PRINCIPLES AND TECHNIQUES OF ARCHAEOLOGY

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UNIT –I

Definition, Nature, Aim and Scope of Archaeology - Archaeology as a Source of Cultural Studies- Different kinds of Archaeology - Marine Archaeology, Aerial Archaeology ,New Archaeology etc., Archaeology – Its relation with other Sciences (Social and Exact)

Objectives:

- To explore the definition of archaeology and understand its core principles.
- To understand the role of archaeological findings in reconstructing historical and cultural narratives.

Definition:

The word archaeology has its origin from two Ancient Greek words ***'arkhaios', meaning ancient or old, and 'logia',*** which stand for learning or study. Archaeology is the study of the ancient and recent human past through the recovery and analysis of material remains. Many consider it to be a subfield of anthropology (the study of all human culture and evolution), along with many other subfields comprising biological, cultural and linguistic anthropology. Archaeology can be considered both a social science and a branch of the humanity (the study of humans and their society). However, it also uses other branches of learning such as biology, chemistry, geology,

botany, geography and various other disciplines. By using all these disciplines, the archaeologists are able to understand human civilizations of the past and recreate main aspects of the environment in which these bygone societies lived.

Archaeology is the only method available for the study of human actions in the material world, when other evidences such as a variety of written materials and oral traditions narrating certain phenomenon fail. The survival of written documents is relatively limited and hence from the time that these documents become available, they provide additional tools to archaeology for its interpretation of past activities of man, on the basis of material remains. Archaeology, from this point of view, has to not only interpret material remains of human activity, but also throw light on the literary interpretations of the past phenomenon.

It helps us to appreciate and preserve our shared human heritage. It informs us about the past, helps us understand where we came from, and shows us how people lived, overcame challenges, and developed the societies we have today. The development of the field of archaeology has its roots in history and those who were interested in the past, such as kings who wanted to show past glories of their respective nations. In the 5th century BC, Herodotus, the Greek historian, was the first scholar to systematically study

the past and perhaps the first to examine artifacts and test their accuracy. In the Song Empire (960–1279) of Imperial China, officials unearthed, studied, and catalogued ancient artifacts. In the 15th and 16th centuries, there was a rise of antiquarians in Renaissance Europe who were interested in the collection of artifacts. The antiquarian movement shifted into nationalism and personal collections were used to create national museums. It developed into a much more systematic discipline in the late 19th century and became a widely used tool for historical and anthropological research in the 20th century. During this time there were also noteworthy advances in the technology used in the field. The exact origins of archaeology as a discipline are uncertain. Excavations of ancient monuments and collection of antiquities have been taking place since times immemorial. In ancient times, the tombs of the Pharoahs of Egypt were looted by grave robbers who probably hoped for financial gains from selling their plunder. We can distinguish this with endeavors of the Italian Renaissance humanist historian, Flavio Biondo, who created a systematic and documented guide to the ruins and topography of ancient Rome in the early 15th century. He is seen as a candidate for consideration as an early founder of archaeology. He was inclined to treat the ruins and topography of ancient Rome with great respect. Tentative steps towards archaeology as a science took place duringthe Age of Enlightenment,

also called as the Age of Reason, in Europe in the 17th and 18th centuries. King Charles of the Two Sicilies employed an antiquities expert, Marcello Ventui, in 1738 to excavate the ancient city of Herculaneum. This first supervised excavation of an archaeological site was likely the birth of modern archaeology. In America, Thomas Jefferson supervised the systematic excavation of a Native American burial mound on his land in Virginia in 1781. During the Egyptian campaign in 1801, Napoleon Bonaparte brought many scientists and specialists in the field of biology, chemistry and languages with the purpose of carrying out a full study of the Egyptian civilization. During these campaigns, some soldiers rebuilding a fort discovered an unusual stone on which ancient scripts were engraved. This stone was known as the Rosetta Stone. Many decades later, the work of Jean-Francois Champollion in deciphering the Rosetta Stone led to the discovery of the hidden meaning of hieroglyphics. This discovery proved to be the key to the study of Egyptology. However, it was only in the 19th century that the systematic study ofthe past through its physical remains began to be carried out in a mannerrecognizable to modern students of archaeology. Richard Colt-Hoare (1758-1838) recorded the past of the countryside near his estate at Stourhead inWiltshire. In his investigations and excavations of such neolithic barrows asSilbury Hill, Colt-Hoare used a terminology that was later adopted

by otherarchaeologists.In later years archaeology continued as an amateur pastime and waspursued by persons such as Augustus Pitt Rivers who collected many artifactsand developed a typology scheme for dating archaeological remains in hispersonal collection in the second half of the 19th century. William Flinders Petrie (1853-1942) was another personality who may rightly be called the Father of Archaeology. His work on the ancient Egyptian civilization developed the concept of seriation, which allowed accurate dating long before scientific methods were evolved to testify his chronologies. Mortimer Wheeler was the next popular figure involved in the development of archaeology. His highly disciplined approach to excavation and systematic coverage of much of Great Britain in the 1920s and 1930sbrought the science on swiftly. His method of excavation still forms the basis of excavation technique. The work of Sir Arthur Evans at Knossos in Crete in early 20th century had shed light on the Minoan Civilization. The archaeological findings from this site were catalogued and kept in a museum at Oxford. Archaeology was increasingly becoming a professional activity. Although the major chunk of excavation's workforce consisted of volunteers, it was mostly led by a professional. Archaeology as a discipline was introduced in schools and universities, and by the end of the 20th century,

nearly all professional archaeologists, at least in the developed countries, were graduates in the subject.

Aims and Scope of Archaeology

Prehistoric archaeology has become an institution nowadays, encompassing a number of different scholars forming sub-disciplines. Each scholar propagates new theories and follows different methods having different approaches. In the recent past, there has been a growing realization that prehistoric archaeology has contributed a lot not only to study the antiquities or relics of the past societies but also to study the modern people or contemporary societies with simple technology from the light of their practices set in prehistoric times. It can also help with specific archaeological studies when the ways of life of the modern society are very much similar to those of the past life. It has become a current focus of research. In one way or another we compare something from the past with an object in use today. For example, megalithism, or using megaliths to create monuments, is a dead cultural phenomenon in most parts of the world. But it is still practiced by different tribal communities in the same way or in some modified form in North-East India, especially in Nagaland, Manipur and Meghalaya. Megalithism is a living tradition among these tribal communities. Hence many specialists in the field of ethno-archaeology take keen interest to

reconstruct the past life of the ancient people of these regions in the light of this living tradition.

History and Archaeology:

Both history and archaeology research the human past. The difference between these two disciplines derives from the source materials. The historians use written sources while archaeologists concentrate on physical remains. Historical sources are committed to dates while archaeological material is basically connected to spatial origin. This basic difference explains why historians and archaeologists have difficulties in understanding each other. Archeology is also related with history in a more particular manner. The history of the earliest literate societies such as those of Egypt, Mesopotamia, Greece and Rome depends largely on archaeology, which was in the first place responsible for the recovery of the written history documents through

archaeological excavations. Archaeology and history complement each other. The two disciplines together provide a more comprehensive record of the past. For example, some of archaeologically invisible activities may be described in historical documents. Also, sometimes history can be used to locate archaeological sites. The two disciplines are related with each other in terms of methodology as they use the same method in the finding the past

events, such as the use of observation to identify a certain place where particular events took place. Archaeology has contributed to the study of written history through the study of artifacts and structures of literate societies. This has led to the development of the new sub-discipline of historical archaeology.

Many physical remains of the past, such as clay tablets, Egyptian choreographic text on papyrus and inscriptions, are historical documents just as much as are the books published in the 17thcentury Europe. Many historical texts are discovered through archeological research. A rchaeology also helps in reconstructing the history of particular events in chronological order. However, history and archaeology also differ from each other in some aspects. History deals primarily with written accounts from the past whereas archaeology deals with the material remains of the past. These material remains are mute, and their meaning and significance depend entirely on the interpretation that an archaeologist can make. In contrast, historical records contain messages, although their meaning and significance are also subject to critical interpretation to discoverer. Historical records lay more emphasis on literate and richest communities such as kings, queens, and high priests, as the prominence of these people could have influenced the storage of their

records, while archaeology is less partial for the elite class as anyone can contribute to the archaeological record.

Another distinction is found in the scope of the two disciplines. Archaeology covers the period from the beginning of human civilization (2.5 million years ago) to the present, while history covers the period from the beginning of written records (3000 BC) to the present. History comprises the stories of what happened, how, where, who did it and what happened next. Archaeology is concerned with the place where a sample, such as the remains of a temple, or an artwork, or an artifact is found.

Pre Historic and Historic Archaeology:

Prehistoric archaeology is a section of archaeology which studies past societies. It is the study of the past before historical records began. It is a field of research that looks at all the pre-urban societies of the world. It has different procedures for analyzing material remains so that archaeologists can reconstruct their ecological settings. The study of prehistoric archaeology reflects the cultural concerns of modern society by showing interpretations of time between economic growth and political stability. It is also very closely related with biology, biological anthropology, and geology. It is sometimes termed as anthropological archaeology because of its indirect traces with complex patterns.

Prehistoric archaeology studies the past cultures based on their material remains. It is as much a part of history as it is a section of archaeology. In fact, for more than 99 per cent of past material, culture is the main source of information if one ignores physical anthropology, which emphasizes on biological (human evolution and variation) rather than man's works (sociocultural

aspects). Colin Renfrew and Paul Bahn opine that the conventional history sources begin only with the introduction of written records around 3000 B.C. in western Asia, and very much later in most other parts of the world. Then a pertinent question arises as to how is the history of illiterate or preliterate people or country known? What were its sources? A prehistoric archaeologist will be able to answer this question. Anything that tells us its past history i.e. language, place-names and study of the people's physical features, customs and manners, legends and traditions, their monuments, even a study of landforms, soils and vegetation, and the animals may help to demonstrate this story. Therefore, a commonly drawn distinction is that prehistoric archaeology deals with the period before written records and history deals with the study of the past using written documents. To put it in other words, prehistoric archaeology deals with the history of the illiterate or preliterate

societies. In this way, it contributes substantially in the understanding of those periods and places where written records, inscriptions and other literary sources are non-existent. It is the responsibility of the prehistoric archaeologists to explore, excavate, examine and interpret the evidence.

Although prehistoric archaeology tells the history of preliterate people, it is distinct from history proper as the former does not depend on written documents or accounts. The artifacts or whatever explored or excavated do not reveal anything without proper analysis and interpretation. It is the prehistoric archaeologist who has to make sense of these finds. He works

like a scientist in this respect. He follows a scientific method. He collects the evidences (data), conducts experiments or formulates hypothesis (a proposition to account for the data), tests hypothesis against more data, and, in conclusion, develops a model, a description that seems best to summarize the pattern observed in the data. He has to develop a picture of the past, just as a scientist has to develop a logical view of the natural world.

Different Kinds Of Archaeology:

One of the primary aims of archaeology is to unravel the human past through material remains. It is an interesting job of interpreting material culture in human terms. It requires hard work in field as well as formulating

hypothesis in the laboratory. Therefore, an archaeologist should be familiar in other related disciplines such as history, anthropology, and other related social and general sciences. Thus, one should have a multidisciplinary approach while

practicing archaeology. Archaeology is of many kinds, and each type demands either specific or multiple specialisations. The different kinds of archaeologies have been classified into two broad categories on the basis of the nature of the work that is involved, and on the basis of historical time periods. Archaeology has been classified into different types based on the nature of the work involved in the process of data collection and analysis. This depends largely on the place of excavation or exploration, and the point of view of the archaeologist who wants to interpret history.

Environmental Archaeology:

Environmental archaeology is a sub-field of archaeology that deals with the study of interrelationship between the past societies and their natural environment. It is commonly divided into three sub-disciplines viz., zoo archaeology that deals with the study of ancient faunal remains, geoarchaeology that deals with the study of soil, sediments, rocks, natural deposits, etc., and their relationship to the archaeological record, and archaeo botany that studies ancient floral remains. Environmental archaeology

answers questions relating to the type of natural habitat that the past societies were surrounded by, the flora and fauna living in that age, varieties of wild and cultivated crops, animals hunted and domesticated, species of plants and animals that are now extinct, climatic changes that took place over a period of time, and the effects of changes in natural environment on the lives of the people and on their subsequent disappearance. Environmental archaeology includes field studies along with laboratory experiments. Karl Butzer (1934-2016) was a pioneer in this field.

Ethno-archaeology:

Ethno-archaeology is the science that deals with the study of past societies, focusing on material remains rather than culture. It is sometimes called anthropological archaeology as it involves extensive application of anthropological methods. By applying ethno-archaeological methods,archaeologists, in a way, try to link the past with the present. It can provide insight into how the ancient people in a given region may have lived. By the application of the principles of ethno-archaeology one can get valuable insight into ancient social structures, religious and cultural beliefs, technology, etc. However, the connection between modern and ancient societies is certainly still very confusing. This is because, even if two societies share some common characteristics, they may be distinct from each

other in many aspects, which tend to change by default over a period of time. Nonetheless, studying advanced techniques of modern communities may help to a certain extent to provide an insight into the rudimentary techniques, which may have been used by the ancients. Lewis Binford (1931-2011) and Ian Hodder (born 1948) have conducted ethno-archaeological studies among the Inuit (Eskimos) in Canada and in several parts of Africa to make a better understanding of prehistoric hunter-gatherers.

Landscape Archaeology:

Landscape archaeology is a broad division in archaeology that deals with the study of the ways in which past people constructed and used the environment around them. It is the study of the various changes occurring in different landscapes, both naturally as well as due to human intervention. For archaeological purposes, landscapes have been categorized into natural and cultural landscapes. The study of how landscapes and natural habitats are interconnected with human behaviour and cultural changes is extensive. There are a variety of changes that landscapes may undergo over a period of time. These comprise natural changes relating to climate, topography, soil, natural calamities such as landslides, floods, tsunamis, rivers changing their courses etc., and human-induced changes such as agriculture, industrial and construction activities, clearing of forest areas, etc. Techniques in landscape

archaeology are also used in order to analyse inequalities that may have prevailed in a social structure at a given period of time.

Gender Archaeology:

Gender archaeology is a method of studying past societies through their material culture by closely investigating the social construction of gender identities and relations. It is the study of the roles, activities, ideologies and identities of men and women, and the differences betweenthem. It is believed that in archaeology, everything is perceived 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. Margaret Conkey (born 1943) and Janet D. Spector (1944-2011) are regarded as the pioneers in the Anglo-American field to examine the application of feminist approaches and insights to archaeological practice and theory. Gender archaeology was created to balance archaeological interest in men and women by directing as much attention to women's activities as to men's, to reveal that women are not the same in all cultures and their activities are of interest for comparative studies, and to help make archaeology into a discipline that concerns people, rather than merely artefacts. Sarah Pomeroy (born 1938), a classicist and art

historian, is considered a leading authority on women in the ancient Mediterranean world.

Cognitive Archaeology:

Cognitive archaeology is a theoretical point of view in archaeology which focuses on the ways ancient societies thought and the symbolic structures that can be perceived in past material culture. Collin Renfrew (born 1937) and Paul Bahn (born 1953) are the chief propagators of this theory. Cognitive archaeologists examine the role that ideology and differing organizational approaches would have had on ancient peoples. The way that these abstract ideas are visible 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. Cognitive archaeology is interested in the material expression of human ways of thinking about things, such as gender, class, status, and kinship.

Historical Archaeology:

Historical archaeology is a form of archaeology which studies that period of the history of mankind from which we have ample written records and oral traditions. So, historical archaeology involves the study of not only the artefacts obtained from the archaeological sites but also of the

documented evidences that have been left behind. A large number of sites associated with historical archaeology are spread across the world, and each of these helps reconstruct different kinds of aspects of human past, such as industries, trade, art and architecture, social and cultural history and military history. However, it should be kept in mind that historical records are not always accurate, and for this reason, it should be supplemented with other evidences.

Forensic Archaeology:

Forensic archaeology is a recently developed branch of archaeology. It is concerned with the use of archaeological methods in finding evidences on crime scenes. Forensic archaeologists are generally engaged by the security services with the purpose of investigating crimes and catching the offenders. Forensic archaeologists collect evidences like human burials, artefacts, footprints, tool marks, etc., and attempt to understand the situation in which a particular crime might have happened; and to determine the influences on the remains of external factors that may have disturbed the crime scene. They also attempt to find whether all the remains are in situ, and if not, how and when they landed up where they currently lie. The discoveries of forensic archaeologists prove to be very valuable in the court of law, and help the police to a great extent in the investigation of the committed crime.

Medieval and Modern Archaeology:

Medieval archaeology is concerned with the study of material remains of human culture belonging to the middle ages. Likewise, modern archaeology pertains to the study of the colonial and post-colonial periods in history. Material remains of these periods, in most cases, help only to establish firmly the facts from the written records of these periods, which are available in large numbers.

Industrial Archaeology:

Industrial archaeology is the methodical study of material evidence concerned with the industrial past. The evidence, collectively referred to as industrial heritage, comprise buildings, machinery, artefacts, sites, infrastructure, documents and other items related to production, manufacture, extraction, transport or construction of a product or range of products. The field of industrial archaeology encompasses a range of disciplines including archaeology, architecture, museology, technology and urban planning and other specialties, in order to piece together the history of industrial activities.

Experimental Archaeology:

Experimental archaeology is a type of archaeology in which the archaeologists attempts to figure out how the archaeological deposits are formed. In the course of this search, they experiment with different processes

that they believe people in the past have applied to manufacture all those things which make the archaeological deposit. It has been part of archaeology since the beginning of the discipline. As artefacts were identified and arranged into hronological sequences, so assumptions were made about their manufacture and use. Replication of prehistoric stone tools is an interesting activity practiced in experimental archaeology. Some of the most methodical experiments in pre-historic agriculture were conducted in Denmark in thefirst half of the twentieth century, but the concept became more formally recognised as an archaeological tool in the 1960s. The formal recognition of experimental archaeology culminated in two important books published in the 1970s, by John Coles and Robert Ascher.

Commercial Archaeology:

Commercial archaeology is a branch of archaeology that deals with everything that is associated with trade and commerce. This comprises evidences regarding the commodities that were traded and bartered, numismatic finds, ancient means of transportation that were used for commercial purposes, and others. The study of ancient trade routes and sea ports, harbours and marketplaces is also incorporated in commercial archaeology. This is a fascinating study, as it answers questions such as which countries had trade relations and in what commodities, what were the

media of exchange between them, how the commodities were transported, who and what allwas involved, how they coordinated, etc. Sometimes, at commercial sites, ancient inscriptions are found, which are valuable resources forreconstructing economic histories.

Household Archaeology

Household archaeology is a relatively recent development in archaeology that occurred between the late 1970s and early 1980s. It involves a small-scale excavation within a specified area on an archaeological site. It considers each household as a social unit that not only depicts the social, cultural, economic, and political responsiveness of the people of a particular household/family, but also throws light on the affiliation of the society in general. It is also helpful in studying features of secular art and architecture, food habits of the people, their religious beliefs, and so on. Gender classification in the social order is an interesting aspect that can be studied by this kind of archaeological method. Different kinds of evidences are taken into consideration in the study of household archaeology, which include floral and faunal remains, pottery, processes of site formation and so forth.

Underwater Archaeology

Underwater archaeology is also known as marine archaeology or maritime archaeology. It is a discipline within archaeology as a whole that

particularly studies man's interaction with the sea, lakes and river. It is concerned with the study of underwater evidences such as shipwrecks, water-buried cities, and other inundated archaeological sites. It is an expensive branch of archaeology and is much costlier than any terrestrial archaeological excavation. Archaeological remains in the sea or in other underwater environments are typically subject to different factors than artefacts on land. Underwater excavations require knowledge of specific techniques and methods that need to be adopted. Underwater archaeologists try to discover submerged evidences by diving into the deep waters along with sophisticated archaeological tools. Sometimes an underwater excavation may also turn out to be a little risky because one cannot guess what the conditions under the sea would be like. However, it makes an exciting profession for adventure lovers. Discovery and recovery of king Henry VIII's warship Mary Rose and Titanic are considered among the extraordinary achievements in the field of underwater archaeology.

Salvage or Rescue Archaeology

Salvage archaeology or rescue archaeology, is a technique of retrieving the data from threatened archaeological sites. Rescue excavation was a term coined in the 1960s when development and road building destroyed much of our archaeological heritage. Salvage archaeological

operations are conducted on sites that are on the verge of being destroyed by new road constructions, dams, buildings, or any other kind of infrastructure development. The duty of the archaeologist, then, is to locate maximum possible sites in an assigned area, explore them, and excavate them if deemed necessary, and ultimately record in detail all the finds that have been obtained. Generally, in the case of salvage archaeology, time is a constraint, and so detailed excavation is difficult to carry out. Therefore, archaeologists tend to record whatever is found on the surface at the time of exploration. But, if it is realized during the exploration that the site holds an important place in history, then detailed excavation can be carried out and can thus alter the construction plans in some way or the other.

Historic Time Period

The other broad categorization of archaeology is on the basis of historical time periods. This categorization is with the purpose of easing the process of giving peculiar characteristics to the discoveries of a particular era, a particular dynasty, or a particular region.

Prehistoric Archaeology

Prehistory is the study of past before the invention of writing. Since there are no written records or historical accounts from the prehistoric time, whatever we know about prehistory is purely on the basis of physical

archaeological finds. It has very close links with biology, biological anthropology and geology. On the basis of the developments that took place over a period of time in the human lifestyles, prehistory has been classified into Palaeolithic, Mesolithic, Neolithic and Chalcolithic periods. Prehistory also comprise periods before the Stone Age, which preceded the human existence. Thus, prehistoric archaeology is a vast discipline, and there is a lot of scope for original research, as there are numerous prehistoric mysteries that are to be yet unravelled.

Proto-historic Archaeology

Proto-history is the period or stage of human development or of a particular culture immediately before the emergence of writing. It is the period that lies in between prehistory and history. Though this is a period that emerged after the invention of writing, many of the evidences have not yet been deciphered. Proto-history includes the Bronze Age and Iron Age, and sometimes even the copper age, but this vary from region to region. Determination of dates of this period is a difficult job for an archaeologist, as this again depends on regional.

Classical Archaeology

Classical archaeology is a sub-field of archaeology which is related only to Greece and Rome. It deals with an in-depth study of the ancient

civilizations of Greece and Rome. The Grecian Empire, the Roman Empire and the transitional period between the two, the Greco-Roman Period, together permit an almost 2,000-years long era of classical history. The period between 500 BC and 300 BC was known as the Classical period or Golden age of Greece. These short years have given us the great monuments, philosophy, art, literature and architecture that are now the building blocks of western civilization. Classical archaeology not only studies these two civilizations independently, but also in relation to other contemporary civilizations of that period. It also examines the influences of other civilizations on the ancient Greeks and Romans, and vice versa. It is a very exciting field of study, but because it pertains to specific regions, is limited in scope.

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Unit- II

Beginnings in Archaeology from Antiquarianism to Archaeology - Process of Archaeology in the West - Growth of Archaeology in India- Development of Archaeological Survey of India,

Objectives:

- To explore key figures and milestones in the transition from early antiquarian pursuits to modern archaeological practices.
- To trace the history and development of archaeological research in India, starting from the colonial period to the present.

BEGINNINGS OF ARCHAEOLOGY FROM ANTIQUARIANISM TO ARCHAEOLOGY

The beginnings of archaeology as a systematic discipline can be traced through several key phases:

1. Antiquarianism (16th-18th centuries):

Curiosity and Collection: Early antiquarians were primarily interested in collecting artifacts and studying ancient monuments for their own curiosity or for display in private collections. Notable figures include **John Aubrey and William Stukeley** in England, who documented and sketched ancient monuments like Stonehenge.

Classical Influence: Interest in the classical civilizations of Greece and Rome sparked early archaeological endeavors, such as the excavations of Pompeii and Herculaneum in the 18th century.

2. Scientific Approach (19th century):

Systematic Excavation: The development of more methodical excavation techniques marked the transition from antiquarianism to modern archaeology. Pioneers like General **Augustus Pitt Rivers introduced rigorous recording and stratigraphic excavation methods**.

Discovery of Ancient Civilizations: Major discoveries, such as Heinrich Schliemann's excavation of Troy and Sir Arthur Evans' work at Knossos, captured public imagination and advanced the field.

Establishment of Institutions: The founding of societies and institutions, like the Archaeological Institute of America (1879) and the British Archaeological Association (1843), helped formalize the discipline.3. Professionalization and Theory (20th century):

Professional Training: Archaeology became a recognized academic discipline with specialized training programs and university departments.

Development of Theoretical Frameworks: The emergence of archaeological theories, such as processual (New Archaeology) and post-

processual archaeology, provided different lenses through which to interpret archaeological data.

Technological Advances: The introduction of technologies like radiocarbon dating, GIS, and remote sensing revolutionized archaeological methods and expanded the scope of research.

4. Modern Archaeology (Late 20th century to present):

Interdisciplinary Approaches: Collaboration with other scientific and social science disciplines enhanced the understanding of archaeological findings. Public Archaeology and Cultural Heritage: Increased emphasis on the preservation of cultural heritage and public engagement through museums, heritage sites, and community archaeology projects.

Global and Inclusive Perspectives: Modern archaeology places greater emphasis on previously underrepresented regions and cultures, promoting a more global and inclusive view of human history.

Key Figures in the Early Development of Archaeology:

John Aubrey (1626-1697): An English antiquarian who documented prehistoric sites like Avebury and Stonehenge.

William Stukeley (1687-1765): An early antiquarian who also studied and documented **ancient sites in Britain.**

Giovanni Battista Belzoni (1778-1823): An early **explorer and antiquarian** who conducted significant work in Egypt.

Heinrich Schliemann (1822-1890): Known for his **excavations at Troy,** which brought significant attention to the field.

Sir Arthur Evans (1851-1941): Excavated the palace of Knossos on Crete, uncovering the Minoan civilization.

The evolution of archaeology from a hobby of antiquarians to a rigorous scientific discipline reflects broader trends in the intellectual and technological advancements of society. Today, archaeology is a dynamic field that continues to adapt and grow, incorporating new methods and perspectives to explore the human past.

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western civilization. Classical archaeology not only studies these two civilizations independently, but also in relation to other contemporary civilizations of that period. It also examines the influences of other civilizations on the ancient Greeks and Romans, and vice versa. It is a very exciting field of study, but because it pertains to specific regions, is limited in scope.

Antiquarianism:

An antiquarian or antiquary (from the Latin: antiquarius, meaning pertaining to ancient times) is an aficionado or student of antiquities or things of the past. More specifically, the term is used for those who study history with particular attention to ancient artifacts, archaeological and historic sites, or historic archives and manuscripts. The essence of antiquarianism is a focus on the empirical evidence of the past, and is perhaps best encapsulated in the motto adopted by the 18th-century antiquary Sir Richard Colt Hoare, "We speak from facts, not theory."

Despite the importance of antiquarian writing in the literature of ancient Rome, some scholars view antiquarianism as emerging only in the MiddleAges. Medieval antiquarians sometimes made collections of inscriptions or records of monuments, but the Varro-inspired concept of antiquitates among the Romans as the "systematic collections of all

the relics of the past" faded. Antiquarianism's wider flowering is more generally associated with the Renaissance, and with the critical assessment and questioning of classical texts undertaken in that period by humanist scholars. Textual criticism soon broadened into an awareness of the supplementary perspectives on the past which could be offered by the study of coins, inscriptions and other archaeological remains, as well as documents from medieval periods. Antiquaries often formed collections of these and other objects; cabinet of curiosities is a general term for early collections, which often encompassed antiquities and more recent art, items of natural history, memorabilia and items from far-away lands.

The importance placed on lineage in early modern Europe meant that antiquarianism was often closely associated with genealogy, and a number of prominent antiquaries (including Robert Glover, William Camden, William Dugdale and Elias Ashmole) held office as professional heralds. The development of genealogy as a "scientific" discipline (i.e. one that rejected unsubstantiated legends, and demanded high standards of proof for its claims) went hand-in-hand with the development of antiquarianism. Genealogical antiquaries recognised the evidential value for their researches of non-textual sources, including seals and church monuments.

Many early modern antiquaries were also chorographers: that is to say, they recorded landscapes and monuments within regional or national descriptions. In England, some of the most important of these took the form of county histories.In the context of the 17th-century scientific revolution, and more specifically that of the "Quarrel of the Ancients and the Moderns" in England and France, the antiquaries were firmly on the side of the "Moderns". They increasingly argued that empirical primary evidence could be used to refine and challenge the received interpretations of history handed down from literary authorities.

Development of New Archaeology:

New Archaeology or Processual Archaeology is a form of archaeological theory that has its origins in 1958 with the work of Gordon Willey and Philip Phillips, 'Method and Theory in American Archaeology' in which the authors stated that 'American archaeology is anthropology or it is nothing.' Proponents of this archaeology assert that with the rigorous use of the scientific method it was possible to cross the limits of the archaeological record and know something about how the people who used artifacts lived. It was an intellectual movement which believes in logical positivism as a guiding research philosophy, modelled on the scientific method—something that had never been applied to archaeology before. Before the emergence of

new archaeology in 1960, culture-history was a dominant point of view. In fact, the century before 1960 was the 'long sleep' of archaeological theory, in which very little explicit discussion of theory occurred. The inability of culture-history to answer the 'how' and 'why' of the past events was because of its mono-casual explanations and the descriptive level of this framework. Together these factors led to the emergence of new archaeology.

The processualists discarded the cultural-historical belief that culture was a set of norms held by a group and communicated to other groups by diffusion and instead maintained that the archaeological remains of culture were the behavioural results of a population's adaptation to particular environmental conditions. Theory in the new archaeology attempts to explain change and recognise the process by which it came about. Thus, it represents an important movement from the main traditions of archeology, in which the description was considered to be more important than the explanation of change. It was time for a New Archaeology that would apply the scientific method to find and make apparent the laws of cultural growth in the way that societies responded to their environment. Archaeologists have generally recognised the works of Colin Renfrew, Kent V. Flannary, Ian Hodder and L.R Binford as indicative of the growth of processual school of archaeology. The New Archaeology laid emphasis on theory formation, model building,

and hypothesis testing in the pursuit of general laws of human behavior. According to processualists cultural history cannot be repeated: it is futile to tell a story about a culture's change unless you are going to test its inferences. There is no scientific ground to determine as to whether a culture history one has built is correct. The processualists clearly wanted to go beyond the cultural-historical methods of the past (simply building a record of changes) to focus on the processes of culture (what kinds of things happened to make that culture). In processual archaeology, culture is considered basically as the adaptive mechanism that permits people to adjust with their environments. The processualists had two tools to strike out in this new archaeology Ethno-archaeology and the rapidly growing varieties of statistical techniques. Ethno-archaeology is the study of the social organization and other ethnological features of present-day societies based on their material culture, in order to draw conclusions about past societies from their material remains. It is the application of archaeological techniques on deserted villages, settlements, and sites of living people. Lewis Binford conducted the classic processual ethno-archaeological study by examining the archaeological remains left by mobile Inuit Upper Palaeolithic hunters-gatherers.

Since the processualists uses scientific method so there arose a need for examination of huge amounts of data. Processual archaeology came about

during the quantitative revolution, which comprised an explosion of complicated statistical methods fueled by growing computing powers and growing access to them. Data collected by processualists (and still today) comprised both material culture characteristics (like artifact sizes and shapes and locations), and data from ethnographic studies about historically known population make ups and movements. This data was utilized to build and ultimately test a living group's adaptations under particular environmental conditions and thus to explain prehistoric cultural systems.

Processualists were concerned with the dynamic relationships (causes and effects) thatoperate among the components of a system or between systematic components and the environment. The process was by definition repeated and repeatable: first, the archaeologist observed phenomena inthe archaeological or ethno-archaeological record, then they employ thoseobservations to form clear hypotheses about the connection of that data to theevents or conditions in the past that might have caused those observations.Next, the archaeologist would decipher what kind of data might support orreject that hypothesis, and finally, the archaeologist would go out, collectmore data, to test the validity of the hypotheses. If it was found to be validfor one site or circumstance, the hypothesis could be tested in another one. Since there was a plenty of data and so much variability, the search for

general laws rapidly became difficult. As a consequence the archaeologists found themselves in sub-disciplinary specializations to be able to manage: spatial archaeology dealt with spatial relationships at every level from artifacts to settlement patterns; regional archaeology required understanding trade and exchange within a region; inter-site archaeology sought to identify and report on socio-political organization and subsistence; and intra-site archaeology planned to understand human activity patterning.

Before procession archaeology, archaeology was not naturally seen asa science, because the conditions on one site or feature are never similar and so by definition not repeatable. Richard Gould states that one of the dictums of archaeology is that every site is unique. What the new archaeologist's didwas to make the scientific method practical within its limitations. However, what procession archaeologists found was that the sites and cultures and circumstances varied too much to be simply a reaction to environmental conditions. It was a formal, Unitarian principle that archaeologist Alison Wylie called the 'paralyzing demand for certainty'. There had to be other things going on, including human social behaviors that had nothing to do with environmental adaptations. The weakness of procession archaeology appeared from the beginning of its approach. The archaeologists believe that it is difficult to dig up a social system, ideology, a

kingship terminology and a philosophy. Apart from thisit is very complicated to reconstruct the social organization and ideology ofa society. This is the most important reason for them to discard procession archaeology. The critical reaction to processualism born in the 1980s was called post-processualism, which is a different story but no less influential on archaeological science today. The post-procession archaeology, which identifies itself as an interpretative perspective and is against processualism, stresses the subjectivity and historical particular; anti-science and objectivity; symbolism, ideology; relative position and highlights the plurality of events and individuality.

THE ASIATIC SOCIETY

The Asiatic Society was founded on 15 January 1784 by Sir William Jones in a meeting presided over by Sir Robert Chambers in the Grand Jury Room of the Supreme Court at the Fort William in Calcutta, then capital of the British, to enhance and further the cause of Oriental research. At the time of its foundation, this Society was named as ‘Asiatick Society’. In 1825, the society dropped the antique k without any formal resolution and the Society was renamed as ‘The Asiatic Society’. In 1832, the name was changed to ‘The Asiatic Society of Bengal’ and again in 1936 it was renamed as ‘The

Royal Asiatic Society of Bengal.' Finally, on 1 July1951 the name of the society was changed to its present one. The main objectives of the Society.

On September 29, 1796 the Society decided to have its own building. J.H. Harrington, then Vice-President selected the corner of Park Street and Chowringhee Road Kolkata (present location) for the Society's house and the site was granted to the Society. The original plan for the new building was prepared by Captain Thomas Preston and modified by the French architect, Jean-Jacques Pichou. The first quarterly meeting of the Society was held at its new building on 3 February1808. The Society is housed in a building at Park Street in Kolkata (Calcutta). The Society moved into this building during 1808. In 1823, the Medical and Physical Society of Calcutta was formed and all the meetings of this society were held in the Asiatic Society. Charles Wilkins and Alexander Hamilton were the distinguished early members of the Society. Initially, the Grand Jury Room of the Supreme Court was used for the meetings of the members, who were required to pay a quarterly fee of two mohurs. The members were elected by means of ballot-voting. Initially, only the Europeans were elected members of the Society. However, at the initiative of Hoarse Hayman Wilson, a number of Indians were elected members in 1829, which included Dwarakanath Tagore, Sivchandra Das, Maharaja Baidyanath Roy, Maharaja Bunwari Govind Roy,

Raja Kalikrishna Bahadur, Rajchunder Das, Ram Comul Sen and Prasanna Coomar Tagore. Ram Comul Sen was elected 'Native Secretary' on December 12, 1832. Later on, Rajendralal Mitra became the first Indian President of the Society in 1885. Both the orientalist, Brajendranath De, and one of his grandsons, the historian, Barun De, were for some time vice president of the Asiatic Society. in this library is Juli Firmici's Astronomic rum Libra which was published in 1499. It also has a large number of books printed in India in the late 18th and early 19th centuries. The library also possesses many rare and scarcely available books. It has a rich collection of about 47,000 manuscripts in 26 scripts. The most noteworthy amongst them are an illustrated manuscript of the Qur'an, a manuscript of the Gulistan text, and a manuscript of Padshah Nama bearing the signature of Mughal Emperor Shahjahan. At present there are around 80,000 journals in the library.

Sir William Jones

Sir William Jones was an English philologist and a student of ancient India, particularly known for his proposition of the existence of a relationship among Indo-European languages. He was born at Beaufort Buildings, Westminster, London on 28 September 1746. His father William Jones, F.R.S, an able mathematician, died in 1749 and William Jones was raised by his mother Marie Nix Jones. He was sent to Harrow School in September

1753 and then went on to Oxford University. He graduated there in 1768 and completed his post-graduate degree in 1773. He was a linguistic prodigy. Alongside his studies he learnt Greek, Latin, Persian, Arabic and the basics of Chinese items at an early age. He then embarked on a career as a tutor and translator. During this time at the request of King Christian VII of Denmark he published Histoire de Nader Chah (1770), a French translation of a work originally written in Persian by Mirza Mehdi Khan Astarabadi. At the young age of 24, he acquired a reputation as an orientalist. In 1770, he joined the Middle Temple and studied law which ultimately led to his appointment as puisne judge to the Supreme Court of Judicature at Fort William in Calcutta, Bengal in March 1783. He arrived in Calcutta on 25 September1783.

As mentioned earlier, Sir William Jones established the Asiatic Society in January 1784. Governor-General Warren Hastings was its patron and William Jones was its founding president. Jones was a great philological scholar who was proficient in Arabic and Persian languages when he was appointed to India and he knew 28 languages by the end of his career there. He gradually developed interest in Sanskrit, translating significant pieces of Hindu literature and Hindu and Arabic/Muslim legal texts, which contributed to the establishment of a civil law code in India. His Digest of Hindu and Muslim Laws (completed by Henry Colebrooke) was his major contribution.

The aims of Asiatic Society were to inquire into history, antiquities, arts, sciences, and literature of Asia, and from the beginning it was envisioned that the learned Indians would become its members. Between 1788 and 1839, the Society collected and published on oriental manuscripts, coins and antiquities in Society's journal Asiatic Researches which set the standard for oriental research of the day. In 1847, the Society started making a wide variety of oriental literature more broadly available in Bibliotheca Indica series. It served as a model for the foundation of the Royal Asiatic Societies in the West.

The foundation of the Asiatic Society in India was the consequence of European Enlightenment. It was the belief in the value and benefits of knowledge and science and in universal history. Biblical history and chronology was based on the belief that all humans were related and one of the major tasks of the Society in India was to prove it. William Jones believed that Indian's were descendents of Noah's son Ham and that Sanskrit was related to other ancient languages, such as Phoenician, Egyptian, and Celtic. He pointed out that Sanskrit was the fountain head of many languages: "The Sanskrit language whatever be its antiquity, is of a wonderful structure more perfect than the Greek, more copious than the Latin, and more exquisitely refined than either, yet bearing to both of them a stronger affinity,

both in the roots of verbs and in the forms of grammar, than could possibly have been produced by accident. He further believed that for 3,500 years Sanskrit was the language Archaeology in India - I of philosophy, religion, medicine, astronomy, mathematics, literature and of all branches of learning not only in India, but also in every other region influenced by the Indian culture until their conquest by Muslims and the use of Arabic by the new ruling class and religion. Through his knowledge of Sanskrit language, a mixture of many older Indo-Aryan dialects, and by comparing it with the history and developments of other languages, he created Indo-European linguistics. By associating Sanskrit to the European language family, William Jones integrated Hindu civilization to that of Europe. He had an indirect influence on the growth of the science of comparative philology. He collected evidences to prove that the game of chess was discovered in India. He supported the premise that Plato and Pythagoras borrowed their philosophical ideas from India. The two principles of non-duality of God (advaitavada) and the transmigration of the soul of Hinduism fascinated William Jones. He showed that India excelled in logic, geometry and arithmetic. In his last discourse to the Society he observed that Newton's theory and part of his philosophy may be found in the Vedas. Thus, William Jones is one of the most interesting figures in the history of India. He was not only an erudite

scholar who knew more than two dozen languages but made a number of great discoveries in Indian studies. He died in Calcutta on 27April 1793 at the age of 47 and is buried in South Park Street Cemetery. The Asiatic Society survived William Jones's death and opened its doors to the members of the Bengali intelligentsia in 1829. Dwarkanath Tagore was among the first Indian members of the Society. By promoting Indian culture, William Jones gave India a weapon in their hands which could be used against the Europeans whenever they attempted to belittle the Indian civilization.

James Prinsep

James Prinsep was born on 20 August 1799 to John Prinsep and his wife, Sophia Elizabeth Auriol. John Prinsep went to India in 1771 and became a successful indigo planter. After earning good money he returned to England in 1787 and established himself as an East India merchant. He moved to Clifton in 1809 after incurring losses. He managed to find work for all his sons and several members of the Prinsep family rose to high positions in India. John Prinsep later became a Member of Parliament. James Prinsep initially went to study in a school in Clifton. He showed a flair for detailed drawing and mechanical invention made him study architecture under the gifted but eccentric Augustus Pugin, an Anglo-French artist, architect and critic. However, due to some problem with his eyesight he was unable to take

up architecture as a profession. His father knew of an opening in the assay department at the mint in India and sent him to train in chemistry in a hospital and later as apprentice to Mr Bingley, assay master at the Royal Mint in London (1818–19).

Prinsep found the job of an assay master at the Calcutta mint and reached Calcutta on 15 September 1819. A year later he was sent by his superior, the eminent orientalist Horace Hayman Wilson, to work as assay master at the Benares mint where he stayed till 1830. He then moved back to Calcutta as deputy assay master and when Wilson resigned in 1832, he was promoted as assay master. On his position as assay master he conducted many scientific studies. He also formed intimacy with Major Herbert, a scientific officer of the East India Company's army, who had started a periodical called Gleanings in Science with the proposed object to make known in India, the discoveries made in arts and sciences. Prinsep contributed several articles to this periodical. In 1831, Major Herbert was appointed astronomer to the king of Avadh and transferred the conduct of his periodical to Prinsep, who improved it to rival publications of the same nature in Europe. In 1833, he called for reforms to Indian weights and measures and advocated a uniform coinage based on the new silver rupee of the East India Company.

James Prinsep was a gifted artist and draftsman. He made meticulous sketches of ancient monuments, astronomy, instruments, fossils and other subjects. He continued to take an interest in architecture at Benares. After his eyesight was restored, he studied and demonstrated temple architecture, designed the new mint building at Benares in addition to church. In addition to his official duties, he improved the drainage of the city by constructing an arched tunnel. He helped renovate the dilapidating minarets of mosque built by Aurangzeb. He conducted the city's first census, built a church there and Archaeology in India - I prepared a balance of extraordinary precision to indicate the 3/1000th part of a grain. He also made a series of sketches related to Benares in pencil and ink drawings that were later reproduced as lithographs under the title of Views and Illustrations of Benares.11 In 1832, Prinsep succeeded H. H. Wilson as secretary of the Asiatic Society of Bengal. By merging Gleanings in Science with the society he became the founding editor of Journal of the Asiatic Society and contributed articles on chemistry, mineralogy, numismatics and on the study of Indian antiquities. He was also very interested in meteorology and the tabulation of observations and the analysis of date from across the country.

Prinsep showed great interest in numismatics. He used bilingual Indo-Greek coins to decipher Kharoshti script. He interpreted coins from Bactria

and Kushan as well as Indian series coins, including 'punch marked' ones from the Gupta series. According to Prince there were three stages of development of coins--the punch-marked, the die-struck, and the cast coins. He initially held the view that ancient India had no native coinage but he later modified his view and suggested that old Indian coinage was restricted to those 'punch-marked' on silver and gold. James Prinsep provided the real impetus for archaeological research in India. Both Alexander Cunningham and Falconer emphasized on his 'burning, irrepressible enthusiasm' which led him to complete the task of a dozen men. James Fergusson, a Scottish architectural historian, was of the opinion that if James Prinsep would have lived to continue for a few years longer, the researches which he commenced and continued with such success, probably would have succeeded in raising the veil which still shroud in obscurity the antiquities of India.

The deciphering of the Indian scripts is a remarkable story. Its culmination was reached in Prinsep's deciphering of the Brahmi script in 1834, a discovery which can be compared with Henry Rawlinson's reading of the cuneiform Sumerian script in 1835. This was followed up by the decipherment of the Ashokan inscription and the establishment of his contemporainity with the Greek rulers of the East who are mentioned in the inscriptions. Thus, for the first time Indian history was placed on a sound

chronological basis. Later on, the second script used in the North-West of the Indian subcontinent, commonly known as the Kharoshthi script, was deciphered.

Development of Archaeological Survey of India

The **Archaeological Survey of India (ASI)** is the premier institution responsible for archaeological research and the preservation of cultural heritage in India. Its development has a long history, beginning in the colonial period and continuing through various stages after India's independence. Here's a detailed overview of the development of the ASI:

1. Early Beginnings (1784-1861)

- The roots of the ASI can be traced back to the **Asiatic Society of Bengal**, founded by Sir William Jones in 1784. This society aimed to promote oriental studies and was one of the earliest bodies to conduct archaeological research in India.
- The first formal step towards a survey of India's antiquities was taken by **James Prinsep** and **Alexander Cunningham**, who played key roles in studying India's ancient inscriptions and monuments.
- Cunningham, often called the "Father of Indian Archaeology," initially worked under the British East India Company, carrying out surveys of archaeological sites.

2. Formation of the Archaeological Survey of India (1861)

- The ASI was officially established in **1861** by Alexander Cunningham, who was appointed as its first Director-General. His work focused on surveying and documenting India's ancient sites, inscriptions, and monuments.
- Cunningham's efforts led to the identification of important historical sites such as Sanchi, Sarnath, and Taxila. He emphasized the need for a systematic survey and documentation of India's archaeological heritage.

3. Expansion under British Rule (1861-1947)

- The ASI expanded its activities under various British officials, including **James Burgess**, who conducted extensive surveys in western India and central India.
- During this period, several landmark discoveries were made, such as the excavation of the **Indus Valley Civilization** at Harappa and Mohenjo-daro in the 1920s by **Sir John Marshall**, who was the Director-General of the ASI from 1902 to 1928.
- In 1904, the **Ancient Monuments Preservation Act** was passed, giving the ASI the legal authority to protect and conserve ancient monuments and archaeological sites.

- Under Marshall's leadership, the ASI undertook systematic excavations and conservation projects, including at Sanchi, Sarnath, and the Ajanta and Ellora caves.

4. Post-Independence Period (1947-Present)

- After India's independence in 1947, the ASI became a part of the newly formed **Ministry of Culture** of the Government of India.
- The **Ancient Monuments and Archaeological Sites and Remains Act, 1958** replaced the previous legislation, further empowering the ASI to protect heritage sites and monuments. This act provides the legal framework under which the ASI operates today.
- In the 1950s and 1960s, the ASI carried out significant excavations, including at sites such as **Lothal**, **Kalibangan**, and **Dholavira**, which contributed to the understanding of the Indus Valley Civilization.

5. Modernization and Expansion (1980s-Present)

- From the 1980s onwards, the ASI began to adopt modern technologies for archaeological research, including **remote sensing**, **aerial photography**, and **ground-penetrating radar**.
- The ASI oversees the protection of over **3,600 monuments** across India, including UNESCO World Heritage Sites such as the **Taj Mahal**, **Red Fort**, **Qutb Minar**, and **Hampi**.

- The ASI also manages a network of regional offices and archaeological circles across India to monitor and preserve cultural heritage at the local level.
- In recent years, the ASI has collaborated with international institutions for excavations and conservation projects, contributing to the global understanding of India's ancient history.

6. Key Functions and Responsibilities

- **Excavation and Research**: The ASI conducts archaeological excavations at various sites, contributing to the understanding of India's ancient civilizations and cultures.
- **Conservation and Preservation**: The ASI is responsible for the conservation and maintenance of protected monuments and archaeological sites across India.
- **Public Awareness**: The ASI works to promote public awareness of India's cultural heritage through museums, publications, exhibitions, and heritage walks.
- **Training and Education**: The ASI's **Institute of Archaeology** provides training to students and professionals in the field of archaeology and conservation.

7. Challenges and Future Directions

- The ASI faces challenges such as **illegal encroachments**, **looting of artifacts**, and **funding limitations**. The need for modernization in terms of technology and expertise is also recognized.
- The ASI continues to work towards the preservation of India's rich cultural heritage, with increasing emphasis on **community involvement**, **digital documentation**, and **international collaboration**.

The Archaeological Survey of India remains a vital institution in preserving the country's ancient history, playing a critical role in the discovery, conservation, and promotion of India’s cultural heritage.

UNIT- III

Exploration- Aims and Methods; Methods of Exploration – Manual and Scientific; Excavation – Methods of Excavation – Vertical, Horizontal, Quadrant Method , Stratigraphy : Definition, Scope and Methodology - Recording Methods: Photography, Plan and Section Drawing, Three Dimensional Measurements - Dating Methods: Relative Dating and Scientific Dating.

Objectives:

- To analyze the techniques used in manual exploration, such as traditional surveying and systematic fieldwork.
- To define stratigraphy as the study of layers (strata) within an archaeological site.

EXPLORATION:

Exploration is an interdisciplinary investigation, which endeavours to locate and understand the potentials of an archaeological site. An archaeological site is based on many factors. Generally, an archaeological site has a deposit formed as a result of cultural and natural processes. Different techniques are applied for the retrieval of archaeological materials from archaeological sites, such as exploration and excavation. Archaeological

exploration implies on-destructive scientific survey and documentation of sites.

The important task of an archaeologist is the identification of a site. An archaeologist should have an eye to be able to locate the cultural and natural processes. So before going for exploration an archaeologist should have an overall idea of the region under investigation. Maps can be helpful for attaining this knowledge. Maps showing various geographical features with the help of symbols can be useful. Other maps include geological maps, vegetation maps, agricultural maps, rainfall maps, soil maps, maps depicting natural resources and maps that indicate isolated but specialized features. An archaeologist should have an ability to understand these maps.

The nature of an archaeological site changes according to the cultural periods. So, when one looks for an archaeological site, the parameters under consideration changes from areas to areas, and from cultural periods to cultural periods. The artificial mound found in an archaeological site is a relic of the original site and differs a lot from the natural mound. Artificial mound can be located in several ways. It can be located with the help of religious literature. Exploration of Buddhist antiquity sites conducted by Sir Alexander Cunningham is the best example of this kind of exploration. It was done by using Buddhist sacred literature, Tripitakas and accounts of Chinese travelers

FaHsien and Hiuen Tsang. Another way to locate the mound would be to conduct village to village surveys and enquire with the local people about visible potsherds there. Sometimes, the folklores and certain terms in local dialects are useful to locate archaeological sites.

Different methods are used for exploration of sites: desktop study, surface survey, field walking, aerial photography, magnetometer survey, electrical resistivity survey, probing, remote sensing, and also with the help of Geographical Information System (GIS) which are briefly explained as below:

Field Survey:

Also called Pedestrian Survey it is one of the oldest and authentic site survey methods in archaeological explorations. In this, a team of archaeologists surveying an area simply walk over the surface of the site covering almost all parts, observes, and collects material remains. This method is advantageous in the way that the chances of missing out even a small activity area are less.

Magnetometer Survey:

In this method an instrument known as proto-magnetometer is used to identify structures or features which show the property of thermo remnant magnetism (e.g. hearths, brick structures etc.). It detects variance between the

general magnetic field of an area and the one above or near the buried features or structures. The use of proton-magnetometer is based on the electrodes fixed into the ground at regular intervals and the variance between the electrodes can then be plotted.

Remote Sensing:

It is a modern technique used to obtain archaeological data with the help of aerial photography and satellite imageries. This method enables the archaeologists to uncover unique data that is unobtainable using traditional archaeological techniques and have an overall idea of the features on a given landform, which is otherwise difficult to view while standing on the field. A series of ground-based geophysical methods such as Ground Penetrating Radar (GPR) and Magnetometer are also used for archaeological imaging.

Aerial Photography:

It is the earliest and perhaps the most important remote sensing tool available to archaeologists looking for new archaeological sites. This survey uses airborne and space borne remote sensing tool. It has two components -- Data Collection, which comprise capturing photographs or image from aircraft or satellite, and Data Analysis, in which such photographs are analysed, interpreted and integrated with other evidences. This method allows an archaeologist to have a bird's eye view of the mound and gives the outline

of any aspect. It plays a key role in distinguishing features which are otherwise invisible when looked from the ground level.

Excavation – Methods of Excavation

Excavation is the most traditional archaeological tool for understanding the human past, and it undoubtedly represents the type of activity that most people attribute to archaeology. Excavation methods are the different techniques employed within archaeology to dig, expose, identify, process, and record archaeological remains. It involves the removal of soil, sediment, or rock that covers the artefacts or other evidences of human activity. Early excavation methods involved destructive random digging and removal of objects with little or no location data recorded. Modern excavations generally involve slow, careful withdrawal of sediments in very thin layers, detailed filtering of sediment samples, and exacting measurement and recording of arte fact location. An archaeological project often commences with a survey of the site under examination. Geological surveys have proved to be useful in various archaeological researches. Human burials comprise a major source of evidence for human history. Burials excavated by archaeologists may report on both the individual commemorated and on society at large. Two methods of excavations are generally followed—vertical excavation and horizontal excavation. Horizontal excavation refers to

excavating a broad area with the purpose of exposing the remains of a single point in time. Archaeological excavation is innately destructive because it permanently removes both artefacts and the surrounding soil matrices from their original context. Therefore, responsible and accurate recording is the most vital component of any project, and excavation has no meaning without written and visual records. Archaeology has undergone far-reaching changes since the time when an excavation was simply a mining of artefacts. Nowadays, the removal of arte facts requires that the spatial relationships and context in which they are found be fully documented.

Site Survey

An archaeological project often commence with a survey. A regional survey is an effort to methodically locate previously unidentified sites in a region. A site survey is an attempt to systematically locate features of interest, for example, houses and maddens, within a site. Each of these two objectives may be achieved by more or less the same methods. Initially in archaeology, a survey was not much practiced. The researchers and historians were generally satisfied with discovering the locations of monumental sites from the local people, and excavating only the clearly visible features there. Gordon Willey initiated the method of regional settlement pattern survey in 1949 in the Viru Valley of coastal Peru, and survey of all levels became

famous with the rise of procession archaeology later on. If conducted as a preliminary exercise, an archaeological survey is more beneficial than even the excavation. It needs comparatively less amount of time and expense, because it does not require processing large volumes of soil to search out the artifacts. However, surveying a large region or site can prove to be expensive, so archaeologists often use sampling methods. Just like with other types of non-destructive archaeology, survey avoids ethical issues related to destruction of a site by means of excavation. It is the sole means to gather some forms of information, like settlement patterns and settlement structure. Survey data is generally amassed into maps which may exhibit surface features or distribution of artefacts. Surface survey is the simplest survey method which involves walking over the ground surface recording, mapping and collecting artifacts encountered. This method cannot notice sites or features that are completely buried under earth, or overgrown with vegetation. It may also comprise mini-excavation methods like augers, corers, and shovel test pits. In case no Excavation Methods-I materials are found, the surveyed area is considered to be sterile. Aerial survey is carried out by using cameras attached to aero planes, balloons, or even kites to get a bird's-eye view. It is useful for quick mapping of large or complex sites. Aerial photographs are used to document the status of the archaeological

excavation. Aerial survey also uses infrared, ground penetrating radar wavelengths and other methods. Another very effective survey to see beneath the ground is the geophysical survey. Magnetometers detect even slight deviations in the Earth's magnetic field caused by iron artefacts, kilns, some types of stone structures, and even ditches and middens. Machines that measure the electrical resistivity of the soil are also extensively used. Archaeological features whose electrical resistivity differs with that of surrounding soils can be detected and mapped.

Geological Survey

For a long time, the study of geology has been basic in answering various questions in archaeology. Geological surveys have proved to be useful in various archaeological researches. In 1976, the term Archaeo-geology was, for the first time, used by Colin Renfrew to describe the contribution of the geological sciences to archaeology.

logical society of America (GSA) established the Archaeological Geology Division in 1977, with the aim of providing suitable forum for presentation of papers on archaeological geology and to encourage research and teaching in archaeological geology. The previous documentation of the influence of geology in archaeology is supposed to have started in 1830 when Charles Lyell published his work Principles of Geology. In 1863, he published his

famous book The Geological Evidence of the Antiquity of Man, in which he used geological context to document the remains and artifacts of early humans. Fagan defines archaeology as the scientific study of the human past, of ancient human behaviour, from the earliest time right up to the present. By itself, archaeology is part of wider discipline of archaeology which studies all aspects of humanity, ancient and modern. However, archaeologists are unique among scientists in that they study changes in human culture over long period of time. g period of time. Collin and Paul, on the other hand, define archaeology as partly discovery of treasures of the past, partly the meticulous work of scientific analyst and partly the application of the creative imagination. It is both physical activity out in the field and an intellectual quest in the study of laboratories. In general, the study of archaeology is concerned with analysis of human culture by using cultural remains and other cultural phenomena. Geology can be defined as an earth science of solid earth, the rocks of which it is composed, and the procedures by which they change with time. It can also mean the study of the solid features of any celestial body. It gives insight into the history of earth by providing the primary evidence for plate tectonics, the evolutionary history of life, and past climates. Applied geology is the geology that is used in various areas of practice including mining, engineering, hydrology and environmental issues

and, in due course, archaeology. Norman and Evan, in their book, Geological Methods for Archaeology, mention that geology covers considerable roles in various archaeological processes. Geology smoothen the progress of archaeological sites exploration. The first decision that must be taken in any new archaeological venture is where to dig. This decision can be based on historical records in many of the cases, by the visible remains of ancient construction, or by the discovery of plentiful artefacts. However, to see deep enough into the surface so that decision can be taken on particular target areas for excavation, and also to get an idea of what artefacts and constructions to expect, techniques involving geology are increasingly used. In archaeology, landscapes and environment can be reconstructed by means of studying of geomorphology and sedimentology entrenched in geology. As such, geology is used for the analysis of the deposits found in the surface that gives ample evidence for changes in land forms over time. These deposits may include residual materials, formed by the weathering of underlying formations, or may have been formed elsewhere and then transported by wind, water, or humans to their present site of deposition. The kind and amount of surgical materials alter with changing land surface and climatic conditions and so provide the best evidence regarding the evolution of the landscape. An understanding of these changes on a site can be used to

recreate the palace environment at the time of occupation and modeling of the prehistoric land-use patterns. Archaeological exploration in an area is made convenient by first indicating desirable habitation sites of the time and then targeting these sites for geophysical and geological vision.

Horizontal Methods

Excavation is a destructive, but a most systematic and scientific, documentation of archaeological sites. Through this process the cultural remains are brought out very carefully. It is a time consuming and expensive field activity. Generally, excavations are team efforts and require enormous funds for their successful completion. Augustus Pitt Rivers was the British Archaeologist who contributed to the development of different excavation methods. In the present scenario of the problem oriented archaeology, archaeologists plan excavation according to the imminent problem. For the excavation team, it is now almost essential to engage a palaeo-zoologist, palace-botanist, geo archaeologist, archaeological chemist and other such experts. Before the commencement of excavation, the contour map of the site is prepared.

The nature of the excavation depends basically on the character and needs of the site and the methods of excavation can also vary depending on its objectives. It is very important to have an index trench in any excavation

which goes up to the natural soil and gives an idea about the cultural sequence of the site. On the basis of the nature of the site, such as, architectural features, diverse activity areas etc., it is to be decided whether the site is needed to be excavated horizontally or vertically. Two types of excavations are generally conducted—vertical excavation and horizontal excavation. Of these, a vertical excavation is generally undertaken at a limited scale. Due to their limited nature, these are restricted to providing only patchy information regarding the social, economic and religious practices of the people of a particular culture. Excavation Methods-I Therefore, for getting further details horizontal excavations are meticulously planned and conducted in a systematic manner. A horizontal excavation is a method of excavation in which full horizontal extent of a site is cleared and large areas are open while preserving a stratigraphic record in the balks between large squares. A gradual probe may then occur. So the horizontal excavation aims at exposing the deposits horizontally. Sir Mortimer Wheeler is one of the chief opponents of this excavation by using the grid method. Extensive horizontal excavations are conducted to obtain detailed knowledge of the cultural periods or phases present at an archaeological site. Unlike the vertical excavation which is not extendable towards the area away from the parallel peg lines, the horizontal excavation is definitely advantageous in that

it is extendible in all directions, thus, expanding the scope of the excavation. As a result, horizontal type of excavation is followed to unearth the town planning of a site.

Horizontal excavation is generally conducted for a habitation site in order to know the area of its extent.1 However, to conduct a horizontal excavation some fundamentals are required to be considered:

- ✓ Easily and clearly sub-divide the site for record and control;
- ✓ Capable of progressive expansion in any direction without breaking down or weakening preliminary datum lines;
- ✓ Ability of preserving for constant reference at a maximum number of points, complete vertical sections until the last phase of excavation;
- ✓ Capable, ultimately, of easy integration into a continuously exposed regional excavation;
- ✓ Readily accessible at all points for the soil removal, without impediment from intervening cuttings or traffic across excavated surfaces; and
- ✓ Adequately open to the sky to make certain the easy inspection of well-lighted sections at all the required depths.

Laying out a trench The layout of the horizontal excavation is based upon a square. After the contour mapping of the site, the entire mound is divided into a grid of square trenches. The squares or grids are separated by a baulk measuring around 50cm. the baulk is the unexcavated region and is held intact till the end of the excavation and this act as the four sides of each trench. It also allows the preservation of the vertical sections of the site. To impose a grid of square trenches, reference lines are drawn from the centre of the single mound type sites. These lines intersect each other at a right angle leaving the mound divisible into four quadrants. Each of these four quadrants is further divided into equal sized small squares.

Vertical Methods

Vertical Excavations Vertical excavation, as the name suggests is intended to understand the vertical cultural sequence of a site. In the conventional method, the vertical excavation of the trenchesare laid in a pattern of lay out that cannot be extended laterally. However, a site, after gridding the area, a series of grids may be selected for vertical excavation. The vertical excavation is intended for understanding cultural sequence and chronology of the site. It is generally limited to a few trenches. It should not be seen as an entirely distinct method from the horizontal excavation and the

documentation and recovery of the material remains should be done with great care in both the excavation methods.

Advantages Vertical excavation focuses on the cultural sequence of a site and hence, it aims to understand all the cultures present in a site. It requires limited time and resources when compared to the horizontal excavations. It can help to understand the cultural history and long term variations in cultural life patterns of adaptations. It is ideal for understanding longterm cultural developments of a region.

Vertical excavation is useful for diachronic perspectives, it may not be very helpful to develop a holistic understanding of a particular culture and its contexts. Because the focus in this methods on long term cultural developments. Spatial organization within a specific cultural context cannot be understood using this method. Therefore its limitation lies in its fragmentary approach, but it can help in reconstructing the long-term chronological sequence in ceramics and tool typology and technology. Another problem with the vertical method is there is nocertainty that all the cultural periods are represented in a particular locality of a site that was chosen for excavation. For instance, in one specific time period people might have shifted their activities to another locality and the activities of this cultural period may not be found in all areas of the site.

Therefore, vertical excavation cannot be a substitute for the horizontal excavation method. Another limitation is the fragmentation of evidence; since vertical excavation concentration of the long term perspective, certain activity areas in a context may be partially recorded and/or destroyed in the intention to go deeper, and to find the earlier evidences. However, the horizontal method would focus on the documentation of the evidences from a holistic context and then it would proceed deeper. In the case of very important architectural remains or cultural features found in a context, the evidence has to be documented properly, and then lifted (salvaged) to a locality before proceeding for further excavation. Nowadays in the excavation methods heritage component is also taken into consideration, since the idea of site museum and local development are stressed in many contemporary social contexts.

Solutions Vertical and horizontal excavations cannot be seen as entirely distinct methods. Ideally, the vertical and horizontal excavations have to be combined for a better understanding of an archaeological site.

Quadrant Method

. Quadrant Method In Quadrant method, the burial area is usually divided into four quadrants, following cardinal directions. For this, first, four peg marks or stakes are fixed on four cardinal directions about two meters

outside the stone circle area. Each of the stake is marked with the corresponding direction in which it is fixed. Thus the stakes will have E, W, N, S as per the direction in which they are fixed. Then the trenching thread is fixed to the 5" (five inch) nails fixed at the bottom of each stake. Thus the trenching thread divides the burial area into four quadrants of approximate equal size. Each of these quadrants are known accordingly as North-West Quadrant, North-East Quadrant, South-East Quadrant and South-West Quadrant. First excavation is taken up in two diagonally opposite quadrants. It is not necessary to leave baulk in the first two quadrants while excavating. Similarly, about 10 cm of platform also should be left unexcavated around the circle stones. The other procedure of excavating the burial pit, skeletal remains and the funerary assemblage is same as described above. After completing excavation in the first two quadrants, excavation is taken up in the rest of the two quadrants, leaving the burial contents in the first quadrants intact. For this, first, a 50 cm. baulk is marked along the thread in the identified quadrants. Leaving this baulk, excavation is taken up in the rest of the quadrant areas. Care also should be taken to include about one meter of area outside the stone circle, as there are instances, where material has been found beyond the circle area. After completing excavation in all the four quadrants, and after proper recording of the strata and burial contents, the

baulk is also removed to expose the complete burial area. The advantage with this method is that we will have proper stratigraphic context of the total burial area. But, still some times it has been observed that, the quadrant method has some disadvantages. It has been observed that, sometimes, the same stone circle is used for multiple burials made at different periods. If a particular burial is confined within the excavated area of a quadrant, then the stratigraphic context of that particular burial with the other burials is difficult to establish. To overcome this difficulty, the following strip method is recommended.

Stratigraphy methods

Stratigraphy can be described as a 'layer cake' type arrangement of deposits called strata, with the older layer beneath the latest. It is also known as the 'Law of Superposition'. It is the branch of the geology that deals with the study and interpretation of the sedimentary stratified rocks, as well as of the identification, description, sequence, both vertical and horizontal, cartography and correlation of the units stratified of rocks. The artefacts that are discovered in successive undisturbed cultural layers can be dated relatively on the basis of the principles of stratigraphy. The principle of cultural/archaeological stratification is fundamental and it plays a dominant role in archaeological investigations. Modern excavation techniques are

based on stratigraphic principles. The concept of stratigraphy in geology was shaped by Sir Charles Lyell. There are certain fundamental laws and notions that are followed in identifying and studying stratigraphy. These are Laws of Superposition, Laws of Original Horizontality, Laws of Original Continuity and Laws of Faunal Succession. This concept was introduced in archaeology by the scholars like C.J. Thomsen, Kathleen M. Ken yon, J.J. Worsaae, and Mortimer Wheeler. Subsequently, it was developed to suit the needs of archaeology by Edward C. Harris in the 1970s. In his book Principles of Archaeological Stratigraphy published in 1979, Edward Harris questioned the direct application of geological laws in archaeology. He worked out a new method of interpretation of archaeological stratification which is popularly known as the Harris matrix. It works on a simple fundamental principle that if one cultural layer lies upon another, then the lower layer must have been deposited before the upper layer. The time gap between the depositions of two cultural layers may be a century or a millennium and it depends upon the nature of cultural deposit. According to this concept, the contextual layer on the top is considered younger than the layer that is found below. Therefore, a succession of layers would provide a relative chronological sequence from earliest to latest. Any cultural material found in a particular contextual layer can be dated relatively younger and older depending upon from which layer

the particular artefact is picked up. The artefacts recovered from orderly placed stratified layers would help to categorize them in certain chronological order. For example, the collection of Stone Age tools such as Palaeolithic tools, Microlithic tools and Neolithic tools in different cultural layers helps to establish the approximate date of a particular cultural layer.

Definition, Scope and Methodology - Recording Methods

Introduction Archaeological excavation is the systematic process of recovering the archaeological and environmental data that are buried in the soil deposits, to understand the ways of life of the past communities on the whole. The purpose of the excavation is to understand the past cultures, human behavior and spatio-temporal organization. The process of undertaking excavation involves the contribution of several workers, researchers and the experts, who may not be able to attend the excavations. In addition, the excavated remains may be displayed in the museums and/at site museums for the benefit of the public. Hence, recording is an important aspect of archaeological excavations and research. The excavation operation is a process that is momentary and it cannot be visualized, or recalled from memory at a later context, but the information is essential for the third parties. The excavated data, apart from the materials, are required for the reconstruction of the ways of life of the cultures that produced the materials

remains found at the excavated site, and also for future researchers as well as for the public as part of heritage education. Therefore, the proceedings of an excavation need to be recorded using various means, and this recording actually transcribes the characteristics of the sediments, activity areas, architecture and the findings that are encountered in an excavation, as accurately as possible. Hence, multiple methods of recording are important for proper documentation of an excavation. The methods of documentations have been perfected from the time of early excavations in the 18th century to the latest excavations, and the documentation of excavations has advanced to a very high level with the use of advanced digital cameras, videos and 3D imaging tools. Excavation is considered as a documented destruction.Before "destroying" the sediments and layers, and during and after excavation several types of documentation have to be done. This module focuses on the recording or documentation of the data from archaeological excavations. The recording of underwater excavations is not discussed here.

What is Recording/Documentation

Recording/documentation refers to the collection of complete, relevant dataset from an excavation. It is basically capturing data about the material culture and its context that are excavated for understanding the past

cultures. The recording of an excavation involves collection of data in the form of geo coordinates, texts, images, video and audio.

- ✓ Descriptive recording of the features, artifacts, architecture, sediments, layers and their composition and other features, and their distribution, function and nature. Photography of features and architecture
- ✓ Line drawings of features and architecture
- ✓ Top-plan, section and elevation drawings of buildings, layers and loci
- ✓ Section drawings: layers and features visible on the cut surface of the trench
- ✓ Drawing of excavated materials and architectural features• Digital Documentation of the materials, architecture and contexts
- ✓ Artist's representation and rendering of the site

Why Documentation

- ✓ Once the site is excavated it is lost or destroyed; therefore, for the reference of future researchers and scholars, the evidence from the excavations has to be documented. While the excavator may have direct knowledge of the excavations at the time of excavation, the excavator may forget the details and finer aspects of the excavated features and their context in course of time.

- ✓ Hence, it is important to document the excavation for the benefit of the research on the past cultures and to write the report and for the reference of future researcher. Documentation is essential, since it provides the proof and evidence as part of scientific research and interpretation. Once an excavation is documented, the records can be consulted again and again• for a better interpretation and reference.
- ✓ It can be a tool for education and training.

Tools and Implements

Archaeological documentation or recording has to be done with a number of tools and implements. The main agency behind the documentation is the excavator (the human element) or archaeologist who acts as an observer. No machine or equipment can replace the humans in the documentation and interpretation of the cultural materials and their context, since observation of the excavation is done by human observation, perception and cognition. However, the recording/documentation has to use a number of tools and implements as part of the scientific approach and established procedures related to the archaeological excavations. As often mentioned by archaeological textbooks, excavation is a documented destruction, and hence, it is necessary that an excavation is documented properly.Several tools,

aids, records and datasheets are necessary for a detailed recording of excavations and some of them are listed below.

Notebooks and Registers

Trench notebooks and registers are the key documents to be maintained during an archaeological excavation. Each trench may be assigned a trench notebook, for the description of the excavations and observations on various features that are excavated. The nature of the loci(activity areas), their numbering and the soil colour and types and contents may be described in the trench notebooks. Trench notebook is a complete record of the digging activities in a trench. Although nowadays datasheets are introduced, maintaining trench notebooksis also essential.

Datasheets

Datasheets can be used for capturing the data from excavations. They can collect data in an organised manner, according to the research design and plan. Since they provide a template (with a ready set of fields) that can be filled up by the trench supervisors,they can be very useful to capture the data that is required by the research problem, as designed by the principal investigator. But, datasheet

cannot be a complete alternative to the trench notebooks. However, data collection through trench notebook should also be maintained.

Drawing Equipment

Unlike the early years of excavations and documentation, drawings have become much easier nowadays because of the development in Information Technology and digital media.But the basic tools of drawing cannot be substituted. Pencils, ink pens, tracing sheets, graph sheets, drawing compass tools, and drawing stands and pad for preparing the drawings at the site and umbrella to provide shade while drawing, plum bob, line levels, and thread are essential for the preparation of drawings. The software programs such as Photoshop and AutoCAD and other image editing software can also be used for drawing the features and architecture from the excavations. However, a professional draughts person is important for accurate drawings of features. Students and research scholars may also be trained in this process.

Mapping Tools

Mapping tools include Theodolite and Dumpy levels of the yesteryears, but nowadays Total Stations are very useful as they help

in the mapping of the sites and architectural features. Here too software helps to bring out an accurate digital output.

Camera

Camera is another important tool for taking photographs during the excavation. Video cameras can also be used now. Many advanced cameras are now available in the market for high resolution digital documentation. Professional help would be useful in photo documentation.

Computers

Computers are important tools for digitization of the data from the excavations. They can help the digitization of visual and text data. The photos and other forms of digital data can be manipulated and transferred through computers. Scanners and printers are other associated tools required for the documentation.

Photo Register

A photo register is necessary for keeping account of the photos of various features excavated. Although online and digital database are common nowadays, registers can still be useful both in soft and hardcopy versions.

Tape measures

For documentation and measurement, various tape measures and scales are required.

GPS: Global positioning system

GPS system is necessary to document the trench location. Although some of the GPS machines are not very accurate, the coordinates of the trenches should be documented using the GPS for GIS implementation.

Colour chart

Colour charts are useful for the documentation of beads. These charts have standard colours and they assist in the accurate documentation of colours. In the documentation of rock art IFRAO scales are used and such scales are includes in the photographs for colour and size comparison.

Scales of various sizes for photo documentation

Since photo documentation provides a very good idea of the excavated features and objects, the images in the photographs should be made measurable. Providing a scale nearby the objects in the photos could help the reader or observer to understand the dimension of object inthe photo. A 5 m, 1 m or 10 cm or 5 cm scales with cm or 50 cm or 1 cm intervals marked on them can be usedin photography.

Often archaeologists use pen or mobile or other objects for photography, although these may be acceptable in extraordinary circumstances, proper scales are necessary for the documentation of archaeological objects and features.

Documentation of Excavations

Documentation of excavation is a complicated process, and several individuals have to be involved in the documentation process. The documentation of excavation can be divided into Descriptive and Illustrative Documentation Photo documentation Video documentation Audio recording.

Site Mapping

Site map is the first documentation to be done at any site before planning the excavation. Preparation of contour/elevation maps and having fixed reference points at the sites are also crucial aspect of mapping. The mapping is now done with a Total Station device and the coordinates are transferred as a digital document. The site map has to have contours, disturbed areas and all the features, both cultural and natural, of modern and ancient features. Site mapping is important, even if the research involves only surface survey. During the surveys, if it is not possible to prepare proper map or at least a

sketch map on the location and access to the site proper can be prepared. But, the excavation project should have proper site maps. Site mapping is done prior to the excavations, during and after excavations.

Site Documentation Register/Site Notebook

Site Documentation Register/notebook is an important documentation about the site and the overall excavations. Site notebook is about the documentation of the digging activities in a site. Site notebook is a record maintained by the director of the excavation or the site supervisor. This would have all the observations on the several trenches excavated in different areas of the site, the location, distance of the trenches in relation to the site datum, Geo-coordinates Datum points, logic behind choosing the location of a trench, correlation of layers and stratigraphy and other general information and finds about the site. Some of these details may be repeated in the Trench Notebook. Sometimes parallel documentation is also important in archaeological excavations.

Trench Notebook: Descriptive Documentation

Trench refers to a specific enclosed area/pit that is excavated. When a large area is excavated, in some instances, baulk is left in

between the trenches. In this system, a trench becomes a separate unit. In such case, a series of documentations have to be maintained for each trench. Text description is a verbal narrative of the site that is excavated. It contains text description of the process of excavation, features, sediments, layers and their composition and other features. It is like a running commentary; one may compare it to the cricket commentary. Here the layers, sediments, architecture, structures and features are described during the excavation and finally after the excavation. This notebook will have data on thelayers, loci, sediments, colour with Munsell colour reading, date of the excavations, strategy adopted, type of sieve, availability and frequency of various cultural materials, interpretation, discussions, sketch maps, issues faced during the excavations and all other important observations. Each and every step has to be thoughtfully recorded and explanation has to be offered for changes in documentation.

Sediments and Layers

The loci excavated in a trench could be a sedimentary layer or a locus. The colour, composition, soil ph, and other parameters of a sedimentary layer should also be recorded. Collection of samples for

analysis is also important. In the documentation of the soil colour and composition, the standard description used in geology may be adopted. The Munsell soil colour chart of the US agricultural department is useful for the description of soil colour.

For a long time the capturing of the third dimension, the depth or height was challenging. Traditionally, excavation plans and sections were documented in two dimensions. Objects were also recorded in two dimensions, often from different angles. Remote sensing images like aerial photographs were represented as flat surfaces. Although depth could be visualized with techniques such as stereoscopes, analysis of relief was troublesome. Three-dimensional recording is the recording of artifacts and structures in time and space. The provenience of archaeological finds is recorded with reference to the site grid.

The need for recording archaeological finds by three-dimensional method has been emphasized by Sir Mortimer Wheeler in his renowned work. Several methods for three-dimensional recording have been prescribed. For example, by intersecting measurements from two reference points and leveling with a bubble level attached to surveying pole or similar straight

edge. Wheeler advanced an Orthogonal System of measurement. It consisted of a line of datum pegs connected by string and not more than one meter distant from each other and of a strong wooden square long enough to cover the width of a normal excavation trench. Thus the string marks a reference line and measurements are taken at right angles to it, the square being held level.

Another method described later on is based on another principle in general usage in modern surveying. From a base point or station we measure direction, the distance between base point and the feature to be recorded and finally the difference in level. To get the direction more conveniently the angle between true north and the line pointing to the feature (azimuth) should be determined as in surveying practice. Since the distances involved are very limited for the present purpose, any complicated and expensive instrument is not required. A simple angular division fixed upon the wooden peg marking the base point is needed. Other things required comprise a tape, a small spirit level, a plumb bob and a prismatic compass. This method is very economical and yields very reliable results. When the excavation work is conducted in simple, straightforward way, Wheeler's Orthogonal System may be superior.

All this changed at the end of the last century with the introduction of computer based digitization technologies, 3D software, and digital near

surface sampling devices. 3D recording is conducted preferably with an electronic recording device, the total station or base point; or if no total station is available, with tapes, plumb bobs, and surveyor's levels. The new technology which usually involves off-site computer manipulation of the data, adds further accuracy to three-dimensional recording.

The spatial properties of the multi-scale archaeological dataset can now be accurately recorded, analyzed and presented. Relationships between artifacts can be elucidated by visualizing the records in a three dimensional space, computer-based simulations can be made to test hypotheses on the past use of space, remote sensing techniques help in detecting previously hidden features of landscapes, thus shedding light on bygone land uses.

Drawing:

After the conservation of an artifact, a drawing provides more relevant, detailed, easily edited, and potentially comparable information than is possible in a photograph. One of the most common jobs of an archaeological illustrator is drawing the finds and features from excavations and museums. The archaeological drawings are not just making a pretty picture of the item.

The purpose is to provide most of the information in a form that the viewers can read. A good archaeological illustrator is well aware of the conventions

governing how artifacts should be drawn. The knowledge of techniques of recording and drawing artifacts makes the work accurate and clear. The definition of a quality artifact drawing is '…one which incorporates an understanding of the component parts of an artifact with an ability to make an accurate and aesthetic rendering of its character.

Drawing artifacts reinforce an archaeologist's observational powers, and highlights features relevant to identification and interpretation. Drawings can depict both easily visible and fainter surface areas. All illustration should have a metric scale. What gives drawing its strength is the amount of information that can be expressed in a single image. By excluding the detail that renders a drawing realistic and applying a variety of conventions for various materials, archaeological drawings become interpretive diagrams rather than artistic or realistic portrayals of the artifact. The illustrator can furnish the drawing to his or her intended audience whether it is for publication, where a more technical drawing is common, or for museum display, where a more artistic portrayal is appropriate. This is also depends upon the available technology, and while 3D imaging is becoming increasingly possible, most illustrators continue to use the more cost-effective pen and ink method. When illustrating for publication, drawings make it

convenient for researchers to examine and interpret the artifact to better understand itsuse in both a historical and archaeological context.

Techniques of Drawings:

There are many different techniques that are used for artifact drawings nowadays. Also, different projects, laboratories, and illustrators use different 'in-house' techniques that are specific to that specific person or place. In spite of this, there are many universal goals within artifact drawing, and a limited way of achieving them. These common principles are described below:

Orientation:

It refers to the minimum to be included in a plan view of both sides and profile view, as required. If an object is bent it should be drawn as such, but the original shape can also be included. Conventions for orientation are based on types of artifact. For instance, pointed objects such as swords or pins are drawn with the tip facing down; however projectile points are aligned with the point upwards. The illustrator should provide as many views as necessary to convey the most amount of information.

Scale:

It is important have the knowledge of the scale before drawing and how much the reduction or enlargement will affect the details of the artefact.

A linear scale should also be included indicating which scale is being used on the actual drawing for future reference. A majority of the small finds can be drawn at a 1:1 scale, meaning 1cm in reality = 1cm on paper. Tiny artifacts, such as beads could also be enlarged to show more detail. For larger objects it may be necessary to scale down as necessary, which can include a scale of 1:2 or 1:4, etc. generally objects are drawn at a larger size, considering the reduction that will take place during the publication process.

Outline

There are different methods of outlining the object according to the available material. It can be traced directly, measured with an object such as a setsquare, drawn using a grid system, scanned, projected, or traced from a scaled photograph provided that the image in the photo was not distorted or taken from an undesirable angle, etc.

Views:

When including multiple views of an object, it is vital for the illustrator to show the relationships between those views. Link lines are used to indicate this relationship, and are typically short dashes to clarify to the reader what he or she is looking at. When suitable, it is also sensible to include a cross-section of the object. This is performed by variety of

methods, but in the final drawing the cross-section is either blacked in or for some materials diagonal lines or stippling is used.

Shading

Shading is always done with the light source at an angle of 45˚ from the top left corner of the drawing. For different materials either stippling or lines are used to fill in the shaded areas. Shading is basically used to depict the relief of the object and should be kept to a minimum if possible.

Cataloguing:

Cataloguing refers to the accounting used in the laboratory after the artifacts and eco-facts are processed initially and giving the numbers with which they are marked for storage. Its records describe and record what was found during an archaeological exploration and it is the primary record for all materials after excavation. The catalogue number is a unique number given to each individual item, or group of items, in an archaeological collection. Most archaeologists are fanatical about cataloguing their finds because it is easyfor one distracted lab worker to mess up an artifact's record of provenience.

Cataloguing is the assembly of all basic information about each item in the collection. This process is essentially a descriptive one, in which a series of observed variables are noted, identified and recorded. The most important aspect of cataloguing for an archaeological collection permanently

associating a specimen with its archaeological context. It involves keying a number that is associated with the specimen to a written record of its provenience.

The cataloguing process starts at the excavation and continues in the lab after the field season is over. Each and every object must be accounted for and its provenience maintained through a catalogue. The beginner's first join a lab is almost always cataloguing. This can consume a lot of time. As per the thumb rule in archaeology, for every week spent excavating, archaeologist spend three to five weeks or more cleaning, conserving, and cataloguing the finds. Sometimes it appears tedious, but meticulous cataloguing is essential because without recording its precise provenience, an artifact's value to future researches is greatly reduced.

The chief objective of cataloguing is to identify and document an objector a group of objects with the purpose of collecting valuable information. Such information may comprise object's identification number or code and its provenience. Even though the purpose of cataloguing is not to record characteristics or collect data for research purpose, catalogue information is important and useful for research. It allows the researcher to know about the objects in collection and the identifications made for cataloguing sometimes can be used for very general analysis. Without

cataloguing, an item cannot be properly indexed and will not be easily accessible to the museum staff or the public. Sometimes a repository may also catalogue the records concerned with an archaeological collection. Generally the accession number is linked to both the specimens and the records.

Catalogue or identity numbers give a code for uniquely identifying objects and for linking archaeological objects to their provenience. The cataloguing can be done on paper and later entered into an electronic database, or it may be recorded electronically first. It is not possible to visualize all the variables that another archaeologist might desire to analyse, but a good catalogue provides ample information to enable others to know what artifact is being described without even looking at the artifact. All artifact cataloguing depends on the ability to recognize and interpret artifacts and their characteristics, and this comes only through training and experience.

An artifact catalogue is a record of the characteristics of an artifact pertinent to the dimensions of space, form and time. For archaeologists, space-or which site, and where on the site, the artifact come from is the most important variable. It should be recorded both in the catalogue and on the label associated with the artifact. Form means the shape, size, colour, weight,

material, pattern and the manufacturing technique. Information regarding these attributes can be acquired by observation and measurement of the artifact. Time or the age of the artifact can be ascertained with reference to the variable of form, because mostly one or more the characteristics will vary with time as the fashion and technology changes. Lastly, the quantity of artifact remains should be recorded.

Apart from these characteristics, the artifacts are often classified as per the functional characteristics on the basis of assumptions made about their usage. Accordingly artifacts can be grouped into categories such as domestic, architectural and personal. Domestic comprise the items used at home, for example, ceramic tableware, bone and metal cutlery, glass bottles etc. Architectural items includes those which were used in constructing buildings such as ceramic bricks, plaster, wallpaper, iron nails etc. The majority of functional classification systems are based on the work of Stanley South, who was the proponent of the use of functional classification with the purpose of facilitating pattern recognition on sites. This comprised the identification of site-specific activities and activity areas within sites, and the comparison of different sites. However, functional analysis has its limitations.

CONSERVATION METHODS:

Conservation is an action in order to prevent, stop or retard the process of deterioration of the artifacts. It is sometimes supplemented by the restoration work, which means the treatment of objects with necessary corrections and alterations. The idea of conservation is an eventual reality, which comprise both preservation and restoration.

Any buried artifact would have reached a chemical and physical equilibrium with its environment. It remains quite stable in that environment. After burial in the earth, they have to acclimatize with the new environment through certain modifications to establish equilibrium with its microenvironment. The artifacts will again need to adjust with the new environment when it is excavated. Consequently, this process leads to breakdown of the object either physically or chemically or biologically or combination of all these factors.

The recovered materials are needed to be conserved. Earlier the artifacts were washed with water (except things that water could harm). But nowadays, many archaeologists hesitate to wash some artifacts as this might lead to damage and destruction of some information. For example, stone and ceramic artifacts can contain pollen or blood residues, plants, or other materials that can be identified and used to reconstruct tool use and diet—but

not if an overenthusiastic lab worker has thoroughly polished the piece. Though, in general, a simple cleaning is in order.

Some artifacts may require more attention, particularly organic or metal artifacts recovered from wet deposits. It may also be necessary to reconstruct broken pieces. This is frequently done with pottery since ceramics are mostly found in broken state, and reconstruction apparently tells us about the shape, size and decoration of the vessel.

Archaeologists need to employ certain methods for the care of archaeological materials. There are three methods--cleaning, repair and stabilization. Cleaning implies the careful removal of dirt to facilitate examination, recording and conservation of the artifacts. Repair means securing the original position of the objects. Stabilization refers to strengthening of the specimens in all means to reduce or arrest its further deterioration. Different methods are applied 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 their microenvironment is dry, wet, or humid, the object must be placed in the same microenvironment. Various chemical applications are practiced for the preservation of inorganic materials like potteries, stone, metals etc.

Relative Dating:

Relative dating is basic to chronology. It is the ordering of events in the absence of any written record or evidence. Under relative dating method a tentative date is achieved based on archaeological stratigraphy, paleography serration, linguistic style, context, art and architectural features. Archaeologists use relative dating techniques when the absolute dates are not possible or feasible. Before the advent of the scientific techniques; most of the archaeological and historical objects were dated based on relative dating methods. Relative dating techniques identify the order in which sites or artifacts were used in sequence from earliest to latest.

Typology:

Typology involves putting a number of finds into chronological order. It is a method of comparing reference objects with the purpose of classifying them according to their similarity or dissimilarity and associating them to a specific context or period. This technique is often used when it is not possible to make use of absolute dating methods. It generally allows the archaeologists to identify the period to which a cultural site or object belongs, without stating the date of occupation. This method is mainly applied to projectile points and ceramic vessels. These present many characteristics that are used for comparing them, such as morphology and raw materials in the

case of stone tools, and decorative techniques and motifs in the case of ceramics.

Stratigraphy:

Stratigraphy can be described as a 'layer cake' type arrangement of deposits called strata, with the older layer beneath the latest. It is also known as the Law of Superposition'. It is the branch of the geology that deals with the study and interpretation of the sedimentary stratified rocks, as well as of the identification, description, sequence both vertical and horizontal, cartography and correlation of the units stratified of rocks. The artifacts that are discovered in successive undisturbed cultural layers can be dated relatively on the basis of the principles of stratigraphy. The principle of cultural/archaeological stratifications fundamental and it plays a dominant role in archaeological investigations. Modern excavation techniques are based on stratigraphic principles.

The concept of stratigraphy in geology was shaped by Sir Charles Lyell. There are certain fundamental laws and notions that are followed indentifying and studying stratigraphy. These are Laws of Superposition, Laws of Original Horizontality, Laws of Original Continuity and Laws of Faunal Succession. This concept was introduced in archaeology by the scholars like

C.J. Thomsen, Kathleen M. Ken yon, J.J. Worsaae, and Mortimer Wheeler.

Subsequently, it was developed to suit the needs of archaeology by Edward C. Harris in the 1970s. In his book Principles of Archaeological Stratigraphy published in 1979, Edward Harris questioned the direct application of geological laws in archaeology. He worked out a new method of interpretation of archaeological stratification which is popularly known as the **Harris matrix**. It works on a simple fundamental principle that if one cultural layer lies upon another, then the lower layer must have been deposited before the upper layer. The time gap between the depositions of two cultural layers may be a century or a millennium and it depends upon the nature of cultural deposit. According to this concept, the contextual layer on the top is considered younger than the layer that is found below. Therefore, a succession of layers would provide a relative chronological sequence from earliest to latest. Any cultural material found in a particular contextual layercan be dated relatively younger and older depending upon from which layer the particular artifact is picked up. The artifacts recovered from orderly placed stratified layers would help to categorize them in certain chronological order. For example, the collection of Stone Age tools such as Paleolithic tools, Mesolithic tools and Neolithic tools in different cultural layers helps to establish the approximate date of a particular cultural layer.

Seriation

Seriation is a relative dating method in which artifacts from several sites, in the same culture, are placed in chronological order. It is a method of ascertaining the age of the artifacts on the basis of style, type, and technique. It is broadly classified into two categories namely stylistic serration and frequency serration. Stylistic serration is a method in which artefacts and attributes are positioned on the basis of resemblance in style. For instance, dish-on-stand, S-shaped jar and perforated jar are some of the diagnostic styles available in Harappa sites. The marinated vessel is the diagnostic pots fjord we ware. The availability of such diagnostic wares would help to determine the cultural phase. The frequency serration is more strictly inclined towards sequential ordering of the artifacts and assessing the origin, popularity and disuse of the artifacts. The length of time and degree of popularity (frequency) would be assessed in the given archaeological context. The frequency with which each form of artifact appears can be plotted as ars on a timeline. Generally it produces a shape known as a 'battleship curve' because it resembles the aerial view of a battleship. The changing popularity of each form will appear as a sequence of battleship curves. Other sites can be dated elative to the first site by comparing their serration. For example, Painted Grey ware, Northern Black Polished ware and roulette ware were

observed in a particular time range only. Based on the quantity and frequency of the diagnostic ware, the date of the particular cultural phase is established. The Harappa ceramics were also examined on the basis of structure and shape.

Absolute Dating:

Absolute dating is a method in which involves precise dating of artefactsusing various scientific techniques and in a few cases it is dated based on thehidden historical data available with historical documents such as inscriptions, copper plates, seals, coins, inscribed portrait sculptures and monuments.

Radio Carbon Dating (C-14):

Radiocarbon dating (also known as carbon dating or C-14 dating) is a method for determining the age of an object containing organic material by using the properties of radiocarbon, a radioactive isotope of carbon. The radiocarbon dating is the oldest and perhaps the most widely used in archaeology. This method was developed in 1948 by Willard F. Libby as spin-off from atomic research during the Second World War. He received the Nobel Prize in Chemistry for this work in 1960.

It is based on the principle that radiocarbon C-14 is constantly been formed in the atmosphere by the interaction of cosmic rays with the nitrogen present in the atmosphere. The resulting C-14 combines with atmospheric oxygen to form radioactive carbon dioxide which is absorbed by the plants by means of photosynthesis and by animals through eating. When the plantar animal ceases to be living it stops receiving fresh supply of C-14. The existing C-14 now undergoes a process of decay which is called radioactivity.C-14 is a radioactive isotope or element of C-12, and both are present in equal amounts. We may measure the decaying C-14 with reference to C-12, and find out the number of years that have elapsed since the decay began. The object which contains less C-14 proves to be older in age, and that which contains more C-14 turns out to be younger. This measurement is based on the fact that the half-life of C-14 is 5568 years. The half-life of a radioactive material is defined as the period during which one-half of the amount of the material decays out. Since most organic materials perish in due course, charcoal because of its high content of carbon is the commonest material utilized for radiocarbon dating.

The development of radiocarbon dating has had a profound impact on archaeology. Apart from allowing more accurate dating within archaeological sites than previous methods, it allows comparison of dates of events across

great distances. Histories of archaeology often refer to its impact as the 'radiocarbon revolution'. Radiocarbon dating has allowed key transitions in prehistory to be dated, such as the end of the last ice age, and the beginning of the Neolithic and Bronze Age in different regions.

It was believed that the dates produced by radiocarbon dating were precise until it was discovered that amounts of carbon in the atmosphere have varied over time. This had led to underestimating the age of prehistoric sites by up to 800 years. To overcome this problem, radiocarbon dates are calibrated. Radiocarbon dates are never exact. Even after calibration there is a scope of error that is calculated statistically. This generally means that there is a 68 per cent chance or 'level of confidence' (LOC) that the real date is within the range indicated and a 95 per cent LOC that it is within twice the range. C-14 is mostly used to date organic materials including bone, shell and plant remains. It does not work on cremated bone although it will work for charred bone. It is more precise with wood samples from twigs and nuts than from trees that may have lived for hundreds of years. Radiocarbon's practical use is for periods from 200 to about 10,000 years with less reliability to around 40,000 years. Until recently at least 10 grams of charcoal or 200 grams of bone were needed for results. However, the development of a process known as **Accelerator Mass Spectrometry** (AMS) has facilitated

much smaller samples of material to be dated, down to the one grain of cereal. It is a technique that measures the amount ofCarbon-14 in an organic object and provides a rough indication of its age. Samples need to be handled carefully to avoid contamination.

Dendrochronology:

Dating of wooden objects on the basis of tree rings or growth rings of agree is called Dendron chronology. It is derived from the Greek word Dendron meaning ‘tree limb’ chronos mean ‘time’ and logy meaning ‘study’. It is adapting method that uses the number, thickness and density of annual growth rings of ancient trees. This method was first developed by the American scientist A.E. Douglas at the beginning of the twentieth century.

This is the most accurate chronometric dating method. It is based on the principle that every year many species of trees produce growth rings of new wood under their bark during annual growing seasons. The width of the ring(i.e., the amount of growth) for each year is determined by various internal and external factors, but it tends to vary mainly in proportion to either the amount of available precipitation or the prevailing temperatures. The rings are wider in good conditions than in poor ones. Samples are obtained by using an increment borer, a simple metal tube of small diameter that can be driven into a tree to get a core extending from bark to centre. This

core is split in the laboratory, the rings are counted and measured, and the sequence of rings miscorrelated with sequences from other cores.5 Trees located in the same area will have similar ring pattern which means wood from different periods can be matched in overlapping sequences. These are tied to historical dates by modern trees anchors the tree-ring chronology in time.

Dendrochronology mostly uses softwood species that are sensitive to changes in growth conditions, while hardwoods exhibit rather little variation in ring width. This method provides precise dating, sometimes to the nearest year. It is especially used to develop calibration curves used to correct data obtained from radiocarbon dating, a technique that remains imprecise due to fluctuations in the concentration of C-14 in the atmosphere over the centuries.

The bristlecone pines of California, which live for 4,000 years, were used to construct sequences over 7,000 years in the USA. However, this method has limitations. Not all areas have sufficiently varied season's or sufficient surviving timber to make it possible to construct sequences. To effectively date wood around fifty years of tree rings are needed. Since this represents quite a thick piece of wood, the technique is better for dating building timbers than artifacts. Its direct use is from the Neolithic onwards

when buildings were used and it has been widely used on medieval ships and buildings.

Dendron chronology actually dates when the tree dies or is felled. Where wood has been reused, as often occurred with structural timbers in the past, this method can overestimate the age of a structure. However, Dendron chronology is also the key method for calibrating radiocarbon dates and therefore is indirectly used in dating a wide range of organic materials for up to 11,500 years.

Archie magnetism:

Archie magnetic dating is the study and interpretation of the signatures of the Earth's magnetic field in the past recorded in archaeological materials. Archaeomagnetic dating is based on the established fact that the direction and intensity of the earth's magnetic field fluctuate over the years. Clay soils contain magnetic minerals and when the clay is heated to a certain temperature, these minerals will assume the direction and a proportional intensity of the magnetic field, which surrounds them. They will maintain this direction and intensity after they are cooled. By measuring these qualities, the age of the sample can be ascertained if the changes in the earth's magnetic field at that location are known.

The magnetic field of the earth at any given point is defined by three measurements, the angle of declination, the angle of dip, and the magnetic intensity. When a needle is suspended at its centre of gravity so that it can swing freely in all directions, and is then magnetized, it will get inclined to the horizontal direction. The angle of magnetic dip depends strongly on the latitude. In addition to inclination, the needle will exhibit definite directions in a figurative horizontal plane. The directions defined by the needle are called magnetic north and magnetic south. The angle between magnetic north and geographic north is called the angle of declination.

Robert Dubois, an expert in archaeomagnetic dating, uses the paratactic magnetometer in his dating laboratory. This magnetometer embodies the principle of the compass needle. It consists of three bar magnets, spaced ona slender rod suspended from a very fine wire of phosphor bronze or quartz. The entire assembly is enclosed within a plastic tube that protects it from air currents. A thin beam of light shines on a mirror attached to the rod, then reflects, like a pointer, to a numbered scale. The horizontal component of the earth's magnetic field is annulled by passing an electric current through largecoils of wire that surround the magnetometer by means of wooden scaffolding. Locally produced magnetic fields with a vertical gradient are annulled by the use of the three bar magnets. The upper and

lower magnets are equal in strength and anti-parallel to the middle magnet, which has double strength. With this arrangement there is zero torque from any vertical magnetic field.

The three magnets work like a double set of diametrically opposing magnets of equal strength. Since the pull on the two parts of each magnet system is equal and opposite, the effect of the earth's field is cancelled and the beam of light points to zero. When a sample is placed on a platform directly under the suspended magnets, the entire assembly above it rotates slightly. This rotation is caused by the lower magnet, which is affected more strongly than the other magnets, and swings towards the direction of the sample, rotating the entire assembly as it moves. The reflected beam of light moves across the scale, exactly like a compass needle, indicating just how far the clay sample has caused the magnets to turn. By setting the sample on its top and bottom, its angle of declination is measured directly; the angle of dip is calculated from readings taken when the sample is positioned on each of its four sides. These values then are used to calculate where the geomagnetic pole was located when the clay was fired. Measurements on a number of samples facilitate the investigator to compute a mean vector. This is the common and suggested procedure for archaeomagnetic dating.

Potassium-Argon (K-Ar) Dating:

Potassium-Argon dating is also a radioactive method. Potassium (K) is one of the elements that occur in great abundance in the earth's crust. Itis present in almost every mineral, either as a principal constituent or as atrace element. In its natural form, potassium contains 93.2% K-39, 6.8%K-41 and 0.00118% radioactive K-40. For each 100 K-40 atoms that decay,89% become Calcium-40 and 11% become Argon-40, one of the rare gases. As potassium in rock crystals decays it produces argon gas at a known rate.Argon-40 is an inert or inactive gas, which by means of diffusion can easily escape from its parent material under certain conditions.

During rock formation virtually all Ar-40 that had accumulated in the parent material escapes. As the rock or mineral crystallizes the concentration of Ar-40 drops off to practically zero. The process of radioactive decay ofK-40 continues, but the concentration of Ar-40 that develops over time willow, when dated, denote the moment of rock formation. By measuring the amounts and ratios in a laboratory a date at which the crystal was formed can be obtained. This technique has been used in volcanic regions to datelayers of rock which sandwich human remains. For instance, at KoobiFor ain East Africa early hominid remains were dated to 1.89 million years BP±0.01 million years.

The potassium-argon dating method can only be used in situations where new rock has been formed. The lavas, tuffs and pumice found as overlying strata at localities that contained culture-bearing deposits in such diverse areas as Italy, East Africa and Java are useful for this dating.

The preparation of sample involves first, crushing of the rock samples, second concentrating it to high purity, third washing it on sample screens to remove fines, and fourth, treating it with hydrofluoric acid. The major problem of the technique is the removal of atmospheric argon from the sample. By removing the outer layer of the sample, most of the atmospheric argon will be removed. However, treatment of samples with hydrofluoric acid has proved to be very effective in reducing the atmospheric argon in the sample. Soon after sample preparation and drying it should be put into the extraction line and placed under vacuum.

Potassium-argon dates are calculated from measurements of the sample content of Argon-40. The amount of potassium in a sample fraction can be determined by a flame photometer, although for small concentrations, isotopic dilution analysis and even neutron activation analysis can be used. The determination of the concentration of argon is determined by mass spectrometric analysis.

Thermo luminescence

Thermo luminescence (TL) dating is a method that is based on the analysis of light release when heating crystalline material. It is used in mineralogy and geology, but is also increasingly being applied for dating of anthropological and archaeological samples. Thermo luminescence uses the phenomenon of ionizing radiations that exist naturally in the atmosphere. This dating method is mainly applicable for material with mineral or crystalline structure or with spurious crystalline contents. It is only functional for insulating material not for metallic artifacts. This technique is based on a unique physicochemical property of certain minerals (especially quartz and feldspar) that have an imperfect structure and therefore retain radioactive elements in the natural environment. Radioactive decay in the quartz crystals found in clay leads to a build-up of electric charge at a known rate. The electrical charge is released as light when the crystals are heated. When pottery is heated the energy in the flash of light is measured and used to calculate the time since it was fired. Thermo luminescence is a technique which involves complex manipulation. To obtain a date for a single pottery sample, it is necessary to perform a laboratory fractionation of the clay mineral used in the manufacture of the pottery and prepare around 75 sub-samples; some of these are heated to release the level of thermo

luminescence, while others receive a radiation dose to measure their sensitivity to radiation. Thermo luminescence can replace radiocarbon dating to date events that occurred more than 50,000 years ago; it is used mainly for dating stone fireplaces, ceramics and fire remains.6 Thermo luminescence dating is used for material where radiocarbon dating is not available, like sediments. Its use is now common in the authentication of old ceramic wares, for which it gives the fairly accurate date of the last firing. This technique has been used with reasonable success to date heat altered stone tools, burned hearths, and pottery. It is not as accurate as C-14 dating and can give incorrect readings due to radiation from the soil or if the initial heating was at low temperature. However, it is useful for older periods and cases where there are no organic remains such as dating Upper Paleolithic figurines.

Fluorine Test

Fluorine test dating is another method of relative dating. It is based on the fact that amount of fluorine deposited in bones is proportional to their age. Most of the ground waters contain small amount of fluorine. The fluorine ions combine with hydroxyapatite crystals of the bone to form fluropatite. A bone buried for a longer time will absorb more fluropatite and vice-versa. The date of the bone is determined on the basis of the amount of fluropatite present in the bone. This test is useful in dating bones that cannot

be attributed with certainty to any particular stratum and cannot be dated according to the stratigraphic method. A limitation of this method is the fact that the rate of fluorine formation is not constant, but varies from region to region. The quantity of fluorine can be determined either through chemical analysis or with the X- ray crystallographic method. In 1953, this test was used to easily identify that the 'Piltdown Man' was forged, almost fifty years after it was originally 'unearthed'. Like fluorine, uranium or nitrogen content of the bones also can be measured.

Nitrogen Test

Nitrogen provides another measurement of relative age. Nitrogen dating is a form of relative dating which relies on the reliable breakdown and release of amino acids from bone samples to estimate the age of the object. Bones are composed of calcium phosphate, fat and bone protein or collagen. In contrast to fluorine, nitrogen in the bone decreases with the length of time it has been buried. On death, the collagen decays at a uniform rate and turns into nitrogen. Like fluorine method, the amount of presence of nitrogen is measured and dated accordingly. The rate of decay depends on physical and chemical composition of the soil. Therefore, it is not universal. However, one can differentiate the date of the bones collected from a single deposit or from

a single burial. In some situations, like thin porous bones might more rapidly change the dating created by multiple methods.

Pollen Test

Relative dating can also be done on the evidence of floral remains. A common method of dating through floral remains is known as palynology. All flowering plants produce the almost non-destructible grains called pollen. The outer skin (exine) of these grains is resistant to decay and is hence preserved in lake sediments that have allowed the pollen experts to reconstruct detailed sequences of past vegetation and climate. The botanical samples are collected by means of a technique called flotation technique. Several screening methods are being used in the recovery of micro or macro botanical remains. The Flotation technique developed by Anthony J. Legge remains the best method and is being adopted throughout the world as it yields the best recovery rates. The pollen is extracted and then concentrated and stained before being examined under a microscope. Pollen grains can be recognized by their shape, and the percentages of different species present in each sample are recorded on a pollen diagram. A comparison of the pollen diagrams for different levels within a deposit allows the identification of changes in the percentages of a species and thus changes in the environment. The most well-known chronologically placed pollen sequences are those

developed for the Holocene times of northern Europe. By examining the pollen samples from a particular site, one can safely place them in particular time-ranged pollen zones. The type of pollen found in any geological stratum depends on the kind of vegetation that existed at the time such stratum was deposited. A site or locality can therefore be dated by determining what kind of pollen was found associated with it.

UNIT IV

Archaeological Studies in Universities and State Department of Archaeology and other Institutions: University of Madras, Deccan College Pune, Tamil University Tanjore.- Archaeologist in India: Alexander Cunningham, Sir John Marshall, Sir Mortimer Wheeler, H.D.Sankalia.

Objectives:

- To Understand explore how major universities, such as the **University of Madras**, **Deccan College Pune**, and **Tamil University Tanjore**, contribute to the study and research of archaeology.
- Understand the Evolution of Archaeology as a Discipline in India

Archaeological studies in India are carried out by various universities, state departments of archaeology, and other specialized institutions. These institutions offer formal education in archaeology, conduct research, and oversee the preservation and excavation of historical sites. Here's an overview of how archaeological studies are organized across different platforms:

1. Universities Offering Archaeological Studies

Many universities in India offer undergraduate, postgraduate, and doctoral programs in archaeology and related fields such as history, anthropology, and heritage management. Some of the prominent universities include:

- ✓ **Deccan College Post-Graduate and Research Institute, Pune**: Known for its Archaeology department, it offers master's and doctoral programs in Archaeology.
- ✓ **Banaras Hindu University (BHU), Varanasi**: Offers a variety of courses in ancient history, culture, and archaeology.
- ✓ **Delhi University (DU)**: Offers postgraduate courses in Archaeology and Ancient Indian History.
- ✓ **Jawaharlal Nehru University (JNU), New Delhi**: Offers advanced courses in history and archaeology.
- ✓ **Madras University, Chennai**: Offers programs in archaeology and heritage studies with a focus on Tamil Nadu's rich history.
- ✓ **Institute of Archaeology, Archaeological Survey of India (ASI), New Delhi**: This is the official training institute of the ASI and offers specialized training in archaeology and conservation.

2. State Departments of Archaeology

Each state in India has its own Department of Archaeology, responsible for protecting and preserving the state's cultural heritage. These departments conduct excavations, manage museums, and oversee heritage sites. Some prominent state archaeology departments include:

- ✓ **Tamil Nadu State Department of Archaeology**: Actively involved in excavations, heritage conservation, and publication of archaeological findings. They work on sites like Keezhadi and Kodumanal.
- ✓ **Maharashtra State Department of Archaeology**: Engages in preserving ancient sites, conducting research, and managing museums.
- ✓ **Karnataka State Department of Archaeology**: Known for its efforts in protecting Hampi, a UNESCO World Heritage Site, and conducting significant research.

3. Archaeological Survey of India (ASI)

The ASI, under the Ministry of Culture, Government of India, is the premier organization responsible for archaeological research and protection of the cultural heritage of the nation. It conducts excavations, preserves monuments, and regulates archaeological activities across the country. Key responsibilities include:

- ✓ Excavation of sites.
- ✓ Conservation of monuments.
- ✓ Management of heritage buildings.
- ✓ Training of archaeologists through the Institute of Archaeology.

4. Specialized Institutions

Various institutions focus on specific aspects of archaeology, heritage management, and conservation. These include:

- ✓ **Indian National Trust for Art and Cultural Heritage (INTACH)**: A non-profit organization that works towards heritage conservation and awareness.
- ✓ **National Museum Institute (NMI), New Delhi**: Offers courses and conducts research in conservation, museology, and history of art.
- ✓ **National Institute of Advanced Studies (NIAS), Bangalore**: Engages in interdisciplinary research, including archaeology and heritage studies.

5. International Collaboration and Research

Many Indian universities and institutions collaborate with international bodies for archaeological research. For example:

- Collaboration with universities such as Cambridge and Oxford.
- Participation in global research networks, such as the South Asian Archaeology Group.

6. Museums and Research Centers

Several state and national museums also engage in archaeological research and study. These include:

- **National Museum, New Delhi**: Houses archaeological collections and engages in research and exhibitions.
- **Government Museum, Chennai**: Plays a significant role in archaeological studies in Tamil Nadu.

7. Publications and Journals

Research in archaeology is often published in academic journals and bulletins. Some well-known publications include:

- ✓ **Indian Archaeology – A Review**: Published by the ASI.
- ✓ **Man and Environment**: Published by the Indian Society for Prehistoric and Quaternary Studies.
- ✓ **Ancient India**: A journal dedicated to archaeology and history.

These institutions contribute to the education, research, and preservation of India's vast archaeological heritage, playing a vital role in understanding the country's ancient history and cultural evolution.

Alexander Cunningham

Alexander Cunningham was born in London on 23 January 1814 to Allan Cunningham and his wife Jean née Walker. He received his early

education at Christ's Hospital, London. Through the influence of Sir Walter Scott, Alexander Cunningham obtained cadetship at the East India Company's Addiscombe Seminary (1829–31), and received technical training subsequently at the Royal Engineers Estate at Chatham. At the age of 19, he joined the Bengal Engineers as a Second Lieutenant and spent the next 28years in the service of British Government of India.

Cunningham arrived in India on 9 June 1833. Those were the daysof Orientals in India. He met James Princes and during 1837 and 1838,he was in daily communication with Princes. Soon, Cunningham became Prinsep's intimate friend, confidant and pupil. Princes passed on to him his lifelong interest in Indian archaeology and antiquity.

He served as an aide-de-camp (ADC) to Lord Auckland, the then Governor-General of India, from 1836 to 1840. He paid his visit to Kashmir during this period. In 1841, Cunningham was made executive engineer to the king of Oudh. In 1842, he was called by the ruler of Jaipur to serve in the army for suppressing an uprising in Bundle and. He was then posted
At Now gong in Central India before he saw action at the Battle of Punniarin December 1843. Then he joined as an engineer at Gwalior and in 1844-45, he got constructed an arched stone bridge over the Morar River. In1845–46, he was sent to Punjab where he helped construct two bridges of boats across the

Beas River prior to the Battle of Soprano. In 1846, he was appointed commissioner to demarcate boundaries. Letters were written to the Chinese and Tibetan officials by Lord Harding, but no officials joined. In 1847, a second commission was set up which was led by Cunningham to establish the Ladakh-Tibet boundary, which also included Henry Strachey and Thomas Thomson. The commission aimed at delimiting the northern boundaries of the Empire after the First Anglo-Sikh War, concluded with the Treaty of Amritsar, which ceded Kashmir as war indemnity expenses to the British. His work Essay on the Aryan Order of Architecture (1848) resulted from his visits to the temples in Kashmir and his travels in Ladakh during his tenure with the commission. He also explored the Buddhist monuments of Central India along with Lieutenant Massey in 1851 which is mentioned in his account.

In 1856, he was assigned the duty of Chief Engineer in Burma, which had just been annexed by the British. But archaeology remained his obsession. He stayed there for two years and from 1858 served for three years on the same post in the North-Western Provinces. In both regions, he established public works departments. He was therefore absent from India during the

Revolt of 1857. In 1860, he was appointed Colonel of the Royal Engineers and retired as Major General on 30 June 1861.

Alexander Cunningham's contribution towards Indian Archaeology:

Cunningham had showed keen interest in antiquities early in his career. Excavations became a regular activity among British antiquarians after Jean-Baptist Ventura, general of Ranjit Singh, who inspired by the French explorers in Egypt had excavated the bases of pillars to discover large stashes of Bactrian and Roman coins. In 1834, Cunningham wrote to the Journal of the Asiatic Society of Bengal, an appendix to James Prinsep's article on the relics in the Manikyala Tope. He had conducted excavations at Sarnath in 1837 and made careful drawings of the sculptures. In 1842, he excavated at Sankissa and at Sanchi in 1851. He published The Bhilsa Topes in 1854 in an attempt to establish the history of Buddhism based on architectural evidence.

After Cunningham's retirement from the military service, the Viceroy of India Lord Canning appointed him as an archaeological surveyor to the Government of India in 1861. He held this post from 1861 to 1865. Most antiquarians of the 19th century who took interest in identifying the major cities mentioned in ancient Indian texts did so by gathering clues found in classical Graeco-Roman records and the travelogues of travellers to India

such as Fa-Hein and Hsuan-Tsang. Cunningham succeeded in identifying some of the places mentioned by Hsuan-Tsang and counted among his major achievements the identification of Aornos, Taxila, Sangala, Srughna, Ahichchhatra, Bairat, Sankisa, Shravasti, Kaushambi, Padmavati, Vaishali, and Nalanda.

Cunningham would also regularly corroborate his identifications through field surveys unlike his contemporaries. Particularly the identification of Taxila was made difficult partly due to miscalculation of the distances recorded by Pliny in his Naturalism Historian which pointed to a location somewhere on the Haro River; two days march from the Indus. Cunningham noticed that this position did not match with the route of Chinese pilgrims. His subsequent explorations in 1863-64 testified his hypothesis.

After his department was disbanded in 1865 due to lack of funds, Cunningham returned to England and wrote the first part of his Ancient Geography of India (1871), covering the Buddhist period; but failed to complete the second part, which covered the Muslim period. In 1870, Lord Mayo revived the Archaeological Survey of India, wherein Cunningham served as the Director-General from 1 January 1871. So he returned to India and made field explorations each winter, conducting excavations and surveys

from Taxila to Gaur. He produced twenty-four reports, thirteen as author and the rest under his supervision by others. Other major works included the first volume of Corpus inscriptional Indecorum (1877) which included copies of the edicts of Ashoka, the Stupa of Bharhut (1879) and the Book of Indian Eras (1883) which allowed the dating of Indian antiquities. No archaeologist in India, before or since, has had such a close personal familiarity with such an impressive stretch of territory. In his Memorandum of Instructions to his assistants written in 1871, Cunningham set a high ideal for archaeology:

Cunningham collected a large number of coins, but much of that was lost when the steamship he was travelling in, the Indus, was wrecked off the coast of Sri Lanka in November 1884. However, the British Museum obtained most of the gold and silver coins. He had suggested to the British Museum that they should use the arch from the Sanchi Stupa to mark the entrance of a new section on Indian history. He also contributed numerous papers in the Journal of the Asiatic Society and the Numismatic Chronicle. He retired from the Archaeological Survey on September 30, 1885 and returned to London to continue his research and writing and wrote two books on numismatics. He was knighted in 1887. He died on 28 November 1893 in London.

Archaeological Survey Of India:

A survey of archaeological remains throughout India is indispensable to the study of history. For the period when writing was unknown, we have to rely only on archaeological remains to trace the history. Moreover, ancient records have perished with the passage of time. The first systematic research into the subcontinent's history was conducted by the Asiatic Society, which was founded by William Jones on January 15, 1784.

Prominent among the early members of the society was Charles Wilkins who published the first English translation of the Bhagavad Gita in 1785 under the patronage of the then Governor-General of India, Warren Hastings. However, the most important of the society's achievements was the decipherment of the Brahmi script by James Prinsep. This successful decipherment inaugurated the study of Indian paleography. Alexander Cunningham, a protégé of Princes, carried out a detailed survey of the Buddhist monuments. Inspired by early amateur archaeologists like the Italian military officer, Jean-Baptist Ventura, Cunningham excavated many stupas of India. Cunningham funded many of his early excavations himself. However, he gradually realized the need for a permanent body to oversee archaeological excavations and the conservation of Indian monuments and used his stature and influence in India to lobby for an archaeological survey.

Thus, the Archaeological Survey of India was eventually formed in 1861 by an act passed into law by Lord Canning with Cunningham as the first Archaeological Surveyor.

Between 1865 and 1871, the survey was abolished briefly due to the lack of funds but restored by Lord Lawrence, the then Viceroy of India. In 1871, the Survey was revived as a separate department and Cunningham was appointed as its first Director-General. Continuing until today, Alexander Cunningham is regarded as the 'Father of Indian Archaeology'.

In 1885, Cunningham was retired and was succeeded as Director-General by James Burgess. Burgess started a yearly journal The Indian Antiquary (1872) and an annual epigraphically publication Epigraphic India (1882) as a supplement to the Indian Antiquary. Under Burgess much attention had been devoted to the great monuments of Agra, Jaunpur, Delhi, Lahore etc. The post of Director General was permanently suspended in 1889 due to paucity of funds and was restored in 1902. During this period, conservation work in the different circles was carried out by the superintendents of the individual circles.

Lord Curzon restored the post of Director-General in 1902. Breaking with tradition, Curzon appointed John Marshall, a professor of classical studies at Cambridge University, to head the survey. Marshall served as

Director-General from 1902 to 1928. He replenished and revived the survey whose activities were fast dwindling into insignificance. He modernized the approach to archaeology, introducing a program of cataloguing and conservation of ancient monuments and arte facts. He initiated the practice of allowing Indians to participate in excavations in their own country.

Marshall created the post of Government epigraphist and encouraged epigraphically studies. However, the most noteworthy event of his tenure was the discovery of the Indus Valley Civilization in 1921. The success and level of the discoveries ensured that the progress made in Marshall's tenure would remain unsurpassed. Harold Hargreaves succeeded Marshall in 1928. Hargreaves was succeeded by Daya Ram Sahni, supervisor of Marshall's excavation of Harappa in 1921, who in 1931 became the first Indian Director General of the Archaeological Survey of India.

Daya Ram Sahni was succeeded by J. F. Blakiston and K. N. Dikshit both of were involved in the excavations at Harappa and Mohenjo-Daro. In 1944, Mortimer Wheeler, a British archaeologist and army officer, took over as Director-General and served till 1948. During his tenure, Wheeler excavated the Iron Age site of Arikamedu and the Stone age sites of Brahmagiri, Chandravalli and Maski in South India. Wheeler established a new archaeological journal, Ancient India in 1946 and presided over the

partitioning of ASI's property during the Partition of India and helped establish an archaeological body for the newly-formed Pakistan.

Wheeler was succeeded by Niranjan Prasad Chakravarti in 1948. On 15 August 1949, the National Museum was inaugurated in New Delhi to house the artifacts displayed at the Indian Exhibition in the United Kingdom. Chakravarti was succeeded by MadhoSarup Vats and Amalananda Ghosh Ghosh's tenure, which lasted until 1968, is renowned for the excavations of Indus Valley sites at Kalibangan, Lothal and Dholavira. In 1958, the Ancient Monuments and Archaeological Sites and Remains Act was passed which brought the archaeological survey under the aegis of the Ministry of Culture. A. Ghosh was succeeded by BrijBasiLal who conducted archaeological excavations at Ayodhya to examine whether a Ram Temple preceded the Babri Masjid. During his tenure, the Antiquities and Art Treasures Act (1972) was passed advocating central protection for monuments considered to be 'of national importance'.

Lal was succeeded by Madhusudan Narhar Desponded whose tenure lasts from 1972 to 1978 and BalKrishan Thapar who served from 1978 to 1981. On Thapar's retirement in 1981, archaeologist DebalaMitra succeeded him and became the first woman Director- General of the Archaeological Survey of India. Mitra was succeeded by M. S. Nagaraja Rao. Archaeologists

JagatPati Joshi and Munish Chandra Joshi succeeded Rao. When the Babri Masjid was demolished in 1992, Munish Chandra Joshi was the Director-General of ASI. The demolition generated Hindu-Muslim riots all over the India. As a result of the demolition, Joshi was terminated in 1993 and controversially replaced as Director-General by Indian Administrative Service (IAS) officer Achala Moulik, a step which initiated a tradition of appointing IAS bureaucrats in place of the appointment of archaeologists to head the survey. The tradition finally culminated in 2010 when Gautam Sengupta, an archaeologist, replaced K. M. Srivastava, an IAS officer, as Director- General. He was again succeeded by Pravin Srivastava, another IAS officer.

Srivastava's successor Rakesh Tiwari was also a professional archaeologist. He was succeeded by another bureaucrat Usha Sharma who is the present Director General of Archaeological Survey of India.

The Archaeological Survey of India functions as an attached office of the Ministry of Culture. Till date, it has declared 3,686 monuments to be of national importance to the country. The major activities of ASI are-

1. Maintenance, conservation and preservation of centrally-protected monuments/sites and remains;

2. Conducting archaeological explorations and excavations;

3. Chemical preservation of monuments and antiquarian remains;

4. Architectural survey of monuments;

5. Development of epigraphical research and publications;

6. Setting up and reorganization of site museums;

7. Training in different areas of Archaeology.

Sir John Marshall:

Sir John Hubert Marshall was the Director-General of the Archaeological Survey of India from 1902 to 1928. He was born on March 19, 1876 at Chester in England. He was educated at Dulwich College, London as well as King's College, Cambridge. In 1902, the Viceroy of India, Lord Curzon, hired John Marshall immediately after he finished his degree at Cambridge on the basis of his archaeological experience in Greece and Turkey. He was appointed as the Director-General of Archaeology within the British Indian administration. Marshall modernized the approach to archaeology introducing a program of cataloguing and conservation of ancient monuments and artifacts. He was at the forefront of the archaeology era in India becoming a prominent scholar who focused on the Indian archaeology scene. It was under the direct patronage of Lord Curzon that John Marshall began work. It was he who laid down the basic guidelines of this work:

It is in the exploration and study of purely Indian remains, in the probing of archaic mounds, in the excavation of old Indian cities, and in the copying and reading of ancient inscriptions, that a good deal of the exploratory work of the archaeologist in India will in future lie . . . It is in my judgment equally our duty to dig and discover, to classify, reproduce, and describe, to copy and decipher, and to cherish and conserve."

Marshall initiated the practice of permitting Indians to participate in excavations in their own country. In 1913, he started the excavations at Taxila, which lasted for two decades. In 1918, he laid the foundation stone for the Taxila Museum, which today hosts many artifacts. He then moved on to other sites, including the Buddhist centres of Sanchez and Sarnath.

Marshall's work gave evidence of the age of Indian civilization especially the Indus Valley Civilization and the Mauryan age. He started the excavation at Harappa with Daya Ram Sahni as the director and Harappa was discovered in 1921. In 1922, work began at Mohenjo-Daro with Rakhal Das Banerjee. The results of these excavations, which revealed a seeming ancient culture with its own writing system, were published in the Illustrated London News on September 20, 1924. Researchers linked the artifacts found at the two sites with the ancient civilization of Sumer in Mesopotamia. John Marshall announced the discovery of a new civilization in the Indus valley to

the world. As S.N. Roy noted in The Story of Indian Archaeology, 'Marshall left India three thousand years older than he had found her.' This was because similar, till-then-unidentified seals were found at excavations at Mesopotamian sites. It was then that the world knew not only of a new civilization, but also of one contemporaneous with Mesopotamia. John Marshall also conducted excavations at the prehistoric site of SohrDamb mound near Nal in Baluchistan. He is also known for his important role in the excavations at Knossos and many other sites on Crete between 1898 and 1901. Marshall was appointed a Companion of the Order of the Indian Empire (CIE) in June 1910 and knighted in January 1915.

A new era of archaeology dawned with John Marshall. He reorganized the administrative structure of the Archaeological Survey of India and gave it a permanent footing for, 'the work of the archaeological officers is of a kind which cannot be discharged by any other existing agency and it can only cease if the government cease to admit their responsibility for the preservation of the ancient remains in the country.'

Marshall directly shaped the course of Indian archaeology. Conservation of ancient monuments and objects was among his main concerns and the basic principles of conservation laid down by him in the Indian context are still pursued by the survey. The survey was reorganized

and centrally consolidated. The whole of the Indian sub- continent was divided into a number of archaeological circles, each with its complement of officers and men. Under John Marshall, the Archaeological Survey of India became the largest single organization of its kind in the history of archaeological research and witnessed it's most magnificent period. The details of the discoveries and excavations conducted in India during this period by Marshall and his colleagues perhaps do not fit into the present survey of archaeological traditions, but a few significant points cannot be ignored. Firstly, the Annual Reports reveal that each and every part of India was given due attention. Secondly, a study of the number of memoirs published shows that specialized studies of monuments, sites and areas were not ignored. Thirdly, some of the discoveries and excavations revolutionized the study of Indian archaeology and ancient history-the discovery of the Indus Valley Civilization, explorations of Aurel Stein in Baluchistan and of N. G. Majumdar in Sind, and the excavations at Taxila and at some of the most important early historical sites of the Gangetic valley.

Fourthly, it was during this period that the people of the Indian subcontinent were appointed to superior positions in the Survey and associated with both excavations and discoveries. Many Indian scholars like BhagawanlalIndraji, Ram Raj, and Rajendralal Mitra had shown their merit

in the field of Ideological studies in the nineteenth century and the help of the traditional Indian scholars was indispensable for the early decipherment of inscriptions. However, it was during this period that archaeology became a renowned part of Indian academic thinking.

Historical scholarship about India had already come of age when John Marshall was directing the Indian archaeological scene. Political history, religion, economy and culture of ancient India had been established on the basis of textual, inscriptional, numismatic, architectural, sculptural and other sources. Important sites associated with the course of ancient Indian history remained largely unexcavated so the historical image of ancient India was not clear. However, the excavations conducted by Marshall at the sites of Taxila, Bhita, Sravasti, Vaisali, Rajagriha, Sarnath and Nalanda unveiled the curtains. The work started by Marshall suddenly made the Buddhist period alive in the Indian cultural consciousness. In the field, Marshall was primarily concerned with the horizontal exposure of sites. This had not been earlier attempted in the Indian context. In fact, except the work of Bellasis at Brahmin bad in Sind, no archaeologist had even thought about the total picture of the site.

Under Marshall's leadership, structures were separately described and their positions plotted in relation to the total plan of the site. Their history was determined on the basis of successive structural phases. Plans were drawn of the excavated settlement all together and the main cultural occupations were recreated both on the basis of structural remains and antiquities.

Marshall's excavation methods have been criticized on the ground that the depth of antiquities and 'strata' was interpreted in relation to a fixed bench-level on the top of the mound, in defiance of the principles of modern stratigraphic excavation. However, he achieved what he desired: a total picture of the site and its main historical-cultural periods. This point was later on accepted by Mortimer Wheeler who the strongest critic of Marshall's excavations.4 He retired in 1928 and passed away on August 17, 1958.

Sir Mortimer Wheeler:

Sir Robert Eric Mortimer Wheeler was a British archaeologist and officer in the British Army. He was born on September 10, 1890 in Glasgow to a middle class family. He was raised largely in Yorkshire before relocating to London in his teenage years. He studied the Classics at University College London (UCL) and started working professionally in archaeology, specializing in the Romano-British period. During the First World War he

volunteered for service in the Royal Artillery. Later on, he obtained his doctorate from UCL before taking on a position at the National Museum of Wales. In 1926, he was appointed Keeper of the London Museum. In 1934, he established the Institute of Archaeology as part of the federal University of London, adopting the position of Honorary Director. During the Second World War, he re-joined the Armed Forces and rose to the rank of brigadier.

In 1944, he was appointed as the Director-General of the Archaeological Survey of India. From the beginning of his tenure, he sought to distance himself from previous Directors-General and their administrations by criticizing them and tried to introduce new staff who had no loyalty to his predecessors. He was assigned with a four-year contract (1944-48). He then toured the subcontinent, seeking to meet all of the Survey's staff members. He had drafted a prospectus containing research questions that he desired the Survey to lay emphasis on. These comprised understanding the period between the Indus Valley Civilization and the Achaemenid Empire, discerning the socio-cultural background to the Vedas, dating the Aryan invasion, and establishing a dating system for southern India before sixth century A.D. His tenure also witnessed a 25 per cent budget increase for the Archaeological Survey, and convinced the government to agree to the construction of a National Museum of Archaeology, to be built in New Delhi.

His work was exceptional in many respects. First, he took an overall view of archaeology beginning with the Paleolithic Age and stressed the need for scientific analyses in archaeology. For example, the study of animal, human and crop remains at the Indus Valley cities of Mohenjo-Daro and Harappa, and the chemical analyses of metal samples from some sites. It was Wheeler who first argued the basic necessity of scientific aids in archaeology in India. Second, he emphasized the need for careful archaeological planning which was something new for India. Third, by conducting excavations at Taxila, Harappa and Arikamedu he not only demonstrated the importance of such planning by solving major problems associated with these sites but also introduced the modern concept of archaeological stratigraphy to India. He also introduced there for the first time the importance of the study of stratified ceramic material for determining the cultural succession at excavated sites and its importance in comparative study of material between different sites. Fourth, he gave field training in his methods to a large number of Indian students who have kept his excavation techniques alive since then. He also wrote many articles on the excavation methods. Fifth, he realized that in such a large country like India it was not possible for Archaeological Survey alone to do the work. So he introduced effective participation by the

universities and it was under his guidance and inspiration that several Indian universities started archaeological research.

Among other innovations, he developed the use of a Cartesian coordinate system, or three-dimensional grid, with which the materials found in archaeological excavations, could be recorded. Wheeler's final contribution to the tradition of Indian archaeological research is something indescribable and can be cherished only by those who have felt it, directly or indirectly. He was at the helm of the Survey for only four years; despite this he infused an element of urgency into the Indian archaeological research. Archaeology in India became more exciting under him. He retired from the University of London in 1955 and died on July 22, 1976 in Leatherhead, near London.

Robert Bruce Foote

Robert Bruce Foote (September 22, 1834-December, 29 1912) was a British geologist and archaeologist who conducted geological surveys of prehistoric sites in India for the Geological Survey of India or GSI. Foote joined the GSI on December 29, 1858 as an Assistant under Dr. Charles Oldham. He was posted in the Madras Presidency, Hyderabad region and Bombay. In 1887, he became a Director of the GSI. He was one among many geologists in British India whose persistent enthusiasm, inexhaustible energy

and relentless explorations reigned supreme. His integrated approach of geological and prehistoric expeditions in different regions of southern and western India brought forth significant evidence of prehistoric cultures. Foote's explorations in south India was a turning point, from where branched off the twin-fields of prehistory and geology. There was a happy coincidence of Foote's early discoveries with the establishment of the Archaeological Survey of India (in 1861). It took nearly eight decades for the Survey to commence organized expeditions into the prehistory of India. In 1942, at the instance of the Archaeological Survey, the late Professor H.D. Sankalia began from where Foote had left Indian prehistory. With equal strength he attempted to fill the gaps observed by Foote and largely succeeded in placing Indian prehistory on a scientific footing.

He supported the cause of stratigraphic and economic geology, and prehistory of India. Mounted on a horseback he carried the torch of Indian prehistory and trekked through the hilly tracts of what is considered to be the hottest zone (the Rayalaseema) in the south. He travelled around 53,000 km along with his friend for his findings, on horseback. In the end, he had accomplished an inimitable task and had lit many dark areas of India's past. Though Foote had several forerunners in Indian prehistoric research, his innate search for the prehistoric age opened up an entirely new area of

research. Within five years of joining the Geological Survey he had reached a milestone that ushered in an era of discoveries. He was the first to pick up a Palaeolithic find and his modesty prevented him making a sensation. Instead he brought this significant discovery to knowledge of his senior geologist, Dr. Oldham. Foote's account of Palaeolithic finds was first published in 1866, in the Madras Journal of Literature and Science. This heralded the commencement of systematic documentation of prehistoric evidences in India. He not only described the geological perspective of stone tools but also endeavoured to fix their probable age in addition to contemporary climatic conditions. He agreed with others that the chipped stone implements were made by the ancestors of the modern tribes in India and not by Aryans. Between 1863 and 1912, Foote discovered 459 prehistoric sites in various parts of southern India. He published comprehensive geological reports of several parts of the former Madras Presidency which represent a leading example of European dedication towards unravelling India's past in its entirety. Between 1879 and 1880 he mapped the geological features along the east coast of India. These sites are being revisited by the present-day geoarchaeologists with the purpose of reconstruction of the procedures involved in the formation and preservation of stone tools in these deposits. In 1884, he also excavated caves at Billasurgam in Kurnool District of Andhra

Pradesh. He also stayed in Bellary The Bellary-Raichur-Kurnool area has come to be recognized as the centre of Neolithic culture in south India. After becoming the first geologist of the Mysore Geological Department, Foote traversed through the former Mysore State and published his field notes in the first memoir of this Department. He laid strong foundation of Indian prehistoric studies over which present-day archaeologists have to a large extent succeeded in constructing the superstructure and have kept pace with the developments in method and theory taking place elsewhere in other parts of the world. No stone was left unturned by Foote in fifty years of relentless endeavour-both geological and prehistoric. During his nearly six decades of stay in India, he lived his relentless geological tours with a missionary zeal, considerable intensity and passion for collecting prehistoric tools. He was a pioneer in the real sense of the term. He is truly regarded both the 'Father of Indian Prehistory' and 'Father of South Indian Geology.

H.D. Sankalia

(Hasmukh Dhirajlal Sankalia) (1908–1989) was a pioneering Indian archaeologist often referred to as the "Father of Indian Prehistory." He is widely recognized for his groundbreaking contributions to the field of archaeology in India, particularly in the study of prehistoric cultures and the establishment of archaeology as an academic discipline in the country.

Key Contributions and Achievements:

1. **Education and Early Career**:
    - ✓ H.D. Sankalia studied Sanskrit and ancient Indian history, earning his PhD from the University of London in 1936. His doctoral research focused on the city of **Kaushambi**, an ancient urban site in northern India.
    - ✓ Initially, he taught history at various institutions in India but gradually shifted his focus towards archaeology after being influenced by the work of British archaeologists.
2. **Founding of the Deccan College's Archaeology Department**:
    - ✓ In 1939, Sankalia joined the **Deccan College Post-Graduate and Research Institute** in Pune, where he played a central role in founding and developing its Department of Archaeology. Under his leadership, the department became one of the premier centers for archaeological research and education in India.
    - ✓ Sankalia served as the head of the department for many years, training several generations of archaeologists who went on to make significant contributions to Indian archaeology.
3. **Pioneering Prehistoric Research**:

- ✓ H.D. Sankalia's most significant contributions lie in the study of prehistoric India. He conducted extensive fieldwork across various regions of India, uncovering evidence of prehistoric human activity.
- ✓ He led major excavations at sites such as **Nevasa** (Maharashtra), **Brahmagiri** (Karnataka), **Utnur** (Andhra Pradesh), and **Sangankallu** (Karnataka). These excavations revealed important insights into the Stone Age cultures of India, particularly the Paleolithic and Neolithic periods.
- ✓ His work on the **Acheulian culture** (Lower Paleolithic) and **Neolithic settlements** helped to establish a timeline for human evolution and cultural development in India.

4. **Promotion of Scientific Methods**:
   - ✓ Sankalia was an advocate of using scientific methods in archaeology. He encouraged the integration of disciplines such as anthropology, geology, and paleontology into archaeological research to provide a more comprehensive understanding of ancient cultures.

- ✓ He introduced and popularized modern excavation techniques, stratigraphic analysis, and the study of material culture in Indian archaeology.

5. **Major Publications**:
    - Sankalia was a prolific writer, publishing extensively on various topics related to Indian archaeology, history, and culture. Some of his major works include:
        - ✓ *Prehistory and Protohistory of India and Pakistan* (1974)
        - ✓ *Indian Archaeology Today* (1962)
        - ✓ *Excavations at Nevasa* (1960)
        - ✓ *The Archaeology of Gujarat* (1941)
    - These works have become standard references for students and scholars of Indian archaeology.
6. **Recognition and Legacy**:
    - ✓ H.D. Sankalia received numerous awards and honors for his contributions to archaeology, including the **Padma Bhushan** in 1974, one of India's highest civilian honors.

- ✓ He was also a fellow of various academic societies and served on advisory boards for archaeological research in India and abroad.
- ✓ Sankalia's legacy continues through the Deccan College, which remains a leading institution for archaeological research in India. His efforts laid the foundation for systematic archaeological research in India, especially in the field of prehistory.

Influence on Indian Archaeology:

H.D. Sankalia's work transformed the study of Indian prehistory and ancient history. His emphasis on fieldwork, scientific methods, and interdisciplinary research set new standards for archaeology in India. Many of his students went on to become influential archaeologists, further expanding the field. Through his dedication and pioneering work, Sankalia helped to establish a deeper understanding of India's ancient past, contributing significantly to both Indian and global archaeological knowledge.

UNIT V

Interpretation of Excavated Materials - Classification of Artifacts - Contextual and Site Catchment Analysis Pottery and Antiquities: Description and Analysis - Scientific Analysis of Organic Materials.

Objectives:

- To study the various methods of classifying artifacts based on material, function, style, and chronology.
- To understand how artifact classification helps in identifying cultural patterns and technological developments in historical periods.

Classification of Artifacts in Archaeology

Artifact classification is essential for interpreting archaeological data. Artifacts are classified based on various attributes such as material, form, function, and context, providing insights into the past.

Key Methods of Classification:

- ✓ **Typological Classification**: This involves grouping artifacts based on shared characteristics, such as shape, decoration, and material. For example, pottery can be classified into types based on rim shape, surface treatment, and decoration style.

- ✓ **Functional Classification**: Artifacts are classified according to their assumed function, such as tools, weapons, ornaments, or religious objects.
- ✓ **Chronological Classification**: This involves organizing artifacts into temporal categories based on their style, manufacturing technique, or stratigraphic context. This helps in dating sites and understanding the sequence of cultural phases.
- ✓ **Material Classification**: Artifacts are categorized by the material used in their construction, such as stone, metal, ceramics, bone, and organic materials.

2. Contextual and Site Catchment Analysis

Contextual Analysis:

- **Context** refers to the position and association of an artifact within its surroundings, including its location in the stratigraphy (layers) and its relation to other artifacts and features. Contextual analysis helps in reconstructing the activities that took place at a site and understanding the cultural significance of the artifacts.
    - ✓ **Primary Context**: Artifacts found in their original position of use or deposition, providing direct evidence of past activities.

- ✓ **Secondary Context**: Artifacts that have been moved from their original position, often due to natural or human actions, complicating interpretation.

Site Catchment Analysis:

- ✓ This is a method used to study the relationship between a site and its surrounding environment. It involves analyzing the natural resources available within a certain distance (the "catchment area") from the site, which can shed light on the subsistence strategies and settlement patterns of the people who lived there.
  - ✓ **Catchment Areas**: Defined by how far people could reasonably travel to exploit resources. Typically, these areas are categorized into zones, such as agricultural, hunting, or gathering zones.
  - ✓ **GIS (Geographic Information Systems)**: Modern archaeologists use GIS technology to map catchment areas and analyze the distribution of resources in relation to archaeological sites.

3. Pottery and Antiquities: Description and Analysis

Pottery and antiquities are among the most common artifacts found at archaeological sites, and their analysis provides valuable information about past cultures.

Pottery Analysis:

- ✓ **Form and Shape**: Pottery is analyzed for its shape (e.g., bowls, jars, plates) which can reveal its function (e.g., cooking, storage, serving).
- ✓ **Surface Treatment**: This includes decoration, painting, glazing, and other techniques used to finish the surface of the pottery.
- ✓ **Fabric Analysis**: Refers to the composition of the pottery's clay, including temper (material added to clay to improve its properties) and texture. This can provide information on the pottery's origin and the technology used.
- ✓ **Technological Analysis**: Includes studying how the pottery was made, such as wheel-thrown or hand-built, and the firing conditions used in its production.

Antiquities:

- ✓ Antiquities, such as sculptures, tools, jewelry, and weapons, are analyzed in terms of their material, craftsmanship, and stylistic features. The study of these objects provides insights into the

technological capabilities, trade networks, and artistic traditions of ancient societies.

4. Scientific Analysis of Organic Materials

Organic materials such as wood, bone, plant remains, and textiles are often fragile and require specialized scientific techniques for analysis. These materials can provide critical information about diet, environment, and technology.

Common Techniques:

- ✓ **Radiocarbon Dating (C-14 Dating)**: This technique is used to date organic materials by measuring the decay of carbon isotopes. It provides an absolute date range for materials such as charcoal, bone, and plant remains.
- ✓ **Dendrochronology**: The study of tree rings to date wooden artifacts and structures. This method can also provide information about past climatic conditions.
- ✓ **Pollen Analysis (Palynology)**: The study of pollen grains preserved in soil samples. This helps reconstruct ancient environments and understand how past people interacted with their landscape.

- ✓ **Phytolith Analysis**: Phytoliths are microscopic silica structures found in some plant tissues. They can survive long after the plant has decayed and are used to identify ancient plant species.
- ✓ **DNA Analysis**: Modern advances allow for the extraction and analysis of DNA from ancient organic materials. This can be used to study ancient human populations, domesticated animals, and plants.
- ✓ **Stable Isotope Analysis**: Isotopic analysis of carbon, nitrogen, and oxygen in organic remains provides insights into ancient diets, migration patterns, and climatic conditions.

Conclusion

The classification and analysis of artifacts are central to archaeological research. By examining artifacts within their context, and utilizing scientific techniques to analyze materials such as pottery, antiquities, and organic remains, archaeologists can reconstruct past lifeways, technological developments, and environmental conditions. Modern methods such as GIS for site catchment analysis and advanced scientific analysis of organic materials further enhance our understanding of ancient cultures

References / Recommended Books

1. Raman, K.V. : Principles and Methods of Archaeology
2. Rajan.K : Archaeology: Principles and Methods

3. References

4. Atkinson.R.J.C : Field Archaeology, 2nd edn
5. Barker Philip : Understanding Archaeological Excavation
6. Fleming.S. : Dating in Archaeology
7. Renfrew, C and Bhan : "Archaeology"
8. Robert.f.Heizer(ed.,) : The Archaeologist at Work: A source Book in Archaeological
   a. Method and Interpretation
9. Roy.Sourindranath :The Story of Indian Archaeology
10. Renfrew, C &Paul Bahn : Archaeology: Theories, Methods and Practicals