

ASSIGNMENT 4

HUMAN ORIGINS

We begin our journey through human prehistory with a glance at the Great Ice Age, at the complicated climatic fluctuations of the past 2.5 million years. These changes have been particularly dramatic over the past 700,000 years, and assume great importance in later prehistory. The second part of Assignment 4 examines the scientific evidence for the origins of humankind, focusing on recent discoveries in tropical Africa. How did humans evolve and why? What behavioral changes are associated with human origins, and what is the archaeological record for human origins?

IMPORTANT: Please note that the Olduvai exercise is a two-week assignment in order to give you sufficient time to complete it with your group. You will present and discuss it during Week 5.



WHAT LIES AHEAD?

Assignment Objectives

1. Outline and describe the basic chronology and major climatic fluctuations of the Ice Age, with special reference to the past 128,000 years.
2. Describe the salient features of Oldowan technology and its implications for studying early human behavior.
3. Be able to evaluate the archaeological evidence for the earliest human behavior with special reference to the archaeological record at Olduvai Gorge.



WORK REQUIRED

1. Readings: World Prehistory. Read Chapter 2, plus Anthology.
2. Web Exercises: 4-1: The Ice Age, 4-2: Introducing the skeletons in your closet, 4-3: Principles of Lithic Technology, 4-4: The Formation of Olduvai Gorge, and 4-5: The Archaeology of Olduvai Gorge.
3. Group Projects: Olduvai Gorge Exercise Begins

Note: You should be working on your Mid-term papers!



LECTURE 1: HUMAN ORIGINS

This week's lecture provides important general background. We:

- Describe the early history of research into human origins, with special reference to the challenges unique to this kind of archaeology.
- Characterize the latest thinking on the development of modern humans, including the evidence for our African origins around 200,000 years ago and the controversy over some of the latest discoveries.



LECTURE 2: PALAEOANTHROPOLOGY

The archaeology of human origins is a complex multidisciplinary enterprise. How does one excavate an early hominid cache, camping, or kill site? What methods are most productive and how are the finds analyzed? The site of Terra Amata in France serves as a case study.



FILM: NEANDERTHALS ON TRIAL

This film examines the controversy about our relationship to our nearest extinct relative - or are they still here... ?



CHRONOLOGICAL TABLE

The Chronological Table below is the first of a series of cumulative chronologies of human prehistory. Each of these tables is for your reference, as we do not intend to spend a lot of time on dating here. Take a careful look at this table, and note the time scales for the various hominid forms discussed in the Assignment, the time scale for major developments such as toolmaking, and the major biological and cultural developments in the right hand columns. The major geological and climatic framework appears at right.

Now Read on...

CHRONOLOGICAL TABLE			
Years B.P.	Geology	Fossils	Developments
Present	BRUNHESES	Homo sapiens sapiens	New World Settlement
		Early Homo sapiens	
		?	
		?	
		?	
1 million		Homo erectus	Peopling of Temperate Zones
		?	
		?	
		?	
		?	
2 million	MATUYAMA	Homo ? habilis	? Fire
		?	
		?	
		?	
3 million		Australopithecus	Tool-Making
		?	
		?	
		?	
4 million		Ardipithecus Ramidus	Bipedal Posture



STUDYING THE ICE AGE FRAMEWORK

As we saw in Assignment 2, a combination of deep sea cores, pollen analyses, and geological studies provide us with the critical framework we need for linking the events of the Ice Age with human prehistory.

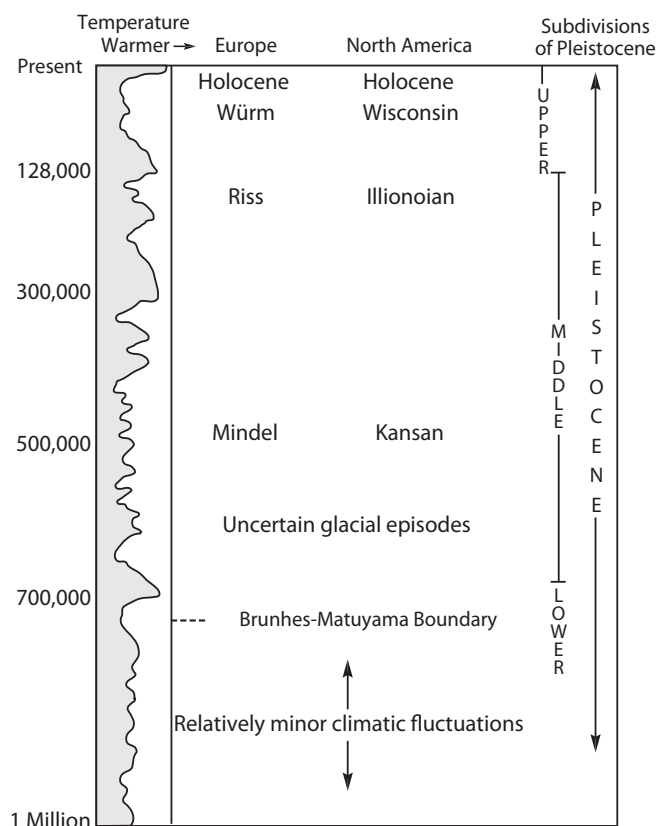
Clearly, many details of the Ice Age are irrelevant for our very general purposes. For most of the past, and certainly until about 50,000 years ago, the human population of the Old World was infinitesimal by today's standards, probably only a few hundred thousand people. But the scattered human bands that did flourish were affected by short- and long-term climatic change both in very general ways and as important members of their local ecosystem. Here we are concerned with global changes in Ice Age climate and how they affected ancient societies.

- First, we will look at the general pattern of Ice Age climatic change over the past 2.5 million years, using mainly data from deep sea cores.
- Then we will examine the last interglacial and the last (Würm) glaciation in considerable detail. This is because the closing 128,000 years of the Ice Age, the period covered by the last interglacial and the Würm are comparatively well known, and also of great importance for understanding the spread of modern humans all over the globe.

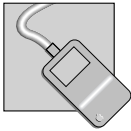
THE GENERAL FRAMEWORK

Let's start with the general outline. The Table (4.2) provides you with this framework. Please study it closely and note the following:

1. The so-called Brunhes-Matuyama boundary, which represents the moment when the earth's magnetic field changed from being reversed (before 730,000) to its normal, present day, polarity. The beginning of the Brunhes is clearly marked on the diagram as a base line for later climatic changes.
2. Climatic changes until about 800,000 years ago were relatively minor. Since then, glacial periods have occurred about every 90,000 years.



3. There have been at least nine glacial periods. For at least 70% of the past 730,000 years, the world's climate has been in transition between warm and cold or vice versa.
4. The Upper Pleistocene, a term we use occasionally, began 128,000 years ago.
5. The names of the major glaciations in North America and the Old World, which we will use frequently.



Web exercise 4-1: The Ice Age
(60 minutes)

This exercise is designed to show you some of the dramatic changes in Ice Age climate during the past 100,000 years, reconstructing climate and major environmental zones of the world during the height of the Würm glaciation, when Neanderthals and modern humans inhabited the earth. The exercise has two stages:

1. The first stage animates the changes in ice sheets, sea levels and vegetational zones during the cold millennia and at the end of the Ice Age. This highlights the complicated changes that took place and the relationships between them.
2. The second reconstructs the global environment 20,000 years ago, at the height of the last cold snap of the Ice Age, and relates this to the challenges of human settlement, to the needs of people living in such an environment, with bitterly cold nine-month winters.

When you have finished this exercise, come back to the Study Guide and read on...



HUMAN BEGINNINGS

The origins of humankind have fascinated scholars for centuries, a search that was once shackled with the chains of theological dogma. Then, in 1859, Charles Darwin's Theory of Evolution and Natural Selection opened up a limitless expanse of prehistoric time for the complicated processes of human evolution. The length of the human past has expanded dramatically during the past half-century. As recently as 1959, people thought in terms of 100,000 to 200,000 years. Now a date of 2.5 million years for the first appearance of Homo is widely accepted.

In this Assignment, we can but examine the highlights of the many controversies that surround human origins. Let's begin, however, by identifying two areas of common agreement:

- There are many similarities in behavior and physical characteristics between the hominids (members of the family Hominidae, which includes modern humans, earlier human subspecies, and their direct ancestors) and their closest primate relatives. These can be explained by identical characteristics that each group in-

herited millions of years ago from a common ancestor.

- It is almost certain that humans originated in tropical Africa, since this is where most species of apes are to be found.

Disagreements surround:

- The fossil and archaeological evidence for human evolution and very early human behavior.
- The changes in human behavior that served to distinguish hominids from their nonhuman primate relatives.

We focus on the disagreements here, as they are the core of the problem of human origins.

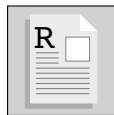
The material is organized into four topics. First, we cover the history of research into human origins, with some background on the Leakeys. From there we examine the fossil and archaeological evidence for the first toolmaking hominids. Lastly, we evaluate the hypotheses surrounding the origins of human behavior.

Please read on



RESEARCH INTO HUMAN ORIGINS

Anthology section: "1. History of Research." Read this passage in its entirety.



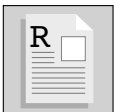
When you have finished, read on here . . .



FOSSILS, DATES, & EVOLUTIONARY SCHEMES

In this section, we trace three anatomical strands—*anatomical, chronological, and evolutionary*—and will take you through them in a sequence of learning activities. We strongly recommend that you plan to go through this section in one session, to ensure continuity.

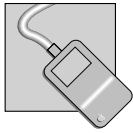
We begin with two readings:



World Prehistory: A Brief Introduction. Read pages 36-58.

Anthology section: "2. Human Evolution, the fossil evidence."

The important thing to realize is that the ladder like schemes of a generation ago have now given way to much more elaborate, bush like formulations, which allow for a great diversity of hominids after 4 million years ago.

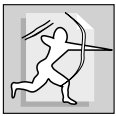


Now a web exercise:

Web exercise 4-2: Introducing the skeletons in your closet
(30 to 40 minutes)

This exercise is designed to familiarize you with your distant hominid relations. The exercise presents basic information on each hominid form. In addition you can examine the cranial morphology of each species as well as artists' reconstructions of what we believe these beings looked like in the flesh. Review the information presented and make notes as necessary in order to incorporate this information with your reading material for later use - note that the reading from the textbook is more up-to-date.

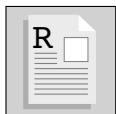
When you have finished, read on here:



THE ARCHAEOLOGY OF HUMAN ORIGINS

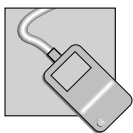
Now it's time to delve into the archaeological record in much more detail, to examine the record of human behavior at Olduvai and other major sites.

Let us say at once that the sites and artifacts we describe are very ancient indeed, to the point that it is impossible to draw meaningful analogies between modern hunter-gatherers or living non-human primates and traces of human behavior found in the ground. This means that archaeologists have used a variety of minute, and often specialized, methods to probe and interpret the concentrations of animal bones and stone artifacts found at Olduvai Gorge and elsewhere. These methods will become apparent in the work that follows. Again, a sequence of learning experiences, mainly on the Web, as follows:



World Prehistory. Read pages 59-63.

This passage covers the simple technology of the first humans.

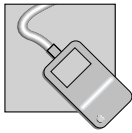


Web exercise 4-3: Principles of Lithic Technology
(30 to 45 minutes)

Web exercise 4-3 introduces you to the fundamentals of stone tool manufacture, from the basics of fracture mechanics through the main toolmaking methods used by people through time and throughout the world. Finally, we introduce you to the three main types of the earliest stone tools—such as those found at Olduvai and elsewhere in East and Southern Africa.

Web exercise 4-4: The Formation of Olduvai Gorge
(30 to 45 minutes)

This exercise explores the reasons why East Africa has been such a rich area for the discovery of early hominid sites and remains. We begin with an overview of the entire East African tectonic region—the geological and tectonic context within which sites like Olduvai Gorge, Omo, Koobi Fora, and Hadar were formed. We then zoom in to examine the formation processes of the Olduvai Gorge region, illustrating the cycle of deposition and erosion that has made it one of the premier hominid sites in the world. Review the developmental sequence for Olduvai carefully, as it provides clues for the problem posed in Exercise 4-5.



Web exercise 4-5: The Archaeology of Olduvai Gorge

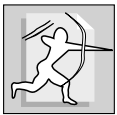
A Group Project to be presented and handed in during section next week (4 to 6 hours)



Complete instructions and background briefing appear in:

Anthology section: "3. The Olduvai Exercise."

Anthology section: "4. Oldowan technology"



THE EVOLUTION OF HUMAN BEHAVIOR

Perhaps this is the most controversial subject of all, the one where academic titans clash. How did humans become "human" and how do you define "human?" A summary of the issues appears in:



World Prehistory. Read pages 63-67.

You have now completed Assignment 4.

Remember, your Midterm Short Papers are due at the end of this week!

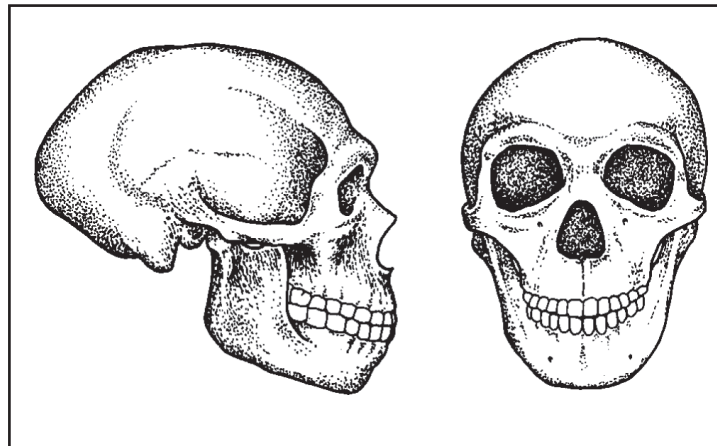
E N D O F A S S I G N M E N T 4

ASSIGNMENT 4: ANTHOLOGY & OLDUVAI EXERCISE

1. HISTORY OF RESEARCH

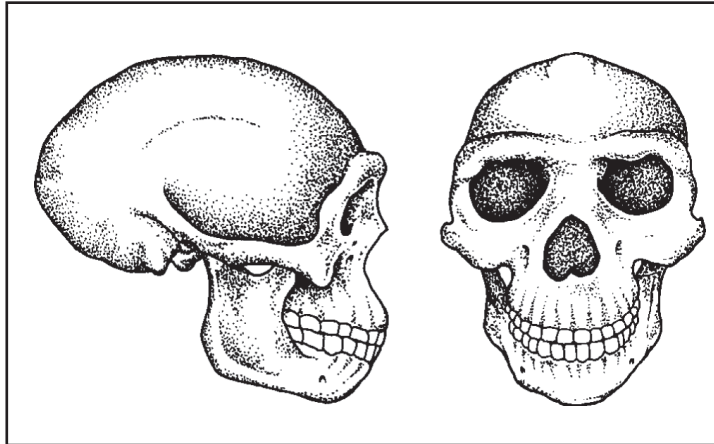
The discovery of our early ancestors has a long and colorful history that begins with the discovery of the bones of extinct animals in association with humanly manufactured stone tools in the eighteenth and nineteenth centuries. Two major discoveries in the mid- to late-nineteenth century revolutionized the archaeology of human origins.

The first was the discovery of the Neanderthal skull in a German cave in 1856. This heavily built, beetle-browed skull was quite unlike any known modern cranium. Some scientists thought it was from one of Napoleon's soldiers, others that it was the skull of a pathological idiot. But the great biologist Thomas Huxley, famous for his ferocious defense of evolutionary theory, studied the Neanderthal find in minute detail. In his immortal *Man's Place in Nature* (1863), he wrote an elegant description of the skull when compared to that of a chimpanzee. Huxley believed the Neanderthal skull showed that there was an anatomical relationship between humans and apes, and suggested that the primeval human ancestor might have been ape-like.



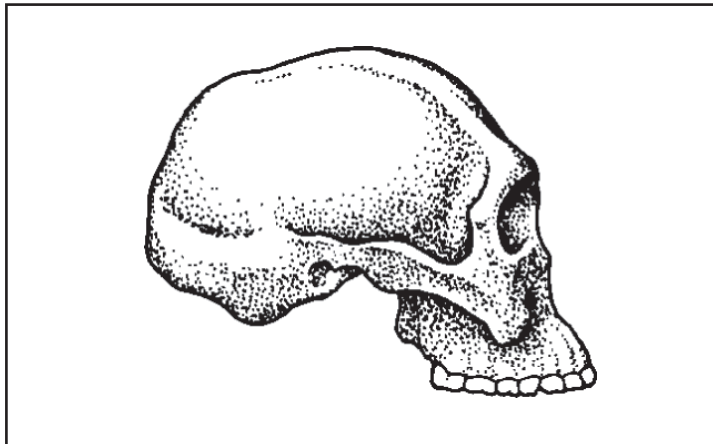
There ensued a search for a so-called "Missing Link," the transitional ape-like human that was the evolutionary bridge between apes and people. It was the search for this elusive creature that took Dutch surgeon Eugene Dubois off to remote Java in south-east Asia in 1890. A year later he made the second great nineteenth century fossil discovery, an ape-like human primitive in appearance but with modern limbs. Dubois' critics did not believe him and dismissed his finds out of hand. It was not until similar human beings came to light in China's Zhoukoudian Cave near Beijing in the 1920s that scientists were convinced finally that Dubois' fossils were those of a primeval human. They named this *Homo erectus*, "human being who stands upright."

In 1924, a young Johannesburg anatomy professor named Raymond Dart re-



ceived two boxes of fossil bones from a limestone quarry in the Cape Province of South Africa. One of the lumps of cemented rock in the crates held the skull of what looked like a young baboon. It was not until Dart had chipped away the matrix that he realized that the young primate was something very different—an ape-like creature with uniquely human features like smaller teeth and a more rounded head. Dart named his find *Australopithecus africanus*, the “southern ape-person of Africa.” Like Dubois, he was ridiculed, for most scientists believed he had found a fossil ape. Dart and an eccentric fossil hunter named Robert Broom discovered many more Australopithecines before World War II, identifying at least two forms, one a robust type, the other much more gracile. It was not until the late 1940s that Dart was vindicated, and the Australopithecines were identified for what they are—very early hominids.

THE LEAKEYS

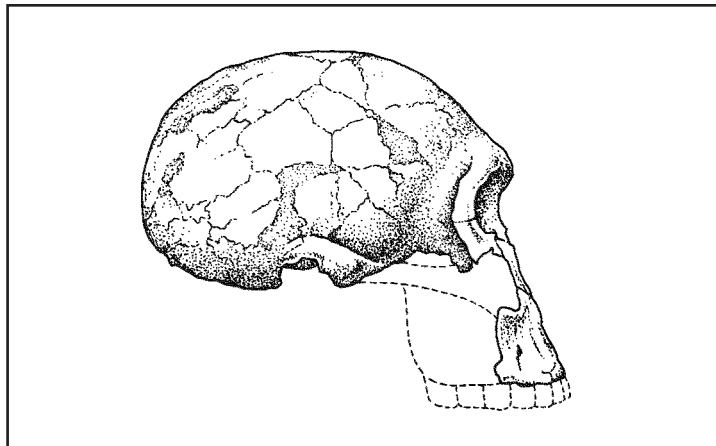


If any archaeologists are family names, it is the Leakeys — Louis, Mary, and Richard. Their fossil hunting adventures are the stuff of which dramatic movies are made, adventures that have the added spice of rewriting the evolution of humankind at the same time. We do not have the space to cover all their exploits, but they can be

quickly summarized:

- Between 1931 and 1959, Louis and Mary Leakey surveyed and excavated at Olduvai Gorge, Tanzania, on a small scale. They found what they called “living floors,” places where very early humans had dropped stone tools and broken bones, but no fossils.
- In 1959, Mary Leakey unearthed a robust Australopithecine, which the Leakeys named Zinjanthropus, on an ancient land surface that was subsequently dated by potassium argon dating to 1.75 million years ago. They found further fossils including an anatomically more advanced human, *Homo habilis*, in the early 1960s.
- During the 1970s and 1980s, Richard Leakey surveyed and excavated even earlier sites on the eastern shores of Lake Turkana in northern Kenya. Here, an international team of scientists found not only several Australopithecines, but anatomically more advanced *Homo habilis* individuals as well. Some of these finds dated to 2.5 million years. Richard Leakey also found a *Homo erectus* fossil dating to about 1.5 million years.

All these finds have given us a tantalizingly incomplete picture of early human evolution, one thwart with controversy.



LUCY

In 1979, Donald Johanson found the skeleton of a diminutive Australopithecine in the Afar region of Ethiopia, far to the north-west of the East Turkana discoveries. This find was dated by potassium argon to between 3.0 and 3.75 million years ago. Johanson and physical anthropologist Tim White claimed that “Lucy” was a new form of Australopithecine, quite different from those found by Dart and the Leakeys. They named her *Australopithecus afarensis*.

Since Johanson’s discovery, research has accelerated, especially in Ethiopia, where

international research teams led by Tim White of UC Berkeley have found the earliest hominids in the world, 4.4 million year-old *Ardipithecus ramidus* and an even earlier 5.8 million year old ancestor *Ardipithecus kadabba*, *Australopithecus garhi*, a later (2.5 my-old) hominid of previously completely unknown form, as well as some of the earliest anatomically modern humans, who lived in Ethiopia 160,000 years ago. Discoveries continue apace today, rapidly improving and sometimes changing our understanding of human evolution (the more recent discoveries will be presented in Lecture and are discussed in *World Prehistory*, pp. 44-58).

2. HUMAN EVOLUTION, THE FOSSIL EVIDENCE

After six million years ago, molecular biology tells us the last common ancestral hominoid stock split into two main lineages: the ancestors of chimpanzees and the ancestors of humans. The details of this split remain a complete mystery, largely because fossil beds dating to this critical period are very rare in Africa.

In 1925, a young anatomist named Raymond Dart caused a sensation when he identified a fossil primate from Taung in South Africa, which displayed both apelike and human features. He named this primate *Australopithecus africanus* ("southern ape-human of Africa"). For a quarter century, Dart's colleagues refused to believe that *Australopithecus* was a potential human ancestor and dismissed it as an ape. Ape-like and standing upright, but with humanlike teeth, and in both gracile and robust forms, Dart's ape-humans remained an evolutionary enigma until the 1950s, when a torrent of new discoveries placed the australopithecines very close to the human line. Today, there can be little doubt that much of our common ancestry is shared with various, and confusing, forms of Australopithecines, described in the *World Prehistory* textbook.

The ladderlike evolutionary schemes of a generation ago have now given way to highly tentative studies of early human evolution completed by reconstructing precise evolutionary relationships from fossil specimens, a process fraught with difficulty when bone fragments are the raw materials. It is a matter of fine and careful judgment, the weighing of anatomical details, the weighting of different characteristics, and the assessment of chronology and stratigraphy. The problem is complicated by an extremely thin fossil record between 4 and 1 million years ago, representing less than 1500 individuals. Most of these are single teeth found in fossil-rich South African caves. Very few are skull fragments or jaws, the most valuable of all fossil finds. During this three-million-year time period, our ancestors went through dramatic transformations, visible only through an incomplete paleontological lense. We know that many hominid forms flourished in tropical Africa during this period. Which of them, however, were direct human ancestors? We can only achieve an understanding of human evolution by getting to know as many species as we can, and this task has hardly begun. The summary of fossil hominids which follows is certain to be outdated within a few years (see Table).

Most paleoanthropologists now believe that East Africa was the main crucible of early human evolution, largely because this is the area which has yielded the greatest diversity of primordial hominids. Five to four million years ago, the now-desertic regions of Ethiopia and northern Kenya were open savanna grassland, teeming with herds of antelope and other mammals, hunted by both predators and our remote hominid ancestors. And it is here that the earliest known hominids have been found.

Paleoanthropologists make a clear distinction between the hominids of earlier than 1.9 million years ago, and *H. erectus* and its successors who evolved after that date. It implies that a behavioral and evolutionary chasm separates true humans from the many other hominids who flourished in Africa before 2 million years ago. Quite what caused this adaptive shift in human evolution is unknown. Did it correspond with significant climatic and environmental change, with equivalent evolutionary changes in other large mammal groups, or with specific changes in hominid culture? The answers will have to come from a new generation of research.

Hominid evolution can be thought of as a series of adaptive radiations which unfolded over at least 5 million years. The first radiation was of bipedal apes, which lived, for the most part, in the drier parts of Africa. Two later radiations gave rise to what is still called early *Homo* and the robust australopithecines, each with their own adaptive theme. In the case of early *Homo*, expanded brain size played a key role, while the robust australopithecines developed specialized teeth. Although the latter varied greatly in morphological terms, later humans radiated not so much morphologically as ecologically, spreading from Africa and creating distinct geographic populations. This flowering of hominid types is exactly what evolution is about: "an endless production of novel ways of doing things, exploring alternatives, trying out new strategies as conditions themselves shift and change all driven by natural selection." Hominids were no different from other mammals, which began as a slim stem and radiated into distinct branches. We still do not know much about the relationships between such branches.

3. BRIEFING ON THE OLDUVAI GORGE WEB EXERCISE

We must now examine the archaeological evidence for early human behavior at a specific archaeological site, Olduvai Gorge. Although there are earlier sites in the East Turkana area, notably Koobi Fora, a small scatter of fractured bones and stone tools dating to about 2.5 million years ago, Olduvai is the most thoroughly studied, and is ideal for our purpose.

You are presented with a wealth of information in this exercise—more information than you may actually need to solve the problem. There are two keys to successfully completing the exercise. The first is pattern recognition. You are looking for a difference in the composition of the stone tool assemblages between levels at multi-component sites, and between sites (both single component and multi-component) that occur in different geological strata in the Gorge. The stratigraphy

of multi-component sites and the stratigraphy of the Gorge provide you with the chronological context within which your tool assemblages occur. The composition of the assemblages give you clues as to the differences in tool industries. The second key to this exercise is focusing your attention on the information that is actually useful in solving the problem at hand. The best way to do this is to do what an archaeologist would do in the same situation. First, take some time to just tour around the Gorge and the sites to get familiar with their vertical and horizontal positioning, and to get a feel for the types of stone tools present at the sites. Next, think about the problem. Break it down into its component parts—what stratigraphic information do you need, what information about the tool assemblages do you need, etc. Then develop a research plan. This plan will make sure that you don't miss information as you go along, but it will also allow you to decide in advance what information to ignore. Finally, come back to the exercise, armed with your research plan, extract the data you need, and write your summary.

Before starting the computer exercise, please read the passage on Oldowan technology below (4 below), and review the information on the web exercise 4-3. This gives Oldowan technology background to the exercise, which will examine Olduvai from four perspectives. Before starting the exercise itself, jot down the major points that emerged from your reading of these pages, in note form for convenience.

This computer exercise has a number of interlinked features that allow you to tour the Gorge and visit a number of sites. The central node of the exercise is the overview map of the Gorge area. It provides you with information about the locations of all of the fossil localities found in the Gorge. By clicking on the specially marked site icons on the map (squares with an x in the center) you can zoom-in to a model of the sites. The site models include plan maps, profile drawings, representative artifact illustrations, and summary tables of the numbers and types of different stone tools found at the site.

Your objective is to do a little deductive detective work. We know from Mary Leakey's work that there are three stone tool industries represented at Olduvai — the Oldowan, the Advanced Oldowan, and the Acheulean. The distinctions between their artifact inventories revolve around the presence or absence of bifaces. The Oldowan has no bifaces, but choppers, flakes, and other tools, while the Advanced Oldowan has some "proto-bifaces," artifacts with flaking on both sides that appear to be early forms of the handaxe, the characteristic artifact of the Acheulean. You can use these tool forms to distinguish between the three. Each of these industries represent stages in the development of hominid technological innovation. Your job, using all of the resources available to you, is to present a reasonable argument as to which sites you believe to represent each stage of development. Your statement should not exceed 2 typed pages, but may include printouts of tables, maps, and profiles as corroborating evidence. The objectives of this exercise are:

1. To give you a greater appreciation of the complexity of the problem of interpreting early hominid behavior.
2. To provide you with a more in depth understanding of the importance of stone tools as clues to hominid behavior.
3. To give you an opportunity to exercise your observational and inferential skills.

To carry out this exercise, we suggest you follow this procedure:

1. Print out the tool summaries for each level,
2. For multi-component sites, create a chronology by percentages of tool types,
3. By strata, classify tool types into Early Oldowan, Developed Oldowan, and Acheulian.

You are working in groups, so you can develop a group statement. This is an exception to the general policy that exercises should be written independently.

LIFE IN THE OLDUVAI COMPUTER ENVIRONMENT

- 1) The overview map gives you a large scale bird's-eye view of the gorge area. Click on the map and a new window will open with a detailed plan of the gorge showing the distributions of sites.
- 2) This detail map contains triangular icons that indicate the locations of known archaeological sites. There are six (6) sites that are marked with squares and have cross-hatching within them. You can click on these icons to zoom into a summary of the information for those 6 sites. Note that in the area of the confluence of the two main branches of the Gorge (the Fourth Fault), there is an additional level of detail that you can get to from the detail map when you move the mouse within it. This higher detail map was necessary because there are so many sites in that part of the Gorge. In fact, three of the sites that you have access to are located in this region.
- 3) The site information is divided into 5 sections. The first section is a plan map of the site showing the lay of the land, and the locations of the excavation units. In some cases, you can click on a unit and zoom into a detailed plan drawing of the locations of artifacts within the different levels of the unit. This information is not available for all sites or all units (unfortunately). The second section is a representative catalog of the artifacts found at that site. The catalog presents a picture of the artifact, and some summary information. From the catalog, you can get to the remaining sections of the site information. There is a button that will take you to the profile drawings for the site. The profile drawings will give you information on the stratigraphy of the site. Clicking on any of the

stratum symbols will take you to a brief written description of the stratum. The stratum information will tell you about the consistency of the fill, the general artifact density, and any potassium-argon dates that have been determined. There is also a link that will take you to a tabular summary of the types of tools found at the site, and the frequency and percentages of those tool types by level within the site. This information is critical to completing the exercise. This tabular information can be printed out or saved to a text file. You should print this information out. DO NOT print the catalog cards. You may want to print the site maps or the profile drawings for reference when you write your report later. That is up to you. To get back to the overview map of the Gorge, hit back in your browser.

- 4) Your game plan should be as described above. The key to the exercise is in noting differences in the percentages of the different tool types between sites — the information presented in the tabular summary in each site's catalog. Additionally, you should be looking for tool types that occur in one assemblage, and not in other assemblages — that can be vitally important.

4. OLDOWAN TECHNOLOGY

Everyone has always assumed that the earliest stone technology would be very simple. When the Leakeys found crudely chipped stones in the long-buried lake beds at Olduvai Gorge, the artifacts were indeed nothing much to look at. (The Leakeys called their early tool assemblages Oldowan, after the gorge where they were first identified.) Most were broken cobbles and flakes, flakes being in the majority. Some Oldowan tools were so crude that only an expert can tell them from a naturally fractured rock, and experts often disagree.

All the Oldowan choppers and flakes strike one as extremely practical implements; many are so individual in design that they seem haphazard artifacts, not standardized in the way later Stone Age tools were. Classifying them is very difficult, for they do not fall into distinct types. The tools cannot be described as primitive since many display a sophisticated understanding of stone's potential uses in toolmaking. We now know that the Olduvai hominids were adept stone toolmakers, using angular flakes and lumps of lava to make weapons, scrapers, and cutting tools. The tools themselves were probably used to cut meat and perhaps wood. Most likely, the hominids made extensive use of simple and untrimmed flakes for many purposes.

Oldowan industries have been found on several sites in East Africa dating to between about 2.6 and 1.5 million years ago. There appears to be relatively little variability between different toolkits, and the artifacts show certain common technological features. All of them were made from cobbles, often struck from lumps,

with edges flaked from both sides. Some of these cores may have served as crude choppers, for the toolkit consisted of both heavy- and light-duty tool forms, some modified into crude scrapers. This seems like a very simple technology, but the artifacts show a skilled appreciation of basic stone-flaking techniques and flaking sequences that were envisaged in the mind's eye.

For years, archaeologists thought of the Oldowan as a static technological stage without any perceptible change. As more sites come to light and analytic techniques are refined, though, the Oldowan appears in a different light—as a simple, highly effective technology that grew more complex over time, with the appearance of crude bifacial working, in which cores were flaked on both sides.

Mary Leakey studied the Oldowan choppers and flakes from the early hominid levels at Olduvai and divided the artifacts into different morphological forms. Her classification remained unchallenged until Nicholas Toth and a new generation of scholars approached early stone technology from a more holistic perspective. The objective of their studies has been to learn as much as possible about early hominid behavior from the stone artifacts left behind. Such research is founded on every aspect of technology, from raw material acquisition through artifact manufacture and use to the discarding and incorporation of the tools into the geological record. As part of his work, Toth became an expert stone toolmaker and carried out edge wear studies on sites in East Turkana. For more detail on Toth's work see *World Prehistory*, pp. 59-61.