

# Dating in Archaeology

**Título:** Dating in Archaeology. **Target:** Bachillerato. **Asignatura:** Historia, arqueología, tecnología, Ciencias. **Autor:** María Belén Fernández Carvajal, Licenciado en Geografía e Historia/ Conservación y restauración de Obras de Artes, profesor de Plástica y Visual en Educación Secundaria.

## INTRODUCTION

To define the antiquity of archaeological materials, organic remains like plants and animals, and of archaeological sites it has been always of basic interest for the reconstruction of the sequence and succession of companies in different regions of the world.

In the classic archaeology it was possible to know the age of monuments and events reading documents and inscriptions in Latin and Greek, or finding coins with the effigies of emperors or leaders. For the companies of the Middle East it was possible to do it when the writings are deciphered hieroglyphic and cuneiform (and this way it is possible to reconstruct the dynastic genealogy of Egypt).



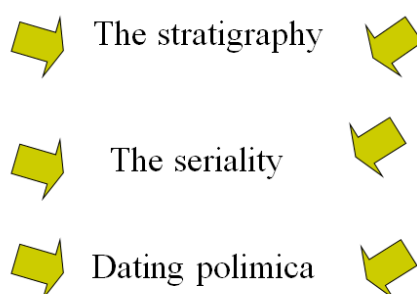
## THE DATING IN ARCHAEOLOGY

**The dating** consists of the location of material remains or of cultures of a certain period. The use of methods in archaeology is essential to be able to determine the antiquity of the opposing objects, the majority of the cases will date the context in which one found the object.

There exist two groups of ways of establishing the age of appliances, organic remains and contexts:

- The relative methods are those that allow to arrange in a temporary sequence (of more ancient to younger) a series of contexts and the appliances and organic remains that one finds in them.
- The methods of absolute dating (or dating chronometrical) are much more precise and consist of measuring the royal age.

### Methods of relative dating



## The Stratigraphy

The Stratigraphy is the branch of the Geology that treats of 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. It cooperates with the Paleontology, science or study of the ancient beings, which studies and interprets the past of the life on the Earth across the fossils. It is fitted inside the Natural Sciences, possesses an own body of teaching and shares foundations and methods with the Geology and the Biology, with that it joins narrowly.

- The Stratigraphy is the principal source to establish a relative chronology treats itself about a linear arrangement of appliances and contexts from the physical relations between them.
- It is a question of a linear arrangement of appliances and contexts from the physical relations between them.
- It is a geological concept applied in archaeology to understand the overlapping of sediments or layers in sites that have had human occupation.



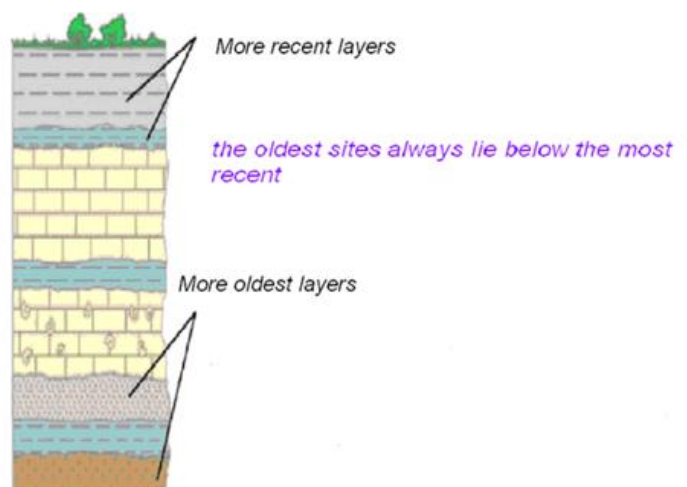
Archaeological sites are mounds created by the accumulation of sediments that are formed in a natural or artificial way, creating archaeological mounds (tell, Barrow, etc.), they are important in the construction of chronological sequences.

### WHICH ARE THE BEGINNING OF THE STRATIGRAPHY?

In an excavation it is very important to extract the land of form arranged to know exactly in what layers was. Every layer will give us information about the context, place and orientation to be able to extract conclusions validated. Once distinguished the levels, it is necessary to arrange them in a chronological sequence, which will be the relative chronology of a deposit.

#### -The law of overlapping of the layers:

The deepest layers are more ancient those, and, logically, those of little depth, youngest.



**-The Law of the original Horizontality:**

Any layers formed of not solid form will have towards the horizontal position.

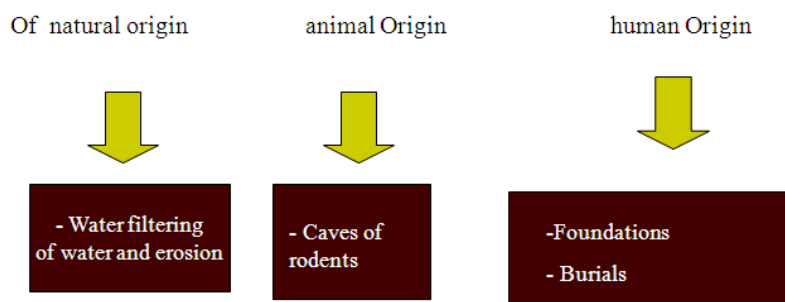
**-Law of the horizontal Continuity:**

Any archaeological warehouse is limited by a basin of deposition or his thickness will be diminishing towards the sides.

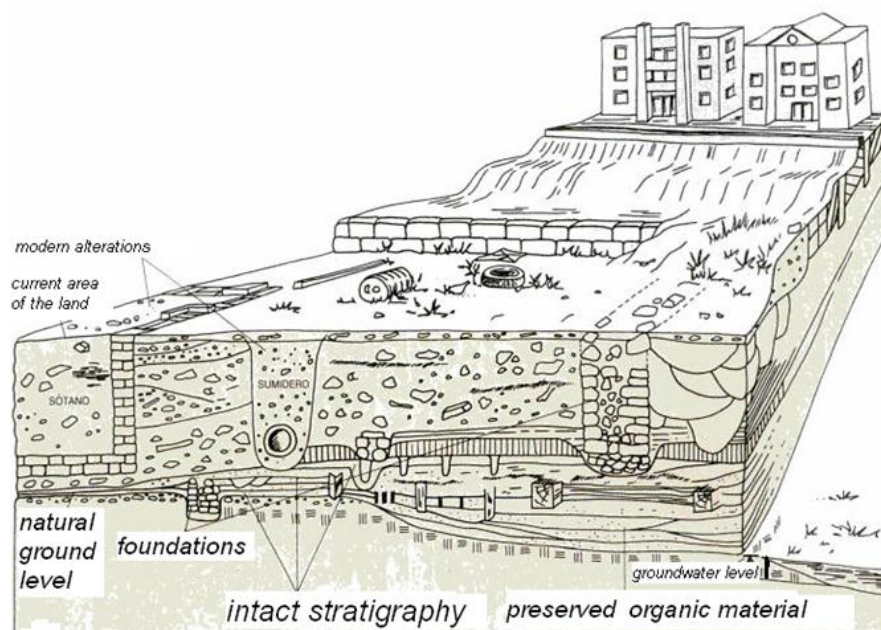
**-Law of stratigraphic succession:**

A stratigraphic unit occupies an exact place in the stratigraphic sequence of a deposit between the (previous) lowest and highest (later) cap.

Factors that modify this human overlapping of capacity utilizations:



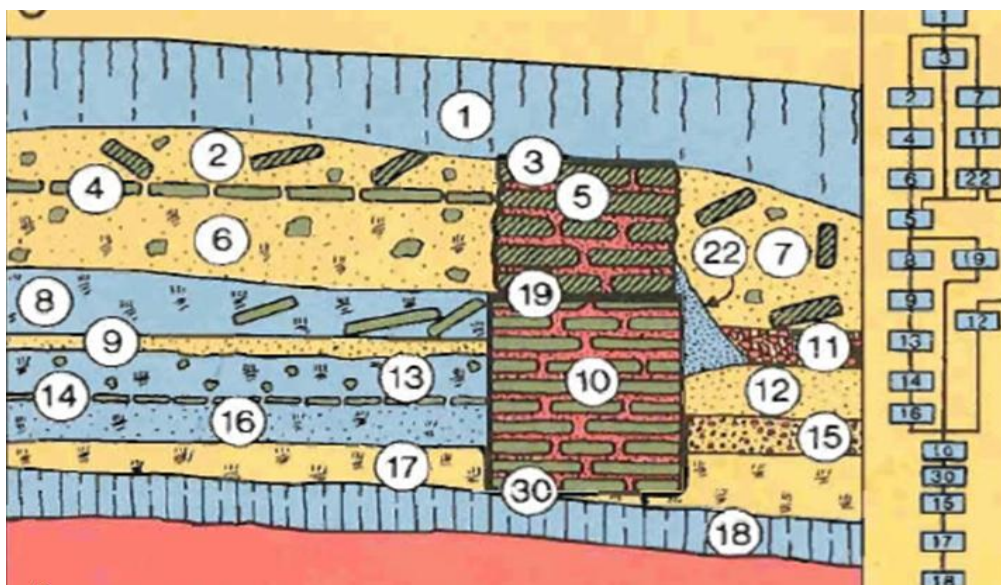
Example of complex stratigraphy (horizontally and vertically):



Almost 40 years ago, in 1093, an archeologist, Edward C. Harris, invented a method that revolutionized archaeological methodology leading to a new contemporary approach when digging a reservoir. This approach soon spread and adopted worldwide, including interventions are applied in architectural character.

But, what is their methodology?

This revolutionary methodology, known as archaeological stratigraphy, was to add a fourth dimension to archaeological studies, the temporal dimension and represent the results of the findings using diagrams, so this method is also known as: Harris Matrix.



In this example, each layer corresponds to a different age or period, therefore, according to the layer where we find an object can date seniority.

Once differentiated stratigraphic levels must establish a chronological sequence to allow correct classification of the field study. For more information you can read the book of **EDWARD C. HARRIS "PRINCIPLES OF ARCHAEOLOGICAL STRATIGRAPHY"**.

### The Seriality

The seriality is a method of arranging in a linear sequence a series of types of appliances from his frequencies (usually percentages) in the contexts in which they are. We know that the stone is more ancient than the steel, and this way it is possible to give him the chronological correct order to the series of percentages obtained for every period.

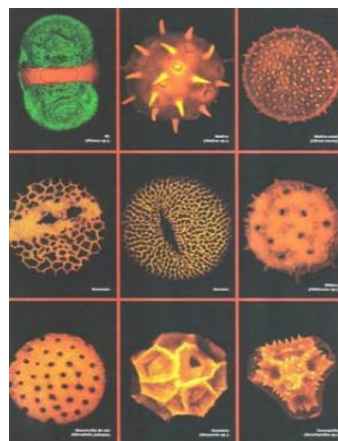
- It is necessary to realize with the appliances derived from the same culture and that they have the same function.
- The process consists of observing the characteristics of the remains and of being placing more nearby those that are more similar, so that between an appliance and of to the side the differences are minimal.
- This work is multidisciplinary and turns out to be indispensable for the archaeology.

Two versions of this technique have been used: contextual Seriation and frequency Seriation.

- CONTEXTUAL SERIALITY: what determines the sequence here, is the duration of the different styles artifact (form and decoration)
- SERIALITY FREQUENCY: it relies mainly on the abundance or frequency, proportional a ceramic style. However it should be borne in mind that the series does not tell us if single to that extreme of a given sequence is the original and which is the final, actual chronology must to be determined by other means, as already mentioned connections with the stratigraphic sequences.

### Dating polimica

All plants with flowers produce pollen, and its conservation in peat bogs and lake sediments allowed the epimerization to develop detailed sequences of the vegetation and climate of the past. These sequences are of great help to understand the ancient environments and as relative dating methods



- Lets you know what kind of plant life existed at the time of the layers where has been found.
- Informs us climate change, diet, etc.
- It can be stored for tens of thousands of years and is very easy to decide what kind of plant belong to
- looking at it under a microscope. The Neanderthal from Shanidar (Iraq) site is famous because on a burial found pollen from flowers and this was attributed to these were deposited by the way as an offering to the deceased.

## METHODS OF ABSOLUTE DATING

In archaeology, absolute dating allows to evaluate the age of objects or archaeological remains in terms independent of other objects of study. For this purpose, used various techniques based on physical properties.



The numbers close to the bars represent the maximum age of efficiency of the method of dating

### Radiocarbon (C-14)

This method was developed by W.F. Libby in 1953, initiating a process of very important advances in the ways to obtain absolute dates of eco-facts (organic remains related to the diet - animal bones, charcoal stove, and charred seeds).

- The radiocarbon method is the oldest and perhaps the most widely used in archaeology. Dates of a variety of organic samples can be obtained: wood, burnt wood or coal, human and animal bone, shell, remains of plants and grains both dried and carbonized.
- Samples for radiocarbon dating are very stable but can become contaminated. It is essential to use a clamp or gloves and keep aluminium sample paper.
- The technology samples for radiocarbon analysis have come a long way: today there is the conventional analysis and AMS (Accelerator Mass Spectrometry - it is more accurate, works with very small amounts, but it is more expensive and laborious)
- What data using this technique is the date in which occurred the death of the body, not the date it occurred the historical fact; is dated when the wood which was built a tomb, was cut not when the burial was carried (is dated when the wood which was built a tomb, was cut not when the burial was carried)

## DESCRIPTION AND OPERATION

All be live breathes and thus absorbed, among other things, carbon-14. When the organism dies, it stops absorbing C14 and so you know how long ago that he died for the amount of carbon 14 that is in the body (organic sample).

## APPLICATIONS

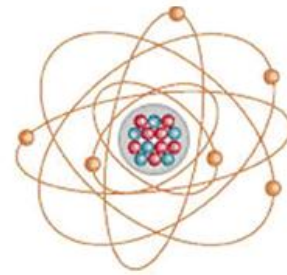
Organic remains of 5 - 10 grs. Used in any climate

## TIMELINE AVASTE

50,000 to 80,000 years

## FEES OF ERROR

The cosmic background radiation contaminates and gives an error rate (+ / -) is well calibrated until 2500 BC. Then there is an error of + 250 years.



## The Dendrochronology

Dendro: tree, chronos: time). Currently Fundamental and necessary to correlate

Results of C-14. Discovered by Andrew Ellicott Douglass (age 30).

Dendrochronology is the dating method that uses the number, thickness and density of annual growth rings of ancient trees. The trees of the same species growing in the same area have the same pattern of rings and then can go riding a chronology of the area. This method accurately dating the remains of the last 2000 or 3000 years.

Not all regions of the world have suitable tree species for dendrochronological analysis



Rings and subtraction of a sample

## OPERATION METHOD

The tree rings haven't the same thickness:

1 - Growth varies according to the season in the same year:

-Summer: more growth

-Winter: less growth

2 - The lines closer together as you get older the tree



AVASTE TIMELINE: Dating of wood in the past 8000 years.

ADVANTAGES: It removes a sample of tree rings uncut

DISADVANTAGES:

- It is easy to establish local chronologies "floating" (series that are not associated with the main leader sequence).
- Not be used in areas without marked seasons
- Sets the time of cutting the tree and not the use of wood. You need to have the entire sequence of rings in good condition

## Thermoluminescence

The dating thermoluminescence is based on a crystalline structure materials (ceramics containing small amounts of radioactive elements, uranium, thorium and potassium). These decay at a steady and known, emitting alpha, beta and gamma that bombard the crystal structure and displace electrons, trapped in cracks in the crystal lattice. As time goes increasingly are trapped electrons. Only when the material is heated rapidly to 500 ° C or more, electrons can escape retained, resetting the clock to zero and as they do emit light known as thermoluminescence. Thermoluminescence can be used to pottery and burnt flint dating materials inorganic until 50,000 - 80,000 years old.

### APPLICATIONS

Two distinct types: flint and pottery

### TIMELINE AVASTE

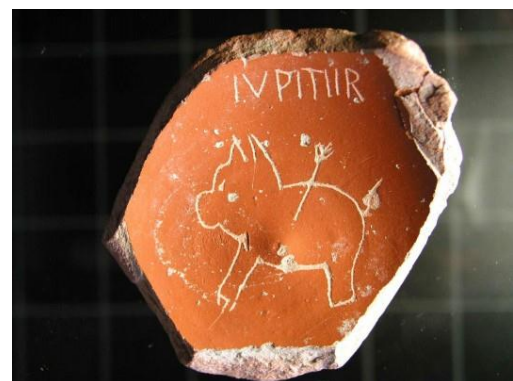
50000 to 80,000 years

### WATCH RADIOACTIVE

When heated to 500 ° C is set to zero

### SAMPLES

Samples of 5 to 10 gr





### ERROR RATE CALIBRATION

It has an error rate of less than 10%

### DISADVANTAGES

Samples often bring impurities: we need to consider the contour found and if necessary attach with a sample piece to examine its radioactivity.



### Archaeomagnetism

Earth's magnetic field has relatively frequent changes in direction and intensity terms. The various historical archives have allowed archaeologists recreate the changes in the direction of magnetic north observed in places of those files from compass readings of the past 400 years, or earlier times through the magnetization of structures clay ancient periods have been dated independently (Renfrew and Bahn, 1993: p. 145-147).

### Dating by the potassium-argon (K40 y Ar 40)

- It is another dating technique radioactivity from
- Shows reliable dating between 350 000 and more than 3 million years.
- It applies to the determination of the rocks that contain minerals potassium, allowing know the age of the strata of the crust and dating archaeological materials existing in them.
- The procedure is to evaluate the amount of radioactive argon is kept in a body. Among the applications of the method can cite the dating of volcanic lava and fossil hominids.

### CONCLUSION

In the early 20th century archaeologists had only the help of relative dating methods and the occasional absolute dating, as in the case of dendrochronology. But from the second half of this century began to discover more accurate procedures for dating archaeological remains. In recent decades there have been reviews of various methods, which have contributed to its accuracy. They make it possible to have, at times, with exact dates (eg calendars) and others with very approximate or probabilistic estimates of character, as in the case of radiocarbon. At present investigations continue to refine the absolute dating procedures of archaeological samples in the future is estimated to be more precise dating ways that help, largely, to the task of the researcher. ●

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