11 Come Tell Me How You Lived

CHAPTER OUTLINE

Ankole ox from Uganda, East Africa.
(1001slide / iStock by Getty Images)

PREVIEW

Chapter 11 discusses the ways in which archaeologists reconstruct ancient subsistence. To establish entire ancient diets is often near-impossible, except when isotopic analysis on bones can be used or human coprolites are available. We describe zooarchaeology, the study of animal bones, the identification of animals, the study of butchering methods, and comparing different assemblages. Next, we turn to botanical remains and flotation methods before briefly surveying ways of studying birds, fish, and mollusks. We also assess ways in which rock art can throw light on ancient subsistence.

How did ancient peoples make their living? The old stereotype of Stone Age hunters pursuing large game animals like saber-toothed tigers and living off orgies of frenzied meat consumption vanished generations ago. We now know that plant foods and fish were vital components in many ancient diets, and ancestral Native Americans had an astounding knowledge of potentially cultivable native plants. Reconstructing ancient subsistence is a painstaking process involving days of analysis of animal bones broken into tiny fragments and highly specialized research into tiny plant seeds recovered with sophisticated sampling machines.

In some ways, studying ancient subsistence is archaeological detective work at its best. Astoundingly detailed information about prehistoric foraging and agriculture can come from the tiniest of clues, such as fish scales and seed impressions in clay pots. But, as always, these triumphs of detection form part of a larger concern, a search for answers to fundamental questions. For example, when studying prehistoric subsistence the archaeologist seeks to answer many fundamental questions, among them the role of domestic animals in a mixed farming economy. How important was fishing to a shellfish-oriented population living by the ocean? Was a site occupied seasonally while the inhabitants concentrated on, say, bird snaring to the exclusion of all other subsistence activities? What agricultural systems were used? How was the land cultivated? In this chapter we review some of the ways we seek the answers to these and related subsistence questions.

Evidence for Subsistence

The archaeological evidence for prehistoric subsistence consists of artifacts and food remains. How much survives depends, of course, on preservation conditions on the site. All too often the evidence for ancient diet is incomplete. Stone axes or iron hoe blades may give an indication of hunting or agriculture, but they hardly yield the kind of detail archaeologists need. Many artifacts used in the chase or for agriculture were made from such perishable materials as bone, wood, and fiber (see Figure 11.1).

Food remains survive very unevenly. The bones and teeth of larger mammals are the most common subsistence data, but careful excavation often reveals remains of such small animals as birds, fish, and frogs as well as invertebrates such as beetles. Plant remains are very perishable and usually are underrepresented, despite the development of sophisticated field recovery methods.

Ancient Diet

The ultimate aim in studying prehistoric food remains is not only to establish how people obtained their food but to reconstruct their actual diet. An overall picture of prehistoric diet requires, of course, constructing a comprehensive list of food resources available to

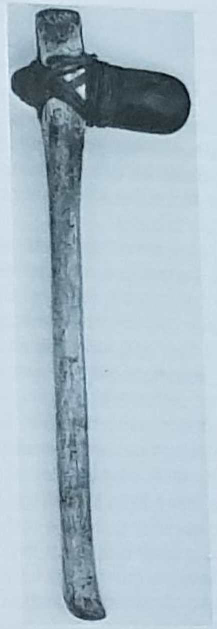


Figure 11.1 Ground stone ax with a modern wooden handle, location unknown. (Heritage Image Partnership Ltd / Alamy)

the people within that particular environment and then answering questions such as these: What proportion of the diet was meat? How diverse were dietary sources? Did the principal diet sources change from season to season? Was food stored? Were some foods more desirable than others? These and many other questions can be answered only from composite pictures of prehistoric diet reconstructed from many sources of evidence.

Occasionally, however, it is possible to gain insights into actual meals consumed thousands of years ago. The stomach of Tollund Man, whose body was buried and preserved in a Danish peat bog, contained the remains of finely ground porridge made from barley, linseed, and several wild grasses (see Figure 9.6 on p. 226). No meat was found in his belly. The Ice Man from the European Alps, described in Chapter 13, consumed meat, unleavened bread, and an herb for his last meal (see Figure 13.4 on p. 312). However, his bones showed clear signs of malnutrition from famines in his ninth, fifteenth, and sixteenth years. Ancient digestive tracts also yield informative waste products. Human excrement (coprolites or feces) found in dry caves in the United States and Mexico has been analyzed microscopically. The inhabitants of *Lovelock Cave* in the central Nevada desert were eating bulrush and cattail seeds as well as Lahontan chub from the waters of nearby Humboldt Lake. These fish were eaten raw or roasted over a fire. One coprolite contained the remains of at least fifty-one chub, calculated by a fish expert to represent a total fish weight of 3.5 pounds (1.6 kilograms). The same people were eating adult and baby birds as well as water tiger beetles. Human feces from Texas caves near the mouth of the Pecos River have been subjected to pollen analyses so precise that the investigators established the sites to have been occupied regularly during the spring and summer months for 1,300 years between 800 B.C. and A.D. 550.

Discovery

The Göbekli Tepe Carvings, Turkey, 1994

German archaeologist Klaus Schmidt discovered the large Göbekli Tepe mound in southeastern Turkey during an archaeological survey in 1994. He knew at once that it was a site that dated from the very earliest centuries of agriculture, around 9600 B.C., from the stone artifacts scattered on the surface. At the same time, he picked up dozens of smashed limestone slabs, many of them carefully shaped.

Göbekli Tepe lies atop a large hill overlooking the surrounding plains. It's a conspicuous landmark, but it turned out to be a site whose occupants were still hunting and gathering and were not farming at all. But they built a series of unique and evocative shrines and erected large decorated pillars, which Schmidt calls megaliths. Most were T-shaped monolithic pillars, standing several feet high and weighing as much as 10 tons. The limestone came from nearby quarries. One, abandoned there, was nearly 23 feet (7 meters) long and weighed an estimated 50 tons.

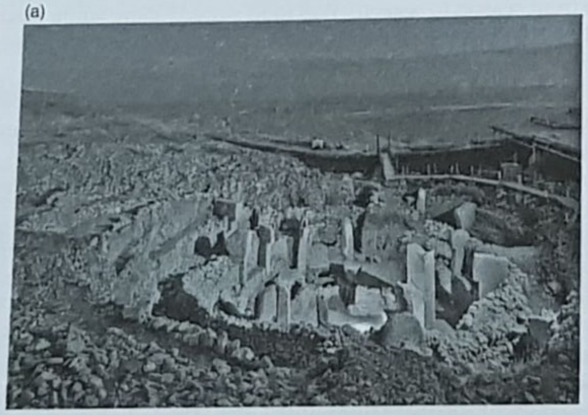
Many of the pillars bear pairs of arms and hands in low relief, as if they were stylized depictions of people, the horizontal part of the T representing the head (see Figure 11.2). Some bear carvings of lions, foxes, wild boars and oxen, even birds, spiders, and insects. Bones of most of these creatures come from the village middens. The pillars themselves formed circular or oval enclosures, as many as twelve of them separated by stone benches. Two pillars of the finest quality and greater size lay in the center of each enclosure.

Fortunately for Schmidt, later farmers dumped refuse into the enclosures and buried them before they could be disturbed. Schmidt excavated four, but a geomagnetic survey has revealed traces of at least twenty more containing more than 200 pillars.

What are we to make of Göbekli Tepe? A prodigious amount of labor created the pillars and enclosures, but there are no signs that the site was ever an inhabited settlement. There are no dwellings, no courtyards, and little domestic refuse. Göbekli Tepe was a shrine, a place that must have been known to villagers living over a wide area, who could see the mound from a long way off. Nearby lies Nevali Çori, another settlement that Schmidt had excavated earlier. But Nevali Çori was a place where people lived for a considerable period, where there was a small shrine with T-shaped megaliths and carvings of humans and animals. Schmidt believes that the inhabitants of this and other settlements visited Göbekli Tepe on a seasonal basis, when they quarried and carved megaliths and erected them in sacred enclosures. Once one structure was completed, they would infill it and build another. He also believes that the enclosures were built not for the living but for the dead. So far, the excavators have found no traces of burials, but they may lie behind the enclosure walls or beneath the stone benches. This would account for the progressive abandonment and building of the shrines.

Tiny hunter-gatherer communities produce relatively small food surpluses. It would have been difficult for them to muster the large numbers of people to build shrines and erect monoliths to commemorate their ancestors. Perhaps agriculture in this region began when hard-pressed hunter-gatherer bands looked for new ways to feed people as they fulfilled their ritual obligation to the dead. One logical way to do this would have been by increasing the supply of wild plant foods by sowing them to supplement the food supply. If Schmidt is correct in this assumption, then it may be that human beliefs and social systems changed before economic life, when ritual observances and obligations to ancestors and clan figures became overwhelmingly important to hunter-gatherer societies. After all, everyone was familiar with the germination of wild plants. Why not then plant them deliberately?

(a)



(b)

Figure 11.2 Göbekli Tepe, Turkey. (*a*) A large subterranean building showing monoliths embedded in the dry stone walls at the edge of the building, where a bench is emerging from the excavations.
(National Geographic Image Collection / Alamy)
(*b*) A monolith from the site, with low-relief sculpture.
(Marion Bull / Alamy)

Although coprolite studies are a promising source of dietary information, the food remains from most sites are far too incomplete to allow more than a very general impression of diet. Research using the ratio between two stable carbon isotopes – C-12 and C-13 in animal tissue – has enabled scientists to establish the diet of prehistoric populations as they switched from wild foods to a predominantly maize diet. Carbon is metabolized in plants through two major pathways: C4 and C3. Maize, for example, is a C4 plant. In contrast, most indigenous temperate flora in North America is composed of C3 varieties. Thus a population that shifts its diet from wild vegetable foods to maize also will experience a shift in dietary isotopic values. Because C-13 and C-12 values do not change after death, researchers can study archaeological carbon from food remains, humus, and skeletal remains to gain insight into ancient diet.

For example, a detailed bone chemistry analysis of adult burials from *Grasshopper Pueblo* in east-central Arizona shows the great potential of this approach. Joseph Ezzo was able to show that between A.D. 1275 and 1325, males had greater access to meat and cultivated plants, and females had greater access to wild plants. Between 1325 and 1400, both men and women ate virtually the same diet, one in which meat and wild plant foods were less important. This may have resulted from a combination of social and environmental factors: increased population, drought cycles, and use of marginal farming land, which compelled the Grasshopper people to live on agricultural products. The people responded to food stress by increasing storage capacity, reducing household size, and eventually by moving away.

The stable carbon isotope method has been used to study the diet of prehistoric Northwest Coast populations in British Columbia. Forty-eight samples from prehistoric human skeletons from fifteen sites along the coast revealed a dietary reliance of about 90 percent on marine sources, a figure much higher than crude ethnographic estimates. The same data suggest that there has been little dietary change along the British Columbia coast for the past 5,000 years, which is hardly surprising, given the rich maritime resources of the shoreline.

The Iron Gates gorges of the Danube River were a rich fishery, especially for migrating sturgeon as well as large catfish and pike, all harvested during spring and fall.

Between 7200 and 6300 B.C., people exploiting the river occupied settlements often used for long periods of time. Stable isotope samples from human skeletons at two sites – Vlasac and Schela Cladovei – show that between 60 and 85 percent of their diet came from aquatic sources.

Recent research has focused on nitrogen isotopes that allow researchers to distinguish among marine, freshwater, and terrestrial food sources, an approach of importance when investigating changeovers from more land-based diets to marine ones, an important issue in ancient California. **Trace element analysis** of such materials as strontium and zinc in bones and other organic materials tells us much about ancient diet. Nearer to modern times, a sample of President George Washington's hair has revealed a diet of wheat, beans, and much corn. The sample also revealed a strong but not overwhelming signal from meats, while Washington also ate some seafood. His diet was roughly in the middle of a chart compiled from dietary surveys of 10,000 modern-day University of Virginia students. Isotopic tests also allow research into child weaning practices, dietary changes over the life of an individual, even mobility from one area to another, identified by studying the bone chemistry of burials in royal graves and cemeteries (sacrificial victims, for example, could come from a different area).

Animal Bones

Broken animal bones can tell us a great deal about ancient hunting, herd management, and butchery practices. One can identify mammal species from their skeletal remains. Unfortunately, however, most animal bones found in archaeological sites are highly fragmentary. Until recently, researchers assumed they were in such small fragments because the inhabitants slashed to ribbons every carcass they butchered. But research on modern predator kills and controlled experiments on butchered animals, mainly in Africa, have shown that a great many complex and little-understood forces act on bones found in archaeological sites long after they are dropped where archaeologists find them. Weathering as bones decay in the open air, compaction of the sediments in which they are buried, chemistry of the soil, even treading by animals can break up bones and help determine which parts of the body survive and which do not. Add to these accidents the butchering activities of the prehistoric inhabitants, and you have an archaeological jigsaw puzzle to piece together (see Figure 11.3).

Generally speaking, the older the archaeological site, the more daunting it is to study postdepositional forces. The problem is particularly confusing at locations such as Olduvai Gorge or Koobi Fora in East Africa, where hominins chewed and cut bones more than 2 million years ago – and probably scavenged their meat from predator kills as well. On more recent sites, one finds that people often utilized the carcasses they butchered to the maximum. Every piece of usable meat was stripped from the bones of even the smallest animals or from the larger mammal portions brought back to the settlement. Sinews were made into thongs. Skins became clothing, containers, or even part of a shelter. Even the entrails were eaten. The hunters smashed the bones themselves to get at the marrow or for manufacture into arrowheads or other tools. Animal bones were fragmented by many domestic activities, quite apart from trampling underfoot and scavenging by dogs and carnivores. Thus one has the formidable task of identifying from tiny, discarded fragments the animal that was hunted or kept by the site's inhabitants and the role the animal played in the economy, diet, and culture of the community.

Faunal Analysis (Zooarchaeology)

Most animal bone collections consist of thousands of scattered fragments from all parts of a site. Occasionally, however, a kill site, perhaps from prehistoric bison kills on the Great Plains or the big game slaughtered by Stone Age hunters in East Africa, provides a chance to reconstruct the hunters' activities in more detail. Apart from such unusual finds, most collections have to be sorted out in the laboratory simply to give a general impression of hunting and stock-raising techniques at the site. The goal of zooarchaeology – the study of animal bones found in the archaeological record – is to reconstruct the environment and behavior of ancient peoples as thoroughly as animal remains allow. But the study of such bones is complicated by the natural and anthropomorphic (humanly induced) processes that operate on organic remains as they lie on or in the ground. The study of this transition by animal remains from the biosphere is known as **taphonomy**.

Taphonomy involves two related forms of research: observing recently dead carcasses as they are gradually transformed into fossils, and studying fossil remains with the knowledge gained from these observations. The crux of the zooarchaeologists' difficulty is their subject: a collection of animal bones, the part of the fossil assemblage that is actually excavated or collected. This fossil assemblage in turn consists of the body parts that survive in the archaeological record, an assemblage very different from the original community of live animals that once populated the natural environment in their "natural" proportions. Animal bone analysis involves two fundamental problems: first, estimating the characteristics of a fossil assemblage from a collected sample, a statistical problem; and second, inferring what the original bone assemblage was like before it became a fossil, a taphonomic problem (see Figure 11.3).

Researchers begin by isolating the diagnostic fragments. Often only a few bones are identifiable to the species level. One 3,000-year-old Central African hunter-gatherer settlement yielded only 2,128 identifiable fragments out of 195,415 bones! The actual identifications are made by comparing such diagnostic body parts as teeth, jaws, horns, and some limb bones with modern animal skeletons (see Figure 11.4). This procedure is not as easy as it sounds. Domestic sheep and goats have skeletons that are almost identical to those of their wild ancestors; the bones of the domestic ox closely resemble those of the African buffalo; and so on. But accurate identifications are vital, for they provide answers to many questions. Are both domestic and wild animals present? If so, what are the proportions of each group? Were the inhabitants concentrating on one species to the exclusion of all others? Are any now-extinct species present?

Comparing Bone Assemblages

Having identified the animals present, how do you compare the proportions of different species from one site with those from another? The work is fraught with difficulty because it is almost impossible to infer the once-living population from the surviving bones.

Zooarchaeologists therefore apply two measures of specimen abundance to study the relative abundance of species:

1. *The number of identified specimens* (NISP) is a count of the number of identifiable bones or bone fragments present that can be identified as to animal. This count has obvious disadvantages because it is easy to overestimate one species at the expense of another, especially if its bones are cut into small fragments. The NISP has some limited use in conjunction with the minimum number of individuals.

2. *The minimum number of individuals (MNI)* is a count of the number of individuals necessary to account for all of the identifiable bones. This count is based on careful inventories of individual body parts (e.g., jaws). The MNI is a much more accurate estimate of the number of animals present in a collection. For example, Joe Ben Wheat used the bison skulls from the Olsen–Chubbuck bison kill to estimate that the hunters killed no fewer than 190 animals.

Using these two counts together brackets the actual number of animals present in a bone sample, but the figure is still only an approximation, even when used with sophisticated computer programs.

Species Abundance and Cultural Change

Climatic change rather than human culture was probably responsible for most long-term shifts in abundance of animal species during the Ice Age. Some changes in the abundance of animals in bone collections, however, must reflect human activity – changes in the way in which people exploited animals.

Zooarchaeologist Richard Klein has studied two coastal caves in South Africa – Klasies River and *Nelson's Bay* – to document such changes. The Klasies River Cave on the Cape coast was occupied by Middle Stone Age hunters from about 130,000 to about 70,000 years ago during a period of progressively colder climate. The people took seals, penguins, and shellfish and lived off the eland, a large antelope. The nearby Nelson's Bay cave was occupied by Late Stone Age people after 20,000 years ago. These people took not only dangerous or elusive land mammals such as the Cape buffalo but birds and fish, both quarries requiring some skill to hunt or take successfully.

Did these changes between the two sites reflect cultural change or climatic differences? Were eland more abundant in earlier times or just easier to hunt? Klein examined the toolkits from each cave and found that Middle Stone Age artifacts were large spear points and scrapers, but the later Nelson's Bay people used bows, arrows, and an elaborate toolkit of small, more specialized tools. This more specialized toolkit allowed the Nelson's Bay groups to hunt more dangerous and tricky quarry with great success. Therefore, eland were less common prey later not because of climatic change but because other animals were hunted, too. Then, too, in later times the population was larger. Klein suggests the growth from his examination of the limpet and tortoise shells from both sites. The Nelson's Bay specimens are smaller, as if these creatures were allowed to grow larger in earlier millennia when fewer people were there to exploit them.

Game Animals

A collection of game animals yields a wealth of information about the great variety of mammals that ancient hunters killed with astonishingly simple weapons. North American Paleo-Indian bands used game drives, spears, and other weapons to hunt herds of now-extinct big game. Twenty thousand years ago, big-game hunters on the banks of the Dnieper and Don rivers in western Russia cooperated in pursuing mammoth and other arctic mammals. They cached supplies of game meat to tide them over the long, bitterly cold winters, which lasted more than eight months.

When the identified game animal bones are counted, one species may appear to dominate. Some hunters concentrate on one or a few species, whether from economic necessity, convenience, or cultural preference. They may take hundreds of bison in fall, when they are fat from summer forage, and kill the minimum in spring, when the animals are in poor condition after the harsh months. Even with these differences taken into account, the figures can be misleading, for many societies restrict the hunting of particular animals. Others forbid males or females to eat certain species, although other species may be consumed by everyone. The !Kung San of the Kalahari today have complicated personal and age- or sex-specific taboos to regulate their eating habits. No one may eat all of the twenty-nine game animals regularly taken by the San. Indeed, no two individuals have the same set of taboos. Such complicated restrictions are repeated with innumerable variations in other hunter-gatherer societies. The simple dietary figure of, say, 40 percent white-tailed deer and 20 percent wild geese may, in fact, reflect much more complex behavioral variables than mere concentration on two species.

Domesticated Animals

Domestic animal bones present even more difficulties. Owners can affect their herds and flocks in many ways – by selective breeding to improve meat yields or to increase wool production, and by regulating the ages at which they slaughter surplus males and old animals. All domesticated animals originated from wild species with an inclination to be sociable, a characteristic that aided close association with humans.

Animal domestication may have begun when a growing human population needed a regular food supply to support a greater density of people per square mile. Wild animals lack many characteristics valuable in their domestic relatives. Wild sheep have hairy coats, but their wool is unsuitable for spinning. The ancestors of oxen and domestic goats produced milk for their young but not enough for human consumption. People have selectively bred wild animals for long periods to enhance special characteristics. Often the resulting domestic animals can no longer survive in the wild.

The history of domestic animals must be written from fragmentary animal bones found in sites occupied by prehistoric farmers. The difference between domestic and wild animal bones is often so small that it may be next to impossible to tell the two apart. From a single jaw, no one can tell a domestic sheep or goat from a wild one. Archaeologists have to work with large numbers of animals, studying changing body sizes and bone characteristics as the animals undergo selective breeding. Early Southwest Asian domestic sheep are smaller and display less variation in size than their wild relatives. Even then, it is, according to the Scriptures, "difficult to tell the sheep from the goats."

Ancient Butchery

Prehistoric peoples hunted game animals for food and used their hides for garments and tents and their stomachs for bags. Domesticated animals provided meat and were used for plowing, for riding, or for their milk. Establishing such practices from fragmentary animal bones is difficult, involving close study of both the age of slaughtered animals and the ways in which they were butchered.

Just as with comparing different assemblages, the problem is turning figures and percentages into meaningful interpretations of human behavior. Research such as Lewis Binford's studies of Alaskan caribou hunters has provided valuable information for such approaches (see Chapter 9).

Determining the sex and age of an animal may provide a way of studying the hunting or stock-raising habits of those who slaughtered it. Many mammal species vary

Plant Remains

Animal bones tell only part of the subsistence story. Throughout human history, people have relied heavily on plant foods of all kinds. For the past 12,000 years, they have grown them as well. In many societies game meat formed far fewer meals than vegetable foods, which are often completely invisible in archaeological sites. For example, the !Kung San, present-day inhabitants of the Kalahari Desert in southern Africa, know of at least eighty-five edible seeds and roots. Most of the time they eat only eight of these. The rest of the vegetable resource base provides a reliable cushion for this foraging population in times when key vegetable foods are scarce. Such people have a buffer against famine that many farmers with their cleared lands, much higher population densities, and crops that rely on regular rainfall rarely enjoy. The San's lifeway raises a question: is a farming life really to be preferred? A few studies of the skeletons of early farming populations show how malnutrition due to food shortages was commonplace in many areas.

Until about twenty-five years ago, most evidence for plant remains came from sites in very dry environments – Hogup and Gatecliff in the Great Basin of the arid West are two examples, much of the former's deposits consisting very largely of chaff, seeds, and other botanical remains. In Mexico's Tehuacán Valley, Richard MacNeish assembled a continuous sequence of human occupation for the period from 10,000 years ago to the Spanish Conquest. He dug more than a dozen open sites and caves, all so dry that they yielded 80,000 wild plant remains and 25,000 specimens of domestic corn. MacNeish was able to identify diminutive maize cobs in several caves, which have been AMS dated to about 2700 B.C. These early maize cobs were no more than 0.78 inches (2 centimeters) long, but later ones were far larger. Unfortunately, MacNeish was unable to identify the original wild ancestor of Tehuacán maize, now known to be a native grass still growing in Mexico today – teosinte. The earliest maize cultivation in the Americas currently dates to the sixth and fifth millennia B.C. on the basis of pollen grains at the San Andrés site in lowland Veracruz, Mexico, and new evidence from the Panamanian rainforest, dating to about 5000 B.C.

Under less-than-ideal preservation conditions elsewhere, the only plant remains that survived are **macrobotanical remains** – easily recognizable items such as pine nuts, maize cobs, charred nuts, or seeds preserved in a hearth or charcoal, very rarely remains of cooked meals. Grain impressions preserved in wet clay pot walls occasionally provide information (Figure 11.6a). For example, Maya farmers in northern Belize cultivated raised fields in wetlands. The waterlogged soils contained avocado, maize, and other domesticated grass seeds. At Dust Cave in Alabama, already described in Chapter 7, the inhabitants processed large quantities of hickory nuts and acorns, also black walnuts, hackberry, and hazelnuts. But hickories were the dominant nut, the discarded shells being used as fuel, for they have a high fat content and burn hot. Acorns were an important staple throughout the West and elsewhere. They have the disadvantage that they require quite lengthy processing to leach out toxins, but they both provide protein-rich food and have the priceless quality of being easily stored for months, an important consideration for people living in arid environments with only seasonal nut harvests.

In recent years, major strides have been made in the study of plant remains using a variety of lines of evidence that were previously unthinkable.

In recent years, **paleoethnobotanists** – scientists who recover, identify, and study ancient vegetable remains and assess the relationships between people and plants – have made major strides in the study of plant remains, using a variety of methods and

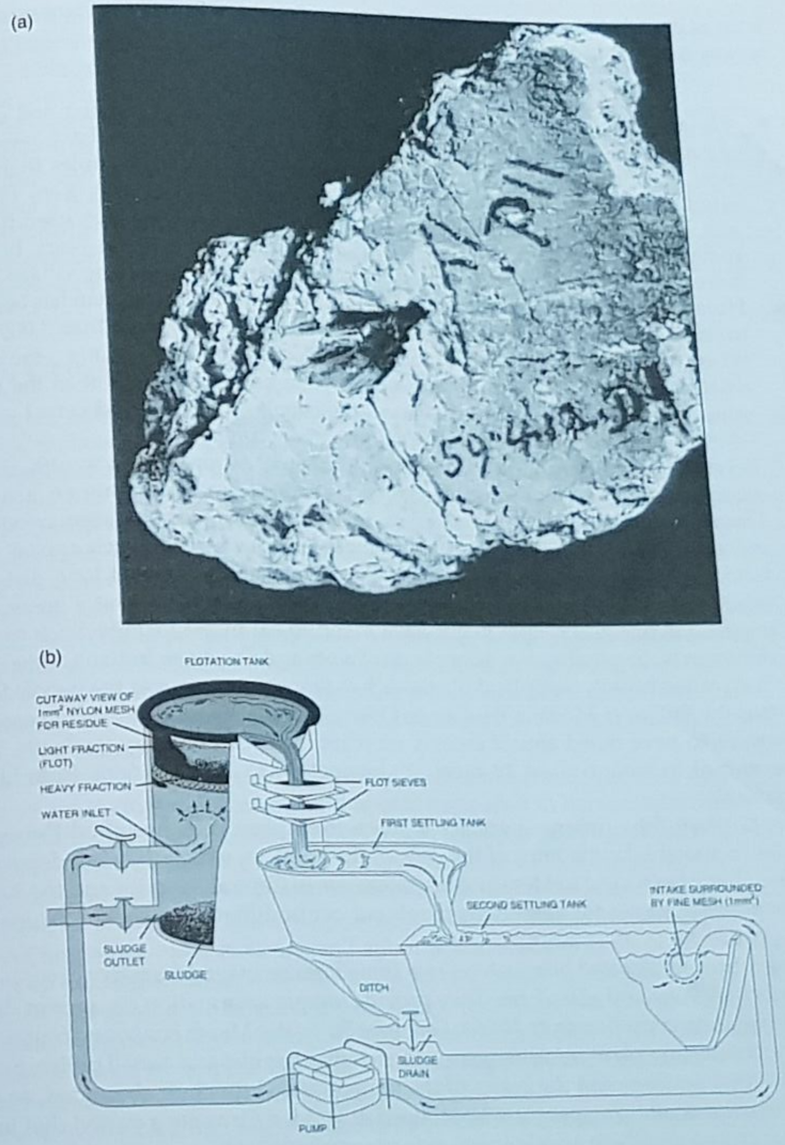


Figure 11.6 Recovering evidence for gathering and agriculture. (*a*) A grain impression preserved on a clay pot fragment from an early farming site in eastern England, approximately 2.2 inches (5.6 centimeters) in diameter. (*b*) Model of a water flotation device for recovering plant remains using recycled water, developed by British botanist Gordon Hillman. The lightest remains float to the surface and are caught in special sieves. The heavier material sinks and is trapped in light nylon mesh.
((*a*): Cambridge Museum of Archaeology and Ethnography, Cambridge University. (*b*): Annick Boothe after Hillman & Pearsall 1989. From Colin Renfrew and Paul Bahn, *Archaeology: Theories, Methods, and Practice*, New York: Thames and Hudson, Inc., 2001. Reprinted by permission.)

lines of evidence that were unimaginable in earlier years. Some important methods of recovering and studying plant remains are now routine:

- **Flotation** recovers tiny seeds and other botanical finds by passing soil samples through water or chemicals (see Figure 11.6b). Flotation methods have revolutionized the study of ancient plants, for they provide large seed samples that can be studied with statistical methods. At the *Ali Kosh* mound in Iran, Kent Flannery and Frank Hole thought that plant remains were scarce. Then they used flotation methods and recovered 40,000 seeds from the trenches. In recent years, botanists have obtained literally pints of seed samples from the early farming village at Abu Hureyra in Syria – samples so complete that botanist Gordon Hillman has been able to chronicle major shifts in plant-gathering preferences over more than 3,000 years. When Abu Hureyra was a small foraging settlement before 10,000 B.C., the people relied heavily on acorns and other nut crops in nearby forests. But as the forests retreated in the face of dry conditions, the people turned to wild cereal grasses, which they soon domesticated to provide extra food supplies.
- **Palynology (pollen analysis)**, described in Chapter 10, provides a wealth of information not only about ancient environments but also about human activities. Domesticated plants have characteristic pollen spores. So do cultivation weeds, like *Plantago lanceolata*, described at the beginning of Chapter 10, which appear when land is cleared for cultivation. Pollens are minute and can travel long distances, which means that samples from an archaeological site provide but a generalized impression of what people might have found to eat in the vicinity. Such impressions can be invaluable. For example, the Paiute and Shoshone Indians of the Great Basin relied heavily on upland plants such as piñon nuts, whereas the people living near the *Stillwater Marsh* in the Carson Desert, Nevada, about a thousand years ago appear to have relied almost entirely on plant foods from nearby wetlands. They seem not to have walked 12 miles (20 kilometers) to obtain piñons from higher ground.
- **Opal phytoliths** (minute particles of silica from plant cells absorbed through a plant's roots) take the form of the cells of the plants in which they are deposited. They have been used to identify early maize use in Central America and the Andes but are of most use for identifying the abundance of different grasses in occupation deposits.
- **Coprolites** (desiccated human feces) are sometimes recovered from dry caves in the American West and elsewhere. They provide unique information on ancient diets. For instance, coprolites from *Hidden Cave* near Stillwater Marsh contained fragments of bird, fish, and plant remains, among them bulrush millet and cattail pollen. Small waterfowl feathers and the bones of the minnow-sized tui chub abounded, as did insects and snails. The people who stopped at Hidden Cave ate a varied diet from an environment where a wide range of foods were available.
- **Bone chemistry** Bone and stable isotopes, described earlier in the chapter, provide valuable information on diet at a general level. For instance, the bone chemistry of the inhabitants of Pecos Pueblo in the American Southwest shows that they ate predominantly maize and very little meat. Northwest Coast populations tended to have diets that relied heavily on maritime foods, as one would expect.

These are but a few of the methods that are now used to study ancient plant remains. These inconspicuous, and hitherto often neglected, finds can yield valuable information

on important questions. Samples from flotation analysis can provide enough seeds to record differences in seasonal occupation. For instance, a spring visit in search of one form of edible grass that ripens in spring and is overwhelmingly abundant in the sample is clear evidence for seasonal occupation. But a word of caution: ancient environments differed often dramatically from those of today, so any study of plant use cannot be divorced from a parallel understanding of the surrounding environment at the time. Plants had, and still have, important symbolic and ritual associations in many societies, among them hallucinogenic mushrooms and peyote. Many ancient societies had an encyclopedic knowledge of medicinal and poisonous plants for curing all manner of diseases and for such esoterica as toxic arrowhead poisons and substances like aconite, smeared by native Americans in Alaska on their whaling harpoons and lances.

Birds, Fish, and Mollusks

Bird bones, although very informative, are often neglected at the expense of larger mammal remains. As long ago as 1926, Hildegarde Howard studied a large bird bone collection from an Indian shell midden on the eastern shores of San Francisco Bay. The inhabitants had hunted many waterbirds, especially cormorants, ducks, and geese. When Howard looked more closely at the bones, she found that all of the geese were migrant winter visitors that frequent the Bay Area between January and April. Nearly all the cormorants were immature specimens, birds about five to six weeks old. What time of the year had the Indians occupied the site, she wondered? Howard consulted present-day records pertaining to when cormorants hatch and used these to estimate what time of year the earlier inhabitants must have eaten the young cormorants. Based on these records, she estimated the cormorants had been killed about June 28. She then determined that the Indians must have lived there once in the winter and a second time in the early summer.

The Howard study is a venerable classic, well worth citing, but there are numerous more recent examples, including studies of a major shift in human subsistence during the warming and rise in sea levels after the Ice Age, some 10,000 years ago. Many hunting groups in what is now the Baltic region trapped and killed large numbers of waterfowl, including ducks and swans. Hunters in the Great Basin and in the Mississippi Valley used decoys that allowed them to catch swimming waterfowl, many of them during migratory visits in spring and autumn. The study of birds includes, of course, not only hunting them but also the early domestication of chickens, geese, and later turkeys. Nor should we forget that people kept falcons for hunting and other birds for pleasure, activities sometimes reflected in archaeological sites. So is the trade in exotic plumes flaunted by tropical birds like macaws, highly prized by Pueblo Indians in the Southwest and traded north from tropical environments in Mexico.

Fishing, like bird hunting, became more important as people began to specialize in different lifeways and adapt to highly specific environments. Evidence for fishing comes from both artifacts and fragile fish bones, which, when they survive, can be identified with considerable accuracy. Freshwater and ocean fish may be caught with nets or with basketlike fish traps. Indians who lived on the site of modern Boston in about 2500 B.C. built a dam of vertical stakes and brush. When the Atlantic tides rose, fish were directed into gaps in the dam and trapped in huge numbers. Barbed fish spears and fishhooks are relatively common finds in some archaeological sites, but such artifacts tell us little about the weight of fishing in prehistoric subsistence. Did the people fish all year or only when salmon were running? Did they concentrate on coastal species or venture far offshore in large canoes? Such questions can be answered only by examining the fish bones themselves.

The Chumash Indians of southern California were remarkably skillful fishermen, whose intensive fishing activities go back at least 5,000 years, probably longer. In later times, they went far offshore in plank canoes to fish with hook and line, basket, net, and harpoon. It was no surprise when the fish bones found on archaeological sites at the *Talepop* site in southern California included not only the bones of such shallow-water fish as the leopard shark and California halibut but the remains of albacore, ocean skip-jack, and large rockfish, species that occur in deep water and can only be caught there. Early Spanish accounts speak of more than 10,000 Indians living in the Santa Barbara area of California alone, a large population indeed. Archaeology has shown that this maritime population was able to exploit a very broad spectrum of marine resources, but despite this abundance there were occasional famines.

Fishing, with its relatively predictable food resources and high protein potential, allows much more sedentary settlement than other forms of hunting and gathering. The Northwest Coast Indians enjoyed a very rich maritime culture based on ocean fishing and salmon runs that enabled large numbers of people to live in one area for long periods and to build permanent dwellings.

In medieval times and later, the Atlantic cod, *Gadus morhua*, became a staple part of European diet. Easily dried and salted, butterflied cod from the Lofoten Islands off northern Norway served as hardtack for Norse seamen voyaging to Iceland and Labrador. Thousands of cod bones from sites in Iceland and in the Lofotens dating to after A.D. 1000 document highly standardized curing methods and a preference for medium-sized cod, up to 3 feet long. Catholic doctrines of meatless holy days, Fridays, and Lent created a huge demand for cod, which endured into modern times.

Shellfish from seashore, lake, or river supplied a good portion of the prehistoric diet for many thousands of years. In places like Japan and Scandinavia, they were an important food during the lean months of late winter and early spring. Freshwater mollusks were important both to California Indians and to prehistoric people living in the southeastern United States. Most mollusks have limited food value, and so great quantities are needed to feed even a few people. One estimate for 100 people's mollusk needs for a month runs as high as 3 tons. In all probability, mollusks were more a supplemental food at set times of the year than a staple. They were simply too much effort to collect in sufficient quantity.

Even sporadic collecting led to rapidly accumulating piles of shells (shell middens) at strategic points on lake or ocean shores, near rocky outcrops or tidal pools where mollusks were commonly found. Shell midden excavations in California and elsewhere have yielded thousands of shells, which are counted, identified, and also measured to check for size changes. When Claude Warren sampled a shell midden near San Diego, California, he found five major species of shellfish commonly exploited by the inhabitants. The earliest shellfish collectors concentrated on the bay mussel and oysters, both of which flourish on rocky shores. But by 4000 B.C., the lagoon by the shell middens had so silted up that mud-loving scallops and Venus shells were now collected, for the earlier species were unable to flourish in the new, sandy environment. Soon afterward, however, the lagoon became clogged and the shellfish collectors moved away, never to return. Their abandoned seashells told the story of the changing environment around the sites.

Both freshwater and saltwater shells were widely used as ornaments in prehistoric times. Gulf Coast shells were bartered over enormous distances of the southeastern and midwestern United States to peoples who had never seen the ocean. Sometimes such ornaments could assume incredible prestige value. When nineteenth-century explorer David Livingstone visited Chief Shinte in central Africa in 1855, he found him wearing two seashells that had come over 994 miles (1,590 kilometers) inland from the distant East African coast. The chief told him that two such shells would buy a slave; five would buy a large ivory elephant tusk. Small wonder that enterprising merchants were trading china replicas of these shells in central Africa half a century later.

shells as ornaments

Rock Art

Sometimes prehistoric rock art gives vivid insight into subsistence activities of long ago, such as hunts and fishing expeditions. Hunter-gatherers and fishing cultures have left behind paintings of their daily life on the walls of caves and rockshelters. In recent years, South African archaeologist David Lewis-Williams and others have used oral traditions and nineteenth-century ethnographies to develop interpretations of some of the rituals depicted in the paintings. However, the art also has a valuable role to play in the interpretation of subsistence activities. Careful examination of these paintings can take us back centuries and millennia to the time when people were killing the animals whose bones lie in occupation deposits under the observer's feet. Many details of weapons, domestic equipment, and hunting and fishing methods can be discerned in these vivid scenes.

The Stone Age paintings of southern Africa have long been known not only for their representations of important symbolic rituals in hunter-gatherer life but also for their depictions of life in prehistoric times. At the *Tsoelike River* rockshelter in Lesotho, southern Africa, paintings show fishermen assembled in their boats. They have cornered a shoal of fish that are swimming around in confusion. Some boats have lines that seem to be anchors. The fishermen are busy spearing their quarry. Another famed scene depicts a peacefully grazing herd of ostriches. Among them lurks a hunter wearing an ostrich skin, his legs and bow protruding beneath the belly of the apparently harmless bird. One can only wonder if his hunt was successful.

The artists painted big-game hunts, honey collectors, women gathering fruit, cattle raids, even red-coated British soldiers. Scenes like these take us back to hot days when a small group of hunters pursued their wounded quarry until it weakened and collapsed. The hunters, having stalked their prey for hours, relax in the shade as they watch its death throes. Then they settle down to butcher the dead animal before carrying the meat and skin home to be shared with their group. Few artifacts survive from scenes such as these, but the objective of reconstructing ancient subsistence patterns is to re-create, from the few patterned traces that have survived in the soil, just such long days in the sun.

SUMMARY

1. Archaeological evidence for subsistence comes from artifacts and food remains, with animal bones forming the most common source of information.
2. Reconstructing entire diets is much harder, for the proportions of different foods in the diet have to be established. Bog corpses, human feces, and stable carbon isotope analysis provide invaluable information on ancient diets.

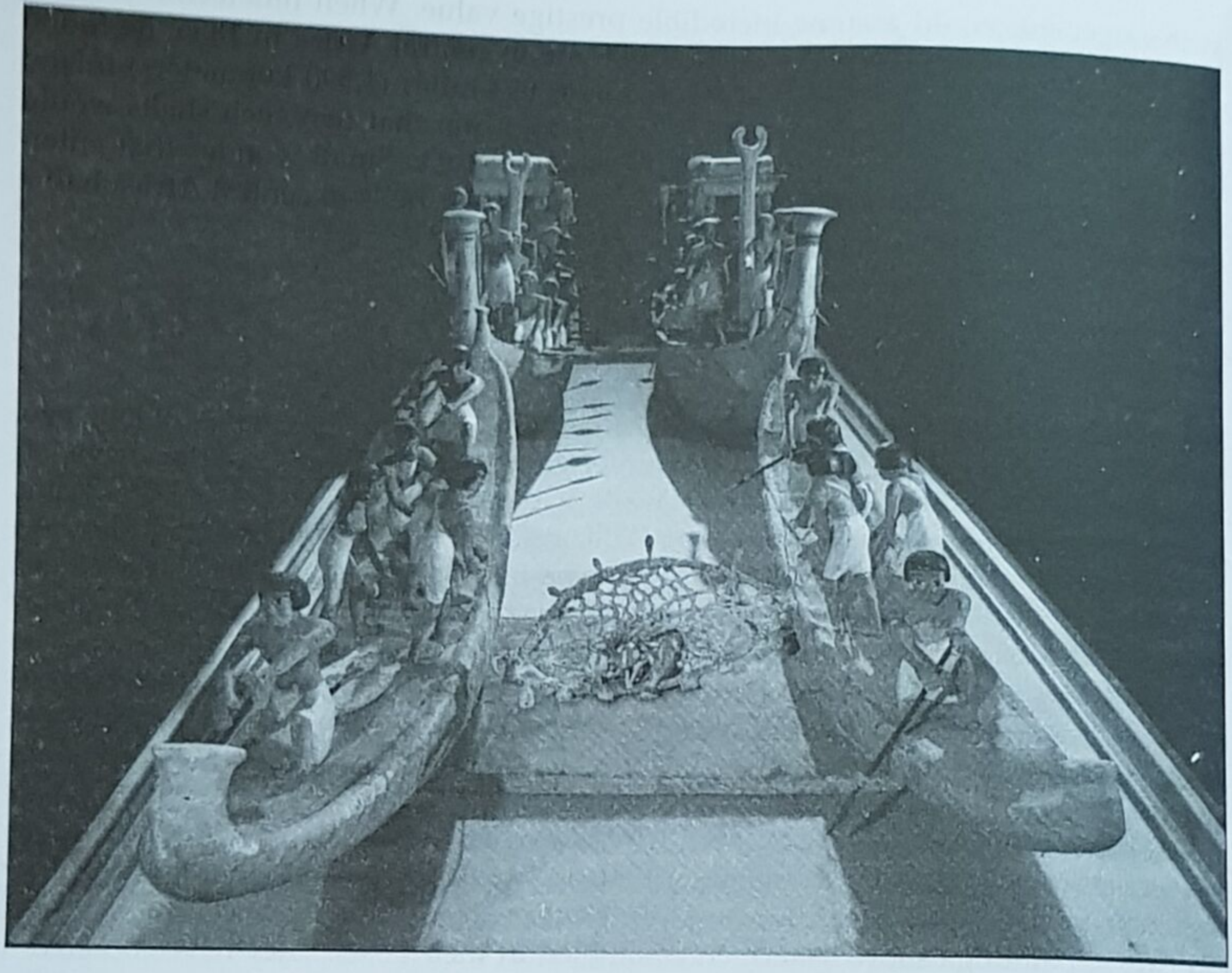


Figure 11.7 Two Ancient Egyptian fishing boats raise a seine net on the Nile. A model from the tomb of Chancellor Meketre, *c.* 1975 B.C.
(Heritage Image Partnership Ltd / Alamy)

3. Fragmentary animal bones broken up for food (zooarchaeology) provide information on hunting and herding, requiring careful analysis of the minimum numbers of species present and counts of the minimum number of individuals.
4. Zooarchaeology can sometimes provide information on hunting preferences, butchery, seasonal occupation of camps, and early domesticated animals and animal husbandry.
5. Wild and domesticated plant remains can be studied in carbonized seed form, or as imprints on clay pot walls, but flotation methods provide larger statistical samples for analyses of changing foraging and farming practices. AMS radiocarbon dating lets researchers date individual seeds or cobs, providing new information on the origins of food production.
6. Birds, fish remains, and shellfish are invaluable sources on seasonal occupation and intensive foraging in many parts of the world.

QUESTIONS FOR DISCUSSION

1. What are the uses and limitations of zooarchaeology for reconstructing ancient subsistence?