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A Short Introduction to Archaeology

V. Gordon Childe

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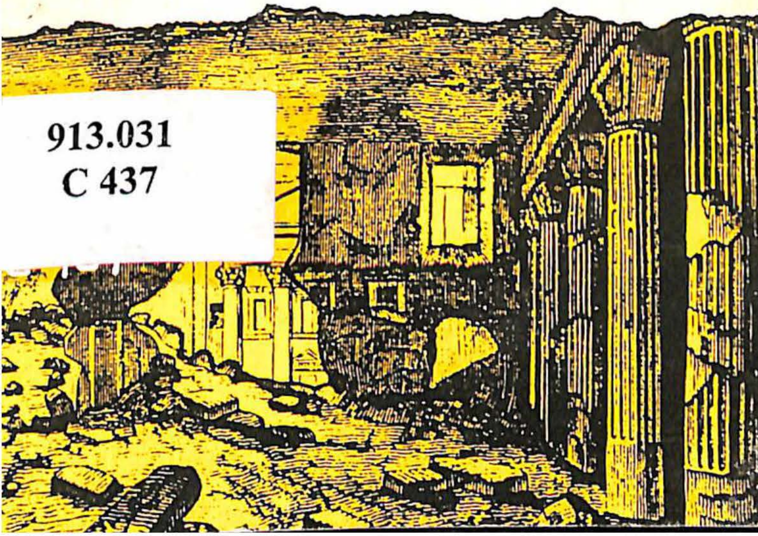

A Short Introduction to Archaeology

"For amateur archaeologists and for history-minded readers who like to sense the past in their drives about this area, this excellent text is a must.

"It literally is a manual for the beginning archaeologist, tells him what to look for and why, details the nature of his findings, acquaints him with proper and safe techniques, and, in short, is priceless. Non-archaeologists will be equally entertained and will, further, gain a new appreciation of the work of the archaeologist in recreating the past."

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"In approach, it is quite different: instead of a historical treatment, Childe has grouped his material by topic and technique (e.g., stratigraphy, mounds and flint work). He is thus able to convey a great deal of fundamental information in a very meaningful way, and to give an idea of what archaeology is like, to its practitioners, as a science."

—*Natural History*

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A Short Introduction to ARCHAEOLOGY

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Contents

A Short Introduction to

Archaeology

Chapter 1

Archaeology and History

1. The Archaeological Record

ARCHAEOLOGY is a source of history, not just a humble auxiliary discipline. Archaeological data are historical documents in their own right, not mere illustrations to written texts. Just as much as any other historian, an archaeologist studies and tries to reconstitute the process that has created the human world in which we live—and us ourselves in so far as we are each creatures of our age and social environment. Archaeological data are all changes in the material world resulting from human action or, more succinctly, the fossilized results of human behaviour. The sum total of these constitute what may be called the *archaeological record*. This record exhibits certain peculiarities and deficiences the consequences of which produce a rather superficial contrast between archaeological history and the more familiar kind based upon written records.

Not all human behaviour fossilizes. The words I utter and you hear as vibrations in the air are certainly man-made changes in the material world and may be of great historical significance. Yet they leave no sort of trace in the archaeological records unless they be captured by a dictaphone or written down by a clerk. The movement of troops on the battle-field may "change the course of history," but they are equally ephemeral from the archaeologist's standpoint. What is perhaps worse, most organic materials are perishable. Everything made of wood, hide, wool, linen, grass, hair and similar materials, nearly all animal and vegetable foods, and so on, will decay and vanish in dust in a few years or centuries, save under very exceptional conditions. In a relatively brief period the archaeological record is reduced to mere scraps of stone, bone, glass, metal, earthenware, to empty cans, hinges without doors, broken window-panes lacking sashes, axe-heads without handles, post-holes in which no post now stands. How serious the resultant gap is can be judged by a quite cursory glance through the ethnographic galleries in any museum. Better still, go through the catalogue of a general stores, like the Army and Navy, and tear out all the pages dealing with foodstuffs, textiles, stationery, wooden furniture and similar articles; the fat tome will have been reduced to a slim pamphlet. And remember that even in England a few centuries ago not only country carts but also complicated geared machines were constructed entirely of wood and leather without even metal nails, while in a normal farm-house receptacles of perishable wood and leather took the place of the familiar china and earthenware. Still modern archaeology, by applying appropriate techniques and comparative methods, aided by a few lucky finds from peat bogs, deserts and frozen soils, is able to fill up a good deal of the gap.

What have irreparably vanished are unexpressed thoughts and unexecuted intentions. Now it has been said that all history is the history of thought. Does this judgement, then, at once invalidate archaeology's claim to be a source of history? No; unless expressed in overt action—in deeds or words—no thought nor purpose can claim any historical significance whatsoever. However superlative the vision granted to a seer, however ingenious the device conceived by an inventor, unless he can express it and communicate it, its historical significance is exactly zero—zero indeed unless he can inspire disciples to accept and propagate the message, unless he train apprentices to reproduce his invention and induce clients to use it! In fact, it is only thoughts objectified by the approval of a society, adopted, applied and realized by a group of thinkers who are also doers, that any historian need, or can, consider.

All archaeological data are expressions of human thoughts and purposes and are valued only as revelations thereof. This differentiates archaeology from philately or picture-collecting. Stamps and pictures are valued for themselves, archaeological data solely for the information that they provide as to their makers' and users' thoughts and way of life.

The most obvious results of human behaviour, the most familiar archaeological data, may be termed *artifacts*—things made or unmade by deliberate human action. Artifacts include tools, weapons, ornaments, vessels, vehicles, houses, temples, canals, ditches, mine-shafts, refuse-pits, even trees felled by a woodman's axe and bones intentionally broken to extract the marrow or shattered by a weapon. Some of these are movable objects that can be picked up, studied in a laboratory and perhaps exhibited in a museum; such may be termed *relics*. Others are too heavy and bulky for that treatment or are absolutely earthfast like mine-shafts; all these may be designated *monuments*. But many data are not strictly artifacts, are neither relics nor monuments. A Mediterranean shell in a mammoth-hunters' camp on the middle Don or in a neolithic village on the Rhine is a precious document in the history of trade, though not an artifact. The deforestation of Southwestern Asia and the conversion of the prairies of Oklahoma into a dust-bowl are results of human action. Both are historically significant events and by definition archaeological data. Yet their short-sighted authors in neither case consciously envisaged or deliberately planned the regrettable results. If an irrigation system is an artifact, an accidentally produced desert is not.

The public, I suspect, still thinks of monuments as ivy-clad ruins and isolated blocks of stone, carved or inscribed. To many, relics are single coins or flint implements, turned up in ploughing or ditching, if not personal mementoes—a button from Prince Charlie's vest, the joint of a martyr's toe, a tooth of Buddha. None of these, least of all the last group, are likely to be significant archaeological data. To have a meaning that an archaeologist can hope to decipher, an object must be found in a *context*. An archaeologist can classify ruins and so extract history from them just because they are not empty and isolated. They contain—equally fragmentary—relics left by their builders and occupants; normally in any archaeological province several ruins conform more or less closely to the same plan, and in that case may be expected to yield a very similar assortment of relics. In this case some pattern, a strategic or administrative plan, may be made out from the distribution of the monuments.

2. Types

Of course, if a monument be inscribed, say, "John Doe, died 1658," it can be classified at least chronologically. So can a relic stamped with the manufacturer's name and date of manufacture. A stone implement, on the other hand, found alone would be quite meaningless unless it closely resembled other implements that had been found in a significant context—to put it technically, unless it conformed to a recognized *type*. As anyone can see from a glance at a collection, stone implements assume an enormous number of distinct shapes and sizes. One type occurs in Britain in graves under round barrows, often accompanied by small objects of copper or bronze; another type sometimes turns up in long barrows that never cover any sort of metallic objects; yet another may be recovered from caves, together with bones of reindeer or extinct animals; and so on. If the stray implement conforms to any one of the foregoing types, an archaeologist can assign it a relative age. Then it tells him that men were living near the find-spot in the period thus determined. But if the implement be unique, it is not a datum for archaeology at all; it remains just a curio until a similar implement, that is, one of the same type, be observed in a significant archaeological context.

The definition given on the first page can then be reformulated thus: the archaeological record is composed of types found in significant associations. Both the words "type" and "association" need further explanation. Archaeology begins as a classificatory science, as did botany or geology. Only after classifying his data can the archaeologist begin to interpret them, to extract history from them. Now a class is an abstraction. So archaeologists deal with abstractions. So do other scientists. A zoologist, for instance, may study horses—species and sub-species of horses—but not individual horses. From his studies he may make generalizations and thence deduce predictions as to the probable behaviour of any typical representative of a given sub-species (breed), e.g. its chances of efficiently pulling a plough or carrying packs over high mountains. But no zoologist can predict which horse will win the 3.30 Stakes. The punter's tips are not deductions from scientific generalizations, but are based on subjective estimates of "form." The archaeologist must imitate the zoologist; he studies abstractions—types of relics, of monuments and of archaeological events; the rôle of the racing tipster devolves upon the connoisseur.

Of course, no two products of human handiwork are absolutely identical. Even the purchaser of an automobile, turned out on the assembly line from preformed parts, may discover disconcerting deviations in the performance of his latest acquisition. The divergences between the several chairs or pairs of shoes, handmade by one and the same craftsman, may be more conspicuous. Still, all shoes turned out by Mr. X conform sufficiently to a standard pattern to satisfy his customers, and on the whole his standard keeps so close to the fashion for men's shoes current in the West End in 1950 that their wearers will not look odd or feel conspicuous in their clubs. In fact, despite small differences in cut and finish, all shoes worn in town by upper-middle class Londoners are so much alike that any pair could at once be recognized as an approximation to one of three or four types of fashionable footwear. In the same way, though fashions changed with time, all knives used in England at one date, be it A.D. 1950, 1750, 1250, 250 or 250 B.C., reproduced exactly one or other of a very few fashionable types. Archaeologists must ignore the small individual peculiarities of any given knife and treat it as an instance of one or other of those standard types, as a member of that class of knives.

Only so can the bewildering variety of human behaviour be reduced to manageable proportions for scientific treatment. An archaeologist thereby renounces certain of the rôles usually claimed by historians. An archaeologist as such may study the general study of Greek vase painting, trace its stylistic development and distinguish it from Phoenician or Egyptian ceramic art. He would be no longer an archaeologist, but an art-historian if he went on to attribute a particular *phiale* to Euphronios rather than Euthymedes, or to attempt an aesthetic appreciation of this or that painter's idiosyncrasies. Similarly, an archaeologist unaided might hope to determine roughly where and when the wheeled cart or the railway locomotive was invented. Without the aid of written texts he could not recognize that Rocket I was really the first locomotive, and, since carts were invented before writing, he will never identify the first. In each case it was only when the original model was copied and reproduced that it became a type and so a normal archaeological datum.

The restriction of archaeology to types means, of course, the exclusion of individual actors from archaeological history. Such history cannot aspire to be biographical, and archaeologists are excluded from the school of "great man" history. We shall see in a moment that the actors in archaeological history are societies and that the disappearance of individual *personae* need not deprive the drama of human interest. But "association" needs to be explained first.

Archaeological data are said to be associated when they are observed occurring together under conditions indicative of contemporary use. A classic example is provided by a pagan burial. Take a warrior with his accoutrements and insignia, provided with food and drink and a complete table service, laid on his back in a coffin hollowed out of an oak trunk which is then covered by a barrow (burial mound). In this instance the skeleton, the burial ritual and the several items of mortuary equipment are associated; they constitute what we may term an assemblage. In the same way all objects left on the floor of a hastily abandoned house, together with the house itself and its fixtures, are considered associated and termed an assemblage. On the other hand, this term cannot be applied without reservation to everything found on the site of a house, in a single rubbish-pit, or in the same bank of river gravel. If the house had been occupied for several generations, objects of different age may have got trampled into the floors or lodged in chinks and crannies. The contents of the local rubbish-pit may be equally varied. In both cases modern techniques should enable an excavator to distinguish and collect several consecutive assemblages from the pit and house-site. Not so with a gravel bank. The same bed of river-laid gravel may contain stone implements made and lost by men actually encamped beside the river's course together with other implements that had been lying about on the ground within the catchment area for 100,000 years before the flood-waters picked them up and bore them to the gravel bank. In such an *aggregate* no excavation, however expertly conducted, would distinguish assemblages of associated types. An examination of the implements' "state of preservation" might help in that direction.

3. Cultures

Now it is found that, within a definite area or province, the same types occur associated together at a number of distinct sites. So today on the sites of bombed towns in England we should find most of the ruined houses to have been laid out on much the same plan, built in the same way of brick, and containing fragments of the same kinds of teapots, saucepans, kettles, cutlery, light fittings, beer bottles, radio valves and so on. At least as much uniformity would have been observed among the ruins of North Russian towns bombed at the same time, but the houses would have been of wood not brick, and their plans, furniture and contents conspicuously different from the English. Archaeologists call an assemblage of the same types that recurs at several distinct sites a *culture*. Since they can contrast two or more such assemblages, as for instance those from the English and the Russian towns, they may use the word in the plural too. In fact, like anthropologists, archaeologists employ this hard-used word in a *partitive* sense. In this sense the word "culture" is so frequently used in archaeological literature, and this usage is so unfamiliar that it needs some further explanation and justification, even at the cost of a digression.

Anthropologists and archaeologists use the word to denote patterns of behaviour common to a group of persons, to all members of a society. All the behaviour concerned is learned behaviour, learned by the child from its elders, by one generation from the one before. In fact, almost all human behaviour is thus learned. Men inherit very few innate instincts or rather such very generalized instincts that they have to be given form by education if they are to lead to safe and satisfying action. In contrast to lambs or kittens, human infants have to be taught what to eat, and so strong is the effect of this early training that many persons really cannot stomach perfectly wholesome and nourishing food to which they have not been thus accustomed. Hence there is no single pattern of behaviour to which the behaviour of all members of our species conforms to anything like the same extent as the behaviour of all sheep or all pike does. On the other hand, every society of men does impose on its members close conformity to more or less rigid standards or norms of behaviour.

Most obviously we must all speak the same language. I did not invent the words I use nor yet the rules of grammar and syntax regulating their use. Society presents them ready made and I have no choice but to accept them. Then even today our choice of clothes is very narrowly limited. It simply would not occur to the average Englishman to go about in a loin cloth and a sleeveless robe instead of a pair of trousers and a tailored coat. If it did, he could not buy such garments in a London clothier's. If he could induce a tailor to make them specially, he would feel odd and uncomfortable when he boarded the bus! Of course some individual deviation is always permitted. No two persons pronounce words identically nor use quite the same vocabulary. Despite compulsory education and the B.B.C., many people use "him" for "he" and "her" for "she," and perhaps these last relics of inflexion will be eliminated from English speech as the subjunctive mood and dative case have been. In other domains still wider choice and more freedom for individual caprice is allowed among civilized peoples. But the smaller a society is, the less freedom it grants an individual to deviate from the approved norm of conduct. On a coral atoll in the Pacific or in a mountain valley in New Guinea, behaviour is infinitely more uniform than in Manchester or Zürich. On the one hand, hardly any alternative modes of behaviour are presented to the Pacific islander or the Papuan tribesman as they are to a literate Englishman who has at least read of the curious habits of foreigners and may have seen Chinamen eating with chopsticks. On the other hand, the force of public opinion is much greater in a small community. In a big city minor eccentricities of dress will not provoke hoots of derision or hostile demonstrations; in a village the children will jeer at any abnormality and adults may make their disapproval felt in still less pleasant ways.

Traditional standards of behaviour differ more conspicuously between small, than they do between large, societies. Yet even in the contemporary world of mechanization and rapid communication norms of behaviour, standards of politeness and beauty do differ between Russians, Americans and Britons. And many of these divergences of tradition are expressed, as has just been shown, in visible differences in material objects, capable of becoming archaeological data. Differences in fashions of dress or domestic architecture will to some extent be reflected in the archaeological record, dialectic differences not at all.

Archaeologists use divergent traditions the results of which do fossilize, or rather the different results of actions inspired by such traditions, to distinguish various cultures. And each of these cultures, they believe, represents a society. A culture, it will be recalled, is just an assemblage of types repeatedly found in association at a number of sites. Now a type is a type because it is the result of distinct actions all inspired by one and the same tradition. Types are associated because the several traditions expressed in them are maintained and approved by a single society. The same assemblage of associated types recurs on a number of sites, because all the sites were occupied by members of one and the same society. What sort of unit that society was—a tribe, a nation, a caste, a profession—can hardly be decided from purely archaeological data. But these societies, however they are to be designated, do provide archaeologists with actors in an historical drama.

4. Archaeological Time

Traditional behaviour may change in the course of time. Types expressive of such behaviour may differ not only because they are produced by different societies, but also because fashions have changed within one society. Accordingly, we may contrast English culture in 1945 with English culture in 1585 as well as with Russian culture of 1945. The plan of a Tudor town and its constituent buildings and their appointments and contents are as different from those of a contemporary English town as the latter are from those of a Russian town. Concretely, then, culture means the same in both cases—a distinct assemblage of types repeatedly associated together. But the secondary meaning, the interpretation, is different. We deduce from written records, and could probably infer from the archaeological data alone, that contemporary English culture with all its constituents has developed out of Tudor English culture by a gradual and continuous process of technological and scientific progress, economic and political change, without any breach in tradition and without any replacement of the society carrying those traditions by another society of different genetic constitution or cultural ancestry. In fact, what we mean by "Tudor culture" is "English culture of the Tudor period." It would be better to say so, for it is not always self-evident.

Now in successive levels of a stratified site, archaeologists observe assemblages of different types following one another. In other words, they observe a succession of cultures and then say they have established the *culture sequence* at the site. Provided the same assemblages do occur in the same order at several sites—and within a natural region this is generally true—this usage is literally correct. Indeed, an archaeological period in any province and at any site in that province is actually constituted by the culture, or rather by the distinctive types that distinguish the relevant layers from those that precede or follow. Confusion may be caused by applying the same name both to a chronological division of the archaeological record and to one group of actors appearing in that division. In the case of "Tudor culture" no ambiguity arises; no one imagines that it denotes a phase of French or Russian or any other culture than English. The student must be warned at once that a similar usage applied to prehistoric assemblages has led to horrible confusion. He must learn to distinguish between "culture periods," i.e. phases of culture, and the cultures that result from divergences of social tradition in one and the same archaeological period. Terminology should reflect this distinction, but unfortunately it does not always.

Finally, some types change faster than others, and many traditional patterns of behaviour are common to several distinct societies. In the last fifty years types of automobile have changed almost beyond recognition, types of farm cart not at all. In the same time fashions in men's boots have remained almost constant, while taste in hats has varied markedly. In the same way the electric light bulbs and teacups from a bombed town in Russia will be much more like the English than the stoves and teapots. Distinct assemblages, whether chronological or other divisions of the archaeological record, are usually differentiated by only a few types. Types that are thus useful for distinguishing cultures or phases of culture are usually termed *type-fossils*—the concept has in fact been borrowed from geology. In whatever assemblage a type, found to be distinctive of a period, is discovered, the assemblage is held to be "dated" by it and is assigned to the period of which that type is a distinctive type-fossil. For chronological classification, therefore, a single associated example of a well-established type-fossil is enough to date the assemblage with which it is found associated. To define a culture, however, the type-fossil must recur repeatedly and on several sites. But of course the type-fossils do not characterize or constitute the culture, though prehistorians often write as if they did. The electric light bulbs were just as significant constituents of Russian culture as the stoves.

Men have been living and acting on the Earth for some half a million years. Throughout this vast period they have been making changes in the material world and so leaving traces on the archaeological record. Archaeological history surveys, or tries to survey, the whole of these 500,000 years. Not more than 5,000 years ago some societies—the Egyptians and Sumerians—invented systems of writing and began recording names and events, thus initiating written records. Subsequently other peoples—the inhabitants of the Indus valley, the Hittites of Asia Minor, the Minoans of Crete, the Mycenaeans of mainland Greece, the Chinese—began to write, and the practice spread till by now most, but by no means all, human groups are literate or at least comprise some persons who can read and write. Written texts, of course, supplement and enrich the archaeological record without arresting it or making it superfluous. Still, the enrichment of the content of history by written records is so dramatic that it has become customary to make the beginning of writing the basis for a dichotomy of the archaeological record. The part that is unaided by contemporary written texts is conventionally termed *prehistoric;* when written records begin in any region, there begins the archaeology of the *history period.*

This division has no profound philosophical significance and involves no fundamental change in method. All the devices used for the collation, classification and interpretation of prehistoric data are equally applicable to so-called historical sections of the record. But, of course, the existence of written sources makes some of them unnecessary and introduces others. Now the purest archaeological concepts and the most refined techniques of excavation have been worked out for dealing with prehistoric remains. In default of written dates, a distinctively archaeological system of chronology, based exclusively on uninscribed data, had to be devised, but it often turns out to be convenient to apply the same sort of system to later periods too. Then the remains left by our preliterate ancestors, to say nothing of the earlier pleistocene men, are so rare and so poor as compared with those left by the civilized Romans, Greeks, Egyptians or Sumerians, that prehistorians had scrupulously to collect and to study minutely every scrap that does survive and to think out ways of detecting and reconstituting traces that have been almost completely obliterated. On the contrary, Mesopotamian archaeology was for long just a hunt for inscribed tablets and *objets d'art* in which private houses, domestic pottery, weapons and tools of metal and such other humble relics were light-heartedly destroyed or thrown away unrecorded. Yet the earlier literary documents from Mesopotamia and also from Egypt are fragmentary, and very limited and jejune in content. It is only within the last two or three decades, by the application to Sumerian and Babylonian sites of techniques of excavation and interpretative concepts elaborated by prehistorians, that the vivid picture now available of life in the Ancient East has been built up. Even in respect of chronology purely archaeological data had to be invoked to correct the ambiguities and errors of the ancient written records; one result was to reduce the date of the first great lawgiver, Hammurabi, by nearly 250 years!

So, too, classical archaeologists for a long time concentrated their attention so much on the architectural features of public buildings, on statuary, mosaics, engraved gems and figured vases that no one knew until 1935 what a Greek house of the classical period was really like! While Greek and Roman historians have left us voluminous accounts of political and military events, they are painfully silent on such mundane matters as commerce, population density and technology. The volume and extent of Greek trade with barbarians—of course all non-Greeks including the Egyptians and Babylonians were thus described—is being recovered by archaeologists counting the Greek wine-jars dug up in southern France, South Russia, Iran and other "barbarian" lands and plotting the find-spots on maps. Estimates of the population of Athens—the best-known city of classical antiquity—based on references in literature vary between 40,000 and 160,000! The complete excavation of a city, like Olynthus, disclosing the total number of houses, provides substantial data for a reliable estimate. Even on military history to which classical authors gave such prominence, archaeological excavation has supplemented and even corrected their testimony. Layers due to destructions and reconstructions in the forts and legionary camps of North Britain reveal vicissitudes in Roman fortunes and fluctuations in Imperial policy on which literary sources are silent.

Indeed, whole branches of history, as now understood, have to be based on uninscribed archaeological data. For the history of science, for instance, its applications in technology are at least as important as the speculations of theologians or even natural philosophers. Yet down to the 16th century technology is virtually ignored in the written texts. The history of machines applying rotary motion is gradually being written by the discovery by archaeologists of actual querns and water-wheels or representations thereof on carvings or mosaics.

So it remains convenient indeed to distinguish prehistoric from other branches of archaeology. But no further apology is needed for giving that branch the most prominent place in the sequel.

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Chapter 2

Classification

1. The Triple Basis

To extract history from his data, the archaeologist must classify them. He inevitably employs three distinct bases of classification which may be termed functional, chronological and chorological. In other words, he asks about each datum three questions: "What was it for?"; "When was it made?"; "Who made it?" The reader may pardonably feel alarmed at the formidable terms just used. So to help him to understand their implications let us consider an imaginary instance—not quite imaginary, for the basic chronological classification still used for prehistoric data was actually devised for arranging specimens in a museum.

Imagine the Director of a rather unusual museum classifying an exceptionally varied collection of specimens, gathered not only from England but from various European countries and parts of Asia and even Australia, for exhibition and preparing explanatory labels for each. The collection is confined to artifacts—things made by man—but comprises not only actual specimens but also photographs, plans and drawings; for a church or a castle is an artifact just as much as a pipe or a thimble, but less convenient for putting in a show-case. The aim of the museum is to exhibit and present visually the lives of peoples and societies at different periods in their histories—i.e. successive stages in their cultures, and of course monuments are as much a part of culture as relics.

The museum is in fact designed to illustrate the development of culture and to be a visual concrete cultural history as this term is now understood. Hence the Director will have to exhibit together the things used together—at the same time and by the same people. History being a process in time, a sequence of consecutive events, the huge collection will have to be dispersed over a series of galleries each devoted to a single period and all arranged in chronological order. Our imaginary Director is lucky enough to have a sky-scraper at his disposal, a veritable Tower of History. So he can devote a whole storey to each major period. The visitor will climb from prehistoric basements through, say, Roman, Anglo-Saxon, Norman, Tudor, Jacobean, Georgian, Victorian floors to reach the contemporary Neo-Elizabethan storey at the summit.

If the collection be as comprehensive as we imagine, it will, of course, need a series of parallel but interconnecting sky-scrapers—let us say wings—to house it. Contemporary Indians, to say nothing of Papuans, wear very different clothes from contemporary Englishmen. Though both costumes are being worn at the same time, they are not normally being worn together. Being contemporary, they should be housed on the same storey, but yet should occupy distinct galleries, in different wings. Similar differences should be shown on lower storeys. Indeed, the lower we descend the greater local divergences are likely to be. Luckily, like most sky-scrapers, our imaginary museum is broader at its base than near its apex.

Incidentally, we may note that the mere geographical division of the wings will not suffice to do justice to the actual diversity of cultures at any period, i.e. on any floor. Within a single country there may be two or more groups of people whose cultures are so different that they should be assigned to different rooms. Even in England, Gypsies on the Victorian and Georgian floors would deserve at least a separate group of show-cases. In the Indian wing more complete separation would be needed; if the artifacts made and used by Hindus, Muslims and Parsees do not differ so drastically as to need distinct rooms, there are pagan tribes like the Todas and the Orans whose way of life is so totally unlike those of the "civilized" majority and one another that each could reasonably claim a room of its own. Luckily for the Director, the behaviour of such a tribe leaves considerably less fossilized results than does that of the majority. An alcove will comfortably house the exhibits illustrative of each.

In early times, even more distinct societies lived in a single small area. In the Stone Age, for example, three can be distinguished in a country so small as Denmark. Yet, though enough of the behaviour of each has fossilized to leave the prehistorian in no doubt that he is confronted with three quite distinct patterns, all the results could be displayed adequately in three small cases. Each of these societies, whether the three anonymous groups in prehistoric Denmark or the Hindus and Todas in India or the English and the Gypsies, has created a culture of its own, and this culture has developed or at least changed in time so that it should be represented on more than one storey. In fact, our imaginary museum does not purport to illustrate the development of culture; for there is no such thing. All it can document is the development of cultures, the changing behaviour patterns of distinct human societies. That is why the edifice has many wings. Each many-storied wing constitutes a Department and will need a distinct Keeper to arrange and classify its contents.

2. Functional Classification

The Director and the Keepers who assist him will of course have to label each specimen so as to inform the visitors how it was used, what it was for, in a word what *function* it fulfilled in the life of the society that made and used it. So the staff will have to sort through the specimens and exhibits and group together, say, personal ornaments, shaving appliances, means of transport, objects and buildings used for cult, games and playing-fields, and so on. They will give each exhibit an appropriate number, what might be called its functional coordinate and write a short label to explain what it was for.

This labelling, incidentally, is not so easy as might be imagined. Apart from the fact that it takes encyclopaedic knowledge to understand the use of the innumerable gadgets used in modern, or even ancient, industries, the meaning of the symbols of the myriad competing cults, orders and lodges, and the intricacies of popular games, exhibits illustrating the earlier stages present peculiar problems. Archaeological specimens of any high antiquity are likely to be very incomplete for reasons indicated on the first page. So the older spades and spears will have no handles. Only the barbed bone prongs of leisters will survive. Stone axe-heads do not look the least like the axes we use today. Their handles have, of course, perished, but evidently they did not pass through a hole in the butt of the blade, as the latter are unperforated. Such implements were actually supposed to be thunderbolts in classical antiquity and in medieval England. Their real use was only recognized when the Red Indians of America were observed using precisely similar stone objects as hatchet-heads. So, too, barbed bone points, collected from very ancient Danish and Swedish settlements, were regularly labelled "harpoons" till it was observed that they were much more like the prongs of the iron fish-spears (*leisters*) used today by Scandinavian fishermen.

A later chapter is designed to suggest how the fragments that alone survive in the archaeological record can with confidence be completed. The two examples just given are intended to suggest how the function of mysterious archaeological specimens may be illuminated by reference to folk-lore and ethnography. In corners of Europe that have still escaped industrialization, in the Western Isles of Scotland, in the depths of Finnish forests or along the less accessible Balkan valleys, peasants and fishermen have preserved intact traditions going back without interruption to the Stone Age and express them in tools and products that can be matched precisely by relics and monuments four thousand or more years old. In the Arctic or in the Kalahari, folk still live very much as Europeans lived during the Ice Age or as the latters' contemporaries lived in North

Africa. Similarities in surviving equipment justify us in treating these modern savages as in a sense representatives of Old Stone Age societies.

When the specimens have been thus sorted into functional groups, our Director is likely to be embarrassed to find that in many groups he has far too many objects to display even in his spacious Tower of History. He can reduce these groups to manageable proportions by neglecting minor differences between individual specimens. Several are thus seen to belong to the same type; only one need be exhibited, the rest can be sent to store or disposed of.

For instance, Bulby Motors Inc. since 1925 have turned out annually a thousand of their 5-h.p. Democrats differing only in the engine- and chassis-numbers. Our Director has acquired forty specimens of the 1928 model distinguished chiefly by the dents in the mudguards. But for his purpose the dents are as irrelevant as the numbers. He will display one as a type specimen and scrap the remaining thirty-nine. Again, the collection may comprise thirty men's suits, differing indeed in size and stuff but all conforming to the same fashionable cut. One suit will suffice to represent this type. Women's dresses might cause more embarrassment; the "creations" of *haute couture* will prove less amenable to this treatment. But the costumes of a single Balkan village, often of a whole province, are all strictly identical in pattern save for the designs embroidered on each. The latter differences can be ignored; one costume will stand for the type current in the province of Split. By thus applying the concept of type, already expounded on page 12, the Director will be enabled to weed out his collection and to reduce each of his functional groups to a not too unwieldy assemblage of types. He can then distribute his selected type specimens among the several Departmental Keepers. Each of these will have to regroup them on the appropriate storey, assigning each a second index number, its chronological co-ordinate.

3. Chronological Classification

The Departmental Keeper's first step might be to group the specimens allotted to his charge in a chronological order down his study. He intends, you remember, to exhibit together things that were in contemporary use. So with his 1928-model Democrat he will display the sort of suit its driver might wear, the sort of house he might build, or buy newly built, a tombstone such as he might order for his wife, and so on. Round a stage-coach the Keeper will assemble a similar group of quite different clothes, dwellings, tombstones. A war-chariot might form the focus for a smaller group of exhibits, yet less like those displayed with the motor-car, and so on. The Keeper plans in the end to display the successive changes that British culture has undergone as a series of scenes or tableaux, each on a different floor and each representing one significant phase in what was really a continuous process. Each scene represents such a phase, each flat forms a period room.

The Keeper may give each period a convenient arbitrary label—"Victorian," "Georgian," "Tudor," "Romano-British," "Secondary Neolithic"—and mark the future exhibits accordingly. For his immediate purpose these names signify nothing more than positions in a series. Numbers would do just as well. In fact, many of his later specimens may already bear such indicative numbers. The motor-cars and the tombstones are sure to bear *dates* inscribed upon them, the costumes certainly will not. All cardinal numerals indicate relative position in the series of natural numbers: 1926 comes after 1852. Date-numbers indicate the number of years that had elapsed, i.e. the number of times the Earth revolved round the Sun, between the conventional beginning of the era and the dated event—say the erection of the tombstone. (Note that the years may be reckoned from the era's zero in either direction, backward or forward). For the English Department, of course, the era's starting-point will be "the Birth of Christ." Other Departments in the Tower of History will use other eras—for instance, the Hejira or flight of Mohammed from Mecca in A.D. 622.

Numbers indicating the date before or after an era not only indicate the relative positions of two events in the sequence that constitutes English history, they put each event in its place in a series of events affecting the whole Earth's surface—its place in a universal, or at least global, frame of reference. Dating of this kind is termed *absolute chronology* and contrasted with *relative chronology.* You may know that arc lamps preceded incandescent bulbs (i.e. their relative chronology) without knowing how many years ago either was invented. In more technical language, you know the relative age of the two events, not their absolute age. As long as he is just arranging in order the specimens to be exhibited in his Department, the Keeper can be content with relative chronology. Absolute chronology need worry him only when he has to decide in which storey in the composite museum any period room ought to be installed.

At the same time a date in years is a measure of the antiquity of an event; for instance, the manufacture of a car. Grouping the specimens in his own Department to represent successive periods, a Keeper need not bother about the duration of the several periods thus represented. As long as he keep within his own Department he need know only the order in which the periods succeed one another. So, we may say, he need only keep *archaeological time.* For archaeological time exhibits succession but not duration. The order of events can be determined by purely archaeological methods. Unaided by nuclear physics, astronomy, geology or written records, archaeology cannot say how long ago an event happened, how old a building is, or how long a period lasted.

For his planned exhibition the Keeper must know which specimens were in fact in contemporary use. Of course he may look at the dates inscribed upon them and put together those bearing more or less similar dates. Or he may consult written descriptions. Neither procedure is altogether satisfactory, and both are at best available for only a small part of the collection. He had better rely on the archaeological principle of association. After all, the best guarantee that types were in contemporary use is that they should have been found associated under the circumstances indicated on page 14. (When available, contemporary pictures may provide as good evidence for contemporary use as observations made in the course of an excavation.)

Association by itself will give no guidance as to which floor a given assemblage of types should ultimately occupy. For the projected chronological arrangement, the assignment of an assemblage to its appropriate storey depends upon the relative position of that assemblage in a sequence of assemblages. Of course if one or two specimens associated with each assemblage were inscribed with a date, the appropriate position of the whole group of associated types would be plain—but only in the light of written records. For dates are often given not as numbers of years from an era, but rather in the form "Fifth year of King George III," or "in (the year of) the consulate of Crassus," or "in the year when King——." Such date-formulae can only be translated into years before or after our era when complete written records are available.

But all our Keeper needs to know at present is the relative age of the several exhibits. He must know that this automobile is older than that one but contemporary with that tombstone. Relative chronology can be determined by purely archaeological methods without reference to the researches of literary historians at all. Two principles might be invoked: stratigraphy and typology. The latter, though the less reliable, is most easily explained, and the Keeper could apply it without ever going outside his museum. Railway locomotives afford a simple example. No one would imagine that the Royal Scot is older than the Rocket type. The reverse is obvious from inspection and an inversion of the relationship would be unthinkable. A series of drawings and photographs could easily be arranged to show how cumulative improvements led from the relatively primitive and inefficient Rocket to the contemporary express engine. Knowing the two terms, the several intermediate types could confidently be arranged in their right order without reference to the dates obligingly stamped by the manufacturer on his products. Such a succession of increasingly efficient types constitutes what is termed a *typological series*. The component steps or stages can be used to determine the relative positions of whole assemblages with which one or other of them is associated. Museum-keepers love to sit comfortably in their studies arranging their specimens—or cards representing them—in neat typological series. But, however pretty they may look, little reliance can be placed on them unless they be corroborated either by literary authority or by the other archaeological test—stratigraphy. But to apply this test the Keeper must leave his museum and himself dig in the dirty earth or at least read carefully the boring reports of excavators!

The idea of *stratigraphy* has been borrowed by archaeology from geology. The principle asserts that in any undisturbed deposit the lowest layer is the oldest the uppermost the latest. The principle is so important that we shall have to return to its applications in the next chapter and be content here with a very sketchy outline. If a cave or a village be inhabited for several generations, layers of rubbish will accumulate on the cave floor, in the streets or in a rubbish-pit, and they will comprise archaeological data including types of durable artifacts—buttons, broken bottles and crockery, spare parts from cars and so on. Some at least of the types will change from layer to layer. The principle of stratigraphy assures us that the oldest types are those from the lowest layer unless the deposit has been disturbed. If the latest occupant had dug a rubbish-pit in the cave floor, recent objects might be found lower down than more ancient ones.

If such a stratified (i.e. layered) site be systematically excavated, one or two types should be identifiable that are confined to each layer and do not recur above or below it where different types occur. Types thus confined to, say, layer C are recognized as distinctive of layer C. With luck the same types will be found in corresponding layers, that is layers occupying the same relative position, at other sites within the province. Then they may be called type-fossils and used to define an archaeological period, a division of the local archaeological record. All deposits in which they occur will be treated as contemporary—in archaeological time—and assigned to the same period, to which will likewise belong all types associated with them. The relative position of the period thus defined in the local sequence of archaeological periods, its place in the local archaeological record, is settled by the stratigraphical position of the type-fossils.

The reader should note two points with especial attention. The period defined by type-fossils is not a division of sidereal time but only of local archaeological time, that is limited to the region over which the distinctive types were in current use: samovars might define a period in Russian archaeology, but not in British. Secondly, not all archaeological phenomena are apt to yield type-fossils. To the first point we return below. The second has been adequately dealt with in Chapter 1.

If our Keeper had been the head of an independent museum of local antiquities, stratigraphy and typology would have given him all the information he needed for arranging his collections in a chronological order. But he is in charge of only one Department in a composite museum in which types in contemporary use, not only in England but also in Greece, Iraq, India, New Zealand and elsewhere, are to be displayed on the same storey. The visitor, it will be remembered, should be able to proceed not only vertically from one phase of Indian or English culture to the next, but also horizontally so as to see what was going on in England, India, New Zealand and elsewhere at the same time.

Now the period labels—"Tudor," "Norman," "Romano-

British," "Secondary Neolithic"—will not help the Keeper of the English Department to assign the exhibits thus marked to the right storey that shall house the specimens in contemporary use in Iraq or India. These will bear quite different labels—Ottoman, Abbassid, Parthian, Akkadian or Mogul, Gupta, Greco-Bactrian, Harappan. In so far as these labels can be translated into numerical dates in terms of the Christian, Mohammedan or other era, in so far as relative chronology can be converted into absolute chronology, the resultant figures would adequately indicate the appropriate storey in each and every wing. But that translation is dependent mainly on data from written records. Now the Maoris of New Zealand were illiterate when Captain Cook landed there in the Georgian period of English archaeology, the Red Indians of Canada were not yet keeping written records in the Tudor period of English archaeology, England itself was still prehistoric when Julius Caesar staged its invasion and even when Claudius Caesar effected its annexation to the Roman Empire. So beyond these points written history can give no guidance to the several Keepers, whatever geology and nuclear physics may do. The Director will have to decide on which storey the several collections are to be displayed.

To some extent at least his problem, getting on the same storey specimens in contemporary use in the regions represented by the several wings, could be solved by purely archaeological means. Types current in Tudor England were carried across the Atlantic and traded to the Red Indians of America, while some contemporary Amerind artifacts found their way back to England as curios. Some collections from North America can thus be identified as contemporary with the Tudor group from England and confidently assigned to the same floor. In much the same way, albeit more surprisingly, British manufactures reached Mycenaean Greece, while weapons and beads, fashionable in Greece in the Mycenaean Age, were imported into England. So a model of Stonehenge and relics, known to be contemporary with that sanctuary, can legitimately be displayed on the same floor as a model of the Lion Gate of Mycenae and replicas of the treasures from the Shaft Graves, 1550-1400 B.C.

4. The Chorological Classification

In our illustration of chronological classification we have assumed that the Director knew to which Department specimens should be assigned and left it to the Keepers to classify them chronologically. In technical jargon, he had already carried out the chorological classification of the collection before its contents had been classified chronologically. In practice that would have been impossible without some outside source of information. But by purely archaeological procedures the Director could have distributed his specimens, not indeed into regional Departments such as we have envisaged, but at least into cultures in the sense expounded in the first chapter, provided he knew what specimens were associated together. But he would have had to classify them chronologically first. Most of the Keepers will have to do this with part of their collections anyway. Their procedure has already been outlined.

Within the same chronological class or period will still be found a variety of types, all fulfilling identical functions. How are these differences accounted for? An American type of express engine is obviously different from any British type; it is, for instance, fitted with a cowcatcher, a bell and a searchlight. These additions at least would not enhance the locomotive's efficiency for drawing express trains over British railroads. They cannot, therefore, be improvements on the older British model. So these differences are not due to discrepancies in age—to chronological differences. The explanation must rather be a chorological distinction, divergence of tradition between two distinct societies (the fencing of railroads or the use of public highways to carry railway lines is, of course, a matter of social tradition in no sense inherent in the nature of railways as such). Now types are repeatedly associated together not only because they were current at the same time, but also because they were made and used by the same people. Conversely the reason for differences between types within one and the same functional group is either improvements and changes of fashion in the course of time or divergences in traditional ways of acting and in taste between distinct peoples. The contrast between the Rocket and the Royal Scot is due to the first cause, that between the latter and the Bostonian to the second. Using the locomotives as type-fossils, all that can be associated with the Royal Scot—not only corridor coaches and signals, but farm-buildings, passengers' costumes, cricket bats and table knives—are assigned to one culture and represent one people, whatever is associated with the Bostonian to another. Of course many items will be common to both assemblages, but viewed as wholes the contrast between the two cultures is patent. In the example taken from contemporary cultures, the distinction can easily be verified and the explanation offered can be empirically justified. Moreover, political or ethnic names can be attached to each culture. So, too, with cultures of which written accounts survive. The same inferences may accordingly be drawn from the differences between prehistoric assemblages. But to these no political label can properly be attached.

Very exceptionally a linguistic label, such as Celtic or Iberic, can be affixed to late prehistoric cultures with the aid of toponymy and written sources. Usually the assemblages recognized have to be distinguished by some quite conventional name. This may be the designation of a type-fossil or a distinctive trait; so we have Battle-axe, Single Grave and Bell Beaker cultures. Sometimes the name of a province where it is well represented is applied to a culture, for instance, Lusatian, more rarely a geographical name qualified by a chronological adjective: Thessalian Neolithic A, British Iron Age A (in a book devoted exclusively to British prehistory the geographical term could be omitted). The standard practice today is, however, to name a culture after the site where it was first distinguished or is typically represented. Unhappily the same terms are occasionally used to designate local divisions of the local archaeological record, i.e. local periods. Prehistoric cultures and periods have in fact both to be identified with the aid of type-fossils, and both are substantially constituted of assemblages of types. The two concepts are still perfectly distinct, but may easily be confused if given the same designation. To help the student to understand the older textbooks and to avoid the pitfalls inherent in the ambiguities of prehistoric terminology, an historical excursus must close this chapter.

5. Prehistoric Periods and Cultures

Local divisions of archaeological time, the successive chapters in the local archaeological record, have to be distinguished by some sort of label. In the prehistoric sections, year numbers, dates in terms of an era, are *ex hypothesi* not available. Since about 1815 it has become customary to divide the prehistoric sections of the archaeological records into *Three Ages,* a system devised by Thomsen in arranging the new Museum of Northern Antiquities in Copenhagen. Thomsen had decided to display together such objects as had been in use at the same time. The collection included many assemblages of types found associated together in shell-mounds, peat-bogs, megalithic tombs and barrows. So he knew what types to display together, but not in what order to arrange them. But, like the Roman poet Lucretius, he believed that before men learnt the use of iron, they made their cutting tools and weapons of bronze and, still earlier, being ignorant of all metal, had relied on stone, bone and wood. So Thomsen put together all objects of iron and all types ever found associated with such and attributed all, whatever material the individual specimen might be made of, to an *Iron Age.* From the rest all bronze objects and all stone, bone, wood or pottery types ever found in association therewith were separated out and assigned to the *Bronze Age.* The remainder filled a *Stone Age* gallery. Subsequently stratigraphical excavation provided objective justification for Thomsen's ordering and showed that his system was applicable to Switzerland, Italy, France and Britain as well as to Denmark. It is in fact of universal application.

But the "Three Ages" are really three consecutive technological stages that always followed one another in the same order wherever they occurred at all. It might have been wiser to call them "Stages" from the first. For though always occupying the same position in the sequence—to put it technically, being everywhere *homotaxial*—one "Age" does not everywhere occupy the same section of sidereal time, i.e. is not everywhere *contemporary.* The Stone Age ended in Australia with the establishment of a British colony at Botany Bay, in Central America with the landing of Cortez, in Denmark about 1500 B.C., in Egypt well before 3000. The word "Age" is likely to suggest a strip of absolute time, a division of absolute chronology, whereas only a stage in a sequence is intended. Geological ages, epochs and periods are considered to be contemporary over the whole Earth and so belong to the domain of absolute chronology. Archaeological ages are divisions of archaeological time and belong to relative chronology. Otherwise the Three Age system in its original form provided a satisfactory frame within which a reliable prehistoric chronology has been built up. Attempts to improve it have landed prehistorians in endless troubles.

When after 1859 the existence of pleistocene man had been recognized and stone tools had been collected from geological deposits formed during or even before the Ice Age, Thomsen's first Age was obviously disproportionately long. In 1863 it was divided into an Old and a New, into *Palaeolithic* and *Neolithic.* To the former division were assigned the chipped stone tools found in pleistocene deposits with the remains of extinct and exclusively game animals. As neolithic were described artifacts, including chopping implements sharpened by grinding and polishing, that had been found in the Swiss lake-dwellings and in Danish dolmens associated with a recent fauna and with the bones of domestic animals and evidences for agriculture. The division was thus based on three criteria: (1) geological—Pleistocene or Recent; (2) technological —edging by flaking alone or by polishing; and (3) economic—a wild-food (food-gathering) or a farming (food-producing) economy. It was assumed that all three coincided, but in fact they do not. So eventually, after 1921, a third division of the Stone Age—the *Mesolithic*—was added. Today Palaeolithic is equivalent to Pleistocene, and all post-Pleistocene cultures that carry on unchanged the old economy of hunting, fishing and collecting are classified as Mesolithic. Or rather they should be; in practice the term is not applied to contemporary food-gatherers in Australia, South Africa, or Tierra del Fuego, nor even to the late prehistoric cultures of the North Eurasiatic coniferous and tundra zones. Three Ages provided a logical and unambiguous basis for chronological, or at least serial, classification; five ages do not. Still, even they do represent in any region successive stages that are also divisions of archaeological time, sections of the local record.

Further "Ages" have been proposed, but fortunately not generally adopted, and need only be mentioned to relieve the student who may run across them in reading. Some authors have proposed to insert between the Stone and Bronze Ages (Stages) a Chalcolithic (in Italian *eneolitico,* in French *énéolithique*). As originally used by Italian prehistorians, this meant a stage or period in which tools and weapons of copper were used side by side with similar types in stone. But this happened everywhere in the earlier phases of the Bronze Age, since the metals, being very costly, were only available to a few members of most societies and were hardly ever used for missile points or for tools intended for rough work. This stage cannot therefore be profitably contrasted with the more generally established "Early Bronze Age."

It might be more useful to distinguish a stage when native copper, treated like a superior sort of stone and shaped by forging, was alone employed. Chalcolithic is sometimes used to denote this technological stage. But, native copper being very rare, such a stage does not universally precede the Bronze Age and so does not represent a general stage in technological progress. "Copper Age" is occasionally used to describe such a stage, but more often to denote a period when unalloyed copper was used instead of bronze, an alloy of copper and tin. But this criterion is hard to apply; for without analyses artifacts of copper cannot confidently be distinguished from those of bronze. Where analyses are available outside Europe, it turns out that most tools and weapons traditionally attributed to the early Bronze Age were actually made of unalloyed copper. The term Bronze Age is therefore chemically inaccurate and might profitably be replaced by "Palaeometallic." But to try to distinguish an independent Copper Age in this second sense can only produce greater confusion.

Turkish archaeologists, misled by a German excavator, unhappily use the terms "Chalcolithic," "Copper" and "Bronze" Ages to designate consecutive phases of Anatolian prehistory. In fact, their "Copper Age" is typologically equivalent to, and largely contemporary with, what is known as "Early Bronze Age" on the coasts of the Aegean and in Syria-Palestine. The preceding "Chalcolithic" seems mainly homotaxial with the Neolithic of Greece though perhaps overlapping with the Aegean Early Bronze Age. So Chalcolithic and Copper Ages can still be scrapped. Mesolithic is by now too firmly established to be thus disposed of. The student must wrestle with five ages!

Even five ages give too coarse a frame to reflect satisfactorily the progress of human culture. The first and longest age, the Palaeolithic, was subdivided last century by de Mortillet. On the basis of the stratigraphy observed at several sites in France, he distinguished six assemblages or cultures that followed one another in the same order at all relevant sites. These he took to represent periods within the Palaeolithic Age and, on the analogy of Devonian, Cambrian, etc., in geological nomenclature, he named each after a site where it had been first recognized or was well represented—Chelles, Saint Acheul, le Moustier, Aurignac, Solutré, la Madeleine (I have deliberately simplified the history a little here). Now in so far as de Mortillet's series did reflect the observed stratigraphical succession (in its original form it did not), these six cultures did represent chronological divisions of the archaeological record *in France* and stages in the development of culture *in France*. But under the influence of the then novel doctrine of Evolution they were taken to represent stages in the evolution of human culture and periods of absolute time, as universally contemporary as the periods and eras of geologists!

In reality, Aurignacian or Magdalenian or any other of these names denotes an assemblage of types repeatedly associated together in a specific area. Outside that area not all the types are found in association, and the several constituent types themselves are not universal. So it is quite wrong to speak of an "Aurignacian period" in Siberia or South Africa. Yet many prehistorians have been guilty of precisely this error. In English books and articles published before 1938, and in Russian works down to 1950, de Mortillet's terms are used to designate divisions of absolute (geological, if not sidereal) time and applied to assemblages which the writer in question thought would occupy the same position in the local sequence as the culture originally designated did in the French sequence. The truth is that Aurignacian, Magdalenian and so on denote cultures—units in the chorological classification. It is confusing to use the same term to denote chronological divisions.

This abuse is not confined to the divisions of the Old Stone Age. The names of cultures, i.e. of chorological divisions, are still applied to chronological divisions of Mesopotamian and Egyptian prehistory and to subdivisions of the European Iron Age. Even in England the label "Hallstatt" is attached to an assemblage of types none of which is found at the eponymous site nor on allied sites in Central Europe and eastern France, and which in time is contemporary with the La Tène cultures in the latter regions. The trouble, of course, is this: a division of archaeological time, or period, and a chorological division, a culture, are both constituted by an assemblage of distinctive types that the name denotes. Its ambivalence causes no ambiguity when the chronological division falls within historical times. If we speak of Jacobean culture we are never contrasting it with the contemporary culture of France or India, but with Tudor or Georgian culture, i.e. the culture of Tudor or Georgian England. For the former comparison we can translate Jacobean into "17th century," thanks to written documents. In a work on local archaeological history it is often convenient and quite harmless to use a culture name to designate a chronological division of the local record; in a work on world history preference should be given to an independent chronometer.

Even in prehistory such may be available. Palaeolithic cultures can be thus assigned to the appropriate divisions of the geological record given by advances and recessions of glaciers and correlative regressions and transgressions of the sea (i.e. periods of low and high sea-level). The sole excuse for writing of a "Moustierian" or a "Magdalenian period" would be a profound distrust of current correlations of these cultures with phases of the Ice Age. In that case it would be better to speak of Lower, Middle and Upper Palaeolithic periods and to divide the latter into phases distinguished by numbers. "Solutrean" then would be replaced as a period by "West European Upper Palaeolithic II."

In post-Pleistocene times it is less easy to find a substitute for culture names. Descriptive terms—the names of type-fossils—have been tried. So Danish prehistorians used to talk of "Dolmen," "Passage Grave" and "Dagger" periods of the local Neolithic, and Germans now call the latest phase of the Bronze Age in Central Europe the "Urnfield" period. Such terms, if qualified by a geographical adjective—Danish, South-west German—have the advantage of saying frankly what they mean. But passage graves or urnfields are really distinctive of only one of several cultures that flourished in the period thus designated. Danish prehistorians therefore now prefer to speak of Early, Middle and Late Neolithic, and English prehistorians are following their lead. A similar tripartite division of the Bronze Age has long been current for cis-Alpine Europe and for Palestine-Syria, while in Crete, Greece, the Cyclades and Cyprus the term "Bronze Age" has been replaced by "Minoan," "Helladic," "Cycladic" and "Cypriote" respectively. It might indeed be better to drop the "ages" altogether and denote the successive culture periods in each province by consecutive numerals. The ideal, of course, would be to correlate the several local series by the archaeological means adumbrated on page 34 so that the whole of prehistory should be covered by a single scheme of numbered divisions. It is more likely to be possible to translate the several relative dates into absolute dates with the aid of physics and astronomy!

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Chapter 3

Archaeological Sites and Their Stratigraphy

ANTIQUITIES MAY be found alone projecting from the surface of the ground or turned up in the course of ploughing and digging. Such objects in themselves are only potential archaeological data, while the location of each is a datum, but not normally a monument. Relics and monuments only become data if they conform to classified types, and types can only be classified in the light of their associations, of the context in which they have been found. Historical information can only be extracted from types instances of which have been found in company with other types on sites. Sites are of many kinds—dwellings, graves, forts, mines, sanctuaries, wells, and so on. We shall consider a few with special reference to the chronological information to be expected from them.

1. Caves

Men's oldest habitations, occupied already early in the Old Stone Age, were caves, and, as temporary shelters or permanent residences, caves have been frequented down to the present day by huntsmen and shepherds, picnickers and refugees, hermits and bandits, smugglers and fishermen. Resulting from natural processes, caves are not in themselves archaeological data or monuments, but many bear upon their walls paintings or engravings, inscriptions or representations, that can raise them to this rank. For archaeologists caves have one special advantage: their occupants are not, and seldom have been, very tidy. All too often they leave behind a good deal of litter—battered tins and broken bottles, worn-out knives and gnawed bones. Such rubbish gets trodden into the floor and buried under cave earth or fallen rock, and so preserved. On the other hand, save in very early times, caves' occupants are liable to be relatively humble folk. So the rubbish they leave behind will be anything but representative of the average level of prosperity and the real technical achievements of the societies to which the cave-dwellers belonged. If an archaeologist forgets this warning, he may take a family of tramps or a band of smugglers as typical of 19th-century Englishmen. But this defect is counterbalanced by a further advantage.

Caves may preserve a very clear stratigraphical record (1).* Some people camp on the earth floor of the cave; ashes from their fire are scattered over the floor and the refuse from their meals and broken vessels and implements get trodden into it, forming an occupation layer. When the cave is deserted, this layer under appropriate conditions will become covered with a sterile layer of stalagmite, cave earth, bats' dung or bits of rock fallen from the roof, which seals in the underlying occupation layer isolating it from the deposit which will be left above the sterile layer if men return and reoccupy the shelter. Under the cold conditions of the Ice Age sterile layers formed quickly and are generally hard and impervious. Thus in the limestone caves of Western Europe Moustierian, Aurignacian, Gravettian, Solutrean and Magdalenian occupation layers occur stratified in sequence and each neatly insulated by a sterile bed, thus giving unimpeachable proof of the order in which these industries followed one another.

Unfortunately these conditions do not always hold, and in late periods seldom do. All too often the cave-filling consists of loose earth, easily moved by burrowing animals or human diggers, or alternatively of angular chunks of rock between which artifacts may slip or be carried by rats. In such cases, as men often dig graves or other holes in cave floors and burrowing animals frequent these shelters as often as men, the stratigraphy is likely to be dis-

* The parenthetical numbers refer to bibliographies at the ends of chapters.

turbed. No conclusions should be drawn from the mere depth at which relics are found, unless an expert excavator can satisfy himself that they come from intact layers.

Since Middle Pleistocene times caves have been used for burials. Chronologically the burials must be later than the layer in which they lie; the corpses are at best those of the men who left the occupation deposits immediately overlying them, but they might of course be very much later. If the successive layers be well defined, it should be possible to decide how many layers have been cut through by a grave pit; the latter belongs chronologically to the layer from which it has been dug down.

Caves are often venerated as sacred spots. The famous grotto at Lourdes is a recent example of a practice going back at least 5,000 years. Pious visitors are wont to deposit votive offerings in such hallowed spots, and some of these, such as clay images or metal ornaments, are likely to survive. Usually no orderly sequence is to be observed in the arrangement of the offerings. But if these include types, variously dated by the stratigraphy of other sites where they occur, the oldest of them will give a date by which the cult must have begun.

Finally, the walls of many caves are decorated, sanctified or disfigured by paintings, engravings, sculptures or scratchings left by visitors or residents. The habit of scratching or scrawling one's name with a date has been ubiquitous among literate peoples since the 6th century B.C. However much we deprecate the practice today, archaeologists are apt to hail as precious historical documents the older inscriptions, even though they have been executed as light-heartedly. The palaeolithic paintings, engravings and bas-reliefs in the caverns of the Dordogne, the Pyrenees and the Cantabrian mountains are world famous; they provide unique information as to the artistic capacity, the psychology, the pursuits and the environment of palaeolithic men for the historian, and even for the zoologist an indispensable supplement to the meagre information to be extracted from fossilized bones as to the appearance of animals now quite extinct, like the mammoth and the woolly rhinoceros. Scarcely less instructive are the pictures painted or engraved on shallow rock-shelters in south-eastern Spain, northern Africa and South Africa. Only uncertainty as to their age detracts from the value of the information derivable from them. From later ages and more sophisticated cultures, too, cave walls yield priceless information, from the superb Buddhist paintings at Arjanta in India to the rude "Pictish symbols" and "Early Christian inscriptions" in coastal caves in Scotland.

The archaeological age of pictures or undated inscriptions on cave walls can occasionally be determined, or at least delimited, directly. In several French sites(2) part of a scene on the wall is covered by the occupation deposit on the floor. In two others, fragments of the scene have split off the wall and been found embedded in an occupation deposit on the floor. In either case the picture must be as old as, or older than, the deposit that covers it or in which parts of it are embedded. The deposits in question luckily comprise types that can be precisely classified chronologically and so dated. Usually, however, for dating parietal art and rock-pictures we have to rely on comparisons of the weapons, costumes, ornaments and other artifacts depicted with types directly dated archaeologically or from written sources.

The relative chronology of the pictures in a single cave or province can, however, be determined directly. Often artists at different periods of archaeological time used one and the same rock surface as their canvas. If the several designs were painted, their relative ages can be determined by stratigraphy. Close scrutiny may disclose layers of colour that form parts of distinct pictures overlapping one another in places. The bottom layer belongs to the oldest design, those painted over it must be later. By this means Breuil was able to establish a regular sequence of styles of painting in the Franco-Cantabrian region. Stratigraphy has no meaning in reference to engravings. But when two or more pictures are superimposed on the same rock surface, it is often possible to decide which line cuts through a line already incised. The latter belongs to the older of the two pictures.

2. Houses and Settlements

After all, most people live, and have lived since Upper Palaeolithic times, in artificial shelters built of turfs, mud, brick, wood or stone. No doubt before 1940 it was generally believed and confidently repeated in popular books that prehistoric men, including the "Ancient Britons" as late as the invasion by Julius Caesar, habitually lived in "pit-dwellings," wholly or partially excavated in the ground. Of course subterranean or semi-subterranean rooms do provide protection against extremes of heat and cold and are actually inhabited today both in the far north and in subtropical deserts. The sites of such sunken dwellings occupied during the last Ice Age have been identified in Russia and Moravia. But most of the "pit-dwellings" (*Wohngruben, fonds de cabane*) of earlier writers, whether cut in the chalk of England or sunk in the löss of Central Europe, are now considered by all competent authorities to have been only silos, clay-pits, rubbish-pits, pigsties, or at best weaving-sheds. The last-named would take the lower ends of the warp strands which were hung on a vertical loom and stretched by stone or clay weights; these should be found on the bottom of the pit and identify its function.

The walls of prehistoric, as of later, houses normally rose above the ground surface and should be recognizable by archaeologists even when they have been razed or collapsed. But their traces differ according to the material of which they were built—mud, wood, stone or brick. Houses' floors were less variable, and the recognition of floors is crucial in the excavation of a domestic site if only for its chronological implications. Of course if the floor was paved with flag-stones, tiles, baked brick or mosaic, it can be easily recognized, but even flags were sparingly used in the past, and tiles, marble or mosaic pavements are peculiar to civilized, literate societies, and even among them are generally confined to the mansions of the rich or to public buildings.

Wooden floors were far less popular in antiquity than they are today and have not been recorded from prehistoric times; for the floors of lake dwellings were of clay, though this was laid on a platform of horizontal timbers (not planks). So the floors in most archaeological sites, as in peasant houses in Ireland or the Balkans today, are just earth. Such earth or clay floors are quite hard to identify in an excavation. Being stamped hard, they can with luck be felt by an excavator working with a trowel, but a spade would cut through them unnoticed. If the floor be not too well swept, a thin layer of ashes or scraps may distinguish the floor surface and show up even in section. In moor villages round the Alps, where house-floors had repeatedly to be renewed owing to the damp, birch bark was laid down as a damp-course under each clay floor. A vertical section may expose a dozen clay floors one above the other, each neatly separated from the next by the thin black layer of bark. The beautiful stratigraphy thus provided has not been much used for the chronological classification of relics. For the marsh villagers not only swept their floors, but actually scraped away the dirty surface before laying down the bark basis of the next floor(3). Round the hearth, however, the floor is likely to be superficially baked. Then the resultant hard red surface should give a clue to the general floor-level.

An even better guide may be given by objects standing on the floor or constructions raised above it. A living-room, save in hot climates, is almost sure to contain a hearth paved with flags or pebbles or framed within a baked-clay moulding or a kerb of stones. In very cold climates a clay oven, too, likewise baked, may stand on the floor. Its base will provide a recognizable point on floor-level. This can also be inferred from the position of a stone or brick threshold or of the *socket stone* on which the door was pivoted. (Hinges were a late invention; previously a projection from one bottom corner of the door rotated in a socket in the threshold or in a stone set flush with it, while the corresponding projection from the top corner was hung in a loop of thong or metal.)

For house walls compacted mud, generally mixed with pebble or straw, is an admirable building material in a dry climate, and the ruins of houses built therefrom leave archaeologists a lucid stratigraphical record. During building, of course, the material must be wet enough to be plastic and to allow successive courses to stick together, but, exposed to the sun, it will harden and solidify. Thus used, the material is termed, even in English, *pisé* or *adobe.* If the lumps of mud are first moulded in the hands to a suitable shape and then allowed to harden in the sun before being put together, we have already *bricks,* but so far only *hand* bricks. Better results are obtained if all the lumps are reduced to the same shape by pressing them, while moist and plastic, into a wooden frame. The results, like hand bricks, are termed *mud bricks* to distinguish them from bricks baked in a kiln. The latter were indeed used as early as 3000 B.C., but only for palaces and temples. In a dry climate, kiln-fired bricks are an unnecessary luxury, consuming needless labour and much scarce fuel.

Mud bricks are laid in moist mud mortar and the wall surfaces are generally smeared over with coats of mud plaster that may subsequently be whitewashed or painted. Provided the wall tops are protected by broad eaves of thatch, stone slabs or tiles, a mud or mud-brick house will stand for a couple of generations, perhaps even for two centuries in a dry climate. Throughout South-western and Central Asia mud brick is still, and always has been, the normal material for house-building. Where the rainfall is rather heavier, as in parts of Turkey and the Balkan Peninsula, the wall foundations must consist of two or three courses of stone supporting the brickwork.

Many early bricks, though formed in a mould, are quite unlike ours in shape. The earliest bricks used in Mesopotamia were flat like tiles. Then, in what is termed the Early Dynastic period, say 2750 to 2350 B.C., these were replaced by so-called *plano-convex bricks,* flat on one face, but cushion-shaped on the other. Such were frequently laid, not horizontally but obliquely with each alternate course sloping in the opposite direction. Each pair of courses thus looks like a horizontal herringbone. Stones were sometimes laid in the same way, producing *herring-bone masonry,* which was employed round the Aegean in the Early Bronze Age and can still be seen in dry-stone dykes in Spain and Cornwall. But herring-bone brickwork was not intended to be seen, but was masked by the mud coating.

A compact cluster of mud or mud-brick buildings occupied for many generations constitutes a classic instance of a stratified site(4). Eventually walls of these materials decay and relapse into shapeless mud. By then the ground-level outside will have been raised by the accumulation of the refuse habitually thrown into the narrow alleys separating the houses. The decaying walls can then be razed down to the new street-level and their remains, being simply earth, spread over the old floor and stamped flat. The surface thus prepared serves as the floor of a new house whose walls will rise above the new street-level more or less vertically above the first house. The repetition of this process produces an artificial hill, commonly termed a *tell.* (This is an Arabic word; a tell is locally called a "hüyük" in Turkey, a "tepe" in Iran, a "maghoula" or "mogila" in the Balkans and a "kurgan" in Central Asia, but the last two terms are used also for burial mounds.)

The plains of the Balkans, South-western Asia, Pakistan and Central Asia are quite thickly studded with mounds, representing the sites of cities, towns or hamlets, and they can still be seen growing up in Iraq and India. Some achieve imposing elevations: Tepe Gawra in Kurdistan rises 100 feet above the plain. Such heights are, however, abnormal, and their summits generally turn out to have been occupied by citadels or holy places. In a tell, archaeologists can find, neatly arranged in the right order one above the other, relics and monuments distinctive of successive periods. Here consecutive volumes of the archaeological record are stacked in stratigraphical order. Yet the recovery of these volumes by the excavation of a tell presents unexpected difficulties and traps.

Mud walls and mud bricks, being just earth, are extremely hard to distinguish from the formless earth from which they have been formed, into which they decay and in which they are found embedded. Experience alone can reveal the subtle differences in texture and colour by which the distinction can be made. On a neatly levelled and clean-smoothed surface, such as will best disclose the plan of a wooden house, stumps of mud walls will not show up at all unless perchance one or both faces of a wall be painted. Then the wall top should be marked by a very thin white or coloured line (or a pair of such) just discernible on a well-cleaned horizontal section. It was thus that the very early "White Temple" at Erech in Mesopotamia and its predecessor were discovered.

Secondly, the earth from which mud bricks are made or with which spaces between wall stumps are filled is liable to comprise relics left by earlier occupants of the site, which may thus be raised far above the level to which they historically belong. For instance, the earliest farmers in Mesopotamia made and broke thousands of painted pots, and vast numbers of pot-sherds are still to be found lying about the sites of their villages. Some of these sherds did in fact get incorporated in the mud used for much later buildings—the White Temple at Erech is a case in point. They are thus found in strata representing periods long after such pottery had gone out of fashion.

Finally, in a tell even more than in a cave an excavator must remember that men can—and indeed in this case must—dig wells, refuse-pits, drains or graves below the ground surface on which they live, so that, falling down these holes, things the diggers used or wore may be found on the same level as objects that had long become antiquated. Ideally the excavator(5) should follow floor-levels, recognize the mouths of wells or grave-pits, and assign the latters' contents to the level from which they have been dug down. But that method of excavation consumes much time and money.

Some information can be secured much more quickly and cheaply by sinking a test pit(6) through the several levels of a tell, keeping together relics found at the same depth (generally in the same half-metre below an arbitrary datum). From such an excavation conclusions can be drawn as to the stratigraphical sequence only of relics numerous enough for statistical treatment, i.e. represented by several hundred specimens each. Suppose, for instance, that three styles of pottery, A, B and C, had been successively current among the occupants of a site. Sherds of ware A will be recovered from all levels, but 80 per cent. of them will have been concentrated in the bottom level. Similarly, some sherds of ware C will have worked down from the top and may account for 5 per cent. from the bottom, though 75 per cent. have been collected from the top level. Of ware B 15 per cent. may come from the highest level, 70 per cent. from the middle and 15 per cent. from the lowest. These figures afford satisfactory stratigraphical proof that the three styles did in fact follow one another in the order A, B and C. Thanks to the large numbers available, the displacement of individual specimens can be discounted. As to a single seal or an isolated pin from, say, the middle level, there is no guarantee that it had not been incorporated in a brick made from older occupational rubbish or slid down from above in a drain or a mouse-hole!

Wood is the most convenient and suitable building material where the rainfall is sufficient to encourage the growth of forest. But wood, of course, survives only in exceptional conditions—in deserts, where, however, trees are scarce, or in bogs. Yet in normal soils the plans at least of wooden houses can be recovered by the application of specialized techniques. The walls and roof may be supported by upright posts planted firmly in the subsoil. Even though all the wood has decayed, the holes in which the posts stood can always be recovered on a properly cleaned and levelled surface of virgin soil. (This term means the subsoil below the humus, undisturbed by the roots of grass or herbs; it is very much harder to detect *post-holes* in disturbed soil, for instance an occupation deposit.) On clean ground the post-holes should show up as dark patches or at least as patches from which rootlets project when the surrounding ground has been shaved clean of such bristles. Usually some scraps of black carbonized wood should be observable at the bottom of the hole, while packing stones will have been rammed in round its sides. For a post-hole should mean the hole dug to receive a post; the impression of a post rammed down vertically into the earth should be termed a *post socket*. The sockets for more slender timbers can be described as *stake-holes*. Post-holes should suffice to define the outline plan of the building, though it may not always be possible to distinguish posts supporting the ridge-pole of a roof from those that support partition walls.

The space between the uprights may be walled with turfs, with mud or mud brick, with *wattle-and-daub* (i.e. interlaced withies plastered with mud or dung), with close-set vertical poles, split timbers or planks, or with horizontal planks or logs. The use of horizontal logs is often described as *log-cabin* architecture. The wattling often, the upright poles or split tree-trunks normally, are set in a narrow trench that can be detected by the same signs as post-holes. If the walls are made of, or plastered with, clay, they can be discovered only if the house has been burned. Then the clay will be fired and so made as imperishable as pottery or kiln-baked brick. The stumps of such unintentionally baked walls may be left standing, while fragments of baked mud plaster, bearing the imprints of timbers or wattle-work, should be lying about on the floor. Indeed, after a conflagration, pieces of a mud-smeared roof, fragments of mouldings that adorned the finials, such as a clay bull's head, and even wasps' nests have been preserved!

In log-cabin architecture the bottom log alone will have left a shallow impression in the subsoil, and the earth-fast uprights may be dispensed with. Instead of posts, planted in the ground, the upright supports for walls and roof may be mortised into a stout horizontal beam, known as a *sleeper beam.* If the sleeper beams rest on the ground or be embedded in it in a sleeper trench, the outlines of the building will still be recoverable by refined technique. They may, however, rest, as they do for instance in contemporary Norwegian houses, on blocks of stone. Unless these had been very regularly arranged and left undisturbed, there will be little hope of recovering the building's plan or even recognizing its existence.

If successive wooden houses have been erected on the same site, their ruins hardly ever produce accumulations of superimposed layers as those of mud houses do. There are no tells in the woodland zone of Eurasia, north of the Po valley and the Hungarian plain. Where a series of houses supported by earth-fast posts have stood on the same spot, the surviving result is just a maze of post-holes. A close scrutiny of detailed plans may disclose groups of holes that form a pattern, the plan of a single house, and therefore all belonging to one period. But, since all holes are on the same level, stratigraphy gives no clue as to the order of these architectural periods. Minute observation on the ground may disclose cases where post-holes intersect one another or cut foundation trenches. Then the order of the buildings to which the respective post-holes and trenches belong should be discoverable.

Tents or conical huts of turf may be supported by a single central post. This need not be planted in the earth, but may rest on a flat stone, leaving no hole in the ground as witness to its existence. Free-standing wooden columns, too, may rest on stone bases. The function of such stones may be disclosed by their relation to other features—for instance, if one occupy the centre of a ring of stones that could serve to anchor the flaps of a tent, or if four be symmetrically grouped round a hearth. Or again, the supporting stones may be carefully shaped to serve as column bases, as in Minoan and Mycenaean palaces.

Stone would be a more economical building material only in countries both rocky and treeless. But its greater durability and less rational considerations have invested it with such prestige that societies, adequately equipped with suitable tools, translated wood or mud-brick architecture into masonry for temples and palaces. These were copied for private houses by those who could afford such luxury.

For walls a mason could use rude boulders collected from the surface of the land, quarried slabs or dressed blocks with parallel faces—cubes or parallelepipeds. Some rocks, such as Cotswold limestone or Caithness flagstone, break naturally into flat slabs, and such slabs may be found lying about on a beach or at the foot of a cliff ready broken up into handy sizes. If these do not suffice or are unavailable locally, blocks of equally suitable shape and size can easily be prised off adjacent outcrops. Flat slabs of this kind may be laid in courses one on the other with or without clay mortar and built up into a wall 10 or more feet high. The neolithic village of Skara Brae in Orkney was built in this way almost entirely of ready-made blocks collected on the adjacent beach. Dry-stone dykes are still being built of undressed slabs, though the dyker has good iron tools. Any building of this kind for which lime mortar is not employed is called *dry-stone masonry*. The use of mortar, of course, not only helps to exclude draughts and moisture but enhances the stability and durability of a wall. Yet at Skara Brae can be seen dry-stone walls that have stood 8 feet high for 3,500 years, while the 40-foot dry-stone tower of Mousa in Shetland is at least twenty centuries old.

With good mortar it is possible to build stout and stable walls from irregular boulders or undressed chunks of refractory rock; East Anglian churches built of flint nodules show how durable such walls are. Without it, a wall of rounded boulders or unshaped stones cannot be reared to any height unless it be made unduly broad. The best results are obtained by using very large stones, set on edge or on end, as a foundation. A row of contiguous boulders set on edge, or better still two parallel rows, with rubble to fill in the chinks and level up the tops, can support enough courses of smaller boulders to enclose a low hut.

If the big blocks be set on end, they may be called *orthostats* and should be tall enough to reach the roof without any supplementary courses of smaller stones. But as the rude orthostats are not all of the same height and are anything but rectangular in profile, smaller stones must be inserted to fill gaps between their edges and level up the tops of the shorter uprights. This sort of orthostatic construction was mainly used for tombs and then is termed *megalithic*. Though etymologically this word refers to the bigness of the stones, it is conventionally confined to sepulchral monuments. For secular constructions of huge stones, such as the walls of Tiryns or Bogaz Köy, "cyclopean" is preferred.

More stable walls can be constructed without mortar if the blocks be shaped so that adjacent edges fit closely. The exposed face is at the same time generally dressed smooth. Shaped blocks are not necessarily parallel sided; archaic Greek town walls were constructed of polygonal blocks. The most durable and economical stone walls are, however, built of blocks so shaped and dressed that all three pairs of opposite faces are parallel. Laid in horizontal courses, each of which normally keeps the same width throughout the length of the wall, these give what is termed *ashlar* work (or masonry). As many blocks are of the same size and mutually interchangeable, the requisite number can be mass-produced by reference to a standard frame, thereas in polygonal masonry each block would need individual dressing to fit its projected neighbour.

Alike in ashlar masonry, in dry-stone building with undressed slabs and in brickwork, the joints between blocks in one course must never coincide with joints in the courses immediately above and below. A *straight joint,* that is a joint running vertically across several courses, is an unmistakable sign of an addition or alteration. Stone and brick walls are usually at least two courses thick. A convenient way of bonding the parallel courses is by an alternation of stretchers and headers. Every other block or brick is common to both parallel courses, being laid with its long axis at right angles to those of its neighbours in the same horizontal course. But often a core of rubble is packed in between two coursed wall faces.

Stone walls ought, of course, to be founded upon the rock. This usually involves digging a foundation trench so that the base of the wall is well below floor-level. Early builders, however, often neglected this precaution. The walls of the houses at Skara Brae are literally founded on sand, yet some have stood to a height of 8 feet or more for over 3,000 years! But nearly all stone walls rest on some sort of *plinth,* that is, one or more courses of flat slabs broader than the wall above and so projecting beyond the line of the wall face.

The collapse of a stone or brick building leaves an irregular pile of blocks that would be unsuitable ground for a new building. If such is to be erected on the old site, this debris will have to be cleared away, all intact blocks will probably be re-used in the new construction, and fresh foundations laid on the old level. If the surviving old wall footings be retained, the spaces between them will have to be levelled up with a filling of miscellaneous rubbish that may comprise objects of any date up to the foundation of the new building. Such a fill must not be mistaken for a stratified occupation deposit.

Moreover, stone and brick buildings are likely to comprise basements—cellars, magazines, crypts or dungeons—built below floor-level and mainly below contemporary ground-level. Basements are likely to be preserved, even when even the floors of nave and chancel have vanished. So ranges of narrow store-rooms are the most conspicuous surviving vestiges of the palaces of Minoan Crete, and the crypt of an early church may be found almost intact when even the floors of nave and chancel have vanished. Such subterranean or semi-subterranean structures are by no means confined to sophisticated buildings of ashlar masonry or kiln-fired brickwork. The *earth-houses* of Scotland, the *fogous* of Cornwall and the *souterrains* of Ireland and France are underground cellars and refuges, lined with dry-stone walls and roofed with stone or timber lintels at ground-level that were attached to flimsy dwellings of the Iron Age of which nothing usually survives. Three thousand years earlier very similar cellars were dug and roofed over in the predynastic village of Maadi near Cairo. Any relics found on the floor of such underground annexes must be contemporary with the buildings to which they belong. But often basements were deliberately filled in, and such a fill may contain objects later than any that could be found on the floor of the dwelling above the annexe.

Domestic sites usually consist of a number of distinct buildings. Even an isolated farm or lone steading may comprise besides the dwelling-house a byre, a granary, a weaving-shed and other accessories. Normally, habitations cluster in hamlets, villages, towns or cities. The latter at least must include in addition to dwellings one or more temples or churches, a palace or a town hall, and other public buildings. Any settlement is likely to be surrounded by some sort of defences or at least a fence to keep out beasts, and will need streets and lanes that may be cobbled, paved (with slabs) or corduroyed (with saplings or logs laid horizontally). The total excavation of a settlement disclosing the number of dwellings and the functions of the several buildings can provide unique information on the demography, economy and sociology of the inhabitants. Domestic sites, including caves, offer the best prospect of obtaining a stratigraphical division of the local archaeological record, and under favourable conditions may provide the most vivid glimpses into early life. They are not all likely to yield complete objects or attractive specimens for exhibition in museum cases. These must be sought in graves.

3. Burial Sites

The most sensational archaeological finds, the most spectacular exhibits in museums, come from pagan burials. The reader must have read of or seen the treasures from the Saxon ship-burial at Sutton Hoo, from Tutankhamen's tomb, from the Shaft Graves of Mycenae and from the Royal Cemetery at Ur. He may not know that the immense majority of Greek vases and Chinese porcelain figures, to say nothing of prehistoric bronze swords and the humbler beakers and cinerary urns, are likewise grave finds. Without these, archaeologists would seldom know what the scraps they dig up on domestic sites really were. Moreover, some grave finds give the best possible proof of association. But stratigraphical data are rarely obtainable from sepulchral deposits. It may here be convenient to distinguish graves from tombs and both from superficially visible funerary monuments. Though this distinction is not really logical and cannot be rigidly maintained, it will be followed throughout this section.

Graves are essentially holes in the ground—pits, trenches or shafts. They may be lined with mats or wicker-work, with wood, with brickwork, or with stone slabs. A slab-lined grave is technically termed a cist—or more accurately a stone cist; for the term "(brick) cist" is currently applied to brick-lined graves. In the British Isles it is customary to distinguish between *short cists* and *long cists.* The former are usually lined with four slabs on edge and covered with a fifth. They are large enough to accommodate only a contracted (doubled-up) skeleton, and here are generally attributable to our Bronze Age. Long cists are designed to take a corpse laid *extended* at full length so that a number of side slabs and cap-stones is required. Most typical long cists in these islands are Early Christian, a few Iron Age.

Deep grave-pits may be called *shafts.* Often there is a ledge in the side walls, a couple of feet above the bottom, to support a covering. In South Russian shaft graves the wooden poles serving as rafters to support the grave ceiling have often been observed with their ends still resting on the ledge. At the bottom of the shaft a niche may be cut in one of the side walls, to be the actual burial-place. Then we have what is known as a *pit cave.* But a pit cave is already a tomb; for any artificial receptacle for corpses more elaborate than a simple vertical excavation deserves this title.

Tombs may be excavated in the ground or built, wholly or partly, above ground-level. Most consist of one or more chambers entered through some sort of portal which is often preceded by a passage. A tomb was, after all, the dwelling of the dead and might patently imitate a house or a palace. Even in Christian cemeteries replicas of house fronts were popular in the early 19th century. The tomb of an Egyptian pharaoh or noble under the IIIrd Dynasty was a complete reproduction of his mansion, hewn in the living rock and provided with suites of rooms including latrines and a harem! Such a tomb was designed to house the mortal remains of a single individual, since by that time the requisite wives, concubines and attendants could be supplied magically. But equally complicated series of subterranean chambers, such as the neolithic hypogaeum of Hal Saflieni in Malta, many Bronze Age tombs in Cyprus and the Catacombs at Rome, were the repositories of multitudes of corpses. Between these subterranean mansions or labyrinths and the simple niche of the pit cave could be set a complete series of intermediate forms. Subterranean chamber tombs, the walls and roofs of which are not built, are described as rock-cut, even though the "rock" be a tough clay.

The portals of rock-cut tombs are often elaborately carved, for example, to imitate a wooden doorway. They could be blocked with a heavy stone or with a genuine door. Unless the tombs be hewn in the face of a vertical cliff, access had to be provided down a *dromos* (a sloping passage or ramp) or a stair. Regular flights of rock-cut steps led down to Egyptian tombs as early as Dynasty I. On the other hand, where, as in Cyprus, a very thin rock roof will hold, a vertical shaft with a single ledge to serve as a step sufficed, which brings us back to the pit cave. The mouth of the entrance passage or stair might itself take the form of a portal. More usually it was carefully concealed and the whole passage or stair blocked with rubble.

Where the subsoil or local rock does not permit of the excavation of subterranean chambers, a tomb could be built at the bottom of a large shaft or in a wide trench driven into a hillside. In the Royal Cemetery at Ur(7) a simple chamber of mud brick or limestone was built for the "king" or the "queen" at the bottom of a huge pit entered by a descending ramp. The bodies of attendants as well as the hearse and other gear were left on the pit floor outside the chamber and the whole pit filled in. So, too, mortuary houses of logs were erected at the bottom of shafts for Hallstatt chieftains in Central Europe, for Scythian kings in South Russia and for princes in the Altai (8). In many cases much of the timber has survived in the moist soil, while in the Altai the whole structure, together with carpets and hangings, has been preserved on ice. (Incidentally, such tombs illustrate the sort of timber construction that could serve to house the living at the period in question.) Stake-holes in the floor of the grave shaft alone survive to show that some Bronze Age chieftains in England and South Russia had been laid to rest in mortuary tents or huts. The directions of the holes show that the poles had converged on the apex of the erection.

Mortuary houses could just as well be built of wood or on a wooden frame above the ground, and traces of them have in fact been detected under barrows, for instance in Holland, Switzerland and Scotland. Conversely, some of the stone-built chambers next to be described were in fact built in trenches or shafts or in open cuttings into a hillside. Some of these stone chambers are currently described as cists and conform to the definition given on page 61, save that they are provided with doorways or portholes. Being, however, subterranean but not provided with any dromos or pit of access, it is evident that the "entries" were just *dummy portals,* the corpses having been introduced by raising the roofing slabs or capstones as in a normal cist.

The most celebrated and conspicuous built stone tombs are those classified as megalithic(9). Originally applied to burial chambers walled and roofed with gigantic blocks of undressed stone, which can now be qualified as *orthostatic,* cf. page 58, the term has been extended to cover chambers of identical plan but walled with coursed rubble masonry and roofed by a false vault. All the tombs in question are believed to have been originally put underground artificially by being covered by a mound of earth or a cairn of stones, though in many cases no trace of the covering mound is superficially evident today.

Megalithic tombs have been traditionally divided on the basis of plan into dolmens (Dan. *dysser*), passage graves (Fr., *dolmens à galerie,* Ger., *Ganggräber*) and gallery graves or long stone cists (Fr., *allées couvertes,* Swed., *hällkìstor*).

Dolmens should be formed of four uprights supporting a single cap-stone, and so differ only in the magnitude of the stones from cists. In fact, the Danish dysser were originally designed to contain a single extended corpse. Dolmens are the simplest form of megalithic tomb, but only in Denmark do they seem to be earlier than other types.

In a *passage grave* the chamber should be wider and higher than the passage through which the corpses were introduced. In *gallery graves* the chamber is itself long and narrow and preceded only by a shallow porch or antechamber usually of the same width. The significance of the distinction should not be exaggerated, and the attribution of a tomb to one or other group is often a matter of taste, as, for instance, with Daniel's "undifferentiated passage graves" or his "transepted gallery graves." Niches or cells may open off the main chamber in both types of tomb. Sometimes at least such niches served as the actual receptacle for the corpses. Or the body may have been deposited in a grave cut in the chamber floor.

In a special form of passage grave, classically represented in Portugal and termed by Daniel a "Pavian passage grave" after a cemetery in that country, the chamber is a regular polygon. Translated into coursed rubble masonry, such a chamber will be circular in plan and, being roofed by corbelling, assume a beehive shape. Such beehive tombs have been traditionally described as *tholoi*—a Greek word originally applied to beehive chambers or rotundas that were not sepulchral in function. Tholoi occur in Spain and Portugal side by side with orthostatic passage graves. But the most celebrated tholoi are those of Mycenaean Greece. Most of these are built in fine ashlar masonry, and some, like the "Treasury of Atreus" at Mycenae, were provided with ornate portals. (Part of the portal of this tomb was carried off by Lord Elgin and is now in the British Museum!) Beehive tombs, identical with tholoi in plan, were also hewn in the rock—for instance, in Sicily. Indeed, most varieties of megalithic tomb have been reproduced in rock-cut chambers. Opposing schools of prehistorians have variously assigned priority to rock-cut chambers, corbelled tholoi, or orthostatic passage graves, or have sought to show that the method of construction was conditioned by local geological formations. None of the conflicting theories has won universal acceptance.

Chamber tombs are by no means exclusively prehistoric. The Holy Sepulchre itself was obviously a normal rock-cut tomb. Many beehive tombs of ashlar masonry or baked brick were built in Classical, Hellenistic and Roman times, if not in Old Greece, in Etruria, Thrace, Anatolia and round the Black Sea. Even orthostatic building was practised in historical times, though peoples civilized enough to write were generally able to dress the orthostats that are megalithic in size but not in rudeness.

The walls of megalithic tombs were occasionally, especially in Brittany and Ireland, embellished with carvings, engravings or paintings. The themes are highly schematized representations of faces, breasts, axes, daggers and the like, or purely "geometric" patterns such as spirals and lozenges. In historical times tomb walls were decorated with more lively paintings or realistic sculptures. Egyptian tomb paintings are familiar; Etruscan, Thracian and Scythian tombs, too, preserve many fine and instructive scenes.

The portal of a chamber tomb, as we have seen, was the object of special attention. Detailed descriptions would be irrelevant here. But one peculiar type of entrance, associated with megalithic tombs (including tholoi) in Sweden, the British Isles, northern France, southern Spain and Portugal, South Italy, Bulgaria, the Caucasus, Syria and peninsular India deserves mention. A port-hole stone is a slab, forming one end of a megalithic tomb or interrupting the entrance passage, in which has been nearly carved a round or sub-rectangular aperture through which access to the chamber might be obtained. (The aperture may also take the form of a spacious notch in the bottom edge of a slab, as in the front of a dog kennel, or of semicircular notches carved in the proximal edges of a pair of slabs.) In Western Europe port-hole stones may give access to any type of megalithic tomb, though most commonly to gallery graves, only to megalithic cists (dolmens) in the Caucasus and India. In the latter regions the apertures are generally too small to admit a living man or a fleshy corpse, but farther west they could be traversed by undertakers conducting interments in the chambers.

The contrast between tomb and monument is admittedly illogical. A barrow—an earthen tumulus or a cairn of stones—is undeniably a monument. But most built chamber tombs were covered by a barrow, and it often formed an integral part of the tomb and played a distinctive rôle in the funerary ritual. The entrance to a megalithic tomb in the British Isles, for example, quite often opens on to a semicircular *forecourt* delimited by a built wall or an arc of orthostats that at the same time forms a façade and a revetment to the mound. For purposes of exposition, however, barrows can be described in general without reference to the tomb they cover. Most barrows, indeed, do not cover a tomb in our sense at all, but a simple grave or even a body laid on the ground surface or the site of the funeral pyre.

Barrows, including under that term both mounds of earth and cairns of stones, may be round or long, though the immense majority fall into the former category. Some *long barrows* are just long enough to cover an elongated chamber tomb such as a gallery grave, but many in Britain and Poland are far longer than was needed for that purpose, while in Denmark and North Germany simple dolmens have been buried under elongated rectangular tumuli. Perhaps no barrow was just a heap of earth or stones piled up anyhow. Many have been shown by excavation to have been constructed on a formal plan with care and with ceremony. The mound itself may be sustained by a built wall of sods, stones or bricks or by a series of stone orthostats or wooden posts or by two or more concentric lines of walling or of uprights. Whether the walls or uprights were visible in the final form of the monument is a matter for discussion in each individual case; today they are generally masked by earth or rubble. A ring of stone uprights is technically termed a *peristalith* ("peristaxyl" should be, but never is, used for posts), while a supporting stone wall is known as a *crepis.* The crepis round the base of historical tumuli is generally built of ashlar masonry that may be relieved by pilasters or even a sculptured frieze. The mound, even if composed mainly of earth, may be covered with white quartz pebbles, a layer of stones or a facing of ashlar masonry. Its summit may be crowned by a wooden pillar, an upright stone or a sculptured construction. A Buddhist stupa reproduces, as a stone or brick shell, the surface appearance of an ornate round barrow, though its hollow vault cover only a minute fragment or symbol of a corpse.

An earthen barrow may be completely or partially surrounded by a ditch or fosse. This served as a quarry to provide material for the mound, but doubtless has a ritual significance too. Indeed, a ring ditch round the central burial is sometimes found entirely covered by the barrow. English archaeologists(10) distinguish several kinds of ditched round barrows. A *bowl barrow* rises directly from the inner lip of the encircling fosse. In a *bell barrow* a flat space, the *berm,* intervenes between the ditch and the mound's foot, while there may be a bank outside the ditch. In a *disk barrow* the earth from the ditch forms a bank outside it, while one or more minute mounds cover interments in the level area encircled by it.

Finally a *pond barrow* is not a mound at all, but a shallow saucer-shaped excavation in the chalk the spoil from which has been heaped round the rim to form a low circular bank.

After a barrow has been heaped over the original or *primary interment, secondary burials* may be intruded into it. The latter are likely to be, as a rule, at a higher level than the primary or farther from the centre of the mound. Barrows are often found to have been enlarged, sometimes more than once, to accommodate secondary burials. Discovery of the relations between primary and secondary interments, and among the latter in a barrow, is the main contribution towards the establishment of relative chronology to be anticipated from the excavation of a burial site. It must not be assumed, however, that a barrow will offer a straightforward stratigraphy. The shaft for a rich and influential chieftain's grave may well be dug deeper than that of a poorer predecessor and may displace the latter's remains at the barrow's centre. To supplement and correct inferences from the spatial relation between burials, the excavator should be on the look-out for intersections of grave shafts and should try to determine from what level in the mound the pit has been dug down. Additions to a barrow will, of course, appear in section as layers superimposed on the surface of the original mound and on one another in stratigraphical order. A burial can hardly be older than the layer in which it is found, but may be later.

Barrows are, apart from simple tombstones, far the commonest and most nearly universal type of funerary monument. The pyramids of Egypt(11) are, on the contrary, easily the most celebrated. In origin the pyramid is not a magnified and glorified barrow (though it has been argued that the pharaohs' monuments of dressed stone or brick inspired the cairns and tumuli of barbarians), but developed out of a quite different structure. Above the shaft graves of the earliest pharaohs and their nobles were built rectangular mud-brick constructions, now termed *mastabas,* enclosing store-rooms filled with the funerary equipment of the deceased. The outer walls of a mastaba were not pierced by any genuine door, but were decorated with alternating buttresses and recesses, imitating perhaps the façade of the pharaoh's wooden palace. One recess, painted as a dummy portal or false door, served as a mortuary chapel where offerings were made. The whole was surrounded with a mud-brick wall. Under Dynasty III the mud-brick mastaba was translated into masonry which generally included an enlarged mortuary chapel and the original enclosure wall. The Step

Pyramid, designed for Zoser, last king of that Dynasty, may be regarded as four mastabas of diminishing sizes, piled one on the top of the other! His successor, Cheops of Dynasty IV, established the classic form. Ceremonial boats were buried in specially constructed graves beside both the earlier mastabas and pyramids.

Inasmuch as a mastaba served as a store-house for grave-goods and formed an integral part of the tomb, the furniture stored in it is contemporary with that deposited in the subterranean burial chamber at the time of the interment. This statement does not extend to the contents of the mortuary chapel, since offerings laid there must be later than the burial. The same remarks apply to the various kinds of overground monuments, combining the functions of tombstone, altar and perhaps even sepulchre, such as are common in Greco-Roman and later times.

Graves and barrows, rock-cut and built chamber tombs very often cluster together in cemeteries. But among some communities it has been the custom to bury the dead under, or close to, the houses in which they had lived. Such burials are usually in simple graves, but in South-western Asia chamber tombs were built or cut in the rock beneath the houses of prosperous townsmen. Then you had only to raise a slab in the floor to be with your ancestors! The practice of burying infants under house floors was still more widespread.

Whether buried in a grave or tomb, the corpses might be wrapped in mats or skins, enclosed in a coffin of wicker or planks, in the hallowed-out trunk of an oak tree, in a stone sarcophagus or in a large jar. (Any large jar was called a *pithos* in Greek, but in other countries archaeologists confine the term to burial jars.) Cremated bones were usually, but not always, enclosed in a smaller vessel of pottery, metal or stone, termed a *cinerary urn*. A cemetery of cinerary urns is described as an *urnfield*. An oak-tree coffin from the Bronze Age barrow of Loose Howe in East Yorkshire was shaped like a dug-out canoe, and a few other oak-tree coffins are boat-shaped if not boats. Rather later, in Sweden, the actual grave was surrounded by a boat-shaped setting or kerb of stones. Finally, in the Migration period and in the ensuing Viking Age, rulers and nobles were buried in actual boats with full gear. The ship burials found at Oseberg in Norway and at Sutton Hoo in Suffolk are world famous. The ships were usually covered with a barrow, but with the decay of the timbers the mound has sunk and is not usually very imposing today.

If a barrow cover several graves, it is generally possible to determine the relative order of the interments. In a cemetery of flat graves there is usually no stratigraphy at all. On the other hand, each grave, whether under a barrow or not, contains a single interment. For when two skeletons, equally undisturbed, are found together in the same grave they must have been interred simultaneously. (Male and female skeletons thus juxtaposed are generally interpreted as cases of *sati,* suttee. Hence the grave goods from a single grave are all archaeologically contemporary and offer a classic instance of association. Chamber tombs, too, may contain the remains of a single person, as was the case in Egypt, and then their contents may be regarded as equally well associated. On the other hand, most chamber tombs were "family vaults" and contain *collective burials,* having successively received over many generations the deceased members of a family, a lineage or a still wider group. So chamber tombs may contain the skeletons of a hundred or more individuals, and so may caves; for natural caves were quite often used as collective sepulchres. The relics from such tombs are obviously not all contemporary, and only rarely do the positions of the grave goods in the tomb disclose their relative age in the succession of interments. Moreover, ancient chamber tombs were at times subsequently turned into cult places. So Greeks of the Archaic period instituted hero cults in some Mycenaean tombs, while the Gauls of the Roman period deposited votive offerings in the neolithic passage and gallery graves of Brittany. Finally, tomb-robbing had been a regular and profitable industry in Egypt from the dawn of written history, while barrows have everywhere attracted the attention of plunderers. Flat graves and rock-cut tombs, the entrances to which have been shrewdly concealed, are the most likely to escape intact. But for this very reason the discovery of intact graves by archaeologists has generally been accidental. If the excavator be not so fortunate, he must discount the relics left by the earlier robbers.

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Chapter 4

Hints on the Recognition of Monuments in the Field

ARCHAEOLOGISTS ARE repeatedly asked, "How do you know where to dig?" Really many, if not most, archaeological sites (other than palaeolithic deposits) are marked by some surface feature, observable by the unaided eye, in fact, by mounds or holes in the ground. Moreover, these surface indications are calculated without excavation to give an expert some guidance as to what sort of monument they indicate and so what may be found there by digging. Hence it may be helpful to give a few hints as to the inferences to be drawn from the commoner archaeological phenomena the reader may observe in walking over the British countryside. *Earthworks,* relatively soft and often grass-grown excrescences and depressions, have traditionally been contrasted with the harder heaps of stones that may mark the sites of masonry structures or of cairns. It will be convenient to follow this usage, though it be not very logical, and to begin with earthworks. These may be divided into simple mounds, mounds elongated in one direction, or banks and hollows.

1. Mounds

An approximately circular mound may be a natural hummock left by the glaciers and ice-sheets that once covered Scotland and Wales and most of northern England. If artificial, it is most likely to be a burial monument, in fact a barrow. But the ambiguity of the native names "kurgan," "maghoula" and "mogila" should have warned the reader that superficially a tell, formed by the accumulation of occupation layers, is scarcely distinguishable from a burial tumulus. In practice a tell is likely to be relatively lower and less regular, and its surface, if not too thickly grassed, is sure to be strewn with potsherds and similar artifacts.

Genuine tells do not occur in the British Isles. But on the level peaty surface of drained marshes, for instance near Glastonbury, very low round mounds do mark the sites of circular huts belonging to lake villages(1). The hut floors were of clay, spread on a platform of logs or saplings that rested ultimately on more or less spongy peat. As the whole was gradually sinking or as the water table was slowly rising, the floor and ultimately the substructure needed periodical renewal. In the end a mound as much as 6 feet high might accumulate. In so far as water-level rose to submerge it, the wooden substructure will have been preserved. Above water-level only the successive layers of clay survive, and these are best preserved and thickest round the central hearth where the clay has been baked.

These little mounds are not likely to be mistaken for barrows, but *mottes* do look very like big and recent barrows. Now barrows were generally surrounded by ditches; tells never are. But mottes are always encircled by a moat. *Motte*(2) is just a corruption of Latin *monte*(*m*) and means an artificial mountain, and, like tell, the name is well deserved. Mottes are always flat-topped; for on the summit stood a wooden tower, surrounded by a stout palisade. The mound consists entirely of earth that has been disturbed and lacks stratification. Yet on the top, under favourable conditions, a skilled excavator can detect the holes for the posts that supported tower and stockade. Often, indeed, the woodwork has been replaced by mortared masonry. For mottes were built by the Normans, and the immediate precursors of the stone *keeps*, many of which still may be seen crowning a motte. If any remains of the keep survive, there can be no uncertainty as to the functional classification of the mound. Otherwise a motte by itself might easily be mistaken for a large barrow. But a motte never stood by itself. At its base was always a larger enclosure, termed a *bailey,* and the rampart and ditch surrounding this can always be discovered, though they are liable to be badly overgrown or damaged by ploughing.

English monuments include not only round, but also long mounds, in fact long barrows. These mounds, varying in length from 90 to 300 feet, were composed of material dug up from substantial ditches that run parallel to the long sides. This feature helps to differentiate long barrows from the remains of more recent archery butts. Now a mound, if sufficiently prolonged, may be called a bank. And in contrast to a mound a bank may enclose a space.

2. Enclosures

Any area defined by a bank or banks may be termed an *enclosure.* Usually there is a ditch running along the foot of the bank. It probably provided material for the bank but, if dug outside the bank, the ditch would serve as an additional obstacle to entry into the enclosure. Provided, then, the ditch be outside the bank, the enclosure may be classified as "defensive," designed to exclude wild beasts or stray cattle if not human foes.

There is, however, in Britain an important class of monuments in which the ditch is inside the bank. It would therefore be a handicap to any defenders. So such monuments are usually regarded as "ritual." Most are circular in plan and comprise bell barrows, disk barrows and *henges* (3). In the latter the central area is flat unless its surface has been interrupted by one or more rings of upright stones (as at Avebury) or of posts (as at Arminghall, near Norwich). In contradistinction to funerary monuments, the bank and ditch are interrupted by one or more gaps and causeways serving as entrances. Atkinson divides henge monuments into two classes: class I having one, class II two, entrances. Several class I henges have proved on excavation to have been used as cremation cemeteries by (secondary) neolithic communities. Though their original function may not have been funerary, some urnfields of our Late Bronze Age were encircled by ditch and bank, slighter and narrower than in neolithic henges. Circular churchyards may thus perpetuate a native tradition going back to a pagan Stone Age, as Hadrian Allcroft long ago suggested. Class II henges are attributed to our Early Bronze Age, but their precise function is even less certain.

Roman signal stations in plan are disconcertingly like class I henges. They are marked superficially by a penannular ditch the upcast from which has been heaped outside it. Collingwood believed that the ditch was primarily for drainage; it is never very formidable. The area enclosed measures 30 to 40 feet across. At the centre once stood a square tower of timber or stone. In the latter case its foundations may still be felt if not seen. Remains of a Roman amphitheatre, an indispensable adjunct to any self-respecting municipality throughout the Roman Empire, are less likely to be confusing. At Dorchester (Dorset), indeed, a prehistoric henge monument was adapted for use as the local amphitheatre (Maumbury Rings), the internal ditch being filled up. But usually amphitheatres were not circular as henges, but oval in plan with gaps at both ends and diameters of the order of 260 by 220 feet.

A penannular bank (that is, a ring interrupted by a single gap), unaccompanied by any obvious ditch and 20 to 40 feet in diameter, is likely to be a *hut circle*. The bank represents the low wall of turves, clay or earth and stones on which rested a presumably conical roof. Excavations in such structures have revealed a central hearth, a drain under the floor running out from the centre through the entrance gap, or a drainage trench under or just outside the bank, such as are dug round tents today, and holes for door jambs and other posts. The best-preserved hut circles are to be found in rocky country, and their walls are composed partly of stone. The bank is faced outside, and often inside too, with boulders set on edge close together. These sustain a core of rubble mixed with earth or turves. No hut circles are demonstrably older than the Iron Age; some may be even medieval.

The term *rath* is applied to circular earthworks, resembling hut circles and class I henges in having only a single entrance, but differentiated from the first by their larger size—50 to 500 feet diameters—and from both by an external ditch that must be "defensive." Some raths are encircled by two or even three concentric rings of banks and ditches. Raths are extremely common in Ireland and are encountered also in the lowland parts of Wales, Scotland and Man. Their sites seldom seem to have been chosen with an eye to defence, but are normally low lying, sometimes indeed overlooked by higher ground. It would seem, then, likely that a rath enclosed and protected the dwelling of a prosperous farmer or rancher who might be a local chieftain or even a king in the Irish sense. In fact, within many Irish raths the foundations of a house or at least a souterrain have been found that must have been connected with an overground dwelling.

Dr. Bersu(4) has, however, argued from his excavations of several raths in the Isle of Man (with diameters of 70 to 90 feet) and of Lissue in Ulster (diameter 150 feet) that the (inner) ring bank was not the wall of a farmyard, but the actual outer wall of the farmhouse itself, on which rested the ends of the rafters supporting a roof that covered the whole interior. The external ditch would have served primarily as a quarry for the material of the wall and for drainage, but not for defence. British and Irish authorities are not inclined to accept generalizations from his observations at three or four sites, especially since Jope has traced the outline of an independent house within another Ulster rath. Some Irish raths seem to go back to the local Late Bronze Age, but most prove to be sub-Roman or Early Christian. Very similar circular earthworks have been recorded in Denmark and Sweden and are there regarded as defensive.

An example excavated at Trelleborg on the Danish island of Zealand proved to be a fortified camp where the young sailors of the Viking fleet were quartered in boat-shaped houses each accommodating the crew of one long-ship.

Rectilinear earthworks are commoner, more varied and consequently harder to diagnose by inspection. Some, despite an external ditch, can only be classed as ritual. The most curious are the so-called *cursûs*(5) (*cursus* is a Latin noun of the fourth declension, so that its plural is *cursûs*, but readers inured to riding in omnibuses may not mind watching races in cursuses!). They seem to be confined to the British Isles. Indeed, up to 1955 no examples have been reported north of southern Scotland. In British archaeology cursus means a long, but relatively narrow, strip of ground bordered on both sides by parallel banks with external ditches that return to meet at each end. The name was given to the Stonehenge example, long the only one recognized, by Stukely, who imagined it to have been a stadium in which ceremonial chariot races were held. Though it is not now believed that chariots were available in Britain when cursûs were being built, no more satisfying explanation has been offered. The Stonehenge cursus is 3,030 yards long and 110 yards wide, but that in Dorset, though only 60 feet broad, can be traced running up and down lowland ridges and intervening combes for 6 miles! Of course such an earthwork could not be recognized as an "enclosure" except from the air. In the light of the meagre finds from two small excavations and of their relation to long barrows, it is believed that cursûs are of the same age as class I henges, i.e. (Secondary) Neolithic.

Apparently confined to Wessex and belonging there to the Late Bronze Age are distinctive trapezoidal enclosures, frequently connected with *hollow ways.* They seem to have been primarily cattle kraals, but the foundations of rather flimsy round huts have been found in some excavated examples.

Rectangular enclosures with an entrance in the middle of one long side or with two entrances centrally situated on opposite sides are likewise regarded as cattle enclosures, but of Roman date. The rectilinear plan might have been inspired by Roman military architecture. But rather similar rectangular earthworks (termed in German *Viereckschanze*) had been built by still free Celtic tribes in Gaul and Central Europe. So the idea may have been Italo-Celtic, introduced into Britain well before the annexation under Claudius. Here it outlasts the Romans. Early medieval *moated manors* recall our cattle enclosures in plan, but the ditch is often filled with water, a wet moat.

The most imposing rectilinear earthworks are monuments of Roman military engineering—marching camps, semi-permanent camps, fortresses and forts. Ideally all should be in plan rectangles with rounded corners, but departures from this standard, dictated by the natural contours of the site, are not unusual in camps and fortresses. In all, the sides are straight and the entrances, four in number, are always placed in the middle of a side. All are protected by a ditch (*fossa*) and, separated from it by a level space, the berm, by a bank (*agger*) that served as the basis for a stockade, the *vallum*. Often the ditches were duplicated, and at Ardoch in Perthshire no less than six parallel ditches protect the exposed side. The entrances were often further strengthened by *claviculae,* mounds so placed as to bar direct access to the gate and compel anyone approaching to turn and expose his flank to the garrison.

Marching camps were theoretically constructed wherever the Roman army on campaign bivouacked for a night. The works were therefore rather perfunctory and are likely to be much effaced. *Semi-permanent camps* were occupied during a whole campaign or a siege (like those round the native *oppidum* of Burnswark in Dumfriesshire). Fortresses were permanently garrisoned by a detachment, while forts offered quarters to a whole legion. In Britain forts may occupy 2½ to 9 acres. In both types traces of platforms for artillery (*balistae*) may be discerned along the ramparts. These are sometimes constructed of stones and mortar, but the masonry is seldom visible without excavation. In forts stood substantial buildings—granary, bath-house, headquarters office, which, however, are not superficially visible.

Hill forts present a complete contrast to the strict regularity of Roman military works and for that matter of British ritual circles. Their sites have obviously been selected with a view to defence, and the protective earthworks take full advantage of the accidents of the terrain to accentuate the difficulties of an assault. In other words, they follow the contours, and this accounts for their irregularities in plan. Within the class it is useful to distinguish *promontory forts* from *hill-top forts*. In the former the defended area occupies the tip of a spur the sides of which are so precipitous as to be virtually unassailable. The only earthworks needed are therefore ditches and banks across the neck joining the extremity to the main ridge. Otherwise the defences do not differ in structure and the arrangement of gates from those completely surrounding a hill-top.

The defences usually comprise both a bank or rampart and a ditch or fosse outside it. If the fosse be missing, the rampart will generally turn out to have been a stone wall even though no masonry show through the turf. But even when the rampart is a true earthwork, it must not be assumed that it originally presented to an assailant so gentle a slope as its exterior appears to be today. Many earthen ramparts were heaped against a timber revetment, supported by stout posts the sockets of which can be found by excavation under the edge of the present bank. In some cases indeed the rampart consisted of a series of *casemates* (chambers or big boxes), framed with horizontal logs and filled with earth. In both cases the assailant would have been confronted with an almost vertical wooden wall, supporting and reinforced by a huge mass of earth. Along the crest of this would run a rampart walk, shielded by a breastwork of stout timbers continuing upwards the line of the wall face. Even where the rampart was not thus revetted, but assumed the form of a glacis, it would be crowned by a palisade.

The hill-top or promontory may be defended by two or more parallel ramparts and ditches. Then the fort is termed *multi-vallate.* Or a series of outworks may divide the whole enclosure into a succession of wards, culminating in a citadel.

One or more gates, now represented by gaps in the banks with corresponding interruptions of the ditch, gave access to the fort. The gate was always strongly guarded, though the precautions against surprise cannot be fully appreciated without excavation. Chiefly in univallate forts, the entrance is likely to be *inturned.* The ramparts do not just stop short on either side of the gap, but turn back inwards and are prolonged for 20 or 30 feet towards the interior of the fort. The gateway is thus converted into a passage, flanked on either side by timbered banks and doubtless barred at both ends by stout gates. It may really have been more like a tunnel, since the hypothetical rampart walk would surely have been continued by a bridge across the gateway and perhaps expanded into a barbican tower. In multivallate forts (but not raths, in which the gaps and causeways are normally in a straight line) the gap in the outer rampart is never directly in line with that in the inner, but so arranged that anyone approaching would have to turn left on passing the outer gate and proceed with his unshielded right side exposed to any missiles hurled from the inner rampart before reaching the gate through it. Defensible outworks were often constructed opposite the gate to control access still more efficiently.

In Britain most hill forts were built in the Iron Age, but one easily recognizable group is assignable to the Neolithic stage. The peculiarity of these neolithic forts (6) —or camps—is that their ditches were interrupted at frequent intervals by causeways with corresponding gaps in the rampart. Hence these earthworks are known as *causewayed* camps. Neolithic causewayed camps are known also in France and the Rhineland, but on the Continent there are neolithic forts not characterized by interrupted ditches. Most large forts in Temperate Europe belong to the Iron Age, as in Britain, or to the final phase of the Bronze Age. Round the Mediterranean imposing fortresses were, of course, built during the Bronze Age, while the literate cities of the Bronze Age Orient were girt with formidable walls.

3. Linear Earthworks

Not all systems of banks and ditches surround a recognizable area. Both in the British Isles and on the Continent the reader might encounter a more or less conspicuous bank with a distinct ditch on one side and could follow it for many miles without finding any indication of its returning upon itself. Such works were presumably territorial boundaries or frontier defences and in fact are known to belong to many different archaeological periods. The earliest examples in Britain are Late Bronze Age, others are medieval. The earlier, or at least slighter, works are found to be discontinuous. A reference to geological maps in studying their courses reveals that the apparent gaps were really closed by natural obstacles—tracts of swamp or dense forest. The several earthworks, each popularly known as Grim's Dyke, that traverse the downlands of Wessex may have marked the boundaries of big ranches or of tribal territories. The very impressive Bokerley Dyke was, Hawkes suggests, the boundary of an Imperial Estate in the 2nd or 3rd century. Offa's Dyke (7) on the Welsh Marches is a veritable frontier work attributable to the Mercians of the 8th century.

The most celebrated defensive earthworks in our Continent were erected by the Romans to protect and define the frontiers of their Empire. Most eventually became stone walls, but the Antonine Wall from the Forth to the Clyde and the earlier version of the better-known Hadrian's Wall from the Tyne to the Solway were true earthworks. Essentially the "Roman Wall" consisted of a defensive ditch, then a level space or *berm,* and finally a massive earthen rampart. Behind the rampart ran a military road and at intervals fortresses were built to house permanent garrisons as well as smaller "mile castles."

Roads and trackways also appear upon the ground as linear earthworks. A *Roman road* may show up as a very low but wide bank flanked on either side by narrow ditches running parallel to one another and quite straight for long stretches. The bank marks the line of the metalled way (*agger*), the ditches are just drains such as must border a modern road too. Often a chain of small holes can be seen running parallel to the line of the road. These were quarry pits that provided material for the *agger.* A *hollow way* is in a sense the negative impression of a Roman road. It appears as a ditch flanked by parallel banks, but a hollow way never runs straight for anything like so far as a Roman road. The "ditch" is simply the track worn by the feet of herds, pack animals and men, while the banks, like railway fences, protect fields on either side.

4. Fields, Farms and Flint Mines

On the ground, hollow ways lead to the sites of field systems, villages or farms. Let us follow them. Ancient field systems are most easily seen on slopes where they appear as discontinuous terraces, technically termed *lynchets*(8). When a patch of sloping ground is ploughed over repeatedly, the earth thereby loosened will gradually be washed down to the bottom of the patch and come to rest on its lower boundary. In time the upper edge of the plot will be hollowed out while the dislodged soil will form a bank at the bottom of the strip. Now baulks of unploughed land are usually left between fields, and on them the cultivator is likely to dump stones and other encumbrances on the land. Lynchets form along the baulks that run parallel to the contours of the slope; a *negative lynchet* is hollowed out at the foot of the upper baulk, while the soil washed down comes to rest against the unploughed strip at the bottom as a *positive lynchet.* The baulk running across the contours will stand out in low relief near the top of the field, but may appear slightly depressed towards its lower end.

In England two types of field have been made visible as a result of this process. Some are roughly square and are traditionally known as *Celtic fields.* Actually they range in date from the Late Bronze Age to late Roman times. The others are long and narrow and are appropriately termed *strip lynchets.* All Anglo-Saxon and early medieval fields conform to this plan and most measure 660 by 60 feet. But strip lynchets go back to pre-Roman times at least in those parts of England occupied by the Belgae, while similar long narrow fields of pre-Roman date have been identified in Denmark and Holland too. It is still likely that Celtic fields are adapted to the light plough, called in Latin *aratrum* and in Danish *ard,* that merely scratched the surface of the soil; for with this instrument cross ploughing was desirable. That was unnecessary with a true plough, fitted with a coulter and a mould board to turn over the sod, and for it a long strip was the more practical.

The *cultivation terraces*(9) to be seen on the south side of Arthur's Seat in Edinburgh and on several other Scottish hillsides are functionally akin to strip lynchets but genetically different. Though long and narrow, they are usually curved to follow the contours of the hill. The downhill side of each strip is an actual terrace, a bank formed of stones and clay deliberately piled up. These terraces are often associated with scooped enclosures and are probably medieval.

A quite different and far more regular pattern is produced by the Roman system of land division termed *centuriation.* According to the rules prescribed in Latin textbooks on surveying, a chessboard grid was laid down about two main roads—the *decurio maximus,* 40 feet wide, and the *cardo maximus,* 20 feet wide—intersecting at right angles. From each main road secondary roads branched off at right angles every 2,400 (Roman) feet. The latter should be 8 feet wide, but a width of 12 feet was prescribed for every fifth one. The secondary roads served as boundaries of the allotments (*centuriae*) and as ways of access to them. All roads are supposed to be metalled and bordered on each side by ditches. These latter features may be visible on the ground and are sure to show up from the air. Traces of centuriation going back to Republican times have been detected in Italy and later appear all over the Empire.

Low banks may also survive to mark the boundaries of ancient fields, but more often define former farmyards. Then they are likely to be connected on the one hand with hollow ways, on the other with farm buildings. No attempt can be made here to survey the very varied remains of the latter that may survive even in England. But *scooped enclosures*(10), having been mentioned, had better be explained. On hillsides in Scotland and Wales medieval peasants would dig a wide but shallow level-bottomed cutting horizontally into the slope, heaping the excavated earth and broken stones in front of the cutting to form a platform. The platform top and the cuting bottom thus formed a level floor for a house that could be backed up against the inner end of the cutting.

Monuments, of course, include, besides mounds raised above the level of the surrounding ground, holes dug into it. Crater-like depressions may mark the site of a flint-mine shaft, of a well, of a collapsed subterranean chamber or what you will. Only excavation can decide. But a cluster of such craters in an area of chalky down are very likely to be flint-mines, such as were dug in Neolithic and Bronze Age times. Again in metalliferous regions a series of deep trenches may be results of opencast mining for copper, silver or lead. Confirmation of that diagnosis would be provided by the discovery of slag heaps in the vicinity. Slag heaps can sometimes be distinguished from other piles of stone or natural rock by the circumstance that they are more bare of vegetation. But in general it is seldom practicable to decide by inspection whether any particular hole in the ground marks the mouth of an ancient well or mineshaft rather than a relatively recent marl-pit or clay-pit. So, too, shallow outcrop workings are not easily distinguishable from quarries from which stone has been won to build a dyke or a sheepfold. But if no such building is visible in the vicinity, the second interpretation is excluded without, however, proving the alternative.

5. Heaps of Stones

A large and roughly circular pile of stones may be a burial cairn, with or without a chamber. It may just as well be the ruin of a small fort or domestic building of dry masonry. (In Caithness cairns generally appear as heaps of naked grey stones, while ruined domestic structures are usually grassed over and so become "green mounds. If a segment of a peristalith or a kerb of close-set boulders is discernible near the edge of the heap, its diagnosis as a cairn becomes very plausible. But a peristalith is not invariably present and in any case is liable to be masked completely by slipped stones or invading peat. On the collapse of a round building, such as a small dùn, a crater-like hollow should be left at the centre, but such could be produced in a cairn by the collapse of a burial chamber or by robbers. A round house or fort should have an entrance marked by a depression running radially across the heap from the centre, but that too might result from the collapse of the passage leading to the burial chamber in a cairn. Courses of a curving wall face, glimpsed through the tumble, will suggest a small ring fort, a dùn or a broch. But some chambered cairns are surrounded with two or even three dry-stone walls the faces of which are visible in quite exceptional cases; for cairn walls are really just revetments, faced on one side only.

If the suspected cairn be not in fact the covering of a chamber tomb, it is most likely to be a small ring fort, or *dùn*. Excavated examples have been found to consist of a stout wall of dry-stone masonry 8 to 16 feet thick and faced inside and out, but with rubble between the faces. Even in a ruin one or both faces may just be discerned projecting through loose stones, and so may the line of the entrance. The latter is likely to have been a passage between well-faced walls which was narrowed near the middle by jambs projecting from both side walls. Just inside the jambs, 2 or 3 feet above the floor, *bar-holes* are to be expected on either side. One of them is a deep channel in the thickness of the wall into which the wooden beam that fastened the gate could be slid back when not in use. To bar the door the beam was slid out till its end engaged in the shallower hole in the opposite wall. This method of barring a gate is, of course, by no means exclusively prehistoric; bar-holes and even bars can be seen in medieval castles. On the other hand, it was already employed in the neolithic village of Skara Brae.

In ring forts there may be chambers in the thickness of the walls instead of some of the rubble between the faces. Such chambers are one feature of a distinctive type of construction, peculiar to Scotland, known as a *broch*. In the walls of a broch there should be, on ground-level, besides a guard-chamber commanding the entrance, to the left of the latter an intramural cell from which starts a stairway mounting clockwise between the wall faces and leading at least to a rampart walk. But in some brochs(11), if not in all, the massive rubble-cored wall was just the basement from which rose a hollow-walled tower that in one instance, on Mousa in Shetland, still stands to a height of 40 feet. The stairway would continue winding up between the inner and the outer walls, which were tied together by horizontal slabs bonded into both and forming the floors of "galleries." Such towers were not very stable. On their collapse the huge mass of stones would fill up the central court so that the ruin may resemble a huge round cairn. Brochs, concentrated in Caithness, Orkney, Shetland, Sutherland and the Hebrides, seem to have been built about the beginning of our era, but some at least were occupied, usually after considerable rebuilding, down to A.D. 600 or later. Other small stone-built forts cannot be dated by inspection, and many may be Early Christian.

Only a small ring fort with an internal diameter of 30 feet or less—and all excavated brochs with one exception fall within this limit—is likely to look like a cairn when ruined. But ring forts, like raths, were of all sizes. The ruin of a larger one will appear as an annular bank of rubble encircling a hollow, normally overgrown with vegetation. But a dilapidated sheepree (Scots for "circular sheepfold") will look just like that too! If the rubble bank really represents the rampart of a "fort," it will originally have exhibited the same features as the wall of a smaller work—inner and outer faces, entrance passage with jambs and bar-holes, exceptionally intramural cells and, still more rarely, stairways. At the same time the stone ring forts termed *cashels* in Ireland are just the counterparts in rocky country of the raths described previously, and must be interpreted in the same way.

Indeed, most of the defensive enclosures described in section 2 could be, and in rocky country generally were, surrounded by stone walls instead of earthen banks and ditches. If the wall was of dry masonry, its collapse will leave just a stony bank that is liable to become grass grown. The wall will naturally have been faced on one or both sides, but the faces are likely to be standing only in so far as they are supported by debris fallen from higher courses resting against them and so hiding them. Yet the faces may sometimes be detected without excavation.

The wall facings may, of course, be composed simply of irregular courses of selected slabs like the wall of a ring fort. But the stone work may have been reinforced with timbers or combined with woodwork, sods or bricks. So vertical posts may support a dry-stone facing at intervals in much the same way as they supported the timber revetment of an earthen rampart. The posts will, of course, have decayed, but the vertical channels or niches in which they stood can be observed interrupting the courses of the masonry. Rows of posts along the inner and outer wall faces, tied together by transverse beams, formed a very suitable frame for a stable rampart. Or two built masonry faces may be tied together by transverse beams laid horizontally and bonded into each. In the faces, the sockets that once held the ends of these tie beams may be detected by a practised eye as rows of evenly spaced gaps interrupting the stone work in every second or every third course. Such walls are correctly described as *timber laced*(12), but have been incorrectly referred to as *Gallic walls—murus gallicus.* The *murus gallicus* described by Julius Caesar was in reality a special kind of timber-laced wall in which precautions had been taken to insulate the wooden components in stone channels to prevent a fire spreading if one beam were set alight.

Any combination of timber and masonry, particularly a simple timber-laced wall, was liable to be set on fire by accident or by enemy action. In that event the space between the faces would become a sort of kiln in which a temperature might be generated high enough to melt easily fusible stones like basalt. The result was what is today called a *vitrified fort.* The fusible stones have melted and fused together lumps of more refractory rock into vitrified masses of varying size. The latter constitute the most conspicuous surviving remains of the rampart which may appear as a continuous wall of fused material. Hence it was once believed that such "walls" were deliberately made, though no one could explain how it was done. It is now admitted that they result from the destruction by fire of timber-laced walls. Without excavation close scrutiny has in a few cases revealed under the vitrified masses the basal courses of the built wall face and even the beam-holes in them. The combustion of a timber-laced rampart, built of more refractory stones, will not melt them to produce vitrifaction but merely calcine them, an effect far less easy to recognize.

In the British Isles vitrified forts are virtually confined to Scotland. There it is suspected that their vitrifaction is the work of the Roman legions under Agricola in A.D. 84, but how much earlier they were built is rather hotly disputed. In Western Europe, too, some vitrified forts are attributed to the pre-Roman Iron Age, indeed to its first or Hallstatt phase. But in east Central Europe most mark the sites of Slavic fortresses of the 8th or 9th century. Yet even in neolithic forts in France some ramparts show signs of calcination. The true Gallic wall is believed to have been devised by the Gauls, perhaps even by Caesar's redoubtable adversary Vercingetorix himself, as a reply to the Roman invasion about 60 B.C.

The ruins of historical buildings, usually constructed of ashlar masonry with the aid of lime mortar, have no place in this chapter. On the one hand, if still visible, they should be self-explanatory. On the other hand, their sites have all too often been used as quarries by later builders. All sound and shapely blocks will have been robbed and re-used elsewhere. At best only the rubble core is left. Now rubble set in good mortar is indeed remarkably durable, and may well survive long after all facing blocks have been carted away. Still, often the foundation trench is all that is left of a good ashlar wall. This, of course, could be found only by excavation, and even rubble cores are now usually below turf-level. Above ground (with a few exceptions) much less remains of a Roman villa or an early Celtic chapel than of a neolithic chambered cairn or a pre-Roman broch!

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Chapter 5

Interpreting Archaeological Data: Elementary Technology

TO INTERPRET the objects he collects, to classify them and even to describe them correctly, an archaeologist ought ideally to be able to make them. He must at least know something of how they are made. The requisite knowledge can only be acquired by actual practice and can only be imparted by demonstration. No attempt will here be made to teach the reader how to make flint arrow-heads or cast bronze statues. The modest aim of this chapter is to explain some of the technical terms inevitably employed in describing the processes used in the manufacture of the commoner classes of relic. Thereby, it is hoped, the reader will be able to follow more easily demonstrations he may witness and even to observe for himself significant features on relics that might otherwise pass unnoticed.

1. Flint Work

In default of metal, a sharp cutting tool can most easily be produced from a cryptocrystalline stone like flint or obsidian (a natural volganic glass). Flint, being by far the commonest, will form the subject of the succeeding sentences, though it could in every case be replaced by "obsidian" or "glass" without affecting the sense. Flint occurs in large irregular nodules or more rarely in flat slabs—tabular flint—in chalk and certain limestones; and nodules, derived from these formations, can be often found lying about the ground in fluviatile or glacial gravels. The nodules are usually covered with a thick opaque crust, termed the *cortex* ("bark"). Under it the flint should be shiny and translucent, but it has often become opaque and white or stained—*patinated*—through processes not fully understood. The nodule in its natural state could not be utilized as a tool, but tools can be made from it by breaking it up in appropriate ways. Their appropriateness depends upon the way in which flint fractures (breaks).

If a vertical blow be struck precisely in the centre of a disk of flint, or glass, the shock waves will be propagated through the mass in a cone the apex of which is the point of impact. Theoretically the cone thus framed will fall out from the underside of the disk and will show on its surface *ripple-marks,* just like the ripples that spread over the surface of a pond when a stone has been dropped in, but that they are three-dimensional and, as it were, frozen. If the blow be struck near the edge of the disk, at a suitable angle, a flake in the form of a conic section will be detached. Under the point of impact the apex of the cone, somewhat distorted, will appear on the flake as a so-called *bulb of percussion,* that forms the focus for a series of more or less elliptical ripple marks. The face of the flake which was originally inside, i.e. against the core, and bears the bulbar swelling, is known as the *bulbar surface.* On the block from which the flake has been detached will be seen its bed—the *flake scar*—and a deeper hollow—the *negative bulb*—corresponding to the swelling on the flake and likewise surrounded by ripple marks.

The block from which flakes are detached—in this case the imaginary disk—is technically designated the *core,* and the flat surface on which the detaching blow was struck is known as the *striking platform.* Observation of the bulbs and ripple marks on a flint implement reveals the position and direction of the blows by means of which it has been shaped. Such observations are especially useful in distinguishing humanly fashioned implements from naturally fractured flints. For battering by other nodules on a beach or the impact of a plough-share in a field may detach flakes showing ripple marks and bulbs as much as a blow with a hammerstone, but the directions of the blows thus inflicted will be random.

To make a good implement from a nodule some preliminary preparation is essential, notably the production of flat surfaces to serve as striking platforms which should intersect at an angle of less than 90°. After this preliminary trimming by sheer bashing the nodule becomes a (prepared) core. From such a core implements can be made in two ways: flakes may be struck from it successively until the core itself be reduced to the desired form. The resultant—what is left of the core—is the desired tool or at least a rough-out thereof and is appropriately designated a *core tool.* Alternatively, the flakes themselves may be utilized as—or for the manufacture of—tools which can be labelled *flake tools.*

After the primary working just described, the rough-out core tool or flake may be subject to secondary working or *retouching,* to improve the shape or the edge. Now the best-known core tools (some have in fact been made on thick flakes) are the so-called *"hand axes"* (*coups de poing*) of the Lower Palaeolithic Abbevillian (Chellean) and Acheulian industries. These have been made by detaching flakes alternately from both faces of the core all round. Thus they can be said to be bifacially worked and are indeed termed *bifaces* in French. The primary working left a very wavy edge, and the secondary working is directed to smoothing out the salients by removing short shallow flakes. Hand-axes were very generalized all-purpose tools and probably never served as axes at all. But neolithic flint axes were often roughed out in the same manner. A special device for producing an axe or adze edge on a core or thick flake is the so-called *tranchet* blow. This detaches from one end of the implement a flake transverse (at right angles) to the main axis of the core or flake. The result is called a *tranchet* in French, and English archaeologists use the same word. Tranchets are very common in the Mesolithic and early Neolithic stages in North-western Europe, but occur also in Egypt, Palestine and even the Solomon Islands.

Flakes could quite often be utilized without any retouching, but to obtain a flake of a specified shape and size very elaborate preparation of the core was needed, in the course of which quite a large proportion of the nodule may have been reduced to waste chips. Two or three flakes of similar outline but of increasing size may be obtained from a "tortoise core" by the "Levallois technique," very popular in Middle Palaeolithic industries. A whole series of long narrow flakes with more or less parallel edges can be obtained from a prism-shaped or conical core. The term *blade* should be confined to flakes detached from such a core. Regular blade production began in Western Europe with the Upper Palaeolithic, so that it is sometimes taken as the differentia of that stage. However, contemporary industries, for instance in Africa, still followed the Levallois tradition, while true blades occur in geologically earlier horizons in Palestine and continued to be produced in the Mesolithic and subsequent stages.

Flakes and blades may be further shaped by retouching into knife-blades, scrapers, awls and other tools. For the production of knife-blades the secondary work generally takes the form of "blunting the back," i.e. one edge, of the flake, so that it shall not cut the finger or split the wooden haft in using the unworked edge for cutting or sawing. *Backed blades,* or simply *batter-backs,* is a handy label for all implements treated in this manner. The secondary working is generally done from the bulbar surface, so that the flake scars left by it appear on the upper or dorsal surface. *Gravers* (Fr. *burin*), however, are made by detaching a flake or facet along one edge of the blade by a blow or shock delivered on a prepared end. At this end is left a very tough chisel- or gouge-like edge that can easily be resharpened by detaching another facet from the same end. Gravers are admirable tools for cutting deep grooves in bone, antler, ivory and stone and were demonstrably used for shaping bone utensils and for engraving on cave walls. In Western Europe their regular manufacture began with the Upper Palaeolithic and continued throughout the mesolithic, but no longer.

For retouching flakes and blades *pressure* could be used instead of percussion. By its application, relatively long but shallow flakes that may extend right across the surface of a blade can be detached. Pressure was often used to remove flakes from both faces of a flake, yielding a very thin product that may yet be classed as a biface. In Western Europe pressure was first used to produce bifacially trimmed laurel-leaf-shaped spear- or arrow-heads in the Solutrean culture. The same technique was normally used for the manufacture of arrow-heads in all later periods, as among the recent aborigines of Australia and America. It was developed in predynastic Egypt to produce superb ripple-flaked knives and in Northern Europe for the manufacture of a celebrated series of daggers as well as fancy forms.

Microliths are diminutive artifacts, less than 1 (or 1.5) inch long. Some are just tiny blades made from minute prismatic or conical cores, but most exhibit fine retouching and may be segments of larger blades. The little irregular and unretouched chips, produced in thousands as by-products of flint working, should not be mistaken for microliths. The purpose of the secondary working on the latter may have been to blunt the back of the instrument or give it some particular shape or a point. Some, but not all, microliths have been thus reduced to regular forms—triangle, trapeze, rhomb, or circle segment (lunate)—and are therefore classified as *geometric*. Microliths were used singly to tip arrows or, arranged in series, to serve as barbs for missiles; becoming detached in a wound, they would tend to keep it open and thus ensure the death of the prey.

Flint implements often exhibit significant traces of the natural forces to which they have been exposed or of the use to which they were put. Mere exposure may produce patination, iron or other solutions in the subsoil waters staining brown or orange. *Rolling,* that is to say battering, by other pebbles among which the implements may have been lying on a beach or in a torrent bed, blunts the tool's edges and the ridges that separate the flake scars on its surface. A rather similar blunting is produced by use as a *fabricator* or as a *strike-a-light.* Pressure flaking was sometimes effected by pressing the flake to be trimmed against the edges of a rod-like flint—the fabricator. From the rod's edges, too, small splinters would be detached till they became blunt. Striking a piece of iron—unsmelted iron ore such as pyrites will serve as well—against a similar flint rod will yield a spark that may ignite tinder, but will at the same time blunt the edges of the rod. Use for cutting may produce minute chips or serrations along the edge of the flake thus employed. Sawing wood will produce a narrow band of lustre along the edge, but cutting straw leaves a much broader band of shiny gloss. Flint blades showing this gloss have probably been employed to arm wooden sickles used in reaping grain and may thus be labelled sickle flints.

2. Fine-grained Stones

More obviously crystalline rocks can be shaped by just the same methods as flint, but the edges thus obtained are less keen and less durable than those on a core or flake tool of flint. To give such an implement an efficient cutting edge it must be sharpened by grinding and polishing. Flint, too, can be edged by polishing, but though the edge thus obtained was tougher, it may be suspected that flint knives and axes were polished largely for aesthetic or prestige reasons.

The commonest ground stone implements are "celts" which served as axe-heads, adze-blades, chisels or gouges. Prior to polishing, the celt could be roughed out of a larger piece of rock by flaking, as in making a core tool of flint, by pounding and battering with a hammerstone—

i.e. pecking—or by sawing. If the preliminary shaping was done by pecking, the unpolished part of the celt will be pitted all over by the hammer-blows. Sawing will leave a celt with a rectangular cross section. Soft stones could be sawn with a flint blade, but generally sawing was done with an abrasive powder, usually sand, that could be actuated by a leather thong or a stick. The celt was ground by rubbing it vigorously up and down a smooth surface of sandstone or other gritty rock. Rock surfaces hollowed out and grooved by this use are known in many parts of Europe, e.g. near Paris, and are termed *polissoirs* in French.

Stone axe-heads were normally stuck into the wooden shaft, but stone can be perforated, and stone ax-heads, pierced with a shaft-hole like modern iron axe-heads, are known. For perforating a block of stone, previously shaped, two or three methods have been employed. (*a*) Percussion; by repeated battering with hammerstone or chisel on a selected point, a cup-shaped hollow was gradually pounded out. When the depth of this hollow was about half the thickness of the block, this would be turned over, and the process repeated at the corresponding point on the opposite face till the stone was hammered through. The final result is a hole that is hourglass-shaped in cross section. The pock marks left by the hammer are generally visible round the perforation. (*b*) Solid boring; the hole, started by percussion as in (*a*) is continued by a flint or metal borer or more often by an abrasive actuated by a bit that may be of softer material. The bit may be either held in the hand and twisted—a process termed *boring*—or attached to a spindle and rotated, when we have a case of *drilling*. In this method, too, the block was generally reversed when bored half through and the process repeated from the opposite face. The perforation is then biconical. On its walls the spiral scratches or striations left by the grains of the abrasive are usually visible. In both these methods all the stone that once occupied the volume of the hole has to be reduced to dust by the force of the operator's muscles. (*c*) *Hollow boring* saves most of this physical labour. The drill bit is a hollow tube. This can most easily be made of metal, for instance by rolling a strip of sheet copper, but a hollow reed would serve quite well though it would not last so long; the actual grinding is done by an abrasive. In hollow boring only a tubular sheath of stone need be worn down to dust by the bit. When the latter has ground right through the block, a solid cylinder of stone of diameter slightly less than that of the perforation should fall out. This is termed the *bore core* (in practice it is seldom a true cylinder, one end being usually a little larger than the other). The whole volume of stone contained in the core would have had to be reduced to powder in solid boring or percussion. Bore cores are often found on sites where stone has been perforated or still in position on unfinished implements that broke before perforation was completed.

Vases could be hollowed out of a block of stone by the same sort of methods as were used for perforation. If percussion were adopted, the craftsman would normally interpose a chisel of flint or metal between the hammer and the block. But, save for very simple or early vessels, some sort of drill would be employed. A cylindrical vase could easily be hollowed out even with a flint bit and sand as an abrasive. For hollowing out globular and other vases that are narrower at the mouth than lower down, the Egyptians had devised a very simple but ingenious method by the time of the earliest pharaohs, 5,000 years ago. They employed a graduated series of crescent-shaped flint bits of increasing width measured between the horns of the crescent. The drill spindle, just a forked stick, gripped the flint crescent at its centre when it was in position. But it had to be inserted endwise through the narrow mouth of the vase and then turned. Thousands of these flint crescents as well as vases in all stages of manufacture have been found, notably by Caton Thompson in the Fayum. Later, when metal became more plentiful, tubular drills were employed. These could be inserted at any desired angle through the vase mouth, but would leave a series of incomplete bore cores projecting from the vessel's walls, which were then chiselled away.

3. Metal-working

Copper, the first metal to be used by man, can be shaped by hammering, for it is *malleable*. But persistent hammering renders copper too hard and brittle for further shaping while cold. *Malleability* can, however, be restored by *annealing*, that is, by heating the metal to a dull red heat. By repeated hammering and annealing a lump of copper can be given almost any shape desired. In prehistoric Europe and in Hither Asia during early historical times axe-blades, battle-axes, spear-heads and daggers used to be thus shaped by forging. Pock marks, left by the hammer strokes, can sometimes be detected on the products.

In pre-Columbian America the native copper of the Great Lakes region used to be beaten out into large thin sheets. The same technique of beating was applied in the Old World to the fabrication of cauldrons, buckets and other vessels, of helmets, shields and other pieces of armour, and of other articles from the beginning of the Bronze Age, and is still applied today by coppersmiths throughout Asia. Such objects of sheet metal can of course be made of bronze, silver or gold as well as of copper. Even without annealing, by the use of appropriate tools quite large and complicated objects can be hammered up out of a small lump of metal by the process termed *raising*.

Larger and yet more complicated articles can be made by fastening several sheets of metal together by riveting, by brazing or by soldering. Sheet metal can also be decorated with relief or sunk patterns quite simply. If the pattern is in relief, hammered up from the back, it is correctly termed repoussé work. But the effect of relief can be obtained by chasing, that is, working with a tracer or fine chisel on the front of the sheet, i.e. the side that is to be seen.

The great advantage of metal—at least of copper or bronze—over stone was that it is fusible. So in the Bronze Stage most tools, weapons and ornaments and even some vessels were shaped by *casting*. Copper, heated to 1,083° C., and bronze, an alloy of copper with tin at a rather lower temperature, fuse and can be poured as liquids into a mould the form of which the metal will assume on cooling.

The simplest way of making a casting is to hollow out a negative of the desired object in a flat bed of clay or a stone slab. In the case of clay the negative is obtained by simply pressing a similar object, a pattern, into soft clay, then withdrawing it and letting the clay harden. This method is known as *open-hearth* casting. It is, of course, applicable to the manufacture only of objects flat on one face and free of re-entrant angles on the other. At the beginning of the Metal Stage open-hearth casting was employed for the production of flat axes, daggers and similar articles, and it continued to be employed for casting simple bars or disks from which other objects could be forged or raised. Open-hearth moulds in stone for such simple castings are common at all archaeological horizons.

For anything more complicated at least a *valve mould* is needed. Such must comprise at least two pieces or valves, each of which bears the negative of half the object desired. For casting an article free from re-entrant angles on both faces a two-piece valve mould can easily be made in clay as follows—the pattern is sunk to half its thickness into a flat block of moist, soft clay. Then, after covering the pattern and the exposed surface of the block with charcoal or fat to prevent sticking, another block of clay is pressed down on to them. When the clay has dried hard, the two blocks are taken apart and the pattern removed. Each block now bears a hollow corresponding to half the pattern. They are then put together again, wrapped in an envelope of clay, and molten metal is poured in through an opening that has been left at one end and is known as the *gate*. To extract the casting, the mould has to be broken up. Many fragments of such moulds have been found at Jarlshof in Shetland and other Late Bronze Age sites. On some fragments the grain of the wood used for the pattern is observable.

The valves were often made of stone or even metal instead of clay. These could be taken apart to extract the casting and then reused, and many specimens survive. Some extant European examples go back to the Early or Middle Bronze Age, but stone valves were still used side by side with clay ones in the Late Bronze Age and subsequently. Moulds, consisting of three or even four valves, must have been employed for casting bronze chains and other complex objects.

The manufacture of socketed celts or spear-heads involved a further complication. A core of clay or stone must be made, equal in diameter and length to the tubular socket into which the wooden shaft is to fit, and be somehow suspended between the valves of the mould so that the metal that is to form the tube is able to flow all round it. Suspension can be effected by lugs projecting from the end of the core to engage in the gate of the mould or by sticking in the surface of the core a couple of tiny metal pins which will be fused and absorbed by the molten metal when it is run in. The expression *core casting* indicates the use of such a core.

However well the valves may fit together, some of the molten metal will always spread along the junction surface. On cooling this will appear as a little ridge, described as the *seam*, running along both sides of the casting when it is removed from the mould. This seam was often filed away by the smith, but traces of it can generally be discovered in inconspicuous places, for instance inside the loops that are sometimes attached to spearheads and celts. A seam is a sure proof of the use of a valve mould; its absence does not prove the contrary. Sometimes the valves failed to register exactly or slipped during the casting. Bronzes exhibiting the consequent distortions are not uncommon and may provide useful information on the process.

The *cire perdue* (lost wax) process is the third method of casting bronze objects. The pattern in this case is a model of the desired article fashioned in wax. The model is coated with, and encased in, clay save for an orifice or gate at the top. When the clay has dried, the enveloped model is heated with the gate downwards. Thereby the clay is baked and the wax melted to run out through the gate. The empty envelope is then inverted and molten metal poured through the gate into the hollow interior. It naturally assumes the exact form of the wax model. To extract the casting, the mould must be broken. Broken moulds are one of the most durable, and therefore commonest, indications of the activities of a smith at a site. No seam is left on a cire perdue casting.

The cire perdue process is still used for casting bronze statues, and its use can be traced back to the Bronze Age. But some objects, once reputed to have been cast cire perdue, may really have been made in clay valve moulds as described earlier. Fine patterns could, of course, very easily have been incised on a wax model and would be faithfully reproduced on the casting. It has been argued that the rich incised decoration on Bronze Age weapons and ornaments from Northern Europe and the Middle Danube basin had been executed in this way, but this is probably a mistake.

Any casting, as it comes from the mould, needs finishing by the smith. In particular, the edges of cutting tools and weapons need sharpening by hammering, which at the same time hardens them. The splay of the blade of a copper or bronze axe is partly the result of this hammering and was originally an unintentional by-product of the essential sharpening. In the sequel it was deliberately exaggerated by making the mould trapeze-shaped in plan instead of rectangular. Save on cire perdue castings, it would also be necessary to smooth away the seam, any remains of metal that had been left in the gate (the so-called "jet") and other accidental excrescences by filing or sawing. Metal files are not known before the Late Bronze Age, but the surface of the casting could be rubbed smooth with pumice or sandstone. Small bronze saws are a characteristic feature of Late Bronze Age founders' hoards.

Iron was probably never cast till the Middle Ages. Previously only wrought iron was available. The processes of forging employed by prehistoric, Oriental and Greco-Roman blacksmiths were substantially those that can be seen in the village smithy today and need no description here. Ancient armourers were also familiar with processes of inlaying, damasceening and the like, but these processes are too subtle for a chapter on elementary technology.

Save in unfavourable soil conditions, such as prevail, for instance, in Mesopotamia, copper and bronze objects have a good prospect of lasting for thousands of years. Iron is much more susceptible of corrosion and may quite soon disintegrate completely. Disintegration is accelerated especially by changes in humidity; the layer of rust formed on an iron object when damp is liable to scale off if the object dries. Hence if the reader happens to rescue a substantial iron artifact from the damp soil of Britain, he should keep it immersed in water or wrapped in wet cloth till it can be given expert treatment. Conversely, if the object be found in the dry sand of the Egyptian desert, it should be kept hermetically sealed, preferably with (but not touching) a dehydrating agent such as quicklime or caustic soda. The treatment of metals is a delicate operation that can be carried out only in a laboratory and by an expert.

4. Pottery

Pottery is chemically just clay that has been heated to a temperature—above 400° C.—high enough to effect a chemical change, the expulsion of the water of constitution. But no one could make a pot of pure clay. A certain proportion of gritty stuff, technically known as *temper* (or grog or *dégraissant*), must be added to the clay unless it be already present in the raw material. The temper may consist of chopped straw, sand, powdered stone or shell, or even comminuted pot-sherds. The nature of the temper may provide useful clues as to the age and provenance of a vessel and the cultural traditions of its makers.

A pot can be made out of a lump of properly tempered clay in any one of two—or more properly three—ways. It may be (1) modelled or built up *by hand,* (2) thrown on the potter's wheel, or finally (3) pressed down into a mould.

(1) Manufacture by hand in fact comprises several alternative processes that can seldom be distinguished on the finished product, even by a professional. The pot may be thumbed out of a lump of clay, built up in rings, or coiled. In coiling, the clay is kneaded into a very long sausage-like roll which is coiled spirally so as to form the wall of a vessel. In ring-building flat strips are bent round to fit the projected circumference of the vessel and laid in courses one above the other. In both cases each successive coil or ring must be pressed down firmly with moist hands on to the one below and the join smeared over with wet clay. On the other hand, each coil or ring must be allowed to harden enough to support the next one before this can be added. This necessity makes the manufacture of a single pot a long and tedious operation and introduces a cause of weakness; a pot is liable to break along the join, and many actually have done so. When a thick pot has thus broken, one edge of the sherd looks like a badly finished rim and may easily be mistaken for such, though some trace of the next ring can usually be detected, like a skin, just below the false rim. By judicious kneading, paring and beating hand-made pots can be given a surprising perfection of symmetry and extremely thin walls.

But the marks of the fingers or the finishing tool are irregular and never strictly parallel. Their irregularity, rather than coarseness or lack of symmetry in the vase, is the best criterion for distinguishing a hand-made from a wheel-made pot.

(2) In *throwing,* the lump of wet clay is "thrown" or placed precisely at the centre of a pivoted disk that can be spun freely. When this "wheel" is rotating at more than 100 revolutions a minute, the centrifugal force imparted to the spinning lump allows the potter to form it as he will without exerting any physical force beyond light pressure from the fingers. But the fingers leave faint, but strictly parallel or concentric, striations on the vessel's walls. These striations are the most reliable evidence for the use of the wheel. Unfortunately the potter was often at pains to remove them by smoothing or beating exposed surfaces. They are most likely to be discernible on the interior walls or on the base.

With the aid of the wheel, a pot can be shaped in fewer minutes than it would have taken hours to build by hand. Now the potter's wheel is a device for the mass production of cheap commodities. It can only be successfully operated by a highly skilled craftsman, who is generally a professional or full-time specialist. To support such a local market is requisite, since pots are too fragile to be exported in bulk until transport has been well developed. On the other hand, it is as easy to make a pot by hand as to weave a piece of cloth, or even to sew this up into a bodice. So among non-industrialized societies today in Africa or America the household pots, like the family clothes, are regularly made by the housewives as one of their normal domestic chores. It was probably the same in prehistoric times in Europe and Asia. While the potter's wheel had been invented before 3000 B.C. and was used in the large agglomerations of population that were growing up in South-western Asia and the Indus valley, it was employed nowhere north of the Alps before 400 B.C. (i.e. Iron Age II), while the more backward villagers of Scotland and Northern Europe were still relying on hand-made pots a thousand years later.

(3) In *moulding,* the wet clay is pressed into a preformed mould, usually itself of baked clay. As in casting metal, the mould may consist of two or more pieces fitted together, but, when the clay has dried, the mould can be taken to pieces and re-used after the vase has been removed. The interior of the mould may be engraved or carved with the negative of a pattern that is to appear sunk or in relief on the finished pot. No striations are left by the process. It was extensively used for the manufacture of decorated vases, including *terra sigillata* or Samian ware, in Hellenistic and Roman times.

After shaping by methods (1) or (2), the pot was generally covered with a *slip* (*engobe, Überzug*), a thin coat of the same clay from which the body had been made, but freer from any coarse grit and of the consistency of cream so that it would "slip" over the surface. Before its application iron oxide or some other earth colour might be added to the slip, in which case it might just as well be termed a *paint.* A slip improves the appearance of a pot and makes it less porous. But it may scale off. Unless it has begun to do so, a slip is very hard to recognize. A very thin coat of slip, applied mixed with so much water as to be quite liquid, is often called a *wash.*

Whether or not it be coated with a slip, the surface of a vessel may be *burnished* by rubbing it firmly with a smooth stone or polished bone before it gets too dry. Burnishing not only improves the surface appearance of a vessel, giving it a sheen, but also reduces its porosity. It may produce a superficial coating of finer clay, resembling an applied slip and therefore described as a *mechanical* slip. A mechanical slip does not tend to peel off.

Still before firing, but before or after burnishing, the pot may be decorated. Decoration may be effected by scratching the surface while the clay is still rather soft (*incision*), by impressing a stamp (*impressed*), by applying other strips or blobs of clay (*relief*), by pinching up or otherwise ruffling the surface (*rustication*) or by applying a coloured slip in stripes (*painting*). Scratching the vase surface *after* firing with a sharp point of flint or metal may be called *engraving,* while colours applied thickly *after* firing produce "crusted ware" (in contrast to paints such colours wash off readily). The relief decoration of Hellenistic (*Megarian*) pottery and of the Samian ware of the Roman period was effected by carving the pattern in the negative on the mould.

Only after these preliminaries would the pot be ready for *firing,* that is for conversion into pottery. This operation not only effected the critical chemical change, but also affected the colour of the product. This would depend on impurities contained in, or deliberately added to, the clay, on the temperature and on the conditions of firing. Pots can be fired either in an "open fire"—which may, however, really be lit in a pit—or in a kiln in which the air supply and the temperature can be regulated. In general, baking in an open fire at a low temperature is likely to yield a dark grey or mud-coloured ware. But if the clay contains a good deal of iron compounds or if a slip rich in iron salts (i.e. *ferruginous*) be applied, the vase surface will be red if exposed to the air while baking and black if the air be excluded. But a black colour could perhaps have been produced by firing clay containing much organic matter at a low temperature, when the organic matter becomes charred—at a high temperature it would be burnt out—or by firing in a smoky fire, when soot should be deposited in the pores of the clay. Pale wares—creamy yellow, buff or greenish grey—can only be produced by firing at a relatively high temperature—1,000° C. or more—in a kiln or hot clear fire.

The colours of paints, themselves consisting largely of clay, are, of course, just as much affected by the firing as the body clay on which they have been applied. So a ferruginous paint will appear black or red according to the amount of oxygen from the air that has had access to it during the firing. Moreover, fusible silicates in the paint may partially vitrify so that the painted surfaces look shiny. Such glossy paints are correctly termed *lustrous* in contrast to dull or *matt* colours. They are often incorrectly described as glaze paints, or, when applied as a thin slip or wash over the whole vase surface, as glazes. But glaze is glass, and to glaze should mean to cover, or produce on, the surface a thin film of glass. The brilliant black "glaze" of classical Greek vases and the red "glaze" of Samian ware in Roman times seem really to be clay slips comprising fusible ingredients and colouring matter; for they do not leave a thin film of glass over the vessel's surface. Correctly they should be called *vitreous slips*.

True glazes and glaze paints can only be successfully applied to pots that have already been fired. A second firing is then required to fuse and vitrify the glaze. Genuine glaze paints had been used by the Assyrians from about 1250 B.C., but were not at all extensively used till late Roman times.

5. Glass

Chemically, glass is an easily fusible silicate, usually of soda, potash, lime or lead. Perfectly fluid when fused, it is very hard and brittle when cold, but between these extremes remains for a considerable time in a viscous state, like treacle. In practice, glass could be produced by heating together quartz sand (i.e. silica), natron, a natural sodium salt or potash, and powdered chalk or limestone. These elements should yield a colourless and transparent material, but it could be tinted blue, red, brown, yellow and so on or rendered opaque by the addition of small quantities of copper, iron, manganese or cobalt compounds or other appropriate substances.

Glass was known in Egypt by 3000 B.C. and probably not much later in Mesopotamia. But it was never shaped by blowing before 500 B.C. At first, glass was shaped by moulding or pressing while viscous. From a crucible full of molten glass it is not too difficult to draw out threads and strips (like the festoons of treacle that hang from a spoon) that will soon harden, and by manipulating these to make simple objects like beads, rings and bracelets. Even glass vessels were made by a mere modification of this process. Jugs and bottles, for example, were built up by wrapping strips of viscous glass round a core of sand that had been moulded to the desired shape on a copper wire. Decoration could be effected by pressing blobs or threads of different coloured glasses into the still sticky surface of the vase or bead or by shaping the latter out of variously tinted intertwined strands.

After about 1200 B.C. vessels and other articles of glass used to be made also in moulds. The glass, however, was not poured into the moulds in a liquid state, as bronze would have been, but pressed into the mould while viscous, much as in making moulded vases of clay. The subsequent invention of glass-blowing has not superseded the older techniques just described. Glass can thus be used by itself for the manufacture of vessels and ornaments, but also to coat and decorate objects of other materials.

Fayence consists of an opaque core coated and bound together with coloured glaze. The core seems to consist of a paste of sand (silica) mixed with a little water and some adhesive. The desired object, whether a bead, a vase or a figurine, was first shaped in this paste either by modelling or pressing it into a mould and was then dipped into a crucible containing molten glass, suitably tinted. Small articles like beads of fayence had been made in Egypt before 3000 B.C., and in Mesopotamia about that date. Subsequently the material was extensively used throughout the Near East for the manufacture of small vessels, ornaments and figurines, including the familiar Egyptian *ushabtis,* while fayence beads were exported thence to England and Poland as early as 1500 B.C.

Enamelling is a device for decorating metallic surfaces by applying opaque coloured glass mixtures. A primitive method was simply to rivet studs of enamel on to the surface to be ornamented. More regularly the enamels, often of varied colours—red, white, blue, yellow and green—were inlaid in cells prepared in one of two ways. In the *champlevé* process the cells to be filled with colour were sunk below the general level of the surface. In the *cloisonné* process the shallow compartments were framed and divided by strips of wire soldered or brazed on to the surface. The art of enamelling by the *champlevé* process was already magnificently developed among the Celts of Western Europe in the La Tène period. It continued to flourish under the Roman Empire and, especially in Ireland, in Early Christian times.

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Chapter 6

Interpreting Archaeological Data: Completing the Bits

To INTERPRET an archaeological specimen it is even more vital to know what it was than how it was made. Yet, as indicated on page 11, most artifacts survive only as mere fragments of the actual utensils from which crucial connecting parts, made of perishable material, have decayed. Indeed, an archaeologist may be called upon to reconstruct a whole cart from two metal lynch-pins and the rein ring that rested on the pole! Here a few hints alone can be given to suggest how in the commoner cases the missing parts should be restored in imagination in order to disclose how the complete artifact really worked.

1. Axes and Adzes: Celts

Axe-heads and adze-blades of stone, and often of metal too, were normally fixed on to, or into, a wooden haft or handle which was not fitted into or through a hole in the head. The simplest, but least efficient method of attachment was to lash the head on to the end of a straight stick, supplementing the thongs with gum. This method was used by the Australian aborigines, but is not illustrated by any specimen surviving from neolithic Eurasia or Africa. A slightly more secure union was obtained if the end of the shaft were split and the stone head lashed and gummed in between the forks. This device, too, is unrepresented by any extant prehistoric example. Thirdly, axe-heads could be fitted into or through a hole cut near the end of a stout piece of wood. Many stone celts thus mounted as axe-heads have been recovered from the Alpine lake-dwellings and from peat-bogs in the British Isles, Northern Europe and Russia.

Instead of inserting the celt directly into such a wooden handle, it could be fitted into the hollowed-out end of a tine, or of a section of the beam, of an antler, and this *antler sleeve* (*gaine*) stuck into the wooden shaft. The antler, being slightly resilient, acts as a cushion for the shaft and reduces the risk of its being broken from the shock of the blow. Moreover, antler can be carved, much more easily than stone, to fit tightly into a squared hole in the handle. By cutting off the beam just below the junction of a tine, the latter's stump can be trimmed to form a *heel* that would engage the wood of the shaft, thus eliminating the danger that each blow with the axe should drive the head farther and farther into the handle till it fell out through the back! Finally, a section of antler beam could itself be perforated and the shaft passed through the hole thus formed. Such a perforated sleeve (*gaine perforée*), with a stone blade inserted into one end, would in fact correspond in principle to the contemporary iron axe-head. Antler sleeves are among the commonest finds from the Alpine lake-dwellings and related neolithic sites. But perforated sleeves were current already in the Mesolithic phase in Denmark and occur outside the Alpine area in France in Late Neolithic contexts. The Melanesians used to employ bamboo tubes as mounts for celts quite like the simpler types of antler sleeve.

Celts can be mounted in sleeves to serve as adze-blades (i.e. with the edge at right angles to the shaft) as well as axe-heads, with the blade parallel to the shaft. Indeed, some Melanesian tribes mounted axe-heads in revolving sleeves, fitting into circular holes in the handle, so that they could be converted into adze-blades simply by turning the sleeve through 90°.

Celts can be mounted directly as adze-blades only by using what is termed a *knee-shaft*, which could be employed also as an axe-handle. A knee-shaft could most easily be made by cutting off a stout sapling just below and a few inches above the point where a bough branched off at a wide angle (75°-90°). The branch would normally become the handle and the celt would be affixed to the part of the trunk left above the junction. If the celt were to serve as an adze-blade, it would suffice to split a strip off the upper section of the trunk on the side opposite the branch. On to the flat surface thus obtained the celt could be simply lashed. Alternatively, the section of trunk could be split medially and the celt stuck into the cleft. The result, if the cleft were made parallel to the branch, was an axe-handle, if perpendicular to it, an adze-handle. Finally, the knee-shaft could be used in conjunction with an antler sleeve made from a section of beam, both ends of which had been hollowed out. The stem—or in this case the branch—is not split but tapered, and its extremity fits into one hollowed end of the sleeve while the other holds the celt. This device may be termed a socketed sleeve. In the Alpine lake-dwellings socketed sleeves appear in Middle Neolithic times.

Stone celts mounted in split-ended knee-shafts have been recovered from the Alpine lakes, from a grave in Central Germany and elsewhere. The metal-flanged and winged celts and palstaves of the Early and Middle Bronze Ages in Europe must have been mounted in precisely the same way, and the split knee-shafts that held winged axes have actually been preserved in the salt and copper mines of the Eastern Alps. The socketed celts that characterize the Late Bronze Age of Upper Eurasia from China to Ireland, as well as their descendants in Early Iron Age I, can only have been mounted like the socketed sleeves described in the last paragraph.

Thus, save perhaps for the earliest flat celts of copper, all bronze and iron celts north of the Alps were mounted on knee-shafts. How metal flat celts—no other varieties occur—were mounted in South-western Asia and India is unknown. In Egypt the straight butt of the local flat celt was continued on either side by projecting lugs. Thongs looped round these projections served to bind the axe-head on to its shaft. Adze-blades were mounted on short-handled knee-shafts.

2. Missile Points

Arrow-shafts were, of course, wooden but were normally tipped with points of flint, bone, slate or metal. Indeed, arrow-heads constitute the most prominent and attractive part of many surface collections of stone implements. Flint arrow-heads were normally fixed into the split ends of wooden shafts and secured in position with resin, *Birkenteer* (birch resin, a gum prepared from birch bark), or other natural adhesive. The shaft was then generally lashed round to prevent it splitting farther. In the case of the tanged and barbed type, familiar as the brand on convicts' garb, only the tang would be covered by the wood of the shaft. In the case of leaf-shaped, triangular or hollow-based arrow-heads, a half or even two-thirds of the length must be overlapped on both faces by the forked end of the shaft.

Triangular arrow-heads, cut out of sheet metal, or tanged ones forged from a metal rod, could be mounted like flint heads. But some early Sumerian arrow-heads of sheet metal have been provided with sockets, formed by folding into a tube a strip of metal projecting from the base of the triangle. Barbed arrow-heads with cast sockets belong to the Late Bronze and Iron Ages. In the latter phase the socketed arrow-heads of the Scythians had three barbs, so that in cross-section they resemble the letter Y. The type seems to be derived from bone arrow-heads mentioned below.

Some at least of the minute flints termed microliths served as arrow-heads. In late Upper Palaeolithic sites in Northern Europe, small asymmetrical shouldered points have been found stuck into the end of wooden shafts, the shoulder forming a barb. Possibly lunates, too, were sometimes so mounted that one horn formed the point while the other projected sideways from the shaft to act as a barb. Lunates and trapezes were, however, more often mounted so that the cord of the arc or the long side of the trapeze, being set at right angles to the line of the shaft, formed a transverse or chisel edge; the arc or short side of the trapeze was embedded in the shaft. Such missiles are known as *transverse arrow-heads,* or chisel-ended arrows. A trapeze thus mounted was recovered from a mesolithic peat in Denmark, and chisel-ended arrows are depicted on Early Pharaonic documents from Egypt and on contemporary sculptures from Mesopotamia, and, later, on Minoan seals from Crete. Some contemporary hunting tribes use them today.

Microliths were also used as barbs for arrows or darts. They would be gummed into grooves along one or more sides of the wooden shaft; the careful working noted on the backs of microliths would be designed to prevent them splitting the wood and at the same time to give better purchase for the adhesive. But in Sweden a microlith has recently been unearthed simply stuck on to the ungrooved side of the shaft with birch-pitch. In this case the retouching presumably formed a bevel that would fit against the curved surface of the shaft.

In bone, simple splinters, polished till the section was cylindrical and both ends were pointed, may have served as arrow-heads. In Neolithic and later stages the bone was shaped so as to produce a point with a triangular or rhombic section from which projected a tapering tang. The tang must have been fitted, not into the split end of a wooden shaft, but into a hollow reed which either itself formed the shaft or served as a *foreshaft,* into the lower end of which a wooden shaft was fitted. Those bone arrow-heads were sometimes translated very literally into slate, flint or metal heads which would be mounted in the same way.

A *harpoon* is a missile equipped with a barbed detachable head to which a line is firmly attached so that, once the head is embedded in the prey's flesh, the victim is held fast. The shaft is normally of wood; the head may be made of bone, antler, ivory or metal. To identify confidently a barbed point as a harpoon-head an archaeologist must find at its butt end either a hole or a notch for the attachment of the line. Duly identified harpoons of reindeer's antler are very characteristic of the Upper Palaeolithic Magdalenian culture in Europe. Heads in stags' antler occur in the Mesolithic Azilian and some Neolithic cultures of Eurasia. The barbed bone points of the Mesolithic Natufians of Palestine and of the Neolithic Fayumis, like ivory points from predynastic Egypt and from the Sudan, were also very probably harpoon-heads. But most of the barbed or notched bone points that are enormously common in the Mesolithic Forest cultures of Northern Europe, and have traditionally been labelled "harpoons," were more probably employed as prongs for fish-spears or *leisters*. Two or three barbed points would be lashed on to an appropriately shaped wooden handle in such a way that the barbs of the outermost projected inwards towards one another; the middle prong, if present, should be notched along both sides. Translated into metal, the leister becomes the trident, symbol of Neptune; for the three prongs can conveniently be cast or forged in one piece.

3. Harness

Draught animals can be harnessed with ropes or thongs that will leave no trace at all in the archaeological record. Just after 3000 B.C., among the Sumerians, draught oxen were controlled, as ill-tempered bulls are today, by copper nose-rings which alone have survived. Horses, too, could be controlled with nose-rope and halter, and even the earliest bits may have consisted of wooden rods or twisted strips of leather, passed between the animal's teeth, and these would be just as evanescent. But to prevent such a bit slipping out sideways each end might be fixed into a *cheek-piece*. Cheek-pieces themselves could be made of perishable wood but were in fact often made of antler. Then they have a good chance of surviving and provide the sole clue as to the sort of harness employed, indeed the sole evidence for the domestication of horses. An antler cheek-piece consists actually of a tine perforated with three holes; two of the holes are always parallel, but the middle one may be at right angles to the plane of the others. Cheek-pieces, of course, were used in pairs with the ends of the bit proper (or mouthpiece) passed through, or fastened to, the middle holes. The remaining holes took the ends of forked cheek-straps, with the aid of which the whole apparatus could be kept in place on the horse's head.

Bit and cheek-pieces were translated into metal soon after 1500 B.C. in the Near East but nowhere replaced hide and antler entirely till iron became freely available. The bit became a solid or jointed metal bar which was generally twisted in imitation of its hide precursor and always terminated in loops for the reins. The cheek-pieces were turned into curved metal bars, or more rarely narrow plates, again provided with three perforations or loops; even when, as in some bits from Hither Asia, the bit was cast in one piece with the cheek-pieces, the latter bear loops corresponding to the terminal loops of the bit.

Horses were first employed to draw carts and chariots and were always yoked in pairs on either side of a pole and not between shafts. Accordingly, graves and hoards usually contain two bits and four cheek-pieces. With each bit may be associated five ornamental bronze disks or rosettes with loops on the back. They decorated and at the same time reinforced the junctions of the several straps required to complete a bridle. On each side one was attached where the cheek-strap forked to join up with the two ends of the cheek-piece. A second, perhaps, decorated the junction of the other end of each cheek-strap with a chin-strap going round the muzzle. The fifth, larger than the rest, adorned the steed's forehead, probably where a head-strap joined the chin-strap to pass between the ears.

With the development of riding, cheek-pieces gradually went out of fashion even for chariot horses. In Europe during Iron Age II (La Tène) their place was taken by large rings (often of iron sheathed in bronze) which passed through the looped ends of the bit and to which the reins were attached. At the same time a third link—it may be just a piece of wire twisted into a figure 8—was sometimes inserted between the two branches of the usual jointed bit. Such three-link bits occur sporadically in La Tène graves in France, whence they were introduced into Britain by Celtic invaders, probably the Parisii, to develop here along original lines.

In England each of the two outer links of the bit came to be cast in one piece with the ring that had originally moved freely in its exterior loop. What had previously been the end of the bit now became a functionless projection inside the terminal ring and was made a vehicle for decoration. But, as the bits were still used to control horses yoked in pairs, only one end of each bit would show at all conspicuously. So these British bits are regularly asymmetrical, one end being more richly decorated than the other.

4. Vehicles

The chariots the horses drew after 1600 B.C., like the carts, wagons and ploughs that oxen or onagers had then been drawing for fifteen hundred years, could be made entirely of perishable materials—of wood and leather. A dozen or so have survived in bogs or as stains on the earth, most have vanished without leaving the faintest trace. Usually only if some part of the vehicle be strengthened or embellished with metal work can the former existence of a vehicle be detected. The parts thus treated are not those that the contemporary motorist or even an Edwardian cart-driver would be likely to suspect. They are in the order of the antiquity of the first surviving examples: rein-rings, "tyre nails," lynch-pins, tyres, nave-caps and axle cases. None of these devices is needed on automobiles, so we had better devote a few words to explaining at least those not required by recent horse-drawn carts; for it is not necessary to travel outside Europe to see horses pulling vehicles, even in 1955.

As the draught animals were yoked in pairs or four-abreast on either side of a central pole, the reins must be crossed so that the driver can pull at once on both, or all four, reins coming from the same side of the draught animals' mouths on whichever side of the pole they may be. The crossing was effected by a rein-ring or terret affixed to the pole. In Hither Asia metallic rein-rings consisting of a pair of loops surmounted by a "mascot" were in use during the 3rd millennium. Kidney-shaped loops of bronze, sometimes encasing an iron core, were a favourite vehicle of decoration in the British La Tène culture and its survivals in the Roman period.

A lynch-pin is a peg fixed through the end of the axle outside the wheel to keep the latter from slipping off. It can perfectly well be made of wood, but as early as 2000 B.C. in Elam the wooden peg was sometimes replaced by a stout "bronze" bolt with a decorative head. In the Iron Age, lynch-pins were regularly made of metal. Normally of iron, they were often cased in bronze and ornamented among the La Tène Celts, particularly in Britain.

The rims of Sumerian and Elamite vehicles' wheels soon after 3000 B.C. were sometimes studded with copper nails to protect them and also perhaps to fasten on leather tyres, and after 200 B.C. copper tyres were attached to some wheels in Elam. But metal tyres only came into general use in the Iron Age and were invariably made of iron. They were fastened to the felloes with long iron nails the heads of which on some Assyrian and European vehicles project as studs to afford additional strengthening to the wheels' rims, like the Sumerians' copper nails.

In the Late Bronze Age and subsequently, the ends of the axles were protected and decoratd by metal caps. Bronze disks, about 2-7 inches in diameter with a collar rising from one face, such as occur in certain Late Bronze Age hoards, are shown to have been thus used as axle-caps by their position in some Bohemian hearse-graves of Iron Age I. The wheel hubs, too, were bound with ornamental metal hoops.

Index and Glossary of Technical Terms

All the technical terms and words used in a specialized archaeological sense are listed below. The numerals following each refer to the page on which the archaeological use of that word is explained. The index is thus designed to serve as a glossary.

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