Unit :- Chronology and Dating Methods Concept of Relative and Absolute dating; Relative chronology; Stratigraphy, Typology, palination, Seriation, palynology, ~~Rhepalaeon~~ palaeontology fluorine analysis
Absolute chronology : radio-carbon, potassium-argon, Thermo luminescence. Dendrochronology.

Relative and Absolute dating :

The earth is approximately five billion years old and life began on it some 3·5 billion years ago. Life evolved on it through various forms. The geologists and palaeontologists are now able to give us geological chronology of major events witnessed on the earth along with the changing life forms. In collaboration with the geologists, palaeontologists, physicists, climatologists and host of other, have provided us a ~~ch~~ cultural chronology. The geological chronology ~~about various eras and epochs in the life of the earth along with the corresponding life~~ and cultural chronology should be studied to understand the geo-climatic background in which culture evolved.

Thus the terms like miocene, pliocene, pleistocene, holocene etc, refer to the geological chronology while palaeolithic, mesolithic and neolithic refer to the cultural chronology. ~~lgeological chronology while palaeolithic, mesolithic and neolithic refer to the cultural chronology.~~

Geological chronology is of two types

(I) Relative chronology (dating)
(II) Absolute chronology (dating)

(I) Method of Relative Dating:

Of the many relative dating techniques available, Stratigraphy is probably the most reliable. Stratigraphy is based on the simple principle that the oldest layer or stratum was deposited first whereas the newest layer was deposited last. Similarly, archaeological evidence is usually deposited in chronological order. The lowest stratum contains the oldest artifacts and or fossils, whereas the upper most stratum contains the most recent ones. Thus, even in the absence of ~~pri~~ precise dates, one knows the relative age of objects in one stratum compared with the ages of those in other strata. The Stratigraphy of a given site can be complicated by geological activities such as earthquakes that shift the position of stratigraphic layers.

(II) Fluorine Method: Another method of relative dating is the fluorine method. It is based

on the fact that the amount of fluorine deposited in bones is proportional to the amount of time they have been in the earth. The oldest bones contain the greatest amount of fluorine. The fluorine test is useful in dating bones that can not be described neither certainly to any particular stratum. This method was vital for uncovering the infamous Piltdown hoax in which a human skull.

Relative dating can also be done by establishing sequences of plant, animal or even cultural remains. For these methods the order of appearance of a succession of plants, animals or artifacts provides relative dates for a site based on a series established in another area.

Palynology:

Pollen dating or palynology is a method of determining chronology and connecting cultural material with climatic phases through the study of fossil pollen. Pollens are small grains or practise released by different flowering plants. The kinds of pollen found in any geological stratum depends on the kind of vegetation that existed at the time such stratum was deposited. ~~A stratum depends on the kind of vegetation~~ A site or locality can, therefore, be dated by determining what kind of pollen was found to associated with it.

Absolute Dating Method or Chronometric Dating:

Chronometric dating methods rely upon advances in the disciplines of chemestry and physics, allowing sciences to calculate the age of physical and cultural remains. Absolute or chronometric dating method give the dates in 'absolute' terms with some margin. Absolute or chronometric dates are based upon solar years and are reckoned in 'years before the present or years before ar after christ (B.C. and A.D)

Radio carbon Dating:

The most widely used archaeological dating technique is radiocarbon dating. This method is based on the discovery that all living things, both plant and animals, contain a radioactive carbon know as carbon 14 (C^{14}). The radio carbon (C^{14}) dating method was developed by physicists J.R Arnold and W.F. Libby in 1949. It is based on the fact that all living organism absorb radioactive carbon (C^{14}), which reaches equilibrium with that in the atmosphere and that this absorption ceases at the time of death. Plants absorb this carbon from the atmosphere. Animals acquire it by eating plants or by eating animals that have eaten plants. The amount of C^{14} normally present in a living plants or animals species is known. Although some disintegration of radio carbon may take place during the life of organism. It is blanced

by the intake of C14. So, in a living organism, the amount of radio carbon remains fairly constant. After death, however, no more C14 is taken in, and disintegration of C14 proceeds at a steady rate. In 5730 years, half of the C14 in the organism has decayed, ~~to~~ this is known as the half life of carbon.

Potassium-Agron Daling:

Potassium-Agron daling is another method of absolute daling. This is based on a techniques similar to that of radio carbon analysis. This techniques is based upon the Transformation of Potassium-40 (K40) into Argon (A 40). The half life period for this is enormously long.

In potassium-argon daling, a radioactive ~~from~~ form of potassium decays at a known rate to form argon. The ages of some rocks can be dated by measuring the potassium-argon ratios. One advantage of this techniques is that it can be used to date older sites than those within the range of C14 daling. But most archaeological sites can not be dated by the potassium argon method.

The half life of potassium is 13 billion years. The potassium argon method can be used to date geological strata and humanity's earliest ~~millenia~~ millennia upto about a million years ago.

(iii) Thermoluminescence

Thermoluminescence dating makes use of the principle that if an object is heated at some point to a high temperature, it will release all the trapped electrons it held previously. Many ~~mine~~ minerals emit light when they are heated, even before the become "red hot". This "cold light" comes from the release under heat of "outside" electrons trapped in the crystal structure. Over time, the objects will continue to trap electrons from radioactive elements around it. The amount of thermoluminescence that is emitted when the ~~objects~~ is heated during testing allows researchers to calculate the age of the objects.

Thermoluminescence dating is well suited to samples of ancient pottery, brick, tile or terra cotta which ~~are~~ were originally heated to a high temperature when they were made. This method can also be applied to burnt flint tools hearth, stone, lava or lava-covered

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Dendrochronology:

Another chronometric method of dating is known as dendrochronology. It is developed by A E Douglass in the course of studying Pueblo Indian sites in the North American South West. This method of dating is based on the fact that in certain climates trees add a new growth ring to their trunks every year. The rings vary in thickness, depending upon the amount of rainfall received in a year. In areas ~~marked~~ marked by seasonal rainfall, each tree ~~and~~ ~~correlated with fragmentary~~ ring represents a year's growth. The rings can be counted and joined in long sequences from different trees and ~~so~~ correlated with fragmentary beams as far back as the first century B.C. B.C. Certain trees, specially the Bristlecon pine (Pinus aristata) found in California has provided different ring structures for as many as 4,900 years.

Dendrochronology is applicable only to wooden objects and it can be used only in regions which trees of great ~~age~~ age, such as the giant Sequoias and the

Bristlecone pine are known to grow. In ~~other words~~ words it can be used only in such places where rainfall is clearly seasonal and growth of annual tree rings is regular.

The techniques of dendrochronology has been used in the southwestern United States, where a master chart of tree ring sequences goes back almost to the time of christ. Dendrochronology cannot be applied to all kinds of trees or in all kinds of environments. Apparently it will not work in New Zealand, and it can not be used in the areas where ~~there~~ there is little annual variation in rainfall. However, tree-ring analysis has been practised with some success in England, Germany, Norway, Turkey, Egypt and various parts of the united states, including Alaska.