Archaeology

The Science of the Human Past

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chapter

The Science of Archaeology

FOR DECADES, SCIENTISTS had studied the pottery of the Moche, an early civilization of farmers and fishers that thrived along the north coast of Peru between about 1,900 and 1,200 years ago. The Moche were superb craftsmen, working with metals (copper, gold, and silver), stone, and textiles. Their pottery (Donnan 1976, 1990) was finely made and depicted plants, animals, and people, some in three dimensions. Other pottery was more simple in form but was wonderfully decorated with scenes of elaborately dressed people engaged in interesting activities. Working diligently over the years, museum specialists had noted that a character depicted in a scene on one vessel was sometimes present in the scene on another vessel. As the decorations on more pottery were analyzed, scenes began to repeat themselves and more links between different scenes were discovered.

By 1974, a series of scenes was linked together to identify a major chronicle, called the Sacrifice Ceremony. The characters were unearthly, their dress and decoration fantastically elaborate, and the activities astounding. Four major priests were identified: Warrior Priest, Bird Priest, Priestess, and an unnamed priest. The four are shown decapitating and mutilating war captives, then drinking their blood from a cup. The entire story and imagery were interpreted as depictions of the Moche gods conducting supernatural activities. The archaeologists working on the pottery thought they were learning only about Moche art and myth.

Although much work had been done to learn about Moche culture, many of the sites had been vandalized and looted. In 1987, vandals discovered an intact royal tomb in a small mud-brick pyramid at the Moche site of Sipán (see-pan). Police caught the looters and were able to recover some of the materials stolen from the tomb, but other materials had already been sold on the black market. Archaeologist Walter Alva examined the confiscated materials and recognized some of the objects as having been depicted in Moche art. Alva realized the scientific value of the discovery and began an excavation to salvage whatever information might remain in the shattered site, knowing that it would be completely destroyed by looters after he left (Alva and Donnan 1994).

Alva began to excavate into the pyramid and soon discovered, remarkably, the intact tomb (called Tomb 1) of a Moche lord (Alva 1988). As he painstakingly uncovered the burial of an adult male, Alva found many artifacts, some of which had never before been seen by archaeologists. Found were very elaborate ornaments worn by the individual, many of which were seen in artistic depictions of warriors, suggesting that the person was a warrior. As the excavation of the main burial was completed, Alva discovered other burials surrounding it, people who appeared to have been sacrificed. Alva realized that he had discovered a person who had been buried with all of the ritual paraphernalia possessed by the Warrior Priest of the Sacrifice Ceremony (Donnan 1988).

A second tomb (Tomb 2) was soon discovered nearby and excavated. This tomb also contained an adult male, but with different dress and ornamentation. Again, other people had been buried in association. A copper cup and a large copper headdress with an owl's head and large wings were found with the main burial. Amazingly, the individual in Tomb 2 seemed to correspond with another of the priests of the Sacrifice Ceremony, the Bird Priest.

A third tomb (Tomb 3; Alva 1990) was found deeper in the pyramid and dated to an earlier time than Tombs 1 and 2. The individual in Tomb 3 was buried alone but with spectacular clothing and ornamentation. Alva was not able to ascertain whether the individual was one of the priests of the Sacrifice Ceremony. However, the tomb of an individual identified as the Priestess of the Sacrifice Ceremony was later found in another Moche site (Donnan and Castillo 1992). Other similar tombs have been discovered at other Moche sites but were looted before they could be documented. However, they appear to have contained similar materials as those of Sipán, in-

dicating that the Sacrifice Ceremony was widespread. There now seems little doubt that the fantastic Sacrifice Ceremony first identified on Moche pottery was actually practiced by the Moche. Warriors engaged in ritualized combat, and vanquished enemies were taken to Sipán as captives. They were stripped naked and bound, their clothing and weapons were bundled together, and they were brought before the Moche priests. There, they were sacrificed: decapitated, dismembered, and their blood collected in cups and consumed in a ritual that was very important in Moche culture.

For the location of Sipán and other sites mentioned in this chapter, see the map on p. 4.

What Is Archaeology?

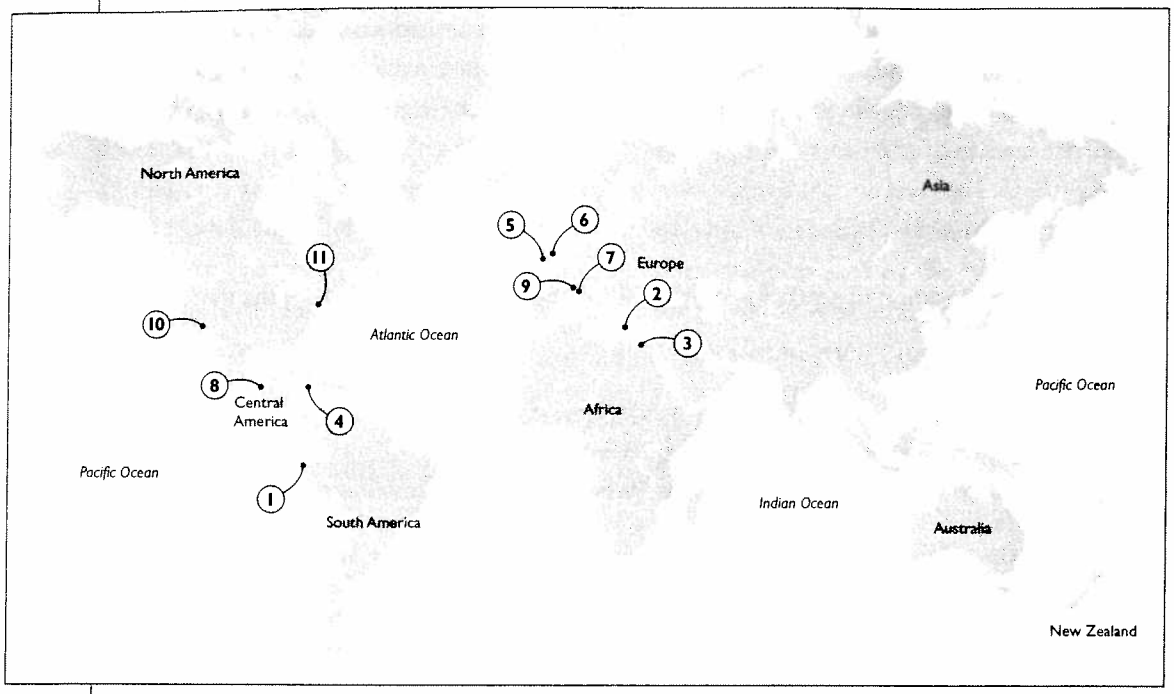
Before 1987, no one would have guessed that the ceremonies represented on Moche pottery were real, that the tombs of the Moche priests depicted in the art would be found, or that an understanding of the scenes represented on those vessels would be gained. Through archaeology, the realities of the past exceed the imagination of the present. To the average person, the word *archaeology* conjures romantic images of jungle adventures, lost treasure, and the romance of the ancient civilizations of Egypt and the Mediterranean. Some see archaeologists as traveling to exotic locales and snatching golden idols from the clutches of arch villains. Others believe that archaeologists are crusty old scientists in pith helmets who dig up dinosaurs or wooly mammoths (those scientists are paleontologists). Neither image is correct, although the former has certainly served to popularize archaeology.

Archaeology is the study of past peoples and cultures. In a sense, archaeologists are detectives, finding clues to the past and trying to sort out what happened in the past and why. But archaeological detectives face a greater depth of time than modern law enforcement agencies. Archaeologists collect clues to reconstruct the behaviors of people from as recently as a few years ago to our earliest ancestors as much as 5 million years ago. Archaeologists do more than obtain facts about the past; they also interpret the information to create an understanding of the past.

Archaeologists do not generally study living people nor do they directly observe past behavior; rather they must infer such behavior from the material remains of past activities. They cannot directly ask questions of the people they study but must find and document the material evidence of past activities and then deduce their behavior. To complicate matters, the evidence of past human behavior can be very difficult to locate, to recover and record, and to interpret properly. Archaeology looks at humans and their behaviors over millions of years, documents change over long periods of time, identifies broad trends, and examines transitions, such as the change from a hunting and gathering to an agricultural way of life.

Humans have the unique ability to grasp the concept of their own past and can use this privileged stance to learn about our past through the study of archaeology in order to more

LOCATION MAP: **Sites Mentioned in Chapter 1**



1 ■ Moche
Sipán, Peru

2 ■ Minoan Civilization
Crete

3 ■ Cleopatra's Palace
Alexandria, Egypt

4 ■ Port Royal
Jamaica

5 ■ *Mary Rose* site
Portsmouth, England

6 ■ Sutton Hoo
Woodbridge, England

7 ■ Porto delle Conche
Pisa, Italy

8 ■ Palenque
Chiapas, Mexico

9 ■ Shroud of Turin
Turin, Italy

10 ■ Pecos Pueblo
Pecos, New Mexico

11 ■ New York Slave Cemetery
New York City, New York

clearly shape and direct our future. Archaeologists are interested in all aspects of the human past and are limited only by the kinds of questions they pose and their ability to find and recover information. Some of these questions seem esoteric, but all are ultimately practical, providing insight into where we came from, how we adapted to changing environments, and where we are going as a species. In addition, archaeology can enlighten us on social processes and social issues, such as nationalism and racism, by illuminating the present with the perspective of the past. Archaeology provides us with the album of our past, much like a family photo album, documenting where we have been, what adventures we have had, our high and low points, and where we may be going. It is a priceless treasure.

Archaeology is a growing and exciting science, encompassing a wide range of specialties and subdisciplines, that tries to foster an understanding of the global human experience over the span of human existence. This is a lofty goal but one that makes archaeology vibrant and ever changing. Although we do not yet know very much about the past, it is knowable: the material remains of the past do exist, they are recoverable, and we can understand them. To do so requires a great deal of work.

Archaeology and Anthropology

Archaeology is closely related to **anthropology,** the holistic and comparative study of humanity across time and space. Anthropology holds several core beliefs. The primary one is that of *cultural relativism*—that cultures should not be judged by any standards other than their own and that no cultures are better or worse than others, although some specific cultural behaviors, such as genocide, are worse. It is also important to recognize that all cultures are valid and important, being the product of many generations of knowledge and skills. The use of terms such as *primitive* to refer to a culture is derogatory and devalues that culture; thus, such terms are to be avoided.

Anthropology is a relatively new discipline, having been formalized within about the last 150 years. In Europe, Australia, New Zealand, Canada, and South Africa, archaeology originally developed from an early background of antiquarianism—collecting things merely for the sake of owning them—and later from classical studies and art history. In those places, archaeology and anthropology are considered as separate disciplines. Being more closely aligned with history, the European system of archaeology has a greater emphasis on objects, art, architecture, and history.

American archaeology, in contrast, has its roots in anthropology, so the two developed with a close association. While not denying its role in understanding history, American archaeology is more interested in the anthropology of past peoples. It has been said that "American archaeology is anthropology or it is nothing" (Willey and Phillips 1958:2). Although this statement should not be taken literally, the connection between archaeology and anthropology is very strong in the United States, and most archaeologists trained at most U.S. universities have degrees in anthropology. In the last few decades, however, it appears that European archaeology is becoming more allied with anthropology, while North American archaeology may be becoming less so (Gosden 1999:4–8).

From the anthropological perspective, discovering the age, history, and development of a past culture is not the ultimate goal of archaeology but the beginning point for the inquiry of the past. Anthropological archaeology is more theoretically tied to science and the scientific method than is the approach concerned with history, although many of the

actual techniques are the same. A separate discipline in Europe, archaeology is one of the four major subdisciplines of American anthropology, the others being cultural anthropology, anthropological linguistics, and biological anthropology.

Cultural anthropology (or *sociocultural anthropology*) focuses on the multifaceted aspects of human culture. Culture consists of a corpus of learned behaviors, such as language, territory, religion, and self-identity, that are learned and transmitted from generation to generation. How a society raises its children, recognizes and names relatives, or practices religion are all learned behaviors that we call *culture.* Individual cultures share specific patterns of this learned behavior, and from one culture to another, these patterns may differ. In the past, difficulties in transportation and communication tended to keep cultures separate. This is less true in much of the world today; such barriers have largely been removed, and cultures are no longer isolated.

Cultural anthropologists generally study extant (living) cultures; the study of a particular group at a particular time is called *ethnography,* and the information obtained is called *ethnographic data.* Because anthropologists are interested in all cultures, large and small, they may wish to study gang subcultures in east Los Angeles or the Aborigines in western Australia. The comparative study of culture—seeing how cultures are similar and different—is called *ethnology.* More than one ethnography is needed to do ethnology, and it is through ethnology that we can learn about culture in general.

In a very real sense, archaeology is closely related to cultural anthropology and might even be considered the "ethnology of the past," in which archaeologists learn about individual past cultures, then compare and contrast what is learned about various past groups to form a broad understanding of human behavior. Archaeologists want to know the same things about a past culture that a cultural anthropologist wants to know about a living one: what people ate, how they lived, how they were organized, what their religious beliefs were, and every other aspect of their lives.

Although the basic goals of cultural anthropology and archaeology are the same, the kinds of information available, as well as how such information can be obtained, are quite different. An ethnographer can travel to a group, live with them, observe, and even participate in their activities. The ethnographer can record what was observed and ask questions to fill in gaps in information. Ethnographers can gather a great deal of very detailed information about a group in a relatively short period of time. Archaeologists cannot do these things, but they can investigate the past in great detail and over long periods of time.

Anthropological linguistics is the study of human languages, including the historical relationships between languages, syntax, meaning, cognition, and other aspects of communication. Archaeologists are interested in linguistics, especially historical linguistics, because certain aspects of language (and so cultures) can be traced back in time (see Chapter 12).

The classification and distribution of languages are used by archaeologists to infer population movements in the past. For example, from the distribution of English around the world it is clear that Australia, New Zealand, much of North America, and portions of Africa were colonized by people from England in the recent past. Of course, we have historical records of these events, but the language distribution alone would also tell us. Such information is available for many regions, and prehistoric linguistics is a fascinating field that helps us understand where people and cultures originated.

The fourth major subdiscipline of American anthropology is **biological anthropology** (or *physical anthropology*): the study of human biology through time, focusing

specifically on biological evolution and human variation. Within biological anthropology are a number of specialities. *Paleoanthropology* is the multidisciplinary study of primate and human evolution and hominid prehistory, as well as the various aspects of geology and biology that serve as the background to such studies (Tattersall et al. 1988). Anthropological geneticists study human variation and short-term (or micro) evolution. The study of our closest living relatives, the nonhuman primates, is called *primatology.*

Biological anthropologists also specialize in human osteology, the study of the human skeleton. Because many biological anthropologists have this training, they frequently use their skills in criminal cases or major catastrophes (such as wars and airplane crashes) in which human remains are badly decomposed, fragmentary, or skeletonized. Archaeologists who specialize in the collection of evidence from crime scenes or battlefields are called *forensic archaeologists* and were called upon in September 2001 to contribute to the evidence recovery efforts at the sites of the World Trade Center and Pentagon terrorist attacks.

Archaeologists rely heavily on biological anthropology. In many cases, archaeologists recover the bodies or skeletons of past peoples and can record and analyze information on past nutrition and health. Analysis of wear and tear on the teeth and bones can tell us a great deal about how people worked and lived in the past, and their chemistry can inform us about diet and disease. Skeletal analysis can also tell us about the nature and direction of human evolution.

Archaeology and the Other Sciences

The field of archaeology is very broad, dealing with humans, their activities, and their environment over long periods of time. To understand all this complexity, archaeologists must rely on the expertise of other disciplines. In addition to cultural anthropology, archaeologists draw from a number of other social sciences, such as history, psychology, and sociology, to help provide a context to understand the cultural and social aspects of past human behaviors. As examples, studies of conditions in contemporary urban settings can be used to help understand the social situations of early cities, and a general understanding of the human mind can shed light on the thinking processes of early humans.

Other fields, too, provide information to archaeologists about things related to human activities. Botanists assist archaeologists in the identification of plants to help understand their evolution and use. Zoologists do the same thing with animals. Geologists study sites and their surroundings and provide information regarding erosion, deposition, age of deposits, and the like.

Finally, archaeologists rely on various specialists to help analyze what is found. Physicists and chemists actually perform most of the techniques used to date materials. Chemists also conduct other studies, such as residue analyses and geochemical sourcing. Mathematicians and computer scientists help in statistical analyses, mapping, and model building. Archaeology is truly an interdisciplinary science.

The Basic Goals of Archaeology

The basic and primary purpose of archaeology is to help us understand ourselves. To move toward that end, most archaeologists pursue three basic goals, each building on the

other. As in all science, archaeology begins with the discovery of new information, which then must be described. Like newspaper reporters, archaeologists ask the five basic "W" questions: *who, what, when, where,* and *why.* The first four questions are answered by the discovery and description of archaeological materials, and once that task has been completed, archaeologists seek to explain the past by addressing the *why* question.

Archaeologists seek to reconstruct the lifeways of past people, their daily lives, where they lived, what they ate, what their tools were, how they interacted, and how they adapted to their environment. Ultimately, archaeology seeks to contribute to the development of a comprehensive understanding of human behavior. At any step along the way, the information and understanding derived from archaeological work can be applied to the management and conservation of the past and to the education of the public about the past.

DISCOVERY AND DESCRIPTION The first goal of archaeology is to generate basic information—*baseline data,* the basic discovery, description, and classification of artifacts and sites. The greater the detail that can be found and recorded, the better the picture of the past will be. Sites are located and investigated, artifacts are described and classified, and regional chronologies are formulated. This basic work has to be done all over the world.

Once some basic idea of the prehistory of a region has been obtained, the information can be synthesized into definitions and a description—a **culture history**—of the past cultures for that region. In conjunction, the delineation of **cultural chronology**, the description and sequences of cultures through space and time, is also a major goal. These initial basic descriptions are often based on relatively few data and serve as foundations for future work. As such work gets done, the chronologies and culture histories will be rejected or revised as necessary. The advent of more accurate dating techniques has permitted much greater precision, and basic cultural chronologies are now much better understood. In spite of all of this work, the basic cultural chronologies of most regions remain poorly understood, and obtaining baseline data remains an important goal in much archaeological work today.

EXPLANATION Once archaeological phenomena have been discovered and described, archaeologists seek to develop explanations for what was observed. Describing material is a relatively simple procedure; understanding why things are the way they are is a much greater challenge. To truly understand cultures, one must understand how they operate, how they differ, how they change, and under what rules they do so. It is important to remember that one cannot seek an explanation of things that are not discovered or not described, so those two basic objectives remain critical.

UNDERSTANDING HUMAN BEHAVIOR Finally, archaeology seeks to contribute to the comprehensive understanding of human behavior. By understanding the past, we can better understand ourselves, and archaeology can help to foster an understanding of the global human experience over the span of human existence. However, archaeology has yet to contribute significantly to the formulation of such laws, partly because of the difficulty in obtaining and analyzing appropriate information. As the discipline of archaeology matures, such contributions should increase.

The Branches of Archaeology

Archaeology can be divided into any number of specialties. Most such divisions are based on the time period or the geographic area being studied. Broadly, materials from the period before written history are considered "prehistoric," and materials dating from times after the advent of written records generally are considered "historical," although historical times are often given other names, depending on the region. Some archaeologists specialize in periods based on technology, such as the Stone Age, Bronze Age, and Iron Age. Some archaeologists specialize in all time periods for a particular region, such as North America or Southeast Asia. Others specialize in particular aspects of archaeology, such as *environmental archaeology,* the study of the effects that past people and the environment had on each other (Butzer 1982), or *geoarchaeology,* the study of the relationship between geology and geological processes and their impacts on archaeological interpretation (Rapp and Hill 1998).

Prehistoric Archaeology

Prehistory is the time before written records. Humans and their direct ancestors have been on the planet for about 5 million years, and approximately 99 percent of that time was spent hunting wild animals and gathering wild plants for a living. Most of prehistoric human activity falls within the Pleistocene, the geologic time period beginning about 1.9 million years ago and ending with the retreat of the glaciers some 10,000 years ago. Prehistory ends when history begins, so prehistoric archaeology can mean the archaeology before written records from any time and any place.

A number of other terms have been used to refer to more specific periods in prehistory. For example, in the Old World (Africa, Asia, Australia, and Europe), the term *Paleolithic,* or Old Stone Age, is commonly used to refer to the archaeology of Pleistocene hunters and gatherers. When wild plant foods became more important at the end of the Pleistocene, the *Mesolithic,* or Middle Stone Age, began. When farming became the primary mode of making a living, cultures were classified as *Neolithic,* or New Stone Age. Each of these prehistoric periods is used to describe general adaptations in the Old World. In the New World (Central, North, and South America), all of the time prior to European contact is considered prehistoric.

Lastly, the archaeology of literate groups whose writing we cannot yet read is considered to be prehistoric. In some regions, writing was never developed and prehistory persisted until the arrival of other people who had writing, sometimes as late as the twentieth century.

Historical Archaeology

With the advent of writing, history and historical times began. This development occurred at different times in different places, beginning in the Middle East more than 6,000 years ago, later in other areas. Early writing was often in the form of simple records; the writing

of narrative history developed later. In its most common usage, however, historical archaeology is considered to be the archaeology of the recent past (Orser and Fagan 1995:5). In most cases, this recent past is that of European colonialism, and the term *historical archaeology* is widely used to refer to the remains of intrusive, nonindigenous cultures. For example, in North America, the archaeology of the late entrants of the continent, including the Chinese, Dutch, English, French, Norse, Portugese, Russian, Spanish, and later the Anglo-Americans, is considered historical archaeology (Paynter 2000).

The archaeology of historical times is important even when historical records exist. History records many things, including events, transactions, royal lineages, taxes, and trade. Some of the records are excellent, others less so; and for many activities, no records exist at all. All history is written by people, and all history contains some biases, sometimes unconsciously recorded. Some history is more obviously biased, written by people attempting to slant the historical record to serve their own interests. Even after records and accounts were made, later people sometimes would alter the records—that is, they would "rewrite history" to serve their own ends when they came into power. Thus, historical records and interpretations are suspect, for we know that much of what we take as history is incomplete, biased, and sometimes even false (and this is still the case).

As a scientific endeavor, archaeology can be employed to confirm, contradict, or correct historical records, to add depth to poorly recorded parts of history, and to elucidate the lives of those who were left out of recorded history, such as the Africans imported as slaves into the American colonies in the seventeenth and eighteenth centuries (Highlight 1.1). Such work can add much rich detail to what is already known.

Archaeology conducted on early literate societies—even though they have written records—is often not considered to be historical per se but is seen as *text-aided archaeology*, "archaeology carried out with the aid of historical documentation" (Orser and Fagan 1995:4). The archaeology of certain early literate societies has been given specific designations. For example, the archaeology of the Middle East from the time of the Bible is called *biblical archaeology*, and the study of the time of the pharaohs in Egypt is called *Egyptology*. In Europe, post-Roman archaeology, that dating between the fifth and fifteenth centuries, is called *medieval archaeology;* all materials dating between the fifteenth and mid-seventeenth centuries in Europe are considered *postmedieval*. In Mesoamerica (Mexico and Central America), a number of groups had written records, but their archaeology is generally called *pre-Columbian archaeology*, referring to the time prior to the arrival of Columbus in AD 1492; more specific names have been given to certain times and regions.

A number of important texts, including religious texts, document people and events of the past, and many cultures base their religion, philosophy, and other things on these texts. There has been a great deal of interest in whether these texts contain information that could be verified by archaeological work. A great deal of effort has been expended investigating the veracity of the ancient texts. In many cases, governments, religions, and some other entities have vested interests in the versions of history described in ancient texts, and there is often considerable resistance when archaeology, or any other science, shows them to be in error. This type of work is still an important part of archaeology.

One of the most famous historical texts is the Bible, a series of documents written over many hundreds of years and compiled into two major volumes, the Old and New Testaments. The Bible contains a number of historical documents that deal with people and

HIGHLIGHT 1.1

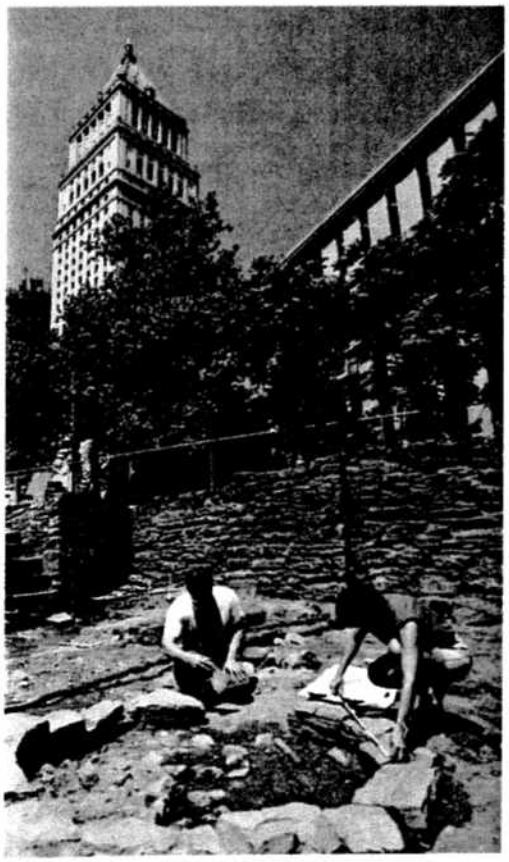
The Archaeology of African Slaves in the New World

Between about 1500 and the late 1800s, millions of people were kidnapped from Africa and transported in crowded ships to the New World, where those who survived the voyage were sold into slavery (slavery was abolished in the United States in 1863, persisted until later in some other countries, and amazingly, is still practiced in some places). Once in the New World, they were sold, lived, had families, and died. In many cases, they continued to practice many aspects of the cultures that they had brought with them and so retained much of their cultural heritage. The casual observer would expect that, during the historical period, records would exist detailing the lives of these people. Although many records do exist regarding the transport and sale of slaves, very few records of their daily lives exist, and those that do are incomplete and biased. As a result, we know very little about how this large segment of the population lived.

What history cannot tell us about these people, archaeology can. Since about 1970, historical archaeologists have become interested in learning about the life of slaves, including where and under what conditions they lived, what they were given to eat, how they may have supplemented that diet, how they interacted with their owners, and many other questions for which there are few documents (Otto 1984; Ferguson 1992; Singleton 1995; Thomas 1998; Heath 1999). The African American community also is interested in the answers to these questions, so that they can reconstruct their history and heritage.

Many of these archaeological investigations have been conducted in the eastern United States. Slavery was abolished in the northern states in the early 1800s but persisted in the southern states until the end of the Civil War. One of the better-known slave-period sites in the northern United States is the slave cemetery in New York City.

In 1991, during the construction of a building for the federal government in lower Manhattan, a portion of an



The rediscovery of the "Negroes Burying Ground" greatly interested New Yorkers, historians, and members of the African American community. It is believed the cemetery originally contained between 10,000 and 20,000 people, sometimes buried three deep.

HIGHLIGHT 1.1 continued

eighteenth-century cemetery was discovered (Hansen and McGowan 1998). The cemetery, shown as "Negroes Burying Ground" on eighteenth-century maps of New York City, was located on a small plot of land then outside the city limits and was used from the early 1700s to about 1790. The area was eventually built over and the cemetery forgotten. After rediscovery of the site in 1991, construction was halted, and work to document and evaluate the site was undertaken.

Excavations have revealed almost 500 burials. Most of the interments were African slaves, but other segments of the population, including the poor and indigent as well as prisoners held during the American Revolution, were also represented. Some of the findings include information about general health conditions and mortality. Nearly half of the bodies are those of children under 12, and some of the adults showed the effects of being overworked, which may have led to their deaths. Many of the bodies were buried in traditional African ways (as evidenced by the kinds of grave goods present and the orientation of the body), attesting to the persistence of African cultural practices among the slaves. A great deal was also learned about the demographics (sex and age at death) of the slave population. Of note was the realization that during the 1700s, slavery was as pervasive in the northern part of the country as in the south and that only South Carolina had more slaves than New York City.

After the excavations, the federal building was completed, creating a bit of a political problem (Harrington 1993). The cemetery was designated a historical district by the city of New York and was named a National Historic Landmark by the federal government. A memorial to those interred in the cemetery was built on the site. Most of the human remains were transported to Howard University near Washington, D.C., and will be reburied in the cemetery when the studies are complete.

CRITICAL THINKING QUESTIONS

1. What branch of archaeology and what related sciences were relevant to the excavation of the New York slave cemetery?
2. What special function of archaeology does the story of the slave cemetery illustrate?
3. What was the impact of the excavation of the slave cemetery on people living today?

events. It has been demonstrated through scientific archaeology that many of the places, events, and people described in the Bible are, in fact, historical, while others may not be. However, showing that one part of a document is based in fact does not mean that all of the other information within it must also be true. Some things have been confirmed by science while others have not, and to believe in the things that are unconfirmed requires faith (Sheler 1999).

Classical Archaeology

Classical archaeology refers to the archaeology of the "classic" states, such as Greece and Rome, in the area of the Mediterranean Sea and surrounding regions (see Bowkett et al. 2001). Classical archaeology is related to these cultures inasmuch as there are written records with which to interpret them. In the Mediterranean, classical (literate) times began about 4,000 years ago with the Minoan culture on the island of Crete and ended with the fall of Rome about 1,500 years ago. Classical archaeologists spend a great deal of their time and energy studying architecture and art, the most visible and spectacular remains from

the classical world. In addition, classical archaeologists seek to find sites related to historical events. As a result, classical archaeology requires different training, and many university classical archaeologists teach art history, rather than anthropology or archaeology.

Maritime Archaeology

Archaeology that has to do with anything related to the marine environment can be considered **maritime archaeology,** regardless of its age or geographic location. Maritime archaeology can be divided into at least two major fields, underwater archaeology and nautical archaeology. *Underwater archaeology* deals with sites of any kind that are located underwater. Many kinds of sites exist underwater, including shipwrecks, sunken cities, such as a portion of Alexandria in Egypt (La Riche 1996) or the pirate port of Port Royal in the Caribbean (Marx 1967), and sites occupied during times when sea levels were lower (Masters and Flemming 1983).

Nautical archaeology deals with ships, cargoes, harbors, anchorages, maritime technology, trade, and the influences that seafaring had on politics, social structure, and military events, along with anything else related to ships and their activities, even if the ships are now on dry land. Most known maritime archaeological sites are shipwrecks (Gibbins and Adams 2001), and many thousands of such sites are known, from the *Titanic,* to Viking ships, to wooden dugout canoes. One of the many famous ships recovered by maritime archaeologists is the *Mary Rose,* flagship of the English fleet in the sixteenth century under King Henry VIII (Highlight 1.2).

Not all shipwrecks are found underwater. Some ships were moved onshore for a variety of reasons, including for use in burials, such as the famous Viking burial site of Sutton Hoo in England (Carver 1998). Other ships sank in harbors that later became filled in, and the shipwrecks are now buried in dry land. For example, at least 17 Roman ships, many still containing their cargoes, were discovered in an old filled-in harbor in the Italian city of Pisa (Kunzig 2000).

The goals and techniques of maritime archaeology are not very different from those of other types of archaeology, although, as one might expect, it is especially difficult to find sites underwater and even more difficult to investigate them, because of logistical problems and the physical limitations inherent in people working underwater. Nevertheless, since the development of lightweight diving gear after World War II, there has been an explosive growth in underwater archaeology. Ancient ships, their cargoes, and even submerged land sites can be investigated in detail. One of the most interesting discoveries was the Swedish warship *Vasa,* which sunk on her maiden voyage in 1628. She was discovered mostly intact, raised in 1961, and is now on display in her own museum in Stockholm. Detailed treatments of maritime archaeology can be found in works by Muckelroy (1978), Green (1990), Dean et al. (1995), Delgado (1998), and Gould (2000).

Public Archaeology

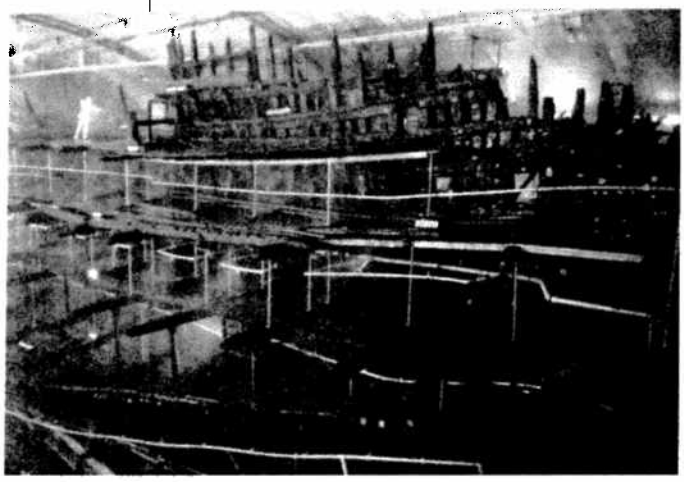
The broad field of archaeology now involves much more than just the scientific quest to learn about the past. Archaeologists today work to preserve and protect the past and educate the public through the application of the various branches of archaeology.

HIGHLIGHT 1.2

The *Mary Rose*

The *Mary Rose* was an English warship constructed between 1508 and 1511, during the reign of Henry VIII (McKee 1974; Bradford 1982). The ship, which was built in Portsmouth, England, displaced about 500 tons and was one of the first ships with its guns arranged so it could fire a broadside. The *Mary Rose* had a distinguished career and participated in many campaigns. It was rebuilt twice, and its size was increased to 700 tons. The ship sank accidentally on July 19, 1545, off Portsmouth during a battle with the French, apparently when water entered open gun ports. Some 500 of the crew drowned, and the ship settled on its starboard side into the muddy sea bottom. The English made a failed attempt to raise the *Mary Rose* a few years later, and the enterprise was abandoned. The mud created an anaerobic environment that preserved the keel and starboard side of the ship, but the port side eroded away.

The *Mary Rose* was rediscovered by a fisherman in 1836, and some items were removed before the loca-



Excavations at the site began in 1968. In 1979 the Mary Rose Trust, with Prince Charles as its president, was created to preserve the ship. Excavators recovered some 20,000 items and skeletal remains of 200 crew members (Rule 1983).

Archaeological sites and remains are fragile and once destroyed are essentially lost forever. This fact has long been recognized, and efforts have been made to preserve the remains of the past. For example, the National Museum of Denmark was formed in 1816 with the task of preserving Denmark's past. Since that time, many individual nations, and now the United Nations, have instituted programs to preserve archaeological sites when possible or to rescue or salvage sites threatened by development.

Today, much of the archaeology conducted around the world is related to the preservation and management of archaeological resources, a field known as *cultural resource management* (CRM) and sometimes called *heritage resource management.* Most CRM projects are funded by the government or by the organization doing the development that instigated the projects. Because so much development is occurring, a great deal of CRM-based archaeology is conducted. In fact, most practicing archaeologists today are employed in government or private industry doing CRM. In contrast, relatively few archaeological projects are undertaken as "pure" research. It is critically important that research be an integral objective of CRM projects so that the archaeology conducted can

tion of the ship was again forgotten. In 1967, the ship was again discovered with side-scan sonar. Repeated dives confirmed that about half of the ship was in an excellent state of preservation and included intact decks, passageways, and cabins.

Because very little is known about ships or crews of that time, the recovery of the *Mary Rose* is important for a couple of reasons. First, the ship provides great detail on naval architecture at a time when shipbuilding and ship armament were rapidly changing. Many weapons were found, including large and small cannon, guns, swords, and knives. Guns and cannon represented relatively new technology. The most-feared weapon in the English arsenal at that time was the longbow, only a few examples of which have survived. However, 137 complete longbows, about 3,500 arrows, and other archery equipment were found on the *Mary Rose*, providing a much greater understanding of that weapon system.

Second, the daily lives of the ship's crew can be much better understood because many personal possessions were found, including clothing, games, and weapons. A great deal of food was found on board, providing a clear picture of the diet of the crew. The surgeon's cabin was intact and contained a medical chest and medical instruments, including a razor, a syringe, medicine jars, and a mallet. The carpenter's cabin was also found and contained construction and repair materials, as well as tools.

The ship was raised in 1982 and moved to a permanent display building in the Naval Museum at the naval base in Portsmouth, England. At that time, the *Mary Rose* was cleaned and reinforced, and today it is continually sprayed with a preservative that eventually will replace the water in the wood and preserve the ship.

CRITICAL THINKING QUESTIONS

1. How does the story of the *Mary Rose* illustrate the special problems and rewards of maritime archaeology?
2. Why was the recovery of the *Mary Rose* important? What poorly known technologies were illuminated by what was found?

contribute to our understanding of the past. It is also important to educate the public about the past. Most people are interested in the past, and the past is an integral and vital part of the identity of some. There is a great deal to be learned, both of general value and of immense practical value.

Key Concepts in Archaeology

Archaeologists share a common understanding regarding the nature and manifestation of the past. This understanding is a series of basic concepts related to what things are, rather than how they are interpreted or what they mean. However, the concepts are not necessarily static and they, like interpretations, can change. These key concepts include the nature of the record of the past, the kinds of information present, the relationship between materials in the record, the age of things in the record, and the working

assumption that cultures of the past operated in the same basic manner as cultures in the present.

The Archaeological Record

The evidence of the past exists in the archaeological record—the material remains of past human activities and behaviors. The archaeological record includes the physical remains of people and their tools, houses, foods, or any other materials lost, discarded, abandoned, and stashed by them, plus the geographic localities where these materials are found. The record also includes the various relationships between these materials and the patterns of those materials formed by their relationships.

Contained within the archaeological record is a variety of basic materials, including artifacts, ecofacts, features, and sites. **Artifacts** consist of the tools manufactured or used by people to accomplish some task and come in a vast array of types and forms, from very simple to very complex. Most artifacts are portable. Artifacts contain a wide range of information about a culture, including human skill, knowledge, symbolism, and activities. For example, a projectile point (commonly called "arrowheads" by the lay public) can tell us about warfare or hunting behavior and a piece of painted pottery can tell us about vessel form, function, and symbolism.

Ecofacts are the unmodified (nonartifactual) remains of biological materials used by, or relating to, people and are common constituents of the archaeological record. Most ecofacts consist of food residues, such as the bones of animals or the seeds or other parts of plants. Pieces of charcoal from ancient campfires would also be ecofacts, as would pollen, whether the pollen was purposefully brought in by people as food or was natural and so could be used to help understand the environment at the time. **Features** are nonportable objects used or constructed by people (if the objects were portable, they would be artifacts). Examples of features include hearths, houses, walls, and other such facilities. Artifacts, ecofacts, features, and other aspects of the archaeological record are found in **sites**, specific localities where people lived, worked, or visited. Sites may range in size from very small (perhaps a single artifact) to huge (such as a city). Sites take many forms and reflect the full range of human behaviors.

Cultural Deposition, Stratigraphy, and Dating

As people live at a site, their cultural debris (trash, garbage, and other materials) begins to accumulate and build up, slowly burying materials in the soil and forming a site deposit. Some sites, such as those occupied for only a short time, may have no deposits; others may have extensive ones. Many of the artifacts, ecofacts, and features sought by archaeologists are contained within site deposits. If the activities occurring at a site change over time, the materials discarded into the site soils may also change and result in the formation of distinct soil layers, or strata. Natural strata, such as a layer of mud from a flash flood, may also be present. The various layers combine to form the stratigraphy of the site (Figure 1.1). Different strata in a site may indicate a variety of things, including periods of building, abandonment, destruction, or change in occupation, so archaeologists pay close attention to site stratigraphy. Alfred Kidder, an archaeologist in the early twentieth century whose excavations of Pecos Pueblo in northern New Mexico resulted

Younge

Older

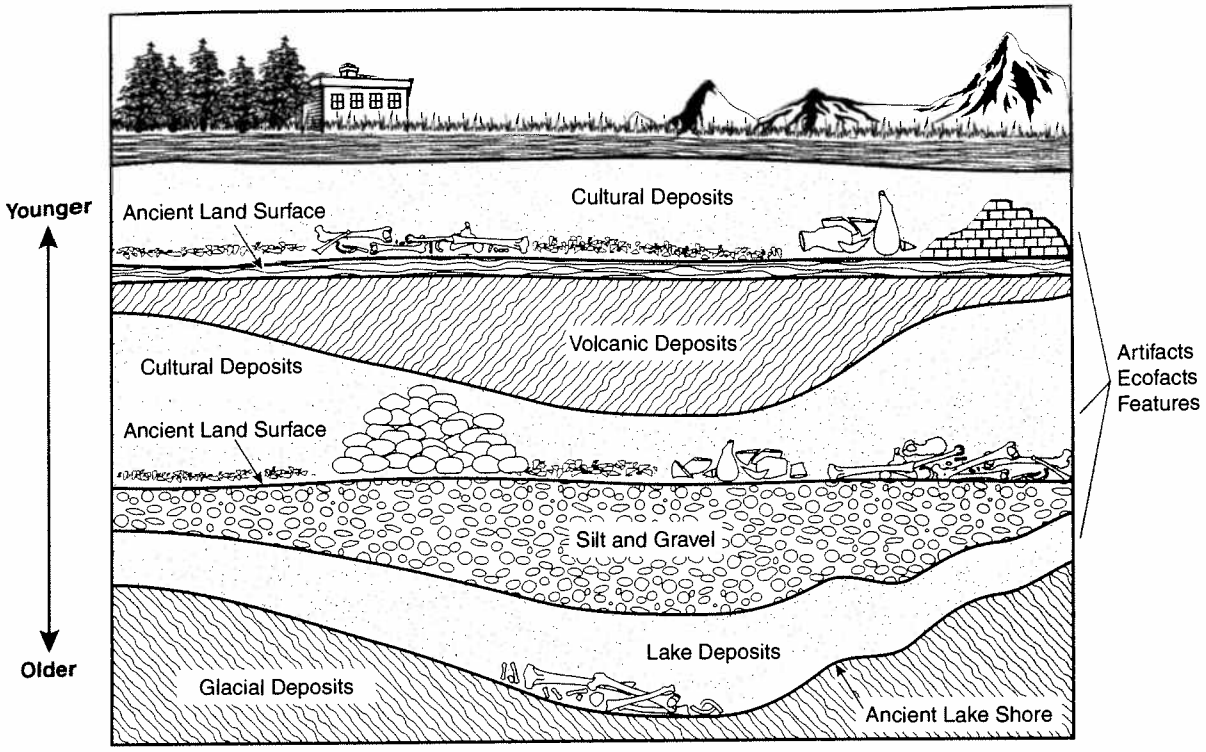


figure 1.1

Stratigraphy and the Law of Superposition. Here is an example of stratigraphy with layers containing archaeological materials intermingled with natural layers. Using the law of superposition, it is clear that the archaeological materials above the volcanic deposits must be younger than those in the layer below.

Source: Adapted from Bernard Campbell and James Loy, *Humankind Emerging*, 8th ed., Fig. 5-1. Copyright © 2000. Adapted by permission by Allyn & Bacon.

in his seminal work, *An Introduction to the Study of Southwestern Archaeology* (1924), used cross-sectional stratigraphic drawings to analyze these sites.

To be able to document change through time, archaeologists must be able to determine how old things are. The ability to date things allows scientists to build chronologies and to track changes in material remains and behavior throughout prehistory and history. Thus, dating is of primary importance in archaeology. Much of the dating done in archaeology is relative dating, determining whether something is older or younger than something else. One of the main techniques of relative dating is through the use of the law of superposition—the idea that a layer, or stratum, as well as the materials in it, is older than the one deposited above it. Using relative dating, archaeologists can work out sequences of artifacts and sites and can provide a great deal of information. However, to really understand the past, *absolute dating*, placing materials and events in real time, is necessary.

Using absolute dating techniques, archaeologists are able to date things in actual number of years ago with reasonable certainty. Several techniques are used, but the most important one is *radiocarbon dating*, a technique that measures the amount of a radioactive isotope of carbon, ^{14}C, within a sample. Because the concentration of ^{14}C in living tissue is known and ^{14}C decays at a known rate, the residual ^{14}C in dead tissue can be measured, and the date of death of that tissue can be determined. Radiocarbon dating can be used to date nearly any organic material and has proved to be a huge benefit to archaeology. The process was discovered by Willard Libby while conducting research on the atomic bomb for the United States during World War II. The first radiocarbon dates appeared in 1949, and the technique is now the backbone of most archaeological chronology. Radiocarbon dating has been refined to the point where very small samples can be dated. Other techniques based on radioactivity have been developed since, but none is as widely used as radiocarbon dating.

Archaeologists use a number of reference points for time. Many use the AD and BC systems, both based on the Gregorian (Christian) calendar, which takes the birth of Christ as its primary reference. The abbreviation AD refers to *Anno Domini*, Latin for "In the Year of Our Lord"; BC means "Before Christ." Some Old World archaeologists use BCE ("Before the Common Era") to mean the same thing as BC, but without the religious connotation. A date of AD 700 is actually about 1,300 years ago, and a date of 700 BC is actually about 2,700 years ago. In addition, many other archaeologists use the BP ("Before the Present") system, where a date of 700 BP is about 700 years ago (Table 1.1).

Archaeological Cultures

Archaeologists widely share the premise that culture, present and past, is patterned and nonrandom; that culture consists of rules and expectations that shape behaviors; and that these behaviors, such as language, territory, religion, self-identity, and to a limited extent

table 1.1

Concordance of the Three Primary Time Systems

SYSTEM	AGE RANGE	STATED AGE	ACTUAL NUMBER OF YEARS AGO (FROM 2002)
AD (In the Year of Our Lord)	1 AD to the present	AD 700	1,302
BC (Before Christ) or BCE (Before the Common Era)	Prior to AD time, counting backward	700 BC	2,702
BP (Before the Present)	Prior to the present, counting backward	700 BP	700

biology, are learned and transmitted from generation to generation. Furthermore, it is believed that these behaviors generate a material record that can be discovered, recovered, and interpreted validly and reliably. This general approach is called the *normative view* and forms the basis for much of the archaeology done today. Often included in the normative view is the basic working assumption that past cultural behavior was rational and that people made "good" decisions. It is known that not all behavior was rational and that not all decisions were good, but this idea is used as the starting point for investigation.

Following the normative view, archaeologists work under the premise that past cultures shared the same basic features of extant cultures—that they were organized in some manner and shared a set of traits. In attempting to describe a past culture, archaeologists actually create a model—a hypothetical cultural entity—to use as an analytical unit. Such a model makes it possible to organize archaeological data in space and time. Traits are plotted and combinations of traits are noted. When some sort of inclusive pattern is detected, the entity reflected by that pattern may be called a "culture." These **archaeological cultures** are essentially models that may or may not be actual cultures (although an actual culture is the goal), and, like any model, they are subject to testing, rejection, or revision.

As additional information is obtained on an archaeological culture, the model is rejected or refined. The greater the number and consistency of the traits assigned to an archaeological culture, the more confidence there is that the culture is real. This tendency to treat archaeological cultures as real cultural groups carries a danger: the archaeologist may come to uncritically accept the model as real and stop testing it. Nevertheless, archaeological cultures are very useful entities; they help to organize data, form models, and provide testable hypotheses.

The use of technological traits alone complicates the issue. For example, if you were to examine only the material culture of the last 200 years in the United States without the benefit of any historical background, it would be easy to create two major archaeological cultures: the horse and buggy culture and the automobile culture. In reality, neither of these "cultures" is real; they are just different technological developments within a single changing culture. Such "ideal" and "real" cultures are a problem for archaeologists, who deal mostly with material culture.

Archaeology as Science

As individuals, we learn things through a variety of means—in school, by reading, through personal experience, and the like. Much of the knowledge we as individuals learn is new to us but is not actually new knowledge, being already known by others. We all question the veracity of what we learn (e.g., is the story in the newspaper actually true?) and employ methods to evaluate what we learn. We then make decisions to accept or reject what we see, read, or have been told.

Science is a formal system with which to learn new things, and it employs a number of premises, an organization of knowledge, and a specific method to evaluate new ideas. All cultures have some sort of science, some more rigorous than others. Modern science (often called *Western science*) is based on several basic premises: that the universe is real,

that reality is objective, that the universe operates according to certain constant laws, and that these laws can be discovered (Feder 2002:16–40). It is true that data are interpreted, that differences and biases arise in interpretation, and that two researchers can look at the same information and come to different conclusions. However, this does not mean that the past is not objective; it means only that there is disagreement within the scientific community. Through science, such disagreement ultimately gets worked out, although perhaps not in the lifetime of the researchers.

Science is empirical and objective, meaning that science can consider only those objects and patterns that physically exist and can be observed, measured, and tested. If something is not empirical or not testable, it is not science. Science requires that a specific method, called the *scientific method*, be employed in scientific investigations, and scientists cannot ignore information that does not agree with their conclusions. Those things that are not empirical and not testable by means of the scientific method are not science and have to be considered through other means.

Science can be divided into three broad categories: (1) the physical sciences, such as physics and chemistry; (2) the natural sciences, such as biology; and (3) the social sciences, such as anthropology and sociology. The physical sciences are experimental and quantitative, classic examples of Western science. The natural and social sciences tend to be more descriptive, less quantitative, and less suited to experimentation, and their results tend to be less precise (Dincauze 2000:21). This does not mean that the natural and social sciences are somehow less scientific; it means only that they are more difficult. Archaeology employs elements of all three categories, the physical sciences through the description and analysis of artifacts and the like, the natural sciences in understanding environment, and the social sciences in its attempt to understand human behavior. Finally, like many sciences, archaeology suffers from incomplete and imprecise information, poor control of conditions (such as time), difficulty in experimentation, and too strong a reliance on inference.

The Structure of Scientific Knowledge

Scientists organize data—empirical and objective scientific facts—into coherent systems of understanding. These systems exist at levels of increasing complexity ranging from simple explanations of observable and measurable data to complex and overarching laws of behavior. Certain specific notions and terminology are employed in modern archaeology,

Archaeologist Margaret Conkey examines rock art at a paleolithic site in France. Dr. Conkey studies the images on the art to explore the structure of human thought patterns. She also studies the role of women in the past, including as depicted (or not) in rock art. (Photo courtesy of Meg Conkey.)

and it is important to understand what these notions and terms mean. The following discussion generally follows that of Babbie (2001:51–52; also see Bell 1994b).

Archaeology generally operates within the **paradigm,** the philosophical framework, of Western science that assumes that the universe is real and knowable. Other, nonempirical frameworks have to be considered by other disciplines such as philosophy or religion. If the theoretical framework within which a discipline operates changes, a paradigm shift is said to have occurred. For example, for many centuries astronomy operated on the basic premise that the cosmos revolved around Earth. When it was discovered that Earth revolves around the Sun, a paradigm shift occurred and all of astronomy had to be rethought.

Laws are universal generalizations about classes of facts (Kaplan 1964:91). A classic example is the law of gravity: bodies are attracted to each other in proportion to their masses and in inverse proportion to the distance separating them. Laws must be truly universal, not accidental patterns found among a specific set of facts. Laws in and of themselves do not explain anything; they merely summarize the way things are. Explanation is a function of theory.

A **theory** is a systematic explanation for observations that relate to a particular aspect of the empirical world. Theories are grounded in fundamental assertions called *postulates* that are taken to be true. For example, for a scientist trying to understand past diet, a starting point could be the postulate that "Everyone desires to satisfy his or her dietary requirements." From such a postulate, we might advance the general proposition that if procurement costs are the same, people should seek to optimize their diet by preferentially seeking foods of higher caloric content over foods of lower caloric content. It is from such general propositions that hypotheses are derived.

A **hypothesis** is a specified testable expectation about empirical data that follows from a more general proposition. Using the diet example once again, we could advance the hypothesis that in the Pacific Northwest, people would abandon root-collecting when the salmon began to run up the rivers and streams because salmon contain more calories per unit volume than roots. Research could be designed to test this hypothesis, and such research could support or fail to support the overarching theory (i.e., whether diet was optimized) only indirectly—by testing specific hypotheses that are derived from the postulates on which that theory was grounded.

Models are logically derived, interrelated constructs used to estimate reality. Scientists often employ them to operationalize and test theories by composing a set of interrelated hypotheses to measure the various propositions of a theory. Continuing with the diet example, a model of the theory that people in the Pacific Northwest optimized their diet might be constructed. Such a dietary model would include hypotheses regarding the caloric return of the various foods eaten by the people (including roots and salmon), hypotheses regarding what technologies were used to obtain the various foods, hypotheses about how to archaeologically detect the use of the foods, and hypotheses about any dietary restrictions the culture may have had. The model would include a variety of aspects that can be empirically observed. Each of the hypotheses would be tested, and upon the outcome of these tests, the model will be supported, revised, or rejected.

In developing hypotheses, models, and their tests, the scientist should seek the most direct and simple explanations, ones that do not require that improbable things be true.

The postulate of "Occam's Razor" states that the most simple explanation is the most likely to be true and that the most complex answer can be true only when less complex answers are shown to be false. However, one must also remember that correlation merely identifies association and association does not equal causation. Discovering a relationship between two things does not automatically mean that they are causally related. For example, one could demonstrate that pollen is always present in the soils of archaeological sites. But, as it turns out, pollen is present in most soils and usually has no direct relationship to people.

The Scientific Method

To generate new scientific knowledge, scientists employ a specific method with rules and requirements designed to ensure an objective understanding of the nature of the universe. The **scientific method** generally encompasses the steps shown in Table 1.2.

table 1.2

The Scientific Method

Data	All science begins with the observation and recording of some empirical and measurable phenomenon, called *data.*
Hypotheses	Data themselves do not explain anything. To explain the data, a hypothesis must be developed that proposes some relationship between two or more variables. A hypothesis must be testable and refutable, with test implications being made, such as "If A is true, we will find B."
Test	To support or refute the hypothesis, a test with predictable results must be devised. To conduct the test, new or other data are required, applied against the test implications. The test and results must be able to be repeated by other researchers.
Retest	The test either supports or refutes the hypothesis. If the hypothesis is refuted, then the researcher will return to the second step and develop a new hypothesis to explain the data. If the hypothesis is supported, a new, perhaps more specific, test may be developed, more data gathered, and the hypothesis tested again. The process is then repeated, with the hypothesis being constantly refined.
Model building	If the hypothesis is part of a model constructed as part of a theory, the support or refutation of the hypothesis will influence the support or refutation of the model and, in turn, the theory. A refuted hypothesis may be dropped or refined and tested again.
Theory	Through the acquisition of new data, a reexamination of existing data, or the formulation of new hypotheses, new theories may be developed. Eventually, new laws may be proposed.

In science, hypotheses, models, and theories are only rejected or supported; nothing is ever proven—in fact, the term *prove* is not even used in science (other than in mathematics). There are always more data, another test, and new hypotheses. Even well-known physical laws, such as the law of gravity, are constantly being tested and refined. Newtonian gravity provides a description that is adequate for most circumstances but does not hold up at the atomic level, so it had to be revised. Science is a never-ending, constantly evolving body of knowledge.

The two main methods of reasoning used in scientific endeavors are known as *induction* and *deduction*. Inductive reasoning moves from the observation of specific data to the development of a hypothesis to explain the data. In contrast, deductive reasoning moves from the general to the specific; if a hypothesis is true, then one should expect to see a set of specific results when the hypothesis is tested.

Scientists of all disciplines use the scientific method in the way outlined in Table 1.2. Phenomena of all types are observed, explanatory hypotheses are developed, and they are tested. Each test, whether the hypothesis is supported or rejected, creates useful knowledge, for it is as important to know what things *are not* as it is to know what they *are*.

Some hypotheses and models describe or explain things at single points in time and are called *synchronic*. All data are synchronic in that they reflect observations of human behaviors at points along a continuum. Other hypotheses/models are *diachronic*—that is, they deal with conditions through some period of time. Both synchronic and diachronic explanations are important to understanding the past.

We all use the scientific method in everyday life. If your car will not start, you will take that information and form a hypothesis: "It may be the battery." You test your hypothesis by checking the battery. If you reject the battery hypothesis, you will form another hypothesis: "I may be out of gas." You test that hypothesis by checking the gas gauge. Perhaps you solve the problem, or perhaps you call in an expert (your mechanic). You encountered a problem, formulated hypotheses, tested them, accepted or rejected them, and acted accordingly. The mechanic will do the same, but with more knowledge and experience. Science is everyday.

Archaeologists use the same logical thought process. When an artifact of unknown function is found, the archaeologist asks, "What was this used for?" The archaeologist formulates a hypothesis such as "It was used for cutting." An examination of the artifact would probably reveal evidence that would support or refute the cutting hypothesis, such as the presence or absence of a sharp edge. If no sharp edge was seen, the cutting hypothesis might be rejected and a "pounding" hypothesis formed. If there was evidence of pounding damage on the artifact, the pounding hypothesis may be supported. Further analysis of the artifact may continue to support the hypothesis, or a new one may be formulated.

Research Design

To conduct research, the scientist must develop a plan to do the work. This plan, or **research design,** includes a statement of the question (hypothesis or model) to be researched, a discussion of what is already known about the question, a detailed description of how the question is to be tested, and what data are expected if the question is to be supported.

Today, archaeologists must develop explicit research designs prior to going into the field. The hypotheses must be explicit, the ways in which they will be tested detailed, and the data expectations for accepting or rejecting the hypotheses explained. The research design can then be reviewed, refined, and improved prior to the work being done.

In some cases, very simple questions may be asked to generate information for the development of a cultural chronology—for example, "How long did people occupy this site?" In other cases, much more complex questions may be posited, such as "What were the organization and subsistence preferences of various groups occupying a site throughout the term of its occupation?" Archaeologists can answer these questions only by studying the past in a systematic, scientific manner.

Pseudoscience

Science makes rigorous demands on data, testing, and acceptance of hypotheses and models. Lack of rigor or of adherence to the scientific method results in the rejection of the data or the hypotheses. In some cases, particularly in "popular" archaeology, people use scientific terms and phrases in an attempt to appear scientific when making their claims. In many of these cases, the data used to support such claims do not meet scientific standards, and many of the "hypotheses" are not testable. Science must reject these claims until and unless they meet scientific standards. Unfortunately, many laypersons are not aware of the unscientific nature of the claims and often accept the hypotheses as true. Such approaches are known as *pseudoscience* and do not generally follow the format of the scientific method (Feder 2002).

A well-known example of pseudoscience is the claim that extraterrestrials visited Earth and influenced a number of ancient cultures, such as the Maya and Egyptians. In his book *Chariots of the Gods*, Erich von Däniken (1970) claimed to have irrefutable evidence that many of the mysteries of the ancient world, including the building of the Egyptian and Maya pyramids, could have been accomplished only through the guidance of ancient astronauts from another world. Von Däniken presented data and developed a series of hypotheses to support his claims. However, his data consisted mostly of questionable interpretations of rather ordinary things. For example, he presented a photograph of a sculpture from the Maya site of Palenque purporting to show a man in a spacecraft with flames coming out the back. The photograph had been cropped and tilted to show only what von Däniken wanted it to show. The full sculpture is of Pacal, a Maya ruler of Palenque, sitting in a chair or throne (the supposed spacecraft) amid the Maya version of the tree of knowledge, the leaves being the supposed flames.

That and other "evidence" reported by von Däniken fails any test of science because it is purposefully partial, perhaps even contrived, and its acceptance requires that a complex and untestable conclusion be accepted. This problem is worsened by the fact that other, much less complex, and quite testable, hypotheses to explain the same data were not even considered. Logic dictates that the most complex answer can be true only when the less complex answers are shown to be false. To believe such a fantastic explanation as that proposed by von Däniken also requires the belief that the ancient Maya or Egyptians were not capable of building their own pyramids. It implies that these people were not creative, clever, intelligent, or capable, which is erroneous.

Frauds

Beyond pseudoscience, there are occasional instances of hoaxes in archaeology (Feder 2002), in which people purposefully fake data, "plant" objects in sites, or otherwise attempt to fool archaeologists. Such frauds have been perpetrated to embarrass, amuse, and bewilder both scientists and laypersons over the centuries. One of the more complex (due to its age) of these cases is the Shroud of Turin, long believed by many to be the burial shroud of Jesus of Nazareth. If the shroud was the burial shroud of Jesus, it would be about 2,000 years old. However, recent extensive radiocarbon dating of the shroud shows that it was manufactured about 700 years ago (an age also consistent with the cloth technology). It appears that the person(s) who made the shroud stained the linen in such a way as to represent the face, body, and even the wounds of Christ. Thus, the shroud is a fraud, although many still have faith that the shroud is genuine. Probably the most celebrated fraud is the Piltdown hoax, in which a human skull and an orangutan jaw were joined and passed off as a fossil hominid (Highlight 1.3). Because of the requirement of science that everything be tested, retested, and reexamined, both of these frauds were exposed. Although a fraud may fool people for a while, science ultimately is self-correcting.

HIGHLIGHT 1.3

The Piltdown Hoax

Between 1908 and 1911, a Sussex lawyer and amateur scientist named Charles Dawson uncovered a mixture of fossil mammal and human skull fragments from Barcombe Mills Manor in the Piltdown region of Sussex, in southern England. Recognizing the importance of such a discovery, Dawson contacted Arthur Smith Woodward of the British Museum to inform him of his remarkable finds. Woodward knew Dawson to be a sincere and knowledgeable person and accepted his descriptions of his recovered material as genuine. The finding of the human remains with extinct hippopotamus and elephants was big news—it suggested that a fossil human of great antiquity had finally been found.

In 1912, when Woodward finally saw the human skull fragments brought to him by Dawson, all apparently from a single individual, he was convinced of the authenticity and antiquity of the remains. They were darkly stained and appeared to have old features. Further excavations by Dawson revealed a broken mandible (lower jaw) that was decidedly ape-like. The associations with the fossil mammals suggested that the "Piltdown Man" might be as old as 500,000 years. Both Dawson and Woodward claimed that this was the most important discovery of a human fossil to date, prompting the *New York Times*, in a headline dated December 19, 1912, to proclaim, "Paleolithic Skull Is a Missing Link" (Feder 2002:68).

But despite the enthusiastic claims, there were some concerns that the Piltdown Man (scientific name *Eoanthropus dawsonii*, or "Dawson's Dawn Man") was out of step with the growing human fossil record from Europe and Asia. By the 1920s, discoveries of early human fossils had suggested that the complete development of the brain did not occur until much later in human evolution,

HIGHLIGHT 1.3 *continued*

whereas Piltdown had a human-size brain and an ape-like face. Java Man and Peking Man (later called *Homo erectus*), believed to be of the same age as *Eoanthropus*, were decidedly different. Further fossil evidence from Africa of an early human ancestor known as *Australopithecus* showed that bipedalism (upright walking on two legs) was a human trait when the brain was still chimpanzee-size. Before long, it appeared that the Piltdown discovery was an aberration rather than a "missing link."

Not until 1949 did a dating technique exist that could determine the true age of the Piltdown skull. This test, which determined the amount of fluorine absorbed by the fossil bones found at Barcombe Mills Manor, was undertaken that year at the British Museum. If the human remains were contemporaneous with those of the extinct animals with which they were found, then their concentration of elemental fluorine, absorbed from the surrounding soils, should be nearly the same. However, the analysis showed that the fluorine values were much lower in the human skull fragments and jaw than in the fossil mammals, indicating they were not the same age. Furthermore, the fossil mammals from Piltdown were found to be no more than 50,000 years old, not 500,000 (Feder 2002). Four years later, a more refined method of fluorine dating was applied to the skull and jaw fragments, which were determined to be from different animals entirely.

This reconstruction of the fraudulent Piltdown Man from skull fragments (darkest areas) resides in the Natural History Museum in London.

After the fluorine analysis, experts took a closer look at the specimens. It soon became obvious that the skull pieces were those of a modern human stained to look ancient, and the jaw was that of an orangutan stained to look old, with its teeth filed down to make them look less obviously nonhuman. The jaw also had been cleverly broken to make it impossible to align with the skull so that no one could tell that the jaw did not fit the cranium. The Piltdown skull had been a hoax from the start.

Who was responsible for the hoax? We may never know, although the finger has been pointed at everyone from Dawson to Sir Arthur Conan Doyle (author of the Sherlock Holmes stories). The latest suspect is Martin Hinton, curator of zoology at the British Museum at the time of the Piltdown discovery. He may be the true perpetrator of the hoax, because incriminating evidence was recently discovered in a traveling trunk tucked away in an attic of the museum (Gee 1996). Several "test pieces" of bone, looking strikingly similar to the Piltdown specimens and with the same artificial staining, were found. Arthur Smith Woodward may have been the target of the hoax, inasmuch as Hinton had significant salary disputes with Woodward when he worked for Woodward in the paleontology department. Whoever the perpetrator, Piltdown Man remains one of the greatest scientific hoaxes of the twentieth century. This somewhat embarrassing episode in anthropology nevertheless demonstrates the self-correcting nature of science.

CRITICAL THINKING QUESTIONS

1. How does the story of the Piltdown hoax illustrate the use of the scientific method in archaeology?
2. How do you think the discovery of the Piltdown hoax changed the way new finds are evaluated?

The Importance of Archaeology

Archaeology is concerned with learning about the past, so the importance of archaeology is largely tied to the importance of the past itself. The past is important for a number of reasons (Figure 1.2), some esoteric and some very practical. Understanding ourselves is one of the most important of human goals, and archaeology contributes to this by helping us to understand the past. Humans are generally curious, and the past holds a great fascination to many. We are all tied to the past through our families, our politics, our religions, and our countries, and we could not function without some understanding of it. As people, we must be able to learn *from* the past; but in order to do that, we must first learn *about* the past.

The acquisition of fundamental knowledge is central to what scientists do. Basic research is critical, because anytime something is learned, science expands and we all benefit. In some cases, the importance of discoveries may not be immediately recognized. New things can also be learned by making new connections between existing data. In addition, existing data may be used by future scientists to solve problems that we could not solve or that we never thought of. All of this holds true for archaeology. In addition, the range of possible human behaviors is vast and difficult to predict (as many sociologists and psychologists know too well). Any information that archaeology can provide regarding human behavior in the past may assist us in understanding current and future behavior.

Archaeology serves to enlighten people about the value of all cultures, past and present, and stresses that they should be preserved. All peoples, worldwide, are ethnocentric; they believe themselves to be superior to all other people. It is an unfortunate truth of history that ethnocentrism has led to the subjugation and ultimate demise of many cultures, all in the name of cultural superiority. For example, as Europeans began to expand across the globe after AD 1500, they felt justified in eliminating certain peoples they encountered, believing that the members of such "primitive" societies were not even human! When evidence of complex ancient societies was found, it was frequently attributed to past peoples of European ancestry, in the belief that native populations were incapable of such architectural and cultural accomplishments. Archaeology has since shown that in all cases these civilizations were the product of local peoples. Even today, these ethnocentric attitudes prevail in many places, as indigenous cultures continue to face extinction at the hands of "modern civilization" (Bodley 1998). In addition, many groups that have survived the onslaught of Western culture have lost some or all of their cultural identities. Archaeology can help these people "rediscover"

- Learn from the past to help predict the future.
- Appreciate and preserve ancient traditional cultures.
- Conserve cultural and biological diversity.
- Recover ancient knowledge and skills for adapting to the environment.
- Manage cultural resources and promote cultural tourism.
- Have an exciting and rewarding profession.

figure 1.2

The Importance of Archaeology

their past and thereby mutually benefit both outsiders and the people themsleves by promoting and enhancing a better understanding of the traditional culture.

Archaeology also makes contributions to a number of contemporary political debates. By understanding the roles of gender, religion, power and politics, indigenous rights, and the like in past societies, we can engage in a more enlightened and informed discourse about these same things in today's world.

Dealing with the past, archaeology discovers the diversity of past peoples and cultures and, to some extent, the past diversity of the natural world. The documentation and preservation of cultural diversity provide an understanding of how humans evolved and adapted, knowledge that will be useful to groups today. Archaeology also serves as a means of discovering and documenting the biological diversity of the past, an important task. An understanding of the genetic origin and diversity of maize (corn), for example, and the preservation of that diversity, could help prevent the loss of maize to some disease or other disaster.

Western culture frequently assumes that nonindustrialized (so-called primitive) peoples, today and in the past, cannot contribute anything significant to the industrialized societies of the world. What westerners fail to realize is that nonindustrial societies were highly successful for tens of millennia, and that these cultures had a detailed knowledge of the natural world that allowed for this success. Nearly 50 percent of our major drugs are derived from plants and animals, many of which traditional peoples used as treatments for illnesses for thousands of years before drug companies and commercial laboratories existed. Unfortunately, as Western culture expands, this traditional knowledge, as well as the art, medicine, philosophy, and religion of traditional cultures, is disappearing. Archaeology can help recover some of this lost information and document past traditional practices and use this knowledge to help the modern world. There is no reason to believe that there is only one successful response to a particular condition, and by understanding the responses of past peoples to various conditions, we can better anticipate and plan our own responses.

Another goal of archaeology is to study how people have interacted with the environment in the past. Archaeologists reconstruct past environments to understand how humans were influenced by their surroundings. This information may have significant applications today, especially with respect to long-term planning and understanding long-term change, such as global warming. For example, archaeologists are discovering evidence that El Niño events, the episodic warming of the western Pacific Ocean with its associated global weather fluctuations, have been occurring for thousands of years and have affected the course of civilizations, including ours (Fagan 1999; Van Buren 2001).

Archaeology provides the basis for cultural tourism, a major industry in many countries, such as Egypt, Greece, and Mexico, that are economically dependent on tourism. These countries focus on their cultural heritage and archaeological resources, and without archaeologists to discover and help interpret the remains, the economies of these countries would falter. The same is true in some parts of the United States where cultural tourism is important, such as the Southwest.

Archaeology is also of great commercial interest. Archaeological themes are widely used in advertising, generating large revenues. Archaeology also is widely used in Hollywood in films and television. Some movies featuring archaeologists have made hundreds

of millions of dollars. The past provides considerable raw material for entertainment, but archaeologists first have to discover the past. Without the work of archaeologists, Hollywood could not use the past (although it does so poorly).

Finally, archaeology is just plain fun! It can be romantic, exciting, fun to learn and discuss, and the discoveries can be thrilling. Archaeology is an excellent and rewarding profession or avocation. There is so much more to learn.

CONTENTSELECT

Search the ContentSelect database for articles using the following key words: *prehistoric archaeology, historical archaeology, classical archaeology,* and *maritime archaeology.* On the basis of your search, which brand of archaeology attracts you the most, and why?

Chapter Summary

Archaeology is the study of past peoples and cultures, developing from a base in history and anthropology within the past 150 years. Archaeologists work with the material record of past behaviors to reconstruct the past. Archaeology can be divided into a number of branches, including prehistoric archaeology, historical archaeology, classical archaeology, and maritime archaeology.

The goals of archaeology are (1) to generate information about the past through the discovery, description, and classification of artifacts and sites; (2) to synthesize information into culture histories and cultural chronologies; (3) to develop explanations for what was observed; and (4) to contribute to the comprehensive understanding of human behavior. Archaeological resources have to be managed, and the public has to be educated about both archaeology and the past. Archaeologists want to learn as much as possible about past peoples, including their subsistence, the size and complexity of their cultures, how their settlements were organized, adaptations, technology, political organization, kinship, religion, symbolism, health, human genetic variability across time and space, and how and why cultures changed through time. Answering these and similar questions is the ultimate goal of archaeology.

The evidence of the past exists in the archaeological record, which includes the material remains (artifacts, ecofacts, and features) of past human activities and behaviors, the geographic localities (sites) where these materials are found, the relationships between these materials (stratigraphy and distribution), and the patterns of those materials formed by their relationships. Knowing how old things are is critical to gaining an understanding of them, so dating is a central issue in archaeology.

Archaeology today is a science, empirical and problem oriented. To learn about the past, archaeology seeks to reconstruct and understand past human activities, to learn the *who, what, when, where,* and *why* of the past. To do this, archaeologists obtain data about the past, organize those data into a coherent system of hypotheses and models, and then

continually test and revise them with the aid of research designs. This is not to say that archaeology is a cold science—in fact, much of archaeology is now done to put a human face on the past. Archaeologists are just as interested in the social and political aspects of the past as they are in objects and dates. Scientists generate data to test hypotheses, rejecting some and supporting others.

Archaeology is important for several reasons. First, it is useful to have a more complete understanding of ourselves, who we are, where we came from, and where we are going. Second, the conservation of cultural and biological diversity, past and present, is urgent. Third, we can recover ancient knowledge and skills for adapting to the environment. Fourth, the past has to be managed to preserve it from development. Last, archaeology is an exciting and rewarding profession and contributes to the well-being of humanity in general.

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