

SHORT COURSE

Stable isotopes in Earth Sciences: principles, methods and applications

Docente: Prof. Mariano Parente (DiSTAR, Università di Napoli Federico II)

Dipartimento Scienze Chimiche e Geologiche,
via Campi 103 – Modena
19 OTTOBRE ORE 14.00-18.00 (aula U 1.2)
20 OTTOBRE 9.00-13.00 (aula Uint.5)

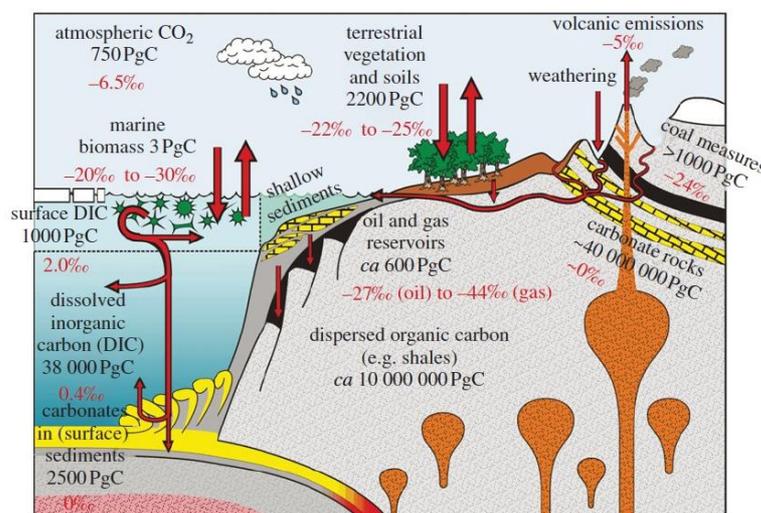
Aim and content:

Stable isotopes have many applications in sedimentary geology. Carbon, oxygen and strontium isotopes have been widely used during the last decades both as tools of high resolution stratigraphy and as tracers of palaeoceanographic and palaeoclimatic changes. These isotopes are routinely analyzed and are a common dataset of many studies in sedimentary geology. At the same time, new isotopic proxies are continuously introduced and refined, paralleling the progress in analytical techniques.

The record of the isotope ratios of geological materials, like sedimentary minerals and rocks, organic matter and fossils, opens a window on the history of earth climate and on the functioning of biogeochemical cycles. Successful application of stable isotope data requires an understanding of the processes controlling isotope speciation and fractionation. Transferal of an isotopic signal from the earth reservoir (i.e. the atmosphere or the ocean) to a geological material acts always as a complex filter. Geological processes, like diagenesis, erosion and reworking, acting during the long span of time from the original imprinting of the isotopic signal in a geomaterial to our analysis in the lab, must be carefully evaluated as they can blur or overprint the pristine signal.

The aim of this course is:

- to give an introduction to the basic principles of isotopic fractionation, and to the applications of stable isotope ratios of geomaterials as palaeoenvironmental proxies and as high-resolution stratigraphic tools
- to review the use of oxygen isotope ratio of sedimentary rocks and fossils as a paleoclimatic proxy.
- to discuss the state of the art of oxygen isotope stratigraphy
- to review the use of the carbon isotope ratio of sedimentary rocks as tracers of perturbations of the long- term carbon cycle (oceanic anoxic events, hyperthermals, ocean acidification events).
- to discuss the potential and limitations of carbon isotope stratigraphy, by illustrating case histories from the geological literature
- to introduce the processes governing the changes of the strontium isotope ratio of the ocean and the use of the Sr isotope ratio of sedimentary rocks as tracers of global tectonics and paleoclimate changes
- to discuss the method of strontium isotope stratigraphy using significant case histories
- to give a short review on new isotope proxies and their applications in stratigraphy and paleoceanography



(from Dunkley Jones et al., 2010)