SECTION B

Archaeological Fieldwork

Archaeological fieldwork includes a number of different activities. In case you are not familiar with the variety of things archaeologists do in the field, we outline the process mentioned in Chapter 1 in more detail here.

Archaeologists record site locations and characteristics during archaeological surveys. Once sites are found, artifacts may be collected from their surface. Since not all archaeological sites have the same potential, and since we cannot know what lies below the ground simply from surface observation, test excavations are often done. Geophysical prospecting may augment test excavations, to give us some idea about the subsurface character of a site without requiring excavation. When there are good indications that a site may provide important information, excavations are conducted. The excavations yield artifacts and information about their context, as well as information about features at a site that allow inferences to be made about the past. Each step of the process is done with a purpose, and each step is guided by a research design.

RESEARCH DESIGN

Though they are sometimes not explicit documents, research designs are the rationale for a particular project. Unlike mountains, which are often climbed because they are there, archaeological sites should not be dug simply because they have been located, unless, of course, they are in danger of being destroyed. Even in that case, it is important to approach the investigation with some notion of an important question, since the problems being addressed determine which of the innumerable potential observations that could be made actually will be recorded. It is often said that archaeology is the only discipline that destroys its data in the course of obtaining them. This, of course, refers to the result of digging: destruction of the relationships among artifacts, features, and deposits. We keep records of those relationships to avoid the loss of valuable information. It is not possible to record everything, even though we try to be thorough. Research designs help focus our observations and help ensure that the required data are, indeed, collected. They also help determine which areas are important to survey, which sites are important to test, and what portions of sites should be excavated.

Research designs can be formal or informal. They are sometimes lengthy documents that cover work over multiple years on large projects. Some research designs are structured in a formal hypothesis-testing format in which hypotheses about the past are proposed, their implications for the material record are determined, and a process for judging whether the implications have been met is developed. Other research designs can be stated by a simple question: "What kinds of archaeological sites are to be found in this unexplored area?"

Although there are many similarities, there are also some important differences between academic research designs and those found in cultural resource management. In academic archaeology, the specific interests and research problems of the archaeologist generally dictate the location of the research. Survey areas are chosen because they are likely to have sites relevant to answering the researcher's questions, and specific sites are chosen because they are the best candidates for producing the desired information. This is also true for many avocational projects. In CRM, on the other hand, survey locations are dictated by the projects the archaeologist is hired to do, and the project areas may make little sense in terms of broad topics like past settlement systems or economic organization.

Occasionally, large projects like the Dolores Archaeological Program (see Section D.5) cover areas that are culturally meaningful, but often CRM study areas are small or arbitrary. The project areas are developed with the needs of a pipeline, freeway interchange, or housing development in mind, not those of the CRM archaeologist. Places that are good places to live today, however, may well have been good places to live during the last 10,000 years, so it is not uncommon to find major archaeological sites in the same areas now undergoing development. CRM archaeologists find sites in areas to be developed, determine which ones have important deposits, and then excavate those that cannot be avoided by the construction. It is the archaeologist's job to develop the best set of research questions for the sites being investigated and to make sure that data are collected to address those questions. The complexities of this process are indicated by "The Pueblo Grande Project: An Example of Multidisciplinary Research in a Compliance Setting" in Chapter 1.

Another difference between academic archaeology and CRM archaeology is timing. Although academic archaeologists must often prepare progress reports on relatively tight schedules and may feel pressure to produce results for consideration in tenure and promotion decisions, they generally can work slowly and stretch projects over a number of years. CRM archaeology is generally done under very tight deadlines. Because CRM is usually only a part of an often lengthy permitting process, there is great pressure to finish work quickly. For the developer, delays in the archaeology may be quite costly, entailing such financial drains as missing windows of opportunity, delaying an entire approval schedule, and requiring longer periods before construction. Further, with most academic research projects, the sites are still available for study when the project is finished. CRM projects, on the other hand, are often the last opportunity to investigate a site before the development process destroys it.

Academic projects may consist entirely of survey or entirely of excavation, or they may analyze an existing collection. They may also include elements of all three. CRM projects usually follow a specific sequence, passing through several phases in order. Phase I CRM studies are archaeological surveys, phase II studies are site evaluations (site testing), and phase III studies, called data recovery or mitigation, usually consist of excavation of significant portions of a site or sites. Put another way, phase I studies ask the question "Are there any cultural resources in the area?" Phase II studies ask "Are any of these cultural resources significant?" Phase III studies ask "How do we retain the information these resources can provide?

SURVEY

Just as the first step in any scientific investigation is a review of the relevant literature, so the first step in the survey or reconnaissance process is the thorough examination of the site records and the reports from other projects in an area. This phase provides an idea of what has already been found in the area and what might be expected. Such studies are useful in the early stages of planning construction projects so that important archaeological sites can be avoided when one is choosing between alternative routes or placing specific project features. In academic research, the literature review provides background and may also include review of important details of the theoretical literature dealing with the researcher's topic.

Archaeological survey is the process of looking for archaeological sites (Figure B.1). Surveys can be performed at different levels of intensity. In the early days of archaeology, intuitive surveys were common. In this type of survey, archaeologists did not systematically cover the landscape. **Probability surveys** look at only part of the project area (a sample), with an eye toward drawing conclusions that apply to the entire area. To this end, the archaeologist usually employs some sort of sampling, or selection of units at random. The area to be sampled is generally divided into conveniently sized units, and each unit is numbered. The sample size desired is determined, and a table of random numbers is consulted to determine which units are actually selected. Because different environments often are apparent in a given area, this environmental variability may be used to stratify the sample. Each environmental zone becomes a subunit in the sample, and units are drawn randomly from each zone to ensure adequate coverage. A survey of a river valley, for example, might define as sampling strata the floodplain, the first terrace, the valley slopes, and the uplands above the valley. Sample units would be drawn randomly from each type of area.

In areas where vegetation is relatively sparse, archaeological survey is an easy matter. The area to be surveyed is defined, and then archaeological crews walk the area systematically, usually in transects that are a specified distance apart. The crew members examine the ground surface for artifacts, dark midden soil, or features (e.g., remnants of walls, mounds) that indicate the presence of archaeological sites. In areas where heavy vegetation covers the ground, such as forests, the crews will augment their inspection of the ground surface with the excavation of periodic postholes or quick **shovel test pits (STPs)** (Figure B.2).

You are probably familiar with **GPS (Global Positioning System)**, the satellite location systems that can determine quite precisely where a GPS unit is located on the surface of the earth. Archaeologists were quick to see the application of this technology to their work (see Figure 14.6). They use these units, which

FIGURE B.1
Archaeological surveyors spacing out in the Allegheny National Forest in Pennsylvania to look for sites along survey transects; compare with Figure 1.12.

can provide a location to within centimeters, to record site locations and to map sites. Because many units have memories, GPS units can provide a record of what areas were covered on surveys. Prior to the advent of GPS systems, archaeologists determined site locations from features on topographic maps. Often compass sightings to points visible from the site and shown on the topographic map allowed the site to be triangulated rather precisely. If there were no prominent features that could be sighted on, location with a compass was difficult. On the Wetherill Mesa Survey in Mesa Verde National Park in the early 1960s, the heavy growth of piñon pine made compass triangulation difficult. Since GPS technology was not available at that time, the archaeologists set up radio transmitters at known locations and used directional radio receivers to triangulate their sites (Hayes 1964). GPS systems provide very precise site locations in digital format. GIS (geographical information systems) computer programs can use this information to manage locational data. In addition to locations, GIS programs can store in different layers mapped data on, for example, topography, vegetation communities, geology, soils, and hydrology. Because archaeological site location can be related to the other mapped information, it is possible to use GIS programs to explore patterning in site location with regard to environmental

FIGURE B.2 Archaeologists digging a shovel test pit at a small rockshelter during an archaeological survey in northwestern Pennsylvania.

variables. With GIS, archaeologists can answer questions like "Are agricultural sites located near certain types of soil?" or "What kinds of vegetation communities have the most sites?" In addition to being a powerful research tool, GIS allows cultural resource managers in government agencies to keep track of archaeological sites, determine the sensitivity of different environmental settings, and predict the potential effects of construction projects on the archaeological sites. Used wisely in the early planning stages of a project, GIS analysis may even help to find the project alternatives least likely to impact archaeological sites. Many state historical preservation offices are now converting state site files to GIS systems for ease of both permit review and research.

Aerial photography, and more recently satellite imagery, has also been of great use to archaeologists. Good photographs provide information on plant cover and on the nature of the landscape. They also can be useful in finding archaeological features of some kinds. In the early 1930s, a pilot flying along the lower Colorado River near Blythe, California, photographed giant figures scraped into the desert pavement. The existence of these ground figures, now called geoglyphs, was previously unknown.

Archaeologists have also used aerial photographs to find large sites such as pueblos or mounds. Archaeologists are now using photographs taken by satellites or the space shuttle. Such photos have been used to map the road systems that radiate out from Chaco Canyon in New Mexico, and various aerial photographs have been used to explore proposed Hopewell roads in Ohio as well. In the Ripley Project described in Section D.1, aerial photographs spanning many decades were helpful in assessing shoreline erosion of site deposits into Lake Erie.

SURFACE COLLECTION

We often find artifacts on the surface of archaeological sites. Indeed, it is usually artifacts on the ground surface that indicate the presence of archaeological deposits, and some archaeological sites have no subsurface deposits at all. Surface collection is the process of investigating the surface distribution of artifacts by picking up items lying on the surface. If a site is overgrown, the archaeologist will generally clear the vegetation; in sites that have a history of being farmed, the archaeologist may order plowing to expose artifacts in the previously disturbed plow zone.

It is important to record information about the location of these artifacts on the site. In some cases the archaeologist will map individual artifacts. If the surface of the site holds a large number of artifacts, the archaeologist may establish a grid over the site and use the grid units to provide locational information. To set up a grid, the archaeologist lays out two lines (or axes) at right angles to each other and usually oriented to the cardinal directions (north–south and east–west). Along each line there will be points and lines (either imaginary or physically marked with stakes and string, as in Figure B.3). Since points are laid out from both axes, the lines extended from them intersect to form a number of grid squares, much like a checkerboard. The squares are given some sort of consistent designation and form the basic collection units. The coordinates of one of the corners, often the southwest, designate the individual squares, so that a square might be called N120E50 because it is 120 meters north and 50 meters east of the origin of the grid (the **datum point**). Such grids form the basis for locating excavation units as well.

Surface collection may be the only type of investigation carried out at a site. Where there are no intact archaeological deposits, and in many other cases as

FIGURE B.3 Surface collection within grid units marked by the stakes and string at the Ripley site (see the case study in Section D.1); collection was being done after the knoll had been disked by a local farmer.

well, it can provide valuable information without disturbing subsurface deposits. Surface artifacts can often allow determination of the date of site occupation as well as the activities carried out at a site. Archaeologists use surface collection as a means of determining site boundaries and as part of the basis for deciding where to dig.

TESTING

As archaeologists, we are often asked "How do you know where to dig?" The answer is site testing. We design site testing programs to determine whether particular sites have deposits that will help address our research designs or fall into the category of sites that require further attention in the environmental review process. Testing also provides information on what parts of sites may have important deposits worthy of additional excavation.

In a testing program, archaeologists seek to gain information about a site while excavating a small number of units relative to the size of the site. Generally, a few square units, often 1 by 1 meter (3.281 × 3.281 ft), are excavated by hand to determine what kinds of deposit lie below the ground surface and what kind of artifacts they contain (Figure B.4). The workers use **screens** to sieve the soil to make sure that smaller artifacts are not missed in the digging. The walls of the excavation units are examined carefully for evidence of stratification. If features are encountered, the archaeologist may decide to expand the unit to explore the feature further, or it may be left for future investigation. Excavation units, which may be trenches as well as squares, are sometimes augmented with the excavation of smaller shovel test pits or by the digging of holes with a posthole digger or hand auger. Postholes and shovel test pits allow crews to work quickly and

FIGURE B.4 This test unit, measuring 1 by 1 meter, has not encountered any features; the two stains that crosscut it diagonally, however, are characteristic of the scarring often found at the base of the plow zone where a farmer's plow has cut unevenly into subsoil.

can provide important information on the areal extent of a site and on the variation in depth of the deposits.

Archaeologists also use some mechanical means to test sites. These range from power augers to backhoes. Power augers and mechanical soil-coring rigs provide quick looks at the soils of a site and allow archaeologists to cover large areas without disturbing much of the site's deposits. Archaeologists often place postholes, shovel test pits, or cores on a systematic grid over the site. Backhoes dig trenches on sites that allow assessment of the depth of the deposits and the nature of the stratification of the site. Some portion of the spoils resulting from backhoe trenches is often screened to provide information on artifact content as well.

The use of testing methods like shovel test pits, soil cores, and postholes is most effective when the site contains midden deposits. Midden soil is dark, with a greasy feel to it; it is the result of humans living on a site and adding organic material to the soil. Since midden soil often contrasts sharply with surrounding soils and with underlying subsoils, shovel test pits and cores can provide information both on the depth of midden and on the extent of the site.

GEOPHYSICAL METHODS

"Wouldn't it be wonderful if we could see beneath the ground so we knew where to dig?" This is another question we are often asked. As it happens, we can, to a degree. Geophysicists have developed several nondigging techniques that provide information on what lies beneath the ground surface. The use of these techniques is known as geophysical prospecting. Included in these prospecting techniques is measurement of the way electric current passes through the soils of archaeological sites. Either the conductivity of the soils or their resistance to the current (electrical resistivity survey) is measured, and localized variations in the readings, called anomalies, may indicate where walls or pits lie buried in the soil.

Another technique measures the variation in the magnetic field at an archaeological site. This technique, called magnetometer survey (Figure B.5), is particularly good at finding burned features and rocks that differ in magnetic properties from the surrounding site soil. Ground-penetrating radar uses radiofrequency energy to look beneath the ground surface. As with objects detected by conventional radar, objects beneath the ground, which can vary from rock-filled features and walls to pits to clay layers—reflect radio waves.

San Diego's Old Town was the location of an interesting use of ground-penetrating radar surveying. Historians and interested local residents had long believed that the old cemetery, El Campo Santo, had originally been larger than the area walled off today. Some records suggested that widening of the road in front of El Campo Santo had resulted in encroachment on the burial area of the cemetery. To test this, a ground-penetrating radar survey was conducted in the street and on the sidewalk. Several anomalies were encountered that were the right size and shape for graves. As a control, an additional survey was conducted within the area in the walled cemetery known to have graves. Similar anomalies were found, though grave markers were not associated with all of them. When an excavation unit was dug, the lid of a coffin was encountered. This supported the inference that the other, similar anomalies were also graves. For several years after this survey, white spray-painted rectangles marked the location of the

FIGURE B.5 National Park Service archaeologist Jennifer Pederson explains results of magnetometer survey at the Hopewell site in Ohio.

graves in the street. When sewer work was proposed in the street in front of El Campo Santo, archaeologists provided the planners with information about the location of the graves and a route was selected that did not disturb them.

EXCAVATION

Now that you know how we figure out where to dig, it is time to discuss how we dig. We have already described the use of grids on archaeological sites to locate surface artifacts. Archaeologists usually establish a grid on sites to be excavated in detail. The units that we excavate take several forms, from square holes or pits located on the site grid to trenches or large blocks opened to expose features. Some site features, such as rooms in pueblos or structures of other kinds, are logical units of excavation in themselves.

It very seldom happens that a site is excavated totally. In the first place, an understanding of the site usually can be obtained without full excavation, which is very costly. In the second place, full excavation is considered unethical by most archaeologists unless the site is going to be destroyed anyway, leaving no opportunity for later archaeologists to return to the site to test the original conclusions. Finally, areas containing graves or those of other sacred importance to descendants may also be avoided. For these reasons, most archaeological excavations investigate only a sample of the potential excavation units at a given site.

In some excavations, the archaeologist will judge where to dig based on his or her study of testing results, surface collection data, and other available information. In other cases, a rigorous statistical (also called probability) sampling design will be developed and followed. Such designs usually include some statistically random element in selection of excavation locations. In a simple random sample, units are selected from the site as a whole by numbering every possible unit and using a random number generator to select which units will be excavated. More often, characteristics of the site such as surface features and surface artifact density are used to define subareas, and random numbers are used to pick units from each of these.

A random sample has two advantages: first, most of the statistical tests that archaeologists use to analyze their results assume that a random sample has been taken; and second, the randomization process helps eliminate the investigator's bias. If one archaeologist working in a particular river valley conducts judgment excavations in which only surface rooms are dug and another digs only trash deposits, it is unlikely that their results will be very comparable. A good probability sample is likely to contain portions of both surface rooms and trash.

In the past, archaeologists often focused excavation on cemetery areas of sites. This was done because whole and museum-quality items were often included in the graves, and because the skeletons provided important information. Biological anthropologists can determine stature, age, and gender, for example, from human bones. Important information about health—both disease and trauma—is also recorded in the human skeleton. Today, however, with new laws and a growing respect for Indian beliefs, archaeologists do not target cemeteries unless they are in the way of a construction project. Such excavations are done after consultation with the relevant Indian community and with Native American observers on the project. Depending on the wishes of the descendant group, the bones may be returned to the Indians for reburial at the end of the project, and the Indians will have a say in the kinds of analysis (if any) that are performed. Often Native American descendants will insist that no destructive analysis (like radiocarbon dating or isotope analysis) be done on human bones.

We use a variety of tools in digging archaeological sites (Figure B.6). For heavy earthmoving we employ shovels and, sometimes, picks. In deposits showing little or no detectable stratification, and where it is unlikely that living surfaces will be encountered, much of the digging will be with shovels. The earth removed from the unit is generally passed through screens to make sure small artifacts are collected. A common mesh size is 1/4 inch (6.35 mm), though both larger and smaller sizes are used in some sediments and contexts. Finer excavation of features, living floors, and thin, complex strata is done with brushes and pointed mason's trowels.

Artifacts found in the excavation are placed in bags or other containers. Small, delicate items such as arrowheads, beads, and small bones are packaged

FIGURE B.6 The archaeologist's toolkit includes a variety of digging and measuring tools as well as screens and record-keeping equipment.

in vials. The excavators label everything carefully with information about where the material was found. The crew then takes the artifact bags and samples to the field lab, where they are processed (Figure B.7).

In addition to artifacts, archaeologists collect samples of the soil. Some samples of sediment will be studied for information about the matrix in which the artifacts are found; other soil samples are collected to be processed for very small remains, including plant material (burned wood and seeds) and small bone that would pass through the screens. Archaeologists often use a process called flotation, through which these tiny remains are extracted from sediments by skimming lightweight items such as seeds, other plant parts, and fish scales floating on the surface of agitated water. This process can be accomplished with hand-agitated tubs (see Figure D2.3) or in flotation machines into which water is pumped (Figure B.8). Chemicals can also be used to float heavier items, like large pieces of wood charcoal. Pollen and phytoliths, microscopic plant parts that allow identification of the plants that grew on or near the site or were brought to the site, are extracted from soil samples as well (see Chapter 2).

Fire-cracked rock (FCR) and building stone often are found on archaeological sites. These items are bulky and do not have the same potential for further study as do artifacts like flaked stone tools or animal bone, and yet they are important to understanding the structure of the site. Often archaeologists will record the quantities of these materials in the field by counting, weighing, or both, but will not bring all of them back to the lab. In middens comprised mainly of shells, the shells may be counted and weighed in the field and left behind.

FIGURE B.7 Archaeologists must carefully label all materials brought in from the field; here field bag labels are being checked and organized before further processing.

FIGURE B.8 Machine processing of flotation samples in the Indiana University of Pennsylvania wash lab.

Generally columns of soil are collected at various points on the site of a shell midden to provide information on the species of shellfish present and their relative quantities. Similarly historical archaeologists may not save all of the coal, brick, and window glass in their collections. After counting and weighing, these items often are discarded.

RECORD KEEPING AND CATALOGING

Throughout the text we stress that artifacts are most useful when their context is known. This is where record keeping comes into the picture. The records of an archaeological project, either survey or excavation, are critical to documenting that project for the future; but they are particularly important in excavations that entail destruction of the context of the archaeological record. The catalog is the record of what artifacts were found on an archaeological project, and of where they were located.

The process of cataloging an archaeological collection is simple. The artifacts arrive at the field lab in bags that include the provenience information. If necessary, the catalog crew will clean the artifacts, being very careful to keep the provenience information associated with the specimens (Figure B.9). Because of advances in analysis procedures, we do not routinely wash every unearthed artifact, since washing can remove residues that can be studied. For example, blood residues are sometimes left on stone tools, and charred food may be adhering to potsherds. Most often artifacts are brushed with a dry brush to remove loose dirt. After whatever cleaning is done, the catalogers assign numbers to the artifacts and create an inventory that includes where the artifacts were found and what they are. Artifacts that will not be harmed by being

FIGURE B.9 The first step in processing artifacts often is washing and drying them.

written on can be numbered directly, but each small artifact collected is stored in a bag with a tag indicating its catalog number and provenience. We generally assign each item a separate catalog number, but for some items like shells in shell middens or flakes that are found in large quantities, we will assign a single number to all the items of a class from a specific provenience unit (e.g., level within an excavation unit, a surface collection grid, or a particular stratum or layer in the fill of a feature). After the cataloging is finished, we store each artifact in a plastic bag and put those in labeled boxes so that we can find specific artifacts for further study.

It should be clear that the notes, maps, and photographs from an archaeological project are as irreplaceable as the individual artifacts. During the course of excavation, archaeologists take notes on what they are doing and what they are finding, as well as the nature of the matrix in which they are digging. These notes are the important link between the artifacts and their context. Excavators use narratives, prepared forms, or both to record the specific details of the areas they are excavating. The project supervisors also record their observations on the site. They record their observations of the larger patterns of artifacts, features, and stratification. Supervisors also record their reasons for deciding how to excavate, for example, how excavation units are to be placed and what the supervisor hoped to learn in particular parts of the site.

In their notes, excavators may draw specific artifacts, but they will also map the locations in which artifacts were found and draw any stratification encountered (Figure B.10). Large maps showing the location of excavation units will also be made, but the photographs are an invaluable part of the record of an excavation. We take a number of different kinds of photograph on archaeological projects. We take general photos to document the condition of the site before and after excavation. We also

FIGURE B.10 These excavators are carefully mapping archaeological features, an important part of excavation.

take photographs of features and artifacts as they are found in the ground (in situ). Photographs also document methods of excavation. As we take photographs on a project, we use photo logs to record details about each frame we expose, including date, time of day, what we intend the photograph to show, and the direction the photographer is facing (Figure B.11). In photographs in modern archaeological reports, the same information that is in a photo log is given in a sign that appears in the photo (see, e.g., Figure B.4). This is a common practice to make sure the identifying information is kept with the image.

For survey projects, the archaeologist's notes will include information about the rationale for selecting the survey methods, the areas actually examined, the amount of surface visibility, and how that affects the confidence the archaeologist places in the survey results, and descriptions of the sites found. The notes should also indicate areas that could not be surveyed for whatever reason (vicious dogs, impenetrable brush, the potential for unexploded military ordnance). Maps and photographs will also be part of the record of the survey. The archaeologist will take photographs to document the kinds of terrain and

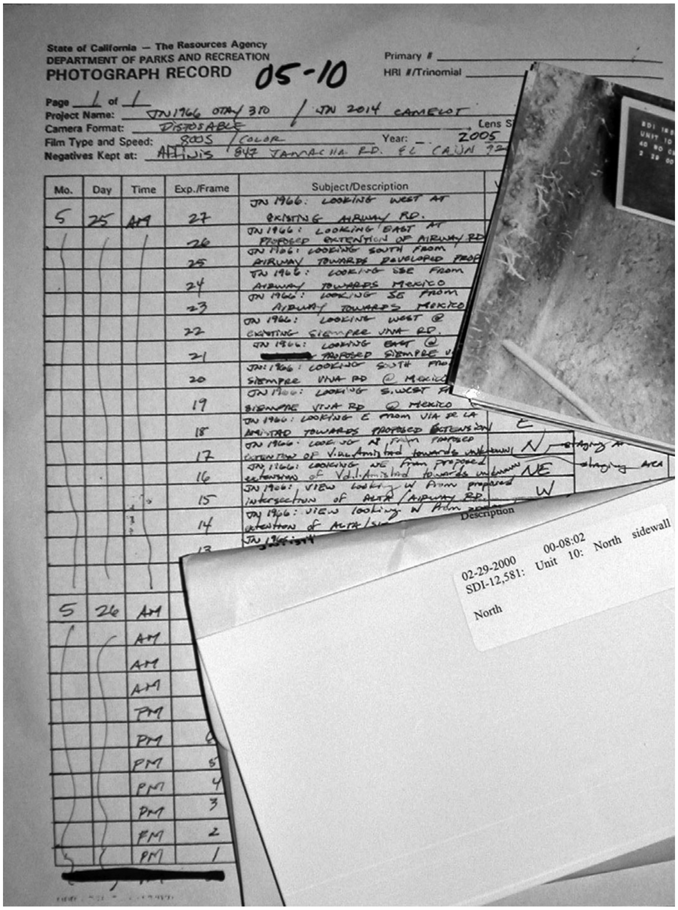

FIGURE B.11 A completed photo log from an archaeological project to which photos like the one shown partially at the upper right can be compared.

the variety of environmental settings found in the project area, as well as the sites located and noteworthy artifacts on those sites. Isolated artifacts will often be photographed as well.

Thus archaeological fieldwork is not much like popular depictions of Indiana Jones's exploits. Instead it is a complicated process that involves physical and mental exertion, as well as great care. Even after fieldwork, there is much remaining work for the archaeologist, as outlined in Section C.