SCIENTIFIC METHODS FOR ACCURATE DATING IN ARCHAEOLOGY

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Archaeology employs various scientific methods to accurately date artifacts, sites, and remains. The ability to tell how old things are and put them in the right order is one of the most important skills archaeologists have, and its called dating. Dating organizes archaeology discoveries in time, for example dates on a calendar. There are two main kinds of dating methods, relative dating and absolute dating. These two main kinds of dating use different methods to determine the dates of artifacts, sites and remains.

## ABSOLUTE DATING

Absolute dating methods measure the physical properties of an object itself and use these measurements to calculate its age. It provides more specific origin dates and time ranges, such as an age range in years. To determine how specific these dates can be will depend on what method is used. After 1950s, the physical, chemical and biological sciences contributed a number of dating techniques that had revolutionary effects on archaeology. Among the absolute dating methods, the Radio Carbon dating method is considered as one of the best available methods today. However, Radiocarbon dating cannot be used for the sample that goes back beyond 60,000 years. Therefore, other absolute dating methods include potassium argon, dendrochronology, fission track dating, Thermoluminescence

### Radio Carbon Dating

Radio carbon dating works by measuring carbon isotopes, which are versions of the element carbon. One of the carbon isotopes that occurs in nature is radioactive; it has 8 neutrons and is called carbon-14. All plants and animals take in radioactive and non-radioactive carbon when they eat and breathe. When they die, the carbon-14 in their wood and bone starts to decay, However, the amount of non-radioactive carbon remains the same. In the process of calculating radio carbon dating, the amounts of stable carbon and carbon-14 in a piece of bone or wood are counted. When these figures are obtained the ratio of stable carbon to carbon-14 is then used to calculate the date when the radioactive decay process started. From there, the problem becomes how to measure the carbon-14. There are techniques developed to measure radioactive and non-radioactive carbon. One of the techniques is to purify a sample so that it emits no other type of radiation except for carbon-14, and then run it through a detector sensitive enough to accurately count the pings emitted by the decay of single atoms. A newer, faster method works by using a particle accelerator to count the atoms of carbon-14. Some of the importance of Radiocarbon dating is that it can be used on any object that used to be alive. That includes pieces of animals, people, and plants, but also paper that was made from reeds, leather made from animal hides, and logs that were used to build houses. Radio carbon dating works on organic materials up to about 60,000 years of age and Conventional radiocarbon dating requires samples of 10 to 100 grams (0.35 to 3.5 ounces) which are some of its limitations.

### Dendrochronology (Tree-ring Dating)

It’s the study of tree rings in woody trees and shrubs. Dendrochronology is based on the fact that many species of trees produce growth rings during annual growing seasons. Samples are obtained by means of 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 center. This core is split in the laboratory, the rings are counted and measured, and the sequence of rings is correlated with sequences from other cores. Once the sample is taken the date of the sample could be established by matching the archaeological sample to the master sequence of tree ring patterns. Thus, a master sequence of tree ring pattern of a region is necessary to date an archaeological sample. The ring measurements taken from trees with overlapping ages can extend knowledge of climates back thousands of years.

Some of the limitations of dendrochronology is that there must be an existing master strip for that area and species, in some areas of the world the species available do not have sufficiently distinct seasonal patterns that they can be used and finally where the right species are available the wood must be well enough preserved that the rings are readable. In addition, there must be at least 30 intact rings on any one sample.

### Potassium Argon

Potassium-Argon (K-Ar) dating method, developed by the scientists at the University of California in 1950, is based upon decay of the radioactive of a rare isotope of potassium(40K) into argon (40Ar) gas. The decay takes place at known rate, which is the half-life of 40K is 1.31billion years. This method can only be used with the volcanic rocks because they contained no argon gas when they were formed. When the rock is super-heated like volcano, all the accumulated gases would be released into the atmosphere. This sets the atomic clock to zero. When the rocks solidify again, radioactive potassium proceeds to decay into argon. Then, the samples collected from volcanic flow are heated at a high temperature and the accumulated argon that is being released is measured.

Limitations of potassium argon include When a sample becomes higher than one million years old it is difficult to determine the actual age and origin and because the potassium argon dating technique relies on the determining the absolute abundances of both 40 Argon and potassium, there is not a reliable way to determine if the assumptions are valid.

## Relative Dating

Relative dating estimates whether an object is younger or older than other things found at the site. Relative dating includes methods that rely on the analysis of comparative data or the context. For example, geological, regional and cultural in which the object one wishes to date is found. This approach helps to order events chronologically but it does not provide the absolute age of an object expressed in years. The most commonly used relative dating are soil stratigraphy and seriation.

### Stratigraphy

Stratigraphy is inspired by geology, it uses the principle of the superposition of strata which suggests that in a succession of undisturbed soils, the upper horizons are newer than the lower ones. Generally, each stratum is isolated in a separate chronological unit that incorporates artifacts.

However, this method is sometimes limited because the reoccupation of an area may require excavation to establish the foundation of a building, for instance, that goes through older layers. In this case, even if the foundation of the building is found in the same stratigraphic level as the previous occupation, the two events are not contemporary.

### Seriation

Seriation is a technique that was common in the mid-20th century, seriation looks at changes in certain styles of artifacts present at a site. A chronology is developed based on the assumption that one cultural style (or typology) will slowly replace an earlier style over time. Seriation is thought to be the first application of statistics in archaeology. It certainly wasn't the last.

In conclusion there are other methods of dating that are not discussed above. As observed each method has its own limitations and combining multiple dating methods or cross-referencing different techniques often strengthens the accuracy and reliability of archaeological dating. The choice of method depends on the nature of the material being dated and the time range of interest.

References

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