

What about those dates?

Why are there so many dates for the Debert sites? 10,600 years old? 11,000 years? 13,000 years? Actually, scientists agree that people were living at the Debert and Belmont archaeological sites sometime before 11,000 calendar years ago. If everyone agrees, why do we hear so many different dates for the Debert sites? The problem of differing dates comes from the larger process of radiocarbon dating and its use.

What was dated at Debert?

Radiocarbon dating can *only* be used on organic materials (animal bone and tissue, plant tissue, shells, etc.). At the Debert site, wood—probably spruce, from fire pits (or *hearths*), was dated. Most experts consider 12 dates from 9 different hearths to be reliable. While we assume that most of these fire pits were for cooking food or heating homes, some were tool-making hearths as the people at Debert used heat to make stone tools.

It is extremely unusual to have this many radiocarbon dates from sites that are this old. In fact, the dates from Debert heavily influence understandings of early sites throughout North America.

Figure 1. The dates from the Debert sites come from the excavations from the first (and largest) site that was excavated by George MacDonald and his crew in the 1960s. The Debert sites remain the best dated sites of this age in northeastern North America. Image courtesy of the Robert S. Peabody Museum of Archaeology, Andover, MA, USA.



How does radiocarbon dating work?

All *living* organisms absorb different forms of carbon from the environment when they are alive. Some carbon absorbed during the organism's life is "radioactive," or unstable, carbon. When an organism dies this unstable carbon begins to change from unstable carbon-14 into the more stable carbon-12. This process of change from unstable, or radioactive, carbon to stable carbon is called radiocarbon decay.

Radiocarbon dating is simply a measurement of this transformation. We know the amount of radioactive carbon absorbed by living organisms is more or less constant, and we know

that it takes about 5,730 years for half of the carbon-14 in the organism to turn into carbon-12. This rate is called a half-life. If a piece of wood contains 50% of the radioactive carbon in the environment around us now, we know it is about 5,730 years old because half of it has turned into carbon-12. Radiocarbon dates are always shown as a range with plus and minus values, which I have not included here for simplicity.

Why do people use different dates?

People use different dates for Debert for three primary reasons. The first reason is that it turns out that *calendar years* and *radiocarbon years* are not the same. Calendar years refer to the normal years people know of—365 days. For a long time, it was assumed that the amount of carbon being absorbed by living organisms was constant all through time. This turns out not to be true. The amount of carbon in the atmosphere has changed slightly through time. So the amount of carbon absorbed per calendar year is not exactly the same from one calendar year to the next. The process of *calibration* corrects radiocarbon "years" into calendar years to account for these changes.

Feature	Section	Sample Number	Date ¹⁴ C BP	Calibrated Age cal BP (2σ)
4	A	P743	10,466 ± 128	11,972–12,638
7A	D	P739	10,656 ± 134	12,135–12,848
7	D	P741	10,545 ± 126	12,063–12,677
7	D	P967	10,641 ± 244	11,760–13,099
7	D	P966	10,572 ± 121	12,093–12,690
11	F	P970	10,518 ± 120	12,056–12,651
11	F	P970A	10,467 ± 118	11,998–12,617
11	F	P971	10,773 ± 226	12,061–13,153
17	F	P975	11,026 ± 225	12,549–13,348
12	G	P972	10,511 ± 120	12,049–12,647
19	H	P977	10,128 ± 275	11,076–12,596
15	J	P973	10,652 ± 114	12,370–12,796
16	J	P974	10,837 ± 119	13,011–13,065

Figure 2. This figure shows the dates from the original Debert site and the calibrations from radiocarbon years to calendar years.

Calibration does not make a big difference for sites that are relatively young (say 1,000 years), but for sites as old as Debert they make a big difference. The earliest radiocarbon date at Debert of 11,100 radiocarbon years calibrates to a little less than 13,500 calendar years (see figure 2).

The second reason there is confusion about the Debert dates is that they range between 11,100 radiocarbon years ago and 10,100 radiocarbon years ago. Some people average the radiocarbon dates to 10,600 radiocarbon years. Other people (me included) do not see any reason to collapse all these dates into an average—at least not at this time. The dates come from a range of “features” (in this case fire pits, or hearths). If

It is accurate to say that people lived at Debert more than 11,000 years ago. It is also accurate to say that people lived at Debert by 13,000 years ago.

we are trying to understand life at the sites, the choice to average the dates or not is very important. If we average the dates, we end up saying something like “people lived at Debert 10,600 radiocarbon years ago,” as if it was a single event. This is very different from saying “people lived at the site on and off between 11,100 radiocarbon and 10,100 radiocarbon years ago.” Was this a place that people lived at once? Or was it a place that generations of people returned to over thousands years?

The last source of confusion over the dates is that a few scientists believe the wood dated from the site is actually older than 13,000 calendar years. This view relies on

interpretations of what was dated—they believe forest fires are the source of the carbon at the sites. They also have questions about how the samples were prepared in the laboratory. So, sometimes we hear people say that people lived at the sites more than 13,000 years ago.

The final word?

In summary, I like to say that people were in Debert more than 11,000 years ago because it leaves the

question of when people actually arrived open. Other people like to use the oldest possible date we know right now, 13,500 years. Either way, it was a time when the climate was fluctuating dramatically (much more than global warming today), and when people’s skills for adapting and dealing with extreme conditions must have been very well developed. It is truly an amazing story!

—Leah Morine Rosenmeier
Research and Interpretation Specialist

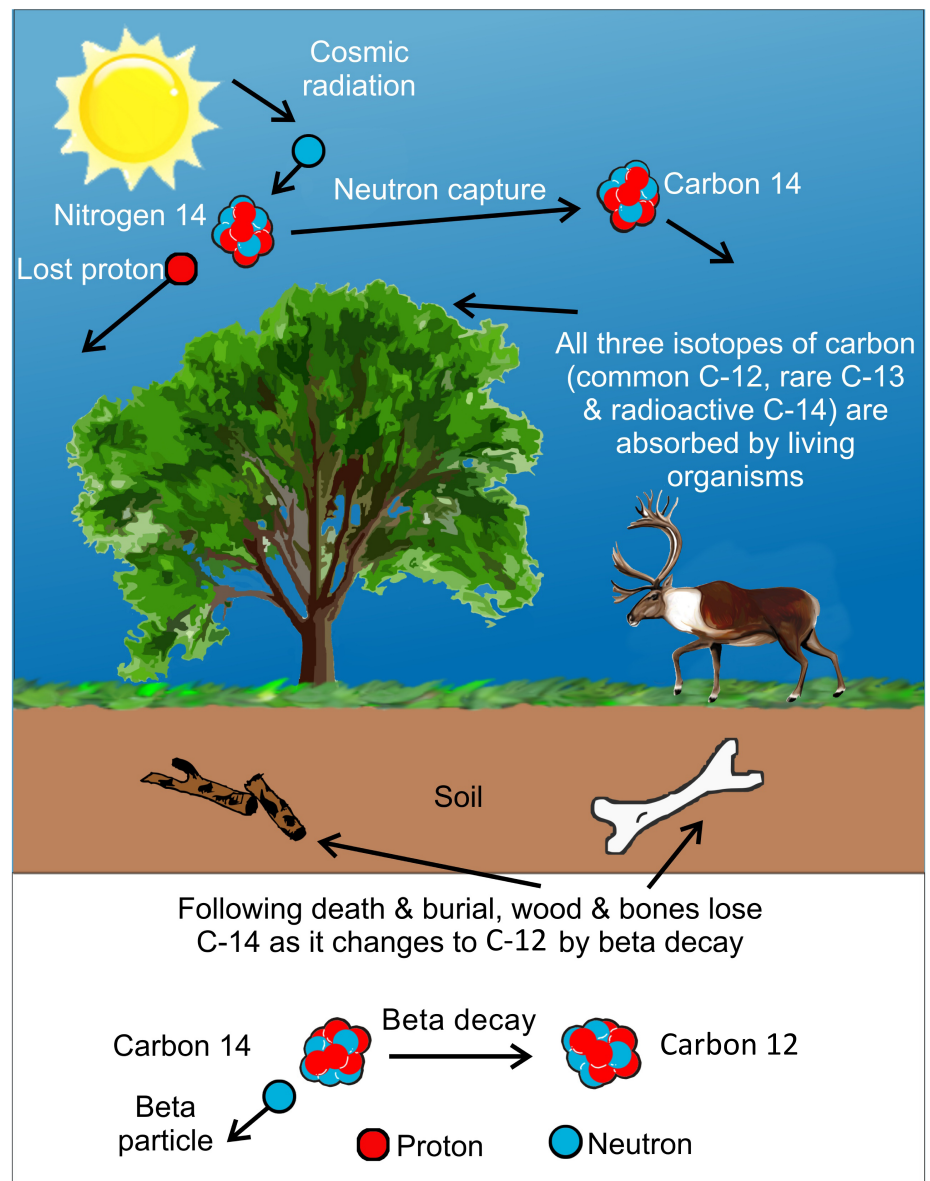


Figure 3. This image shows the chemical processes behind radiocarbon dating. Radiation from the sun bombards nitrogen in the atmosphere, producing carbon-14, an unstable, or radioactive, form of carbon. Carbon-14 is absorbed by all living organisms. When the living organisms die, the carbon-14 begins a process of “decay,” transitioning to the more stable form of carbon, carbon-12. Because this transition to carbon-12 occurs at a constant rate (more or less), we can tell how long ago the organism died by measuring the amounts of carbon left in the artifact. Image adapted by Kyle Gloade from [www.http://www.sciencecourseware.org/virtualdating/files/rc0/rc_0.html](http://www.sciencecourseware.org/virtualdating/files/rc0/rc_0.html).