

Using Carbon-14 for Age Dating

Determining the age of archaeological objects or geological events is important for understanding the historical record. Carbon-14 offers an absolute dating method for time scales very important to archaeologists and geologists studying recent geological history (up to ~60,000 years ago). To complete this activity you will need the interactive Excel spreadsheet or Excelet available at: http://academic.pgcc.edu/~ssinex/excelets/age_dating_3.xls.

Using the *concept tab*, how does the P/P_0 ratio vary with time?

For carbon-14 dating to successfully predict age, what assumption about P_0 must be made? Using the *modern C-14 tab*, is this assumption true? Explain.

Carbon-14 is produced in the upper atmosphere. Using the *modern biota tab* address the following questions about the C-14 amount over time and carefully sketch and label the graph for each:

What type of relation exists if only production of C-14 occurs in the upper atmosphere and C-14 was a stable nuclide? What happens to the C-14 level in a living organism?



What type of relation exists if both production and decay occurs? What happens to the C-14 level in a living organism after a period of time?



What happens to the level of C-14 over time if death occurs to the living organism? Why?



Use the *C-14 dating tab* to address the questions below.

How old is a piece of wood from an ancient campfire with a measured $^{14}\text{C}/^{12}\text{C}$ ratio of 3.86×10^{-13} ? Explain how you determined the age.

Since C-14 dating was first proposed by Libby in 1947, the half-life of C-14 has been reassessed. Let's investigate a single error at a time.

How is the determined age of an artifact influenced for the following possible errors?

- Old half-life is used
- Change the initial ratio, $(^{14}\text{C}/^{12}\text{C})_0 = 1.10 \times 10^{-12}$
- Sample is contaminated with modern living material

What type of error in the carbon-14 ages results when changing from the old to the new half-life? See the *assess II tab* and sketch and label a graph.



Survey of the Radiometric Dating III: Carbon-14 Method Excelet

Please answer the following questions honestly when considering the Radiometric Dating III: Carbon-14 Method Excelet and activity that you have used for this assignment.

Ease of overall use of the interactive Excel Spreadsheet:

real difficult difficult so, so easy real easy

Excelets offer a more visual experience with graphs instead of using just the mathematical equations.

most definitely I think so just barely not at all don't know

Excelets make it easier to grasp or learn a concept.

most definitely I think so just barely not at all don't know

I like the interactive nature of Excelets because it lets me (I don't like interactive)

play & experiment discover on my own think all of these don't know

Do you think that this activity helped you understand the concepts involved with carbon-14 age dating?

Yes No Maybe

Why?

Can you suggest a way to improve the activity? If so, explain.

Any general comments or suggestions?

...and thanks for taking time to provide feedback!