CHAPTER

10

Stratigraphy

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Archaeologists are repeatedly confronted during their excavation careers with maddeningly complex physical situations. In the American West, they may find that a herd of bison was driven into an arroyo and some 190 of them killed and then butchered, leaving a bewildering mass of bones and artifacts, the whole later modified by erosion. That was what Wheat (1972) and his associates encountered at the Olsen-Chubbuck site. In the Middle East, they may find multilayered jumbles of mud-brick walls intermingled with burials, trash, burned-down buildings, all modified by later construction, casual looting, and prehistoric antiquarianism. Dry caves and deserts may yield exquisitely preserved materials and plant remains, but often in the context of dust as fine as talcum powder and sand that runs like water when disturbed. Shell middens in North and South America, geologically rearranged deposits in East Africa, pithouse villages in China, and Maya ruins in Yucatán all present their own unique problems of excavation.

In all of these situations, however, the basic purpose is always the same—to elicit order from the apparent chaos. A primary means of accomplishing this purpose is stratigraphy. As geology analyzes the strata of the earth, in archaeology the strata, or layers, of archaeological sites are studied for chronology and order. The processes of layering are also a significant aspect for understanding the stratification. For the professional archaeologist, there are few satisfactions to match that of reaching a complete, rational, and tested explanation for a complex stratigraphic problem. It is upon such data that the most important goals of archaeology are based, the studies of cultural history and of cultural process.

Both the stratigraphic principle and the practice of stratigraphy were recognized long ago, perhaps as early as Classic Greece. Then, both principle and practice were apparently lost, not to be rediscovered until the sixteenth century. Relative chronology as observed in geological stratification was presented by George Owen in 1570 (*History of Pembrokeshire*), but not published until 1796. The concept of superposition was first published by Nicolaus Steno (1638–1687) in 1669 (*Prodromus*). William Smith (1769–1839), who recognized a sequence of deposits at Kent's Cavern in England in the 1790s, is also among the earliest rediscoverers (see Thomas [1989] for additional details concerning early stratigraphic efforts). **Metric** or **arbitrary-level stratigraphy** (a technique for dealing with weakly stratified or apparently unstratified sites by establishing levels of arbitrary depth; see Chapter 5) was introduced to the New World probably by Boas through his colleague Manuel Gamio, who excavated in such a manner in 1911 (Adams 1960). Nels Nelson's use of the technique probably stemmed from his Old World experience with Paleolithic archaeology, gained while excavating with Obermeier and Breuil. In 1914 Nelson applied this principle to sites in the Galisteo Basin of New Mexico. Nelson's work was much better publicized than Gamio's and had an immediate impact on fieldworkers.

In his use of arbitrary levels Nelson also applied the "index fossil concept" (from geology) to prehistoric pottery recovered from his stratigraphic units. This system allows for intersite comparisons to less stratified sites. A. V. Kidder used the method in his work at Pecos, New Mexico, and it became standard practice in American archaeology in the 1920s (Willey and Sabloff 1993:103–108).

DEFINITION

Phillips et al. (1951) have provided both a succinct definition of stratigraphy and a useful distinction: stratification is what you find; stratigraphy is what you do with it. To properly understand a site's stratification, an archaeologist must combine the law of superposition with a consideration of context.

As already noted, the term and the basic method come from geology. Some of the basic assumptions, such as uniformitarianism, come from geology, too. **Uniformitarianism** is the assumption geologists make of uniformity or continuity in the processes that form the strata of the earth. The processes that acted in the past are like those we can observe today. In other words, when volcanoes erupt today, they lay down layers of ash. Geologists assume that ancient volcanoes did the same. An excellent example of ancient volcanic stratigraphic deposition is reported by Sheets (1983, 1992) for the Ceren site in El Salvador (Figure 10.1; see also Sheets and Grayson 1979). Similar are the depositional effects from flooding by rivers (known as alluvial deposits). Deposits laid down by other natural forces include colluvial, aeolian, glacial, and marine deposits.

Archaeologists also assume that human behavior (the force that forms archaeological deposits) is much the same today as it ever was. For example, most modern communities have a dump for their rubbish and garbage. Archaeologists routinely encounter mixed deposits whose likeliest origin seems to be their having served as the trash heap of a prehistoric people. A. V. Kidder, digging into the Andover, Massachusetts, town dump in 1922, found layering and change there that was markedly similar to what he found in the much older trash deposits at the prehistoric Southwestern ruin of Pecos.

PRINCIPLES

There is really only one major principle in archaeological stratigraphy. This is the **law of superposition.** This "law" dictates that under most conditions, the oldest layers are on the bottom and the younger layers are on the top. A sequence of events, physical and/or cultural, producing the layers is represented by the changes from bottom to top. The excavator should also be aware of the possibilities of "reversed stratigraphy," deposits in which normal stratigraphic processes have been disrupted. Such modifications can be caused by the digging of storage pits or graves, animal burrowing, and the like (cf. Hole and Heizer 1973:147; additional examples are provided by Colton 1946; Pyddoke 1961; and Tolstoy 1958).

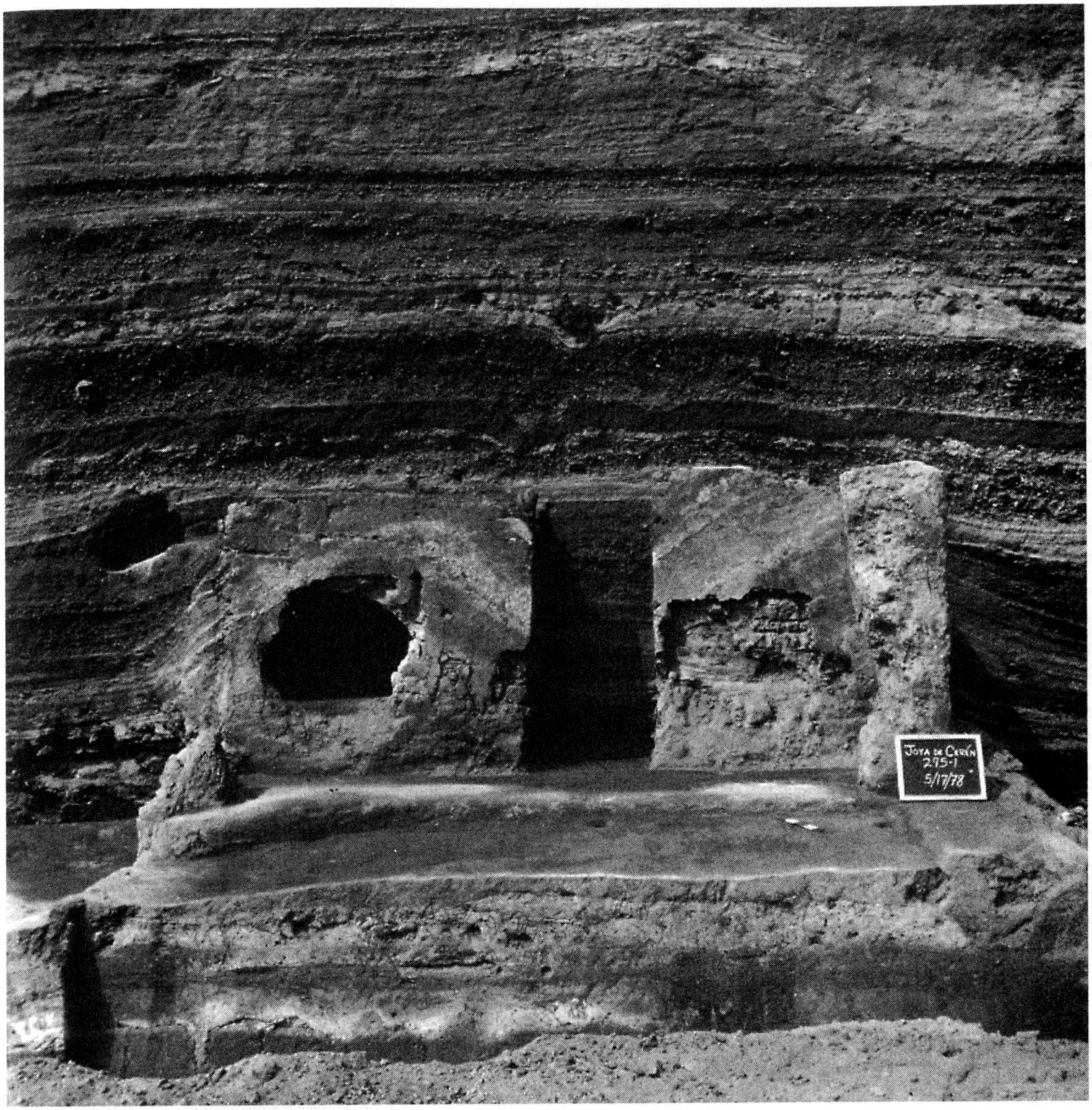


Figure 10.1 View of stratigraphic deposition resulting from volcanic activity at the site of Ceren, El Salvador.

Even normal stratigraphic conditions, however, do not make excavation simple. Strata may be horizontal, slanting, vertical, deformed, or a combination of these. They may be sharply distinguished from one another by color or consistency or contents, or they may grade very subtly into one another. Preservation contexts range from the best (dry caves and deserts) through architectural stratigraphy and open sites to geological deposits (for example, redeposited materials), usually the worst for preservation. The physical nature can range from talcum powder–like dust to heavy clays and stone.

A relatively new subdiscipline of archaeology, usually called **geoarchaeology,** focuses on the sedimentary processes related to stratigraphic formation and context. Geoarchaeology is built on the traditionally close interaction between geologists (especially geomorphologists), other earth scientists, and archaeologists. For recent studies involving such research, including the analysis of soil sediments, soil formation processes, and the manner in which they can be naturally disturbed, the reader is referred to Courty et al. (1989), Donahue and Adovasio (1990), Gladfelter (1981), Goldberg (1988), Hassan (1978), Holliday (ed. 1992), Rapp and Gifford (1985), Rosen (1986), Shackley (1975, 1985), Stein (1987, 1990), Stein and Farrand (1985), Waters (1992), and Wood and Johnson (1978).

GOALS

Whatever the nature of the site and its strata, the minimal goal of archaeological stratigraphy is to work out the sequence of deposits and to elicit the events producing them. In other words, one aims at producing a depositional history for each excavated sample or group of samples. A middle-range goal of stratigraphic work is to establish a site chronology and culture history by synthesizing the histories of the individual deposits.

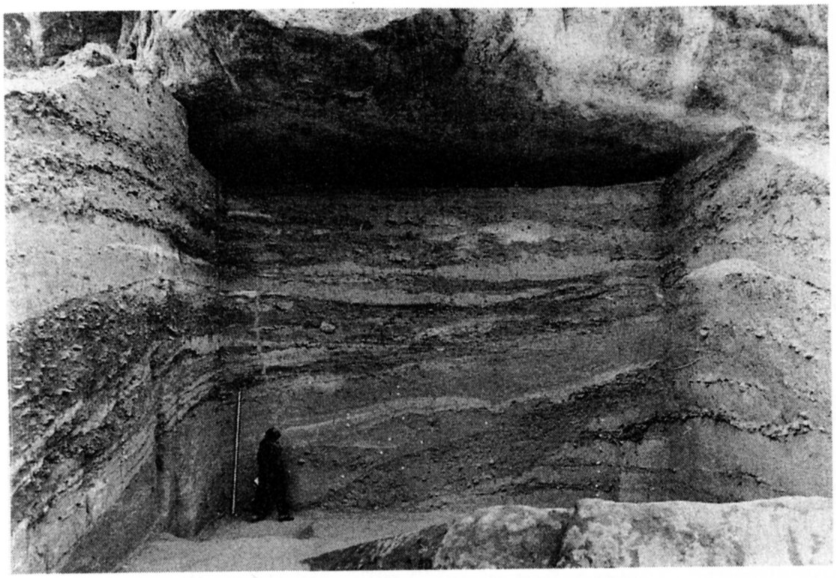
The ultimate aim is to establish a regional sequence into which individual events and site sequences are keyed by means of common factors. Usually it is at this point that one can begin considering problems of culture process, although they may be anticipated earlier.

TECHNIQUES OF EXCAVATION, LABELING, AND RECORDING

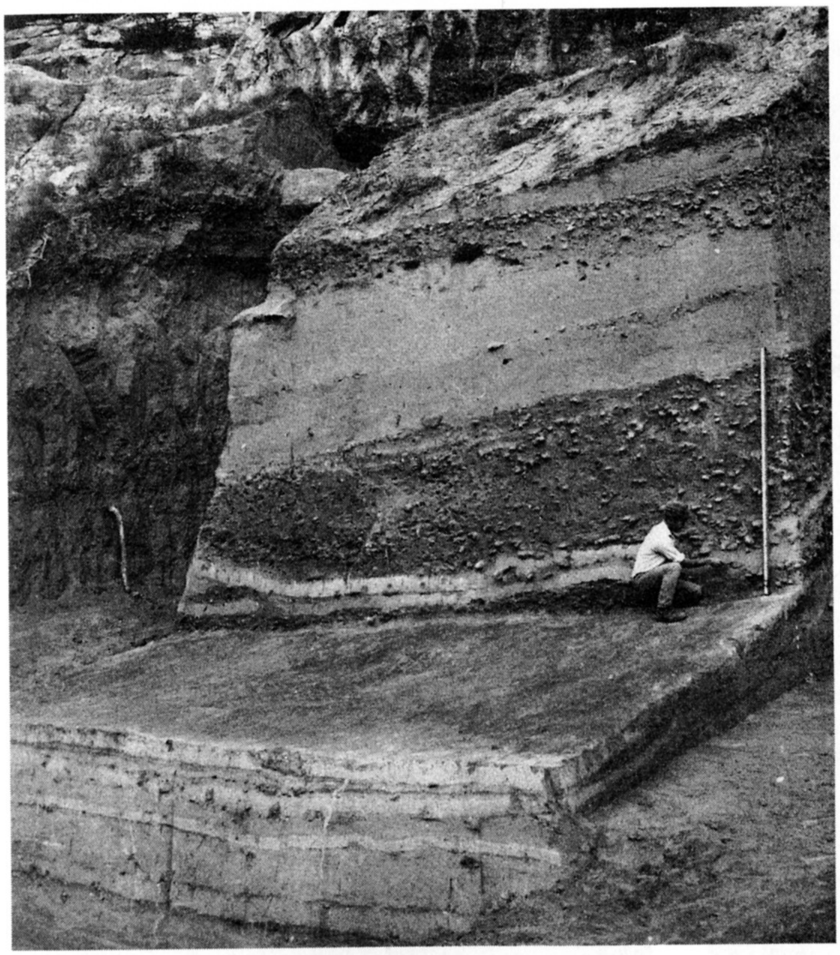
Test pits excavated by arbitrary levels are usually the first means of revealing stratification in the deposits at a site. During excavation of a test pit, it may or may not be possible to discern the natural levels. However, once the pit is dug, the natural levels may show more clearly on the pit walls or profiles. With excavation, whether of test pits or of the main site, extensive and detailed notes should be kept, including schematic drawings on gridded paper showing features as they appear. These features often fade in both color and contrast after exposure, and it is vital to note them promptly as a guide to the final recording procedure (also see below). Soil color is usually an important aspect of the stratigraphy, and description should be done using the Munsell Soil Charts. Grain size, soil consistency or plasticity, and other characteristics should also be noted for each layer. Grain size ranges from clay to silt to sand.

When a unit has been completely excavated, the walls of the pit should be thoroughly cleaned to make the strata easier to see. If the walls are stable, cutting with a sharp trowel will work; otherwise, a method must be improvised to suit conditions. In dry cave deposits, directed puffs of air from an atomizer may be used for final cleaning. In permanently damp sites such as Star Carr, water jets might help in excavation (G. D. Clark 1974:50). Compressed-air brushes may be helpful at times. Wetting with a back-pump sprayer will often freshen and rejuvenate the colors of dirt for recording. Even at dry sites, the profile may first be cut with a trowel and then carefully sprayed (not with jets) with water. This brings artifacts into sharp relief, and microstrata—for example, a thin layer of sand—may erode or wash out at a different rate, becoming visible. This technique was pioneered in North America at Ozette, Washington (Gleason 1973). Sturdy deposits, such as shell middens, may be safely and effectively cleaned with high-pressure water hoses (Marquardt and Watson 1983:Figure 15.5).

Labeling is necessary at least during the final stages of recording. This may be done by attaching numbered pieces of note cards or metal-rimmed tags to the wall with nails. Other, more ingenious means of labeling include the use of cutout plastic numbers and letters that can be attached to vertical surfaces with nails. The aim is to produce a visual reference system for use during recording. At this point a Polaroid color photograph may be taken to guarantee that something of an objective record is made. The labeling system used will naturally depend on the field system in use by the project. It is very convenient to use label numbers that are also the lot numbers assigned to materials from those layers. Thus the excavator and the artifact analyst (if they are not the same person) can talk more easily about tneir various conclusions. See



(a)



(b)

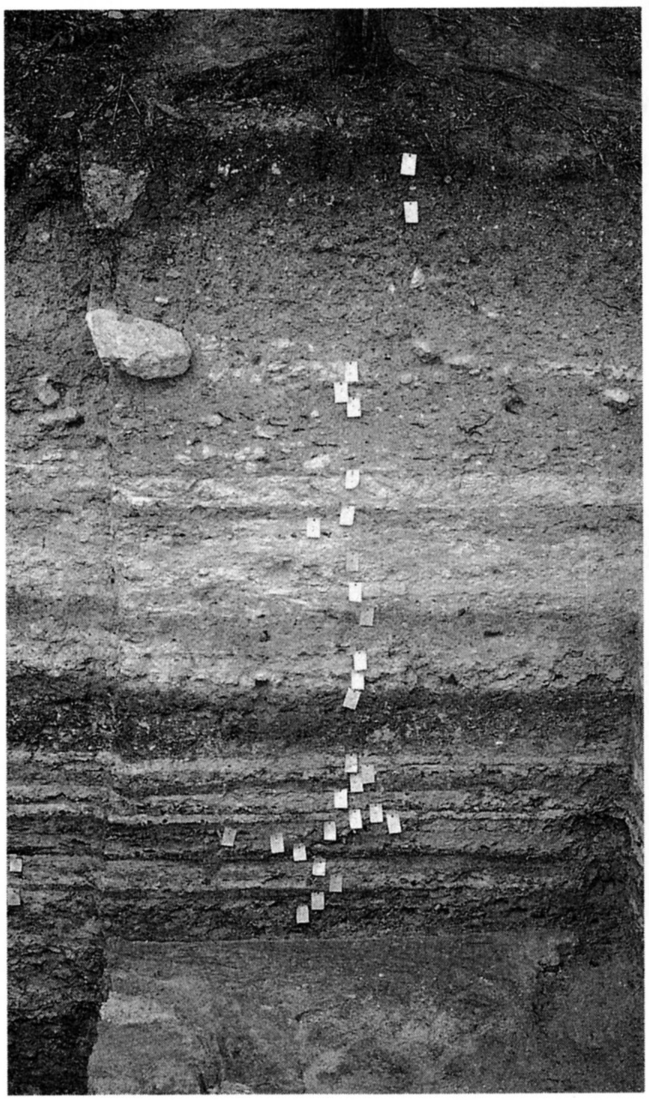
Figure 10.2 Stratigraphic profile at Arenosa Shelter (41VV99): (*a*) upper half; (*b*) section. Note thick layer of flood-laid deposits (just above the stadia rod).

Figure 10.2 for an illustration of labeled cave deposits at Arenosa Shelter in Texas. Figures 10.3a and 10.3b depict strata labeling at the site of Cuello, Belize, using small attached cards; Figure 10.3c shows the same system in use at an archaeological excavation in Africa.

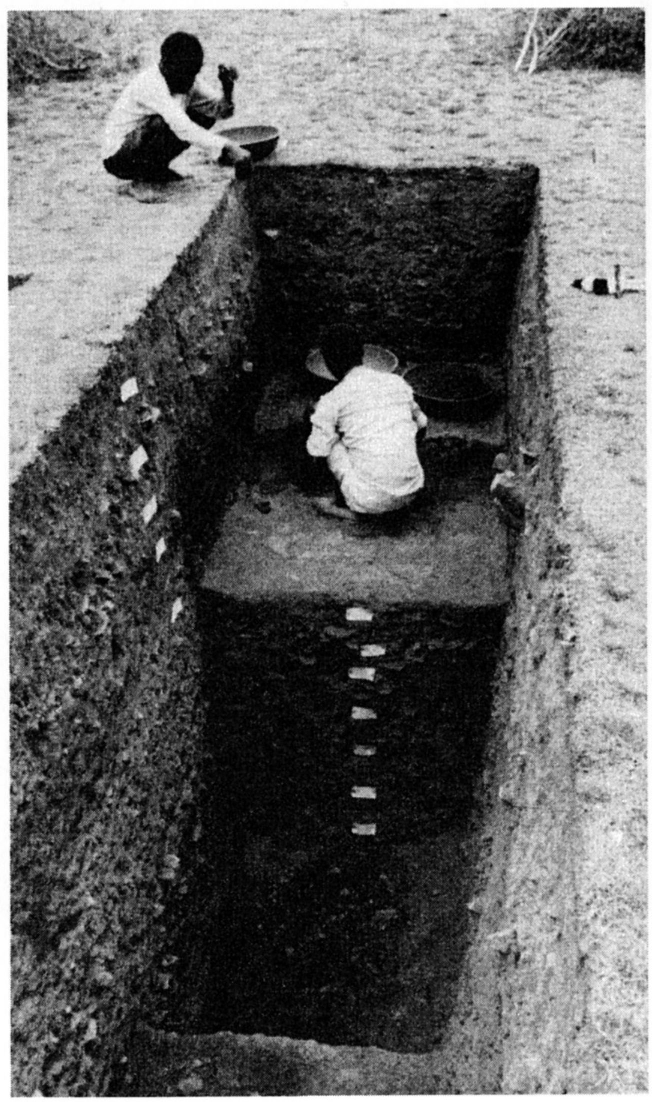
Stratigraphic recording can be done in a number of ways using some sort of scaled reference system. American archaeologists have traditionally stretched vertical and horizontal strings across the face of an excavation to create a grid, using a line level to establish horizontal levels and a plumb bob

Figure 10.3 Excavation block at Cuello, Belize: (*a*) general view. Note the use of tags to mark stratigraphic layers. (*b*) section of stratigraphic profile at Cuello, with tags marking each identified layer. (*c*) stratigraphic excavation at Kibiro Cutting III in Africa. Note wall tags denoting stratigraphic deposits.

(a)



(b)



(c)

to establish vertical ones. All measurements should generally be metric, and millimeter-ruled paper should be used for scale drawings. However, for many historic sites, the English system makes more sense. Long rolls of grid paper or Mylar that can be cut are preferable to 8½-×-11-inch notebook-size paper. Detailed notes may be made on or at the margins of the scale drawings. For each layer, color, composition, unusual features, and content should be described.

Again, a picture is worth a thousand words (see Chapter 8). Color photographs with Polaroid and 35-mm cameras are absolutely necessary. Because color photos are expensive to reproduce, final and detailed shots should also be taken of the wall with black-and-white film (35-mm and if possible, large-format). Detailed shots may be made in 135 mm, but overall final shots should be made using film no smaller than 120 mm. This allows for enlargement without much loss of significant detail. Although it is frowned upon in some quarters as modifying what one is seeking to record, outlining the strata by lightly cutting lines in the face of the wall with a trowel makes the strata much more distinct and the boundaries between them more visible. More-revealing photographs can then be taken. If this is to be done, however, the unmodified excavated face should be photographed beforehand. A very useful technique involves taking a Polaroid photo of the stratigraphic profile with the profile outlined and writing on the photo itself (with a marker). However, this should be used only as a temporary measure for recording data, and the photo should be copied onto acid-free paper for the permanent record.

Photogrammetry is a potentially very valuable means of recording stratification to scale. The use of this aerial photo and mapping technique in archaeology has been pioneered by Jesse Fant and William MacDonald of the University of Minnesota Messenia Project in southwestern Greece (Fant and Loy 1972). Briefly, two cameras (e.g., 120-mm Hasselblads) are placed at opposite ends of a bar mounted on a bipod. The cameras are aimed so that the photos they produce overlap by about 20 percent. The distance from the film in the cameras to the trench wall is recorded. This information is fed into a device called a second-order stereo-plotter, which uses the two overlapping negatives to make scale drawings, at any scale desired, of the trench wall. Although the technique demands a big capital investment in cameras, it is cheap and efficient when one considers the saving in excavators' time and energy. Stratigraphic profiles can be recorded in a fraction of the time required to draw them by hand, in a more objective manner, and the technique can provide a three-dimensional illustration. The drawback to the method is that no detailed record of the stratigraphy is immediately available. The second-order stereo-plotters are seldom located near enough to the field to be immediately usable. This handicap might be overcome by supplemental use of Polaroid shots and schematic drawings.

Because of the press of field conditions and multiple demands on attention, the archaeologist should have either a form that supplements the stratigraphic drawing or a checklist of data that should be recorded. Either in notes or on a form, cross references should be made to all associated drawings, photos, lot numbers, burials, and any other pertinent data.

Another important aid in recording stratification is a video camera (½-inch VHS or 8-mm). The camcorder systems allow for immediate recording and review of the filmed strata not only with pictures but also with a verbal description. Care should be taken to select or acquire the highest quality equipment when feasible (for example, Hi-8 is recommended for the 8-mm format).

The Harris Matrix system (Harris 1979, 1989) of recording obviates a great many possible problems of complex stratigraphy because it is a method of labeling and recording that can be independent of the field system. Harris argues that features such as interfaces between deposits or the burned surface of a wall are stratigraphic elements and reflect human activity or specific events that must be documented. These events are recorded in systematic fashion and emphasize a depositional history. This depositional history is distinct from determining the relative age of the deposits, as implied by superposition, because the first formation could have been redeposited (as in reversed stratigraphy).

Harris (1979) suggests five basic units of stratification: **natural layers** are formed by the movement of material to the place of deposition through natural forces; **man-made layers** are composed of a deposit or deposits formed by humans, such as house floors or the filling of pits, postholes, and so on; and **vertical strata** refer to upstanding strata, including walls and columns. The next two units, known as **interfaces,** are the surfaces of the various strata and follow a division similar to that just explained: **horizontal feature interfaces** are those located in an approximately horizontal state, and **vertical feature interfaces** are directly tied into vertical deposits or constructions. These should be recognized and numbered as they are encountered. The value of Harris's system is seen in the excavation and subsequent analysis of complex archaeological stratigraphy; in essence, it is a method of diagramming the relationship of the many types of stratigraphy usually encountered in block excavations. Hammond (1991) has applied this system at the Maya site of Cuello. Other applications of this system are found in Anthony and Black (1994), Harris and Brown (1993), and Paice (1991). An illustration of this method is provided in Figure 10.4 from Shaw (1994).

Much of the labeling of stratigraphic units in the Harris system is of artifact-free features. It should be realized that artifact-free strata may contribute crucial information in an archaeological investigation. For example, the Paleolithic sequence of deposits at the rockshelter of Abri Pataud (France) include what are called *eboulis,* layers of sterile materials that mark milder climatic episodes during the Pleistocene (see Laville et al. 1980; Movius 1974).

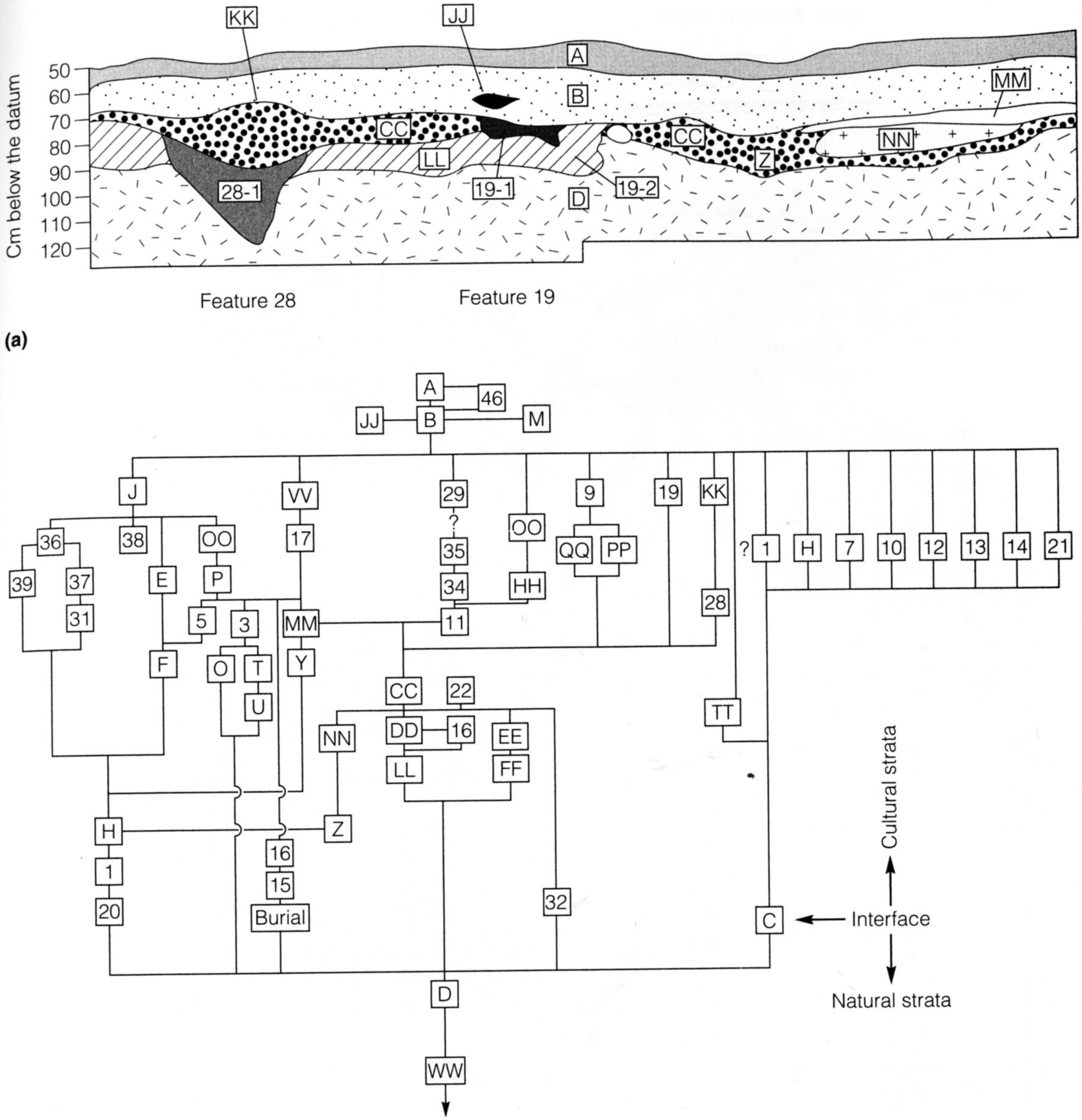
The **arbitrary-level test pit** is not only the most common but the simplest recording and labeling problem that the archaeologist will face. Should the deposits be deep, rich in artifacts, and distinctly stratified by soil color, however, then it is mandatory to take a sample by **natural-level excavation.** A column is first isolated on three sides by digging three pits with arbitrary levels. The isolated column is then excavated by natural levels, which are correlated with the arbitrary units around it, thus increasing the size of the artifact sample. Examples of profiles resulting from this sort of excavation at Altar de Sacrificios, Guatemala, are illustrated in Figure 10.5.

An example of interesting and significant stratigraphy excavated entirely by arbitrary levels within a series of adjacent 5-ft squares is the Devil's Mouth site in the Amistad Reservoir of southern Texas (Johnson 1964; see Figure 10.6). This illustration emphasizes, again, a primary aim of stratigraphy, which is to elicit a depositional sequence in its own terms. Johnson's notes and drawings during excavation were undoubtedly kept according to the individual squares excavated but were later correlated, synthesized, and presented in terms of depositional history.

Trenches reveal long stratigraphic profiles. In recording, labeling, and controlling stratigraphic data from trenches, it is important to be aware of the arbitrary nature of the separation between sections of the trench. Essentially the same techniques are used for trenches as for pits, the major difference being the quantity of data to be handled.

Architectural elements within any excavation complicate matters and necessitate distinct approaches. Structures are often excavated by cultural or depositional levels—i.e., the space between two plaster or beaten earth floors or between two walls. However, rooms or open spaces within architectural complexes must be subdivided both horizontally and vertically.

Stratigraphic situations found in association with architecture are the most complex of all and require infinite patience and a distinct recording system. One workable system is to record by strati-units rather than by functionally designated units. **Strati-units** (compare with the Harris Matrix system) are physically distinguishable units that are clearly the results of a single activity. For example, a stone wall is a strati-unit. In contrast, the **functional,** or **interpretative, unit** might include not only the stone wall, but the plaster floor that runs up to it and the ceiling that lies above it, if that survives. In this system, recording is done on the strati-unit level, which in effect is a natural stratigraphic level. The distinction between this and nonarchitectural stratigraphy is that several strati-units may coexist in the same horizontal level.



(b)

Figure 10.4 Complex stratigraphy at the Willowbend site, Mashpee, Massachusetts: (*a*) profile; (*b*) completed Harris Matrix for the site.

An analogy from linguistics may be useful here. The phonetic unit is the smallest *distinguishable* unit (as is the strati-unit), and the phoneme is the smallest *functional* unit (as is the interpretative unit). Each functional unit is based on interpretation of the physical evidence, which in turn allows an interpretation of an event. This event, the building of a wall and associated floor, also represents a

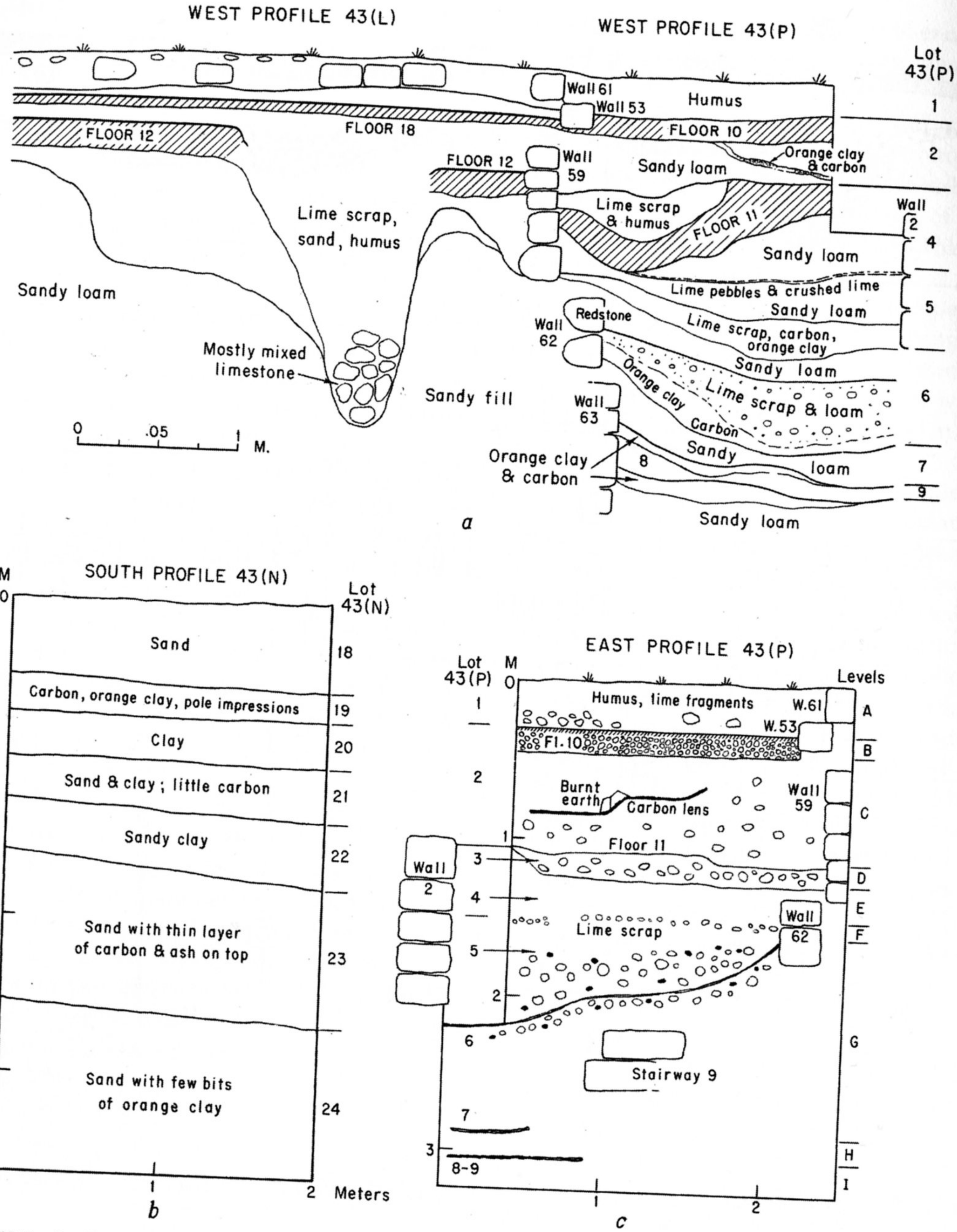


Figure 10.5 Profiles of column 43 at Altar de Sacrificios, Guatemala. This column was first isolated on three sides and then taken out by natural levels. The rich deposits of many types of potsherds in the changing levels were crucial in setting up the Altar ceramic sequence.

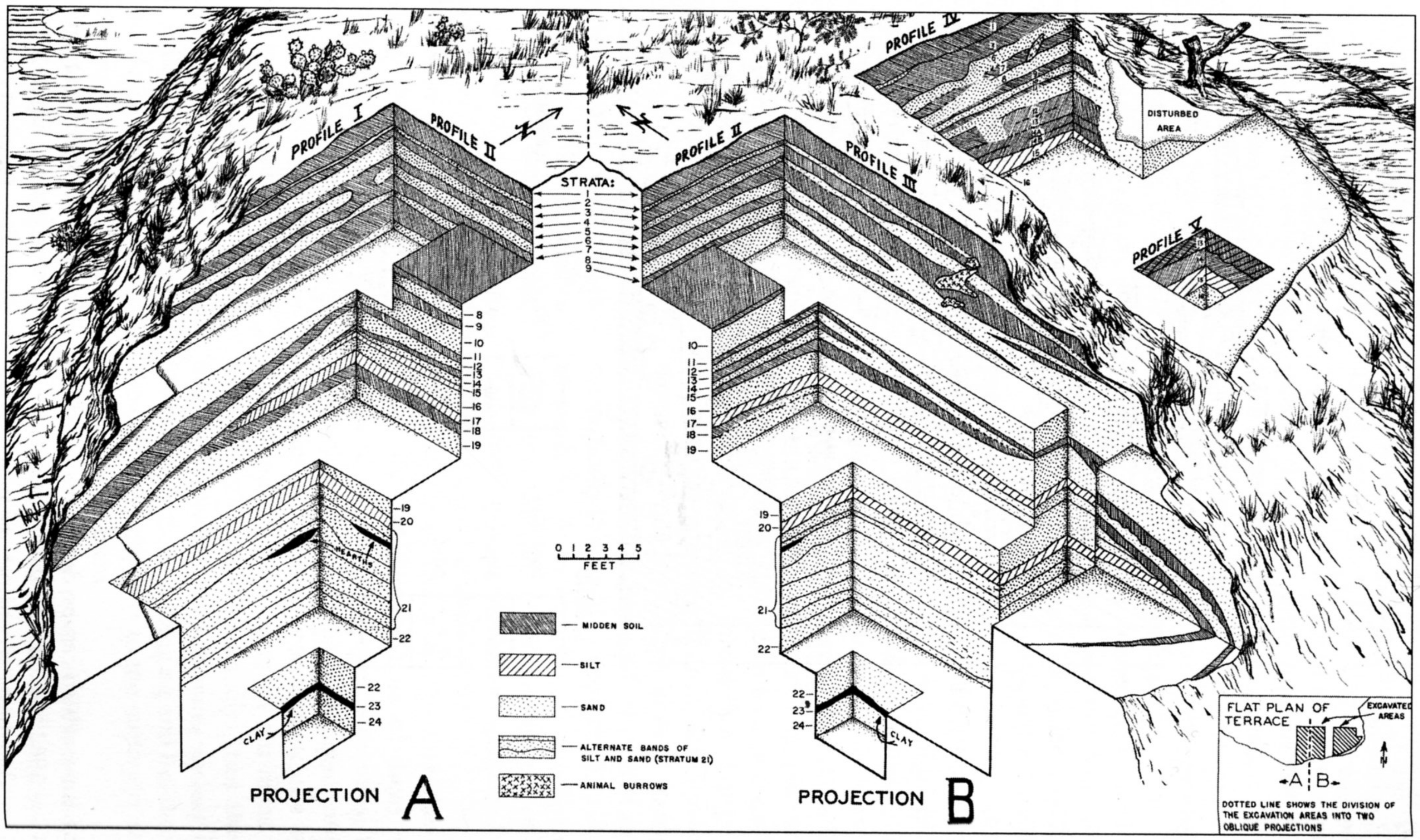
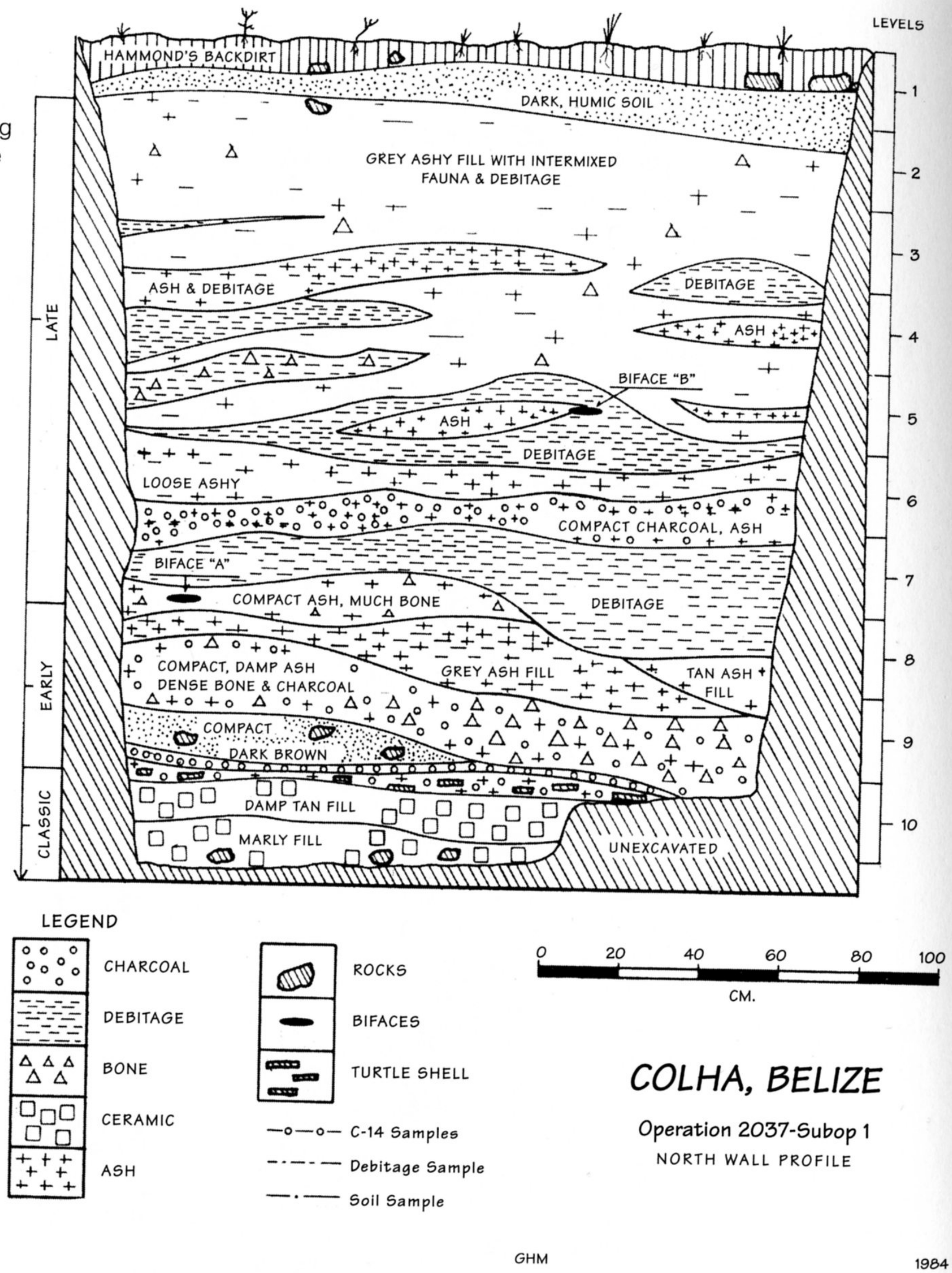


Figure 10.6 A drawn profile from the Devil's Mouth site in the Amistad Reservoir of Texas. Note the technique of presentation and the correlation of deposits from pit to pit.

Figure 10.7 A drawn profile from Operation 2037, Colha, Belize. The system of labeling used here eases viewing and interpretation of the depositional history for this locale.



period of time, which can be designated a "time-span" (Coe 1962:506). If one uses this system of excavation, labeling, recording, analysis, interpretation, and synthesis, one ends up with a depositional history. These depositions may be phrased in either terms of interpretative units or in terms of time spans. Figure 10.7 illustrates the various strata that, together, comprise the depositional history of the structure at Operation 2037, Colha, Belize.

SPECIAL SITUATIONS

Multiple and complex architectural units should be designated by a system using nonsense names. This allows reference to the strati-unit or interpretative unit in notes without the implied sequencing of numbering or lettering. When using a number system, one may number two sequent structures 1 and 2, only to find another structure between them or a building phase off to the side that came between. Rather than using 1a, 1b, and so on, one might use as temporary designators three-letter words like "cow," "zip," "tek," etc. These nonsense tags can be discarded after excavation is finished, and structures can be numbered or lettered in sequence. Figure 10.8 provides an example of a cross section of complex architecture. In the final designation system, it is best to number from the latest to the earliest so that the highest-numbered structural unit is the earliest (Figure 10.9). Then if further excavation uncovers earlier phases, "minus" designations, such as –1, –2, and so forth, can be avoided.

In dealing with large architecture, it is useful to break up an apparently homogeneous mass of fill into manageable units. Structural fill may contain considerable ceramic material from several phases. The stratigraphic evidence from pits and trenches is clearly the only way to order the artifacts within such fill. For example, we know that ceramic complexes given the names Blue, White, Red, and Black are contained within the structure. But we know only the relative age of these complexes (say, that Black is the latest complex, and all the others are earlier) by evidence from undisturbed deposits excavated at another location. This sort of information is most reliable if it is replicated over and over within the segregated blocks of building fill. Those blocks nearest the surface are naturally most open to mixing with material earlier than the Black complex, but segregation of blocks of structural fill will indicate this as excavation proceeds more deeply into the structure (Figure 10.10).

Burials are often found within structures or other deposits, as well as in cemeteries. Artifacts included in burials were clearly in use at the time the person was buried. However, heirloom pieces may have been manufactured long before, or in some cases, depositional circumstances may have "mixed" the finds (see Chapter 11). Sequences based on burial lots may also be faulty if special items were made for the funeral or brought from outside the region to the funeral. The latter may have happened in the case of distant kin groups. Burials are often made under disturbed deposits, and these can date the burial independent of the items contained as offerings. Use of the "not-earlier-than" technique in connection with the evaluation of structural fill is a means of determining this information (see, for example, Adams 1971:59–78).

Vertisols (shrink-swell or self-mulching clays) are a bothersome aspect of archaeological and geological stratigraphy in parts of the world, including the south-central United States and parts of Texas (Duffield 1970), Africa, India, and Australia. These soils are especially susceptible to heaving and cracking and carry artifactual material with them, thus disturbing the original stratigraphic situation.

Sandy soil layers and artifacts in them are particularly subject to modifications and displacement due to that common human activity—walking about the living area. Experimental trampling in sandy deposits has displaced artifacts as much as 8 cm vertically (Villa and Courtin 1983), and perhaps as much as 16 cm according to Stockton (1973). Additional data on the vertical dispersal of artifacts via trampling in archaeological sites can be found in Gifford-Gonzales et al. (1985).

There are various activities that also disturb stratification. Although some of these may no longer be considered "special" situations, they are nonetheless acknowledged and discussed here. Examples of disturbed processes include plowing, which tends to move material out of its context both vertically and horizontally. Thus the identified and plotted material becomes unclear in terms of related positioning. Digging and bulldozing can likewise bring deposits to the surface if not completely remove them.

There are many types of turbation (see Wood and Johnson 1978), including animal burrowing, that may disturb deposits below as well as near the surface. Floods may wash layers away and redeposit them in a secondary context, producing a

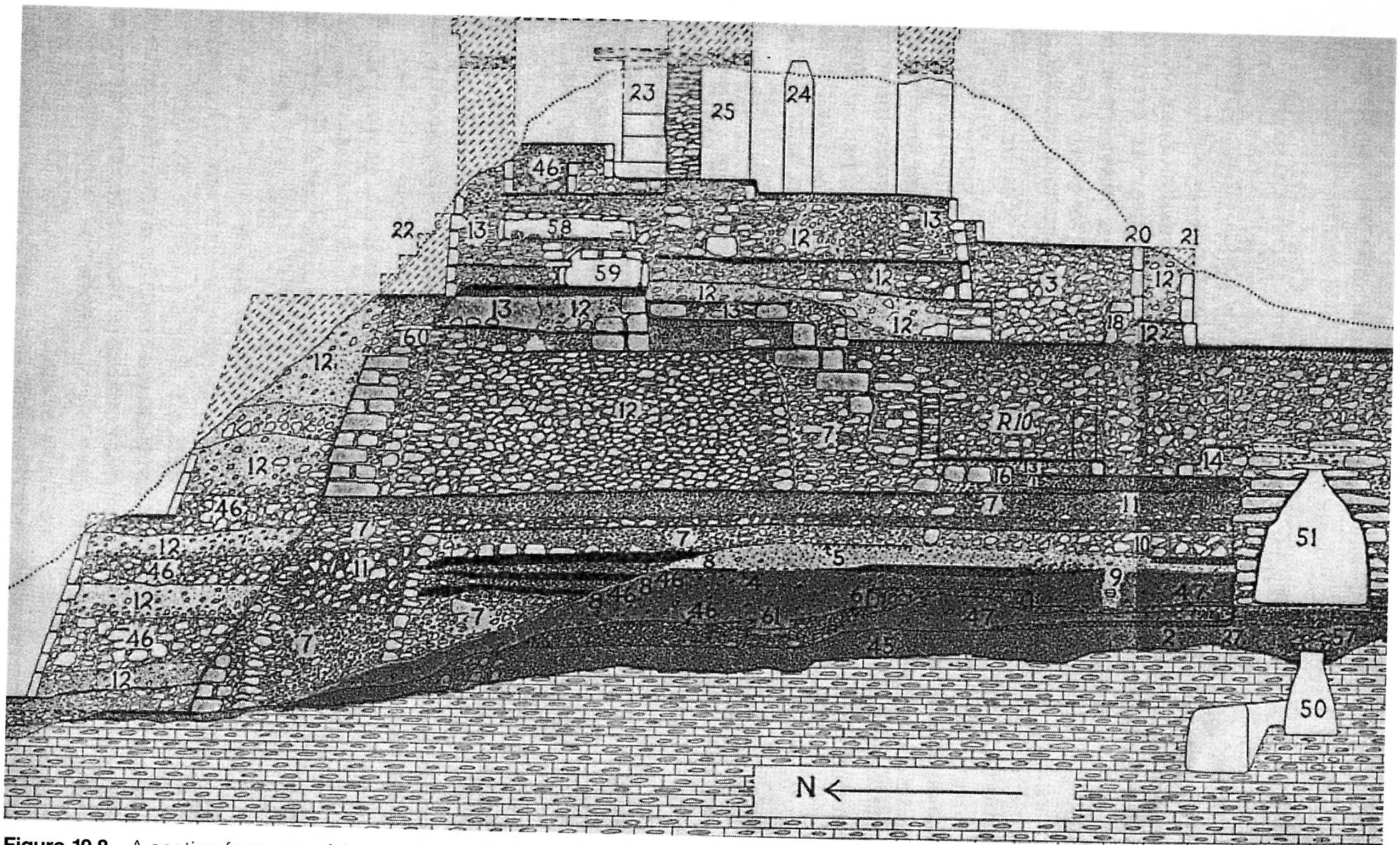


Figure 10.8 A section from one of the most complex architectural profiles in the Maya area, A-V palace at Uaxactun, Guatemala. E. M. Shook produced two detailed cross sections; this is a fragment of one. Shook's extraordinarily accurate drawing is surely a tour-de-force of this kind of recording.

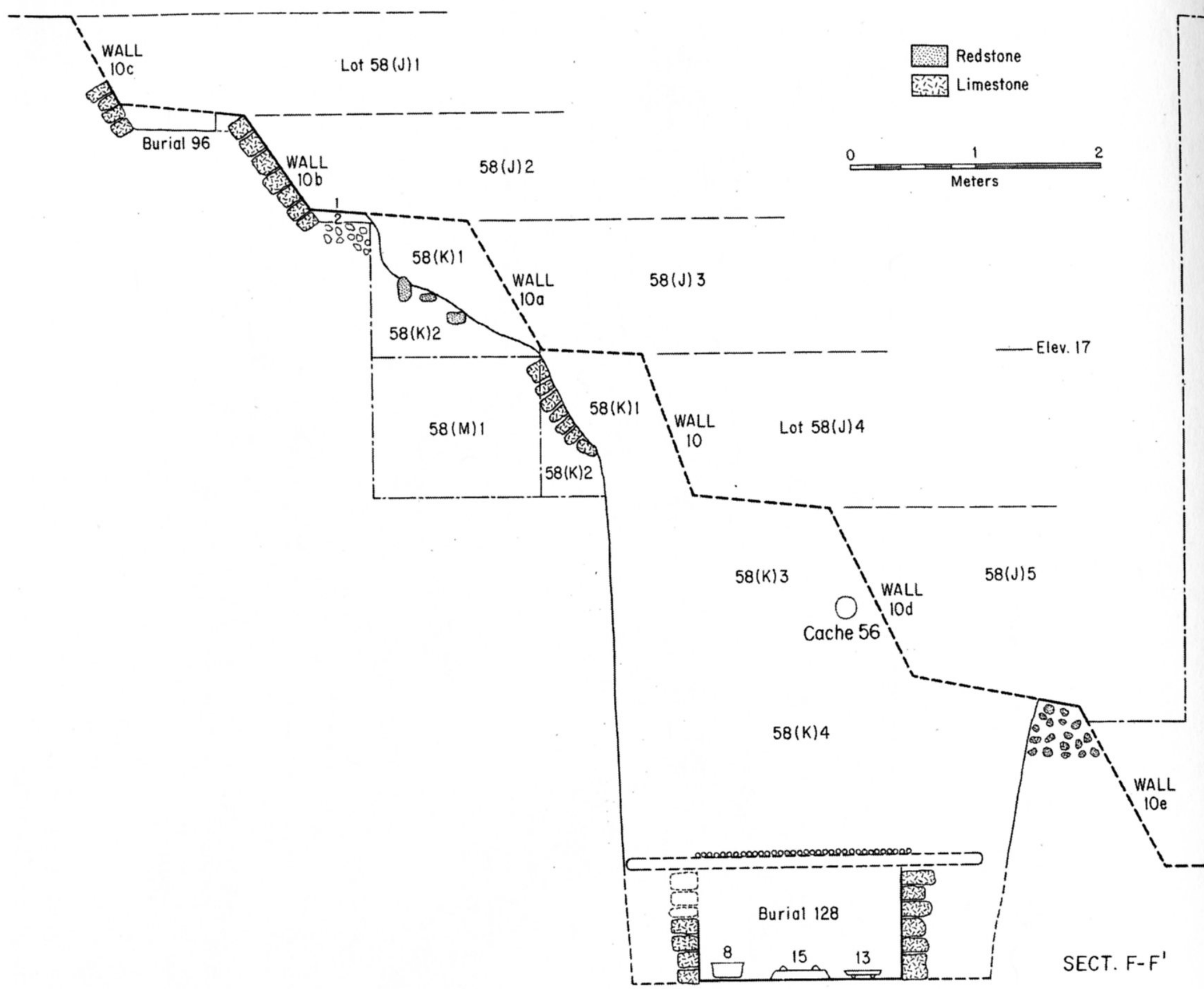


Figure 10.10 Section F-F' through Structure A-III, Altar de Sacrificios, Guatemala. Note the segregation of blocks of structural fill.

stratigraphic situation without any direct relation to cultural activities.

Horizontal stratigraphy is often seen in sites occupying a very large (or long) area. In these situations, the stratification is found across a site rather than vertically. A riverbank, for example, may have been occupied and reoccupied along its length, rather than having experienced continued or continual occupation of the same locality (creating depth). Similar horizontal stratification may be found along with beach formation (DePratter and Howard 1977; Giddings 1966).

Archaeological projects should make every effort to include in the staff a geoarchaeologist or someone with a strong background in geomorphology or soil science. This person can help to make critical distinctions between natural and cultural processes and discern formation and deformation processes (Goldberg 1988).

THE PROBLEM OF SAMPLING

All of archaeology can be viewed as a vast sampling game (see Chapter 3). The reliability of the information gained from stratigraphy is directly related to the size of the sample. In other words, the more you dig, usually, the more reliable your conclusions. And, relatively speaking, archaeologists dig very little. It has been calculated that in the case of a moderately large Maya site, Altar de Sacrificios, only 2–3 percent of the deposits theoretically present were sampled in 15 months of digging. The Jarmo excavations produced only about a 4 percent sample on a relatively small site, one with about 2,000 m^2 of scatter showing on the surface (Braidwood 1974). At the site of Momil in Colombia, the Reichel-Dolmatoffs' (1956) excavations produced a 1/6,000th sample from total theoretical deposits of about 360,000 m^3. Another way the point can be made is that rarely does one get the chance of replicating information by further excavation. The hoary tales of the most interesting finds being made in the final days of a project are true.

One disquieting aspect of stratigraphic sampling is that so much of the information produced is anomalous, confused, and understandable only by means of digging into undisturbed locations with long sequences under them. The latter are statistically rare in any excavation. Thus, a systematic and rigidly based sampling system is not necessarily the best means of *sampling* for stratification; such a system is, however, excellent for *locating* stratification. For purposes of increasing the size and reliability of the sample, however, one must differentially exploit the best-ordered deposits and those with the longest sequences. There is no mechanical cookbook approach to fieldwork that will infallibly yield reliable results. One must approach each situation with a willingness to apply the most appropriate from a full arsenal of techniques ranging from the most subtle and painstaking to the most rapid and narrowly objective oriented.

The archaeologist must approach peculiar and specific situations with technical finesse and theoretical sophistication. Obviously, the extremely detailed and careful approach demanded by a Paleolithic rockshelter (Movius 1974) is not always appropriate for one of the many apartment houses in Teotihuacan. The fact that there are many fewer Paleolithic rockshelters in all of southwestern Europe (about 500) than there are apartment houses (over 2,100) in the single Mexican site of Teotihuacan may influence the approach to the archaeologist's respective stratigraphic problems. However, these are all finite data and many times represent unique excavation opportunities. How one approaches stratigraphic excavation is, in a sense then, another aspect of the sampling problem.

SPECIAL AIDS

Soil samples from the walls of pits or trenches can be taken for special and/or future studies by various techniques. These materials (samples) may, after specialized analysis, assist with stratigraphic interpretations. The wall should always be cleaned immediately before sampling. A simple technique is to dig out the sample from each stratum with a clean knife or trowel, putting each sample into a sterilized container and labeling the material clearly. Specific extraction techniques may be required depending on the type of sample and its intended use (e.g., see Chapter 12 concerning pollen studies). Another technique is to paint the wall with a vertical stripe of latex rubber or other adhering material. Several coats of the rubber will form a strip sufficiently strong to peel off with samples of the various strata adhering to the underside. The sample side can then be protected by wrapping it with cloth, and the whole thing placed in a box, either whole or in sections (see Chapter 12 for a similar discussion). Methods of removing such sediment peels can be found in Goldberg (1974).

For purposes of faunal and floral analyses, specialists in each field should be consulted concerning the collection of samples to be studied. Because specific techniques of collection and methods of analysis affect the samples, only properly trained (or instructed) archaeologists should attempt the sample collection. For equipment and techniques involved in various sample collecting (and analysis) strategies, see Chapters 6, 12, and 13.

Coring tools, especially hand-operated augers or corers, are useful in testing subsurface deposits when one has reached the bottom of a deep pit. Too many archaeologists have assumed that a sterile lens encountered at respectable depths was the bottom of cultural deposits, only to find through later excavation that the most interesting material lay just below (see Drucker et al. 1959; Johnson 1964).

Using a coring device at Kinal, Guatemala, Scarborough was able to reconstruct the stratigraphy of a water reservoir by reviewing the profiles of the cores (Scarborough et al. 1994). A related technique implemented at Rio Azul, Guatemala, involved a motor-driven coring device, but the dirt in the core was not used or analyzed. Instead, a fiber optic line was dropped down the core hole, and the stratification was observed on a monitor and recorded on tape for future consideration (Valdez and Buttles 1991).

As mentioned earlier, air jets and sprayed water, both run by portable engines, can greatly aid in excavation and in making the stratigraphy more visible. These tools may assist in determining fine distinctions between various strata that are often differentiated by slight color differences or minor textural composition. Air jets may be especially useful in outlining mud-brick architecture, where it is often difficult to distinguish between the matrix soil and the structure.

For European Mesolithic sites, G. D. Clark (1974) recommends securing the collaboration of paleoethnobotanists to make sure that the stratigraphy has been interpreted correctly. Indeed, the older the site and the more dependent the archaeologist is on ecological data to explain cultural matters, the more urgent is the need for cooperative colleagues from the natural sciences. This kind of cooperation and interdisciplinary effort have been demonstrated at a number of archaeological sites worldwide, for example, Adovasio et al. (1978), Goldberg (1988), and Stuckenrath et al. (1982). At the archaeological site of Colha and adjacent Cobweb Swamp in northern Belize, soil formation processes, pollen remains, and artifacts have been used in conjunction to reconstruct and understand the stratification (Jacob 1992; Jones 1994). Soil scientists, a paleoethnobotanist, and archaeologists have worked in harmony in the Cobweb Swamp study. Archaeologists should not attempt to acquire all of the skills necessary to do palynology or a similarly complex analysis. They will not only spend valuable time on a secondary commitment but will find that their analyses carry less weight than if done by an appropriate specialist.

A final comment about archaeological stratigraphy and the information presented here. This chapter introduces the student to stratigraphic situations and the complexity of stratigraphy. Although the "law of superposition" and the Harris Matrix system have been introduced, each are worthy of greater attention and are discussed in much detail elsewhere (Harris 1989; Harris and Brown 1993). Other basic geological principles—such as the laws of original horizontality, lateral continuity, and intersecting relationships—are beyond the scope of this chapter but are mentioned as potential areas of additional study (see Harris 1989; Waters 1992). The role of the paleoethnobotanist, soil scientist, and geoarchaeologist in archaeological investigations is ever-increasing as methods of recognizing, defining, and recording stratigraphy continue to develop.

GUIDE TO FURTHER READING

History of Archaeological Stratigraphy

Adams 1960; Phillips et al. 1951; Thomas 1989; Willey and Sabloff 1993

Recording and Interpreting Stratigraphy

Clark 1974; Harris 1979, 1989; Harris et al. 1993; Johnson 1964; Laville et al. 1980; Movius 1974; Sheets 1983; Smith 1972

Disturbances Affecting Stratigraphy

Bollong 1994; Duffield 1970; Gifford-Gonzales et al. 1985; Sheets 1992; Villa 1982; Villa and Courtin 1983; Wood and Johnson 1978

Stratigraphic and Subsurface Sampling

Goldberg 1974; Scarborough et al. 1994; Stafford 1995; Voight and Gittins 1977