

**ARCHAEOLOGY**

**STUDY MATERIAL**

**IV SEMESTER**

**B.A. HISTORY**

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## **INTRODUCTION**

Archaeology is the study of human past through their material evidences discovered from the archaeological sites. This monograph gives a general view about the principles, methods and theoretical framework of archaeology. The first module discusses different phases of the evolution of archaeology as a discipline. It has started from an antiquarian stage and developed to a systematic and scientific discipline in the social science. The processual, post processual and cognitive theories will discuss and a brief survey of the evolution of world and Indian archaeology is also included. The second module introduces the terms and concepts of archaeology. The third module delineates different techniques of archaeological exploration include site survey methods, specialized survey methods and geo-physical survey method. The fourth chapter describes various methods of excavations include vertical, horizontal and quadrant. The three methods of dating like relative, absolute and derogative are also discussing in this part.

### **THE EVOLUTION OF ARCHAEOLOGY**

#### **Definitions**

Archaeology is the study of past through material remains. It deals with the study of human behaviors and cultural changes happened in the past. The word archaeology comes from the Greek-“ arkhaiologia” or archaeolos and logos means ‘discourse about ancient things; but today it has come to mean the study of the human past through material traces. According to Colin Renfrew and Paul Bhan, since the aim of archaeology is the understanding of humankind, it is a humanistic discipline, a humane study.

Archaeology aims to study past of the human interactions with their living environment and the corresponding cultural changes. The human past has broadly divided into the pre historic and historic period by the archaeologists and ancient historians. Pre historic means the period of human beings before the beginning of writing. Paleolithic, Mesolithic, Neolithic and Chalcolithic periods are the example. Historic means the period after the advent of writing or the period after the decipherment of ancient scripts. There is no rigid time limit for archaeology. Archaeology intends to study the life of the human beings in the pre-historic, proto-historic and historic period. It deals with the material remains of the human beings from the early Stone Age primitive tools to the modern palaces, fortifications etc.

#### **Antiquarianism**

Archaeology developed as a recognizable discipline in the late nineteenth century. Before this period, it had only an antiquarian status. A quest for searching the cultural heritage of the Rome and Mediterranean region had developed in the Renaissance period (14<sup>th</sup> and 15<sup>th</sup> centuries AD) onwards and it developed in to an antiquarian stage in the enlightenment period (16<sup>th</sup> to 18<sup>th</sup> centuries AD). Cyriacus of Ancona who traveled in Greece and Mediterranean for

25 years in the late 14<sup>th</sup> century for documenting the archaeological monuments, collecting books, copying inscriptions etc. was one of such noteworthy endeavors

Antiquarianism represents the investigation of the ancient past. It is the study of archaeological objects in orderly manner to find its age and function. An antiquarian researcher will be interested in artifacts only and does not give attention on its context. Who is an antiquarian? A person interested in the past who collects and digs up antiquities unscientifically. The collection of antiquities is based on the passion and curiosity of the Antiquarian. The digging methods of an antiquarian were brutally crude and the main intention was to recover the antiquities as quickly as possible. The Renaissance thinking in the Europe resulted in to a series of the works of antiquarians who engaged in active field archaeology in Britain between the early sixteenth and mid-eighteenth centuries. John Leland, William Camden, John Aubrey and William Stukeley are the prominent antiquarians of this period. Advances in antiquarian research and fieldwork were not restricted to Britain. In Scandinavia, Johan Bure and Ole Worm undertook antiquarian research—with royal patronage—in the early seventeenth century. An indigenous archaeological tradition had also emerged in America by the nineteenth century.

### **Scientific Archaeology**

The systematic and scientific archaeological study developed in Scandinavia with the “Three Age System” of Christian Thomsen. In 1807, Danish government set up an Antiquities Commission to protect sites, promote public awareness of antiquities and establish a museum. The first curator of the resulting National Museum in Copenhagen was Christian Thomsen, who held the post from 1816 to his death in 1865. He analyzed the archaeological evidences kept in the museum based on material, style, decoration, shape and context and established their relative order. Consequently, Thomsen established a theory entitled “Three Age System” as a system of successive human development through the analysis of the archaeological remains of three successive periods; Stone Age, Bronze Age and Iron Age. The museum displays were described in a guide printed in 1836, and received wider attention after it was translated into English in 1848. The archaeologists like as Pitt Rivers reinforced Thomsen’s display method, and it remains characteristic of most museum curators today. However, unlike Pitt Rivers, Thomsen did not attempt either to study the development of the forms of individual artifacts (‘typology’) or to explain the reasons for the changes that he had observed.

Jens Worsaae, Thomsen’s successor as Director of the Danish National Museum, attempted to subdivide the Stone Age into three periods according to the nature of stone artifacts. The earliest period was characterized by hand axes and large flakes found in the gravels and caves of Western Europe; these were followed by finer tools found in Denmark in ‘kitchen middens’ (mounds of shells and bones left by hunter-gatherers. Finally, polished stone tools were associated with elaborate tombs that occasionally also contained the earliest metal

objects. These divisions of the Stone Age were soon named Palaeolithic, Mesolithic and Neolithic (old, middle and new) by Sir John Lubbock in his book *Prehistoric Times* (1865). In short, The Scandinavian archaeologists were involved in identifying the cultural evolution of the human beings whereas the French and British archaeologists devoted much of their time in identifying the antiquity of mankind.

### **Discoveries of Civilizations**

The archaeological discoveries of ancient civilizations of Egypt, Mesopotamia, Indus, China and the remains of classical Greco-Roman world laid a strong foundation to the archaeology discipline.

Egyptian civilization was considered to be the oldest civilization developed on the bank of Nile river. It is often termed as the Gift of Nile. Nekhen (3500 BC) was the oldest settlement in Egypt and archaeologist believed that it was the capital of upper Egypt. Memphis was another area excavated and considered as the capital of ancient Egypt after Nekhen. Circa 3100 BC marks the beginning of the Dynastic Period of ancient Egyptian history. Manetho's, a Greco-Egyptian priest and historian lived in the 3<sup>rd</sup> century BC, *Aegyptiaca* (History of Egypt) listed thirty-one dynasties which had ruled over Egypt. He classified these dynasties into three as Old Kingdom, Middle Kingdom and New Kingdom, which is followed by the modern historians as well. Egyptians had a writing system named Hieroglyphics deciphered by Thomas Young and Jean Francois.

Mesopotamia (C. 3000 to 2000 BC) broadly corresponds to present Iraq. Mesopotamia produced the earliest known Bronze Age civilization- the Sumerian civilization. It was developed on the banks of two rivers; Euphrates and Tigris. The archaeological relics from the major cities of Sumeria like Ur, Uruk, Kish, Lagash etc have given indication on the splendors of the civilization. Based on the excavation of a royal cemetery at Ur city, archaeologist Leonard Woolley proved that C. 2150-2000 BC was the glorious period of Mesopotamian civilization. It had a writing system called Cuneiform, deciphered by Henry Rawlinson.

Indus valley civilization was one of the three Bronze Age civilizations of the world that presently located in India, Pakistan and Afghanistan. Alexander Cunningham, a Colonial Officer cum archaeologist, noticed the remnants of Indus Valley civilization. It was realized with the excavations in 1920-22 at two important sites like Harappa, on the banks of the river Ravi, (D. R. Sahani) and Mohenjodaro, on the banks of the Indus (R.D. Bannerji). It was a well-planned urban civilization of bronze age dated between 2500 B.C–1500 BC. The major features unearthed include the great Bath (Mohenjodaro), Great Granary (Harappa) and Dockyard (Lothal). It had a writing system which still remained as undeciphered. It is a pictographic script. Many attempts have done to decipher it and the work of Asko Parpola, Iravatham Mahadevan, who identified it as a proto Dravidian script, are noteworthy.

## **Scientific Archaeology**

The 1960s witnessed the development of scientific archaeology or Processual archaeology. It represented a drastic change from the culture, the historical and antiquarian approaches to more scientific theories. Processual archaeologists argued that Archaeology is a science and disagree to the traditional view that archaeology is a branch of history that provide material evidences for the historical explanation of the past of prehistoric societies. The new archaeologists argued that archaeology should focus on explanation of archaeological materials. Scientific explanations would demand that archaeologists focus on dynamic systems—an approach called “systems theory”—with the goal of understanding the complex factors driving cultural change, and explaining how people adapted to the environmental factors that drove cultural changes. (2) Focus on culture process: Arguing that culture–historical archaeology results in static snapshots of phases of occupation (an artifact of archaeological collection and not a representation of reality), the processualists focused on generating a more lifelike, fluid understanding of the past, one based on understanding the complex interrelated cultural and environmental factors that contribute to cultural (and archaeological) change over time. (3) An expressly theoretical approach: The theoretical goals of processual archaeology resulted in a number of methodological changes in the ways in which archaeology was (and is) practiced, resulting in a strong focus on survey, the integration of a wide range of new types of data, and on the replacement of the solo archaeologist with an archaeological team of experts, representing a number of fields that contribute to the explanation of the past.

## **Post- processual archaeology**

This theory of archaeology, also known as Interpretive Explanation, has developed as a reaction against Processual or New Archaeology theory. It was pioneered by Bruce Trigger in his book *Time and Tradition* in 1978. He preferred the historiographic approach, the broadly descriptive approach of the traditional historian. However, Ian Hodder is the chief proponent of this theory (see Ian Hodder). He felt that archaeology’s closest link with history, and wanted to see the role of the individual in history. He also very validly stressed what he called “the active role of material culture”, emphasizing that the artifacts and the material world we construct are not simply the reflections of our social reality that become embodied in the material record.

The post processual archaeologists see the context of the material remains and the intention of the deposition of the material in the ground, both in relation to each other and in relation to other elements of the site. They will see the individual’s role or action and the whole process involved in the deposition. The social and the ideology factors are now recognized as active forces of change. The mental structure and belief systems that prevailed in a particular society guide cultural adaptations.

## **Indian archaeology in colonial period**

The history of Indian archaeology started from 18<sup>th</sup> century AD when the British colonial government took initiative to establish Asiatic Society of Bengal. It was established in 15<sup>th</sup> January, 1784 under the leadership of Sir William Jones in order to compile and study various texts and scripts of Indian tradition. Thus, Indology formalized as an academic discipline. William John and Charles Wilkins translated many Indian texts include Sakuntalam, Gita Govinda and Bhagavad Gita. J Babington excavated a cluster of Megaliths at Feroke in Kerala, which he termed as Pandukoolies, in 1819 and unearthed a huge amount burial goods. In 1800, Robert Sewell has done detailed antiquarian survey in the Madras Presidency. James Prinsep, who deciphered Brahmi and Kharoshti script, also emerged as a legendary figure in Indological studies. Robert Bruce Foote discovered the first Palaeolithic tool from Pallavaram, near Madras in 1861. In 1861, Alexander Cunningham appointed as the first surveyor of the then established Archaeological Survey of India, which marked the development of archaeological investigations in India. He gave more importance on historical archaeology (see Alexander Cunningham). He was also responsible for the first volume Indian inscriptions entitled Corpus Inscriptionum Indicarum in 1877. James Burgess, James Fergusson, J F Fleet, Hultzch, Meadows Taylor, John Marshall, Mortimer Wheeler etc were served the archaeological survey of India during colonial period.

In the post-independent period, it came under the Ministry of Culture. It is the premier organization for the archaeological researches and protection of the cultural heritage of the nation. Maintenance of ancient monuments and archaeological sites and remains of national importance is the prime concern of the ASI. Besides it regulate all archaeological activities in the country as per the provisions of the Ancient Monuments and Archaeological Sites and Remains Act, 1958. It also regulates Antiquities and Art Treasure Act, 1972.

For the maintenance of ancient monuments and archaeological sites and remains of national importance, the entire country is divided into 24 Circles. The organization has a large work force of trained archaeologists, conservators, epigraphist and scientists for conducting archaeological research projects through its Circles, Museums, Excavation Branches, Prehistory Branch, Epigraphy Branches, Science Branch, Horticulture Branch, Building Survey Project, Temple Survey Projects and Underwater Archaeology Wing. In Kerala its branch is functioning at Trissur (ASI Trissur Circle).

### **Pitt Rivers**

Augustus Henry Lane-Fox Pitt Rivers was an English army officer, ethnologist, and archaeologist. He was noted for innovations in archaeological methodology, and in the museum display of archaeological and ethnological collections. His international collections were exhibited in the Pitt Rivers Museum at the University of Oxford and at the Salisbury Museum in Wiltshire. He made valuable contributions to the techniques and methods of

field excavation and invented a sequence dating method that made possible the reconstruction of history from the remains of ancient cultures.

### **Sir William Flinders Petrie**

Flinders Petrie was a British Archaeologist and Egyptologist. From 1880 to 1883, Flinders studied and excavated The Great Pyramid of Giza. In 1884, Flinders discovered fragments of the statue of Ramses II during his excavation of the Temple of Tanis. Petrie excavated two Nile Delta sites at Naukratis and Daphnae and unearthed potteries of different periods. Based on the findings he has developed a 'sequential dating method' that would enable him to determine the chronology of any civilization by pottery fragment comparison. He has carried out a six-week season of excavations at Tell el-Hesi of Palestine in the spring of 1890 and introduced the concept that a 'Tell is a manmade mound of successive, superimposed 'cities'. He established the dating of these 'cities' by means of their associated deeply stratified ceramic remains and of the "cross-dating" of these remains with reference to similar finds made in their Egyptian contexts. He has published a work entitled "Methods and Aims of Archaeology," in 1904. He was popularly awarded the title of "The Father of Modern Archaeology."

### **V. Gordon Childe**

V. Gordon Childe, was an Australian archaeologist and philologist. He specialized in the study of European prehistory and working most of his life as an academician in the United Kingdom for the University of Edinburgh and then the Institute of Archaeology London. He was an early proponent of Culture- historical archaeology and Marxist archaeology. His insistence on an international, comparative, and materialist approach to culture change was highly influential in both archaeology and cultural anthropology. His works include *The Dawn of European Civilization*, 6th ed. (2003; originally published in 1925), and *The Danube in Prehistory* (1929), both classics of European prehistory. His books that are aimed at a general readership include *Man Makes Himself*, 4th ed. (2003; originally printed in 1936), an exposition of the parallel evolution of society and technology, and *What Happened in History* (1942), an introduction to prehistoric archaeology. Childe also became one of the first scholars to describe the transition from hunting and gathering to agriculture. He termed this transition as the agricultural revolution, Neolithic revolution. Childe also coined the term urban revolution to denote the shift from small, village-based societies to those with towns and cities. Both terms have retained their currency in archaeology.

### **Sir Alexander Cunningham**

Cunningham was a British army officer and archaeologist who became the first Archaeological Surveyor of India. He was concentrated on the historical archaeology and located many Buddhist sites referred to the Chinese travelogues of Fa-Hien and Hiuen – Tsang like Taxila, Sravasti, Kausambi and Barhut. He was responsible for the publication of the first

volume of *Corpus Inscriptionum Indicarum* in 1877. His main contribution to the archaeology of India was the discovery of the Harappan remains. Thus, he is considered as one of the pioneer archaeologist and the Father of Indian Archaeology.

### **Sir John Hubert Marshall**

Marshall was the Director-General of the Archaeological Survey of India from 1902 to 1928. He was responsible for the excavation that led to the discovery of Harappa and Mohanjodaro, two of the main cities that comprise the Indus Valley Civilization. He conducted excavations at Taxila, Sravasti, Vaisali, Rajagriha, Saranath, Sanchi, Pataliputra and Nalanda. During his tenure, the important legislation called Ancient Monument and Preservation Act 1904 was enacted. He laid the foundation stone for the Taxila museum in 1918.

### **Hasmukh Dhirajlal Sankalia**

H.D Sankalia was an Indian archaeologist specializing in proto- and ancient Indian history. In 1939, Sankalia joined Deccan College as Professor in Proto and Ancient Indian History and started systematic surveys of the archaeological sites in and around Pune with the support of his students. Sankalia's early explorations are on the Megaliths of Bhavsari. He discovered the first ever-discovered human skeleton of the Stone Age Man at Gujarat. He has scientifically excavated a Mesolithic site at Langhnaj for the first time by applying stratigraphical method.

The other noteworthy contributions of Sankalia includes the discovery of the historical site of Kolhapur, the stratigraphical deposit of Palaeolithic industry at Gangapur (Gangawadi) near Nasik, the Palaeolithic industries includes animal fossils at Nevasa, the report of the occurrence of Northern Polished Ware (NBPW) at Nasik-Jorwe, excavations at Navdatoli etc. The Navdatoli excavation has unearthed a full-fledged Chalcolithic culture dated between the decline of the Harappan Civilization and the beginning of Early Historical Period.

### **Sir Robert Eric Mortimer Wheeler**

Mortimer Wheeler was a British archaeologist appointed as the Director General of the Archaeological Survey of India in 1944. He has introduced the scientific method in Indian archaeology and established a training school at Taxila. He strictly emphasized the principles of stratigraphy in the excavations and insisted on problem-oriented excavations. His research focused on the origins and development of the Indus Civilization. He also carried out excavations at the early historic Roman site at Arikamedu and the Megalithic site at Brahmagiri. The official journal *Ancient India* started during his tenure.

### **Raymond Allchin and Bridget Allchin**

Frank Raymond Allchin and his wife, Bridget Allchin are the most influential British partnerships in the post-Independence study of South Asian archaeology. Producing a large body of scholarship ranging from archaeological excavations, ethno-archaeology as well as epigraphy and linguistics, the Allchins made their work and that of others highly accessible through a series of



sole, joint and edited publications. Seminal works include *The Birth of Indian Civilisation* (1968), which was later superseded only by their books *The Rise of Indian Civilisation in India and Pakistan* (1982) and *The Archaeology of Early Historic South Asia* (1995).

### **S R. Rao**

S. R. Rao, was an Indian archaeologist who led excavations of many important sites such as Rangpur, Amreli, Bhagatrav, Dwarka, Hanur, Aihole, Kaveripattinam etc. He has discovered a number of Harappan sites including the port city Lothal and Bet Dwaraka in Gujarat. He was the founder of the Society of Marine Archaeology in India.

The discovery of three-holed triangular stone anchors from Dwarka waters in Gujarat suggested a continuity in evolution of the anchors in Lothal and Mohenjodaro., which had a single hole. According to him, the three-holed triangular anchors of Dwarka belonged to late Harappan phase. In 1992, Rao claimed to have deciphered the Indus script and postulating uniformity of the script over the full extent of Indus-era civilization. He has confirmed that it is definitely an Indo-Aryan language.

### **David Leonard Clarke**

D L Clarke was an English archaeologist who is well known for his work on processual archaeology. His main works include *Analytical Archaeology*, *Beaker Pottery of Great Britain and Ireland*, *Models in Archaeology*, *Spatial Archaeology* etc. David Clarke has claimed that as a discipline, archaeology had moved from its original "noble innocence" through to "self-consciousness" and then onto "critical self-consciousness", a symptom of which was the development of the New Archaeology (see New Archaeology).

### **Lewis Roberts Binford**

Lewis R. Binford was an American archaeologist who is renowned as the proponent of "New Archaeology". The proponents of the new archaeology stated that archaeological cultures were no longer regarded merely as the sum total of their preserved artifacts; therefore, each can be treated as configurations or functionally integrated systems. Archaeologists must explain changes in archaeological cultures in terms of cultural process. Binford popularized this concept among the younger generation of American Archaeologists and this concept has been recognized around the world as the American New Archaeology since 1960s.

### **Colin Renfrew**

Renfrew is a British archaeologist. He is a Senior Fellow of the McDonald Institute for Archaeological Research, Cambridge University, UK and interested in archaeological theories especially the Cognitive archaeology, European prehistory (especially the Aegean), Archaeological science (with particular interest in DNA and molecular genetics) and Origins of linguistic diversity. His works include *The Emergence of Civilization: The Cyclades and the Aegean in The Third*

Millennium BC, *Archaeology and Language: The Puzzle of Indo-European Origins*, *The ancient mind: elements of cognitive archaeology* etc. his edited work with Paul Bahn, entitled *Archaeology: Theories, Methods and Practice*, is one of the leading references among the archaeology students of the world.

### **Ian Hodder**

Ian Hodder is a British archaeologist and pioneer of postprocessual theory in archaeology. He has attempted to explore the effects of non-positivistic methods in archaeology, which includes providing each excavator with the opportunity to record his or her own individual interpretation of the site. Ian Hodder teaches and writes about archaeological method and theory. He is interested in Archaeological theories, European prehistory, material culture, long term social and cultural changes. His publication includes *Symbols in Action, Reading the Past, The Domestication of Europe, The Archaeological Process* etc

### **Bruce Graham Trigger**

Trigger was a Canadian archaeologist, anthropologist, and ethno historian. He was best known his ethno-historical study entitled *The Children of Aata* *The Children of Aataentsic*, Trigger's book *A History of Archaeological Thought* investigates the development of theory and archaeology as a discipline. In *Understanding Early Civilizations: A Comparative Study* Trigger uses an integrated theoretical approach to look at the meaning of similarities and differences in the formation of complex societies in ancient civilizations. Trigger also made significant contributions to theory and debates on epistemological issues within archaeology.

### **Michael Brian Schiffer**

Michael Schiffer is an American archaeologist and one of the founders and pre-eminent exponents of behavioral archaeology. Schiffer's earliest ideas, set out in his 1976 book *Behavioral Archeology* and many journal articles, are mainly concerned with the formation processes of the archaeological record. His most important early contribution to archaeology was the rejection of the common processualist assumption that the archaeological record is a transparent fossil record of actual ancient societies. In fact, he argues, artifacts and sites undergo, respectively post-use and post-occupational modification by diverse formation processes. His works comprised of *Behavioral Archeology*. Academic Press, *Formation Processes of the Archaeological Record, Technological Perspectives on Behavioral Change, Behavioral Archaeology: Principles and Practice* etc.

## TERMS AND CONCEPTS IN ARCHAEOLOGY

The previous chapter has given an outlook on the development of archaeology as an established discipline from the antiquarian stage to the scientific research and the pioneer field archaeologists of the world. This chapter discusses various terms and concepts of archaeology such as archaeological sites, site formation process and the concept of geological archaeological layers, artifacts, assemblage, industry, culture and civilization. A survey about different kinds of archaeology is also included in this part.

### **Archaeological Site/ Tell / Mound, Site Formation Process**

Locations that show significant traces of human activity, essentially where artifacts, features and eco-facts are found together, are known as archaeological sites. It also known as 'Tell', or 'Mound', the name given by Flinders Petrie, a British Archaeologist and Egyptologist after a brief interlude a six-week season of excavations at Tell el-Hesi Palestine in 1890. According to him, a Tell is a manmade mound of successive, superimposed 'cities'.

There are different types of site like habitation sites, burial sites, manufacturing sites etc. The archaeological data found in a site are the result of two basic factors namely behavioural process or cultural formation process and transformational process or natural formation process.

The behavioural process or cultural formation process involves the deliberate or accidental activities of human beings as they make or use artifacts, build or abandon buildings, plough their fields and so on. The artifacts and features are passed through three important consecutive stages known as manufacture, use and deposition.

The transformational or the natural formation processes are natural events that govern both the burial and survival of the archaeological record. The natural agents of transformation include climatic factors like wind, humidity, temperature, flooding, earthquakes and volcanic eruptions. The sudden fall of volcanic ash that covered Pompeii is an exceptional natural process; a more common process would be the gradual burial of artifacts, feature or ecofacts by rain or wind-borne sand or soil. The transporting of artifacts or ecofacts by river action is another example of river action.

In order to reconstruct past human activity at a site it is crucially important to understand the context of a find, whether artifacts, features or eco facts. Every archaeological material had some settings called Matrix, Provenance and Association

Matrix refers to the physical medium like sediments, sands, clay, gravel etc, which surrounds, holds and supports the archaeological material. Its provenance refers to the horizontal and vertical (three-dimensional) position within the matrix. Association refers to the adjacent artifacts found in association with the significant archaeological material in the same matrix. For example, an arrowhead recovered from an alluvial soil at a depth of 7 m in the central part of the site found in association with a human burial represents the matrix (alluvial soil), provenance (central part of

the site) and the association (human burial).

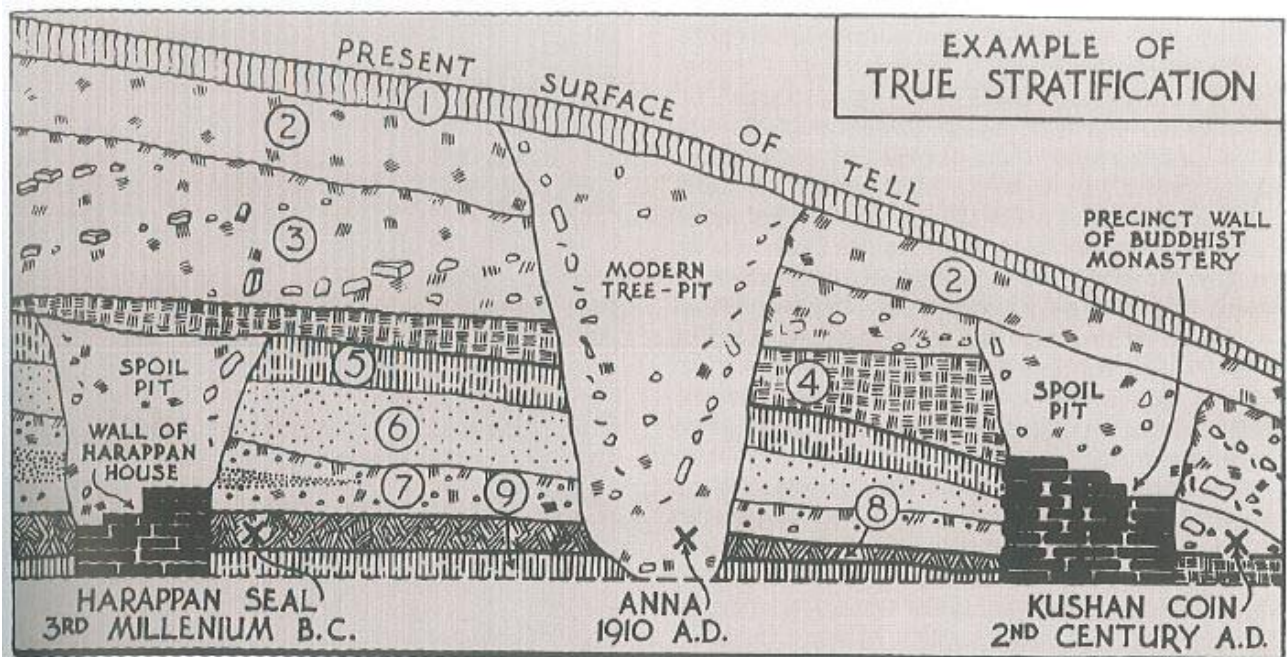
The meticulous observation and documentation of the matrix, provenance and association of archaeological data helps to understand its context. Artifacts found where they were originally deposited in the past are said to be in a primary context. In another word, the material is found in undisturbed condition since its deposition, then it is known as primary context. Objects that have been moved since their original deposit through either natural forces or human activity are said to be in a secondary context.



### **Layer and Stratigraphy**

There are two layers named Geological layer and archaeological layer. The naturally formed sediment layers are the geological layer. The cultural deposit in the geological layers is the archaeological layer. Stratigraphy is the study of stratification; that is, the interpretation of horizontal layers that form the deposits of a site over time. They may compose of entirely natural deposits and may consist of a combination of natural and cultural materials. Archaeologists may be able to understand the history of the site through the study of stratification. Of primary importance is the interpretation of the order in which events occurred at a site and the relative ages of artifacts and features found. This is essential for the relative dating of the cultural materials found.

The archeological study of the strata known as stratigraphy. The Stratigraphical method is the removal of the soil in a reverse order, from the surface layer to the natural layer.



Mortimer Wheeler's drawing of a section across a mound or tell in the Indus Valley (modern Pakistan). Pit disturbance makes dating difficult, but the Harappan seal, for example (age known from similar seals found elsewhere), lies in an undisturbed context in layer 8, and can therefore help date that layer and the wall against which the layer abuts.

### Artifacts, Features and Eco facts

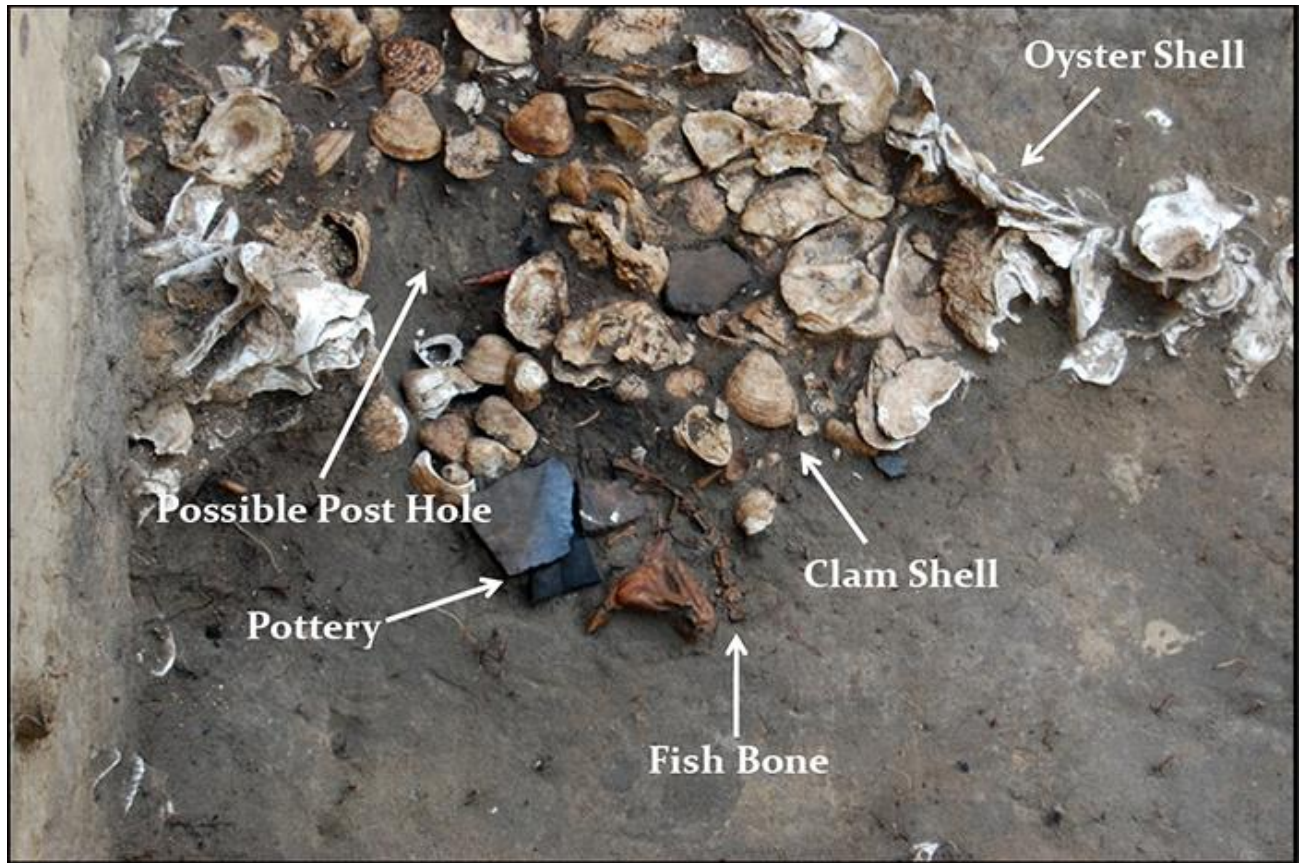
The material remains collect from an archaeological context can be broadly classified into; Artifacts, Features and Eco facts.

Any kind of portable object made, fashioned, modified or used by human beings are the artifacts. For example pottery, beads, plough share, ornaments, etc. It includes unbroken objects, broken objects, manufacturing wastes, rubbing objects, etc.

All types of non- portable artifacts such as hearths, structures of floors, walls, postholes etc are called features. Both artifacts and features are the product of human workmanship.

Eco-facts are the non- artifactual evidences which includes both

- Inorganic eco-facts like geological samples such as minerals, sediments, stones, volcanic ash. etc
- Organic eco-facts like bone, fossils, skulls, teeth, shells etc botanical samples like, plants or wood remains, pollen, nuts, grains, husks, etc.



### **Assemblage, Industry**

Assemblage means a group of artifacts, features and eco facts recurring together at a particular space belong to a particular period. It represents the sum of human activities. For example; the megalithic assemblage which is the grouping of various artifacts like Black and Red Ware pottery, iron Objects, etched carnelian beads, bone fragments etc of a period between 1<sup>st</sup> century AD and 4<sup>th</sup> century AD, from the excavation at Porkalam.

The assemblage of artifacts, features and eco facts termed as Industry. For example, Pattanam Industry, which means the grouping of all artifacts and eco-facts discovered from Pattanam archaeological site.



## Culture

As part of the anthropological studies, 19<sup>th</sup> century witnessed the development of concept of archaeological culture. Archaeologist often found material remains such as artifacts, features and eco-facts in the course of their exploration or excavation in a particular site. They labeled the assemblage of such material remains as culture. For example, the term ‘Megalithic culture of Kerala’ stood for the assemblage of artifacts collected so far from Kerala in association with the Megalithic monuments and it represented the cultural milieu of the people lived in the Megalithic period. E B Taylor, in his work *Primitive Culture*, defined culture as “the complex whole which includes knowledge, belief, art, morals, law, custom and other capabilities and habits acquired by man as a member of a society”. However, in archaeology culture means the grouping of archaeological remains from a particular site and then labeled the site as a distinct culture like Harappan culture, Mohanjodaro Culture, Lothal Culture, Dholavira Culture, Kalibangan Culture, Ropar Culture like that. The assemblage of these cultures stands for ‘Civilization’. For instance, the grouping of the above said archaeological cultures labeled as Indus Valley Civilization. The transfer of material culture from one culture to another is labeled as diffusion. The diffusion of iron technology is often quoted as a good example.

## **Cultural Evolution**

Archaeologists and anthropologists commonly use term 'cultural evolution' to conceive the long-term trends in human history. It represented the evolution of human culture from hunting food gathering to farming; from farming to the origins of civilization and the state; from agrarian civilizations to industrial and now post-industrial society. Consequently, such development has resulted to the increase of population, greater social complexity and inequality, and technologies that are more complex. Archaeologist felt that the culture is always moved from simple to complex or from one condition to another condition. For example, state is evolved from tribal society to chiefdoms and chiefdoms to kingdoms.

The cultural evolution concepts have originated during the 18<sup>th</sup> century Enlightenment period and it is largely influenced by the nineteenth century ideology of Karl Marx and Frederic Engels and heavily influenced by L.H. Morgan's sequence from savagery to barbarism to civilization. Gordon Childe in his *Man Makes Himself, What Happened in History and Social Evolution* clearly demonstrate the changes occurred in the human culture due to the changes occurred in the subsistence strategies. Childe conceived the origins of agriculture (the Neolithic revolution) and the emergence of urban societies (the urban revolution) as major steps in the progress of human societies, because they represented improved adaptations of humans to their environments.

## **Kinds of Archaeology**

There are many branches of archaeology that deal with different aspects of the material remains collected from the archaeological contexts.

### **Ethno-archaeology**

Ethno-archaeology is the study of living people and their material culture undertaken with the aim of improving our understanding of the past. In another words, anthropological observation aimed at the understanding of the nature of archaeological evidence is often called ethno-archaeology. Lewis Binford and Ian Hodder have conducted ethno-archaeological investigations amongst the Inuit (Eskimos) in Canada and in several parts of Africa to make a better understanding of archaeological sites. The study of traditional bead making centers of Khambhat (Gujarat) and Kangayam (Tamil Nadu) and the pottery making centers of Pattanam (Kerala) unearthed valuable data on understanding the technology involving in making of beads and potteries that recovered from archeological sites.

### **Settlement archaeology and Spatial analysis**

Settlement archaeology, which is initiated by Bruce G Trigger, is defined as the study of societal relationships using archaeological data. It is the study of spatial distribution of an ancient human activities and occupation, ranging from the differential location of activities within a single room to the arrangement of sites in a region. The special patterning of archaeological features is analysed



in order to reconstruct past decisions regarding use of environment, allocation of natural resources, ritual pattern, social relationships and other related matters. Gordon Willey's report of Prehistoric Settlement Pattern in the *Viru Valley* has made a pioneer attempt to study the pre historic settlement pattern.

### **Salvage /Rescue Archaeology**

Salvage or rescue archaeology is a method of retrieving the data from archaeological sites which are under hazard. Rescue excavation was a term coined in the 1960s when development and road building destroyed much of our archaeological heritage. It involved trying to excavate and record as much as possible in the time before the builders began work. Occasionally sites were not discovered until bulldozing began. Nowadays, a number of archaeological sites, especially the megalithic monuments, have been reported in Kerala during the construction works and most of them were destroyed. In certain context, such discoveries led to the salvage excavation; the rock cut sepulcher (megalithic monuments) site of Tiruvattur, Calicut, which was salvaged by the State Archaeology Department of Kerala immediately after the accidental discovery during a house construction. Rapid recording and rushed excavation in these circumstances was often the best that could be done. This process of the retrieval of archaeological objects is called salvage and Rescue archaeology.

### **Environmental Archaeology**

Environmental archaeology is the study of past human economy and environment using earth and life sciences. It tells us about ecological, cultural, economic, and climate change. Archaeological sites are created by human activity involving material culture (acquisition, manufacture, use, deposition). Archaeological sites and landscapes are altered by a combination of natural and cultural processes. Natural processes include geological and biological activity, such as erosion, sedimentation, frost heave, reworking by plants and animals, plant growth, deposition of dead plants and animals, and degradation by living ones. Cultural processes include subsistence and ritual activities, building, discarding or loss of material, manufacturing and the creation of manufacturing waste, recycling, deliberate destruction and resource utilization. Environmental archaeologists started reconstructing the past human life and climate drawn from different sources of information such as the study of ancient coastal lines, submerged land surfaces, raised beaches, palaeo-channels, pollen analysis, fossils and animal bones. It aims to study the changes occurred in the flora and fauna of a particular archaeological sites.

### **Gender Archaeology**

The archaeology of gender is the study of the roles, activities, ideologies and identities of men and women, and the differences between them. It is mentioned that in archaeology, everything perceiving through the eyes of men (this is called androcentrism), understanding women only in

biological roles such as mother and sexual partner, and describing the differences between men and women as polar opposites. Thus, the archaeology of gender was created to balance archaeological interest in men and women by directing as much attention to women's activities as to men's, to demonstrate that women are not the same in all cultures and that therefore their activities are of interest for comparative studies, and to help make archaeology into a discipline that concerns people, rather than merely artifacts. The first book on women in the ancient Mediterranean world was by a classicist and art historian, Sarah Pomeroy (*Goddess, Whores, Wives, and Slaves*, 1975). Her data included myths, documents, painted images and statues, but not archaeological sites as such. Historic archaeologists, with a variety of written material such as diaries, will and deeds, along with artifacts and features, had the tools to discuss gender issues as soon as the topic was on the table. The edited volume of Joan Gero and Margret Conkey (1991) entitled *Engendering Archaeology: Women and Prehistory* furnishes a broad perspective on gender in archaeology. The American historical archaeologist Suzanne Spencer-Wood organized the first session on gender at a historic archaeology meeting in 1986. Roberta Gilchrist's *Gender and Archaeology –contesting the past* explores the significance of feminist critique of archaeology and feminist epistemologies. Now it becomes one of the leading sections in the archaeology.

### **Marxist Archaeology**

Marxist archaeology is an approach to archaeological interpretation and explanation that draws on the work of Karl Marx and Friedrich Engels to explore materialist models of social change and the central questions of social relations. Understanding who has power and how that power is exercised are seen as vital elements in explaining social change. Marxists regard each human society as defined and shaped by its 'mode of production', which comprises both the 'forces of production' (i.e. science, technology, and all other human and natural resources), and the 'relations of production' (i.e. the ways in which people relate to one another in order to facilitate the production and distribution of goods). Social organization and change are seen in terms of conflicts between segments of society: for example, those based on class, sex, or age. Among western archaeologists, one of the first to draw heavily on Marxist theory was Gordon Childe, who emphasized the forces of production as being fundamental influences on prehistoric economies, societies, and ideologies. In many of his early works like *Man Makes Himself*, *What Happened in History and Social Evolution* he effectively challenged the fascist German-based views of prehistory current at the time.

### **Geo archaeology**

Geoarchaeology is a multi-disciplinary approach, which uses the techniques and subject matter of geography, geology and other earth Sciences to examine topics, which inform archaeological knowledge and thought. Geoarchaeologists study the natural physical processes that affect archaeological sites such as geomorphology, the formation of sites through geological processes

and the effects on buried sites and artifacts post-deposition. Geoarchaeologists' work frequently involves studying soil and sediments as well as other geographical concepts to contribute an archaeological study. Geoarchaeologists may also use computer cartography, Geographic Information System (GIS) and Digital Elevation model (DEM) in combination with disciplines from human and social sciences and earth sciences. Geoarchaeology is important to society because it informs archaeologists about the geomorphology of the soil, sediments and the rocks on the buried sites and artifacts they are researching on. By doing this we are able locate ancient cities and artifacts and estimate by the quality of soil how "prehistoric" they really are.

### **Behavioural Archaeology**

Behavioural archaeology is the study of how artifacts move from their 'systematic context', the context in which it was originally touched by human beings, to their 'archaeological context' in which they found. Michael Brian Schiffer in his work Behavioural Archaeology highlighted the importance of study of the movement of artifacts and coined the term "Behavioural Archaeology". He emphasized on various process involved in the movement of the artifacts from the original context to the archaeological context like dispositional process, reclamation process, disturbance process and rescue process.

### **Industrial Archaeology**

Industrial archaeology is the systematic study of material evidence associated with the industrial past. This evidence, collectively referred to as industrial heritage, includes buildings, machinery, artifacts, sites, infrastructure, documents and other items associated with the production, manufacture, extraction, transport or construction of a product or range of products.

The field of industrial archaeology incorporates a range of disciplines including archaeology, architecture museology, technology and urban planning and other specialties, in order to piece together the history of past industrial activities.

### **Experimental Archaeology**

Experimental archaeology is the investigation of archaeological issues using experiments. It has been part of archaeology from the very beginning of the discipline. As artefacts were identified and sorted into chronological sequences, so assumptions were made about their manufacture and use. Occasionally, someone would try out an object to see how it worked or how it could be made. Some of the most systematic experiments in prehistoric agriculture were conducted in Denmark in the first half of the twentieth century, but the concept became more formally recognized as an archaeological tool in 1960s. The formal recognition of experimental archaeology culminated in two key books written by John Coles and another American-based edited volume, all published in the 1970s.

### **Contextual Archaeology**

An approach to archaeological interpretation proposed by Ian Hodder in the mid-1980s in which emphasis is placed on methods of identifying and studying contexts in order to understand meaning. This involves two lines of enquiry. The first is to consider the environmental and behavior context of action; understanding an object, for example, by placing it in relation to the larger functioning whole from which it is drawn. Second, it involves looking at the networks of associations that objects were placed within in the past and attempting to read meaning from such groupings as if the objects were words in text.

### **Cognitive Archaeology**

Cognitive archaeology deals with the study of past ways of thought from material remains. Cognitive archaeologists often study the role that ideology and differing organizational approaches would have had on ancient peoples. The way that these abstract ideas are manifested through the remains that these peoples have left can be investigated and debated often by drawing inferences and using approaches developed in fields such as semiotics, psychology and the wider sciences. It is interested in the material expression of human ways of thinking about things, such as gender, class, status, kinship. Collin Renfrew and Paul Bahn are the chief proponents of this theory.

### **Under water Archaeology**

Under water Archaeology, also known as Maritime archaeology or marine archaeology, is a discipline within archaeology as a whole that specifically studies human interaction with the sea, lakes and rivers through the study of associated physical remains like vessels, shore side facilities, port-related structures, cargoes, human remains and submerged landscapes. Underwater archaeology concentrates more on the shipwrecks and submerged ports and cities. It also extends to the study of ancient trade, commerce, ship building technology, navigation etc. Discovery and retrieving of King Henry VIII's warship Mary Rose and Titanic are considered as one of the remarkable achievements in the field of underwater archaeology.

## **ARCHAEOLOGICAL EXPLORATION**

Previous chapters have given an idea about the meaning, scope, types and the various theoretical perspectives of archaeology. Archaeology, as you know, is a systematic and scientific study of human past through material remains like artifacts, features and eco-facts. Various methods are there for the retrieval of archaeological materials from archaeological sites such as exploration and excavation. The present chapter explains the exploration methods and various techniques used in exploration.

### **Exploration**

Archaeological exploration means the non-destructive scientific survey and documentation of

sites. Archaeologists often carry out different methods to explore archaeological sites include Desktop study, Surface survey, Specialized survey and Geophysical survey. Desktop study involves the review of the existing records including the pioneer studies about the site if any and literary references on the site. For instance, the archaeologists involved at Pattanam, Kerala has gone through the previous archaeological reports of Anujan Achan, K.V.Raman, K.P.Shajan, Shinu Abraham etc. They have also examined the Greek-Roman classical literatures like Periplus of Eritrean Sea, Ptolemy's Geography and early Tamil poems like Akananuru and Purananuru that referred to the ancient port city of the Periyar river belt called Muziris before the commencement of exploration. This kind of study has helped them to make a broad outline of the area of ancient Muziris. Desktop study, therefore, involves researching the available maps and historical or archaeological documents in order to make a clear plan of exploration. The other three methods of the explorations; surface survey, specialized survey and geophysical survey, will explain in the course of the following discussion.

### **Identification of an archaeological site or mound**

The important task of an archaeologist is the identification of site. Archaeological sites are the locations that show significant traces of human activity, essentially where artifacts, features and eco-facts are found together. There are different types of sites like burial sites, habitation site, urban site, rock shelters, mounds etc. Archaeological mounds are common in many parts of the world. It is often called as 'Tell' (see previous chapter) in the Near East. Mound site result when the same site is occupied for centuries, even thousands of years. Successive generations lived atop their predecessors' settlements. So many natural and artificial processes, ranging from wind erosion to human activity, led to the formation mounds. For the identification of archaeological sites, the archaeologist often depended on the following methods.

### **Field walking and survey**

Field walking or pedestrian survey is one of the important site survey methods in archaeological explorations, which involves a simple walking over the surface of the site, observes, and collects the materials remains. Surface survey means the collection of archaeological finds from sites with the objective of gathering representative samples of artifacts from the surface. Archaeologists often use various maps like geological, topographic, and satellite imageries of the site before the commencement of field walk. After making an idea about the site based on the available maps, archaeologist will start their field survey. Such exploration usually conducted before any excavation. For instance, a detailed surface survey has carried out in the Kodungalloor and Paravur area of North Paravur, Ernakulam district Kerala, before the beginning of extensive excavation at Pattanam in 2007 onwards. If the surface survey furnishes considerable amount of material remains from a particular area of the archaeological sites, then the archaeologist normally laid down a 'Test pit', which also called as 'Sondage'. Test pits are generally placed to understand the archaeological potentiality of a site. In 2014, based on the previous site surveys, a test pit was laid

out at Pattanam in order to understand the potential of the site. It yielded a sufficient amount of artifacts and features about the maritime traditions of Malabar Coast with the Mediterranean world. Based on the result, KCHR started extensive excavations, which continued until 2015.

### **Aerial photography**

Aerial photography is the earliest, and perhaps still the most important, remote sensing tool available to archaeologists searching for new archaeological sites. It is a survey using airborne and spaceborne remote sensing tools. The survey has two components: Data Collection, which comprises taking photographs or images from aircraft or satellite; and Data Analysis, in which such images are analyzed, interpreted and integrated with other evidences such as may be collected by field survey, ground based remote sensing, or from documentary evidences. Aerial photography gives an overhead view of the past. A site can be photographed from many directions. It gives both vertical (upright) and oblique (slanting) pictures of the archaeological sites. OGS Crawford, an English pilot, introduced this method. Several features are made visible by aerial photography. Crawford termed these features as shadow marks, soil marks and crop marks.

Most familiar are Crop Marks, may be Positive and Negative. Positive marks occur in dry conditions, when the moisture and the fertility of the soil in a buried pit or trench allow the crop above it to grow more vigorously than the surrounding crop, reproducing the plan of the features as a pattern of differential crop growth. This growth results in a colour difference with the stronger crop, which is usually visible as a greener mark, surrounded by yellow, ripening crops. Negative marks occur when the underlying feature (eg. a buried wall) restricts the crop growth and thus the crops ripen sooner (as they have less water) and a yellow mark is visible in a green field. One of the main factors affecting the development of crop marks is therefore the moisture distribution in the soil.

Shadow marks- in low light, either at the beginning or end of the day, shadows are at their longest and even quite minor variations in ground level cast shadows. Soil marks analysis is based on the marked contrast between the colour of the surface soil. For instance, the soil marks of ancient structures are often clear in aerial photographs, because a decaying structure contains and collects a different type of soil than the surrounding areas. In short, shadow marks, soil marks and crop marks etc of the earth are visible to the surveyor flying above and often the surveyor takes both oblique and vertical pictures of the visible patterns which may be analyzed later to find out the site.



**Aerial photography**

### **Sampling techniques**

Sampling is one of the important tasks of the archaeologists as it provides invaluable information on various environmental, social and cultural factors. Sampling a landscape to locate sites can be undertaken either by examining discrete blocks of the landscape (squares or quadrats) or by walking lines across the landscape (transects). The geographer Peter Haggett defined four basic sampling strategies in his classic *Locational analysis in human geography*; simple random, stratified random, systematic and stratified systematic unaligned. His simple random sample involved gridding the area on a map and then using random number tables to select a point on the x-axis and a point on the y-axis. Where the two lines drawn out from these axis points cross is the randomly selected spot on the landscape. How many such random spots are selected will depend on available time and resources and the size of the area searched at the located spot depends on resources.

To do Stratified random sample, the area to be surveyed is broken into geographic zones, like mountains, low hills and valleys. Each zone is then sampled separately in the same way as simple random sampling. This guarantees geographic coverage. It does not, however, get around the problem of clustering.

To avoid clustering, the area could be sampled in a Systematic way. To do this the area is gridded and a point within the first square is selected randomly. Exactly the same location is then selected in each square. An alternative to this is to select randomly a different location within each square. This design, known as Stratified systematic unaligned has the advantage of being systematic (guaranteeing wide coverage) but with a random element.

**Sondage**- Another important sampling method is Sondage or Trial pits or trial excavation in the surveyed surface. The main purpose of this is to understand the archaeological potential of the

site with a short time. It will not take much time and proceed with a rapid excavation strategy. It also helps to make clear the extension of a site before, during, and after the excavation. For example, at Pattanam, in 2004, a trail trench was laid out and yielded significant archaeological evidences. In 2007 extensive excavation started and during this excavation, one trial pit was also laid out in the surrounding area of the larger trench, which yielded a long piece of a wooden vessel. After the excavation in the larger trenches, a number of trial pit were laid out in the surroundings of the major site in order to find out its extension.

**Soil sampling-** the collection of soil samples from the site may help the archaeologist to understand the process of the soil deposition and the environmental aspects of the site in the past.

**Sampling for faunal and floral remains (eco-facts):** The sampling involves attempting to recover very small materials or those not visible to the human eye like pollen. This can be done only by taking soil samples and undertaking extraction under laboratory conditions. Both wet and dry sieving is used by the archaeologist for the collection of eco-facts from the soil. If charcoal, bone, wood, pollen, seeds etc are discovered from a site, the sampling is crucial. Such materials have to be collected and labeled separately without contamination. These materials will be sending to the laboratory for the scientific analyzing, which is a post excavation activity.

### **Instruments used in exploration**

Various instruments are using for the archaeological exploration and documentation. It ranges from the simple measurement tape to the multifaceted ground penetrating radars. Measurement tape is a basic tool of an archaeologist, which uses to document every measurement aspects of the artifacts discovered from the field. Different types of maps, which mentioned above, are also help the archaeologist to make a clear idea about the site before exploration. A magnetic compass is another important tool of a field archaeologist to find out the direction and lay outing of the site.

The equipment for specialized survey includes remote sensing radar (Aerial Photography), electrical resistivity survey instruments (Resistivity Survey), Ground-penetrating radar, proton magnetometer etc. Resistivity survey method is a developed by Atkinson that helps the archaeologist to record the geophysical data. The different soil or rocks of earth conduct electricity differently, offering varying amounts of resistance to the passage of current. Based on the resistance variation, geo-physist locates buried archaeological evidences, especially the structure, tomb or such other archaeological features. The most useful instruments used for this survey is Martin-Clark meter and twin-electron type like the Geoscan Research RM15.



## **EXCAVATION AND DATING TECHNIQUES**

This chapter explores the major methods of excavation and the method of dating. Excavation is a destructive, but most systematic and scientific, documentation of archaeological sites. It is a time consuming and expensive field activity. It requires a group of field archaeology experts include the director, co-directors, trench supervisors, trench assistance, and trained labours. Sampling experts from different disciplines like Geology, Pedology (the study of soil), Petrology (the study of rocks), Paleo-botany, Archaeo-zoology etc is also essential part of a scientific excavation. Mainly three groups of method have developed for the dating the archaeological material remains like relative, absolute and derivative.

### **Excavation**

From the previous chapters we have learned the method of archaeological exploration that help the archaeologists to find out the material remains from the surface. Based on the field surveys, they will proceed with the trial pits in order to understand the potential of the site. Consequently, the archaeologist will start extensive excavation in that area. Excavation is the most systematic and scientific method to retrieve the buried object of the past societies. The excavations are mainly yielding the evidences of two main information on the human past societies; (1) human activities at a particular period in the past and (2) changes in those activities from period to period. Very broadly, we can say that contemporary activities take place horizontally in space; whereas the changes in those activities occur vertically through time. It means in an archaeological excavation pit the horizontal space always represent the contemporary period and the material evidences collected from the horizontal spaces belongs to a particular period. However, after the excavation when we observe all these horizontal evidences vertically we can see the changes occurred in different period.

### **Excavation of mounds**

As we know, the archaeological mounds are the locations that show significant traces of human activity, essentially where artifacts, features and eco-facts are found together. It is a site where the continuous human occupations occurred in the past. Two methods are using for the excavation of an archaeological site or mound; vertical and horizontal digging.

### **Vertical Excavation**

Vertical excavation reveals the total stratigraphy of the site. The sediment layers cut perpendicularly and removed the soil in reverse order. Therefore, vertical digging discloses the entire cultural deposit of a site. Vertical excavation often starts from the present surface, which is known as surface humus layer, and ends at the natural layer, a sediment layer without human interaction.

## **Horizontal excavation**

If the vertical digging exposed the cultural deposits of the past up and down, the horizontal excavation aims to expose the deposits horizontally. It reveals the extension of the site while presenting a stratigraphic record in the baulk left between pits. Mortimer Wheeler is one of the chief opponents of this excavation by using grid method (see Grid method)



## **Open-Area excavation**

This type of excavation aims to expose a large area of the archaeological site without maintaining baulk. Philip Barker is the chief advocate of this method. This may help the archaeologist to realize the total cultural deposit of a site.

## **Grid excavation**

Mortimer Wheeler has developed the grid system, which is also known as Box-Grid System, of excavation to obtain information both horizontally and vertically. He developed the grid system of systematic digging whereby the field was divided into small squares. Each square clearly separated by a narrow baulk that was never excavated. This method permitted an area to be excavated yet preserved a vertical cross-section that revealed the strata of the site as the trench was dug. Wheeler's box-grid system has been used universally in modern archaeology and although less popular in Europe it is still the most simple method to ensure a systematic approach.



### **Quartering**

This is an excavation technique involving cutting archaeological sites in to four quadrants to obtain maximum vertical and horizontal information. It is generally applied to the excavation of small mounds.

### **Excavation of burials (Quadrant Method)**

Burial excavation leads us to understand various aspects of the human life in the past centuries include ritual practices, believes, ancestral belief and belief on life after death. The skeletal remains helps to identify the racial affinities, family groups, age, sex, nutrition, palaeo- demography, palaeo-diseases and other cultural information. Megaliths are the most important burials of Kerala and South India that have archaeological importance. There are different types of megalithic burials like Umbrella stone, Cap stone, cist, dolmen, rock-cut sepulchers, stone circle, urns, sarcophagus etc.

Quadrant method of is normally used for the burial excavation. Quadrant method involves dividing the mound or burial into four segments and each quadrant removed very systematically. After removing the soil of one quadrant, the archaeologist tries to understand the actual position of the burial and then proceed with the removal of remaining three quadrants. Even depth must be maintained in the entire quadrant. For instance, if one tries to excavate an urn burial he/she has to remove the four quadrants until the capstone is identified and then proceed with removal of one or two quadrant simultaneously. Once the burial is exposed the entire burial goods have to be documented. The documentation includes, drawing or illustration, photographs, mapping etc. The samples, especially bones or fossils, charcoal, pottery etc have to be scientifically collected. After the completion all documentation the burial goods will send to the museum.

## **Trench excavation**

Trench is used to refer to small or sample excavation as opposed to open area excavation. Even a large area excavation is only a sample of archaeological landscape and so is really a large trench. Trial trenches or trial pits or sondages are also the sampling excavation of the sites. They are often small square trenches (1m x 1m) in order to recognize the archaeological potentials of the site.



## **Sieving**

Sieving is the most important part of excavations. This method, also known as screening or sifting, used to recover quantifiable data from excavations. The cultural materials meticulously recover through sieving and record its context properly. Prior to the New Archaeology of the 1960s, sieving was not widely practiced and usually was restricted to the use of coarse mesh sieves for the recovery of small artifacts such as coins and beads. However, presently the archaeologists collect and document all artifacts, whether it is small or big, from the archaeological sites.

## **Stripping**

Stripping is not often advisable in archaeological excavation. It involves the removal of topsoil accumulations. It is often carried out after a series of excavations that had taken place in various parts of the site. The removal, as efficiently as possible, of all above the surface those considered archaeologically not significant. For instance, in an urban context, this may involve removing the remains of recently demolished concrete building. This method is employed in contract archaeological work when the time factor is short.

## **Stratigraphy and Law of superposition**

Stratigraphy is the analysis and interpretation of depositional layers or strata in excavated area. In archaeology, stratigraphy involves a careful consideration of the characteristics of individual soil layers in order to understand how these layers relate to one another. As we learned in the previous chapter, there are geological strata and archaeological strata. The relation between the top most humus layer and natural layer in archaeological site explains the continuity or rupture, and changes occurred in the site during the past.

Edward Harris strongly advocates that archaeological stratigraphy differ from geological stratigraphy. There are certain basic laws and notions that are followed in identifying the archaeological stratigraphy. They are Law of Superimposition, Original Horizontality, Original Continuity and Stratigraphical Succession.

**The Law of Superposition** is of first importance in the interpretation of the stratification. It assumes that the strata and features are found in a position similar to that of their original deposition.

“In a series of layers and interfacial features, as originally created, the upper units of stratification are younger and the lower are older, for each must have been deposited on, or created by the removal of, a pre-existing mass of archaeological stratification”.

The Law of Superposition is a statement about the depositional order between any two strata. Since it only relates to any two units of stratification, it can make no declaration about the detailed position of strata in the stratigraphic sequence of a site. The law is simply a statement about the physical relationships of superimposed deposits, i.e. one lies on top of or underneath another, and is therefore later or earlier. By recording superpositional relationships, the archaeologist amasses a body of data, which will be of assistance in determining the stratigraphic sequence of the site.

### **Law of Original Horizontality**

The Law of Original Horizontality assumes that strata, when forming, will tend towards the horizontal. This is determined by natural forces, such as gravity, and results in one deposit succeeding the other in a horizontal order of superposition. This law was originally applied to deposits formed by sedimentary processes under water, but may be used for dry-land deposits. It is defined for archaeological purposes in this way:

“Any archaeological layer deposited in an unconsolidated form will tend towards a horizontal position. Strata which are found with tilted surfaces were originally deposited that way, or lie in conformity with the contours of a preexisting basin of deposition.”

### **Law of Original Continuity**

The Law of Original Continuity is based on the limited topographical extent of a deposit or an interfacial feature.

“Any archaeological deposit, as originally laid down, or any interfacial feature, as originally created, will be bounded by a basin of deposition, or may thin down to a feather-edge.

Therefore, if any edge of a deposit or interfacial feature is exposed in a vertical view, a part of its original extent must have been removed by excavation or erosion, and its continuity must be sought, or its absence explained.”

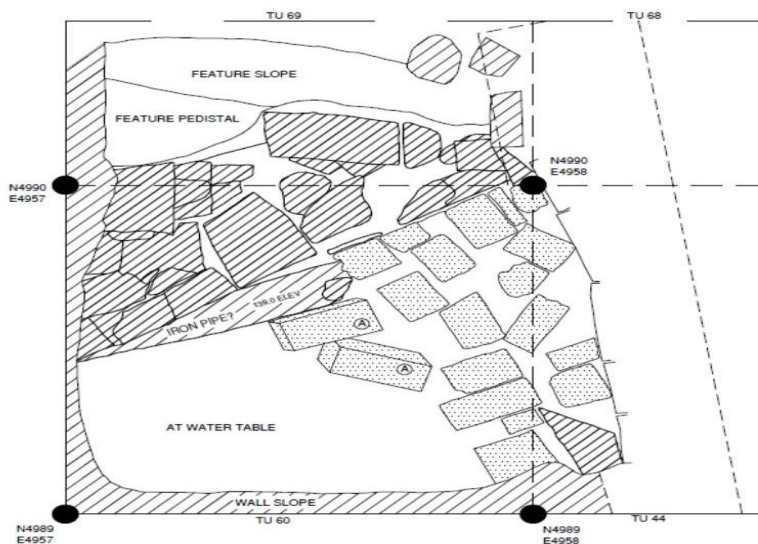
### **Law of Stratigraphical Succession**

“A unit of archaeological stratification takes its place in the stratigraphic sequence of a site from its position between the undermost (or earliest) of the units which lie above it and the uppermost (or latest) of all the units which lie below it and with which the unit has a physical contact, all other superpositional relationships being redundant.”

Most archaeological sites have multilinear stratigraphic sequences, which are the result of the limited extent of archaeological strata, and the presence of upstanding strata and other interfacial features. The upstanding strata (wall) and interfacial (pit/porthole) features create new basins of deposition within which separate sequences accumulate.

### **Mapping of sites**

Map is one of the important tools in archaeological exploration and excavation. It includes topographic map, site map, aerial map, contour map etc. Topographic map depicts the topographical data in combination with representation of archaeological features. Topographic map helps an archaeologist to observe the landforms through which he/she may be able to locate an archaeological mound before and during the exploration and excavation. The contour map represents the elevation or undulation of the landscape. The Satellite maps, Google earth maps etc are also widely used nowadays to locate and document the archaeological site.



### **Excavation reports**

Excavation report is the final product of the excavation. It is generally divided into many parts representing the evidence in a meaningful way and placed in logical sequence. The

first part deals with the discovery of the site, proper identification of the site, previous researches including salvage operations, exploration and excavations, stratigraphical record of the site, and a detailed description of the site.

The second part contains a detailed report of trenches (excavated pits) with description of archaeological layers, material remains and an analysis of the trench supervisor. It mentions the location of the trench and its relation to other trenches if any in the same site, topographical features of the site, the measurement of the trench (eg. 4m x4m), and GPS position of the trench and the ownership of the land where the trench is laid out. The report contains the report of all trenches laid out in the site. (For instance, seven trenches were laid out at Pattanam in 2007. Then in the second part of the report of Pattanam Excavation 2007, a detailed report of seven trenches will be included).

The third part contains a detailed catalogue of artifacts. It includes the list of artifacts and eco-facts collected from the site. The numbers of features if any noticed in the site may also be recorded in this part. This may be placed as appendixes to the report as well.

The last part of the report carries the result of the samples collected during the time of excavation from various experts. It includes the result of carbon dating, thermoluminescence, dendrochronology or such other dating if any. The last part also gives a comprehensive conclusion of the excavation.

### **Interpretation of archaeological data**

Excavated sites represent the cultural sequence of a region from ancient to present. Therefore, the interpretation of an archaeological data is crucial part in any excavation project. The interpretation archaeologist actually gives meaning to the site. The archaeological interpretation of a site is based on the site stratigraphy, cultural materials include artifacts, features, and eco-facts, result of the expert reports, previous research etc. various theories include, cultural context, cultural evolution, ethnoarchaeology, New archaeology, post processual archaeology, cognitive archaeology etc are also using for the interpretation of archaeological data.

### **Preservation and conservation of archaeological sites and materials**

Any buried artifact would have reached a chemical and physical equilibrium with its environment. It remains relatively stable in that environment. After burial in the earth, they have to adapt a new environment through certain modification to establish equilibrium with its microenvironment. The artifacts will again have to adapt to the new environment when it is excavated. This process causes the breakdown of the object either physically or chemically or biologically or combination of all these factors. Archaeologist must follow certain procedures for the care of archaeological materials; Cleaning, Repair and Stabilization. Cleaning means the careful removal of dirt to facilitate examination, recording and conservation of the artifacts. Repair means securing the original position of the objects.

Stabilization means to strengthen the specimens in all means to reduce or arrest its further deterioration.

There are different methods applying for the conservation of organic and inorganic materials. Organic materials like bone, wood, leather, ivory are best kept under the conditions in which they are found. If the microenvironment is dry, wet, or humid, the object must be kept in the same microenvironment. Various chemical applications are practicing for the preservation of inorganic materials like potteries, stone, metals etc.

### **Archaeological museums**

An archaeological museum is an institution that preserves a collection of artifacts and other objects of artistic, cultural, historical, or scientific importance. The goal of museum is to serving the material remains to the researchers also make available to public to get an idea about their cultural heritage.

The earliest necessity to house objects of antiquarian remains dates back to late 1796 AD when the Asiatic Society of Bengal felt the need to house the enormous collection of archaeological, ethnological, geological, zoological pursuits. However, the first museum by them was started in 1814. The nucleus of this Asiatic Society Museum later provided to the Indian Museum, Calcutta.

In Archaeological Survey of India also, due to the various explorative investigations that was initiated since the times of its first Director General, Alexander Cunningham, vast quantity of antiquarian remains were collected. The creation of site museums had to wait until the arrival of Sir John Marshall, who initiated the founding of the local museums like Sarnath (1904), Agra (1906), Ajmer (1908), Delhi Fort (1909), Bijapur (1912), Nalanda (1917) and Sanchi (1919).

National Museum Delhi, Salar Jung Museum Hyderabad, Madras Museum, Trissur Sakthan Museum, Pazhassi Raja museum Kozhikkode, Ambalavayal museum Waynad etc have a good collection of archaeological materials.

### **Dating Methods- Absolute and relative dating techniques**

Archaeologists have used many methods to find out the date of artifacts collected from the archaeological sites. They are mainly classified into three;

1. Relative Dating Methods that identify the order in which sites or artifacts were used in a sequence from earliest to latest. It include historical dating, typology, sequence dating series, geological timescales, varves, pollen analysis, stratigraphy, Geo- chronology etc
2. Absolute Dating (Chronometric) that try to establish an exact or approximate calendar date for a site or artifacts. It includes Radio-carbon dating, Potassium-argon method, Uranium series method, Thermoluminescence, Electron spin resource (ESR), Dendrochronology etc



Along with these two broad categories there is another technique named derivative dating method that includes Fluorine test, Uranium test, Nitrogen test, Amino acid test, Obsidian hydration dating, Archaeomagnetic dating, Cation-ratio dating (CR) etc.

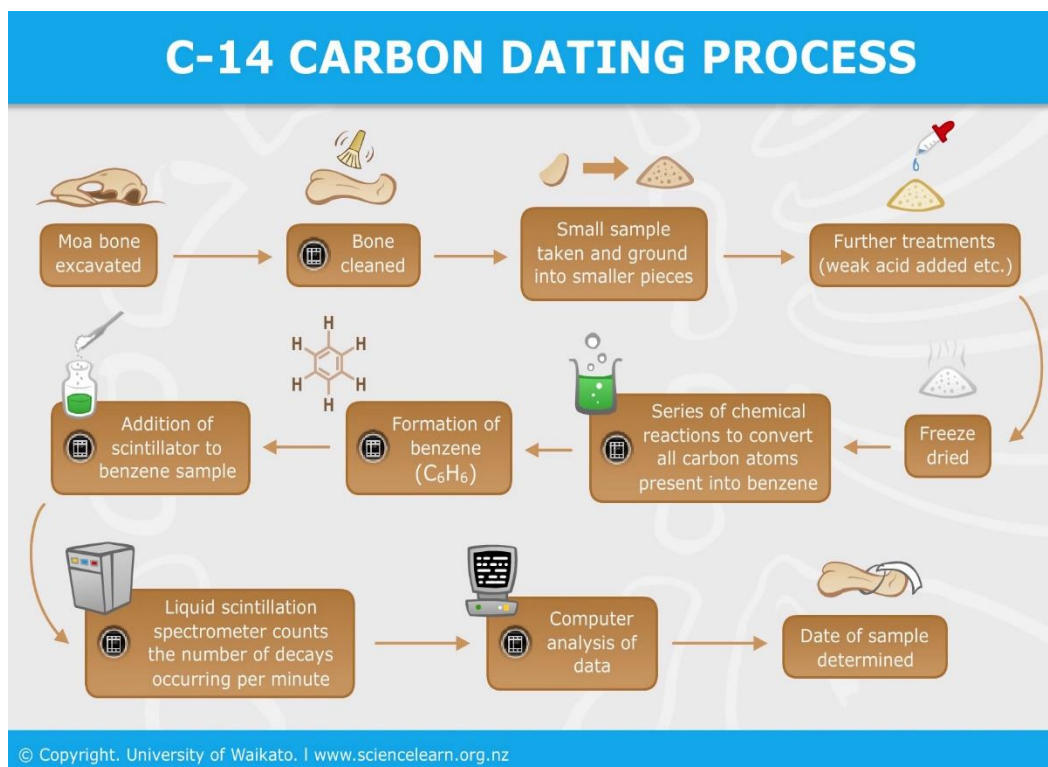
### **Dendrochronology**

A.E Douglass has developed this method in the first half of 20<sup>th</sup> century. This is the most accurate chronometric dating method. It is an approach based on counting the annual growth rings observable in the cross-sections of cut trees. Every year trees produce a visible ring of new wood under their bark. Early in the annual growing season trees produce thin walled 'early-wood cells. Towards the end of the year thick walled 'late wood' cells are produced. This cycle produces a visible 'ring' in the wood each year. The rings are wider in good weather conditions than in poor ones and can provide a record of local climate variation. Trees in the same area will have similar ring patterns, which mean wood from different periods can be matched in overlapping sequences. These are tied to historical dates by modern trees. Scientists have prepared a sort of calendar based on tree ring samples for the last three thousand years. By comparing a sample with these calendars or charts, the archaeologist can estimate the age of that sample.

### **Radio Carbon Dating**

This is one of the most important methods of dating organic materials collected from the archaeological sites, which contain some carbon in them. Willard F. Libby discovered this method in 1946. This method is more reliable one for the dating of the pre-historic material remains. All living things absorb several types of carbon isotope from the atmosphere in similar ratios until death. About one percentage of these carbons is an unstable isotope known as C14 (Carbon 14), which decays at a known rate. By comparing the weight of remaining C14 with amounts of other carbon isotope in organic sample it is possible to work out how much C14 has decayed. These indicate how long it has been since decay began (and the creature and plant was alive).

This method is based on the presence of radio-active carbon of atomic weight 14 in organic matter. Cosmic radiation produces in the upper atmosphere of the earth Neutron particles, some of which hit the atoms of ordinary Nitrogen. This is captured by the nucleus of the nitrogen atom, which gives off a proton and thus changing to Carbon-14. This Carbon-14 in turn is radio-active and by losing an electron reverts to nitrogen. This creation of new carbon atoms and then reverting to nitrogen has achieved a state of equilibrium in the long duration of the earth's existence. C-14 along with the carbon dioxide enter the living organisms in the process of photosynthesis, and all the radiocarbon atoms that disintegrate in living things are replaced by the C-14 entering the food chain. Thus the process of radio carbon present in the living organism is same as in the atmosphere.



It is further assumed that all living animals derive body material from the plant kingdom, and also exhibit the same proportion of C-14 material. Therefore, as soon as the organism dies no further radiocarbon is added. At that time the radioactive disintegration takes over in an uncompensated manner. The C-14 has a half-life of about 5730 years, i.e. only half the C-14 will remain after the half-life period. In the disintegration process the Carbon-14 returns to nitrogen emitting a beta particle in the process. The quantity of the C-14 remaining is measured by counting the beta radiation emitted per minute per gram of material. Modern C-14 emits about 15 counts per minute per gram, whereas Carbon-14 which is 5700 years old, emits about

7.5 counts per minute per gram.

### **Luminescence dating**

Farrington Daniels has developed a method known as Thermoluminescence measurements for dating the ancient pottery in 1953. This method is useful to all terracotta materials like pottery, tiles, bricks and all other terracotta objects. Thermoluminescence is the release in the form of light of stored energy from a substance when it is heated. All ceramic material contains certain amounts of radioactive impurities (uranium, thorium, potassium). Radioactive decay in the quartz crystal found in clay leads to a buildup of electric charge at a known rate. The electrical charge is released as light when the crystals are heated. When the ceramic is heated the radioactive energy present in the clay until then is lost, and fresh energy acquired gradually depending on the time of its existence. The thermoluminescence observed is a measure of the total dose of radiation to which the ceramic has been exposed since the last previous heating, i.e. in the kiln. For calculating dates, the sample is heated

upto 500<sup>0</sup>C and thermoluminescence observed as a flame is measured with very sensitive instruments. The glow emitted is directly proportional to the radiation it received multiplied by the years. However, it is significantly less accurate than C-14 dating and can give false readings due to radiation from the soil or if the initial firing at low temperature. It is useful for older periods and instances where there are no organic remains such as dating pre-historic times.

### **Electro spin resonance dating**

This method is useful to date the bone and calcite material remains discovered from the archaeological site. It has developed by Ikeya and Miki in 1980. Electro spin Resonance (ESR) measures radiation- induced defects or the density of trapped electrons in bone and calcite remains. The tooth enamel particularly with the thick enamel layers is the best material for ESR studies. On counting on the amount of electrons trapped in the bone, the date is determined.

### **Fission track**

Fleischer, Price and Walker has jointly developed this method. The natural splitting of (fission)of Uranium-238 atoms present in obsidian (volcanic lava) and other glassy volcanic minerals, leaves traces called fission tracks. It is known that many minerals and natural glasses (obsidian, tektites) contain very small quantities of uranium. Through time, the uranium undergoes a slow spontaneous process of decay. This method of dating depends upon the measurements of detectable damage called tracks in the structure of glasses caused by the fission. These tracks disappear when the glass is heated above a critical temperature and fresh tracks formed in course of time. The fresh tracks are counted to date the sample. This method is suitable for dating objects which have undergone heating process some 100,000-1,000,000 years ago.

### **Amino acid racemization**

Amino acid method is useful to find out the age of bone. Jeffrey L. Bada has developed this method. This method depends on cumulative changes in amino acids in bone after the creature has died. Among the above 20 kinds amino acid present in the modern bone, only 1 kind of amino acid (Aspartic acid) exist in two mirror-image forms. As long as the organism is alive, the amino acid molecules are in left-handed form (or L-isomer form) but at death, they began to change to distinct right handed form (D-isomers). This process of change called Racemization. If one knows the racemization rate, one could be able to calculate the date of the bone.

### **Obsidian (glass) hydration**

Irving Friedman and Robert Smith, two geologists, began looking into obsidian's potential as a time marker in 1948 and introduced the obsidian hydration dating method to the archaeological community in 1960. Obsidian hydration dating is a geochemical method of determining age in either absolute or relative terms of an artifact made of obsidian.

Obsidian is a volcanic glass that was used by prehistoric people as a raw material in the manufacture of stone tools such as projectile points, knives, or other cutting tools through knapping, or breaking off pieces in a controlled manner. The surface of many geological materials undergoes chemical changes through time. These weathering reactions create a visibly distinct surface layer or patina. When obsidian artifacts are buried, they start absorbing water and form a layer called hydration layer. The thickness of the layer depends on how long the article has been buried; the surrounding temperature condition, long term change in the soil humidity and the petrographic nature of the sample. The sample is dated by measuring the thickness of the hydration layer.

### **Fluorine dating method**

Fluoride (or fluorine) dating is a relative dating method that can be used to date archaeological bone. As a relative dating method, it can determine the relative age of specimens, but cannot provide a calendrical date unless the fluoride chronology is calibrated with an absolute dating method. Bones are primarily composed of the mineral calcium hydroxy apatite. When exposed to water that contains fluoride, a fluoride ion (F<sup>-</sup>) can replace a hydroxyl ion (OH<sup>-</sup>) in the bone mineral. The resulting fluor-apatite is more stable than the original form, thus the fluoride content of a bone will increase over time if it is exposed to a solution containing fluoride ions. Fluoride ions are present in trace amounts in most soils and groundwaters. Over time, buried bones pick up fluoride ions from soil moisture or exposure to groundwater. Older specimens have higher fluoride contents than younger ones when burial conditions are identical. The requirement of identical burial conditions means that fluoride- dating works best when it is applied within a single site with little variation in soil chemistry.

### **Uranium dating and Uranium series dating**

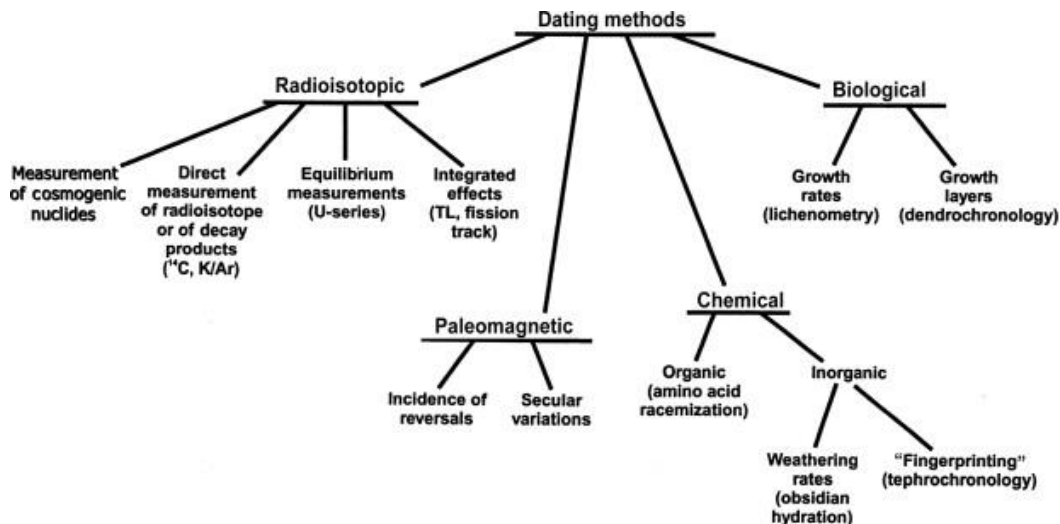
Uranium dating is a radiometric dating method. It is useful to date ancient rocks. Uranium series dating is a radiometric dating technique commonly used to determine the age of calcium carbonate materials such as speleothem or coral. These methods are based on the radioactive decay of isotopes of uranium. The process whereby a radioactive isotope of uranium

$^{238}\text{U}$  decays into  $^{235}\text{U}$  is calculated. The date is determined based on the amount of  $^{235}\text{U}$  that

had accumulated through radioactive decay.

### **Nitrogen dating**

This derivative dating method is useful to date bone remains from the archaeological sites. Bone basically consist of calcium phosphate, fat and bone protein or collagen. On death, fats gradually disappear. The collagen survives much longer though it decays at a uniform rate. These can be measured by a nitrogen assay. The rate of decay depends on physical, chemical and other factors of the soil. Therefore, it is not universal. However, bone of different dates in a single deposit can be distinguished based on nitrogen content.



## Varve Analysis

De Geer and Antevs are developed the Varve dating method. The annual deposit of sediment in the lake bed in called varves, which can be counted. They note a regular alteration between the coarser silts deposited by glacial melt water in the summer, and fine clays deposited as suspended particles settled during the winter months when the lake was covered with ice. The recurring pattern of coarse and fine sediments could be read as a yearly record of glacial discharge. Geologist established a dated sequence of varve by moving back in time from recent layer of known age. The thickness of the varve pairs varies from year to year, depending upon the amount of glacial melting. This also serves as a sequential landmark. Some of the ancient shorelines were established through this system. Considerable deposits of varves were found in Scandinavia, representing thousands of years, stretching from the present back to the begging of the retreat of the glacial ice sheets in Scandinavia some 13,000 years ago.

## Seriation

This is a method of determining the age of the artifacts based on style type and technique. It is broadly divided in to two categories; Stylistic seriation and Frequency seriation. The first one refers to a technique through which artifacts and attributes are ordered according to similarity in style. for example dish on stand, S-shaped jar and perforated jar are some of the diagnostic styles available in Harappan style. this will help the archaeologist to determine the cultural phases. The second one is more strictly oriented to chronological ordering of the artifacts and assessing the origin, popularity and disuse of the artifacts. The length of time and degree of popularity would be assessed in the given archaeological context. For example, Painted Gray Ware, Northern Black Polished Ware, Black and Red Ware are noticed in a particular time range only.

### **Archaeo-magnetic dating**

This method is based on the fact that the earth's magnetic field varies through time. It is based on the constant change, both in direction and intensity, of the earth's magnetic field. The location of magnetic north pole changes its position both horizontally as well as vertically. The direction of that magnetic field at a particular time is recorded in any baked clay structure like oven, kiln, hearth etc that has been heated to a temperature of 650° to 700° C. At that temperature, the iron particles in the clay permanently take up the earth's magnetic direction and intensity at the time firing. This helps to date the newly discovered fired clay samples directly by using the archaeomagnetic data.