and both were in Eurasia. This behavior of course, is subject to site location in the vicinity of a proper water source that would allow for the exploitation of fish. This indicator also does little to influence an assessment on the development of ‘modern’ behavior in past hominins.

Total Number of Sites Where Information on the Behavioral Indicators was Not Available

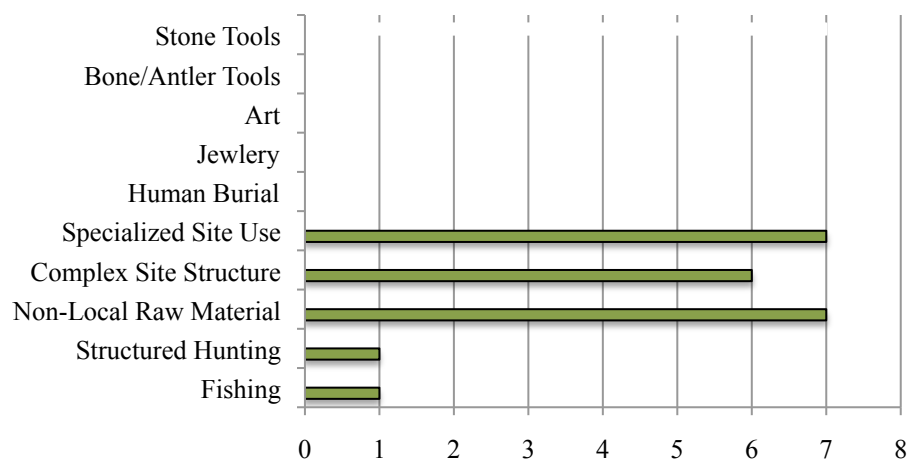


Figure 68: All Sites

Results

Overall, the results of the above data analysis prove to negate conventional wisdom surrounding ‘modern’ behavior in all three categories analyzed; morphology, period, and region. Morphologically, both types examined show substantial percentages of ‘modern’ behavior. Being that anatomically modern morphology shows the highest percentage, it can be understood why the dogma exists that ‘modern’ behavior is a modern human phenomenon. However, the substantial Neanderthal percentage shows that ‘modern’ behavior does not solely belong to modern humans.

Temporally, all three periods at hand; 200-100kya, 100-45kya, and 50-21kya show sufficient percentages of ‘modern’ behavior. The fact that the 100-45kya time period shows the highest percentage, negates the dogma that modern humans fully developed these innovations in Europe after introducing them to the region post 50kya. To the contrary, this shows that ‘modern’ behavior was conclusively taking place before modern humans arrived in Europe.

Regionally, all three categories examined; Africa, the Levant, and Eurasia show similar percentages of ‘modern’ behavior. This also tells us that we cannot concur with the dominant opinion that ‘modern’ behavior was mostly due to modern human innovations in Europe after their dispersal from Africa. But rather, we conclude that these behaviors were developing in the three respected regions simultaneously.

In the end, the bar figures with exact site frequencies ended up painting a different picture than the pie figures displaying overall behavioral percentages. The percentages serve to even out the presence of ‘modern’ behavior across species, time period, and region, suggesting that no category completely dominated the behaviors. The benefit here is that number of sites from each category does not play as big of a factor in the results. When taking the behavioral

percentages into account, the results tell us that ‘modern’ behavior appears to occur mostly in modern humans, during the 100-45kya time period, and majorly in the Levant.

In the bar figures on the other hand, the number of sites in each category does play a factor. This is because they tell us exact frequencies for when, where, and in whom each individual behavior was present. So the categories with more sites will reveal higher frequencies. When looking at it this way, the results tell us that ‘modern’ behavior appears to be dominated by modern humans, occurring mostly post 45kya, and a majorly in Eurasia. This view however, is not as accurate of picture as the percentages because the number of sites per category puts too much influence on the results.

My overall results here tell us that hominin behavior does not match hominin morphology in the archaeological record. We see instead that ‘modern’ behavior actually has a mosaic evolutionary history of developing across region, species, and period.

Chapter 7

Discussion and Conclusion

Discussion

Two perspectives are attained from this study of 15 Middle-Upper Paleolithic sites. These analyses suggests that modern humans are the major producers of ‘modern’ behaviors, which appear to spread from Africa through the Levant, and then into Eurasia. It is also clear that Neanderthals were engaging in these behaviors throughout various periods and regions as well. So it is clear from this analysis why anatomically modern humans have attained the credit for being the innovators of ‘modern’ behaviors. But we also gain the understanding that ‘modern’ behavior is conclusively present Neanderthals, in various regions and periods including those without the presence of modern humans. Therefore ultimately, we see that modern humans are not the sole producers of ‘modern’ behavior.

As seen in my results, ‘modern’ behavior was consistently occurring independently from modern humans during the middle to late Pleistocene. This is apparent from my study in the ‘modern’ behavioral percentage attained by Neanderthals, which comes to 32.1%. Specifically the Neanderthal site of Saint-Cesaire in France, which shows ‘modern’ behavior in the production of jewelry, human burial, specialized site use, complex site structure, non-local raw material exploitation, and structured hunting practices along with fishing. Also, the Neanderthal site of Kebara in Israel, shows ‘modernity’ in stone tools, engravings, human burial, specialized site use, complex site structure, and structured hunting. These are not sites with just one or two indicators of ‘modern’ behavior, but sites that show the Neanderthals living there were fully capable of ‘modern’ adaptations.

Some paleoanthropologists argue that Neanderthals did not come up with the ideas themselves, but learned ‘modern’ innovations from modern humans as they came in contact with each other in Europe (Gravina 2005, Mellars 2007). Although evidence does show that modern humans existed in Eurasia during the latter part of Neanderthal existence, as seen in the sites of Buran-Kaya III, Kostenki 14, and Mladec from this study, we cannot conclusively

say they were interacting from this evidence. It is however inferred from sites like the Chatelperronian type-site in France, where the modern human and Neanderthal layers were interstratified (Gravina 2005), that the two species were sharing ideas. Conclusive evidence of interaction appears in recent human genome studies that have given us genetic proof that modern humans and Neanderthals were interbreeding (Green 2010), and therefore interacting.

From the data collected in this study, there were no modern human and Neanderthal fossils in the same layer in order to draw the conclusion that Neanderthals were directly interacting with, and therefore copying modern human innovations. What this study does show, is that Neanderthals were performing ‘modern’ behavior separate from and before the arrival of modern humans, as in the case of Krapina in Croatia dating from 137-110kya. This evidence negates conventional wisdom and tells us that Neanderthals were capable of not only performing ‘modern’ behavior, but coming up with the ideas themselves.

My results also give us confirmation that ‘modernity’ was clearly showing up in the archaeological record by at least 160kya. This is apparent at the modern human site of Herto, Ethiopia, the oldest site of my study. Also, for all the sites predating 100kya, we see a substantial ‘modern’ behavioral percentage at 28%. Particularly the ‘modern’ is the modern human site of Skhul in Israel, whose relative layers date to c.130-c.100kya, and whose archaeology shows evidence of ‘modern’ stone tools, jewelry, symbolic burial, and structured hunting practices. Also in Israel, the Tabun Neanderthal site dating to c.102-c.122kya, shows evidence of human burial, specialized site use, and structured hunting practices. During the period from 100-45kya we actually see the highest percentage of ‘modern’ behavior at 49.6%. Border Cave, the South African modern human site dates to c.84–c.56kya, and shows ‘modernity’ in stone and bone tools, use of pigments, jewelry, human burial, and structured hunting. And the modern human site of Qafzeh Cave in Israel dates to c.92kya and shows

‘modernity’ in stone tools, artistic expression, jewelry, human burial, specialized site use, non-local raw material exploitation, and structured hunting practices.

From this data we understand that ‘modern’ behavior did not come about in any sort of explosion, but gradually over time. It is actually argued that ‘modern’ behavior extends much further back in time than modern humans have been in existence. Zilhao (2006) even suggests that the search for the emergence of these innovations perhaps should be focused around 2mya during the Lower Pleistocene, with emergence of *Homo erectus*.

We also see in the results of this study that ‘modern’ behavior was occurring to similar degrees across Africa, the Levant, and Eurasia; showing a ‘modern’ behavioral percentage of 35.8%, 44.5%, and 41.2% respectively. The behaviors prove to be present even when modern humans were not currently in the region. Evidence for this is again apparent at the Eurasian Neanderthal site of Krapina in Croatia, which dates some 60ky before the arrival of ‘modern’ humans in Eurasia and has a ‘modern’ behavioral percentage of 25%. And being that the Levant shows the highest ‘modern’ behavioral percentage at 44.5%, we can negate the dogma that the major development of ‘modern’ behavior occurred after modern humans brought these innovations to Eurasia.

‘Modern’ Moderns

Although our results tell us that ‘modern’ behavior came about across species, time, and region, we must still explore the observation that these behaviors do have a higher correlation with anatomically modern humans than in Neanderthals. The answer to this question seems to boil down to, not a particular intelligence advantage in modern humans, but rather to a matter of demographics (Strauss 2010).

DNA studies point to the genetic origins of anatomically modern humans in Africa around 150kya with a dispersal to other regions of the world between 60-40kya (Mellars 2004). This

is reinforced by the fossil evidence, which shows that anatomically modern humans first appear in Africa at c.190kya and then in Europe c.43kya (Mellars 2004). This African homeland provided for a much larger population density than in Neanderthal Europe because of a few reasons in particular. One is size, as Africa proves to be about three times as large as Europe. And even more so during glacial times, since only a narrow belt south of 53 degrees north was available for European settlement (Zilhao 2006). Also the carrying capacity of the subtropical savannahs of Africa would have been much higher than in Europe. This along with the fact that Neanderthals were never present in Africa would allow for increased modern human population growth in comparison to that of the Neanderthals. We also see evidence for this pattern of human presence in the archaeological record, which increases from the Middle to the Upper Paleolithic as modern humans spread across the globe (Strauss 2010).

A larger population size can ultimately serve to facilitate technological innovation, fueling it through increased competition for resources as well as increased intra-human contact allowing for communication and the sharing of ideas. Lower population sizes would mean lower intensity of resource exploitation and less intra-human contact, thus less of a trend to innovate. Therefore, it could likely be a matter of lower population densities in Neanderthals that limited their need for ‘modern’ innovations as well as kept their overall footprint of these behaviors on the landscape less intense than that of modern humans.

Modern Human Evolution Models

The issues that surface during this study call us to judge the various current models for modern human evolution and their origin and path around the globe. The Out-of-Africa replacement model states that anatomically modern humans originated in Africa and expanded out of Africa starting at c.100kya resulting in the replacement and extinction of the

prior present non-modern hominin populations without genetic exchange (Templeton 2002). The Multi-Regional model states that due to geographic isolation, anatomically modern humans arose from past hominin species such as *Homo erectus* independently in various regions of Africa and Eurasia, but that gene flow prevented them from complete independent evolution, eventually leading to a single modern lineage (Templeton 2002). The Assimilation Model states that anatomically modern humans emerged in Africa and radiated from there; but along the way genetic exchange occurred resulting in an engulfing of other hominin species, rather than a direct replacement (Smith 2005).

Although the present study cannot adequately justify a conclusion on the evolutionary path of modern humans, it can allow us to make some educated inferences. The complicated hominin fossil morphological variations combined with the archaeological behavioral mixtures we see across species can lead us to infer that past hominins were mixing, genetically as well as culturally. Therefore, from the results of this study, we are at least safe to reject the Out-of-Africa replacement model. The available evidence is not sufficient to choose between the Multi-Regional Model and the Assimilation Model, however it serves to support the two.

Challenges to Paleoanthropology

When we look at ‘modern’ behavior in light of this study, we see that it is not a phenomenon invented by modern humans who carried it with them and spread it around the globe. Rather ‘modern’ behavior comes about in a mosaic evolutionary fashion, independent of a particular species, period, or region.

This view leads us to challenge some long lasting dogmas in paleoanthropology. For one, we should question the tendency to strictly label past hominin behavior as ‘modern’ or ‘archaic’. And perhaps we should even question well-established site or tool tradition

categories such as the Lower, Middle, or Upper Paleolithic. For these labels only follow past trends in archaeology to place behavioral changes into a lineal progression from simple to complex, separating this progression into steps with clear boundaries or transition events. As more evidence builds, it becomes more difficult to separate the past into these categories. Instead, a different picture is emerging; a picture with a complex, non-directional, and mosaic evolution of 'modern' hominin behavior (Straus 2010).

It is of interest that this problem emerges directly in this study, as none of the sites can be spoken of in absolutes as to being 'modern' or 'archaic' in behavior. If we look at the site with the highest percentage of 'modern' behavior, the modern human site of Kostenki 14 in Russia, it only comes to 69%. Although still very 'modern', the site is lacking in several indicators including projectile points and symbolic burial. Then one of the lowest percentages comes from the Neanderthal site of Vindija Cave in Croatia, at 12.5%. However, this site still contains 'modern' elements such as bone tools and long distance procurement of raw materials. This evidence tells us that all of the sites show some sort of mixture in behavior. Therefore they signal to be part of a complicated process of behavioral innovations occurring to varying degrees in different hominin species.

Not only does this study reveal that behavioral innovation cannot be strictly categorized within certain hominin morphological types, but the study also indicates that skeletal morphology itself is problematic to put into categories. This was seen in the literature on many of these sites that is conflicting as to which morphological type the fossils should be categorized, as they often show a mosaic of characteristics. Across time and region the morphology appears to blend and mix, with transitional forms existing between the established types. So our difficulty in matching the archaeological behavior to certain hominin morphological types is compounded by the difficulty of fitting the fossils themselves into strict morphological categories.

This discussion leads us to make one final, quite large, challenge to paleoanthropology. It calls us to question our current model for the past two million years of hominin evolution. The established model separates past hominins into different species according to skeletal morphology. But as we see here, without clear lines between morphological types, the separating of past hominins into various species based on fossil form is problematic. If the past is anything like today, with such high morphological variation in one living human species, how can we so definitively separate past fossils into such defined groups? Especially when there is such scant evidence. Perhaps, just as we ought to question definitively categorizing behavioral evidence, we should also question our morphological categories. It seems an evolutionary past without the separation of hominins into different species is more suiting. Rather, a separation of one human species into various sub-species based on these morphological differences would be more appropriate.

This would paint a very different picture of the entire *Homo* line. We would see it as a single, highly variant species all the way back to the Australopithecines c.2mya. This subsequently means there would have been no extinctions of various hominin lines, only an assimilation of various hominin types that came into contact with each other as the species colonized the globe. This would ultimately call for our evolutionary model since c.2mya to be revised from its current multiple species cladistical model, into a linear clinal trajectory of multiple sub-species under the all-encompassing umbrella species of *Homo sapien*.

Problematic Issues

The following are some of the problematic issues I ran into when collecting and analyzing the data for the sites. As discussed earlier, if the issue was unsolvable, I rejected the site.

The sites I used were limited by several factors. These include number of information sources, source language, a lack of diagnostic fossils, a lack of associated archaeological

evidence, and/or unreliable dating. Therefore as displayed in Table 2 of Chapter 4, many of the sites that I researched were found to be unusable and my sample size ended up to be quite small.

Certain desired information was often unavailable for many of the sites used in my study. This tends to be problematic in the discipline of paleoanthropology in general, as evidence of this antiquity tends can be very scant. My study faced this problem for several behavioral indicators where the information was not available. This most often occurred in specialized site use, complex site structure, and the exploitation of non-local raw materials. These frequencies are displayed in Figure 68 of Chapter 6.

The fossil evidence itself was sometimes very limited, as in the case of Grotte du Renne, which consisted of only 29 teeth and a temporal bone fragment. These fossils were determined to be diagnostically Neanderthal, so the site was usable. But the fossil evidence from Blombos Cave in South Africa for example, proved to be inadequate. This collection consisted only of 9 heavily worn teeth, so therefore the fossil morphology was indeterminable.

‘Modern’ stone tool production was a problematic category in that I was faced with the question of frequency in declaring ‘modernity’. I decided that if one blade based tool was found at a site, and the rest were flake based; this was not enough to declare the site as showing ‘modernity’ in stone tools. Therefore, I made the category as a greater than/less than value so that blade production had to outnumber flake production in order to display ‘modern’ behavior. This served to exclude Neanderthals from much of the credit for producing ‘modern’ tools, even though they were consecutively doing this, only to a lesser degree than modern humans. This was seen at the Neanderthal site of Vindija. Here flake based tools outnumbered blade tools, but only at a percentage of 56.2%. So there was

significant blade production occurring at the site, but not enough to outweigh the flake production. Thus, the requirement for this ‘modern’ indicator was not met.

Bone tool evidence was sometimes limited, only consisted of a few items. This showed production of the technology, but not the development of an actual bone tool industry. This was the case at Klasies River Mouth. The site revealed only 3 bone items, a bone point and two notched pieces of bone. This is either due to poor preservation or that the hominins at this site had yet barely developed bone tools. Whatever the case, finding a few items is enough to declare that they were producing bone tools at the site and therefore meeting the ‘modern’ qualification for this study.

Artistic expression was often very limited as well, showing mostly only in the non-utilitarian use of pigment or in a few engraved items. Border Cave showed no actual artwork, but the use of pigments was seen in the infant burial as well as in several ochre pencils, the prior being difficult to declare as of a symbolic or artistic use. Engraved items can also be problematic to declare as art, as this assessment is often made on an item that often only shows a few lines scratched into the surface. This was the case at Buran-Kaya III, which revealed only one engraved ivory plate.

Jewelry was often scarce with sometimes only a few perforated items recovered from a site. La Quina revealed only two pierced fox teeth in its uppermost Mousterian layer. Not only is this evidence limited, but also argued to be intrusive from the overlying Aurignacian layer. However based on the evidence, the assessment is made that the hominins associated with this Mousterian layer were the producers of these items.

Site use and site structure were two indicators that were often difficult to assess. This was usually due to poor site preservation from taphonomic processes, out-dated excavation practices, or the complete lack of information in order to make a conclusion as to this behavior.

Of the structured hunting practices, seasonal hunting was the most difficult to assess. This was due to the often lack of testing on the faunal remains to determine their season of death.

Another issue I ran into during this study was placing the fossil remains within a concise period with the archaeological evidence. I was able to find exact dates for the fossil remains, but often not the archaeology. This meant I could only group the two together based on the layer from which they each were recovered. And often the layers at hand spanned long periods, upwards of 30ky. The most extreme case of this was at Klasies River Mouth, where the layers reviewed covered c.44ky. Also the evidence was often discussed not by particular layer, but by general terms such as Middle Stone Age layers or Upper Paleolithic layers. Although this did occur in a few sites, it did not however serve to alter the outcome of the study. This is because I made sure the ‘modern’ indicators counted as present were seen throughout the particular archaeological layer, allowing for the conclusion as to their association with the fossils.

The hominin fossils were also often difficult to categorize into a morphological type. In many cases the authors writing on the sites were conflicted as to with what morphological type the fossils belonged. This was the case with sites such as Tabun, where the fossil morphology is said to be Neanderthal, but also archaic or transitional between the two. Also at Klasies River Mouth, the fossils are declared to be of highly sexually dimorphic modern humans, while suggested by some to be an archaic transitional group. In these cases I took what showed to be the dominant opinion.

The stratigraphy was also often questioned by authors of the sites. Therefore certain artifacts were said to be out of context and thus not belonging to the hominin group present in the particular layer. This was the case at Vindija, where admixture is argued to be the reason that Neanderthal remains are associated with ‘modern’ tool types. However the evidence against this is more conclusive, therefore the site remains eligible for the study.

Dating then became problematic at some sites. This was the case with Koteski 14. Here a layer of ash within the relevant layer was declared as to being from the Campanian Ignimbrite eruption, which post-dates the radiocarbon date attained from the same ash by 7ky. In situations like this I had to choose the most reliable date, which in this case is the radiocarbon date.

One other limiting factor in this study was the out-dated excavation techniques that often occurred at some of the sites. Border Cave for instance, was first dug out first by guano diggers, who removed several fossils without proper report of their location. Also at Mladec, the original excavations from 1881-1882 were said to be more like a collecting of bones. And quarrying at the cave in 1904 removed sediments with archaeological material without informing archaeologists. The sites needed to show that a majority of the remains were recovered and recorded with proper excavation techniques in order to be usable for the study.

My overall approach was strong in that the presence of any particular ‘modern’ behavioral indicator is a conclusive sign that the accompanying ‘modern’ behavior was occurring at the site. However, a major weakness to my approach is that an absence of any indicator does not necessarily indicate an absence of the behavior at that site or in the hominins present there. It could mean either that the behavior was not taking place at that particular location during that period or simply that the evidence is no longer present. This is due to the fact that the expressed behavior is subject to various factors such as seasonality, geographic location, and site type. Also, the preservation of evidence available for recovery has been subject to taphonomic processes since the time of use until the actual archaeology was done thousands of years later. Therefore, such factors must be considered when drawing conclusions on site or hominin behavior based on what little evidence is available.

Most of the above issues, however more difficult they made the reporting of the site evidence, did not serve to deem the evidence unusable. For as many authors that questioned

them, there were as many or more that confirmed them. Thus, the overall functionality of the sites for purposes of my study, were not compromised.

Conclusion

This study has led to the rejection of many established dogmas in paleo-anthropology. One is the reinforced rejection of any sort of human revolution, rather that ‘modern’ behavior came about slowly over time. Two is the rejection of the idea that ‘modern’ behavior is solely a modern human phenomenon, as it is conclusively present in other past hominin species, as seen here in Neanderthals. Three is to reject the tendency to put archaeological evidence into any strict categories, rather viewing it as a mosaic evolution across species, time, and region. And finally to reject the current model for the past 2mya of human evolution as one of multiple species coming in and out of existence and replace it with a model of one species evolving through various sub-species in a mosaic of transitions over time and across regions.

The end results of this study tell us that ‘modern’ behavior does not match modern morphology in the archaeological record; thus the hypothesis is rejected. Instead, we conclude that ‘modern’ cultural remains are associated with both anatomically modern and Neanderthal morphologies; therefore anatomically modern humans are not the sole innovators of ‘modern’ behavior.

References Cited

Ahern, James C.M.

2004 "New Discoveries and Interpretations of Hominid Fossils and Artifacts from Vindija Cave, Croatia" In Journal of Human Evolution 46(1):27-67.

Ambrose, S.

2010 "Coevolution of Composite Tool Technology, Constructive Memory, and Language Implications for the Evolution of Modern Human Behavior" In Current Anthropology 51(1):135-147.

Andrefsky, William Jr.

2009 "The Analysis of Stone Tool Procurement, Production, and Maintenance" In Journal of Archaeological Research 17(1):65-103.

Anikovich, M.V.

2007 "Early Upper Paleolithic in Eastern Europe and Implications for the Dispersal of Modern Humans" In Science 315(5809):223-226.

Arensburg, B.

1989 "New Skeletal Evidence Concerning the Anatomy of Middle Palaeolithic Populations in the Middle East: the Kebara Skeleton" In The Human Revolution pp165-171. Eds. Paul Mellars and Chris Stringer, Princeton University Press, Princeton.

Backer, A.M.

1993 "Spatial Distribution at La Roche a Pierrot, Saint-Cesaire: Changing Uses of a Rockshelter" In Context of a Late Neandertal, Eds. F. Leveque, A. Backer, and M Guilbaud, pp. 105-127. Prehistory Press, Madison.

Backwell, Lucinda

2003 "Additional Evidence on the Early Hominid Bone Tools from Swartkrans with Reference to Spatial Distribution of Lithic and Organic Artifacts" In South African Journal of Science 99(5-6):259-267.

Bailey, Sarah

2006 "Dental Remains from the Grotte du Renne at Arcy-sur-Cure (Yonne)" In Journal of Human Evolution 50(5):485-508.

Bar-Yosef, Ofer

1992 "The Excavations in Kebara Cave, Mt. Carmel" In Current Anthropology 33(5):497-550.

Bar-Yosef, Ofer

1996 "The Dating of the Upper Paleolithic Layers in Kebara Cave, Mt. Carmel" In Journal of Archaeological Science 23(2):297-306.

Bar-Yosef, Ofer and Steven L. Kuhn

1999 "The Big Deal about Blades: Laminar Technologies and Human Evolution" In American Anthropologist 101(2):322-338.

Beaumont, PB

1978 "Modern Man in Sub-Saharan Africa Prior to 49000 Years BP - Review and Evaluation with Particular Reference to Border Cave" In South African Journal of Science 74(11):409-419.

Binford, Lewis R.

1980 "Willow Smoke and Dogs Tails': Hunter-Gatherer Settlement Systems and Archaeological Site Formation" In American Antiquity 45(1):4-20.

Binford, Lewis R.

1989 "Isolating the Transition to Cultural Adaptations: An Organizational Approach" In The Emergence of Modern Humans: Biocultural Adaptations in the Later Pleistocene pp18-44 Ed. Erik Trinkaus. Cambridge University Press, Cambridge.

Bird, M.I.

2003 "Radiocarbon Dating from 40-60 ka BP at Border Cave, South Africa" In Quaternary Science Review 22(8-9):943-947.

Brose, David S. and Milford H. Wolpoff

1971 "Early Upper Paleolithic Man and Late Middle Paleolithic Tools" In American Anthropologist 73(5):1156-1194.

Cartmill, Matt and Fred H. Smith

2009 The Human Lineage John Wiley and Sons, Inc. New Jersey.

Chabai, Victor P.

2001 "The Late Middle and Early Upper Paleolithic in Crimea (Ukraine)" In Les Premiers Hommes Modernes de la Peninsule Iberique pp. 25-35, Ed. Joao Zilhao, Trabalhas de Arqueologia 17.

Chabai, Victor P.

2003 "The Chronology and Industrial Variability of the Middle Upper Paleolithic Transition in Eastern Europe" In The Chronology of the Aurignacian and of the Transitional Technocomplexes: Dating Stratigraphies, Cultural Implications pp.71-88, Eds. Joao Zilhao and Francesco d'Errico, Trabalhos de Arqueologia 33.

Chase, Phillip G.

1989 "How Different was Middle Palaeolithic Subsistence?: A Zooarchaeological Perspective on the Middle to Upper Paleolithic Transition" In The Human Revolution pp338-365 Eds. Paul Mellars and Chris Stringer, Princeton University Press, Princeton.

Chase, Phillip G.

1990 "Tool-Making Tools and Middle Paleolithic Behavior" In Current Anthropology 31(4):443-447.

Chase, Phillip G.

1994 "Taphonomy and Zooarchaeology of a Mousterian Faunal Assemblage from La Quina, Charente, France" In Journal of Field Archaeology 21(3):289-305.

Clark, Desmond J.
1989 "The Origins and Spread of Modern Humans" In The Human Revolution pp565-588
Eds. Paul Mellars and Chris Stringer, Princeton University Press, Princeton.

Clark, Desmond J.
2003 "Stratigraphic, Chronological and Behavioral Contexts of Pleistocene *Homo sapiens*
from Middle Awash, Ethiopia" In Nature 423(6941):747-752.

Cooke, H.B.S.
1945 "Fossil Man in the Lebombo Mountains, South Africa: the "Border Cave"" In Man
45:6-13.

Coppa, Alfredo
2007 "Evidence for New Neanderthal Teeth in Tabun Cave (Israel) by the Application of
Self-Organizing Maps (SOMs)" In Journal of Human Evolution 52(6):601-613.

D'Errico, Francesco
2003 "Many Awns in our Argument: Bone Tool Manufacture and Use in the Chatelperronian
and Aurignacian Levels of the Grotte du Renne at Arcy-sur-Cure" In The Chronology of the
Aurignacian and the Transitional Technocomplexes: Dating, Stratigraphies, Cultural
Implications Eds. Zilhao, J and Francesco d'Errico, Instituto Portugues de Arqueologia.

d'Errico, Francesco
2007 "The Origin of Humanity and Modern Cultures: Archaeology's View" In Diogenes
54(2):122-

d'Errico, Francesco
2010 "Pigments from the Middle Palaeolithic Levels of Es-Skhul (Mount Carmel, Israel)" In
Journal of Archaeological Science 37(12):3099-3100.

Davis, Simon
1974 "Incised Bones from the Mousterian of Kebara Cave (Mount Carmel) and the
Aurignacian of Ha-Yonim Cave (Western Gallilee), Israel" In Paleorient 2(1-2):182-182.

Deacon, Hilary
2001 "Guide to Klasies River" Origins of Modern Humans in Africa Accessed March 15,
2010 from: <http://academic.sun.ac.za/archaeology/KRguide2001.PDF>.

Farizy, C
1990 "The Transition from Middle to Upper Paleolithic at Arcy-sur-Cure (Yonne, France):
Technological, Economic and Social Aspects" In The Emergence of Modern Humans: an
Archaeological Perspective Ed. Paul Mellars. Edinburgh University Press.

Freyer, David W.
2006a "Aurignacian Male Crania, Jaws, and Teeth from the Mladec Caves, Moravia, Czech
Republic" In Early Modern Humans at the Moravian Gate: The Mladec Caves and their
Remains Ed. Maria Teschler-Nicola. Springer Inc., New York.

- Freyer, David W.
2006b "Krapina 3: Cut Marks and Ritual Behavior?" In Periodicum Biologorum 108(4):519-524.
- Gargett, Robert H.
1999 "Middle Palaeolithic Burial is Not a Dead Issue: The View from Qafzeh, Saint-Césaire, Kebara, Amud, and Dederiyeh" In Journal of Human Evolution 37(1):27-90.
- Gaudzinski-Windheuser, Sabine
2011 "On Neanderthal Subsistence in Last Interglacial Forested Environments in Northern Europe" In Neanderthal Lifeways, Subsistence and Technology: One Hundred Fifty Years of Neanderthal Study Eds. N.J. Conrad and J. Richter. Springer Science and Business Media.
- Garrod D.A.E.
1939 The Stone Age of Mount Carmel Clarendon Press, Oxford.
- Gravina, Brad
2005 "Radiocarbon Dating of Interstratified Neanderthal and Early Modern Human Occupations at the Chatelperronian Type-Site" In Nature 438:51-56.
- Grayson, D.K.
2008 "The Large Mammals of Roc de Combe (Lot, France): The Chatelperronian and Aurignacian Assemblages" In Journal of Anthropological Archaeology 27(3):338-362.
- Green, Richard E.
2010 "A Draft Sequence of the Neandertal Genome" In Science 328:710-722.
- Grine, Frederick
1998 "Additional Human Fossils from Klasies River Mouth, South Africa" In Journal of Human Evolution 35(1):95-107.
- Grun, Rainer
1990a "Electron-Spin-Resonance Dating of Tooth Enamel from Klasies River Mouth Cave" In Current Anthropology 31(4):427-432.
- Grun, Rainer
1990b "ESR Dating Evidence For Early Modern Humans At Border Cave In South Africa." Letters To Nature. April. Cambridge University.
- Grun, Rainer
2003 "On the Age of Border Cave 5 Human Mandible" In Journal of Human Evolution 45(2):155-167.
- Grun, Rainer and Chris Stringer
2000 "Tabun revisited: revised ESR chronology and new ESR and U-series analyses of dental material from Tabun C1" In Journal of Human Evolution 39:601-612.
- Grun, Rainer and Chris Stringer
2005 "U-series and ESR analyses of bones and teeth relating to the human burials from Skhul" In Journal of Human Evolution 49(3):316-334.

Gvozdover, M.D.

1989 "The Typology of Female Figurines of the Kostenki Paleolithic Culture" In Anthropology and Archaeology of Eurasia 27(4):32-94.

Hardy, Bruce L.

2001 "Stone Tool Function at the Paleolithic Sites of Starosele and Buran Kaya III, Crimea: Behavioral Implications" In Proceedings of the National Academy of Sciences of the United States of America 98(19):10972-10977.

Harrold, Francis B.

1989 "Mousterian, Chatelperronian and Early Aurignacian in Western Europe: Continuity or Discontinuity?" In The Human Revolution pp677-713 Eds. Paul Mellars and Chris Stringer, Princeton University Press, Princeton.

Henry, Donald O.

2003 Neanderthals in the Levant: Behavioral Organization and the Beginnings of Human Modernity Continuum Publishing Co., London.

Henshilwood, Christopher S.

2001a "Blombos Cave, Southern Cape, South Africa: Preliminary Report on the 1992-1999 Excavations of the Middle Stone Age Levels" In Journal of Archaeological Science 28(4):421-448.

Henshilwood, Christopher S.

2001b "An Early Bone Tool Industry from the Middle Stone Age at Blombos Cave, South Africa: Implications for the Origins of Modern Human Behavior, Symbolism and Language" In Journal of Human Evolution 41(6):631-678.

Henshilwood, Christopher S.

2003 "The Origin of Modern Human Behavior: Critique of the Models and Their Test Implications" In Current Anthropology 44(5):627-651.

Henshilwood, Christopher S. and Francesco d'Errico

2009 "Engraved Ochres from the Middle Stone Age Levels at Blombos Cave, South Africa" In Journal of Human Evolution 57(1):27-47.

Higham, T.

2010 "Chronology of the Grotte du Renne (France) and Implications for the Context of Ornaments and Human Remains within the Chatelperronian" In Proceedings of the National Academy of Sciences of the United States of America 107(47):20234-20239.

Hoffecker, John F.

2010 "Evidence for Kill-Butchery Events of Early Upper Paleolithic Age at Kostenki, Russia" In Journal of Archaeological Science 37(5):1073-1089.

Hovers, Erella

2003 "An Early Case of Color Symbolism - Ochre Use by Modern Humans in Qafzeh Cave" In Current Anthropology 44(4):491-522.

Howell, Clark F.
1957 "The Evolutionary Significance of Variation and Varieties of Neanderthal Man" In The Quarterly Review of Biology 32(4):330-347.

Hublin, J.J.
1992 "Recent Human Evolution in Northwestern Africa" In Philosophical Transactions 337(1280):185-191.

Hublin, JJ
1996 "A Late Neanderthal Associated with Upper Palaeolithic Artefacts" In Nature 361(6579):224-226.

Jankovi, Ivor
2006 "Vindija Cave and the Modern Human Peopling of Europe" In Collegium Antropologicum 30(3):457-466.

Jelinek, Arthur J.
1982 "The Tabun Cave and Paleolithic Man in the Levant" In Science 216(2553):1365-1375.

Jelinek, A.J.
1989 "A Preliminary Report on Evidence Related to the Interpretation of Economic and Social Activities of Neanderthals at the Site of La Quina (Charente), France" In La Subsistance 6:99-106.

Karavanic, Ivor and Fred H. Smith
1998 "The Middle/Upper Paleolithic interface and the relationship of Neanderthals and early modern humans in the Hrvatsko Zagorje, Croatia" In Journal of Human Evolution 34(3):223-248.

Kaufman, Daniel
1999 Archaeological Perspectives on the Origins of Modern Humans: A View from the Levant Bergin and Garvey Pub., London.

Klein, Richard G.
1977 "The Mammalian Fauna from the Middle and Later Stone Age (Later Pleistocene) Levels at Border Cave, Natal Province, South Africa" In South African Archaeological Bulletin 32(125):14-27.

Klein, Richard G.
1989 "Biological and Behavioral Perspectives on Modern Human Origins in Southern Africa" In The Human Revolution pp529-546 Eds. Paul Mellars and Chris Stringer. Princeton University Press, Princeton.

Klein, Richard G.
1996 "Exploitation of Large Bovids and Seals at Middle and Later Stone Age Sites in South Africa" In Journal of Human Evolution 31(4):315-3334.

- Lam, Y.M.
1996 "Chin Morphology and Sexual Dimorphism in the Fossil Hominid Mandible Sample from Klasies River Mouth" In American Journal of Physical Anthropology 100(4):545-557.
- Lavaud-Girard, Françoise
1993 "Macrofauna from Casteperronien Levels at Saint-Cesaire, Charente-Maritime" In Context of a Late Neandertal, Eds. F. Leveque, A. Backer, and M Guilbaud, pp. 73-77. Prehistory Press, Madison.
- Leiberman, Daniel and John J. Shea
1994 "Behavioral-Differences Between Archaic and Modern Humans in the Levantine Mousterian" In American Anthropologist 96(2):300-322.
- Leiberman, D.E.
2002 "The Evolution and Development of Cranial Form in Homo sapiens" In Proceedings of the National Academy of Sciences of the United States of America 99(3):1134-1139.
- Leslie, David E.
2008 "Formal Variation in Lithic Projectile Armatures: Re-Interpreting Points from Tabun Cave, Israel" Masters Thesis, Florida Atlantic University.
- Leveque, Francois
1993 "The Castelperronian Industry of Saint-Cesaire: The Upper Level" In Context of a Late Neandertal, Eds. F. Leveque, A. Backer, and M Guilbaud, pp. 23-35. Prehistory Press, Madison.
- Malez, Mirko
1980 "Upper Pleistocene Hominids From Vindija, Croatia, Yugoslavia" In Current Anthropology 21(3):365-367.
- Marshack, Alexander
1990 "Early Hominid Symbol and Evolution of the Human Capacity" In The Emergence of Modern Humans pp457-489. Ed. Paul Mellars, Cornell University Press, New York.
- Mayer, Daniella E.
2009 "Shells and Ochre in Middle Paleolithic Qafzeh Cave, Israel: Indication for Modern Behavior" In Journal of Human Evolution 56(3):307-314.
- McBearty S. and A. Brooks
2000 "The Revolution that Wasnt: A New Interpretation of the Origin of Modern Human Behavior" In Journal of Human Evolution 39(5):453-563.
- Mellars, Paul
1989 "Technological Changes at the Middle Upper Paleolithic Transition - Economic, Social, and Cognitive Perspectives" In The Human Revolution pp338-365 Eds. Paul Mellars and Chris Stringer. Princeton University Press, Princeton.
- Mellars, Paul
2004 "Neanderthals and the Modern Human Colonization of Europe" In Nature 432(25):461-465.

Mellars, Paul

2006 "Archaeology and the Dispersal of Modern Humans in Europe: Deconstructing the "Aurignacian" In Evolutionary Anthropology 15(5):167-182.

Mellars, Paul

2007 "Confirmation of Neanderthal/Modern Human Interstratification at the Chatelperronian Type-Site" In Proceedings of the National Academy of Sciences of the United States of America 104(9):3657-3662.

Mercier, N.

1992 "Thermoluminescence Date for the Mousterian Burial Site of Es Skhul, Mt Carmel" In Journal of Archaeological Science 20(2):169-174.

Minugh-Purvis, Nancy

2000 "Krapina 1: A juvenile Neandertal from the early late Pleistocene of Croatia" In American Journal of Physical Anthropology 111(3):392-424.

Negash, Agazi

2011 "Varieties and Sources of Artefactual Obsidian in the Middle Stone Age of the Middle Awash, Ethiopia" In Archaeometry 53(4):661-673.

Oliva, Martin

2006 "The Upper Paleolithic Finds from the Mlacc Cave" In Early Modern Humans at the Moravian Gate: The Mladec Caves and their Remains Ed. Maria Teschler-Nicola. Springer Inc., New York.

Patou-Mathis, Marylene

1993 "Taphonomic and Paleoethnographic Study of the Fauna Associated with the Neandertal of Saint Césaire" In Context of a Late Neandertal, Eds. F. Leveque, A. Backer, and M Guilbaud, pp. 79-102. Prehistory Press, Madison.

Pearson, Osbjorn M.

1997 "Re-analysis of the Hominid Radii from Cave of Hearths and Klasies River Mouth, South Africa" In Journal of Human Evolution 32(6):577-591.

Pfeiffer, John E.

1982 The Creative Explosion Harper and Row Publishers, New York.

Prat, Sandrine

2011 "The Oldest Anatomically Modern Humans from Far Southeast Europe: Direct Dating, Culture, and Behavior" In PLoS ONE 6(6):e20834.

Riel-Salvatore, Julien

2010 "A Niche Construction Perspective on the Middle-Upper Paleolithic Transition in Italy" In Journal of Archaeological Method Theory 17(4):323-355.

Rightmire, G.P.

1984 "Homo sapiens in Sub-Saharan Africa" In The Origin of Modern Humans: A World Survey of the Fossil Evidence Eds. Smith, Fred H. and Frank Spencer. New York: Alan R. Liss Inc.

- Rightmire, G.P.
2001 "New Human Teeth from Middle Age Deposits at Klasies River Mouth, South Africa" In Journal of Human Evolution 41(6):535-544.
- Rightmire, G.P.
2006 "Human Foot Bones from Klasies River Main Site, South Africa" In Journal of Human Evolution 50(1):96-103.
- Rink, W.J.
1995 "ESR Ages for Krapina Hominids" In Nature 378(6552):24.
- Russell, Mary D.
1987 "Mortuary Practices at the Krapina Neanderthal Site" In American Journal of Physical Anthropology 72(3):1987.
- Schwarcz, Henry
1989 "ESR Dating of the Neanderthal Site, Kebara Cave, Israel" In Journal of Archaeological Science 16(6):653-659.
- Schwarcz, Henry P.
1998 "Neanderthal Skeleton from Tabun: U-Series Data by Gamma-Ray Spectrometry" In Journal of Human Evolution 6:635-645.
- Schwartz, J.
2000 "The Human, Chin Revisited: What is it and Who has it?" In Journal of Human Evolution 38(3):367.
- Schwartz, Jeffery H. and Ian Tattersall
2006 "Morphology, Variability, and Systematics: Lessons from Krapina" In Periodicum Biologorum 108(4):389-401.
- Shea, John J.
2001 "The Middle Paleolithic: Early Modern Humans and Neanderthals in the Levant" In Near Eastern Archaeology 64(1/2):38-64.
- Shea, John J.
2006 "The Origins of Lithic Projectile Point Technology: Evidence from Africa, the Levant, and Europe" In Journal of Archaeological Science 33:323-346.
- Shick, T and M. Sekelis
1977 "Mousterian Assemblages in Kebara Cave, Mount Carmel" In Eretz-Israel 13:97-150.
- Simek, Jan F.
1987 "Chronological Changes in Stone Tool Assemblages from Krapina (Croatia)" In Journal of Human Evolution 32(6):561-575.
- Sinitsyn, Andrei A.
2003a "A Palaeolithic Pommpeii at Kostenki, Russia" In Antiquity 77:9-14.

Sinitsyn, Andrei A.

2003b "The Most Ancient Sites of Kostenki in the Context of the Initial Upper Paleolithic of Northern Eurasia" In The Chronology of the Aurignacian and of the Transitional Technocomplexes: Dating Stratigraphies, Cultural Implications pp. 89-108, Eds. Joao Zilhao and Francesco d'Errico, *Trabalhos de Arqueologia* 33.

Sinitsyn, Andrei A.

2006 "Radiocarbon Dating and Chronology of the Early Upper Paleolithic at Kostenki" In Quaternary International 152:164-174.

Smith, Fred H.

1984 "Fossil Hominids from the Upper Pleistocene of Central Europe and the Origin of Modern Humans" In The Origins of Modern Humans: A World Survey of the Fossil Evidence Eds. Fred H. Smith and Frank Spencer. New York, Alan R Liss Inc.

Smith, Fred H.

1999 "Direct Radiocarbon Dates for Vindija G1 and Velika Pecina Late Pleistocene Hominid Remains" In Proceedings of the National Academy of Sciences of the United States of America 96(22):12281-12286.

Smith, Fred H.

2005 "The Assimilation Model, Modern Human Origins in Europe, and the Extinction of Neanderthals" In Quaternary International 137:7-19.

Smith, Tanya and Michel Toussaint

2007 "Rapid Dental Development in a Middle Paleolithic Belgian Neanderthal" In Proceedings of the National Academy of Sciences of the United States of America 104(51):20220-20225.

Stefan, V. and Eric Trinkaus

1998 "Discrete Trait and Dental Morphometric Affinities of the Tabun 2 Mandible" In Journal of Human Evolution 34(5):443-468.

Stefan, Vincent H. and Eric Trinkaus

1998 "Discrete Trait and Dental Morphometric Affinities of the Tabun 2 Mandible" In Journal of Human Evolution 34(5):443-468.

Stewart, T.D.

1977 "Neanderthal Skeletal Remains from Shanidar Cave, Iraq - Summary of Findings to Date" In Proceedings of the National Academy of Sciences of the United States of America 121(2):121-165.

Straus, Lawrence Guy

2010 "The Emergence of Modern-Like Forager Capacities and Behaviors in Africa and Europe: Abrupt or Gradual, Biological or Demographic?" In Quaternary International

Stringer, Chris

1984 "The Origin of Anatomically Modern Humans in Western Europe" In The Origins of Modern Humans: A World Survey of the Fossil Evidence Eds. Fred H. Smith and Frank Spencer, pp. 51-136. Alan R. Liss Inc., New York.

Svoboda, Jiri A.

2001 "Mladec and Other Caves in the Middle Danube Region: Early Modern Humans, Late Neanderthals, and Projectiles" In Les Premiers Hommes Modernes de la Peninsule Iberique pg 45-60.

Svoboda, Jiri A.

2006 "The Structure of the Cave, Stratigraphy, and Depositional Context" In Early Modern Humans at the Moravian Gate: The Mladec Caves and their Remains Ed. Maria Teschler-Nicola. Springer Inc., New York.

Templeton, Alan R.

2002 "Out of Africa Again and Again" In Nature 416:45-51

Thackeray, JF

1988 "On Statistical Analyses of Faunal Data from Klasies River Mouth" In Current Anthropology 29(1):149-151.

Traschler-Nicola, Maria

2006 "Taphonomic Aspects of the Human Remains from the Mladec Cave" In Early Modern Humans at the Moravian Gate: The Mladec Caves and their Remains Ed. Maria Teschler-Nicola. Springer Inc., New York.

Trinkaus, Erik

1984 "Western Asia" In The Origins of Modern Humans: A World Survey of the Fossil Evidence Ed. Fred H. Smith and Frank Spencer, New York, Alan R Liss Inc.

Trinkaus, Eric

1985 "Cannibalism and Burial at Krapina" In Journal of Human Evolution 14(2):1985.

Trinkaus, Eric

1989 The Emergence of Modern Humans: Biocultural Adaptations in the later Pleistocene Cambridge University Press, New York.

Trinkaus, Eric

1995 "Near Eastern Late Archaic Humans" In Paleorient 21(21):9-24.

Trinkaus, Eric

2003 "Neandertal Faces were not Long; Modern Human Faces are Short" In Proceedings of the National Academy of Sciences of the United States of America 100(14):8142-8145.

Trinkaus, Eric

2007 "European Early Modern Humans and the Fate of the Neandertals" In Proceedings of the National Academy of Sciences of the United States of America 104(18):7367-7372.

Trinkaus, Eric and Majorie LeMay

1982 "Occipital Bunning Among Later Pleistocene Hominids" In American Journal of Physical Anthropology 57(1):27-35.

Valladas, Helene

1987 "Thermoluminescence Dates for the Neanderthal Burial Site at Kebara in Israel" In Nature 330(6144):159-160.

Valladas, H

1988 "Thermoluminescence Dates for the Mousterian Proto-Cro Magnons from Qafzeh Cave (Israel)" In Nature 331:614-616.

Vallverdu, Josep

2010 "Sleeping Activity Area within the Site Structure of Archaic Human Groups: Evidence from Abric Romari Level N Combustion Activity Areas" In Current Anthropology 51(1):137-145.

Vandermeersch, Bernard

2001 "The Excavation of Qafzeh" In Bulletin de Centre de Recherche Francais a Jerusalem.

Vandermeersch, Bernard

2002 "The Excavation of Qafzeh" In Bulletin du Centre de Recherche Francais a Jerusalem.

Vanhaeren, Marian

2006 "Middle Paleolithic Shell Beads in Israel and Algeria" In Science 312(5781):1785-1788.

Verna, C.

2010 "Two New Hominin Cranial Fragments from the Mousterian Levels at La Quina (Charente, France)" In Journal of Human Evolution 58:273-278.

Verna, C and Francesco d'Errico

2010 "The Earliest Evidence for the Use of Human Bone as a Tool" In Journal of Human Evolution 60(2):145-147.

Villa, Paola

2010a "The Howiesons Poor and MSA III at Klasies River Main Site, Cave 1A" In Journal of Archaeological Science 37(3):630-655.

Villa, Paola and Sylvain Soriano

2010b "Hunting Weapons of Neanderthals and Early Modern Humans in South Africa: Similarities and Differences" In Journal of Anthropological Research 66(1):5-38.

Villa, Paola and Francesco d'Errico

2001 "Bone and Ivory Points in the Lower and Middle Paleolithic of Europe" In Journal of Human Evolution 41(2):69-112.

Vineyard, C. and F. Smith

1997 "Morphometric Relationships between the Supraorbital Region and Frontal Sinus in Melanesian Crania" In Homo 48(1):1-21.

Vogel, J.C. and H.T. Waterbolk

1963 "Groningen Radiocarbon Dates IV" In Radiocarbon 5:163-202.

Vogel, J.C. and H.T. Waterbolk

1967 "Groningen Radiocarbon Dates VII" In Radiocarbon 9:107-155.

Villa, Paola and Francesco D'errico

2001 "Bone and Ivory Points in the Lower and Middle Paleolithic of Europe" In Journal of Human Evolution 41(2):69-112.

White, Randall

1989 "Production Complexity and Standardization in Early Aurignacian Bead and Pendant Manufacture: Evolutionary Implications" In The Human Revolution pp366-390 Eds. Paul Mellars and Chris Stringer. Princeton University Press, Princeton.

White, Tim

2003 "Pleistocene *Homo sapiens* from Middle Awash, Ethiopia" In Nature 423(6941):742-747.

Wild, Eva Maria

2001 "Age Determination of Fossil Bones from the Vindija Neanderthal Site in Croatia" In Radiocarbon 43(2B):1021-1028.

Wild, Eva M.

2005 "Direct Dating of Early Upper Palaeolithic Human Remains from Mladec" In Nature 435:332-335.

Wild, Eva M.

2006 "14C Dating of Early Upper Palaeolithic Human and Faunal Remains from Mladec" In Early Modern Humans at the Moravian Gate: The Mladec Caves and their Remains Ed. Maria Teschler-Nicola. Springer Inc., New York.

Wolpoff, Milford H.

2006a "Aurignacian Female Crania and Teeth from the Mladec Caves, Moravia, Czech Republic" In Early Modern Humans at the Moravian Gate: The Mladec Caves and their Remains Ed. Maria Teschler-Nicola. Springer Inc., New York.

Wolpoff, Milford H.

2006b "Inventory and Photo-Documentation of the Mladec Hominid Remains" In Early Modern Humans at the Moravian Gate: The Mladec Caves and their Remains Ed. Maria Teschler-Nicola. Springer Inc., New York.

Wolpoff, Milford H.

2006c "Lost, Destroyed or Misidentified Postcranial Specimens from Mladec" In Early Modern Humans at the Moravian Gate: The Mladec Caves and their Remains Ed. Maria Teschler-Nicola. Springer Inc., New York.

Wurz, Sarah

2002 "Variability in the Middle Stone Age Lithic Sequence, 115,000-60,000 Years Ago at Klasies River, South Africa" In Journal of Archaeological Science 29(9):1001-1015.

Zollikofer, Christopher, P.E.

2002 "Evidence for Interpersonal Violence in the St. Cesaire Neanderthal" In Proceedings for the National Academy of Sciences of the United States of America 99(9):6444-6448.

Zilhao, Joao

2006 "Analysis of Aurignacian Interstratification at the Chatelperronian-Type Site and Implications for the Behavioral Modernity of Neandertals" In Proceedings of the National Academy of Sciences of the United States of America 130(33):12643-12648.

Zilhao, Joao

2007 "The Emergence of Ornaments and Art: An Archaeological Perspective on the Origins of "Behavioral Modernity" In Journal of Archaeological Research 15(1):1-54.

Images Cited

Figure 1

2006 “Head Skull Anterior View” Wikipedia Commons Accessed August 15, 2010 from http://commons.wikimedia.org/wiki/File:Head_skull_anterior_view.jpg.

Figure 2

2006 “Head Skull Lateral View” Wikipedia Commons Accessed August 15, 2010 from http://commons.wikimedia.org/wiki/File:Human_skull_lateral_view.jpg.

Figure 3

2010 “Modern Humans, Neanderthals May Have Interbred” Skadi Forum Accessed September 1, 2010 from <http://forums.skadi.net/showthread.php?p=858425>.

Figure 4

2010 “Neanderthals” Citizendium Accessed September 1, 2010 from <http://en.citizendium.org/wiki/Neanderthal>.

Figure 5

Trinkaus, Eric

2007 “European Early Modern Humans and the Fate of the Neandertals” In Proceedings of the National Academy of Sciences of the United States of America 104(18):7367-7372.

Figure 6

2010 “Neanderthals” Citizendium Accessed September 1, 2010 from <http://en.citizendium.org/wiki/Neanderthal>.

Figure 7

Smith, Tanya and Michel Toussaint

2007 “Rapid Dental Development in a Middle Paleolithic Belgian Neanderthal” In Proceedings of the National Academy of Sciences of the United States of America 104(51):20220-20225.

Figure 8

2006 “Jebel-Iroud” Wikipedia Commons Accessed September 15, 2010 from <http://commons.wikimedia.org/wiki/File:Jebel-Irhoud.png>.

Figure 9

(n.d.) “Field Projects – Jebel Irhoud” Department of Human Evolution Accessed September 16, 2010 from <http://www.eva.mpg.de/evolution/files/irhoud.htm>.

Figure 10

(n.d.) “The History of Man Through the Study of Tools and Weapons” World Museum of Man Accessed October 20, 2010. From <http://www.worldmuseumofman.org/display.php?item=634>.

Figure 11

(n.d.) “The History of Man Through the Study of Tools and Weapons” World Museum of Man Accessed October 20, 2010. From <http://www.worldmuseumofman.org/display.php?item=508>.

Figure 12

(n.d.) The Iceman: Medical Knowledge we Never Dreamed of 5,200 Years Ago Accessed October 20, 2010. From <http://www.mesacc.edu/dept/d10/asb/iceman/iceman.html>.

Figure 13

(n.d.) "The History of Man Through the Study of Tools and Weapons" World Museum of Man Accessed October 20, 2010. From <http://www.worldmuseumofman.org/display.php?item=505>.

Figure 14

Mellars, Paul

2006 "Archaeology and the Dispersal of Modern Humans in Europe: Deconstructing the "Aurignacian" In Evolutionary Anthropology 15(5):167-182.

Figure 15

(n.d.) "Transverse Arrowheads" Lithic Casting Lab Accessed October 20, 2010. From <http://www.lithiccastinglab.com/gallery-pages/2002novembertransversepointspage2.htm>.

Figure 16

Backwell, Lucinda

2003 "Additional Evidence on the Early Hominid Bone Tools from Swartkrans with Reference to Spatial Distribution of Lithic and Organic Artifacts" In South African Journal of Science 99(5-6):259-267.

Figure 17

d'Errico, Francesco

2007 "The Origin of Humanity and Modern Cultures: Archaeology's View" In Diogenes 54(2):122-133.

Figure 18

McBearty S. and A. Brooks

2000 "The Revolution that Wasnt: A New Interpretation of the Origin of Modern Human Behavior" In Journal of Human Evolution 39(5):453-563.

Figure 19

d'Errico, Francesco

2007 "The Origin of Humanity and Modern Cultures: Archaeology's View" In Diogenes 54(2):122-

Figure 20

d'Errico, Francesco

2007 "The Origin of Humanity and Modern Cultures: Archaeology's View" In Diogenes 54(2):122-

Figure 21

(n.d.) Etsy Accessed November 2, 2010. From

<http://www.etsy.com/listing/16289817/primitive-stone-age-knife-replica-flint>.

Figure 22

Verna, C and Francesco d'Errico

2010 "The Earliest Evidence for the Use of Human Bone as a Tool" In Journal of Human Evolution 60(2):145-147.

Figure 23

Henshilwood, Christopher S.

2001a "Blombos Cave, Southern Cape, South Africa: Preliminary Report on the 1992-1999 Excavations of the Middle Stone Age Levels" In Journal of Archaeological Science 28(4):421-448.

Figure 24

2008 "First Impressions" The New Yorker Accessed November 2, 2010. From http://www.newyorker.com/reporting/2008/06/23/080623fa_fact_thurman.

Figure 25

McBearty S. and A. Brooks

2000 "The Revolution that Wasnt: A New Interpretation of the Origin of Modern Human Behavior" In Journal of Human Evolution 39(5):453-563.

Figure 26

Zilhao, Joao

2007 "The Emergence of Ornaments and Art: An Archaeological Perspective on the Origins of "Behavioral Modernity" In Journal of Archaeological Research 15(1):1-54.

Figure 27

1996 "Stone Age Art" ArtLex Accessed November 2, 2010. From <http://www.artlex.com/ArtLex/s/stoneage.html>

Figure 28

Zilhao, Joao

2007 "The Emergence of Ornaments and Art: An Archaeological Perspective on the Origins of "Behavioral Modernity" In Journal of Archaeological Research 15(1):1-54.

Figure 29

Zilhao, Joao

2007 "The Emergence of Ornaments and Art: An Archaeological Perspective on the Origins of "Behavioral Modernity" In Journal of Archaeological Research 15(1):1-54.

Figure 30

(n.d.) "Koros Culture Environment, Settlement and Subsistence" Accessed November 2, 2010. From <http://www.cardiff.ac.uk/hisar/archaeology/reports/koros/>.

Figure 31

2010 "Global Justice Ecology Project" Climate Connections Accessed February 10, 2011. From <http://climate-connections.org/2010/10/15/africa-and-the-climate-finance-controversy/>.

Figure 32

2010 "Global Justice Ecology Project" Climate Connections Accessed February 10, 2011. From <http://www.zonu.com/fullsize-en/2009-12-22-11445/Europe-satellite-map-2002.html>.

Figure 33

White, Tim

2003 "Pleistocene *Homo sapiens* from Middle Awash, Ethiopia" In Nature 423(6941):742-747.

Figure 34

1979 "Klasies River Mouth Cave, South Africa" flickr Accessed February 15, 2011. From <http://www.flickr.com/photos/gbaku/988626694/>.

Figure 35

2010 "Border Cave" Sw@ziNeT Accessed February 20, 2011. From <http://swazinet.com/border-cave/border-cave-2/>.

Figure 36

Davis, Simon

1974 "Incised Bones from the Mousterian of Kebara Cave (Mount Carmel) and the Aurignacian of Ha-Yonim Cave (Western Gallilee), Isreal" In Paleorient 2(1-2):182-182.

Figure 37

Bar-Yosef, Ofer

1992 "The Excavations in Kebara Cave, Mt. Carmel" In Current Anthropology 33(5):497-550.

Figure 38

Shea, John J.

2001 "The Middle Paleolithic: Early Modern Humans and Neanderthals in the Levant" In Near Eastern Archaeology 64(1/2):38-64.

Figure 39

Shea, John J.

2001 "The Middle Paleolithic: Early Modern Humans and Neanderthals in the Levant" In Near Eastern Archaeology 64(1/2):38-64.

Figure 40

1965 "Qafzeh Human Remains" Science Photo Library Accessed February 30, 2011. From <http://www.sciencephoto.com/media/116067/enlarge>.

Figure 41

Vanhaeren, Marian

2006 "Middle Paleolithic Shell Beads in Israel and Algeria" In Science 312(5781):1785-1788.

Figure 42

(n.d.) "Mount Carmel" Wikipedia Accessed February 30, 2011. From http://en.wikipedia.org/wiki/Mount_Carmel.

Figure 43

2011 "Saint Cesaire Neanderthal Skeleton" Don's Maps Accessed March 10, 2011. From <http://www.donsmaps.com/stcesaire.html>.

Figure 44

Higham, T.

2010 “Chronology of the Grotte du Renne (France) and Implications for the Context of Ornaments and Human Remains within the Chatelperronian” In Proceedings of the National Academy of Sciences of the United States of America 107(47):20234-20239.

Figure 45

Verna, C and Francesco d’Errico

2010 “The Earliest Evidence for the Use of Human Bone as a Tool” In Journal of Human Evolution 60(2):145-147.

Figure 46

Frayer, David W.

2006b “Krapina 3: Cut Marks and Ritual Behavior?” In Periodicum Biologorum 108(4):519-524.

Figure 47

Jankovi, Ivor

2006 “Vindija Cave and the Modern Human Peopling of Europe” In Collegium Antropologicum 30(3):457-466.

Figure 48

Frayer, David W.

2006a “Aurignacian Male Crania, Jaws, and Teeth from the Mladec Caves, Moravia, Czech Republic” In Early Modern Humans at the Moravian Gate: The Mladec Caves and their Remains Ed. Maria Teschler-Nicola. Springer Inc., New York.

Figure 49

Wolpoff, Milford H.

2006b “Inventory and Photo-Documentation of the Mladec Hominid Remains” In Early Modern Humans at the Moravian Gate: The Mladec Caves and their Remains Ed. Maria Teschler-Nicola. Springer Inc., New York.

Figure 50

2011 “Toute l’actualite de mammoth” Le nouvel Observateur Accessed February 20, 2011. From <http://actualite.nouvelobs.com/mammoth/>.

Figure 51

2010 “DNA Analyzed from Early European” BBC News Accessed March 10, 2011. From <http://news.bbc.co.uk/2/hi/8435317.stm>.