MASTER

A 2001 Archaeology of Ancient Mexico and Central America: An Encyclopedia, ed. by Susan Toby Evans and David L. Webster, pp. 26-30. New York: Garland Publishing.

Rovner, I. 1983. Plant Opal Phytolith Analysis: Major Advances in Archaeobotanical Research. In M. B. Schiffer (ed.), *Advances in Archaeological Method and Theory,* vol. 6, pp. 225–266. New York: Academic Press.

Rue, D. 1987. Early Agriculture and Early Postclassic Maya Occupation in Western Honduras. *Nature* 326: 285–286.

Tieszen, L. L. 1991. Natural Variations in the Carbon Isotope Values of Plants: Implications for Archaeology, Ecology, and Paleoecology. *Journal of Archaeological Science* 18: 227–248.

Randolph Widmer

SEE ALSO

Archaeology: Research Design and Field Methods

Archaeology: Research Design and Field Methods

Archaeology is the study of human societies based on their surviving physical remains. Archaeological field methods are used to locate and investigate sites (loci of past human activities). The artifacts (human-made or modified objects) and other preserved remains from the sites are collected and analyzed to assess the cultural patterns, or lifeways, of the society that created and used them.

Archaeological investigations begin with a research design—a formal plan to collect or record physical evidence to answer specific questions or to provide new information on a particular society. It states the problem to be investigated, the data to be collected that bear on that problem, the specialists whose expertise is needed to assess those data, and a budget and time frame for completing the project. The extent of field work envisioned in the research design may be as large as an entire geographic region, to understand the patterned occupation of communities within a large bounded area (settlement studies), or as small as a single site or even a portion of a large and complex site, such as an urban center.

The sites and their artifacts are the patrimony of the modern countries within which they are found, so permission from national caretaker institutions (listed in Table 1), as well as from local authorities and landowners, is obtained in order to undertake fieldwork. Although these countries fund some of the archaeological work carried out within their borders, foreign archaeologists working in Mexico and Central America generally obtain funding for all or portions of their field work from their own governments or private institutions and foundations. At the completion of the project, a written report is submitted to the caretaker institutions and funding agencies, and the findings are published to disseminate that information.

The discovery of sites is referred to as "archaeological reconnaissance," and the assessment of their physical and spatial characteristics is "archaeological survey." Various systematic reconnaissance techniques (see Table 2) are used; the chosen method depends on the size of the area to be covered, the expected visibility of sites—determined in part by the modern vegetation and geography—and their characteristics (for example, whether they exhibit aboveground architecture such as mounds).

Ground reconnaissance (surface inspection) techniques are the most commonly employed. Where the area to be examined is large, time and budget constraints may permit only a portion of a region to be sampled, and

TABLE 1.

Country	*Caretaker Institutions*
Belize	Belize Department of Archaeology
Costa Rica	Museo Nacional de Costa Rica, San José
El Salvador	Museo Nacional, San Salvador
Guatemala	Instituto de Antropología e Historia, Guatemala City
Honduras	Instituto Hondureño de Antropología e Historia, Tegucigalpa
Mexico	Instituto de Antropología e Historia, Mexico City
Nicaragua	Museo Nacional de Nicaragua, Managua
Panama	Museo del Hombre, Panama City

Table 2. Site Identification and Assessment Techniques.

Technique	*Description*	*Used to Detect*
Ground Reconnaissance		
Surface Inspection	walking, riding over terrain to be examined; observing soil exposures in road and river cuts	visible artifacts, structures, human land modification
Aerial Techniques		
aerial photography	vertical and oblique photographic views taken from aircraft	crop marks (patterned discontinuities in vegetation growth), soil marks, frost marks (differential melting of snow), shadows—all indications of low or shallow subsurface features
SLAR	side-looking airborne radar imagery	large-scale landscape patterns hidden under clouds or vegetation
satellite imagery	LANDSAT satellite transmissions	patterns of differential intensity of reflected light or infrared radiation
Noninvasive Subsurface Techniques (Instrument-Based Techniques)		
magnetometry	measures magnetic contrasts in soil	burned soils, rocks, bricks, humic fill in pits
soil resistivity	measures differential electrical resistivity or conductivity of soil	stone walls, foundations, compacted soil, filled pits and ditches
ground-penetrating radar	measures discontinuities in soil via "echoes" of electromagnetic pulses	house floors, compacted layers, stone walls, foundations, voids, rocks, metal
Invasive Subsurface Probes		
coring	removal of continuous section of sediments using hollow cylinder	features, artifacts, soil horizons
augering	drilling hole into soil to examine removed earth and hole	features, artifacts, soil horizons
shovel tests, divots	shovelful of dirt turned over and contents examined	shallow buried features, artifacts

inferences must be made as to how representative the sample is of the entire region. Probabilistic sampling using statistical techniques ensures a more representative sample.

Aerial reconnaissance is a method of remote sensing (the discovery of information at a distance from the phenomenon being investigated). Patterns in the landscape that result from human occupation and that are generally not readily apparent on the ground may be discerned from aerial photographs or satellite images. Suspected indications of human occupation discovered with the various aerial techniques must be verified by ground survey. Aerial reconnaissance is well suited for quickly locating relatively visible sites within a large region.

An adjunct reconnaissance method is to probe beneath the surface to look for buried sites. The surface to be examined is systematically covered at measured intervals, using invasive or noninvasive exploratory techniques (Table 2) in order to detect spatially patterned variations in subsurface soil constituency. Noninvasive techniques require sophisticated instruments to measure the patterned discontinuities below the surface, and these findings must be verified or interpreted by excavation. Slightly invasive probing techniques using a coring tool or shovel allow for rapid examination of subsurface soil characteristics. Because of the time and expense involved, subsurface techniques are often limited to a sample of a larger area and are more frequently used to assess the characteristics of previously discovered sites—for example, to locate buried monuments or structures—rather than to find sites themselves.

Once a site is discovered, the coordinates of its geophysical location are plotted on base maps available from government and other agencies, or on aerial photographs. Hand-held Global Positional System receivers are now often used to pinpoint location via triangulation data transmitted by satellites. Site location information is increasingly being stored using Geographic Information Systems technology, a computer-assisted mapping system in which digitized locational data are entered into a computerized database that allows the storage, manipulation, and retrieval of spatial information. The resulting regional site maps allow the interpretation of settlement patterns with regard to intersite relationships, the interaction of people with their environment, and change in settlements over time.

The archaeological survey gathers information concerning a site's surface characteristics and suspected subsurface features prior to excavation. A site map is made to indicate its boundaries, associated geographic features, relief (topography), and internal characteristics, such as structures, roads, canals, and clusters of surface artifacts. Optical mapping instruments (theodolite, transit, alidade, Brunton compass) are commonly utilized to construct the map, although they are being replaced by more efficient electronic distance-measuring equipment. Photogrammetric maps of sites or regions can be made directly from aerial photographs taken in stereo pairs.

The site map is a first step in interpreting the patterned use of space by a past society. Because spatial patterning of artifacts and other remains is critical to archaeological interpretation, several techniques have been developed to efficiently record provenience (the positioning of archaeological remains in three dimensions). Using the site map as a base, the site is divided into standardized segments to facilitate the recording of horizontal provenience during survey and excavation. Most sites are divided into numbered squares following a grid pattern oriented to magnetic (or true) north. Larger sites, such as urban centers, require more complex subdivision schemes.

Although it is not part of every research design, excavation is necessary to observe and record the spatial organization of subsurface archaeological remains in three dimensions within a matrix (surrounding medium, usually soil). In addition to artifacts, these remains consist of features (non-portable human-modified phenomena that cannot be removed without disturbing their physical structure), such as burials, hearths, caches, trash dumps (middens), and pits; structures (architectural forms) such as houses, platform mounds, and raised roadways; and ecofacts (non-human-made materials) such as seeds, bones, and charcoal, which provide information on diet and environment.

The vertical and horizontal positioning of the archaeological remains relative to one another is referred to as their "association." By assessing the provenience, matrix, and association of the remains, the archaeologist makes an interpretation of their context—a hypothesized reconstruction of the behavioral processes and events that may account for their perceived patterning and characteristics. Interpretation of the context also incorporates evidence of later disturbances of the originally deposited remains by both human and natural actions. For example, mound-building often involved the collection of dirt and rubble from previously occupied areas, so that earlier artifacts were removed from their original location and deposited in a later structure.

Excavation methods and techniques vary depending on the research design and the nature of the site. Only a portion of the site area is excavated, to prevent total destruction of its remains. Surface indications usually guide the placement of excavation units, and in addition, probabilistic (statistically determined) sampling techniques help to ensure that a representative portion of the site is excavated in areas lacking surface clues.

Vertical or penetrating excavations rapidly and efficiently gauge the nature and depth of buried archaeological materials. Most often these excavations take the form of square or rectangular test pits of minimal horizontal extent (generally from 1 × 1 to 2 × 2 meters). The regular size of these units, oriented to the site's gridded subdivisions, facilitates the recording of horizontal provenience information, precisely locating the positions of artifacts and features. Vertical provenience is determined by the elevation of the remains relative to a fixed point, usually on the surface; hence, measurements taken to record locations are often referred to as depth "below surface."

Penetrating excavations also reveal the matrix as composed of sequential layered deposits (strata) that result from both human and natural processes. These include, for example, superimposed house floors, created as buildings were built and demolished on the same site over a period of time. Stratigraphy, the evaluation of these sequential deposits, is essential for interpreting contexts and for dating the various site components (discrete occupations of the site by a group of people), so provenience information must include these strata. Where strata are clearly distinguishable, archaeologists may excavate units layer by layer down to the pre-occupation level, which can be bedrock, subsoil, or soil that is sterile (devoid of cultural materials), providing a quick assessment of changes at the site over time. Until these layers are discerned, or in the absence of discrete layers, excavation is carried out in layers of a standard measured depth ("arbitrary" or "metric" strata), keeping separate the remains found in each layer.

To expand the excavation rapidly to provide more horizontal information, the test pit can be enlarged in a single direction, creating a test trench. Trenches are used especially to cross-section mounds or other large architectural forms. Excavations within very large mounds and some deeply buried sites may require the use of a tunnel. When features or structures are located, the initial exploratory pits or trenches may be further extended to reveal a wider area. These horizontal or clearing excavations maximize the horizontal dimensions of the excavation unit while minimizing its depth, in order better to assess the extent and associations of remains at a single point in time in the past.

While excavations are progressing, an ongoing task is to record all the observations made concerning the spatial relationships of the remains within their matrix, since those relationships will be destroyed by the excavation process itself. Field journals provide a daily narrative or chronological commentary on the excavation. Standardized forms ensure the comparable recording of all characteristics of provenience units and features. They also allow for easy transferral of the information into a computerized database, and portable computers are frequently taken into the field for immediate data entry.

Much of the spatial information is recorded by visual means. Scaled drawings indicating provenience and association are of two types. Plan views are horizontal ("bird's-eye view") renderings of the floor of an excavation unit at a particular depth below surface. Profile or section views depict the sidewalls of the unit or mound, providing information on stratification. In addition to these schematic representations, photographs and slides (both black-and-white and color) are indispensable for recording the progress of the excavations, the plan and profile views of the units, and the individual artifacts and features recovered. A photo board placed within the area to be photographed provides the provenience information for each picture, and a log is kept to record photographs sequentially. Video cameras are also used to provide panoramic views and to record the progress of more complex excavations.

Observations concerning the matrix and its component strata include the texture, physical composition (clay, silt, sand, rock), color, and inclusion of artifacts. Soil color is determined with a standard designating system, the Munsell Soil Color Charts. Features require special treatment and excavation depending on their type: pits and middens are often cross-sectioned to reveal their depth and shape; burials, whether simple graves or tomb interments, are complex features requiring special handling for recording the information on the grave pit, associated objects, and positioning of the body, as well as for the ultimate disposition of the human remains recovered.

Artifacts are collected and recorded by different methods, depending in large part on their context. Where the context is considered to be "primary" (relatively undisturbed since the artifacts were first deposited by their users), the spatial patterning of those remains may be significant enough to require recording the precise location of each artifact where it lies. If the context is considered to be "secondary," or disturbed, it is often sufficient to collect and separate artifacts by provenience lot, usually a single stratum or measured depth within a specific excavation unit. This is efficiently done by removing the soil from a designated layer of an excavation unit and dumping it onto a prepared screen or a layered series of screens of graduated mesh sizes. Shaking the screen or running a trowel across it causes the soil to fall through the screen, thereby separating out the larger artifacts. Screening is also done on the soil removed from primary contexts to recover any additional artifacts. Water sprayed onto the soil (water screening) speeds up the process and is helpful where the artifacts or ecofacts (such as shell and bone) are fragile and may otherwise be damaged.

Because screening and simple hand-recovery techniques are insufficient to collect the smallest artifacts and ecofacts, flotation is used to retrieve very small specimens. Soil is placed in a large container of water with one or a graduated series of very fine screens at the bottom. Light materials, such as seeds or small pieces of bone, float to the surface, while heavier materials are trapped in the fine screens. Chemicals are often added to the water to increase the specific gravity, allowing heavier materials to float. Because flotation is time-consuming, usually only a sample of soil is processed in this manner.

Other ecofacts, such as microscopic pollen and plant phytoliths, are retrieved from specially selected soil samples. Chemical analysis is also performed on soil samples—for example, to detect the presence of phosphates that may indicate a burial in a suspected grave lacking preserved bone. Samples of materials that can be used for dating purposes, such as charcoal and other organic remains, are also collected using special techniques. All remains extracted from the excavation units and surface are carefully bagged and labeled to record their provenience. They are transferred to a laboratory for cleaning, processing, and analysis.

Especially where stone architecture is involved, archaeological projects are usually responsible for consolidating, or even reconstructing, affected structures to restore the integrity and appearance of the original building.

FURTHER READINGS

Breiner, S., and M. D. Coe. 1972. Magnetic Exploration of the Olmec Civilization. *American Scientist* 60: 566–575.

Carr, C. 1982. *Handbook on Soil Resistivity Surveying.* Research Series, 2. Evanston, Ill.: Center for American Archaeology.

Clark, A. 1990. *Seeing Beneath the Soil: Prospecting Methods in Archaeology.* London: Batsford.

Ebert, J. I. 1984. Remote Sensing Applications in Archaeology. In M. B. Schiffer (ed.), *Advances in Archaeological Method and Theory,* vol. 7, pp. 293–362. New York: Academic Press.

Harris, E. C. 1989. *Principles of Archaeological Stratigraphy.* 2nd ed. New York: Academic Press.

Joukowsky, M. 1980. *A Complete Manual of Field Archaeology: Tools and Techniques of Field Work for Archaeologists.* Englewood Cliffs, N.J.: Prentice-Hall.

Kvamme, K. L. 1989. Geographic Information Systems in Regional Archaeological Research and Data Management. In M. B. Schiffer (ed.), *Archaeological Method and Theory,* vol. 1, pp. 139–203. Tucson: University of Arizona Press.

McManamon, F. P. 1984. Discovering Sites Unseen. In M. B. Schiffer (ed.), *Advances in Archaeological Method and Theory,* vol. 7, pp. 223–292. New York: Academic Press.

Millon, R. 1973. *The Teotihuacán Map: Urbanization of Teotihuacán, Mexico.* Vol. 1. Austin: University of Texas Press.

Munsell Soil Color Charts. 1975. Baltimore: Munsell Color.

Scarborough, V. L., R. P. Connolly, and S. P. Ross. 1994. The Pre-Hispanic Maya Reservoir System at Kinal, Peten, Guatemala. *Ancient Mesoamerica* 5: 97–106.

Scollar, I., A. Tabbagh, A. Hesse, and I. Herzog. 1990. *Archaeological Prospecting and Remote Sensing.* Cambridge: Cambridge University Press.

Sharer, R. J., and W. Ashmore. 1993. *Archaeology: Discovering Our Past.* 2nd ed. Mountain View, Calif.: Mayfield.

Sheets, P. D. 1992. *The Ceren Site.* New York: Harcourt Brace Jovanovich.

Stein, J. K. 1986. Coring Archaeological Sites. *American Antiquity* 51: 505–527.

Weymouth, J. W. 1986. Geophysical Methods of Archaeological Site Surveying. In M. B. Schiffer (ed.), *Advances in Archaeological Method and Theory,* vol. 9, pp. 311–395. New York: Academic Press.

Susan D. Gillespie

SEE ALSO

Archaeology: Analytical Methods; Dating Methods

Archaic Period (c. 8000–2000 B.C.)

This cultural stage followed the cessation of Paleoindian hunting of now-extinct Pleistocene animals and preceded the Formative period, when agriculture, village life, and pottery began around 2000 B.C. in Mesoamerica and Central America. The Archaic consists of three substages: (1) Early Archaic or First Forager, marked by new foraging adaptations and a more seasonally scheduled subsistence system, and characterized by grinding stones, the beginning of a complex weaving industry, and extensive use of various storage facilities; (2) Middle Archaic or Incipient Agriculture, when foraging activities were supplemented by the beginnings of agriculture with stone bowls, more complex storage facilities, and various notched projectile points used to tip *atlatl* (spear-thrower) darts; and (3) Late Archaic, a "semisedentary" substage marked by expanded agriculture, use of more species of domesticated plants, and a more sedentary way of life, with pit houses and a mano-metate complex.

The Archaic was a period of adaptation to changing ecological conditions that extended far beyond Mesoamerica. Because it involved different adaptations to