ASSIGNMENT 2

ARCHAEOLOGICAL SURVEY, HIERARCHIES, & ENVIRONMENTS

Assignment 2 explores the fundamental nature of modern archaeology as the association and interpretation of the material remains of human activity in time and space:

- *First, we look at how archaeologists establish chronological relationships.*
- *Next we consider the concept of space in archaeology and define many key terms and concepts in the so-called "hierarchy of archaeological entities."*
- *Then, we discuss archaeological survey: how archaeologists find sites .*
- *Last we look at environmental change, in the context of the Moche state of Peru and El Niño.*

WHAT LIES AHEAD

Assignment Objectives:

1. Compare and contrast Absolute and Relative dating and define and discuss the Law of Association and its importance in archaeology.
2. Describe the Hierarchy of Archaeological Entities and define and assess the significance of the following basic archaeological concepts: Cultural System, Cultural Process, Archaeological Record, Attribute, Artifact, Assemblage, Industry, Component, Feature, Site, and Complex.
3. Describe and evaluate the importance of different approaches to reconstructing long- and short-term environmental change in the past.
4. Evaluate different ways of finding archaeological sites and sampling in archaeological survey.

WORK REQUIRED

This assignment requires you to complete the following:

1. Readings: Archaeology, A Brief Introduction, read Chapters 4-6, 9-10 & Anthology.
2. Web: 1-2 Chronological Methods
3. Written Assignments: Dating Techniques, Archaeological Terms, Stratigraphy.

Lecture 1: Chronology & Context

My lecture deals with how archaeologists can tell an obect, site or monument's age. Dating is critical to all archaeology, but is especially important to anthropological archaeology, which typically involves the investigation of interconnections and interactions between cultures, as well as cross cultural comparisons. Specifically, we discuss:

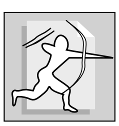
- Absolute & Relative Dating methods
- Time, space, and context.

Lecture 2: Archaeological Survey

Landscape studies are a central part of today's archaeology and add a new dimension to site survey. This lecture surveys some the basic methods and approaches, and a hierarchy of research which proceeds from the household to the entire community and the changing distribution of sites on the landscape.

- How to conduct an archaeological survey and interpret the results,
- High Tech Surveys & Ubar, the Lost City of Arabia.

Martin Luther King, Jr. Holiday
Monday, January 16th



Archaeological Context: Time

Context, in archaeology, simply means the culturally significant location of the find spot of any object in an archaeological site. Cultural context is a sub-category that represents the position of an object; was it found in a pit, in a room, on a surface? The space and time context of an archaeological find provide the basis for building up long sequences of archaeological sites in time and space: culture history. (Definition on page 62 of Archaeology.)

How old is it? This is probably the first question that comes to mind when you see an archaeological site or handle an ancient artifact. There is something very thrilling in handling a tool fabricated by a human being more than 50,000 years ago, or the skull of someone who lived more than 250,000 years ago.

Almost certainly the archaeologist will reply to your question with an estimate: "It's about 5,000 years old," or "A Chumash Indian made it about 750 years ago." This may seem like black magic until you learn how archaeologists establish chronologies.

In a sense, the archaeologist is peopling a vast, featureless landscape that stretches out infinitely beyond the outer limits of historically recorded dates of about 5,000 years ago. We can only people this landscape by using Relative and Absolute dating methods. Relative chronology: Relative dates correlate ancient materials with one another in terms of their age relative to one another.

It's time to read about relative chronology:

Archaeology: A Brief Introduction. Read pages 92-103.

This reading deals with the Law of Superposition, the fundamental principle behind relative chronology. Figure 5.5 in the reading gives an excellent exposition of the principle.

Stratigraphy Exercise: Establishing the relationships between different strata on archaeological sites is often complicated by later building and other activity. In this exercise during Section , you will try your hand at ordering deposits at a Classical settlement.

Ancient British coin minted in the first century BC. An archaeological find of known age.

Absolute Chronology: Dating the past in calendar years before present, using methods of acceptable accuracy for the purpose.

Absolute dates in calendar years are of paramount importance to answering key questions, such as:

- How old is this artifact or site?
- How long was that settlement occupied, or how many centuries have elapsed between the first and second occupations of this city?
- Are these villages contemporary?

Did agriculture begin in southwestern Asia before China, or at the same time in both areas?

We must now describe the most important absolute dating methods used in archaeology.

Begin by examining Figure 5.8 (page 104) in Archaeology, which shows the chronological spans of the major dating methods. Then read Archaeology: A Brief Introduction, pages 103-114.

Pay careful attention to the uses and limitations of each method. If you are still unclear about the different methods or want more detail on dating techniques, go on the Web for . . .

Web Exercise
(40–60 minutes)

This optional exercise describes each major chronological method in turn, taking you back further into ancient times. These are animated exercises, which explain the basic principles of each method.

When you have finished, write down, what, in your view, are the specific limitations of each of these four major dating methods: Objects of Known Age; Dendrochronology; Radiocarbon Dating; and Potassium Argon Dating.

Context - Space & Time

Space in archaeology is not the limitless frontiers of the heavens, but a precisely defined location for every find made during an archaeological survey or excavation. Space is important to us, because it enables us to study the spatial relationships between sites, artifacts, structures, and other evidence of human behavior. Our use of space is based on the Law of Association.

Archaeology: A Brief Introduction. Read Chapters 4 and 5.

A Hierarchy of Archaeological Entities

Space and Time, two critical elements in studying the past, are foundations of a whole hierarchy of important archaeological entities — units and concepts used by archaeologists to subdivide, classify, and interpret the past. By the phrase "Hierarchy of Archaeological Entities" we mean:

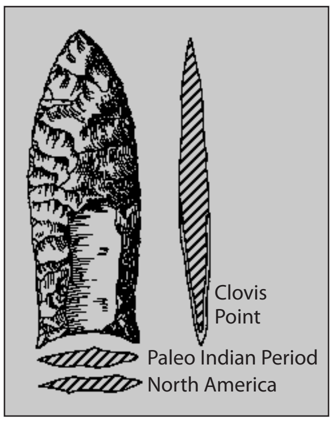
A hierarchy of theoretical terms used by archaeologists that enable them to classify the archaeological record into ordered levels. These levels start at the lowest level with individual archaeological attributes, and at their highest subsume entire culture areas.

An understanding of these arbitrary terms is essential for any journey through the past. You should remember that terms like "attribute," "artifact," and so on are theoretical constructs designed to assist research. They do not necessarily coincide with the original peoples' view of their own artifacts, houses, and so on.

Introduction

When excavating sites, archaeologists use a hierarchy of classifactory terms, which form the basic vocabulary of archaeology. The reading and graphics which follow define and explain them for you.

This assignment is designed to acquaint you with the hierarchy of entities with which archaeology deals. Although we generally think of sites, fabulous artifacts, and lost civilizations when we think about archaeology, there are many more facets of the human experience that archaeologists deal with. Some of them are quite spectacular, but many are the mundane minutia of daily life — in this or any other century. They are all very important in decoding the lifeways of earlier peoples.



Attributes

Attributes are the smallest unit of analysis in archaeology. An attribute is a well defined characteristic of an artifact that cannot be further subdivided.

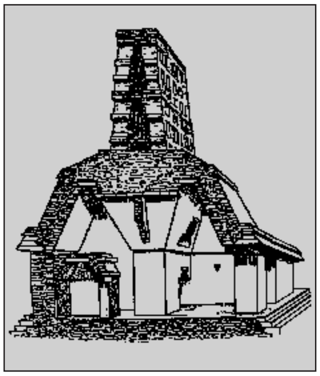
Normally attributes are studied statistically to determine clusters of attributes, including form, style, use and technology of manufacture, in order to classify and interpret artifacts. Attributes can include such things as raw material, color, size, weight, major dimensions, etc., like this Clovis point, which is defined by its proportions, style of flaking, and use in hunting large mammals.

Obviously, attributes will be different for different classes of artifacts. In some cases, only certain attributes are analyzed, selection being based on the problem at hand.

Artifacts

An artifact is any object manufactured or modified by human beings. Artifacts can be as simple as a single stone flake or as complex as the computer you are using. Although attributes are the minimal unit of analysis for artifacts, artifacts are, in practice, the minimal unit of analysis for most types of archaeological research.

Some artifacts, such as this portion of Sumerian tablet recording the exploits of the hero Gilgamesh, or the inner coffin of Tutankhamun's Tomb, are significant as individual objects. That is because they either contain important information, like the former, or are exquisite examples of the craftsman's art, as is the latter. Most artifacts don't have singular significance. The information that artifacts convey comes either from comparison with other, similar objects, or from their association with other artifacts.



Features

A feature is an artifact such as a house or a hearth, which cannot be removed from a site; normally, these are recorded only. In another sense, a feature is an artifact that cannot be collected because the process of collecting it would destroy it. Normal recording procedures for features include plan drawings, photographs, profile drawings, and often the collection of various kinds of samples such as soil, pollen, and archaeomagnetic dating samples.

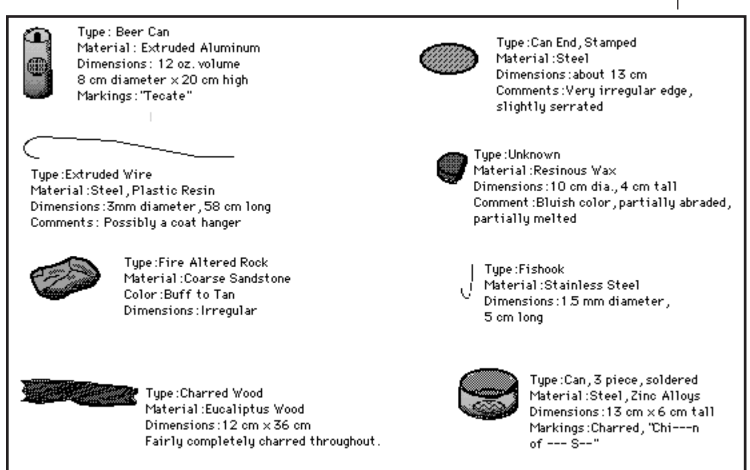
Just as artifacts have attributes, so do features. In most cases features have the same kinds of metric and material attributes as artifacts, but they often have more complex attributes as well. For example, the number, and types of artifacts associated with a feature is an attribute of the feature. In this way we can categorize features, like burials, not only on the basis of the dimensions and style of the grave, or the attributes of the persons buried in them, but also by the kinds of grave goods that were buried with the people.

An important type of feature found in many archaeological contexts is the hearth, or fireplace. Materials collected from hearths can help us date sites, can tell us about the sex of the people using the hearth, the time of the year that the site was occupied, what the people ate, and what some of the principal activities were at the site.

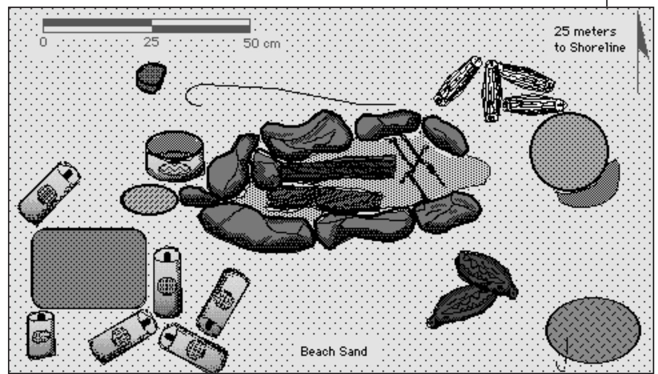
Beach Artifacts

This is a collection of artifacts picked up on a recent survey within Santa Barbara County. By themselves, how much real information do they convey?

Read the attribute information for each artifact.

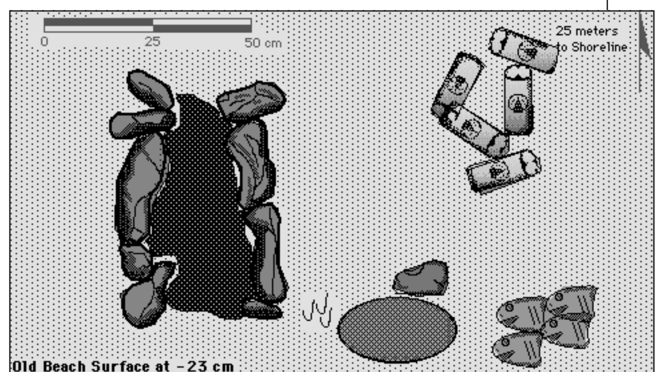


Welcome to Coal Oil Point!



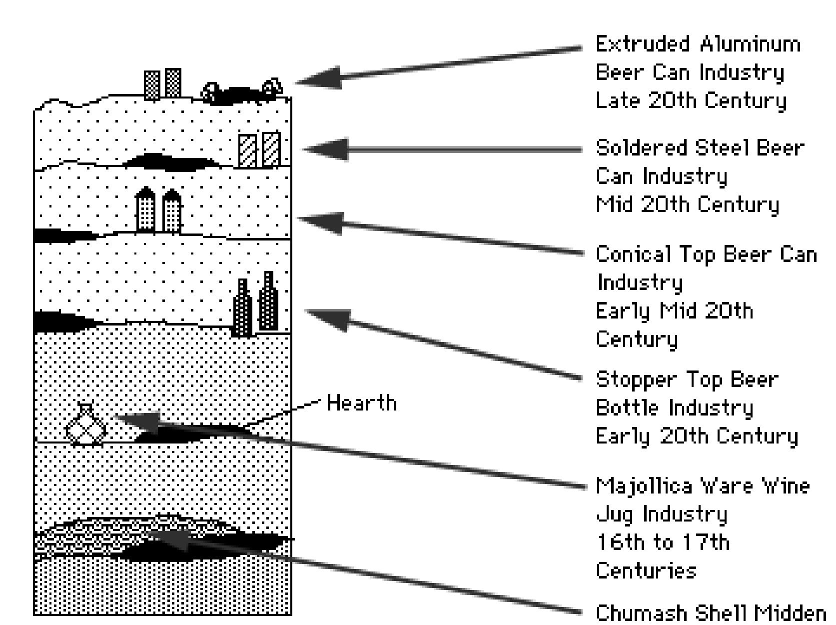
As the previous page pointed out, artifacts by themselves, without any contextual information, can be fairly uninformative. Here are those same artifacts, in the context within which they were recovered. This is a feature, in this case a hearth. Take a few moments to look over the feature and become familiar with it.

Take a few moments to think about how much more information the context of the feature gives you.



Assemblages

An assemblage is all of the artifacts found at a site, including the sum of all of the subassemblages at the site. Subassemblages are all of the artifacts of a particular kind or class found at a site. In the case of the feature that you just finished interpreting, all of the artifacts that were associated with that feature



Sequence of Hearths at Coal Oil Point

are part of the site assemblage. The cans belong to the subassemblage of metal containers.

Industry

An Industry at a site includes all of the artifacts made from a particular kind of material (bone, shell, stone, etc.) found at the site and made at the same time by the same population. In the case of our beach deposit, we could characterize a late 20th Century of the Extruded Aluminum Beer Can Industry, since they are so prevalent in this deposit. Look at the other objects above to see what other industries occurred on this beach during earlier times before you continue.

Component

A component is an association of all of the artifacts from one occupation level at a site. Sites having evidence for only one occupation are called single component sites. More stratigraphically complex sites are called multicomponent sites.

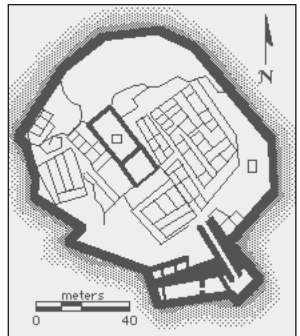
Components are often identified by the presence of particular industries, the association of particular artifact types, or by horizon markers. Horizon markers are artifact types that show enough stylistic change through time that they can be used to mark the horizon, or beginning of a new time period. The example of the different kinds of beer cans from the previous card is a good example of how horizon markers can be used to detect different occupations of a site from different time periods. The industries mentioned could then be used to define the various components of the Coal Oil Point Site.

Component Exercise

You are back at the Coal Oil Point Site. In this case, the site really only consists of the one feature you have already described. This time, however, you will excavate the site to see what lies underneath the surface deposit.

You should look for changes in the artifact assemblages that make up the two components of the site. In this way you can become familiar with the ways in which archaeologists use differing assemblages between the components of sites to determine changes in culture or occupation over time.

Sites



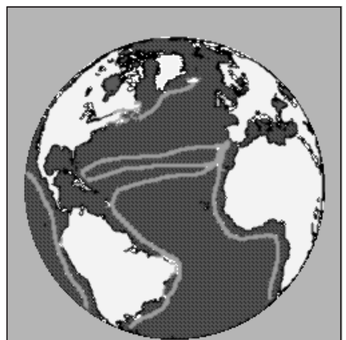
The Ancient City of Troy

A site is any place where objects, features, or ecofacts, manufactured or modified by human beings are found. A site can range in size from a city to a hunting blind, and it can be defined in functional and other ways. We have already attached functional definitions to the two components of the Coal Oil Point Site - a beach party site, and a recreational fishing site. Sites can be single or multicomponent, and can have many features or none.


Extent of the Tecate Extruded Aluminum Beer Can Complex circa late 20th century

Complexes

In archaeology, a complex is a chronological subdivision of different artifact types such as stone tools, pottery, and the like. Complexes are often defined on the basis of the similarities of industries between different sites within a region dating from roughly the same time period. Thus, for our extruded aluminum beer cans, we could define a T.E.A.B.C. Complex that covers the entire region where we find these types of cans, with "Tecate" printed on them.


Exploratory Voyages of Lief Ericson, Christopher Columbus, and Ferdinand Magellan.

Regional Settlement Systems

As technology and communications have progressed through the course of human history, the scale and integration of settlement - villages, towns, and cities - has expanded, coalescing into the globalized world that all of us are a part of today. Yet in spite of globalization local cultures persist, and archaeology can document both the maintenance of local traditions as well as the rise of regional states and empires.

The Hierarchy of Archaeological Entities

You have now been introduced to the hierarchy of entities with which archaeologists work in the process of decoding human prehistory. These various entities or terms are heuristic devices that help in organizing information in a way that facilitates thinking about how archaeological remains relate to past human behavior. These various pieces fit together, working from the minuscule (attributes) to the grand (regional systems) as sets of ever increasing inclusiveness. This system for organizing archaeological information exists within the larger constraints of local and global Environment and both systems are affected by the passage of Time. Time structures the flow, the occurrence and disappearance, of all of the elements of the hierarchy.

When you finish the exercise, write a short definition of each in your own words. Please do NOT copy out the exact words in the exercise. You will not learn if you do. It is VITAL you understand these terms during the remainder of the course.

Archaeological Record:

Attribute:

Artifact:

Assemblage:

Industry:

Component:

Feature:

Site:

Complex:

When you have finished, please read on to learn about archaeological sites.

Finding Archaeological Sites

Of all archaeological research, nothing is more mysterious than the archaeologist's uncanny ability to locate archaeological sites without, apparently, anything to work with. We looked at some sites in the lecture. Now we need to learn about some of the ways to find archaeological sites and preservation of the past.

Archaeology: A Brief Introduction. Read Chapter 6.

Then read Chapter 9 "The Present and the Past" in its entirety to learn about site formation and preservation.

When you have finished the reading, read on below . . .

Clearly, it's impossible for archaeologists to survey every square foot of a research area —it would be too expensive. The solution is to use random sampling techniques, techniques we will use later in one of the Short Papers.

To learn the basics of sampling in archaeology , read:

Anthology Section: "Sampling in Archaeology.

Climate Change and Environmental Reconstruction

Humanity has experienced vast climatic and environmental changes over the past 2.5 million years. This reading gives you a briefing on how scientists study such changes and is important for understanding later material in the course.

Archaeology: A Brief Introduction. Read Chapter 10.

End of Assignment 2

Assignment 2: Anthology

1. Sampling in Archaeology, by George H. Michaels

Introduction

How do archaeologists go about finding archaeological sites, and why is it important? Answering those two questions are the goals of this discussion. Although most of this discussion speaks of sampling as it relates to regional survey for site location, it is equally applicable to sampling as applied to individual sites for both surface survey and excavation, as well as to the problem of sampling things like collections of artifacts. As in all sciences, researchers in archaeology rarely have the time, budget, or resources to collect all of the data relating to a particular problem, phenomenon, region, or site. As a result, in one way or another, all archaeologists end up working with samples of the population that they are interested in studying. Sampling design is that branch of methodology that helps archaeologists collect samples that have a knowable level of reliability in regard to representing the population in which they are interested.

How Do Archaeologists Find Sites?

The ways in which archaeologists go about finding sites are almost as varied as the number of archaeologists. Very often finding sites is a matter of happenstance. It is not uncommon, for example, for farmers, contractors, landowners to accidentally discover sites on their property or job site and then bring those sites to the attention of archaeologists out of curiosity or legal necessity. Much of archaeological history is marked by this kind of fortuitous circumstance. Sometimes archaeologists, armed with some theory about the location of sites within a region, will actually conduct a formal survey of the region in an effort to find sites. These surveys can vary in formality from the classic "Windshield survey" of Mesoamerican, Southwestern, and African archaeology to highly formalized walking surveys guided by probabalistic sampling theory, accurate maps, aerial photographs and even satellite imagery. Most surveys fall somewhere in between these two extremes and often combine elements of a number of different techniques.

Prior to the mid 1960's, most survey conducted by archaeologists consisted of one of three types. These were 1) total surveys—that is surveys where 100% of the region of interest was covered in an effort to collect site information; 2) systematic surveys—these are surveys where some systematic method for covering a proportion of the region of interest is employed in an effort to obtain a reasonable representation of the number and types of sites located in the region; 3) expedient surveys—these are surveys where expedient means were employed to find as many sites as possible in the time available. The classic "windshield survey" is a good example of an expedient survey. In this type of survey, the archaeologist piles into his/her pickup truck and takes advantage of whatever road network exists in a region to explore the area looking for evidence of sites such as standing ruins or mounds. Using this technique, in the right terrain, a large number of sites can be located over a large area fairly quickly. The technique suffers from a bias in that sites that are located far from roads, or that do not have readily identifiable surface manifestations are often overlooked or missed entirely.

Systematic surveys can also suffer from a similar type of bias in the results they return. If there is some periodicity in the distribution pattern of sites that does not coincide with the system of survey coverage, then whole sets or classes of sites can be missed. Although this kind of error is less likely with systematic as opposed to expedient survey, it is still a possibility. The only way that an archaeologist can be absolutely certain of finding all of the kinds and ages of sites within a region is to do a total survey. Unfortunately, few of us have the time or resources available to engage in a total survey.

Archaeologists grappled with these problems, and they were recognized as problems, as best they could until the introduction of probabalistic sampling techniques in the 1960's. What distinguishes probabalistic sampling from other kinds of systematic and unsystematic sampling? At the root of the distinction is the way in which the sample is selected and what can be inferred from the sample after it has been collected.

Probabalistic sampling is based on probability theory. At its core probability theory stipulates that collecting a random sample from a population will result in a more representative sample of the population than any systematic or unsystematic sampling technique by avoiding collection bias that may result in sample bias. The larger the sample, the greater the probability that the sample will reflect the full range of variability in the population of interest. There is, of course, always the chance that some potentially important, but low probability, variability will be missed by random sampling techniques. On the whole, however, probabalistic sampling is better at characterizing most of the variation in a population than non-probabalistic sampling.

Another advantage of probabalistic sampling is that not only are the results probably more reliable, but the degree of reliability can be specified depending on the size of the population, and the size of the sample. Thus while an archaeologist who has conducted a systematic survey of a region can say that in the area covered there were 100 large sites and 50 small sites, she cannot reasonably extend those numbers to the rest of the region of interest. If the same archaeologist had conducted a 20% random sample of the region of interest, and found 100 large sites and 50 small sites, she could reasonably state that there are probably 500 large sites and 250 small sites in the region as a whole, and that the proportion of large sites to small sites in the entire region is about 2/3 to 113.

Thus the real advantages of probabalistic sampling are that it results in more representative data, specifiable levels of reliability, and involves a smaller commitment of time, money and other resources to collect the data than total survey.

Types of Sampling in Archaeology

This section discusses the differences in various types of sampling employed in archaeology, and explores how these various techniques can be used. Central to the discussion is an understanding of two basic terms. The population or universe consists of the whole collection of things that one is interested in studying. Thus the population could consist of all archaeological sites existing in the universe of the Basin of Mexico, or all side notched projectile points found in the American Southwest, or all college students within the United States. A sample is a subset of the population, ideally collected from throughout the appropriate universe. So, for example, a sample of the sites from the Basin of Mexico could consist of all sites found in 20% of the surface area of the Basin, or a sample of the side notched projectile points from the American Southwest could consist of 10% of the points collected from each site where they were found, or all of the students at UCSB would constitute a sample of all American college students.

As mentioned above, some samples are better than other samples depending on the problem the data are expected to address. For example, if we wanted to examine the drinking habits of American college students, which of the following would be a better sample:

1) 10% of the student body of UCSB

2) 10% random sample of the student body of Wellesley Col-

lege

3) 1% random sample of the student bodies of all state universities with enrollments of over 20,000 students.

If you answered with number 3 you were right. The student body of UCSB, while being a sound systematic sample, is probably not representative of the socioeconomic or ethnic composition of college students nationally. Furthermore, by restricting the sample to 10% of the UCSB population, we may not sample the entire range of socio-economic or ethnic groups that are represented at UCSB. The sample from Wellesley would be even more biased because it has smaller enrollments than UCSB, and hence has less chance of being representative. In addition, Wellesley is an all female college, so the drinking habits of Wellesley students would not reflect the drinking habits of all American college students!

The last sample would probably accurately reflect the information for which we are looking. First by being a random sample of all students within the sampling universe, there probably would not be any bias introduced by the collection method. Second, the size of the sample would be such that any bias could probably be discounted (well over 100,000 responses as opposed to 1600 for number 1 and about 500 for number 2). Finally, by collecting only from state sponsored schools, we would be much more likely to be collecting data from a population that includes all socioeconomic and ethnic backgrounds reflected in the total population of all American college students.

The kinds of obvious and not-so-obvious biases that could have clouded our survey of American college students can also cloud archaeological samples of sites, features, artifacts, etc. The purpose of sampling design is to try to control against sample bias in order to ensure that the data collected will help answer the research problem being posed, and to develop a plan that fits within the financial and time constraints that always exist while still producing a useful body of data.

Judgmental Sampling

As the name implies, judgmental sampling relies on the archaeologist making a judgement about where the data collection should occur. Generally these judgments are based on previous experience in the region, some knowledge of the association of topography and the location of sites, and other experiential factors. In short, it is sampling based on looking where you know you have a pretty good chance of finding what your looking for. There are good reasons and bad reasons for employing this kind of strategy, and whether or not a reason is good or bad depends largely on the kind of research problem that the archaeologist is trying to address. Thus, if the archaeologist is trying to characterize the settlement pattern of an entire region, but only looks in locations where he or she knows there are probably sites, ignoring other areas, then his or her characterization will probably not be very accurate.

Systematic Sampling

Systematic sampling relies on imposing a regular system of collection units on the region being studied. Thus something as simple as superimposing a grid on the region and then examining every 5th grid unit is an example of systematic sampling. The idea behind systematic sampling is that the entire area is covered in some systematic way in an effort to improve the representativeness of the sample as compared to the population. The problem with systematic sampling is that there is no good method for extending the results of the survey to those areas that were not sampled. The system in effect can potentially induce its own bias in the collection of data. On the one hand this is desirable, because it ensures that intuitively non-obvious locations are examined as well as obvious ones. The problem with interpretation is that there is no logical justification for why those units that were not surveyed should be excluded, when they had no chance of inclusion from the outset.

Simple Random Sampling

Simple random sampling relies on using tables of random numbers or computer operated random number generators to determine which members of a population will be included in a sample. A random sample simply means that every member of the population has an equal chance of being chosen for any given sample. It is the equality of probabilities of being included in a sample that makes the simple random sample and its cousins such powerful analytical tools.

There are two types of simple random samples, samples with replacement and samples without replacement. A sample with replacement simply means that each member of the population selected for the sample is returned to the pool of possible sample members after having been chosen. Thus in a random sample with replacement there is a chance that some members of the population might be selected more than once. In a random sample without replacement, after a member has been chosen for sampling, it is removed from consideration. Thus, in a random sample without replacement, no member of the population can be selected more than once. A random sample without replacement is the most common type of simple random sample, but is not a pure random sample in the theoretical sense.

Simple random sampling can be employed in a number of ways, depending on the unit of analysis. A common unit of analysis in field biology, botany, and geography is the point. Generally a point is a small area defined by an X and Y coordinate on a grid superimposed on the region being studied. Sample units are chosen by drawing a random number for the X coordinate and a random number for the Y coordinate. Point sampling is not generally used in archaeological survey, but is often used in collecting surface samples from sites. Regional archaeological analysis generally employs quadrats. Quadrats are square units that can be of any size from 0.5 m to 1.0 kin generally. A region will have a grid of quadrat units superimposed on it. Then a certain percentage of the total area will be selected as the target area to survey. Finally, units are assigned sequential numbers from 1 to n. A table of random numbers or a random number generator are then used to pick a sample of quadrats based on the quadrat numbers. Standard surveys vary depending on the size of the quadrats and the total size of the region of study. Standard sample sizes generally range from 5 to 20 percent of total surface area.

Stratified Random Sampling

There are times when it makes sense to break a region up into subregions for analysis. A common problem in many areas is that within the study region there may be dramatic topographic or vegetational differences that may have affected human occupation of the region. In those cases it makes sense to break the larger region into subregions on the basis of topography, vegetation zones, or rainfall. Breaking the region up into separate zones is called stratifying the sample. In a stratified random sample, a certain percentage of the surface area of each stratum is selected for analysis, and within each stratum the units selected for analysis are picked at random, Le each unit within each stratum has an equal chance of being selected for analysis. Thus in a mountainous area, for example, you may have a region of interest covering 100 km 2. You may have reason to believe that topography may have played an important role in determining human settlement patterns in the area prehistorically. Rather than doing a 10% simple random sample of the area, which might neglect some of the elevation zones, you choose to do a 10% stratified random sample based on elevation. This strategy will ensure that each topographic zone is equally represented in the final sample. You would then superimpose a grid over the area, lets say I km’ units, giving you 100 units total. Then you would divide the area into three zones of elevation (low, medium, and high). For this example let us say that your zones have 33 units in the low area, 34 units in the medium area and 33 units in the high area. You then need to select the units in each area that will be surveyed. If you want a 10% random sample, you would use a table of random numbers or a computer random number generator to pick 3 units from the low and high areas and 4 units from the medium area. This gives you a 10% random sample of each area and a 10% stratified random sample from the entire study area (3+3+4 = 10 = 10% of 100).

Sampling Units in Archaeology

Two types of sampling units were discussed above, points and quadrats. There are other types of sampling units that are employed in archaeology. As mentioned above, point sampling is often used in making surface collections from individual sites. In these cases points might be defined as a circle with a 1 meter radius about a specific point, or they might be defined as very small quadrats, e.g. 0.5 meters square. The second type of unit mentioned above was the quadrat or square sampling unit. Quadrats are often used for regional survey, and because archaeologists excavate square holes, they are generally used for sampling a site by excavation. A quadrat can be any size, but in general, for regional survey quadrats are usually not larger than 1 km 2, and may be as small as 0.25 km 2. For excavation samples quadrats are generally 1 m 2, but may be as small as 0.5 m 2 or as large as 5 m 2 depending on the size and type of site, and the research questions being asked. A third common type of sampling unit is the transect. A transect is a linear sampling unit of a specific length and width. Thus, transects used for surface collecting individual sites could be 100 m long and 2 m wide. The person doing the survey would walk a straight line along a predefined path and collect or note all artifacts spotted within 1 meter either side of the center line of the transect. The same principal applies to transects; used for regional survey. In the case of regional survey transects the lengths of the transect are often measured in kilometers, and the width measured in tens of meters. The survey path would be walked by a team of people equally spaced to visually observe all surface features in front of and between team members. The sampling strategies discussed above can be applied equally to point, quadrat or transect sampling units. In the case of transect units, the transects: may be judgmentally located so as to intersect the maximum number of vegetation zones that the archaeologist knows will yield sites. The transects could also be spaced uniformly over a region in a systematic survey. Transects can also be used in simple or stratified random sampling strategies. In the case of simple random sampling, the transects could either be chosen as random latitudes or longitudes crossing the region of interest, or a random starting and ending point might be chosen, and then the surveyors have to walk between the two points—regardless of what's in the way.

Summary

The purpose of sampling design is to try to control against sample bias in order to ensure that the data you collect will help you answer the research problem you are posing, and to develop a plan that fits within your financial and time constraints while still producing a use ful body of data. This simple statement, paraphrased froma landmark paper by Lewis Binford in American Antiquity (1964), revolutionized American archaeology, although slowly. One of the reasons for the relatively slow adoption of explicit research designs and the use of probabalistic sampling strategies, is that they seemed to run counter to the intuitive techniques employed in archaeology since its beginnings. One constantly heard argument from the early history of probabalistic sampling in archaeology was that random sampling techniques could, theoretically, miss sites as big as Teotihuacan in the Basin of Mexico, or sites whose locations could accurately be predicted on the basis of years of experience in a particular area. The argument is absolutely correct. Why then spend the time on fancy variations on probabalistic sampling? The answer is three fold. First, if the goal of research is to cost effectively collect a truly representative sample of sites in a region, or areas of a site, etc. while controlling for possible sampling bias, then only probabalistic sampling can fill this bill. Second, sites or features that are unusually large, unique, or predictable probably would be missed by the people on the ground actually doing the survey, regardless what the sampling strategy is. Archaeologists in the field are constantly bombarded with new and changing information about their study area, from local landowners, casual observations by crew members, etc. Large, unique, or important sites will not go unnoticed if archaeologists in the field have their wits about them! The advantage to probabalistic sampling is that small, unpredictable sites or features will also be found if they exist. Finally, there is no proscription against using any combination of sampling techniques in any given study or study area. In this regard, common sense and good scientific judgement should rule over pure technique or traditionalistic sentiment.

Notes: Two excellent articles to read for more information:

• Binford, Lewis R. 1964. "A consideration of archaeological research design", American Antiquity 29 (4): 42 5–44 1.

• Flannery, Kent V. 1975. "Sampling Methods." In The Early Mesoamerican Village, edited by K V. Flannery, Academic Press, New York.

• Redman, Charles L. 1987. Surface Collection, Sampling, and Research Design: A Retrospective", American Antiquity, Vol. 52 (2): 249-265.