

LA EDAD DE LA TIERRA



Métodos de datación



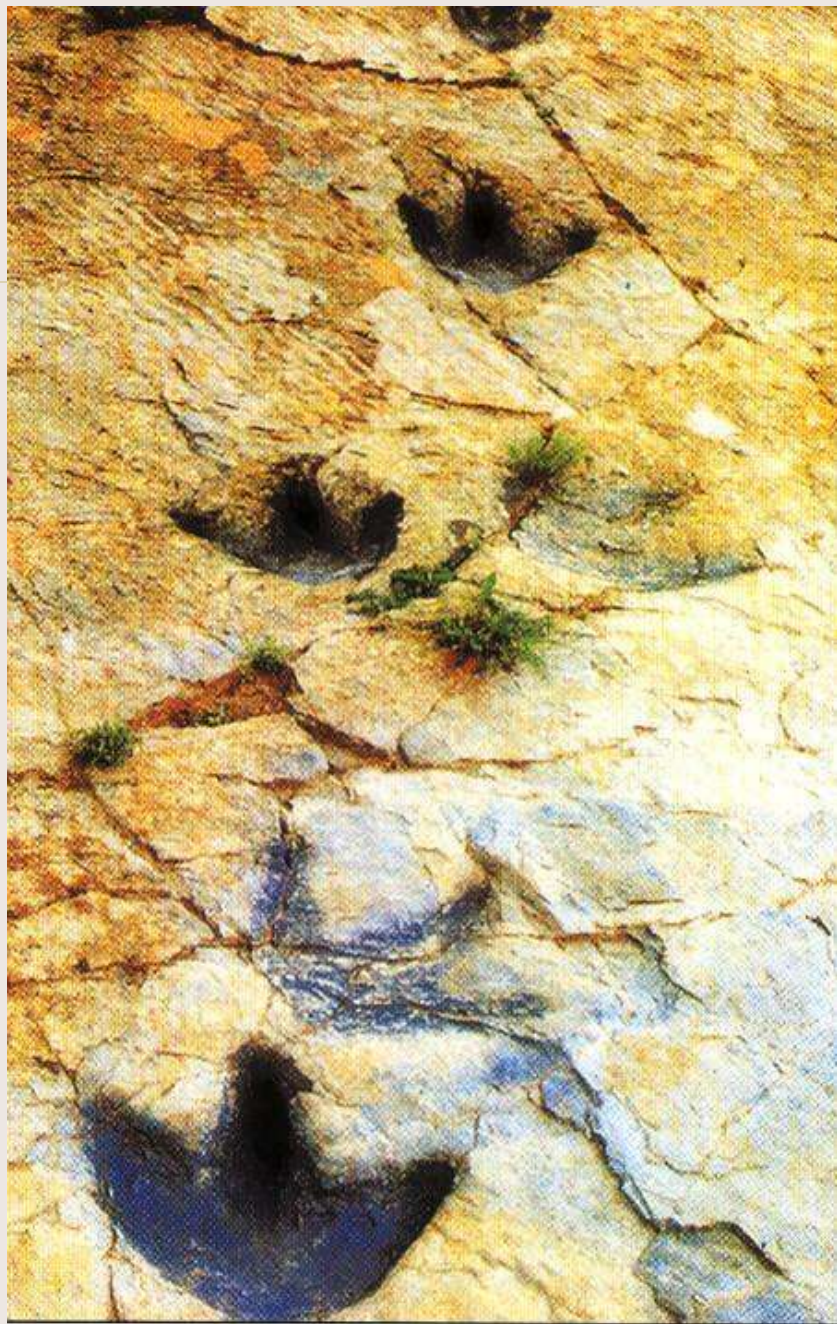
















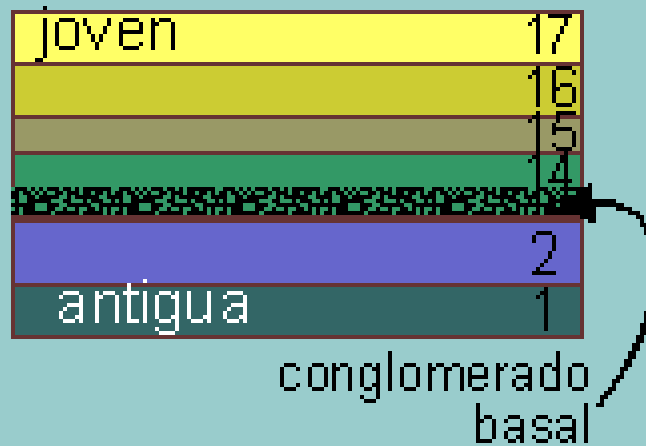




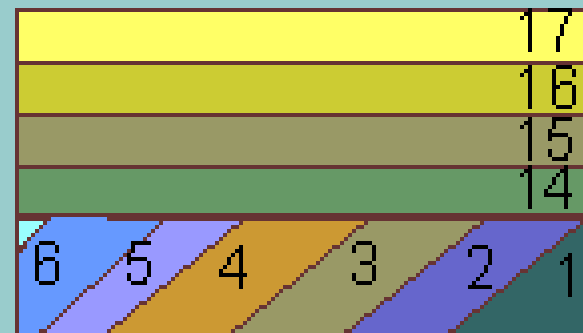


Discordancias

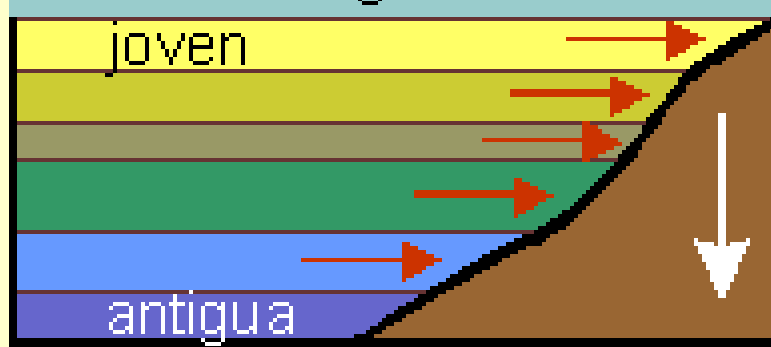
discordancia



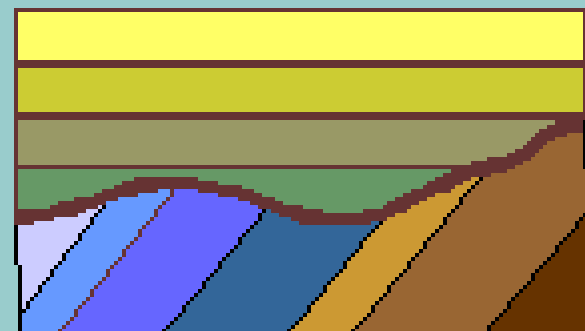
discordancia angular



Transgresión



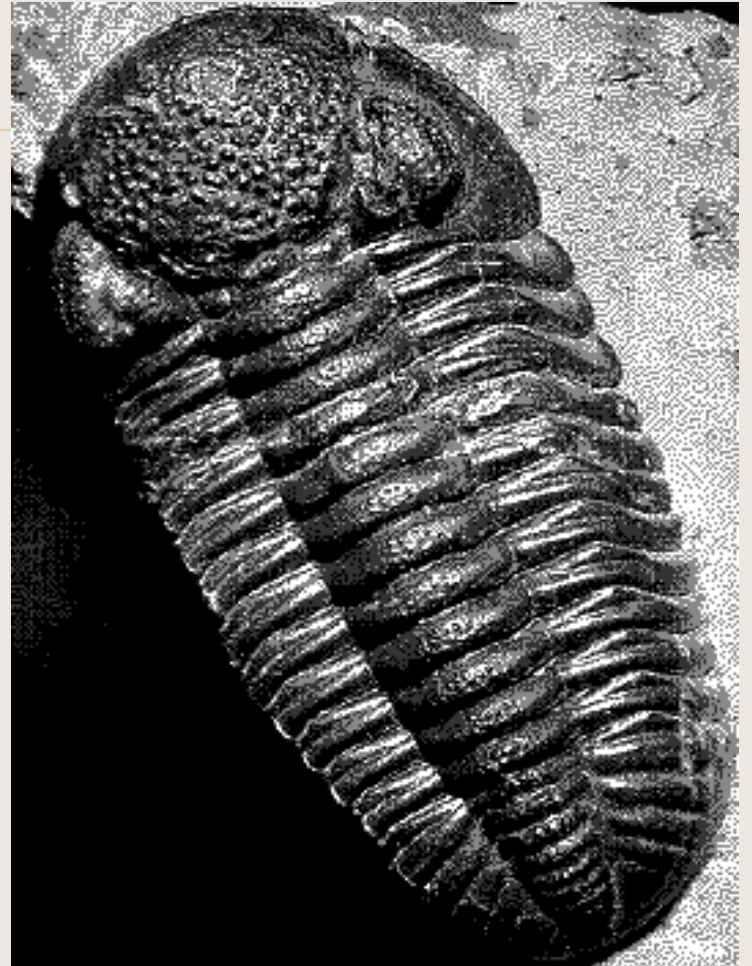
paisaje fósil



WG/Discor01.cdr



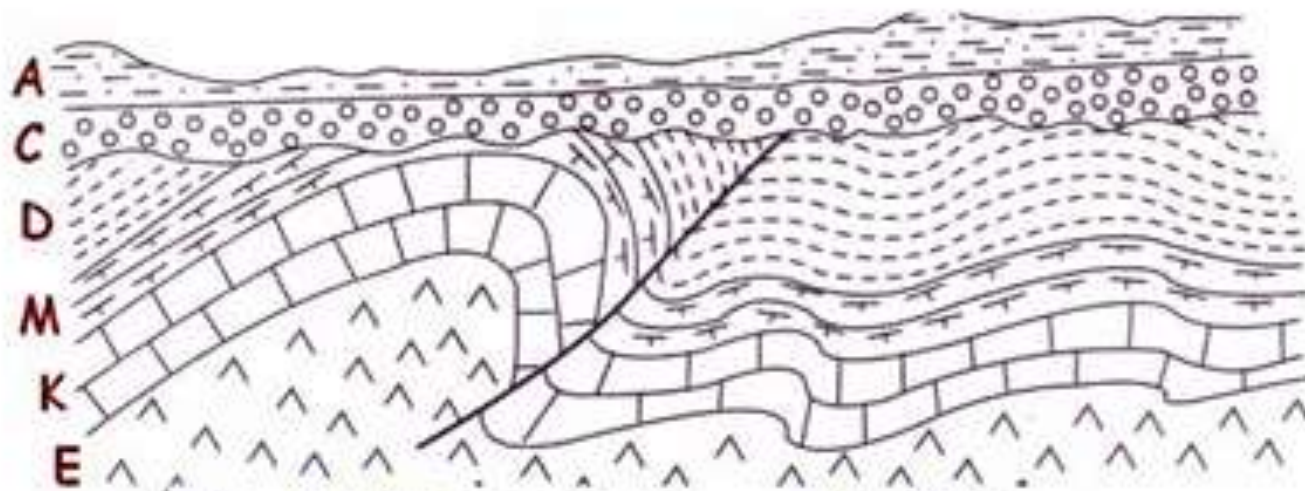
Oxynotoceras (Jurassic) 13cm diameter











A- Arcillas y arenas

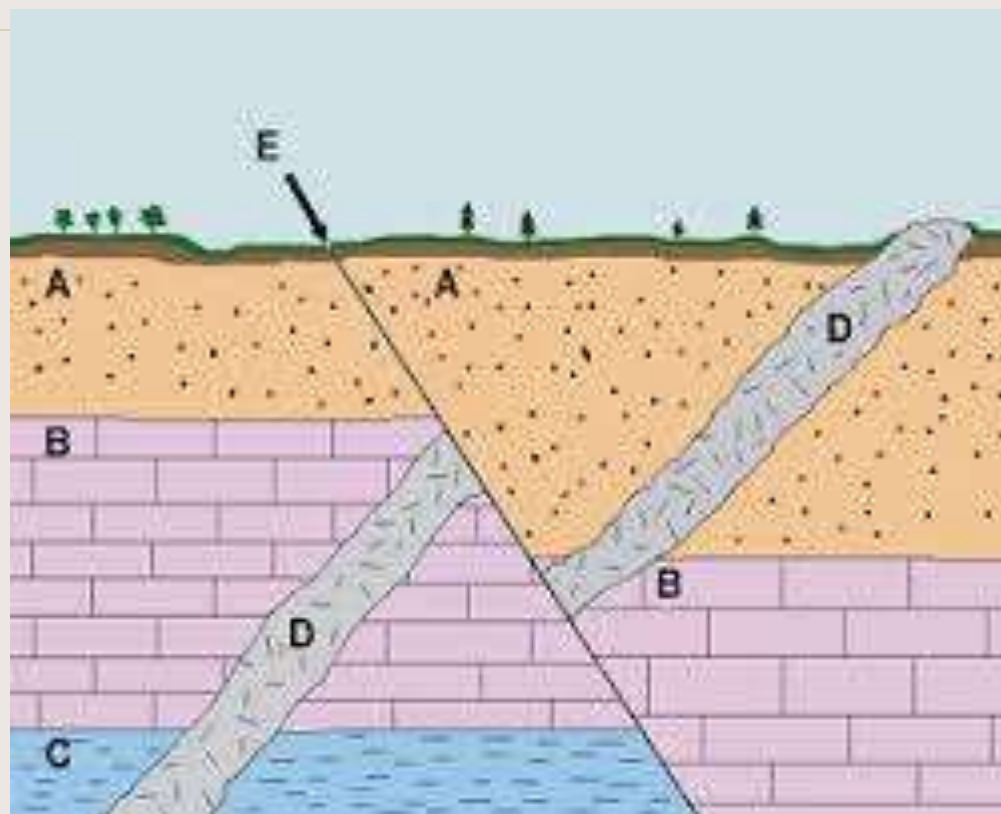
C- Conglomerados

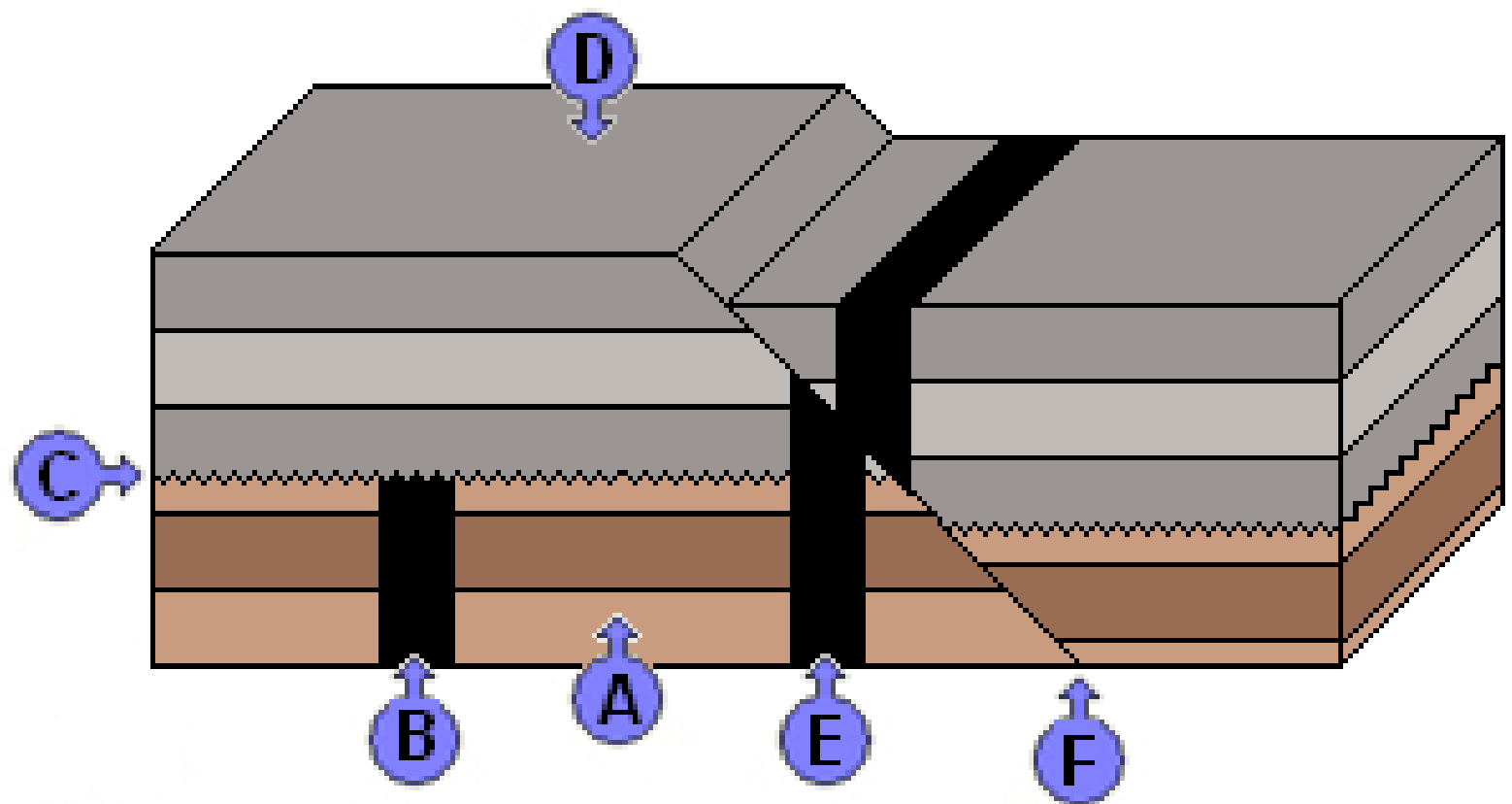
E- Evaporitas y arcillas

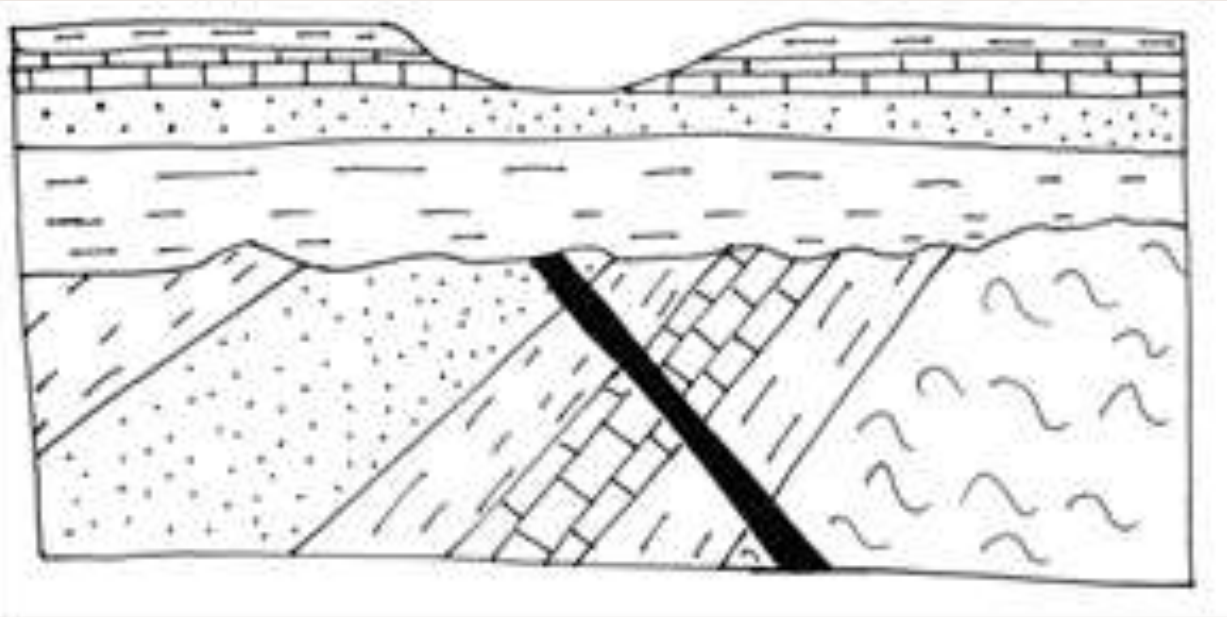
K- Calizas

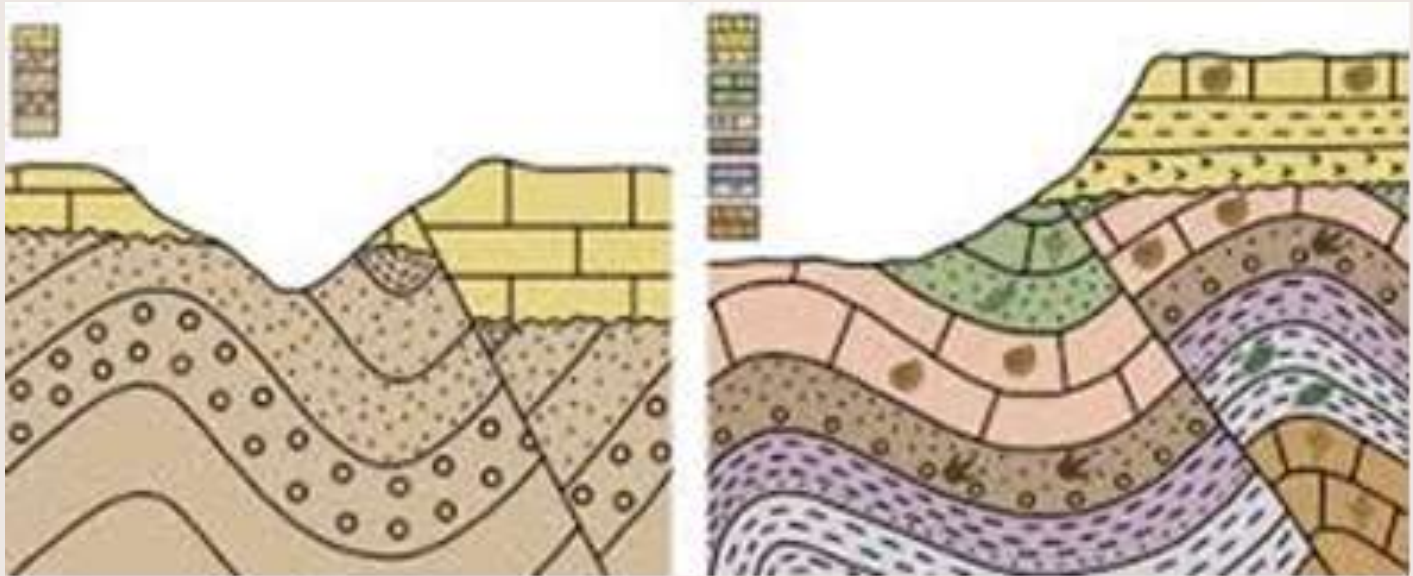
D- Arcillas

M- Margas





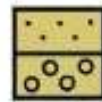






Análisis de cortes geológicos

Corte 4



Conglomerados y areniscas del Terciario



Calizas con ammonites jurásicos



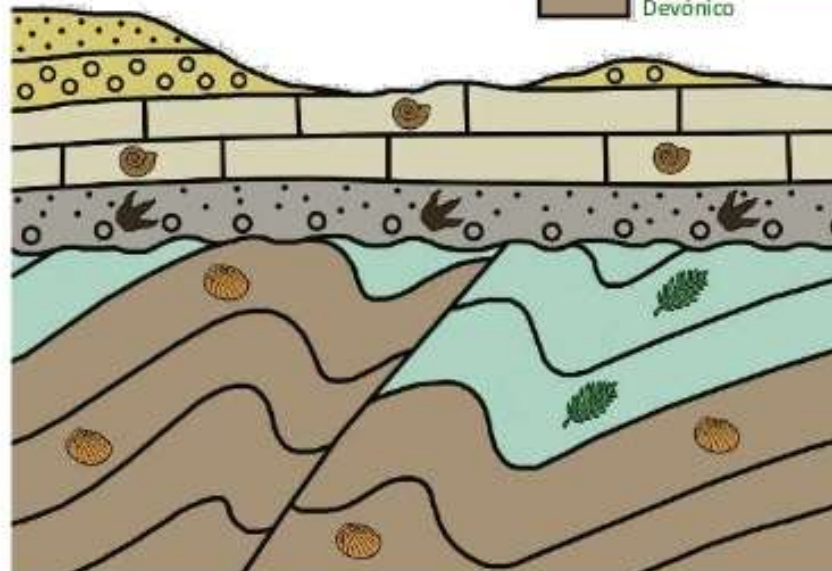
Areniscas y conglomerados con huellas de dinosaurios triásicos



Pizarras con carbón y fósiles de helechos



Calizas con braquiópodos del Devónico



Ammonites



Huellas de dinosaurios

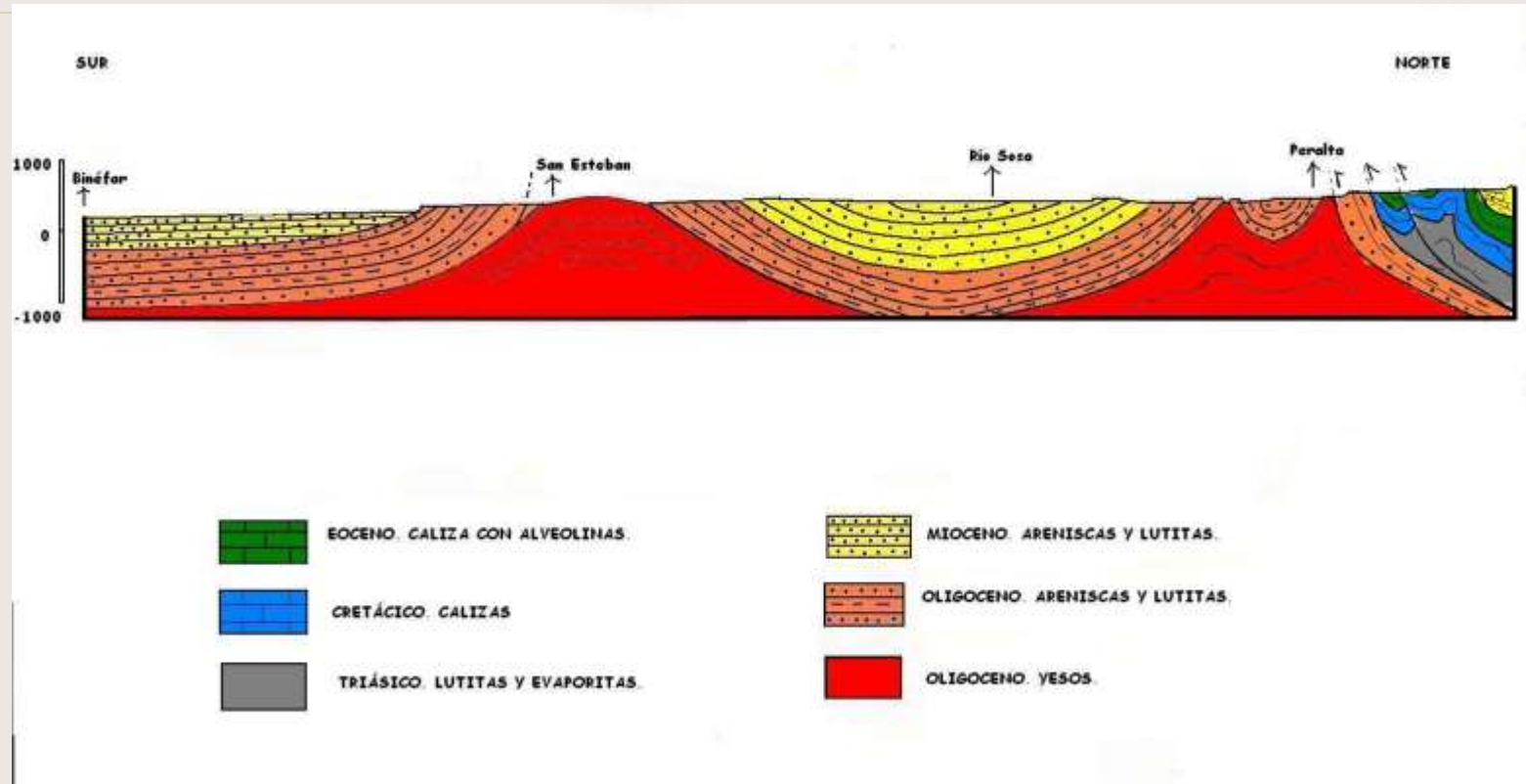


Helechos



Braquiópodos

CORTE GEOLÓGICO BINÉFAR-PERALTA DE LA SAL.



DATACIÓN ABSOLUTA: ANILLOS DE CRECIMIENTO





VARVAS GLACIARES

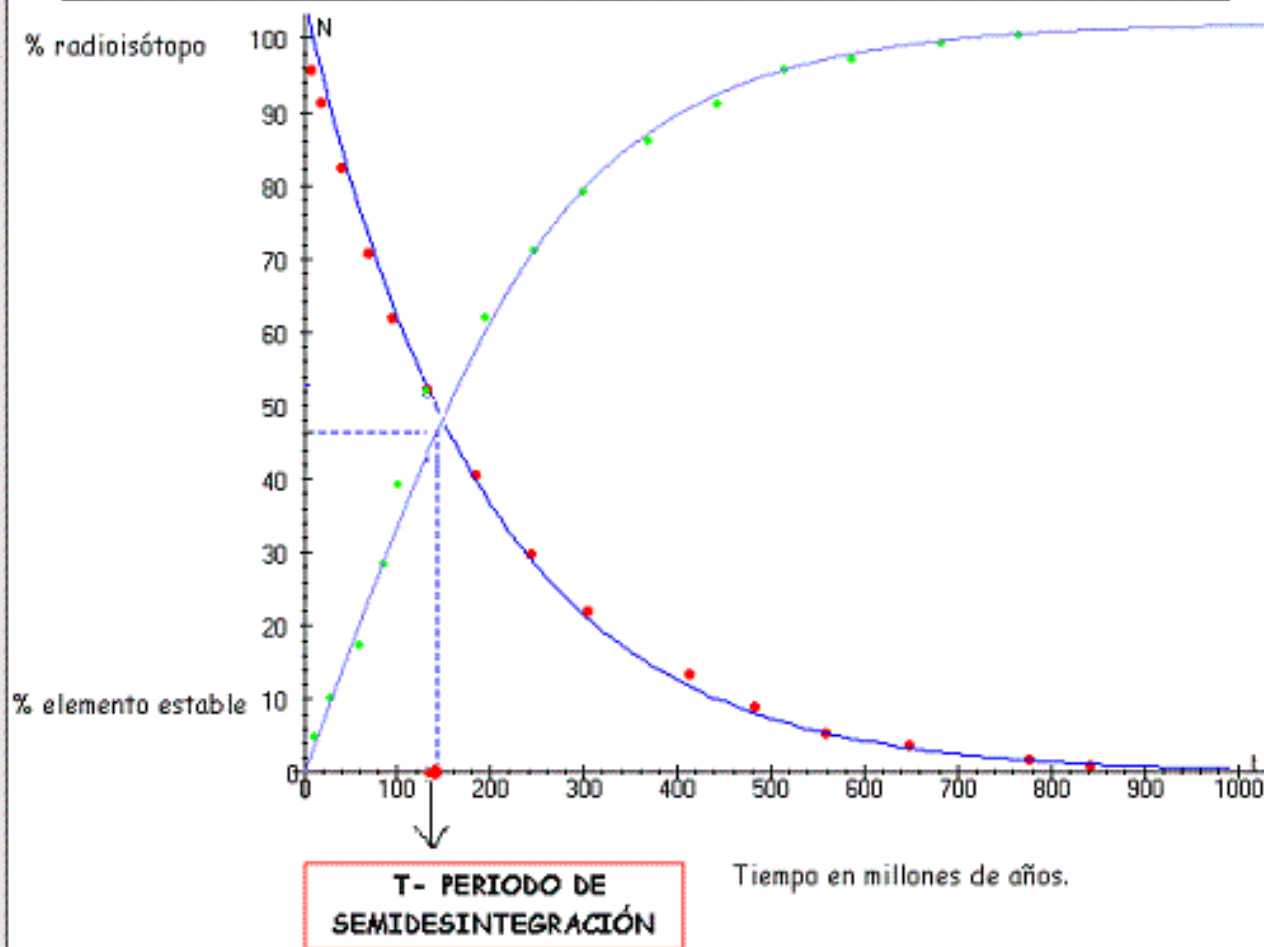








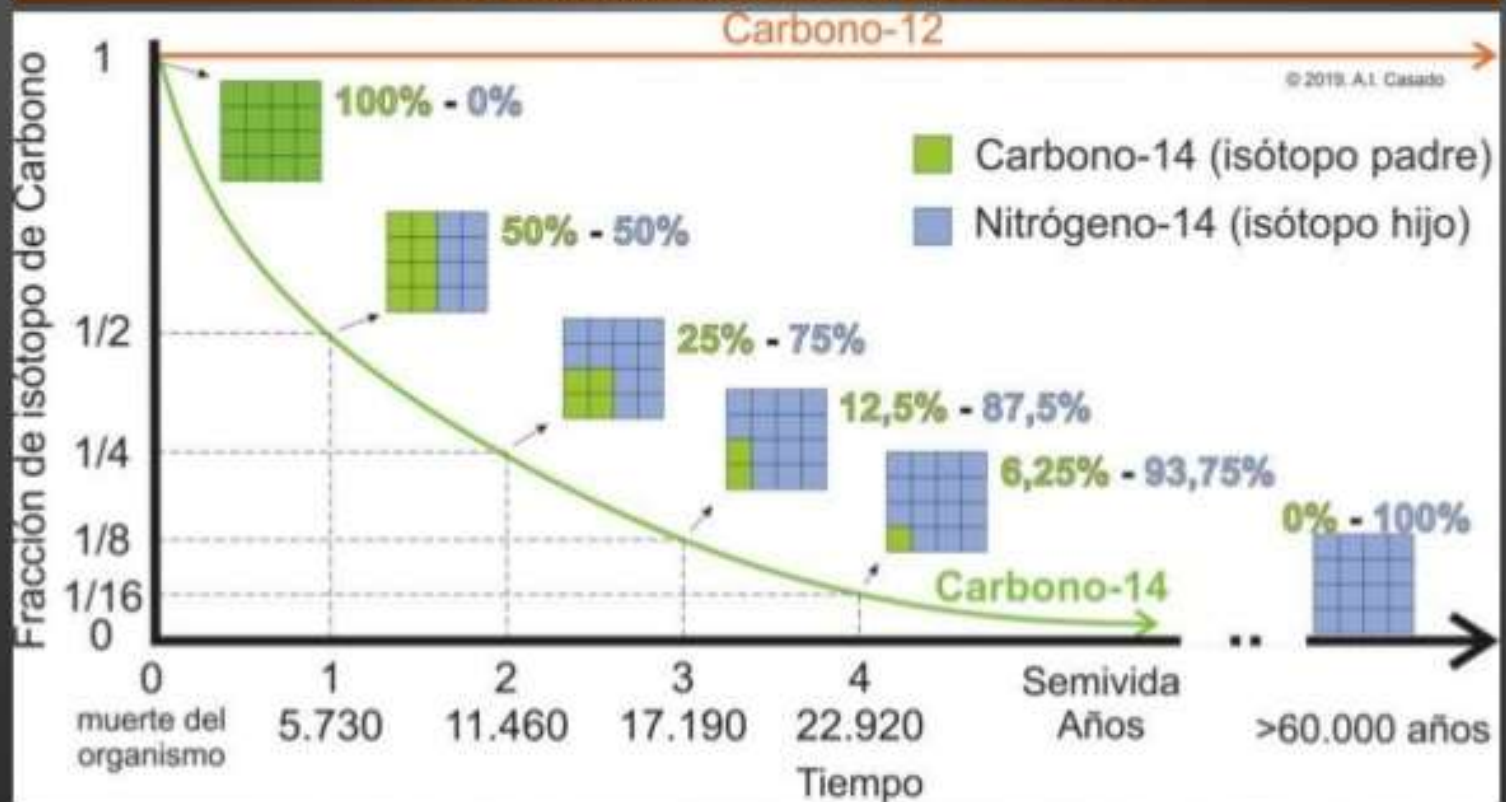
LA DESINTEGRACIÓN RADIOISOTÓPICA.



Tiempo geológico: datación absoluta

Método de datación por carbono radiactivo

Esta técnica de datación se basa en averiguar la proporción C14/C12 en materiales orgánicos: fibras vegetales, madera, huesos, pelo, carbón, etc.



Tiempo geológico: datación absoluta

El espectrómetro de masas es un instrumento que mide las proporciones de átomos de diferentes masas.



Datación Radiométrica

potasio-argón



WG98/Radiom01.cdr

Periodo radioactivo

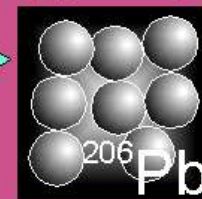


16 isótopos

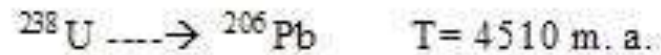
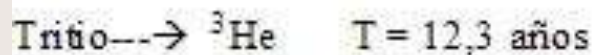
$$\tau = 4,468\text{Ga}$$

serie de desintegración radioactiva

8 isótopos



Radiome1.cdr, S.Griem-Klee



Carbon 14 dating

Developed in 1949 by Willard Libby (Chemistry Nobel Prize in 1960) and perfected in 1977 with the creation of mass spectrometry by particle accelerator, the radiocarbon or carbon 14 is a very dependable method to measure organic remains of up to 60,000 years old, although it is not foolproof.

Dating problems

Something inconvenient about the method is that it assumes that the production of carbon 14 in the atmosphere has been constant for the last 60,000 years. However, there have been fluctuations in different ages and places that have to be taken into consideration. Additionally, the samples may have been contaminated after the death of the living organism, concluding in a dating of less age than the real one.

Loss of carbon

All organisms absorb carbon during their lives and, when they die, lose carbon in a regular and constant way, so the percent of their existence can be dated. The mass spectrometer by particle accelerator (AMS) allows analyzing very small samples.

WHAT AN ISOTOPE IS

They are atoms that have the same amount of protons but different amount of neutrons. Carbon has 3 isomers: ^{12}C , ^{13}C and ^{14}C . Carbon 14 is radioactive, since it decays by emitting a beta ray. This indicates, present in all natural organic beings, about dating number of up to 60,000 years of age.

ION SOURCE

It allows isolating the molecules present in the samples (living). For this, the samples are separated to lower the amount of protons and the detector is equipped to detect and isolate the ions that comprise the molecule in function to their charges.

1 IONIZATION OF THE SAMPLE

It is achieved by electron bombardment. For this, carbon is placed with a small amount of electrons in the sample and others negative carbon ions. The result of such physical phenomenon is placing that is induced by the vacuum.



OTHER METHODS

Dating of the elements can also be done with other scientific techniques.

Dendrochronology

It is the dating based on the tree rings. Every tree produces a new ring each year, with different thickness according to climatic conditions. This method is very accurate, but it is useful to date plants only up to 10,000 years.

Radioisotopes

It is used to date elements. The technique allows measuring the amount of water in the body elements from radiocarbon since they are radioactive when they were in life.

POTASSIUM - ARGON

Like the radiocarbon, it is based on the radioactive decay of potassium-40, which is produced in the earth. It is used to date rocks of up to 4,000 years old, although it can be used to date rocks of up to 100,000 years old.

Uranium 238

Radiocarbon is not the only method that allows dating. Uranium 238, a radioactive element, allows dating rocks of up to 4,000 years old, although it can be used to date rocks of up to 100,000 years old.

Thermoluminescence

It measures radiation emitted by the crystalline structure of minerals. It is used to date rocks of up to 10,000 years old, although it can be used to date rocks of up to 100,000 years old.

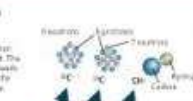
2 MAGNETIC DEFLECTOR

It makes the first separation of negative ions. In this stage, molecules of carbon 14 are separated from carbon 12 and carbon 13. The ions are separated by their mass and deflected by the magnetic deflector.



3 THE ACCELERATOR

It generates a high voltage to accelerate the ions. The ions are accelerated by the positive ions in the vacuum of the device.



4 ELECTROSTATIC DEFLECTOR

This device creates an electrostatic field that deflects ions with positive charges. Carbon 14 ions with higher positive charges continue through the deflector.



5 MAGNETIC ANALYZER

It is used to separate the ions. The ions are separated by their mass and deflected by the magnetic analyzer. The ions of ^{14}C continue to the detector.



6 THE DETECTOR

Carbon 14 ions generate a pulse when they hit the detector. This is measured by the energy of the ions. The amount of the energy of the ions is proportional to the amount of carbon 14 in the sample.



THE ONLY SURVIVAL OF THE RICH

For the dating of the last 10,000 years, the only survival of the rich is the radiocarbon. The sample is placed in a container and the ions are separated by their mass and deflected by the magnetic analyzer. The ions of ^{14}C continue to the detector.



