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Basic concepts

It is now time to meet the archaeology. Exposure to the data is the most important aspect of doing archaeology. However, I resisted opening this book with an account of how we go about finding things and, once found, how we organise them for a good reason. Until I had given you a taste of the varieties of archaeology, which includes both themes (Box 4) and theories (Figure 2.1) there was no point in discussing how we handle data. There is nothing more silent than a piece of archaeological evidence. Pots, stones, bronzes and bones do not speak to us. They make no sense by themselves. They only acquire significance when interpreted. To interpret the themes and theories, questions and problems are necessary before any sensible answers will be forthcoming.

We now have some of that basic framework. What I have shown is that there are many ideas about the past, usually several interpretations of the same data (see the changing views of Sutton Hoo in Chapter 1) and definitely more than one answer to the same question. What all this is telling us is that archaeologists



can disagree because they have developed ways of gathering and organising data that allow them to differ. Fieldwork and analysis run to a set of conventions. To participate in the excitement of archaeology requires a knowledge of the concepts that underpin those conventions. In this chapter I will look at those that deal with data gathering and analysis. Later chapters will expand on other themes. In the present chapter I will concentrate on a framework for practical archaeology which will lead us into a consideration of the nature of the archaeological record.

Starting out with a research design

Doing archaeology starts with questions. As we saw in Chapter 1, with the latest campaign at Sutton Hoo, these are now formalised into a research design that sets out what we want to know, the methods we plan to use and the contribution the answer is expected to make. This is all part of being explicit about the business of archaeology, stripping away, if you like, some of the mystery that surrounds the process and that often amazes visitors to excavations who ask 'How did you know to dig here?'.

Explication – setting out what we plan to do, why we want to do it, how we will do it and what we expect to achieve – lies at the heart of a research design. Put like that some research designs sound very obvious. Too obvious for many, which is why few were written down before the appearance of processual archaeology in the 1960s. Of course, prior to this, the culture history approach had research designs, but they were rarely very elaborate. Usually they involved selecting a region or site for survey, excavation and recovering data. This recovery usually was, and in many cases still is, to sort out issues of dating, sequence and the relationship between archaeological cultures.

For example, questions at a regional scale might ask what relative impact did each of the contemporary cultures Hohokam, Patayan, Anasazi and Mogollon have on each other during almost 9000 years in the Southwestern United States (Willey 1966: figures 4.1 and 4.6). Regional survey and excavation would then be employed to get the answers. At a site scale the question might be about the constructional history of York Minster in England. Did the layout of the cathedral

follow the earlier town plan for the city as established by the Romans and the Vikings?

Answering these questions, which are posed at very different spatial scales, undoubtedly adds to archaeological knowledge. A lot of very good archaeology and many excellent syntheses have resulted from answering similar questions that deal with local and regional culture history.

However, the criticism mounted by processual archaeology was that in many cases such approaches were often unsystematic. While data were recovered, the question was how *representative* of past activities were they? This is what was meant by the new archaeology's call for explication in the 1960s. Research designs had to be stated, goals set, procedures outlined, methods detailed, and then samples could be recovered.

There was a lot of fuss when this strategy was first proposed (Binford 1964). Comments such as 'we don't know what we will find until we start digging' were matched by a reluctance to set down all those ingrained, internal procedures, the experience and knowledge of being an archaeologist. Some of them just seemed too obvious to commit to paper. It was tantamount to revealing hard-won trade secrets. It has also become apparent since, that writing down a research design does not necessarily make for good archaeology. Research designs do, however, expose poor questions and ill-conceived methods very quickly.

Research designs are now standard. In fact you will not get funding without one. The scientific model that Binford and others were following now dominates to the extent that it is a professional fact of life. As a result we do have a much better idea of what we are doing and why. The rise of contract- and developer-funded archaeology has also made explicit research designs essential. Business as well as government wants to know what it is paying for, and why. Accountability has led to the formal management of archaeological projects (Andrews and Thomas 1995; Cooper *et al.* 1995), which seems a far cry from earlier approaches (Wheeler 1954). But archaeology then was still predominantly a pastime rather than the international profession it is today. The jargon of performance indicators, project milestones, value for money, assessment and evaluation are a very

necessary part of securing funding at a scale that 50 years ago would have seemed inconceivable.

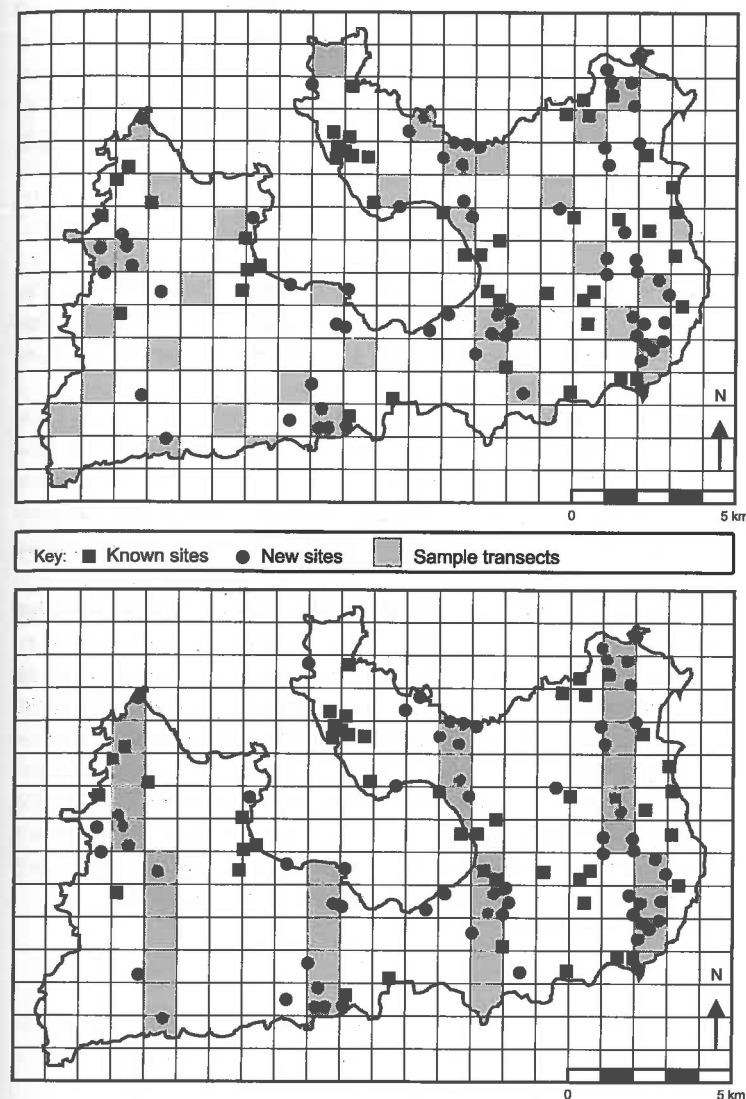
The representative sample

The shift that research designs typified was to dig in order to answer questions rather than to dig for things. The objective was the recovery of a representative sample of material so that the questions about site function and organisation and any changes they underwent could be reasonably answered. Sampling theory was needed. This was not just because archaeologists lacked the time and money to dig and analyse every site or to survey and record every valley. It was needed to meet the criteria of the representative sample.

The culture historians' complaint about research designs included a good point. We do not know exactly what we are going to find. This is clearly a problem for systematic sampling, where a representative sample usually depends on knowledge of the population being sampled. This is why opinion polls and market surveys have an acceptable degree of accuracy. The number of voters is known. Moreover, the larger the population and the greater our knowledge of its size and structure, the smaller the samples can be to get at that representative result. Pollsters do not have to ask every voter about their intentions. They sample.

Archaeologists do not know before they start how many sites they will find in a valley survey. Neither do they know how many potsherds, and what frequency of types, will come from an excavation. If we cannot specify our populations beforehand, how can we recover anything but a grab or haphazard sample?

FIGURE 3.1 A sampling strategy. The Cycladic island of Melos was systematically surveyed using fieldwalking transects. A 20 per cent sample of its surface was covered (lower). The choice of sampling design took into account topography and vegetation. The new sites that were found are shown. For comparison, an alternative strategy using a random set of quadrants is also shown (upper). In both cases the sampling strategy can be extrapolated to the areas not surveyed and a representative island-wide picture of prehistoric settlement built up (after Cherry in Renfrew and Wagstaff 1982)



Space is the answer. Binford (1964) broke the problem down into four populations that need sampling:

- cultural items (artefacts);
- cultural features (buildings, pits, temples within sites, etc.);
- ecofacts (in his terms culturally relevant non-artefactual data, e.g. animal bones, sediments, carbonised seeds);
- sites (as activity foci containing the three populations listed above).

Beyond these lay the region that contains populations of sites. The region, as will be discussed in Chapter 6, also has to be larger than the past activities being studied if a representative sample of those activities is going to be recovered.

So space is the solution to the catch-22 of only finding out about what we want to sample by sampling it. Before we walk that first field transect, lift the turf or make the first dive on a wreck site we can establish our spatial units and sample them as something we do know about (Figure 3.1). This can be applied to most archaeological materials and landscapes.

The units can be arbitrary: a 50 metre square, or a 20 kilometre square grid subdivided into transacts for the surface survey. Alternatively a *stratified* sample can be drawn up to take into account base map soils and the geology of the region or prior knowledge of the site from geophysical prospection or aerial photographs. But the point is that the spatial grid is determined by the kinds of questions being asked. Within it the material, those four populations listed above, is being *cluster* sampled. Therefore space rather than the objects it contains is being sampled. It is on that basis that we systematically recover representative samples which can then be quantified.

Survey and excavation

The past 30 years have seen a move away from excavation as the archaeologist's main method for finding out about the past. Non-destructive survey, principally aerial photography, has been a powerful tool for over 80 years and is now backed by satellite remote sensing. Indeed, with the pace of urban expansion, the dewatering of wetland

areas and, most importantly, changes in forestry and farming practices, such as widespread deep ploughing, the aerial record is now an immense archive of what has been lost in the second half of the twentieth century. Landscapes from all periods, with their settlements, fields and cemeteries, have been obliterated and continue to be under threat. Non-destructive techniques, particularly geophysical survey and other methods such as ground penetrating radar and the controlled use of metal detectors, now allow the rapid (by the standards of excavation) plotting of buried features. Computer enhancement of the results can produce plans of buried cities and landscapes that are very accurate. These serve as a basis not only for finding out about what's there, and analysing it, but also for deciding on a strategy for excavation designed to answer questions about the date, relationships and sequence. Systematic field-survey, where transects are selected according to a sampling design and then walked to recover artefacts from the ploughed soil, has also been instrumental in building up a wider picture of settlement and its changes through time. In many cases material discovered on these surveys is no longer brought back to the lab but recorded on computer in the field and left where it was found. The geographical information systems (GIS) revolution provides a framework for integrating both on-site and off-site data. It grants rapid access to computer-recorded data and allows archaeologists to change their field and excavation strategies, ideally on a daily basis.

Excavation is costly and is increasingly seen as a last resort, particularly in the contract- and developer-funded arena. Often mitigation will change the plans for the road or building so as to preserve the archaeology in situ, as in the case of the Rose theatre (Chapter 1). Preservation by record, which is what excavation boils down to, has to be a well-argued case.

Recovery

Total excavation is nowadays rarely either an option or desirable, and for a very good reason: the archaeological record is highly repetitive. There is a great deal of redundancy in terms of aspects such as what was made, how people used their landscape and where they buried their dead. Such repetition makes sampling for the representative possible.

Sampling will not guarantee the recovery of either the rare or the unique. Some wonderful find may well be in an undug pit that was set aside when a 10 per cent sampling scheme was applied to a site. This reflects contemporary archaeology's interest in the general rather than the unique. Of course we all like to find gold torcs or the oldest bone of a mink. In the early days of the subject when that was all archaeological diggers were after what suffered were the ordinary pots, bones and stones, which were simply thrown away. Rare finds grab the headlines and they do no harm. But archaeologists need to concentrate their marketing skills on generating excitement in the less-newsworthy small Roman villa, medieval farmstead and prehistoric stone quarry.

Recovery is something that we can control (Figure 3.2) or at least be systematic about. In the quest for the representative sample the use of sieving and the broader consideration of preservation has received much attention. The recovery of small elements such as the foot bones of sheep or fish remains is something that can be addressed, so that their absence can be attributed to excavation procedures, inimical soil conditions or past human activity.

Archaeological entities

What we discover and recover from our spatial grids still needs to be organised. These are the entities that we spend a great deal of time analysing, reassessing and shifting around the museum, work-room and laboratory. There are three basic entities that allow us to examine a key archaeological question of why cultures vary in time and space. In ascending order they are: attribute, artefact and assemblage.

Artefact types are classified by the attributes they possess: shape, colour, material, decoration, etc. Assemblages are defined by the frequency of artefact types, itself an attribute of that entity, and cross-checked through stratigraphic context and dating. At a higher level of classification we will encounter archaeological cultures, culture groups and technocomplexes (see Chapter 6).

Attribute, artefact and assemblage have of course been around since the start of systematic archaeology with Thomsen and Montelius

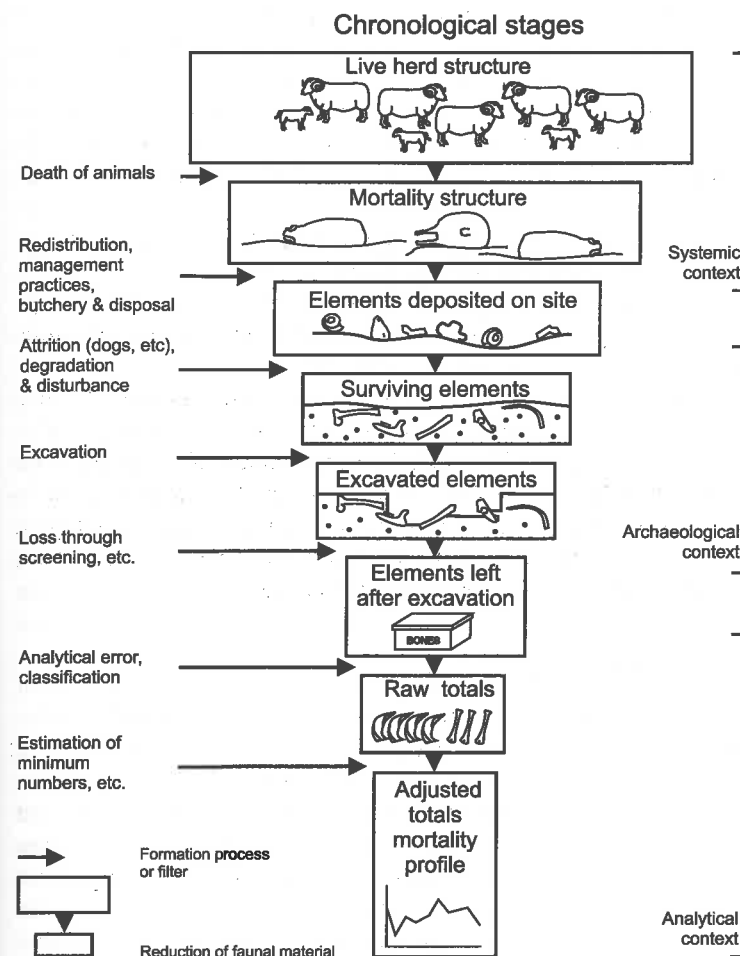


FIGURE 3.2 Recovering samples. This diagram shows what happens to animal bones at each stage in the archaeological process. Similar diagrams have been produced for other materials. The point of this visual jargon is to remind us that what we do, as much as what happens in the ground, affects how representative our samples will be

Monothetic Group						Polythetic Group					
Artefacts						Artefacts					
											
A	✓	✓	✓	✓	✓	A	✓		✓		✓
B	✓	✓	✓	✓	✓	B		✓		✓	✓
C	✓	✓	✓	✓	✓	C	✓	✓	✓		
D	✓	✓	✓	✓	✓	D	✓			✓	
E	✓	✓	✓	✓	✓	E		✓	✓		✓
Attributes						Attributes					

FIGURE 3.3 Polythetic and monothetic systems of classification. The top row of pots are respectively always or partially present as attributes in the culture, or assemblage, A–E (after Clarke 1968: figure 3)

(Chapter 1). They were the building blocks for relative chronologies and the success of culture history. The subject has been structured by them ever since.

They were comprehensively defined for an anthropological archaeology by David Clarke (1968: 37), who also formalised a fundamental observation for archaeological classification (Figure 3.3).

When it comes to using such entities in archaeology it is rare to find that they are *monothetic*, where all the expected attributes and artefacts are always present like students at a nine o'clock lecture. Rather, as the class register reveals, it is the case that attendance is variable as in the *polythetic* group. This is important because we must expect fuzzy rather than clear-cut boundaries to our classifications. Archaeologists spend much of their time deciding how many aspects determine membership of such a group, and in what frequency, as though this was our major problem. This is an aspect of the principle of popularity (see Box 2 and below). Usually the preservation and haphazard recovery of the data are blamed as the usual suspects. However, the data are the data and like children should not be blamed for being difficult. Neither should we get too hung up searching for

ultimate classificatory units as a monothetic approach requires. They will remain elusive. Classification only exists to help answer questions and is not an end in itself, although to read much archaeology you would have to conclude otherwise.

Attributes

Artefacts are examined through their attributes. These can be observations on composition, raw materials, form and decoration as well as the techniques of manufacture and the contexts in which the artefacts were found – a pit, a house or a burial, for example – and what they were found with – bodies, animals, other similar or dissimilar artefacts. Quantity is also an important attribute as is independent dating evidence.

Attribute analysis is also applied to higher-order classifications such as Childe's urban revolution or the neo-evolutionary stages of chiefdoms and state (Chapter 7) proposed by Ellman Service (1962). Here a checklist is drawn up and the attributes of the archaeology of Minoan Crete or Mississippi Moundville compared to it (Box 18). The purpose of investigating such archaeological correlates is purely descriptive and classificatory.

Artefacts

Artefacts can range in size from a glass bead to the continent it was exchanged for. They range in number from the isolated potsherd to the contents of the city of Teotihuacan or the Roman Empire. The term 'artefact' embraces a wide range of objects, many of which are not traditionally thought of as artefacts. The familiar would include hand-held and human-scale objects, for example knives, beds and houses. This also extends to the built environment of towns and cities, with monumental architecture, sculpture, bridges and factories. The less-familiar usage of artefact includes landscapes and worlds used and lived in by people. Many wild areas much loved for their natural beauty turn out to be human artefacts. In southwest England, Dartmoor, a National Park, is seen by many as wild, untamed moorland, in contrast to the farmlands that fringe it. However, the Dartmoor we experience today was created in the Bronze Age when

an elaborate system of boundary banks was laid out and the forest cut down. Subsequent exploitation for sheep, tin, granite, tourism and as a military training area have added to, and preserved a prehistoric artefact.

Dartmoor is therefore a large piece of material culture. But the artefact scale can get still bigger. Consider Australia, the continent of hunters and gatherers. Erroneously, such lifestyles are thought to be shaped by nature rather than to affect it (Chapter 8), a view that owes everything to the evolutionism of the eighteenth and nineteenth centuries when Australian Aborigines were thought by some not even to possess society.

Fifty years of archaeological research has totally reversed that passive view. Long before Captain Cook the continent was a cultural landscape. Stone artefacts, the oldest of which date back some 60,000 years, are found everywhere, even in southwestern Tasmania where nobody lives today. The widespread practice of burning the country, traced archaeologically through charcoal deposits, transformed the vegetation in favour of the fire-resistant eucalypts. Many animals, especially the megafauna marsupials became extinct either through habitat change or human predation. Finally, Australia is one giant canvass of rocks which have been painted, engraved and pecked with signs and representations of animals and humans – artefacts which depict artefacts which contain artefacts.

Assemblage

The third level in the basic classification of archaeological entities is the assemblage. This was defined by David Clarke as an associated set of contemporary artefact types (1968: 188). It is also a small step from there to a type list that defines an assemblage excavated from a stratigraphic level or chronological unit.

The most celebrated debate concerning the interpretation of archaeological assemblages has used Palaeolithic data. It involved, among others, François Bordes and Lewis Binford. It was based on the interpretation of stone-tool assemblages excavated from stratigraphic layers in the many caves and rock shelters used by Neanderthal people 100,000 to 40,000 years ago in southwest France. One of the

most famous is the rock shelter at Le Moustier, after which the widespread Mousterian culture, based on distinctive tools and techniques, is named. The assemblages were studied by François Bordes, who devised a type list with 63 elements such as stone scrapers, points and borers and a series of technical indexes that described the method by which the tools had been knapped (Bordes 1972). Each assemblage contained different proportions of types and variable application of different flint-knapping techniques. What he discovered surprised him. Bordes wrote later that he had expected a spectrum of variation. What he found from his analysis were only five assemblages, or variants, of the Mousterian.

The Mousterian debate, as it is known, revolved around explaining that clustering. Were these assemblages the ethnic markers of five different Neanderthal tribes, as Bordes claimed, or functional toolkits as Binford proposed (Binford and Binford 1969)? Or instead, as others argued (Mellars 1970), stages in a chronological development? Similar assemblage studies based on type list and type frequency abound in studies of archaeological ceramics and metalwork.

Archaeological cultures

Cultures, like the Mousterian, are the next brick in the wall of entities. They are traditionally, and for the foreseeable future, the archaeologist's basic building block. They form both the thing to classify and the thing to explain. Two classic definitions emerged from very different philosophical and political backgrounds. The earlier comes from the ultra-nationalist, and racist, Gustav Kossina, whose settlement archaeology was enthusiastically applied after his death in 1931 by supporters of the Third Reich:

Clearly defined, sharply distinctive, bounded archaeological provinces correspond unquestioningly to the territories of particular peoples and tribes.

Kossina (1926, in Veit 1989: 39)

The second, and better known, was penned by Gordon Childe, an Australian who spent most of his career in Edinburgh and London.

Childe wrote about the past with a Marxist perspective. He defined the archaeological culture concept in the following classic manner:

We find certain types of remains – pots, implements, ornaments, burial rites and house forms – constantly recurring together. Such a complex of associated traits we shall term a ‘cultural group’ or just a ‘culture’. We assume that such a complex is the material expression of what today would be called a ‘people’.

Childe (1929: v–vi)

Childe’s innovation was to pave the way for a social account of the past. His ‘culture = peoples’ hypothesis took into account the mosaic-like character of the archaeology of Europe. He disagreed with Kossina, who put everything good and innovative down to his own ancestors, the northern Aryans, but agreed with the Swedish typologist Oscar Montelius in his acceptance of diffusion from the Near East. The *ex oriente lux* (‘from the light of the east’) direction also provided Childe in his early work with an explanation of change within Europe.

Anthropological culture

The definition that Childe gave us describes the archaeological reality of pots, stones and house types. But culture has a much broader meaning than this within anthropology. E. B. Tylor mapped out the field in the nineteenth century:

Culture, or civilisation . . . is that complex whole which includes knowledge, belief, art, law, morals, custom and any other capabilities and habits acquired by man as a member of society.

Tylor (1871: 1)

It is acquired and transmitted:

Culture . . . refers . . . to learned, accumulated experience. A culture . . . refers to those socially transmitted patterns for behaviour characteristic of a particular social group.

Kessing (1981: 68)

It can be viewed in very adaptive, functional, terms:

By culture we mean an extrasomatic, temporal continuum of things and events dependent upon symboling. . . . A mechanism whose function is to make life secure and continuous for groups and individuals of the human species.

White (1959: 3, 78)

For Leslie White culture was our extrasomatic (literally outside the body) means of adaptation. Although he referred to symbols he did not mean, as Clifford Geertz later proposed, that culture was a network of interpretations:

Believing that . . . man is an animal suspended in webs of significance he himself has spun, I take culture to be those webs, and the analysis of it to be therefore not an experimental science in search of law but an interpretive one in search of meaning.

Geertz (1975: 5)

These poles-apart positions are one of the reasons that the concept of culture is regarded as highly problematic by many anthropologists, even though it is historically their core concept. Recent discussions are provided by Michael Carrithers (1990), Tim Ingold (1994), Christoph Brumann (1999) and Adam Kuper (1999).

Two principles

The entities attribute, artefact, assemblage and culture are the basic bricks in the archaeological wall. They are used to build classifications and to present interpretations. As we saw in the Mousterian debate, these interpretations might differ. But even here the major protagonists agreed that assemblages exist. They only disagreed over what they signify. Two principles help us to understand why such different archaeologists are agreed on the bricks in their wall. These are:

- popularity, and
- stratigraphy.

The principle of popularity

Much of what I have so far described in this chapter depends on the principle of popularity. This has been applied to items as well as types and to styles or traits of manufacture, decoration and use. Fluctuating popularity both identifies a change in the archaeological record and explains it by invoking either the diffusion of peoples or the spread of ideas. Popularity changes with time and across space. The principle of popularity also supposes that things are similar because people share the same ideas and cultural premises. This sharing is presented as a basic aspect of all humans. It started in the Palaeolithic and continues today. For culture historians like François Bordes a stone-tool type is therefore as understandable as a Frenchman's beret or an Englishman's bowler hat. They are all expressing the same cultural imperative whereby sharing norms of behaviour establishes group identity. But this imperative is never analysed, rather it is assumed as the basis for understanding why archaeological units vary and why they changed? It was this lack of clarity that led some, such as Binford, to a serious rethink about what popularity was measuring.

The principle of stratigraphy

Popularity and stratigraphy are two principles that go hand in hand. Stratigraphy turns 'walls of mud' into a record of time and past activity. Most importantly, thinking stratigraphically makes you *look* at time vertically, stacked-up like so many different-coloured bricks and laid down like sediments in a lake. You need to add that *vertical* dimension to your everyday experience of time as *linear*, minutes turn into hours into days, and as *cyclical*, when your birthday comes round once a year (Chapter 6).

The essence of stratigraphic analysis is determining discrete, superimposed layers or features and then examining their contents. A very systematic and thorough analysis is provided by Edward Harris (1989). His logical matrix analysis (Figure 3.4) is a widespread convention in field archaeology. It is an example of visual jargon.

Stratigraphic differences may be geological – variation in soils and sediments that appear as textural or colour changes – or they may

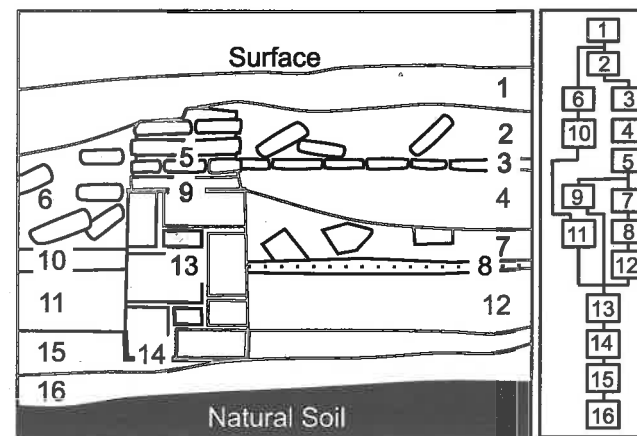


FIGURE 3.4 A Harris matrix for a section in an excavation. This would be combined with all the other sections in the trench as well as with the plans as the excavation proceeded

be features of human activity – the digging of pits and ditches, building of walls and dumping of waste material. Stratigraphy is therefore about the building up of layers and features, as well as their cutting away and reworking as a result of human occupation. A stratigraphic analysis unravels the sequence of that creative process of living in the landscape over periods of time.

Stratigraphic excavations began in the middle of the nineteenth century and some of the best exponents were J. J. A. Worsaae, who excavated prehistoric sites in Denmark, and Giuseppe Fiorelli, who applied a stratigraphic approach to Pompeii in 1860. Not everyone followed suit and not all stratigraphic excavations were well recorded. Moreover, the breadth of interests that Worsaae pursued in his excavations, including the recovery and analysis of organic evidence to reconstruct the environment and subsistence economy, was often lacking. Most digs were just that – digs – with the sole aim of recovering pots, metal, art and burials. The exceptions stand out, such as Ferdinand Keller's pioneering work in the well preserved Neolithic Swiss lake villages which he started excavating in 1854. In England

the military training of General Pitt-Rivers and his unshakeable belief in evolutionary science led to a model of good practice (Bowden 1991). He both excavated sites and published the results from his Dorset estate (1887). In 1882 he became the first Inspector of Ancient Monuments for the country after Parliament passed legislation protecting some important sites.

Sound stratigraphic observation provided archaeologists with a means of comparing their results and building their relative chronologies. Exactly when each regional tradition went through its stratigraphic revolution differs around the world. In North America it took place later than Europe and centred on work in the pueblos of the southwestern United States between 1915 and 1927.

Seriation dating

Combine popularity and stratigraphy and you arrive at seriation (Chapter 1), a standard archaeological procedure that sorts series of attributes and artefacts and then interprets them. One of the best examples of seriation comes from the southwestern United States.

The main question that faced archaeologists investigating the prehistory of this region, with its monuments such as Pueblo Bonito in Chaco Canyon, New Mexico, concerned relative dating. The answer as developed by the anthropologist A. R. Kroeber in a ground-breaking paper in 1916 provided a chronology using frequency seriations of pottery. He made the distinction that variation in the proportion of types could be due *either* to time *or* to geography. Remember, this was a sequence not a scale and no seriation can indicate how long any phase lasted. That would come first from dendrochronology (tree-ring dating) in the southwestern United States and universally through radiocarbon dating after 1945 (see below). The underlying principle in seriation is that change is analytically visible through the shifting popularity, or frequencies, of artefact, usually pottery, types (Figure 3.5).

Kroeber was not alone in developing such techniques but appears to have made the breakthrough independently (Lyman, O'Brien, and Dunnell 1997: 55). Nels Nelson, Clark Wissler and Leslie Spier also produced seriation chronologies for the American

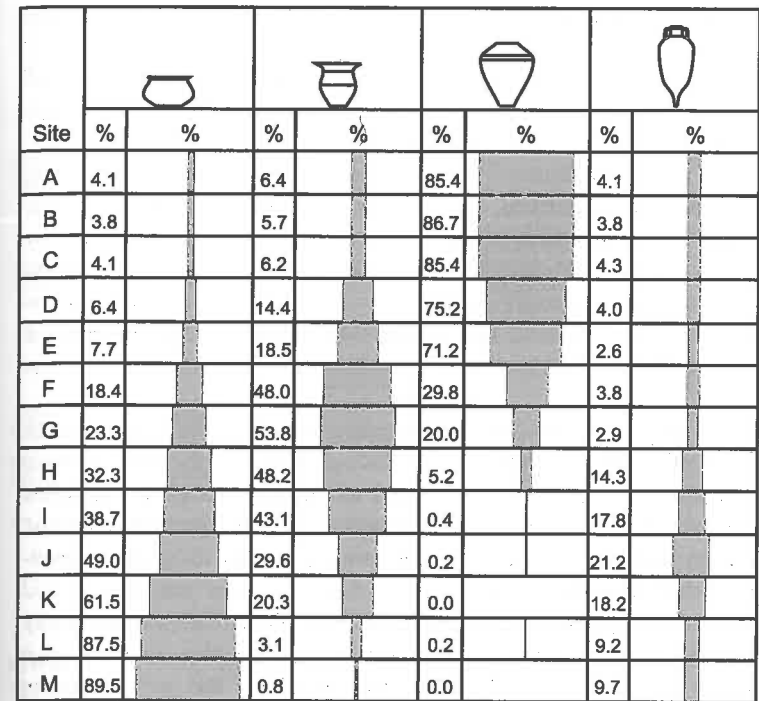


FIGURE 3.5 Battleship curves. This seriation reflects changing popularity among the four pots over time. Each row adds up to 100 per cent

Southwest. The excavations in the Pecos pueblo by Alfred Kidder during the 1920s, using natural rather than arbitrary stratigraphic units, confirmed that these shifts in the frequency of pottery types were indeed chronological. The battleship curves which present a seriation analysis are another piece of visual archaeological jargon.

Absolute dating

Stratigraphy provides a sequence; B came after A but before C. Popularity, when used in a seriation elaborated the process of culture

change. You could now ask 'Who came from where?', based on the popularity of types. However, what archaeologists, and especially prehistoric archaeologists, wanted was a way of measuring time not through changes in relative frequency but in terms of absolute years. How long did those battleship curves last?

The absolute measure of time beyond written records and king lists was first achieved by counting annual lake varves and tree rings. Such continuous records are extremely valuable. They provide very accurate dating but of course depend upon either the preservation of suitable materials, such as wood, or the deposition of artefacts in lake muds. What was needed was a technique that could date items that were found on most archaeological sites – charcoal, bone and shell.

The major breakthrough came after 1945 with the development of isotope-decay methods. Radiocarbon was the first, soon to be followed by a number of related techniques which used different isotopes associated with the elements uranium, potassium, argon and thorium. Now there are also dating methods using geomagnetism, thermoluminescence, electron spin resonance and amino acid epimerisation. Different techniques have different time spans and apply to a range of materials (Figure 3.6). Box 11 lists the materials upon which each technique is based. A full account of this very important but highly technical branch of archaeology can be found in Aitken (1990).

The absolute measurement of time by scientific methods is undoubtedly one of the great achievements of interdisciplinary research. It was primarily a combination of physics, chemistry and archaeology. Willard Libby working in Chicago pioneered the radiocarbon technique in the immediate post-war period. His breakthrough was recognised by a Nobel Prize in 1960. Older techniques such as tree-ring dating and varve counting were later used to refine and calibrate the results when it was realised that some of Libby's original assumptions about the stability of carbon in the atmosphere did not adequately allow for variation over time. A review of the power of dendrochronology and its importance in calibrating radiocarbon is provided by Michael Baillie (1995).

Radiocarbon (C^{14}) dating is very useful for archaeologists

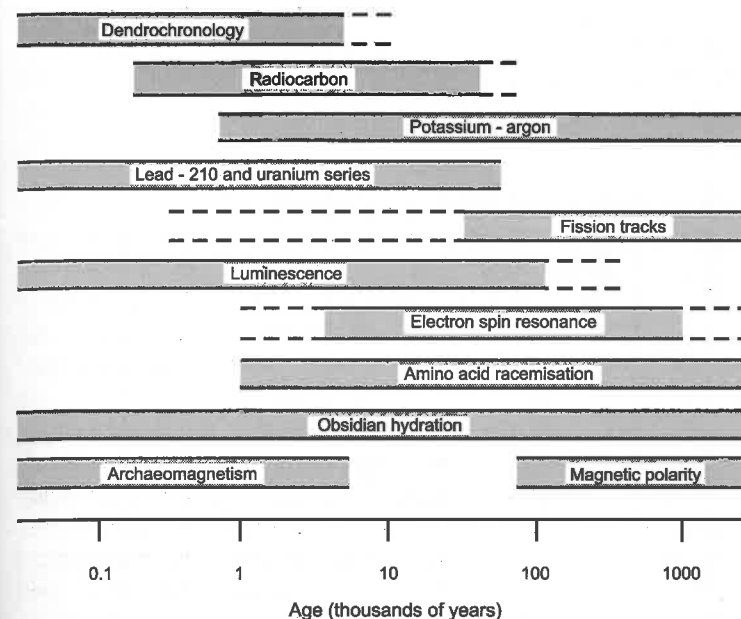


FIGURE 3.6 The age ranges of dating techniques (after Aitken 1990: figure 1.1)

because carbon is so widespread. Charcoal, wood, bone, fibre, shell and seeds can all be dated, though the chemical pretreatment of samples varies and different laboratories prefer different materials. The applicability of this technique worldwide allowed archaeologists to compare global cultures and processes. Archaeological findings were incorporated into global history and the scene was set for a generalising, comparative approach. Science-based dating such as radiocarbon dating was part of the quantitative revolution in archaeology after 1950. It is quite possible that without it the anthropological archaeology of the 1960s (Chapter 2) would have been delayed. I believe it would still have happened but probably not quite in its original form as a hard-nosed, scientific and processual investigation of the past.

Box 11: Some of the most important science-based dating techniques, the materials they date and the ages they cover

Dating technique	Materials	Upper limit (years)	Lower limit (years)
Potassium/argon (K/Ar)	Volcanic rocks	30,000	All of human evolution i.e. 5 million
Thermoluminescence (TL)	Burnt flint, ceramics Unburnt sediments	Present 5,000–10,000	100,000–500,000 50,000
Electron spin resonance (ESR)	Tooth enamel	Present	> 1 million
Uranium series	Stalactite, stalagmite	5000	350,000
Radiocarbon (C^{14}) using accelerator mass spectrometry (AMS)	Bone, charcoal, shell, fibre	Present	50,000, possibly 70,000 in the future
Radiocarbon (C^{14}) conventional methods	Bone, charcoal, shell, fibre	Present	40,000

The archaeological record

I have now described some of our basic units. I have also shown how archaeologists used the principles of popularity and stratigraphy to order their materials, prior to absolute dating, into sequences. The study of change is then possible.

However, the absolute measurement of time did not make the archaeologist's job of interpretation any easier. Instead it contributed to a major debate starting 30 years ago, concerning the composition and nature of the archaeological record: 'What exactly is it, how was it formed and how should it be investigated?'

After 1969 Binford, as he recalled later (1983), became disillusioned with his new archaeology. He was concerned that all that had happened was that archaeology had become a more statistical, and increasingly computer-literate, culture history. Archaeology might have been recast as an anthropological inquiry with a concern for real-life processes, but this still left a yawning chasm that needed a bridge of inference to span it. Quite simply, how could you go from the static facts that could be dug up to the dynamic but invisible behaviour that produced them? The new archaeology, for all its insistence on testing hypotheses, the deductive method, and collecting samples in a more rigorous manner to enable such testing to occur, had difficulty with this crucial methodological point. It had to be addressed if a scientific approach was to succeed. But how?

Middle range theory

Binford's answer was to set out principles that could act as a bridge between the statics of the archaeological record (those bones and pots) and the dynamics of past human behaviour (the now invisible actions that produced and organised them into spatial and temporal patterns). He called this a *middle-range theory* (Box 6). In practice it was based on experiment and on the observation of people and animals doing things in the modern world, which would allow us to learn about how patterns are created.

Binford undertook his own studies among the Nunamiut hunters of Alaska and the Alyawara people of central Australia (Binford 1983).

Box 12: What is taphonomy?

Closely related to both middle-range theory and site formation processes is the field of taphonomy, literally the laws of burial (*taphos* = burial; *nomos* = law). It is the study of a subset of the archaeological record which deals with organic remains (Lyman 1994: 1). Taphonomy has therefore been particularly important in studies of animal bone assemblages, crop residues and other environmental evidence such as geoarchaeology in sorting out the varied agents and processes, natural and cultural, that have contributed to and shaped archaeological samples.

Box 13: Doing middle-range theory

- Understand the dynamics of behaviour by undertaking a detailed ethnoarchaeological study of a modern hunting society to learn about the decisions they face and how the archaeology they create is organised in time and space ([1978], Binford 1978a,b, 1980).
- Hone the skill of recognising relevant patterns in the data. Build a middle-range theory to form the bridge between data and the behaviour, now invisible, that produced it (Binford 1983).
- Compare human hunters with carnivores. Examine how carnivores regularly feed on a carcass and carry food back to their dens. Since the behaviour of wolves and hyenas has remained the same, while humans evolved new adaptations during the Palaeolithic, they provide a yardstick for measuring those changes (Binford 1981a).

He also studied carnivore feeding and denning behaviour in Africa and North America to try to understand how they use and pattern bones (see Box 12). Similar taphonomic studies became common.

In all of this Binford's aim was to determine the range of potentially relevant causal processes for his chosen area, the study of prehistoric hunter gatherers. His strategy was threefold (Box 13).

Not everyone followed Binford's strategy because not everyone was interested in hunters and gatherers. What use were hyenas and modern hunters to the study of sedentary farming societies? Ethnoarchaeological studies have certainly been carried out among agricultural, horticultural and urban communities. But these have started from rather different premises. Modern material culture such as the Tucson garbage project (Skibo, Walker and Nielsen 1995) and Hodder's Baringo work in East Africa (Hodder 1982) are just two well-

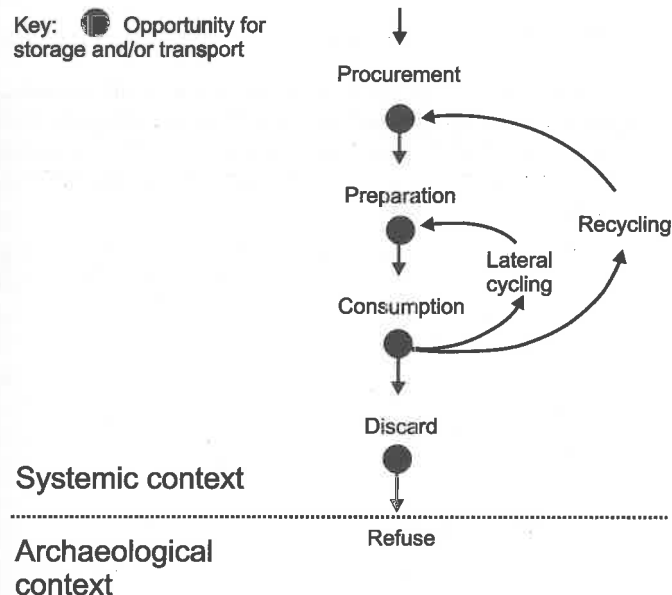


FIGURE 3.7 Making archaeology. The formation of the archaeological record with the passage of materials from a systemic into an archaeological context (after Schiffer 1976)

known examples that raise challenging alternatives to how we think culture works in time and space and how such patterning reveals people consuming and interacting through the medium of material culture.

Site formation

Michael Schiffer, once a Binford student, developed an approach that privileged the study of human behaviour – especially making, using and discarding artefacts. Schiffer (1976) was interested in making explicit the multiple role of laws in archaeological research. For Schiffer it was not middle-range theory as much as the study of how the archaeological record was formed. These formation processes were of two types; natural and cultural. ‘N’ and ‘C’ transforms affected objects and their associations in predictable ways as they moved from the past, systemic context into the present archaeological context, where they became refuse (Figure 3.7).

Box 14: The four strategies of behavioural archaeology (Schiffer 1976)

Human behaviour Material culture

	Past	Present
Past	Archaeology and the study of <i>particular</i> past cultural systems, e.g. rise of palace societies in the Aegean Bronze Age	Ethnoarchaeological studies to inform <i>general</i> archaeological interpretation, e.g. hunter-gatherer settlement patterns
Present	Archaeology's contribution to understanding <i>general</i> aspects of contemporary as well as past behaviour, e.g. population pressure as a cause of cultural change	The study of <i>particular</i> industrial societies, e.g. the Tucson garbage project as an investigation of material consumption

If a difference exists between Binford's middle-range theory and Schiffer's formation processes it lies in the broader archaeological goals they are pursuing. For Schiffer and his colleagues 'the subject matter of archaeology is the relationships between human behaviour and material culture in all times and places' (Schiffer 1976: 4). They identify four strategies which nicely illustrate what they hope to achieve (Box 14).

The purpose of archaeology for Binford (1983), however, is to understand evolutionary transformations such as that from hunting to farming, the replacement of Neanderthals by modern humans and, most recently, asking under which conditions do low-density populations among hunters and gatherers become high density. Further differences between their positions are explored in the next chapter.

Summary

In this chapter I have gone from research designs to the archaeological record. Both of these concepts represented a major shift in the way archaeology was conceived and practised. At one time the archaeological record was not seen as a problem. Indeed it is still sometimes claimed that getting the stratigraphic facts right is our goal (Harris 1989: xiii). But, as we have seen, the archaeological record is more than just an offshoot of geology and its laws of superposition. Instead it provides an active, interpretive problem that begins in Hodder's phrase 'at the trowel's edge'. In the same way being explicit about research designs is another means by which we came to grips with our samples. Obtaining a representative sample has nothing to do with the principles of stratigraphy. Instead it has everything to do with our assumptions about, and approaches to, investigating human behaviour and action through material remains as they are distributed in time and space.

Consequently I have introduced some of the entities, such as attribute, and principles, such as popularity, that archaeologists commonly use. I have provided you with definitions of culture, taphonomy and many other terms. I have acquainted you with

these conventions because they structure the practice of archaeology and so make it intelligible to initiates. These conventions are the shorthands that you will find in site reports, conference papers and textbooks. Suitably armed, it is now time to see what we can do with them.