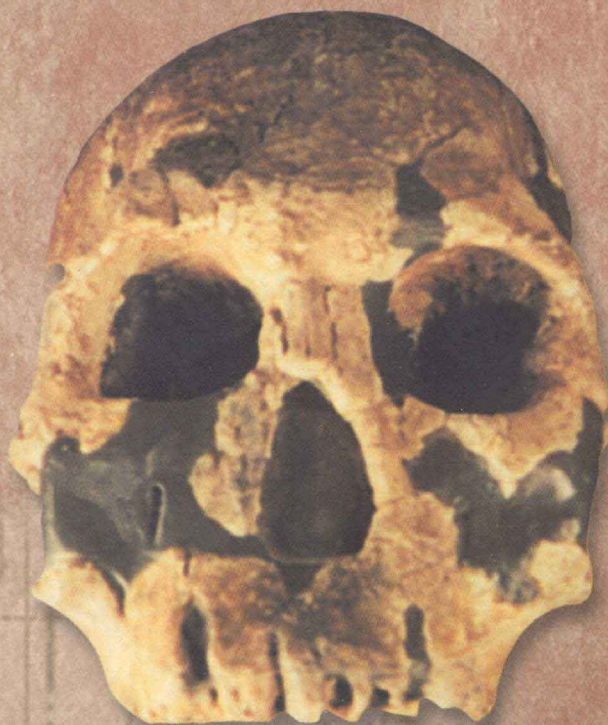


# MYSTERY FOSSIL

A PHYSICAL ANTHROPOLOGY  
LABORATORY EXERCISE

Version 3.0



John T. Omohundro

# Mystery Fossil

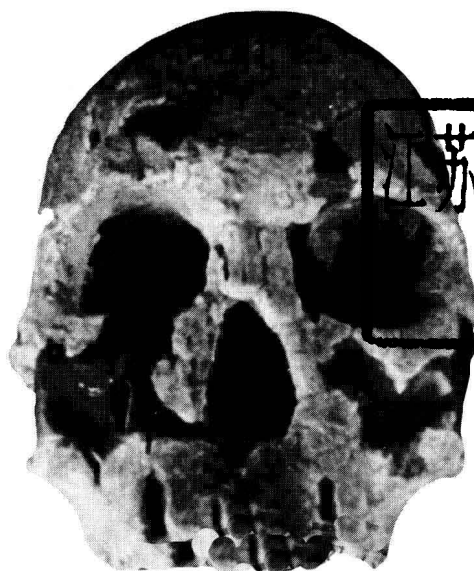
A Physical Anthropology Laboratory Exercise

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John T. Omohundro

with programming assistance from Matthew Keller

*Potsdam College of the State University of New York*



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System requirements for Macintosh: 68030 processor; System 7.1; HyperCard 2.1 or HyperCard Player 2.2 and a "Home" stack; 256-color display; 2MB hard disk space; double-speed CD-ROM drive.

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Audience: College students.

Summary: Covers distinctive characteristics and backgrounds of known hominid species, trends in human physical evolution, and basic paleoanthropological vocabulary. Features multiple, color photograph views of fossils, as well as the details of each fossil's discovery.

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## INTRODUCTION

*Mystery Fossil* helps you to think like a paleoanthropologist who has discovered a new hominid fossil. By comparing your find against known fossils available in the laboratory, you choose the species name of the unknown fossil and position it on the hominid family tree.

Working on this basic problem will help you

- learn the distinctive characteristics and backgrounds of the known hominid species
- understand the trends in human physical evolution
- develop your comparative analytical ability
- become fluent in the basic paleoanthropological vocabulary
- select relevant data for fossil classification from a larger set of data
- argue for your choices among competing species designations and phylogenies

In addition, this manual provides seven other exercises to expand your knowledge and analytical abilities.

### Resources to Solve Your Mystery

This self-contained computerized laboratory exercise provides multiple color-photograph views of

- six mystery fossil crania (skulls and, if available, jaws)
- twelve known fossil crania
- the crania and dentition of a modern chimp and human

The views are supplemented with data on

- who discovered the fossil and when
- what was found and how the fossil was reconstructed
- the site and region where the fossil was excavated
- natural and cultural material found with the fossil
- calculations of the age of the site
- morphology (anatomy) of the specimen

## WHAT YOU NEED TO USE *MYSTERY FOSSIL*

### Macintosh® Version

**Hardware requirements.** You will need at least

- a Macintosh with a 68030 processor, such as a Macintosh SE 30
- a color monitor with 256-color display
- a hard drive
- 2 megabytes of free RAM
- a 2x CD-ROM player
- Access to a printer is also useful but not required.

**Software requirements.** You will need at least

- System 7.1
- the application HyperCard 2.1 or HyperCard Player 2.2 on the hard drive. (HyperCard may be on a network server but responds significantly slower when accessed simultaneously by more than one student.)
- a “Home” stack on the hard drive or the network and in the same folder as the HyperCard application.

### Windows® Version

**Hardware requirements.** You will need at least

- 8 megabytes of free RAM; 5MB hard disk space may be needed
- a 2x CD-ROM player
- a color monitor with 256-color graphics display
- Access to a printer is also useful but not required.

**Software requirements.** You will need at least

- Windows 95, 98, or NT
- Internet Explorer 4.0 or later (provided on CD-ROM)

## LEAPING INTO MYSTERY FOSSIL

If you want a thorough step-by-step introduction to *Mystery Fossil*, then follow the “Guided Tour” starting on page 4.

If you want to learn *Mystery Fossil* by just exploring it, go ahead! You can’t hurt anything by clicking buttons or pulling down menus.

To leap right into *Mystery Fossil*, try these steps:

1. Insert the *Mystery Fossil* CD into the CD-ROM drive of your computer.
2. Double-click the **Mystery Fossil CD** icon that appears on your screen.

Macintosh users: Double-click on the icon of *Mystery Fossil* in the window that appears. *Mystery Fossil* will start up.

Windows© users: If *Internet Explorer* 4.0 or later software is not accessible by your computer, then install it on the computer’s hard drive by opening the “IE” folder and running “setup.exe.”

The first time you run *Mystery Fossil* on a computer, whether or not you performed the above step, open the “setup” folder and run “setup.exe” to install a small file on the hard drive. You will not need to perform these installations again on this computer.

Double click the icon of *Mystery Fossil* and it will start up.

3. Click the **How to use Mystery Fossil** button; on the Help screen that appears, review the goals of the basic exercise.
4. When done with the Help screen, click the hooked arrow labeled **Done** to return to the Start screen; click the **To the fossils!** button to begin work.
5. Click buttons or select from the **Fossils** or **Reference** menus to explore the resources in *Mystery Fossil*.
6. Consult the section in this manual titled “How to Think Like a Paleo-anthropologist” for suggestions on what to look for in the fossil views and their accompanying data folders.
7. Anytime you want to quit *Mystery Fossil*, select **Quit** from the **File** menu.

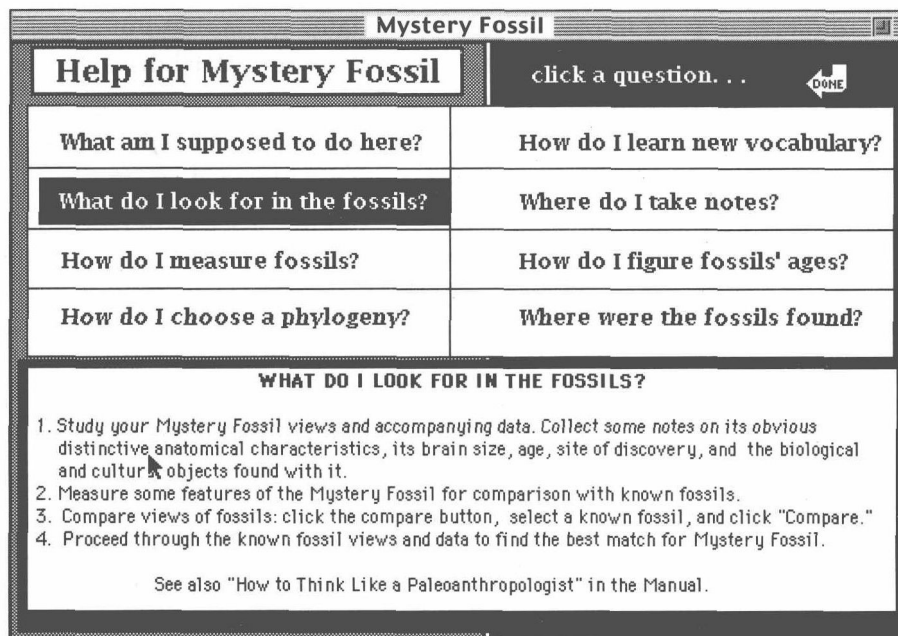
Now leap right in!



## A GUIDED TOUR OF MYSTERY FOSSIL

Follow these instructions for a step-by-step introduction to the many resources of *Mystery Fossil*.

1. Insert the *Mystery Fossil* CD into the CD-ROM drive of your computer.
2. Double-click the **Mystery Fossil CD** icon that appears on your screen; double-click on the icon of *Mystery Fossil* in the window that appears. *Mystery Fossil* will start up.
3. Click the **How to use Mystery Fossil** button. This takes you to the Help screen, where you may review your goals.

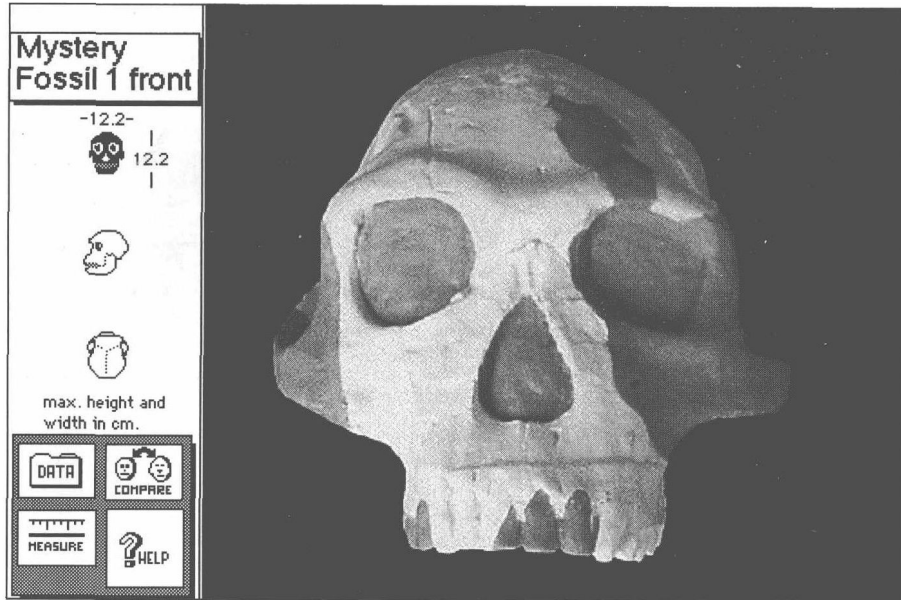


### The Help Screen

Click on the **What am I supposed to do here?** question button and review your challenge.

4. When you are finished studying the Help screen, click the hooked **Done** arrow to return to the opening screen.
5. Click the **To the fossils!** button, and you are presented with a full-screen frontal image of the cranium of *Mystery Fossil* 1.





**The Fossil View Screen**

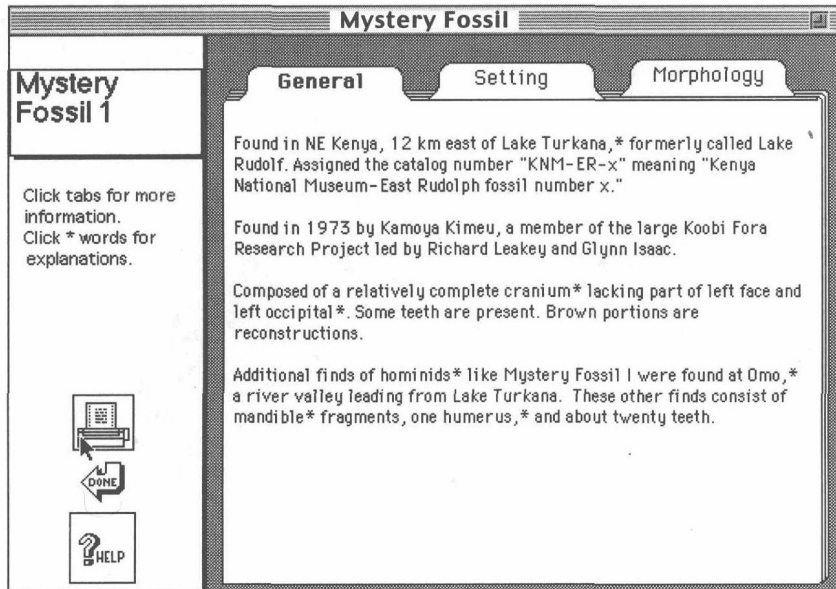
This kind of screen is called the Fossil View, and there are 3 for each of the 20 specimens—front, side, and top views—which you access by clicking the icons on the left side of the screen.

6. Notice that the maximum width and height of the specimen is displayed beside the icons. To measure other features, such as width of nasal cavity or mandible, click the **Measure** button and follow the directions.

“How do I know what to look for?” That’s *precisely* what the anthropologist is trained to know, and here you will gain practice in looking.

Later in this manual you will find a section titled “How to Think Like a Paleoanthropologist” with tips such as noticing sagittal crests, which suggest huge chewing muscles, or examining cranial capacity, alveolar prognathism, occipital buns, the shape of the supraorbital torus, and so forth.

7. Click the **Data** button to examine the fossil's **three** data folders, which contain important information to supplement your visual analysis of the specimen and solve your mystery.

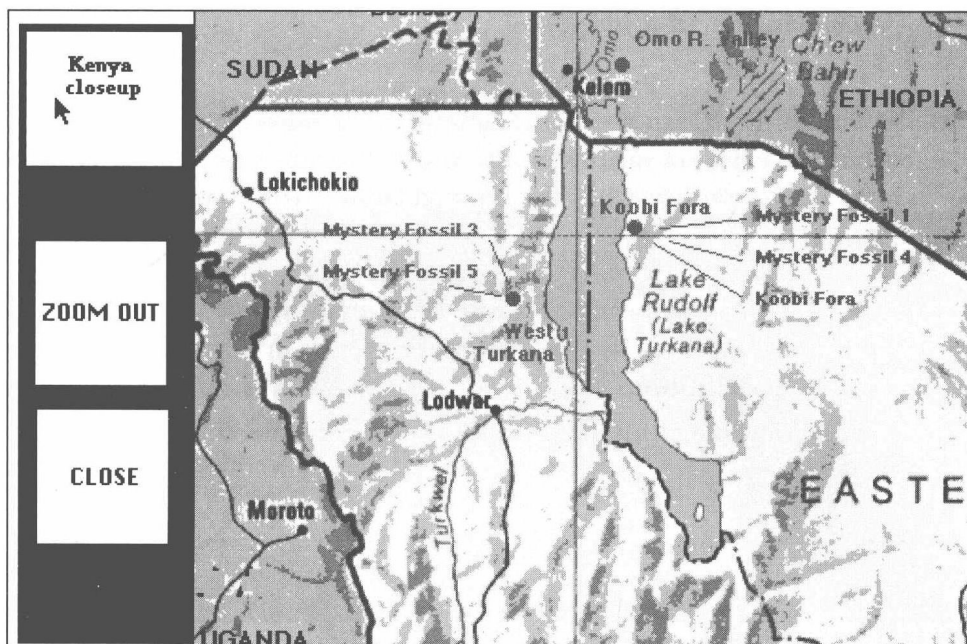


### The Data Folders

Here are data about who discovered the fossil and when, what the fossil was found with, what clues point to its age, and what its key morphological (anatomical) characteristics are.

Click the folder tabs to switch among the three screens.

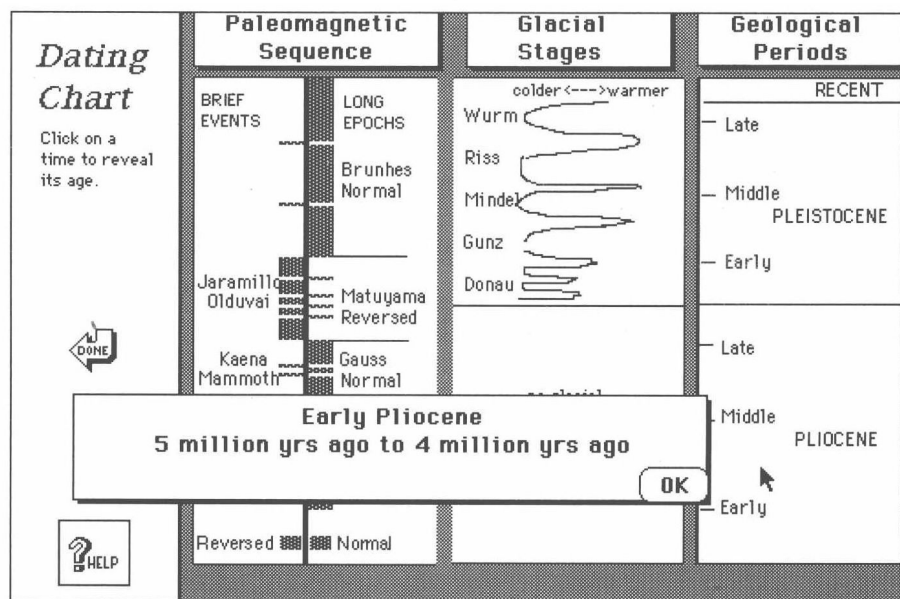
Notice that some words are followed by an asterisk (\*). Click on a couple. If the word is a location, such as "Lake Turkana," the Map Room will appear.



**The Map Room**

Click the location's name, and color maps will appear. Click on the **Close** button to return to the data folders.

If you click on a word that refers to dating, such as "Pliocene," the Dating Chart will appear.

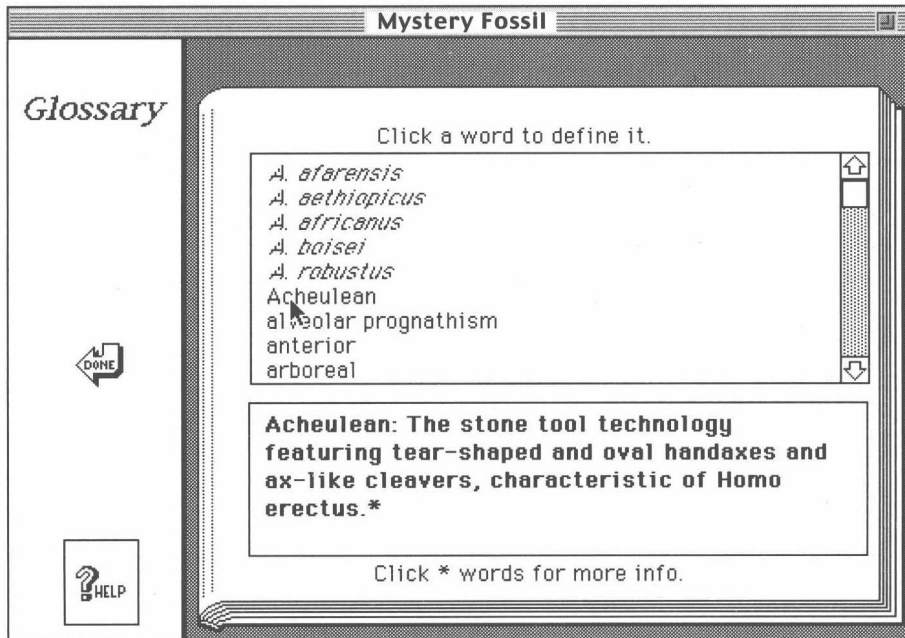


**The Dating Chart**

The Dating Chart shows the time span during which the event occurred. Click on various points in the three columns to see their dates in a pop-up window. Click the hooked **Done** arrow to return to the data folders.

If you click on an asterisked word that is in the Glossary, it will be explained in a small window. Close the window by clicking the small corner box. You can also click asterisked words in that small window for further definitions.

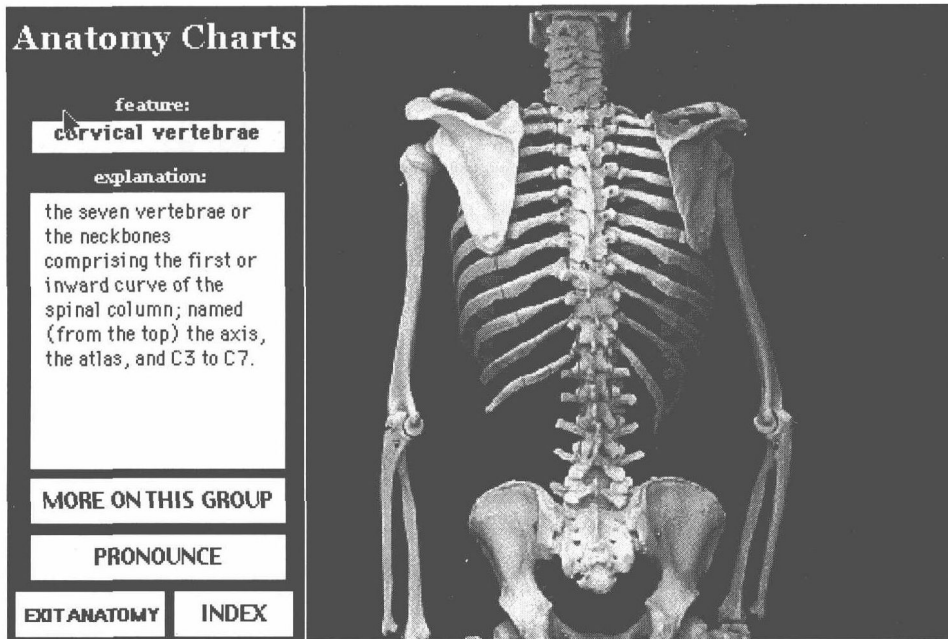
8. You can view the entire Glossary at any time by selecting **Glossary** from the **Reference** menu.



### The Glossary

Browse among the technical terms in the scrolling window at the top of the screen. For example, scroll the window until “occipital torus” appears, and then click on it. Read the explanation that appears below.

Click “supraorbital torus\*” in *that* lower box and the Anatomy Chart will appear.



**The Anatomy Chart**

The feature is highlighted in pink. In the Macintosh© version, click **Pronounce** to hear the feature screen.

Click **More on This Group** to explore other features of the skull and teeth. Click **Index** to explore other features of skeletal anatomy.

Return to your Mystery Fossil's Fossil View screen from the Anatomy Chart by clicking **Exit Anatomy** to return to the **Glossary** and clicking the **Done** arrow to return to the data folders, then clicking **Back to Photos**.

Now you can navigate around in *Mystery Fossil*, and you have seen your resources. It's time to solve the mystery.

9. Select a known fossil such as Hadar from the **Fossils** menu. Examine it with an eye to how much your Mystery Fossil resembles it. Examine the known fossil's three fossil views and read its data folders. Make notes on these findings in the "Notes" section of this manual.
10. Compare the known fossils with your Mystery Fossil as follows:

While you are looking at your Mystery Fossil, click the **Compare** button. Click a known fossil in the list that appears. Click **Compare**. Notice differences in shapes and proportions of the cranium and jaw in this view.

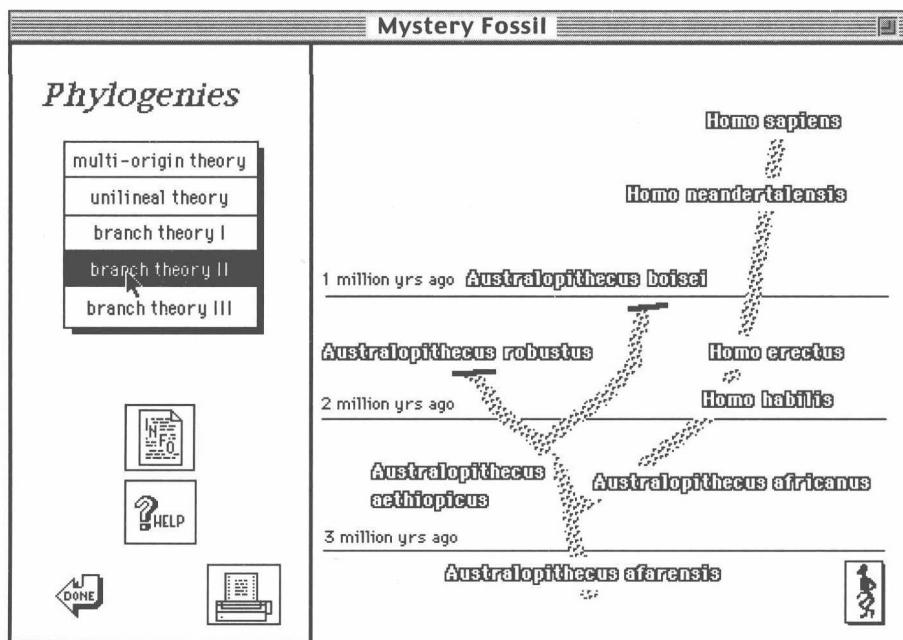
Now click the **Compare** button to switch back and forth between the two fossils. Make notes in the “Notes” section of this manual on the similarities and differences you observe.

Click the **Stop** button to revert to normal operation. Click for the top view of the fossil, and then repeat the comparison.

11. Don’t know what to do next? Click the **Help** button on most screens, and click the appropriate question buttons on the Help screen that appears.
12. Suppose you have compared your Mystery Fossil’s visual and textual information to that of the known fossils, and you have decided which it most resembles. Your Mystery Fossil is probably the same species as that known one. If the match isn’t perfect, you can still argue that it is the same species, because the differences result from its being a little earlier or later, from a different locale, or a different age or sex. (Or maybe . . . it *is* a new species? Think of it: Book contracts! Speaking tours! More research money!)

Turn to the Report, page 18 in this manual, and develop your argument as to what species you think your Mystery Fossil is and how the evidence supports your conclusion.

13. Where does your Mystery Fossil sit on the hominid family tree? Once you’ve become familiar with all the fossils in *Mystery Fossil*, select **Phylogenies** from the **Reference** menu, and you are transported to the first of five diagrams suggesting various interrelationships of all the species represented in the *Mystery Fossil* database.



**The Phylogeny Screen**

Decide which of the five competing models best fits your understanding of the evolutionary connections among the given fossils, as you infer these from the physical and archaeological data provided. You will rely heavily here on your notes from comparing the fossils.

The Help screen and this manual's "How to Think Like a Paleo-anthropologist" section offer guidance in selecting a phylogeny.

- Once you've chosen a phylogeny, drag the fossil icon so that its base rests in the place where you assign your Mystery Fossil. Click the button showing the printer icon to print that screen.

A dialog box asks if you would like to choose a printing device. If you are on a network with a choice between printers, click **yes**. If print jobs from your computer always go to just one place, then click **no**.

Attach your printout to your essay on page 19. Or, if you have your own idea for a phylogeny, you can sketch it there.

- Select **Quit** from the **File** menu when you wish to exit *Mystery Fossil*.

Now you are ready to solve the basic problem posed by *Mystery Fossil* and to undertake any of the seven exercises in this manual.



## HOW TO THINK LIKE A PALEOANTHROPOLOGIST

Working on *Mystery Fossil* resembles what paleoanthropologists do when they make a new find. Like them, you will need to interpret information to formulate and defend your classification of the Mystery Fossils.

The information presented in *Mystery Fossil* is correct according to current research. We've also given you more information than you need. Learning to select relevant data is an important skill in any research.

In your lab report, you will be evaluated on the quality of logic and of data used to defend your position. The final report is not a matter of simply "getting the right answer." The species designations of the six mystery fossils are still being debated. The phylogenetic classification of any fossil must always be a matter of tentative but vigorous argument, especially when many new fossils are being found. Similarly, the five phylogenetic theories are still matters of debate.

### Question One: Assigning a Species to the Mystery Fossil

The following questions will help you determine which species your Mystery Fossil best fits.

1. Is the dating the same as that of a known fossil?

For an overview of dating methods, see page 17. For practice in using dating methods, try Exercise 2.

2. Is there anatomical similarity to a known fossil?

Use the Anatomy Charts in *Mystery Fossil* to become familiar with the bones, teeth, and other anatomical features. Also, try Exercises 1 and 3.

Some morphological similarities are particularly significant as clues to placing individuals in the same species. For an overview of the important morphological features, see the "Examining Physical Features" section starting on page 13.

Remember that individuals in a species exhibit a range of sizes and shapes due to sex, age, and individual differences, so the fossils do not have to be identical. You are looking for a "best match." To gain practice in seeing intraspecific (within-species) differences, try Exercise 4.

## Examining Physical Features

Physical features of fossilized bones usually hint at their function—that is, how a feature worked as a component of the hominid's entire biological system. In turn, function is a clue to the hominid's lifestyle and environment, important factors in deciding how closely related one fossil is to another.

Some physical features are not strongly linked to any function and are therefore not strongly acted upon by natural selection. They might change slowly, if at all, through long segments of the fossil record. When we find such a feature on two fossil bones, it is a good indicator that they share a common ancestor or that one is the ancestor of the other.

Paleoanthropologists generally agree that hominid evolution has exhibited certain trends in the last 4 million years. You may apply the following anatomical trends as criteria to evaluate whether a fossil's features appear earlier or later in the evolution of humans:

***Changes in the Cranium*** In the course of human evolution, the following changes occur in the shape and size of the cranium:

The volume of the interior of the cranium, called *cranial capacity* and measured in cubic centimeters (cc), increases as the capacity for culture grows. An adult male chimp, our closest relative, has about 350 cc cranial capacity. A twentieth-century male *Homo sapiens* has about 1350 cc.

The cranium becomes more rounded, less football-shaped, as its musculature decreases and the brain inside grows larger.

Ridges and crests running over the cranium from front to rear, where heavy jaw muscles attach, become smaller.

The frontal bone (forehead) becomes wider and higher as the forebrain grows, permitting more dexterity and complex language.

The supraorbital torus, or ridge of bone over the eyes, serving to keep the skull rigid during strong chewing action, grows smaller as tools are used instead of teeth.

Ridges on the occipital bone, where neck muscles attach to the back of head, grow smaller. The occipital becomes smoother, and the back of the head becomes more rounded.