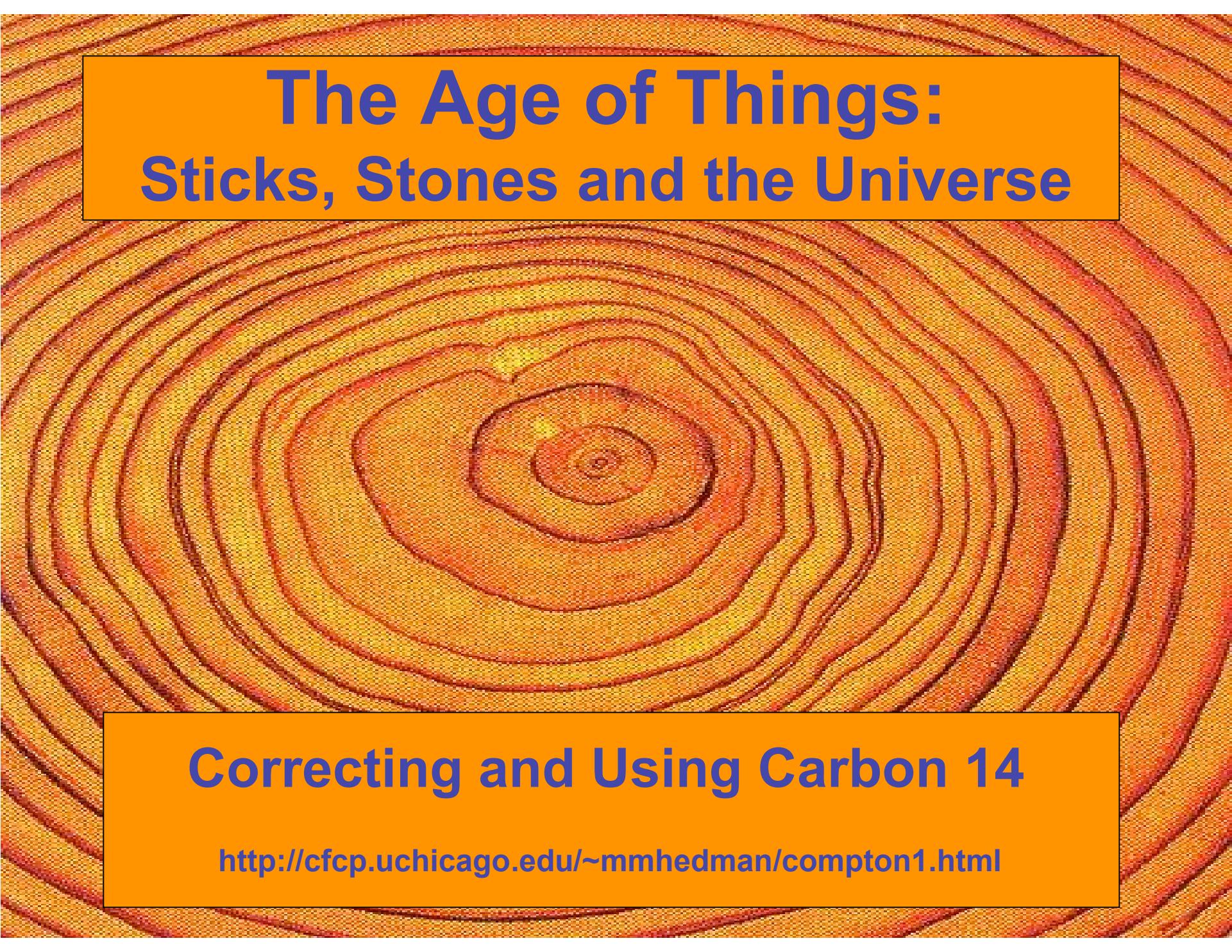


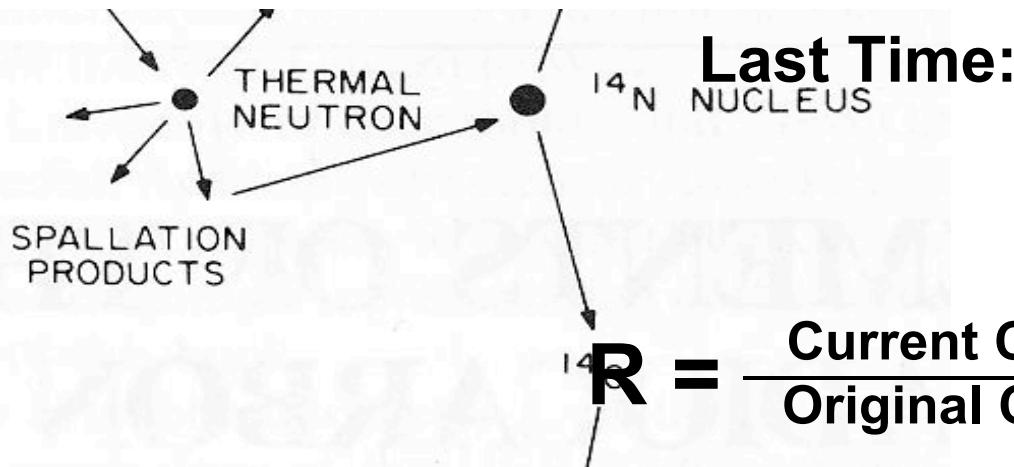
The Age of Things: Sticks, Stones and the Universe



Correcting and Using Carbon 14

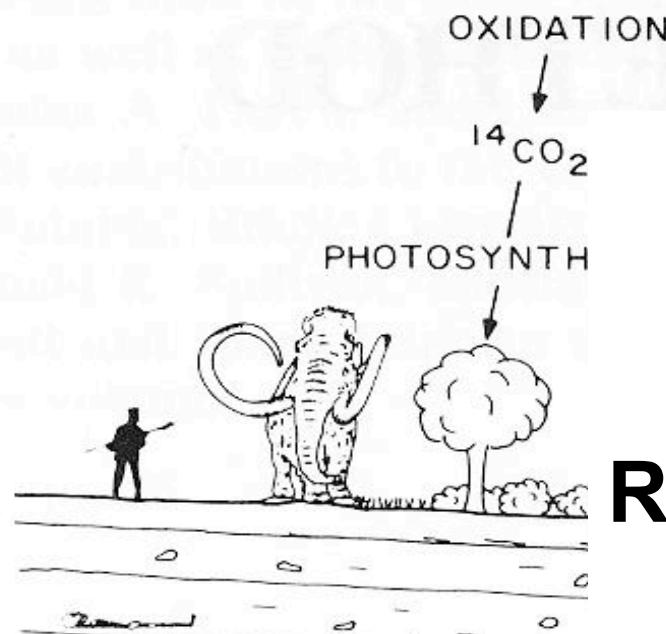
<http://cfcp.uchicago.edu/~mmhedman/compton1.html>

DUCT-ION



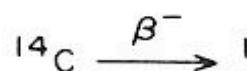
$$R = \frac{\text{Current Carbon-14 Fraction}}{\text{Original Carbon-14 Fraction}}$$

DISTR-BUTION

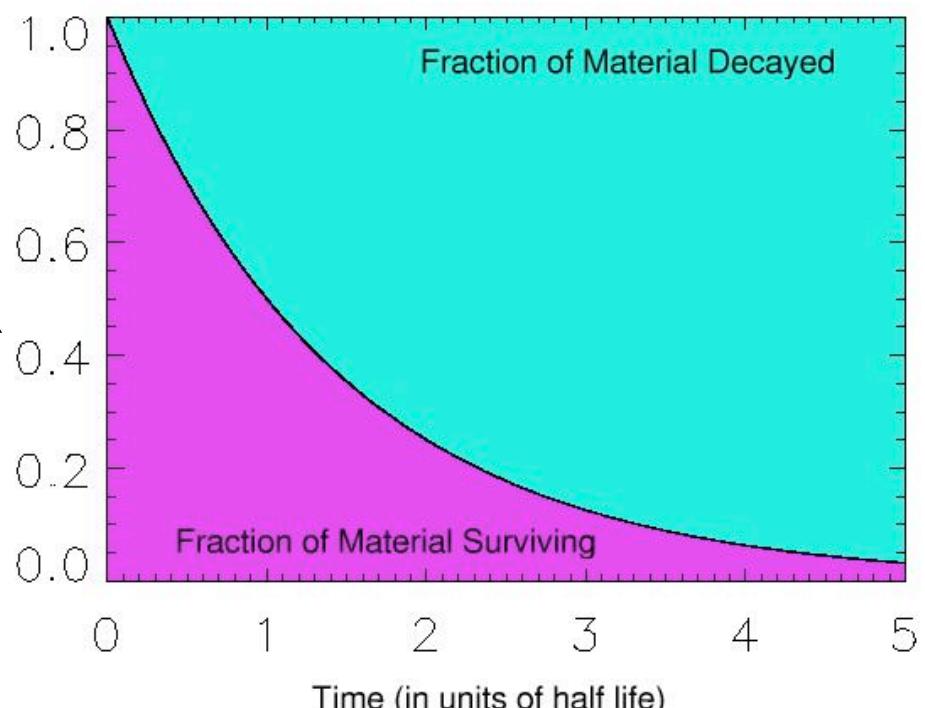
**R**

$$\text{Carbon-14 Fraction} = \frac{\text{Carbon 14}}{\text{All Carbon}}$$

DECAY



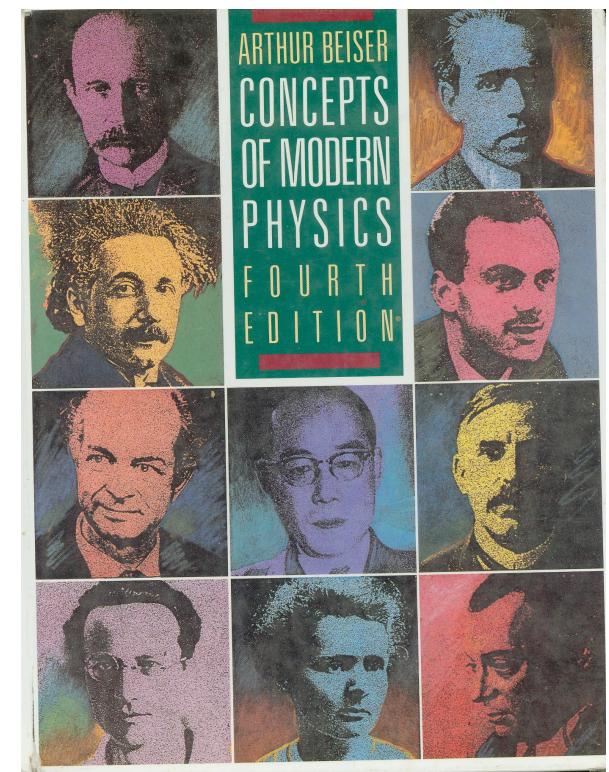
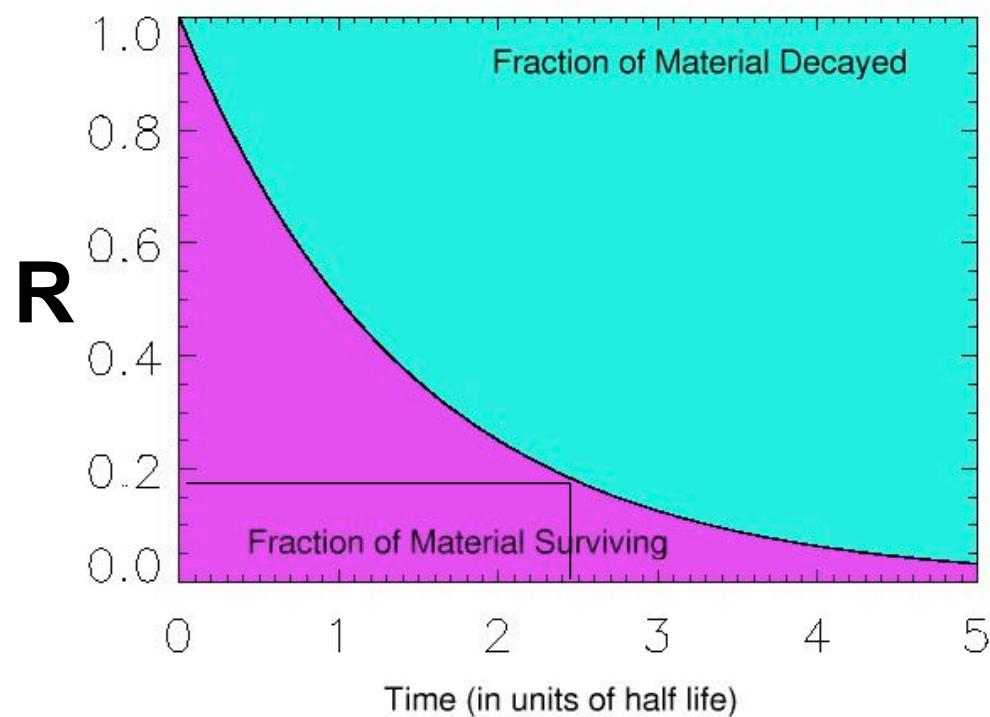
$$t_{1/2} = \text{ca. } 5700$$



A personal aside:

12.3 Radiometric Dating

- 14 The relative radiocarbon activity in a piece of charcoal from the remains of an ancient campfire is 0.18 that of a contemporary specimen. How long ago did the fire occur?



8. The relative radiocarbon activity in a piece of charcoal from the remains of an ancient campfire is 0.18 that of a contemporary specimen. How long ago did the fire occur? To date the wood, we use the radiocarbon dating formula

$$t = \frac{t_0 \ln(1/R)}{\ln(1/R - 1/18)} \quad t = \frac{5760}{0.693}$$

$$t = \frac{5760 \ln(1/0.18)}{0.693} \quad \text{for radiocarbon}$$

$$= 14253 \text{ yr} \checkmark \quad 575$$

This says the tree from which this sample was taken was fallen $\sim 14,000$ yrs ago. However, cannot judge this date as valid w/o adequate context. Does this date make sense in terms of other dates at

the site? For a single date is not very reliable in these situations. Furthermore is the sample contaminated? Could there be factors that would cause the date to be erroneous? Also, the date has not been properly altered to take into account fluctuation in radiocarbon levels from year to year. Finally, even if the above factors were taken into account, we only know when the tree was cut down (when it stopped taking up CO_2) we have no idea how long it might have sat around before being used in a fire. Therefore, unfortunately, we cannot tell when the fire occurred with the limited data given.

My Answer:

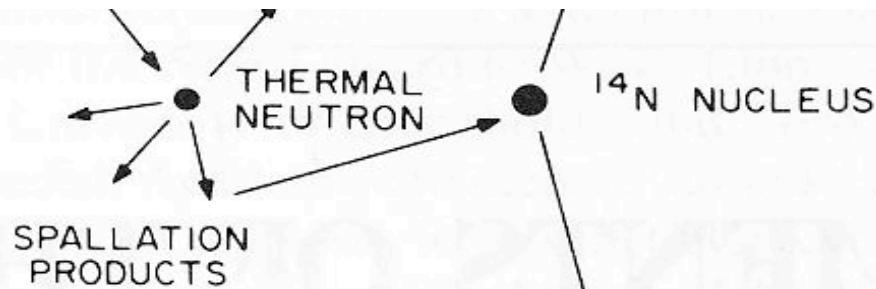
This says the tree from which this sample was taken was fallen ~ 14000 yrs ago. However, (we) cannot judge this date as valid w/o adequate context: Does this date make sense in terms of other dates at

the site? For a single date is not very reliable in these situations. Furthermore, is the sample contaminated? Could there be factors that would cause the date to be erroneous? Also the date has not been properly altered to take into account fluctuations in radiocarbon levels from year to year. Finally, even if the above factors were taken into account, we only know when the tree was cut down (when it stopped taking up CO_2) we have no idea how long it might have sat around before being used in a fire. Therefore, unfortunately, we cannot tell when the fire occurred with the limited data given.

DUCT-ION

DISTR-BUTION

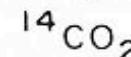
DECAY



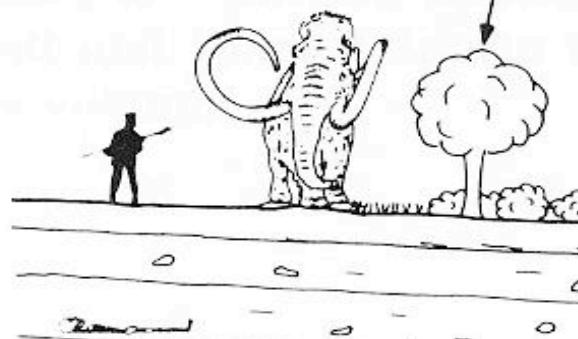
$$R = \frac{\text{Current Carbon-14 Fraction}}{\text{Original Carbon-14 Fraction}}$$

Measured with radioactivity
or AMS methods

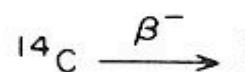
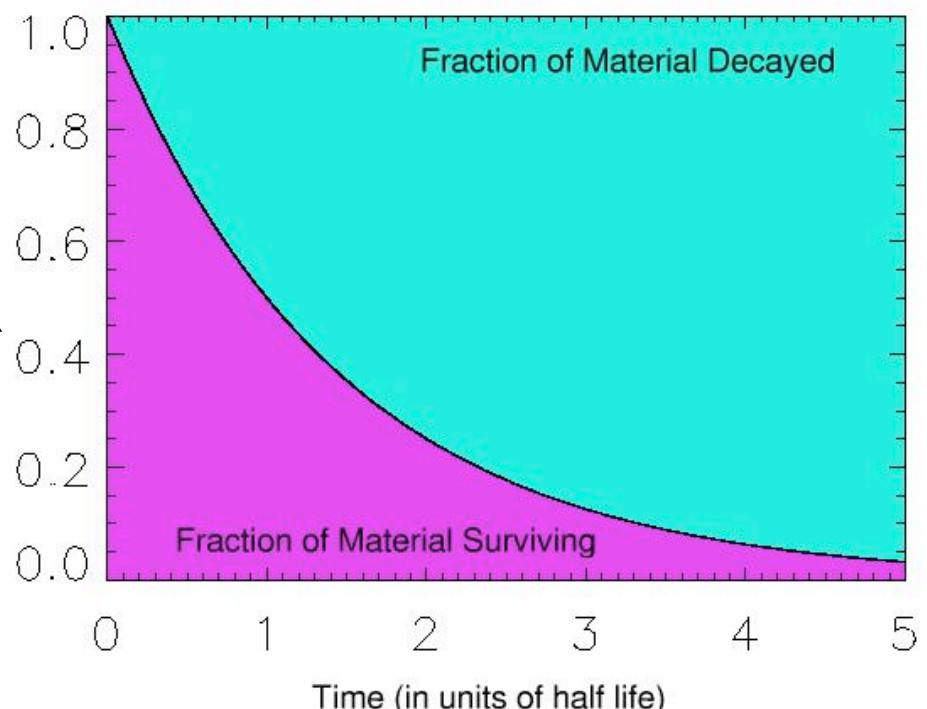
OXIDATION



PHOTOSYNTH

**R**

Measured using a contemporary
reference sample



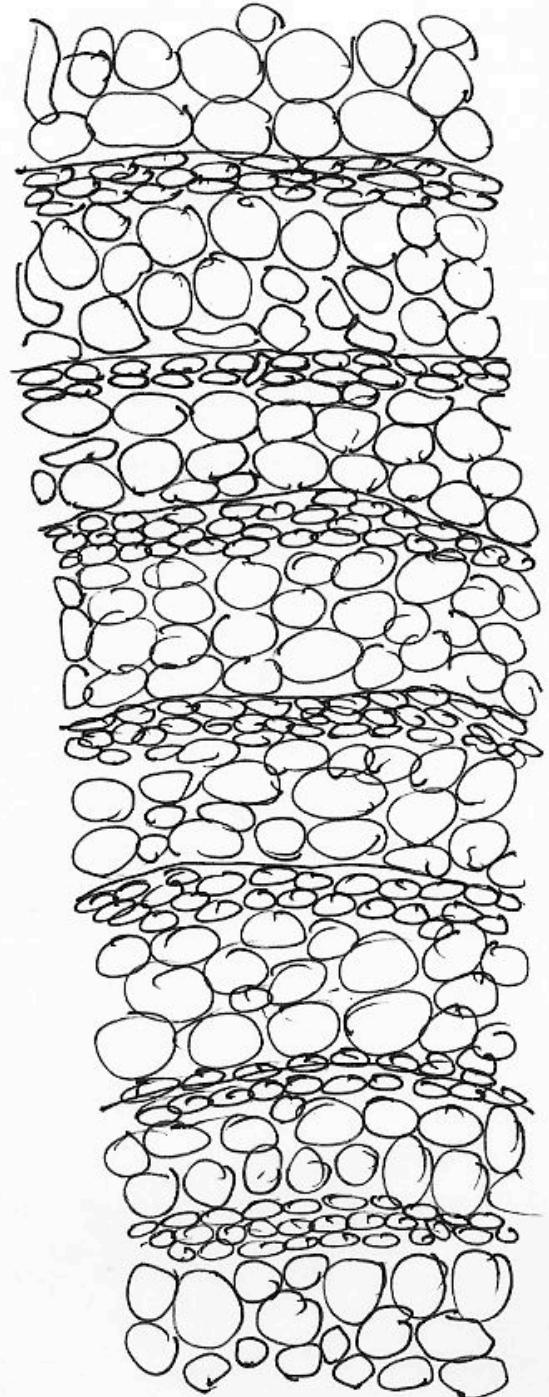
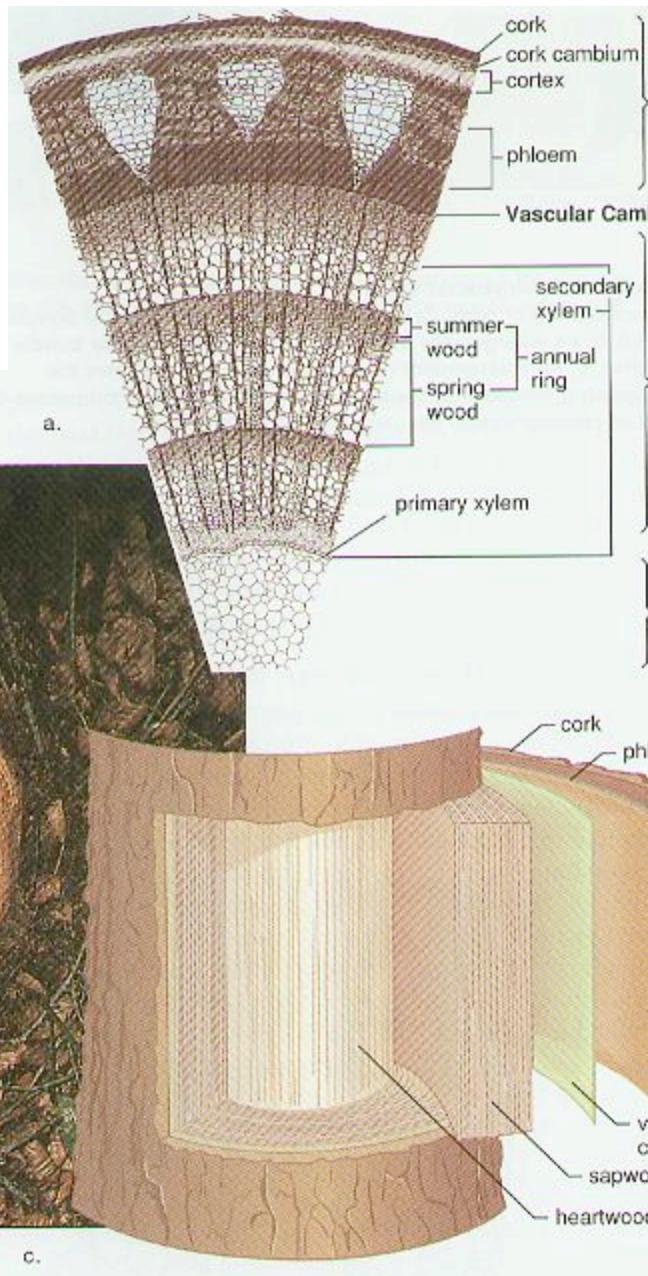
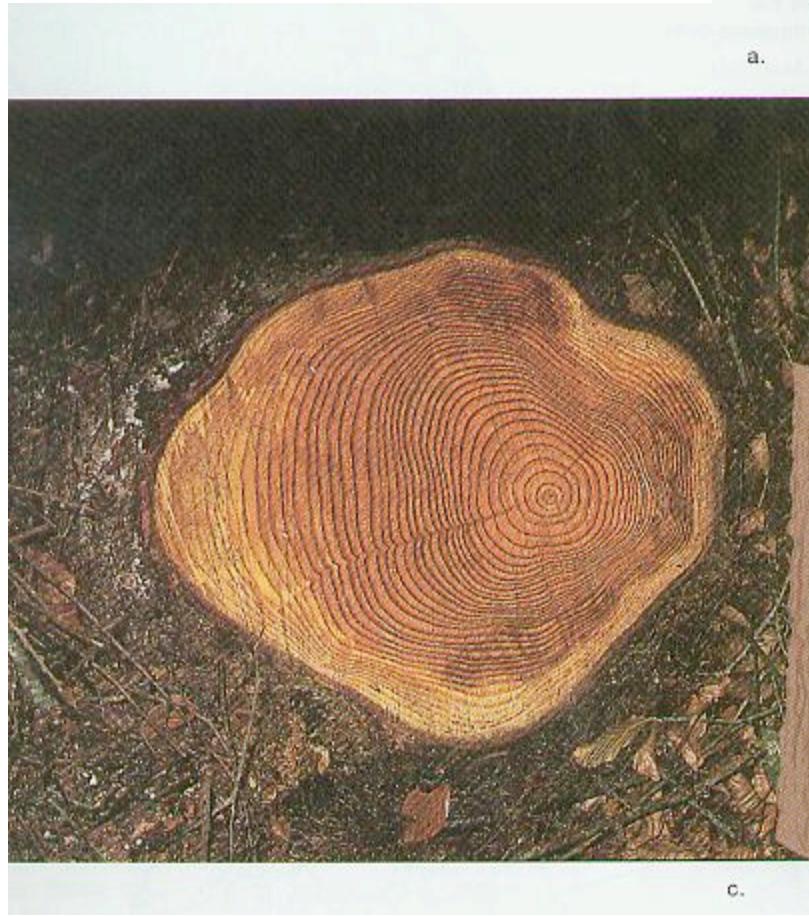
$$t_{1/2} = \text{ca. } 5700$$



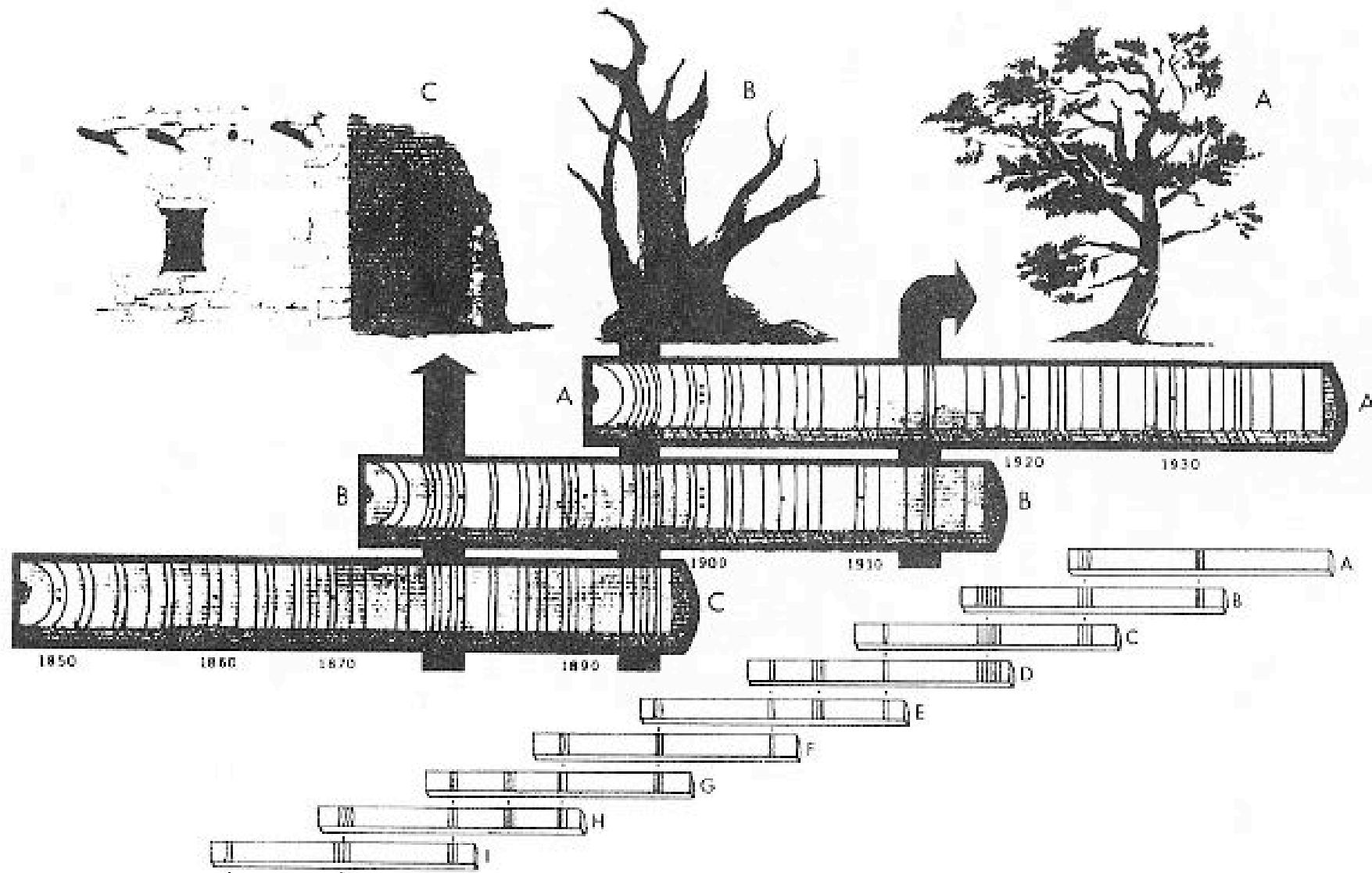
Warning!

Astrophysicist Talking about Tree-Rings!

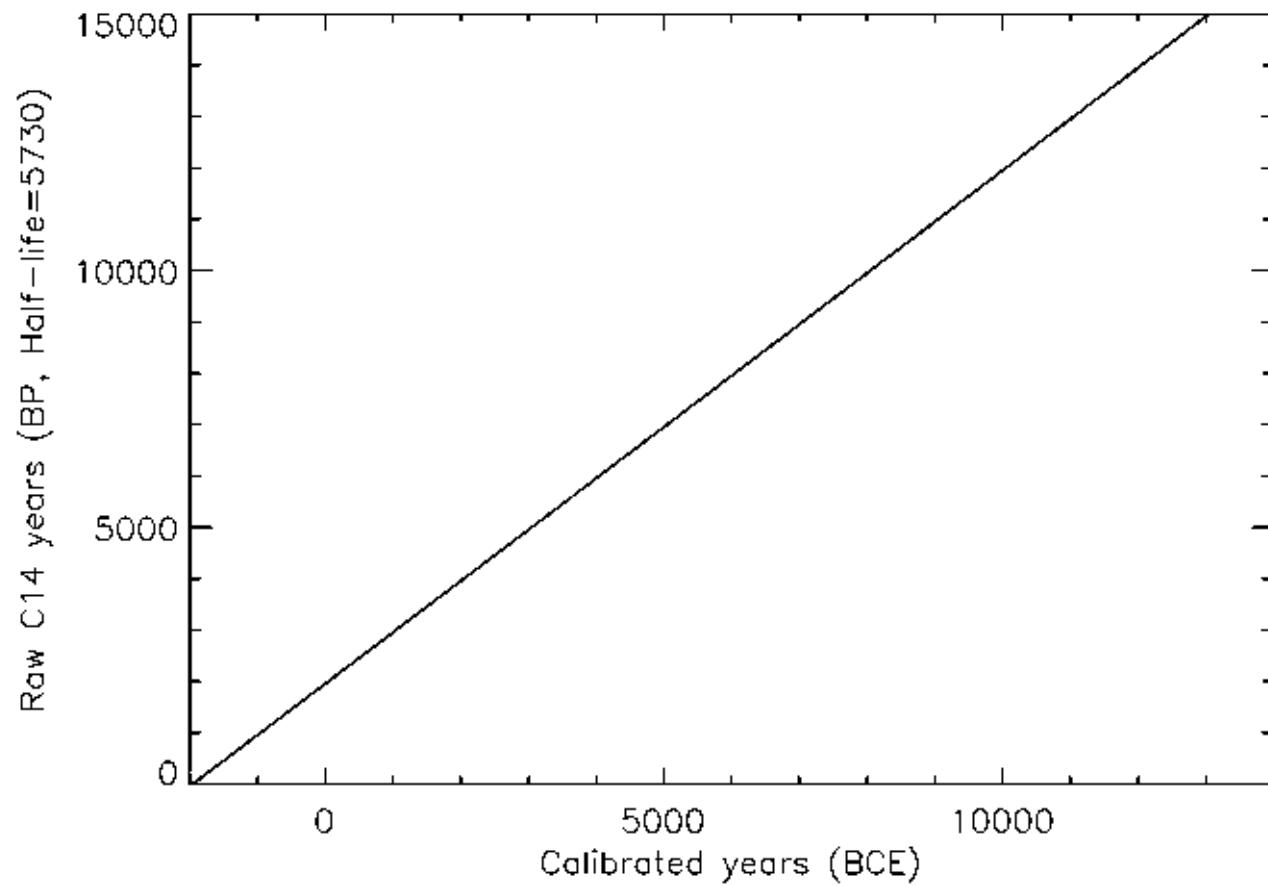
Correcting Carbon-14 With Tree Rings



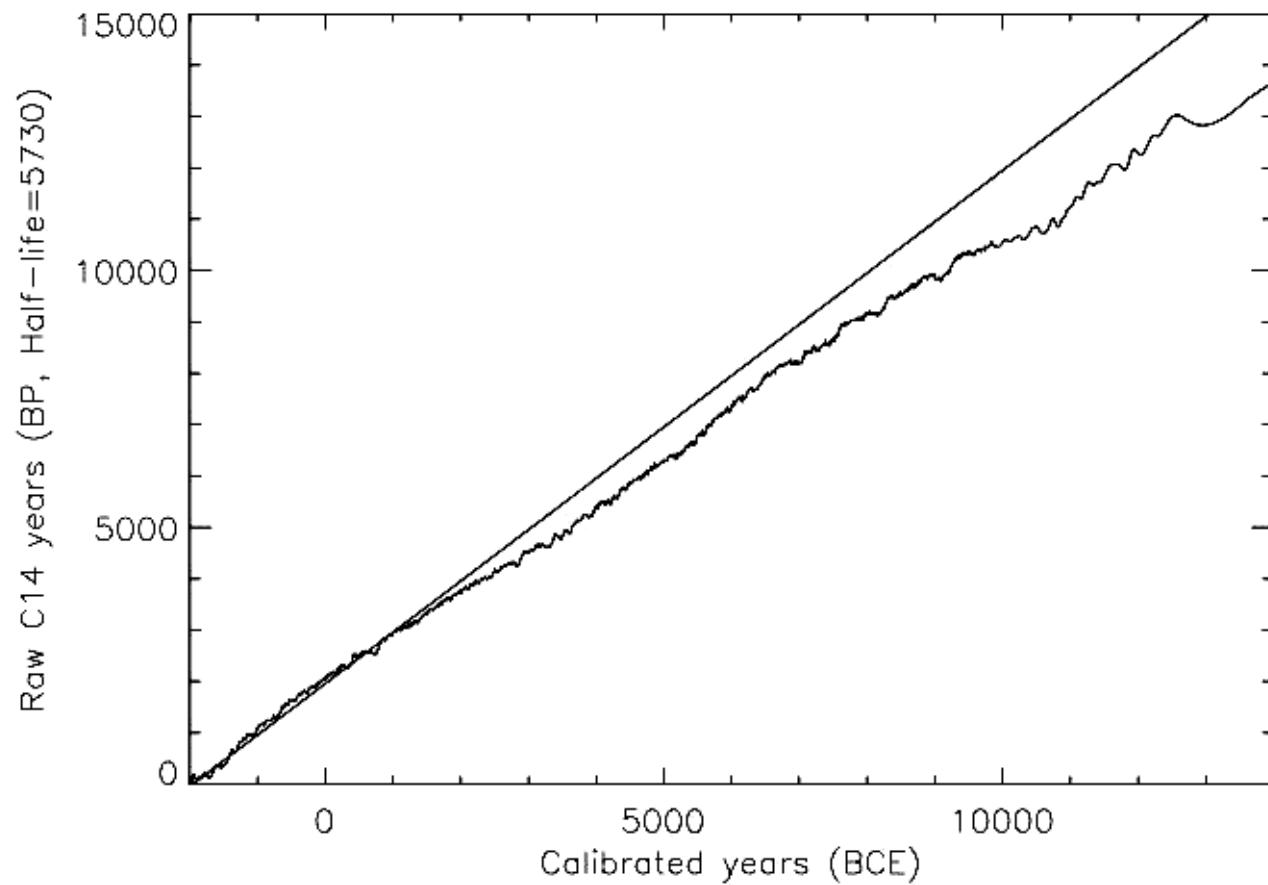
Dendrochronology



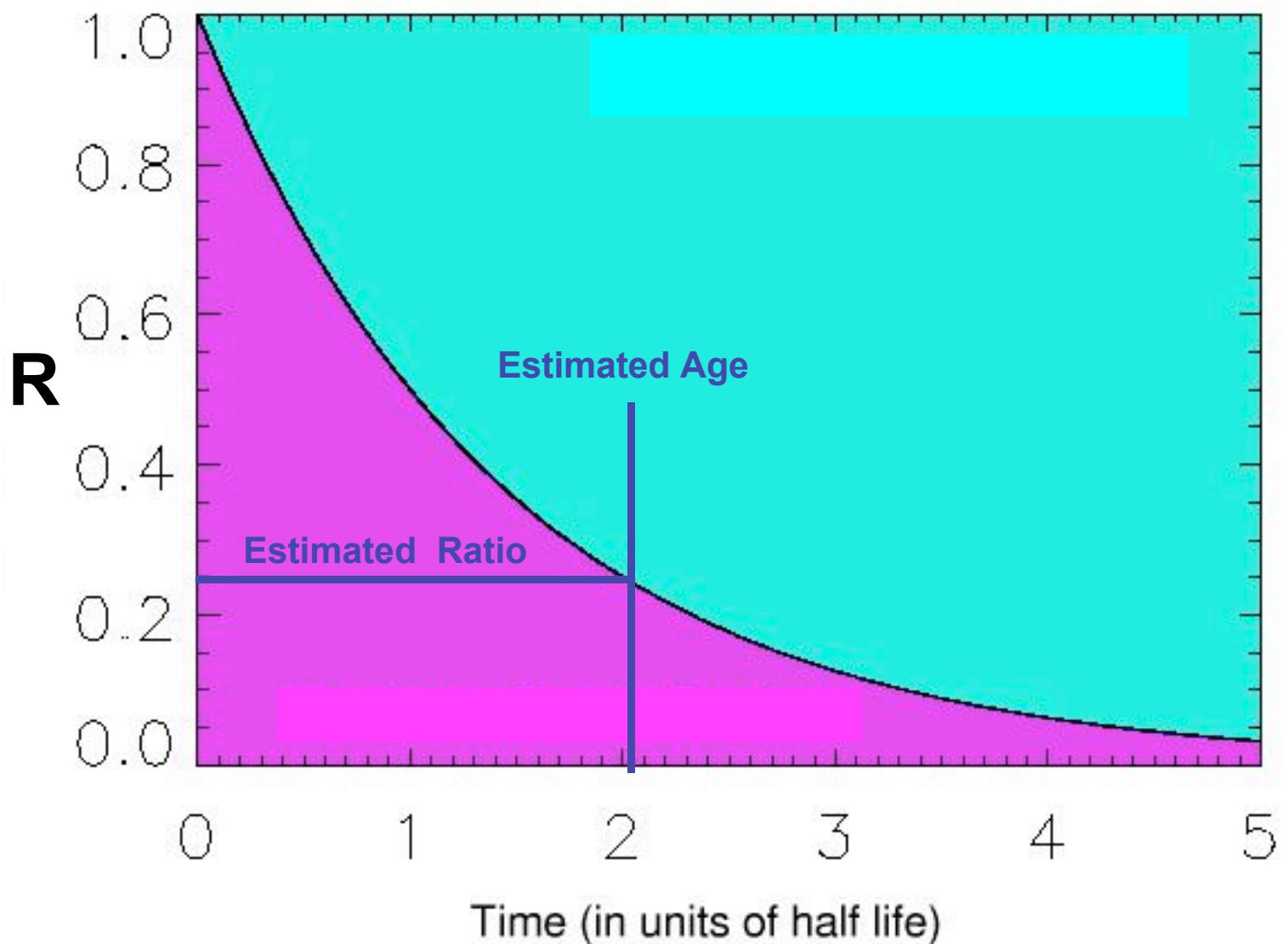
Calibrating Carbon-14 Dates with Tree Rings



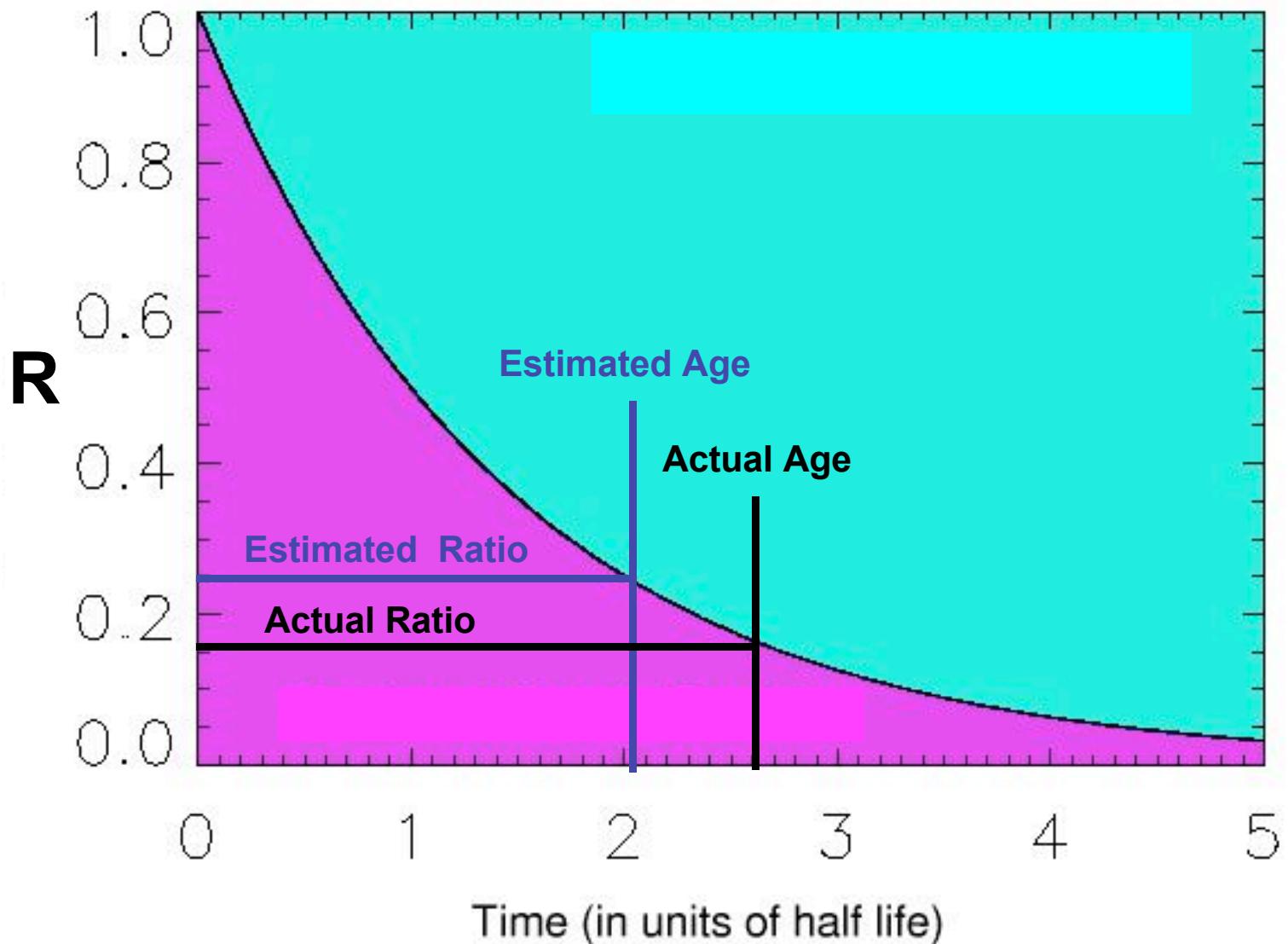
Calibrating Carbon-14 Dates with Tree Rings



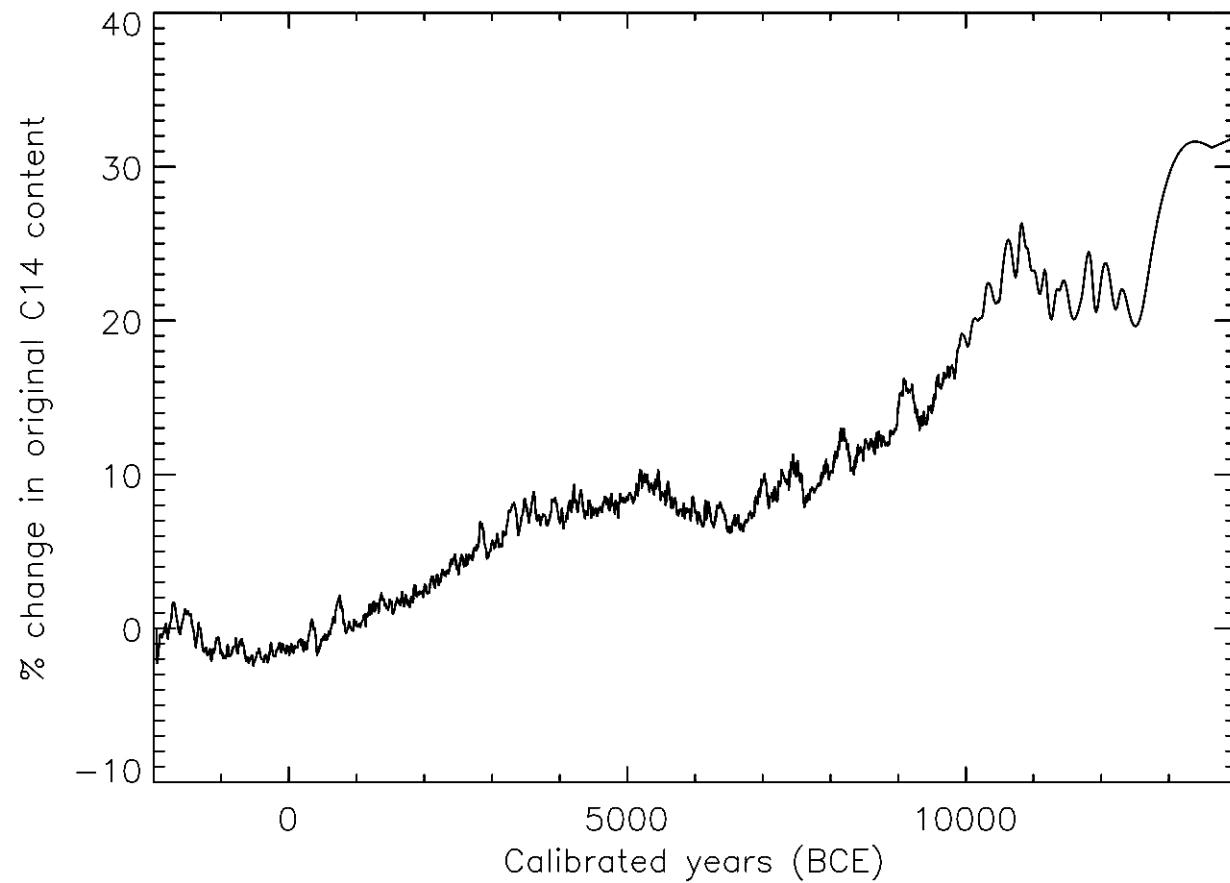
$$R = \frac{\text{Current Carbon-14 Fraction}}{\text{Original Carbon-14 Fraction}}$$



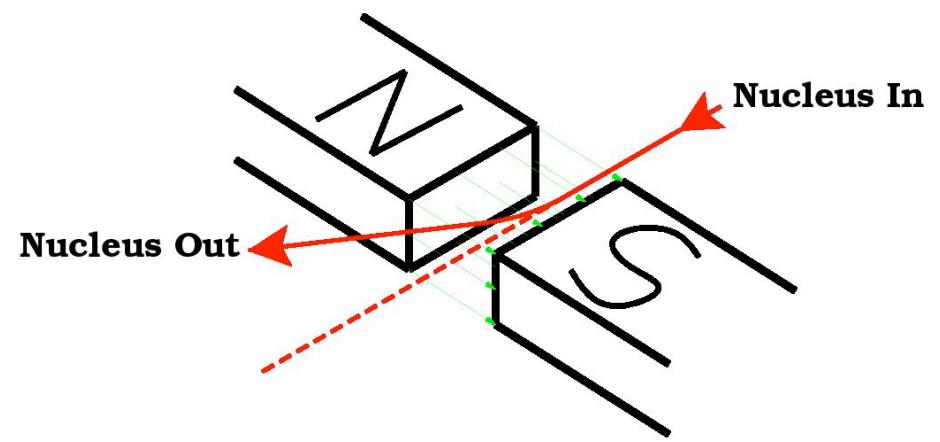
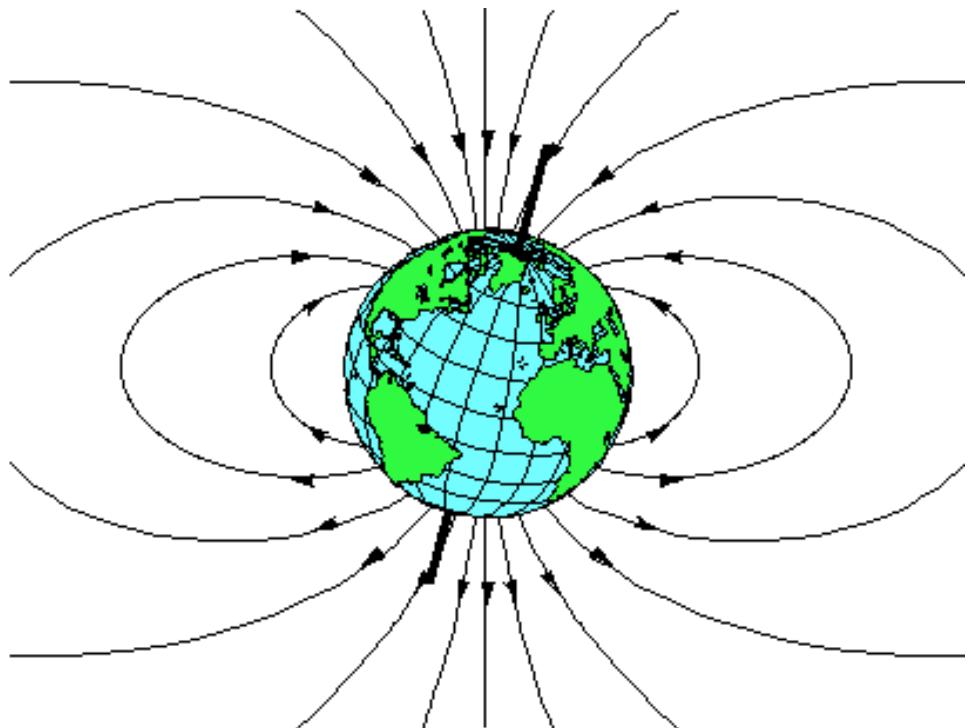
$$R = \frac{\text{Current Carbon-14 Fraction}}{\text{Original Carbon-14 Fraction}}$$

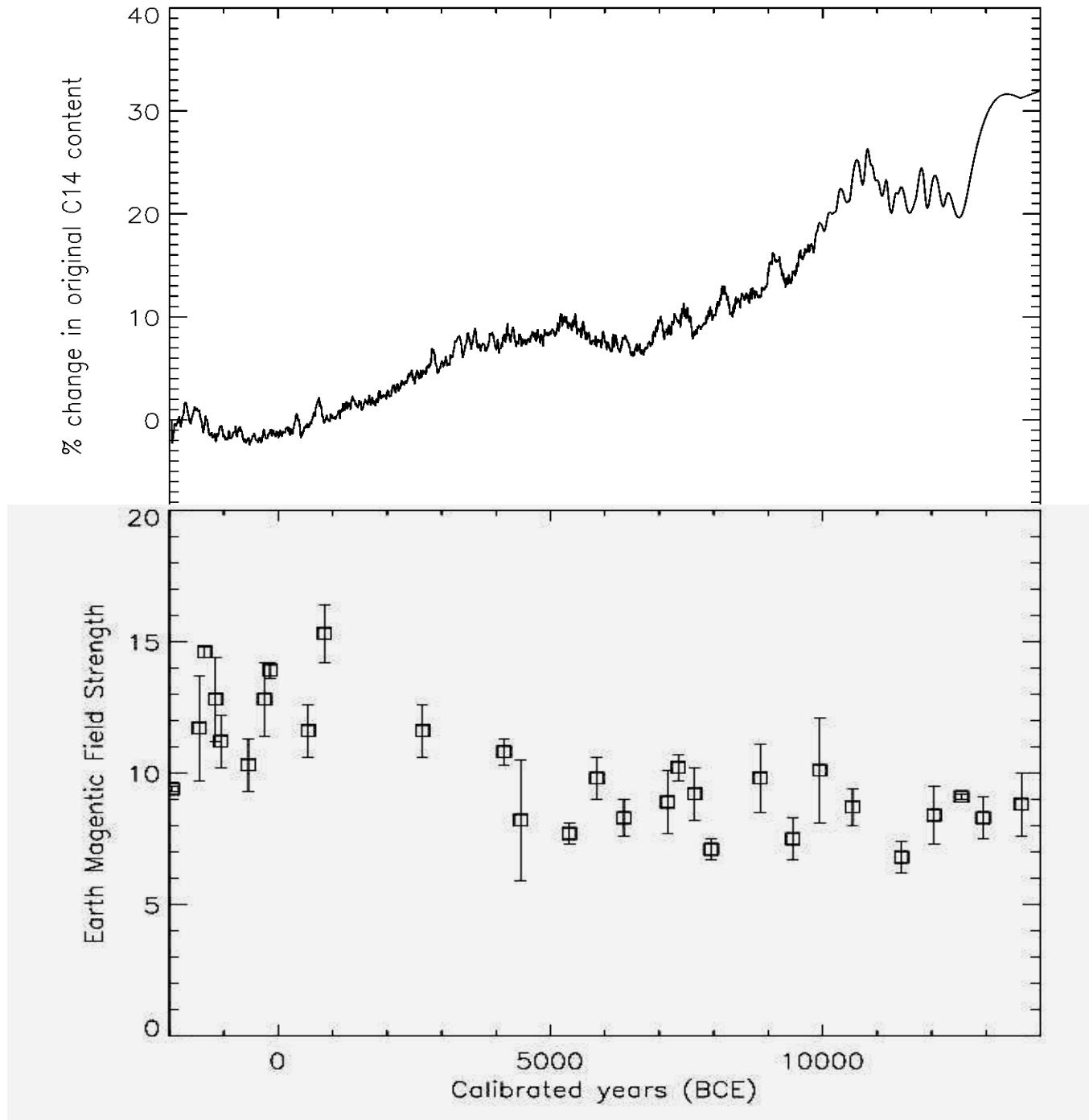


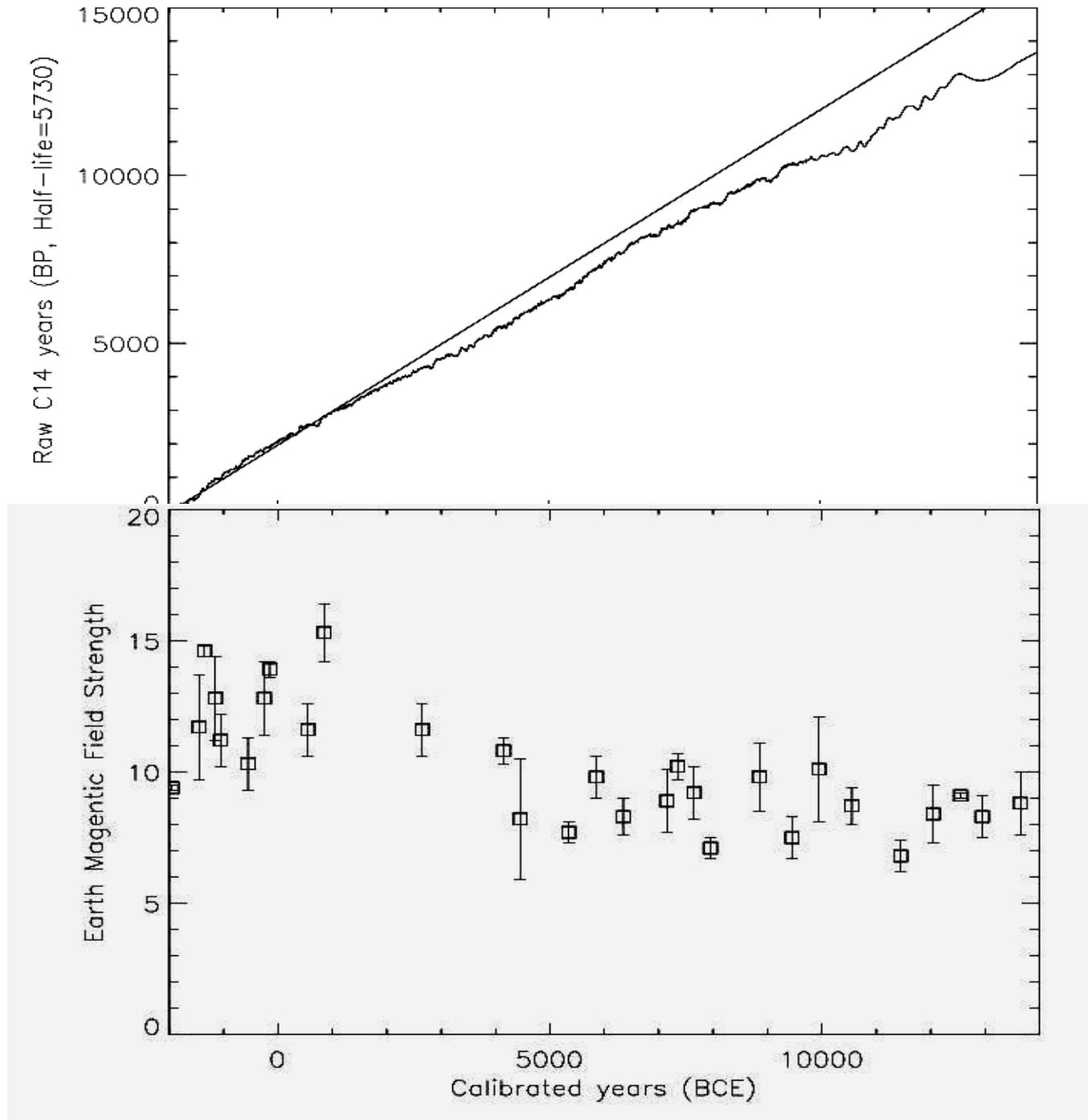
Atmospheric Carbon-14 fraction changes with time



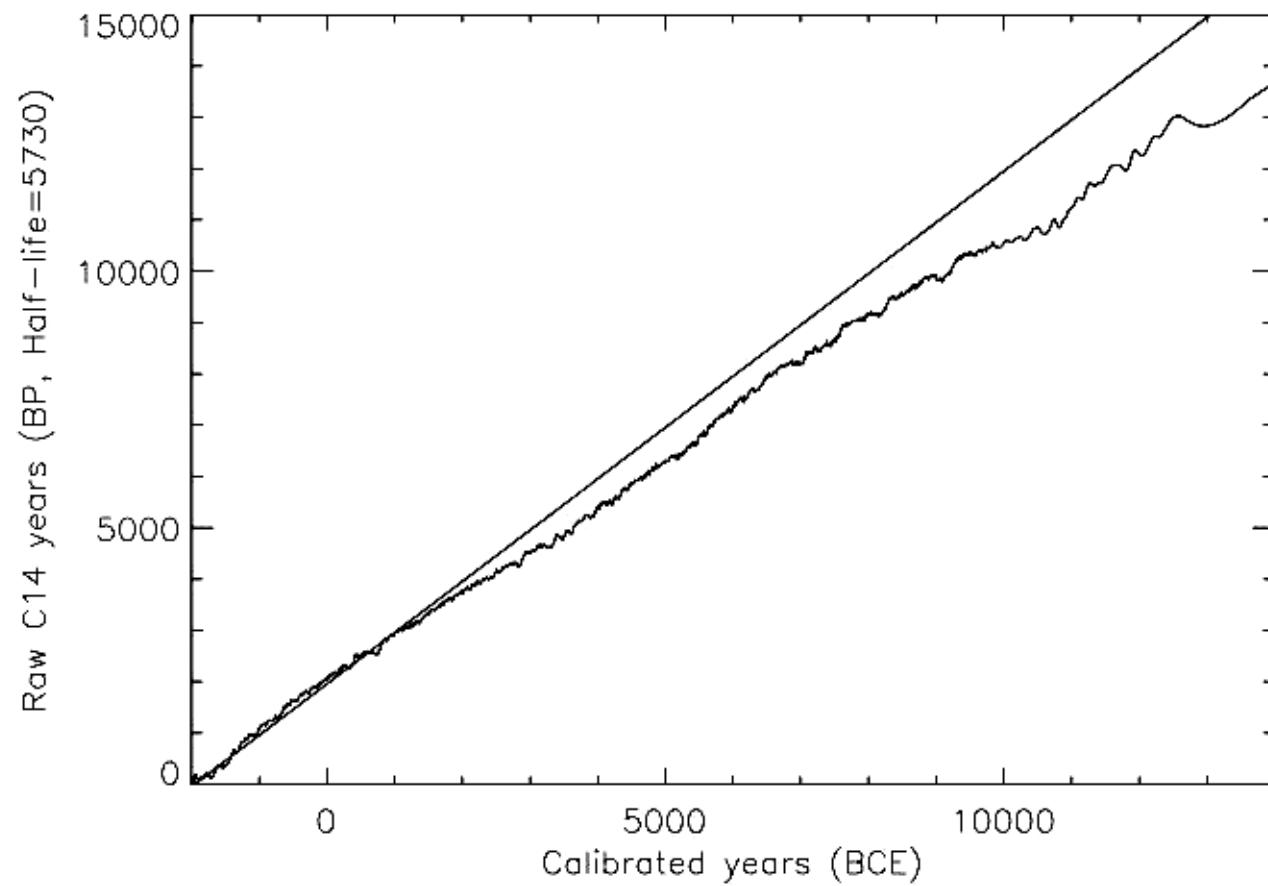
The Changing Magnetic field



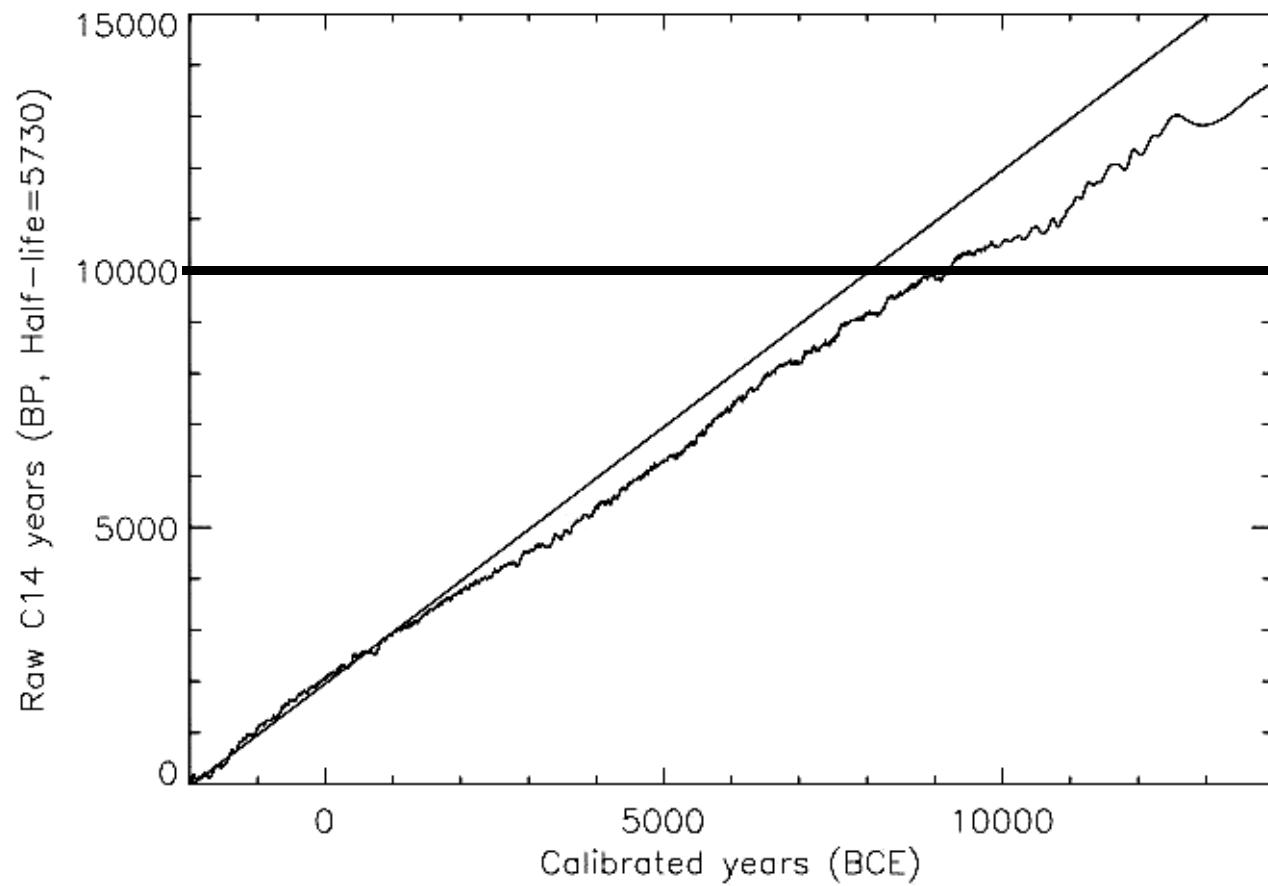




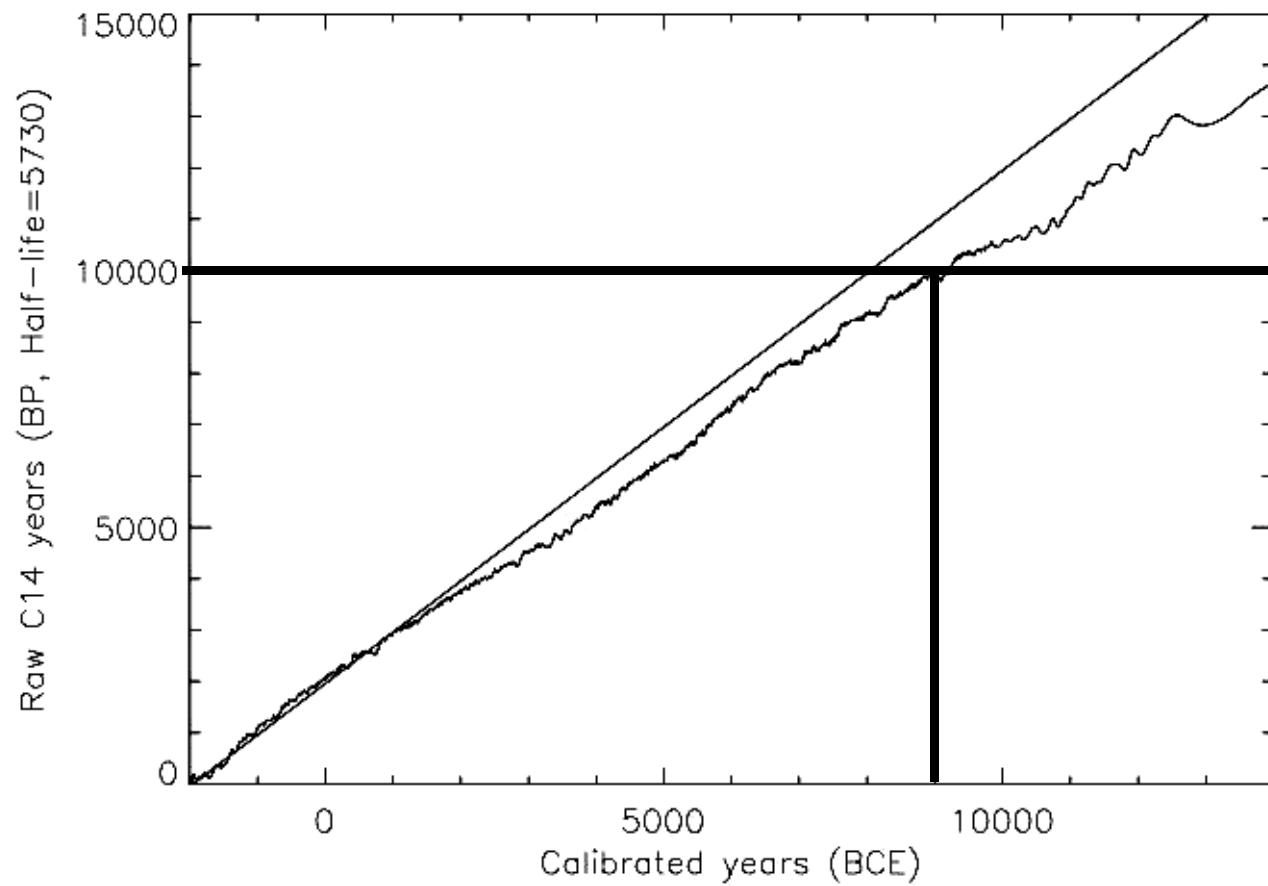
Calibrating Carbon-14 Dates with Tree Rings



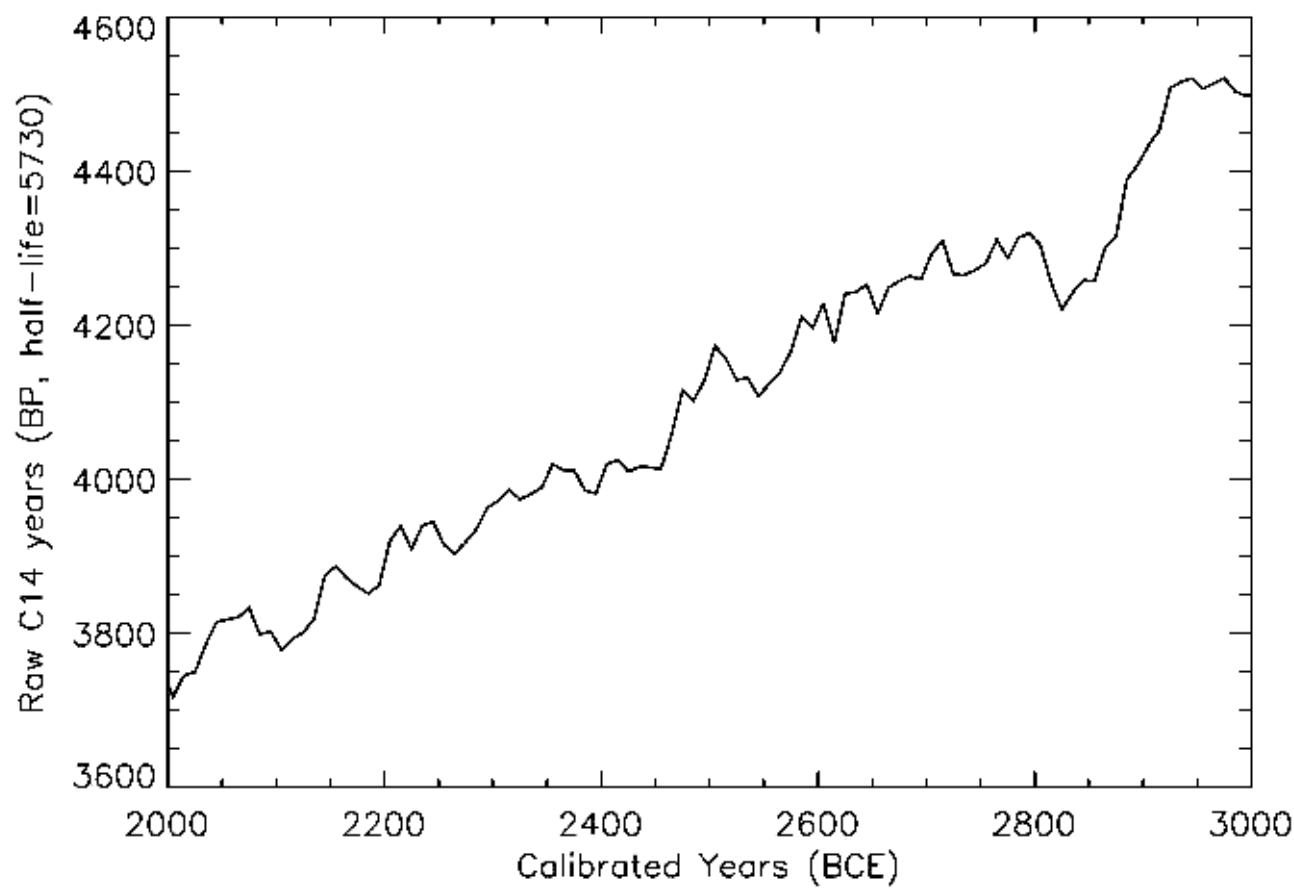
Calibrating Carbon-14 Dates with Tree Rings



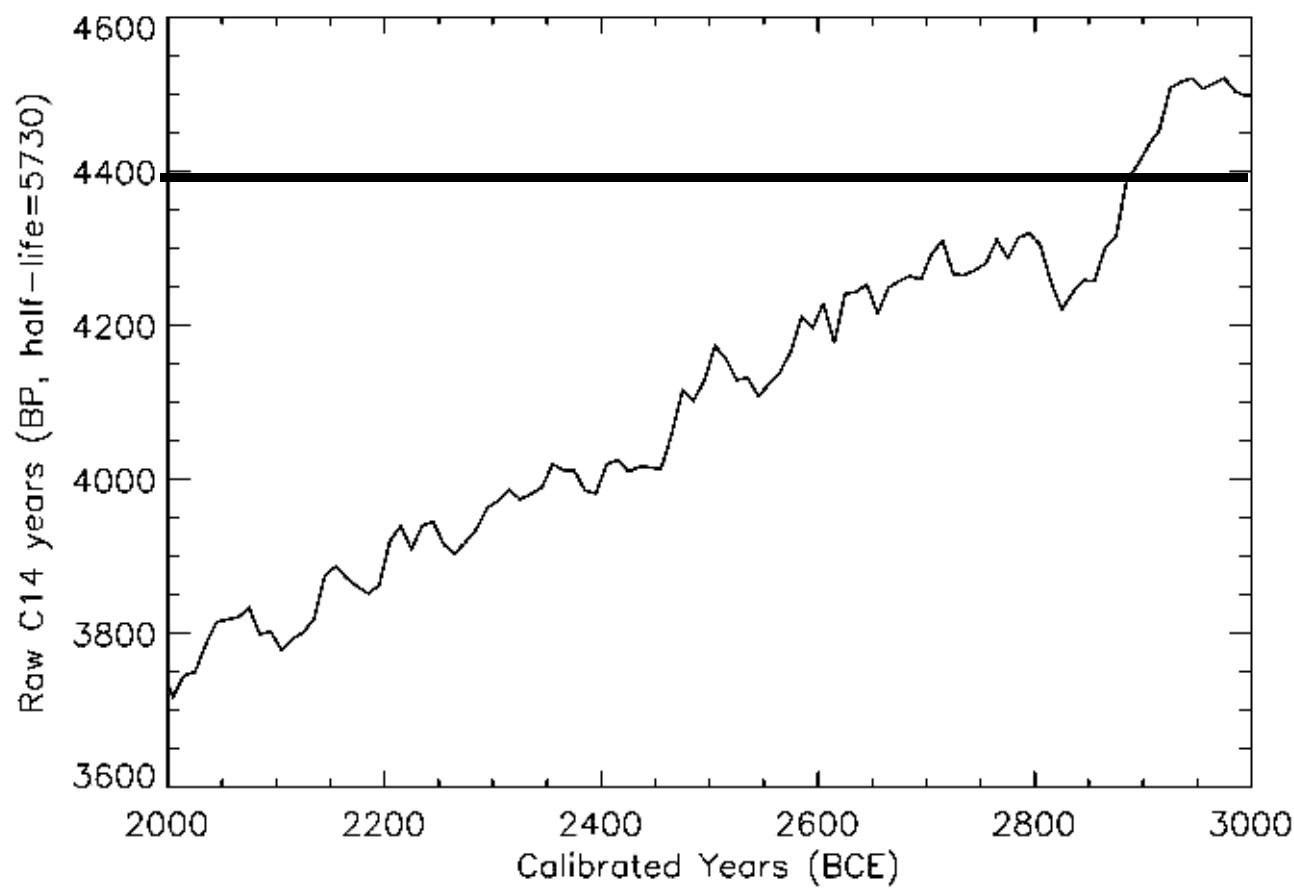
Calibrating Carbon-14 Dates with Tree Rings



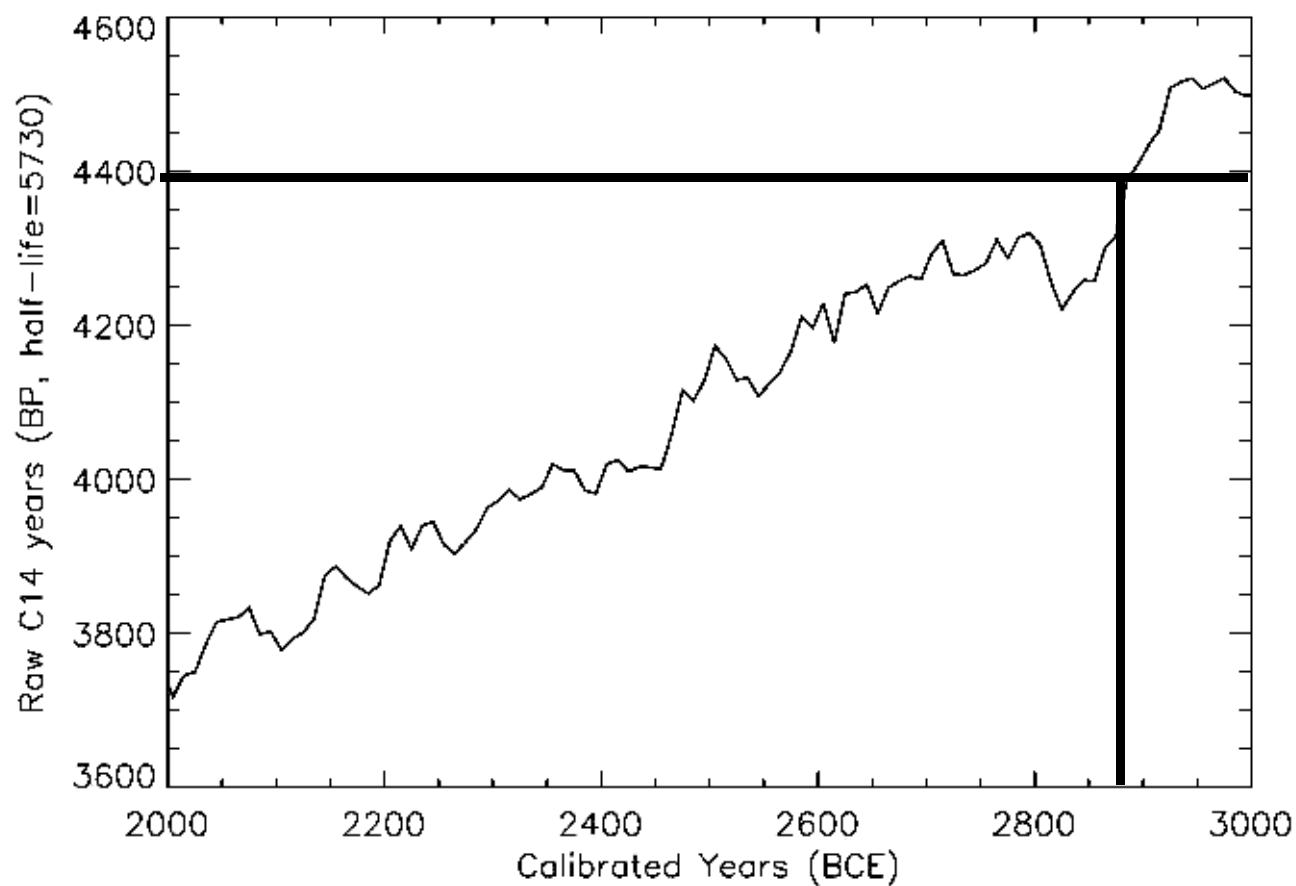
Calibrated Carbon-14 Dates



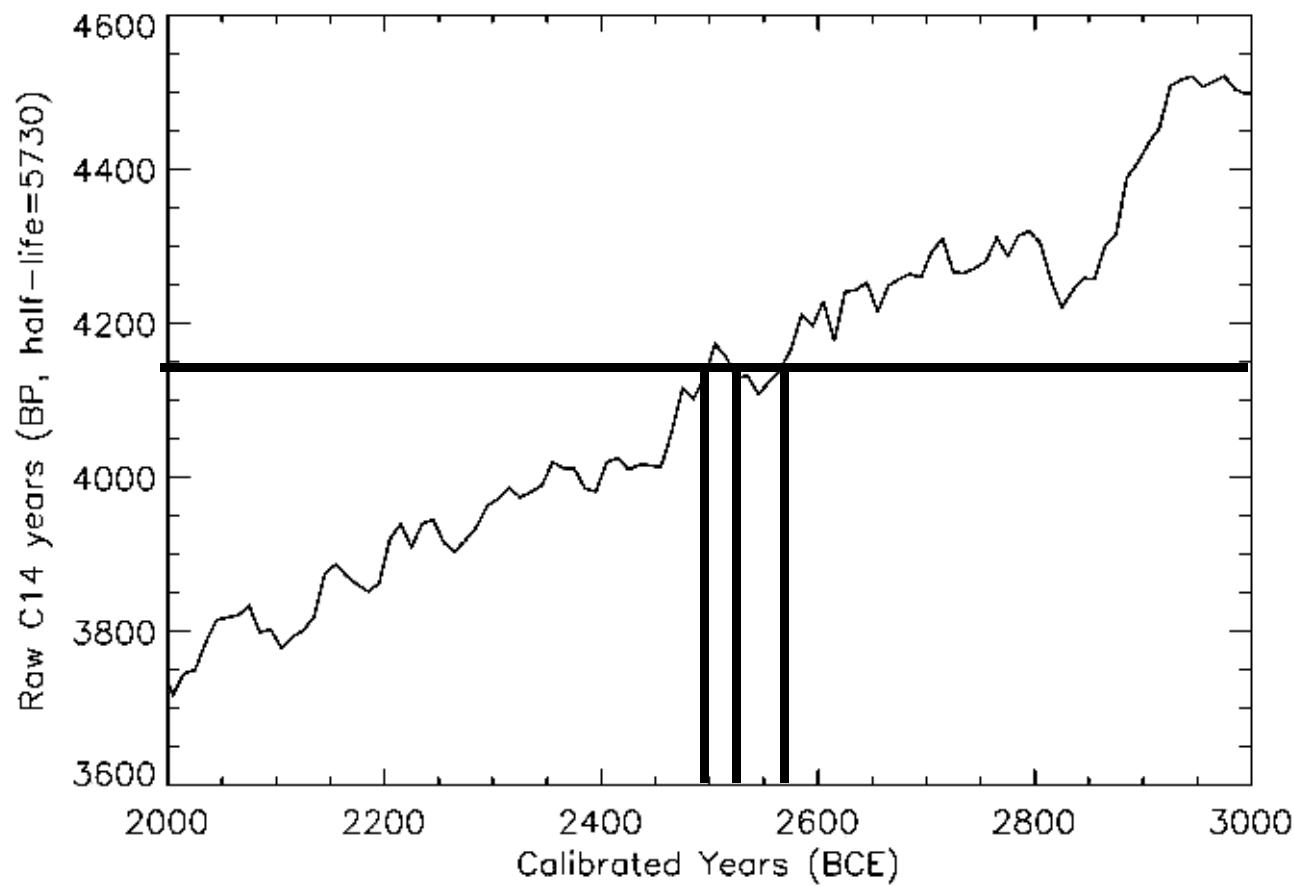
Calibrated Carbon-14 Dates



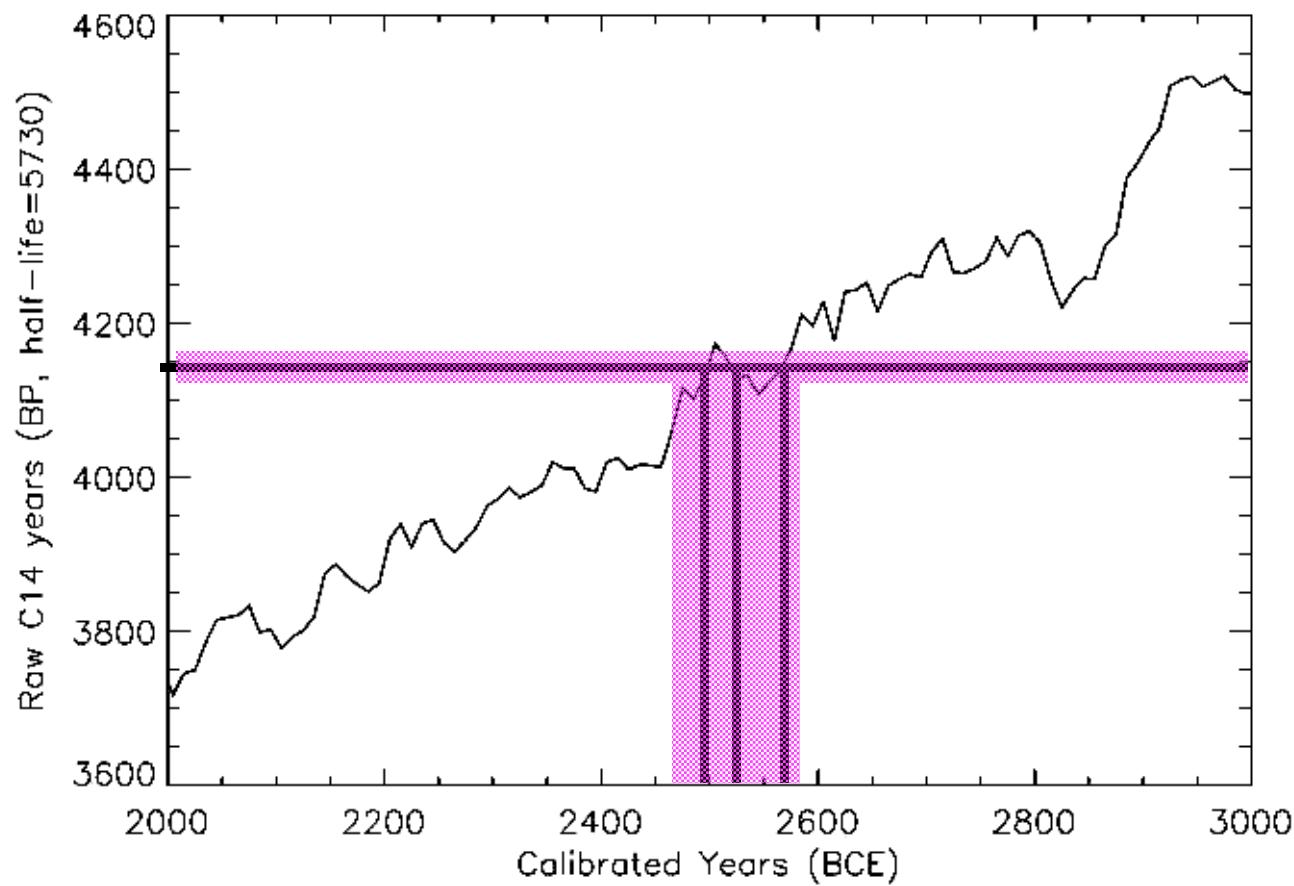
Calibrated Carbon-14 Dates



Complications



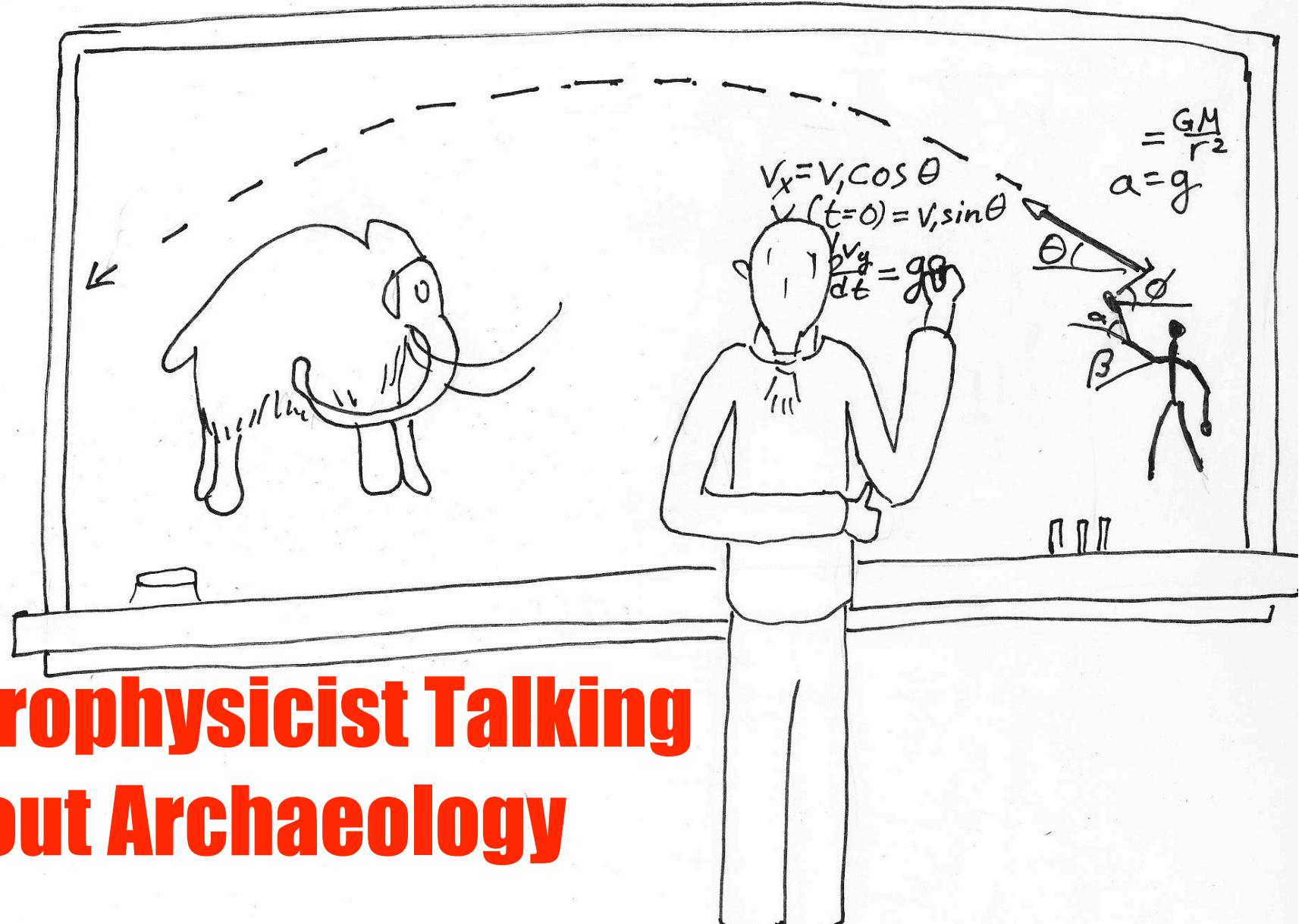
Complications



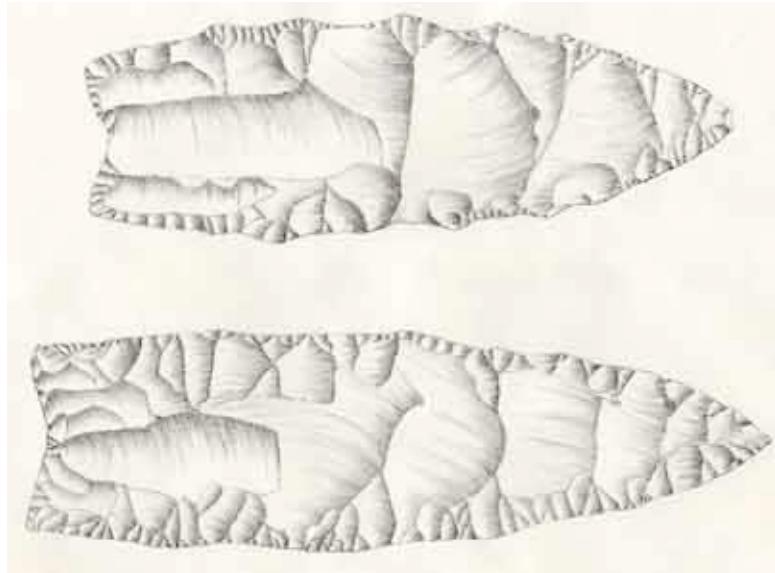


The Early Americans

Warning!



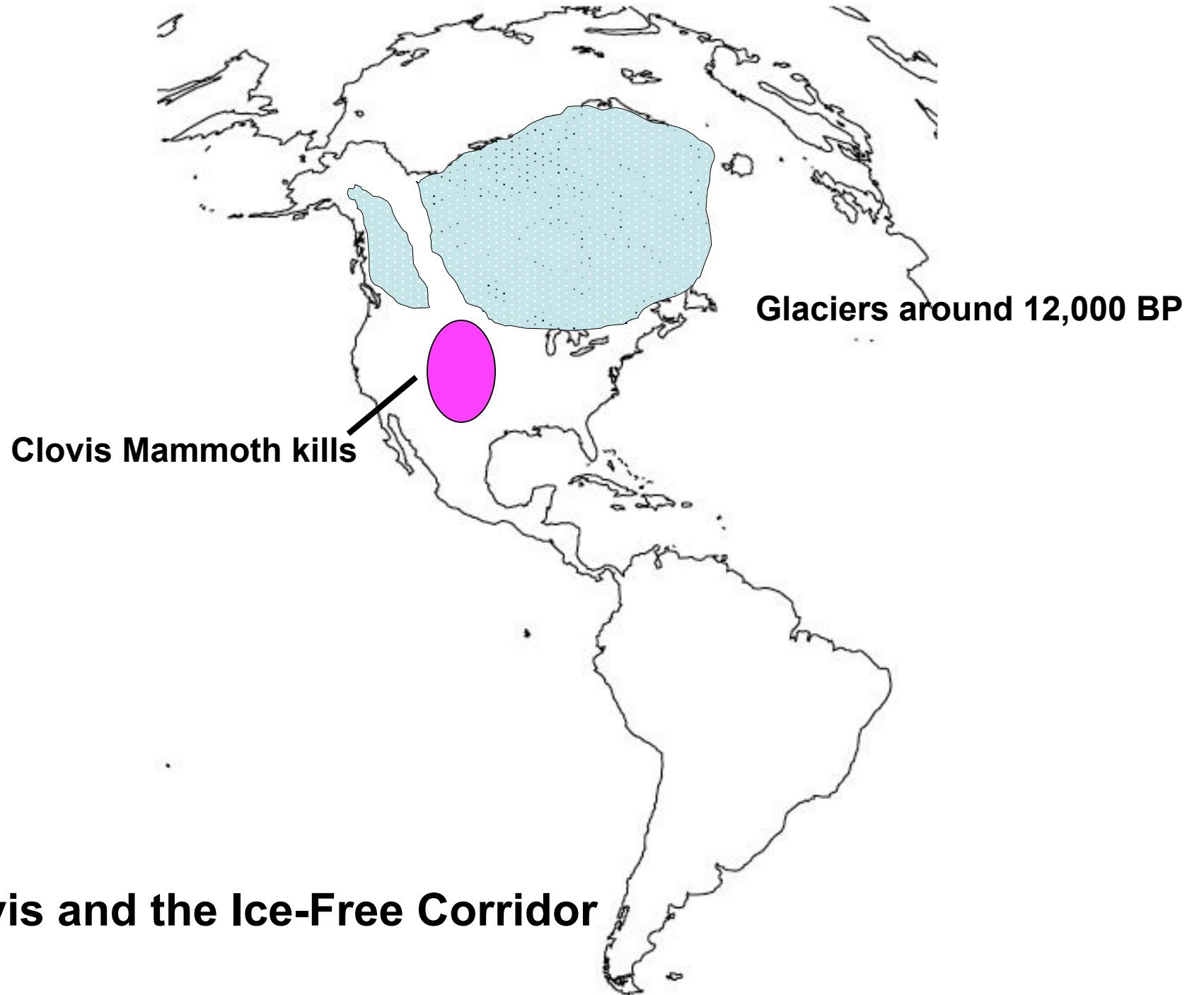
**Astrophysicist Talking
About Archaeology**

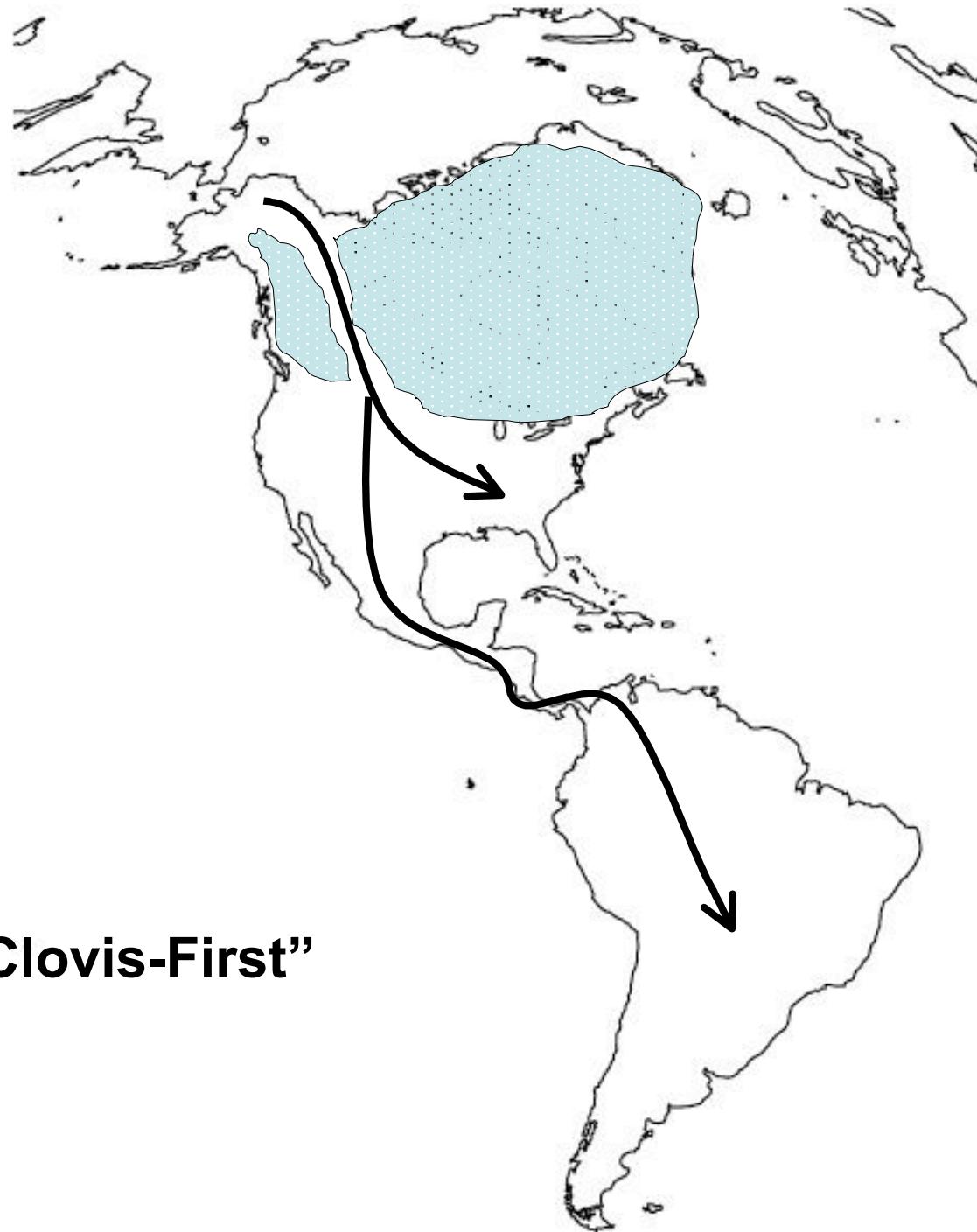


Clovis Points



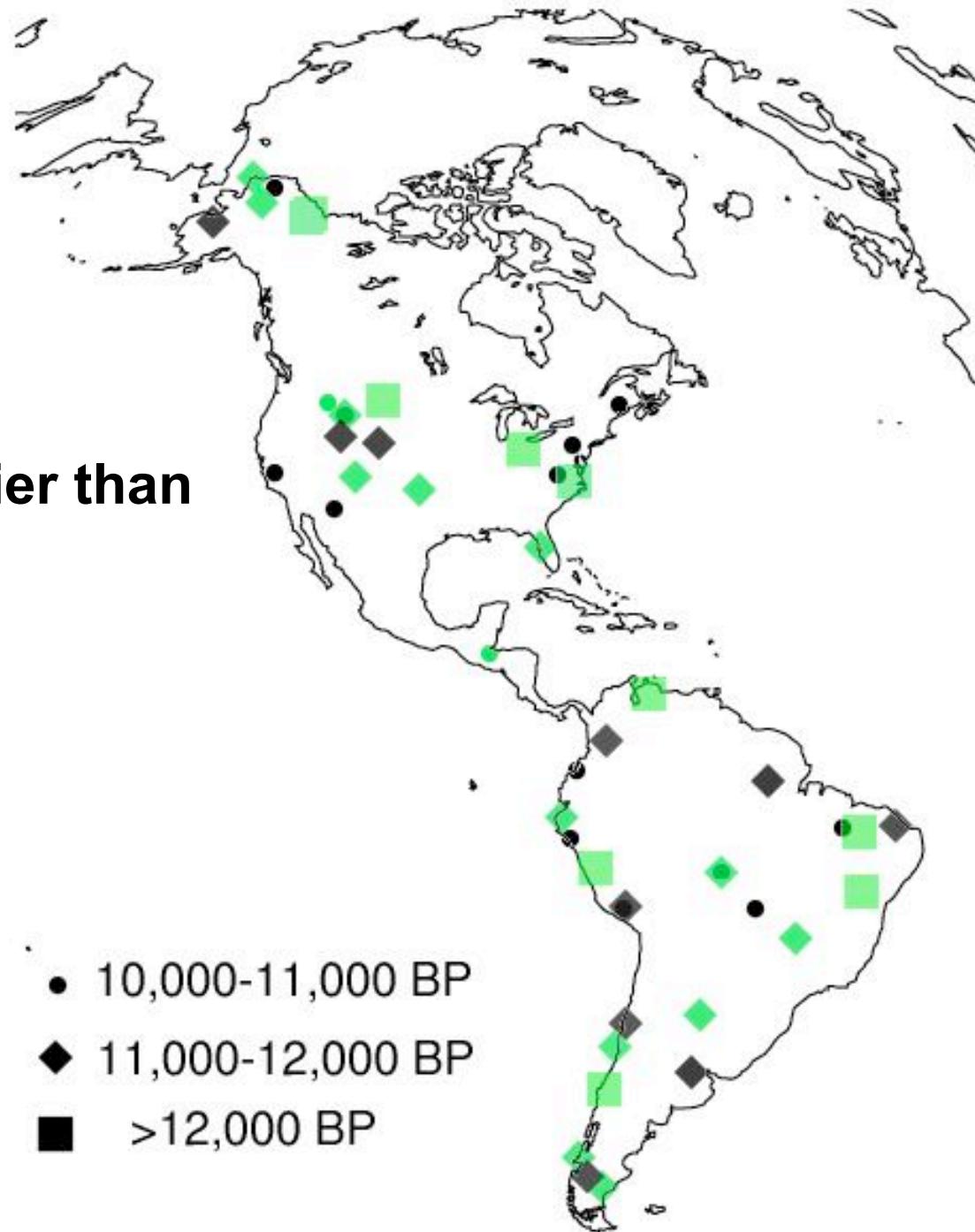
The Land Bridge

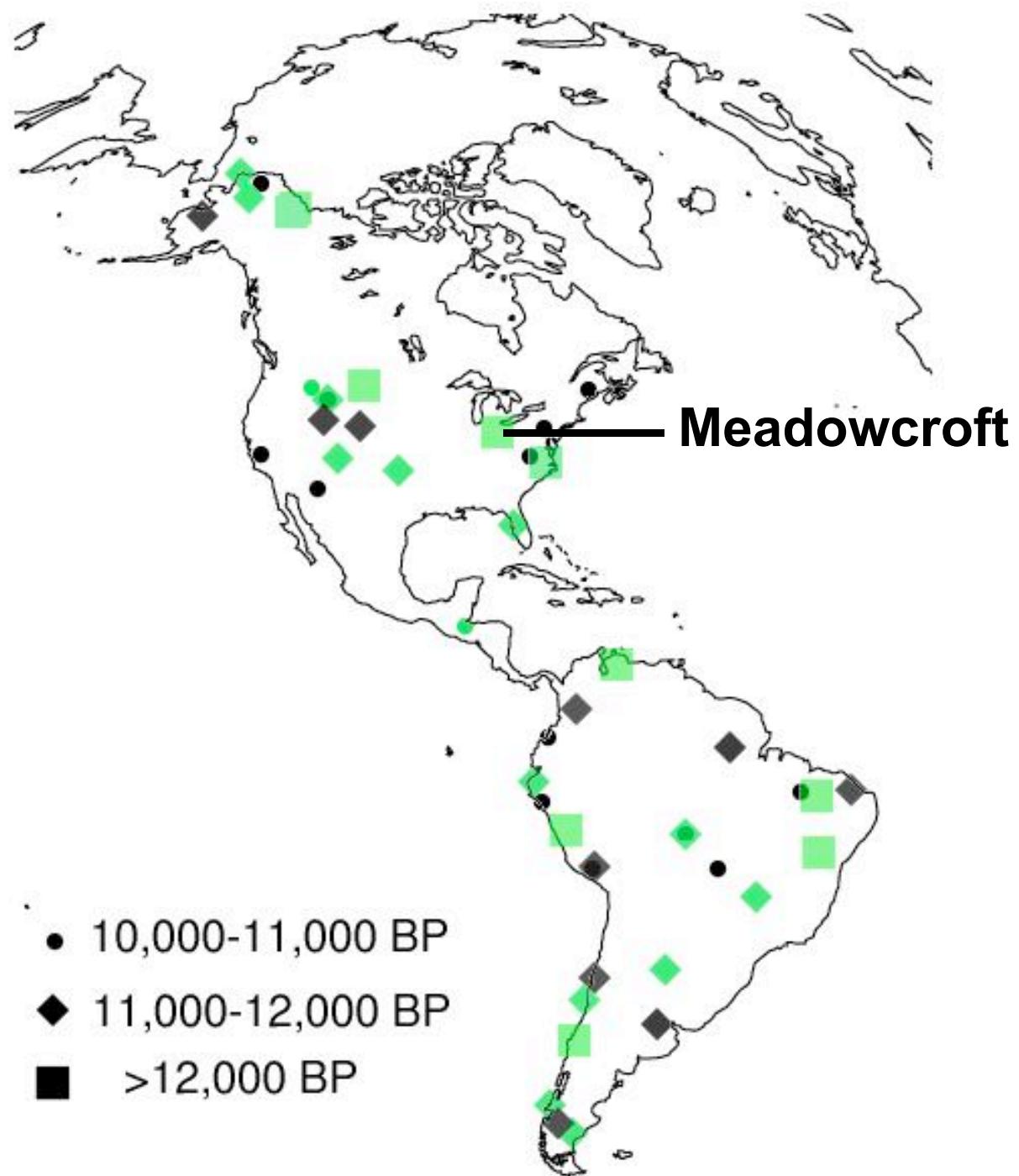




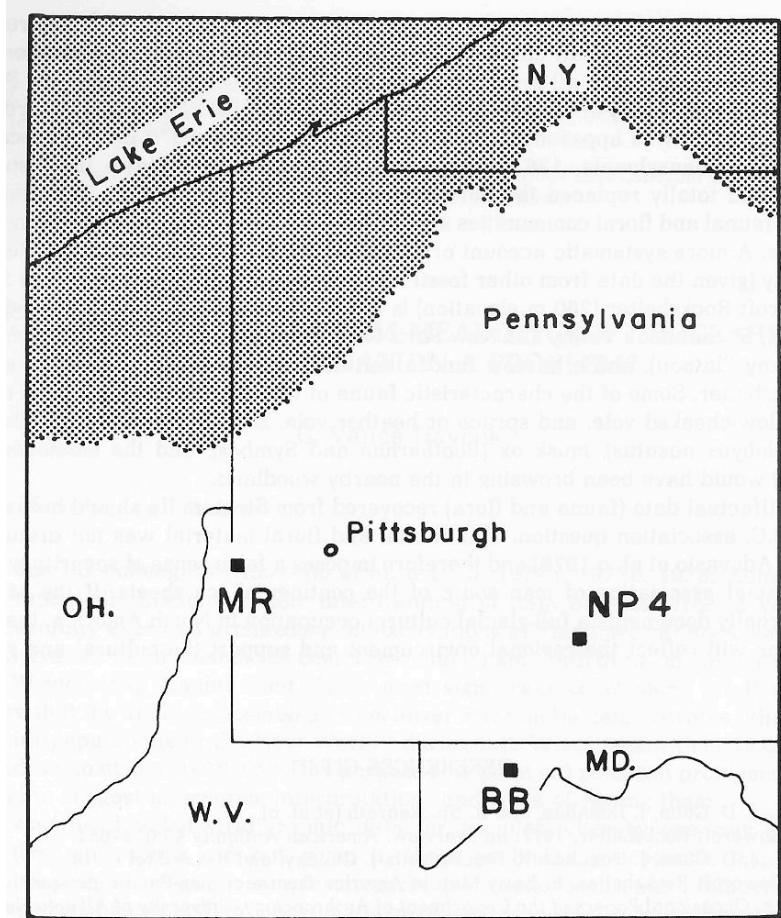
The “Clovis-First” Model

Are there Sites earlier than Clovis?

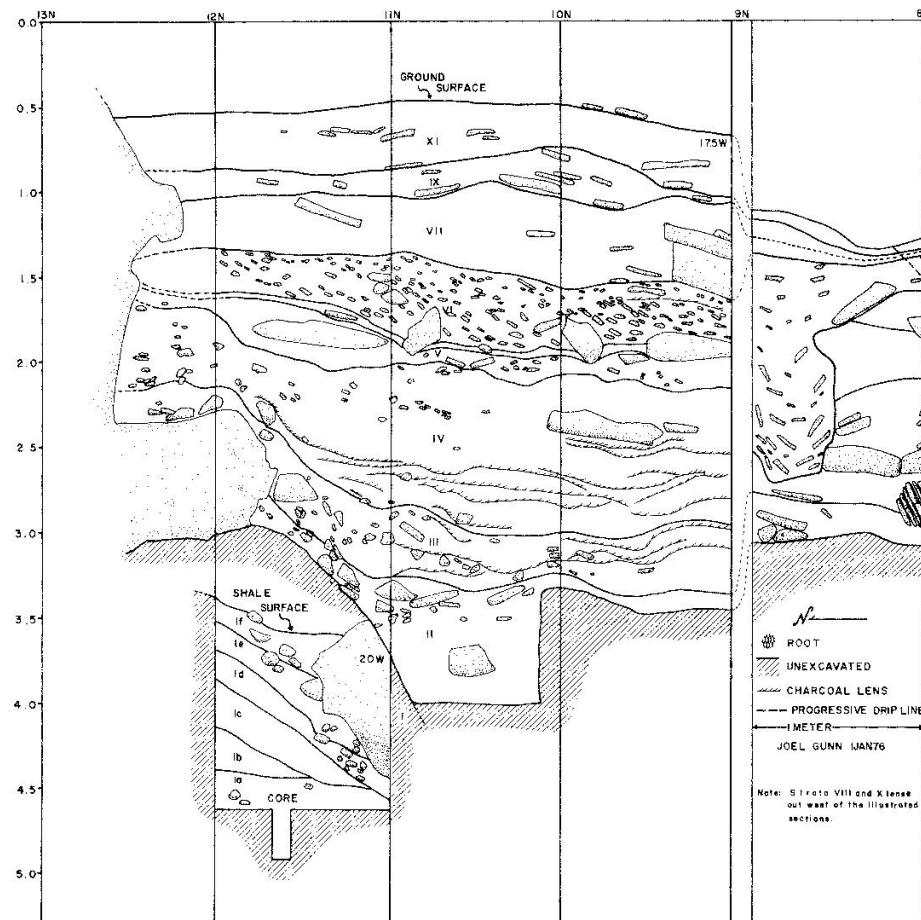




The Meadowcroft Rockshelter



Dates at Meadowcroft

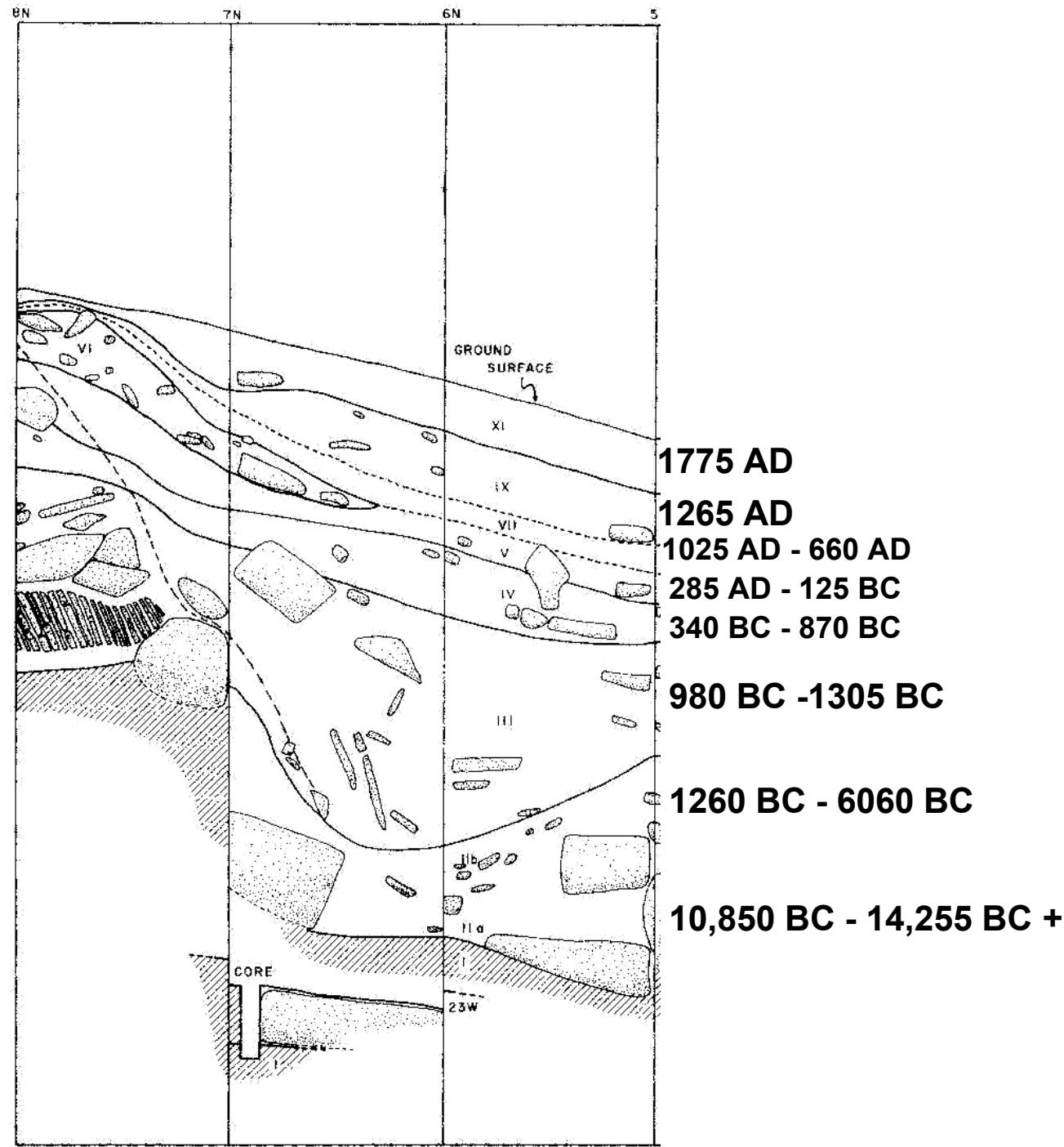


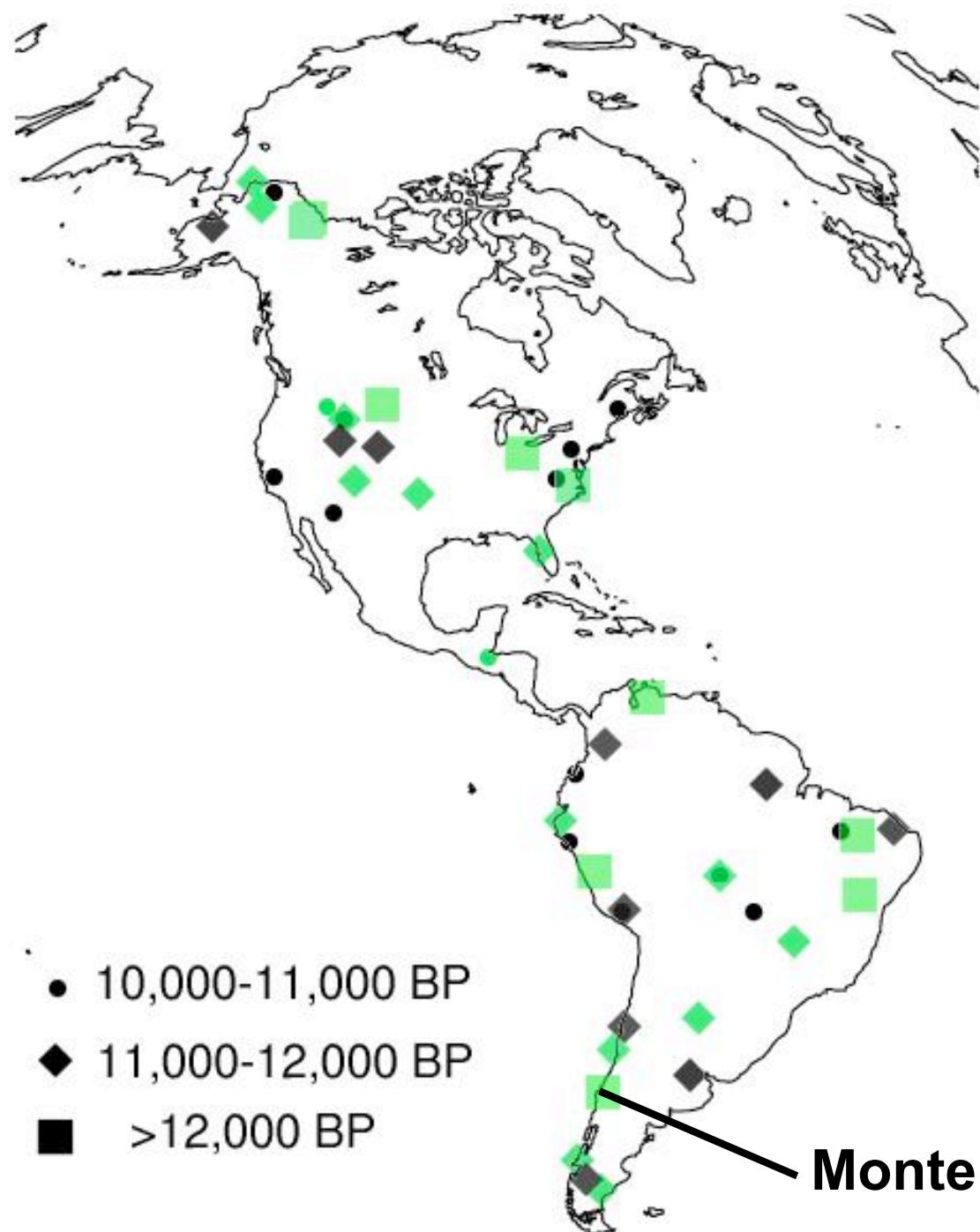
Stratum (field designation)	Provenience/description	Lab designation	Date	Cultural period
XI (F-3)	Charcoal from firepit/ middle 1/3 of unit	SI-3013	A.D. 1775 ± 50	Late Woodland/Historic
X (F-25)	Charcoal from firepits	Samples not yet processed		Late Woodland
IX (F-9)	Charcoal from firepit/ upper 1/3 of unit	SI-2363	A.D. 1265 ± 80	Late Woodland
VIII (F-12)	Charcoal from firepits	Samples not yet processed		Late Woodland
VII (F-13)	Charcoal from firepits/ middle 1/3 of unit	SI-2047	A.D. 1025 ± 65	Late Woodland
VI (F-63)	Charcoal from firepits and lenses	SI-3026	A.D. 660 ± 60	Middle/Early Woodland
V (F-14)	Charcoal from firepits/ upper 1/3 of unit	Samples not yet processed		Middle/Early Woodland
		SI-3024	A.D. 285 ± 65	
		SI-3027	A.D. 160 ± 60	
		SI-3022	A.D. 70 ± 65	
		SI-2362	125 ± 125 B.C.	
IV (F-16)	Charcoal from firepits/ upper 1/3 of unit	SI-2051	340 ± 90 B.C.	
	Charcoal from firefloor/ middle 1/3 of unit	SI-1674	375 ± 75 B.C.	
	Charcoal from firepit/ middle 1/3 of unit	SI-1665	865 ± 80 B.C.	Early Woodland/ Transitional
	Charcoal from firepits/ firefloors lower 1/3 of unit	SI-1668	870 ± 75 B.C.	
	Samples not yet processed			
III (F-18)	Charcoal from firepits/ upper 1/3 of unit	SI-2066	980 ± 75 B.C.	
	Charcoal from firepits/ firefloors lower 1/3 of unit	SI-1664	1115 ± 80 B.C.	Transitional (Broadspae Tradition)/Archaic
	Charcoal from firepit/ middle 1/3 of unit	SI-2053	1140 ± 115 B.C.	
	Charcoal from firepits/ firefloors lower 1/3 of unit	SI-1679	1305 ± 115 B.C.	
	Samples not yet processed			
IIb (F-46 Upper)	Charcoal from firepit/ upper 1/3 of unit	SI-1681	1260 ± 95 B.C.	
	Carbonized basketry fragment/ upper 1/3 of unit	SI-1680	1820 ± 90 B.C.	
	Charcoal from firepits/ middle 1/3 of unit	SI-2063	2000 ± 240 B.C.	
	Charcoal from firefloor/ lower 1/3 of unit	SI-2058	2020 ± 85 B.C.	
	Charcoal from firepits/ lower 1/3 of unit	SI-2054	2055 ± 85 B.C.	
	Charcoal from firepits/ firefloors lower 1/3 of unit	SI-1685	2870 ± 85 B.C.	Archaic
	Charcoal from firefloor/ lower 1/3 of unit	SI-2055	4720 ± 140 B.C.	
	Charcoal from firepit/ lower 1/3 of unit	SI-2056	3350 ± 130 B.C.	
	Charcoal from firepits/ lower 1/3 of unit	Samples not yet processed		
IIa (F-46 Lower)	Charcoal from firepits/ upper 1/3 of unit ^a	SI-2064	6060 ± 110 B.C.	
	Charcoal from firepits/ firefloors middle 1/3 of unit	SI-2061	7165 ± 115 B.C.	
	Samples not yet processed			
	Charcoal from firepits/ lower 1/3 of unit	SI-2489	10,850 ± 870 B.C.	Paleoindian
		SI-2065 ^b	11,290 ± 1010 B.C.	
		SI-2488	11,320 ± 340 B.C.	
		SI-1872 ^b	12,975 ± 620 B.C.	
		SI-1686	13,170 ± 165 B.C.	
		SI-2354	14,255 ± 975 B.C.	
	Charcoal concentration/ deepest level within unit	SI-2062	17,150 ± 810 B.C.	Paleoindian ?
	Carbonized fragment of cut bark-like material/ possible basketry frag- ment deepest level within unit	SI-2060	17,650 ± 2400 B.C.	
I (F-85) (Omega Unit)	Charcoal from lenses at interface of Strata IIa	SI-2121	19,430 ± 800 B.C.	No cultural associations
		SI-1687	28,760 ± 1140 B.C.	

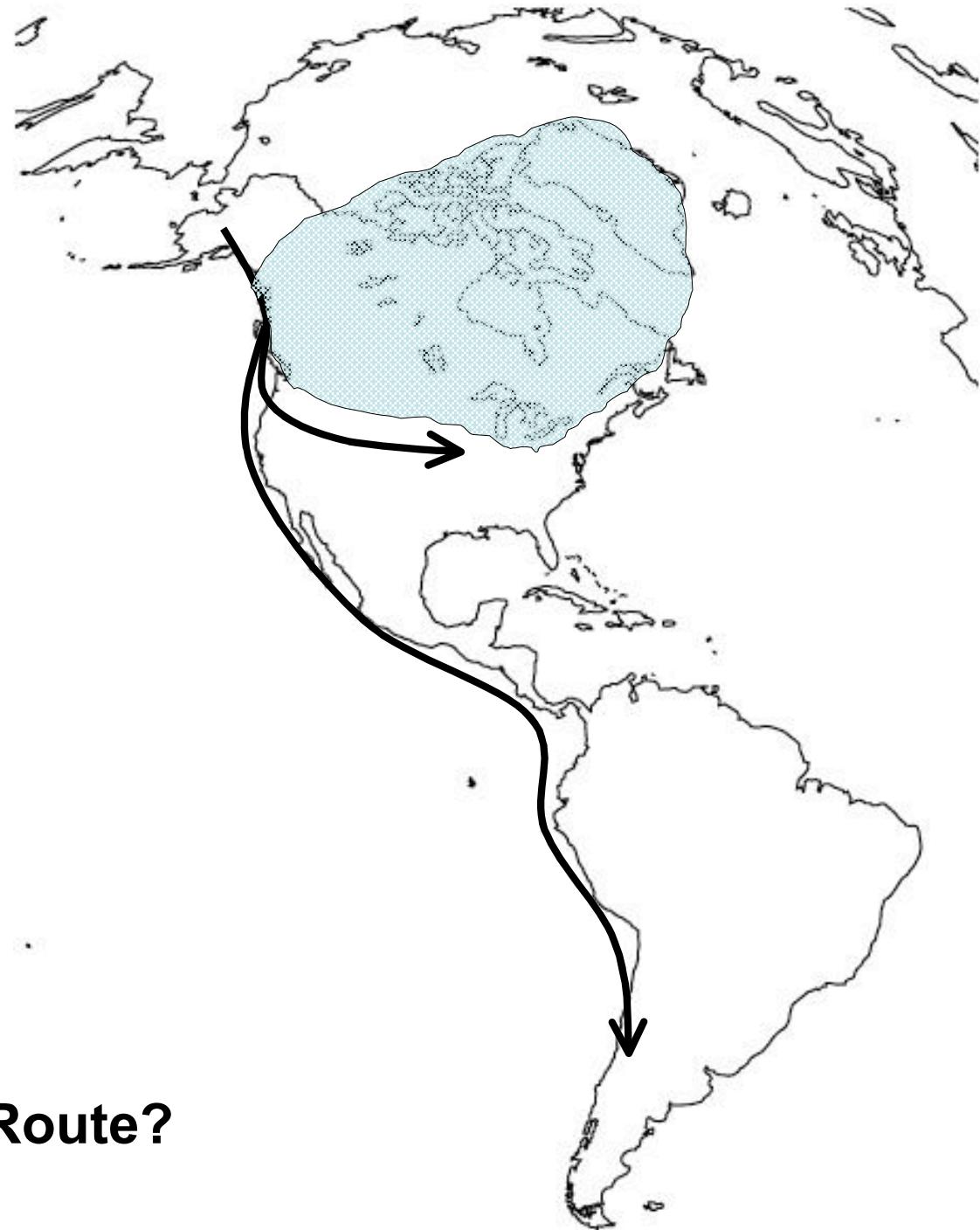
^a Provenience originally listed incorrectly in Adovasio et al. 1975.

^b Date originally listed incorrectly in Adovasio et al. 1975.

Dates at Meadowcroft

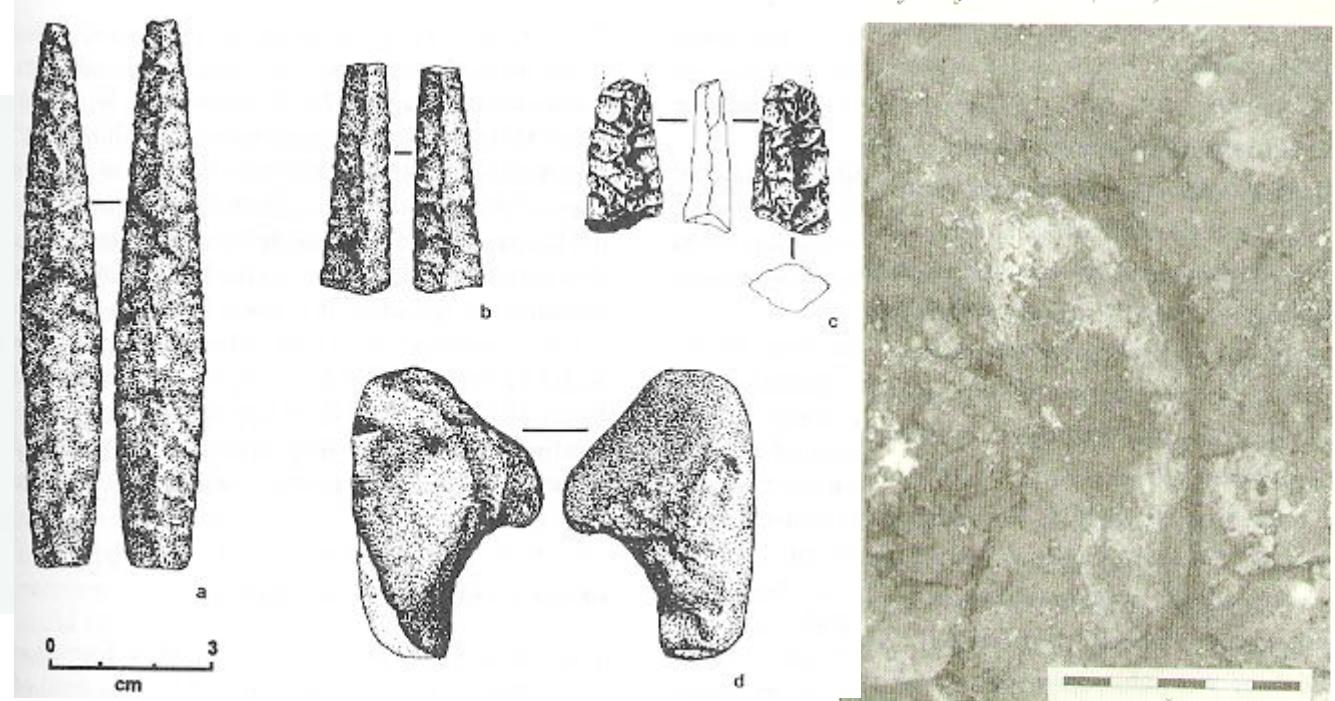
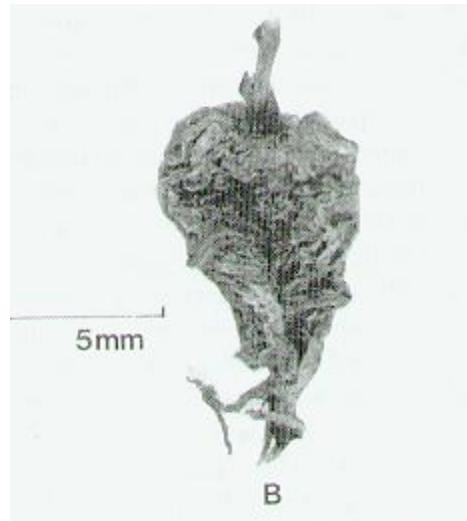
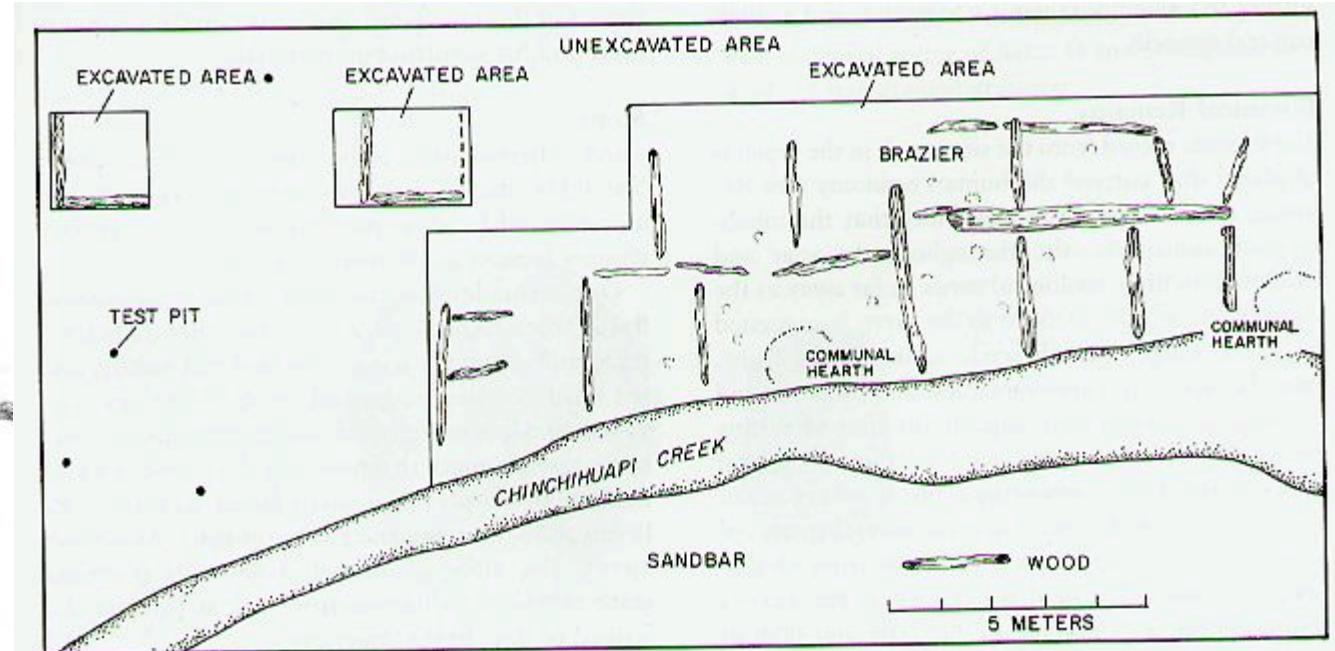
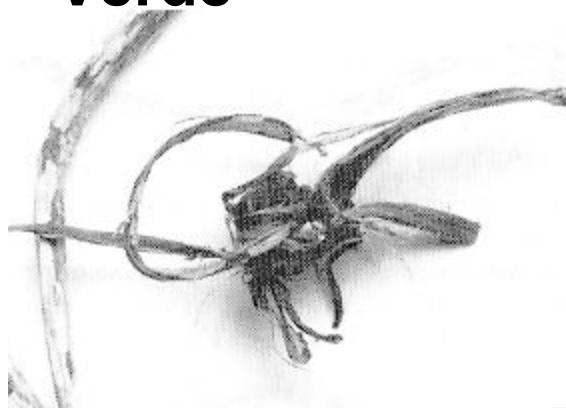






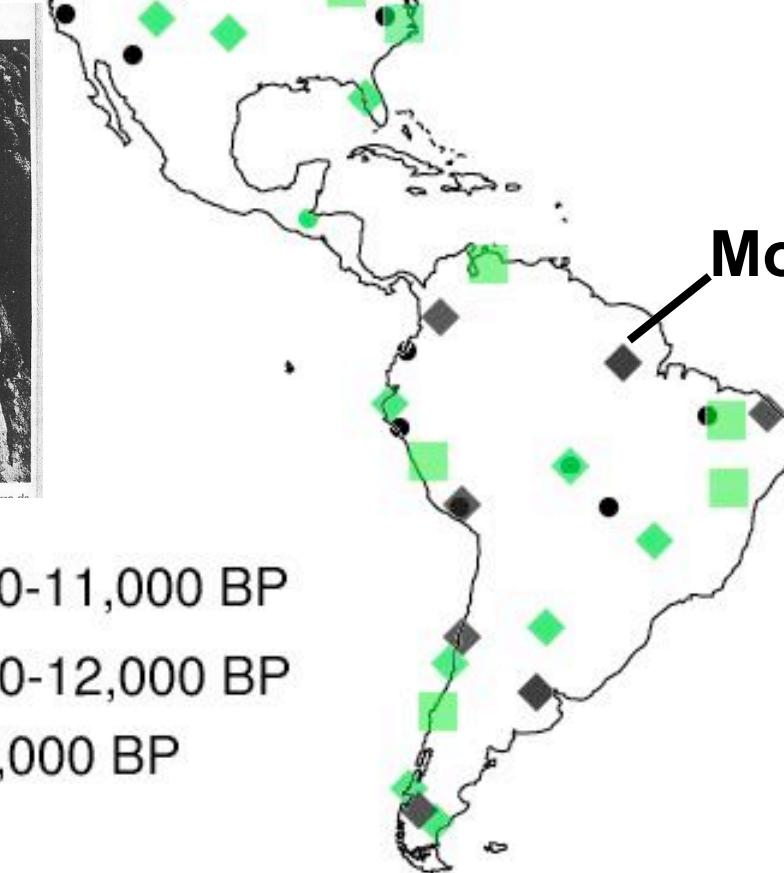
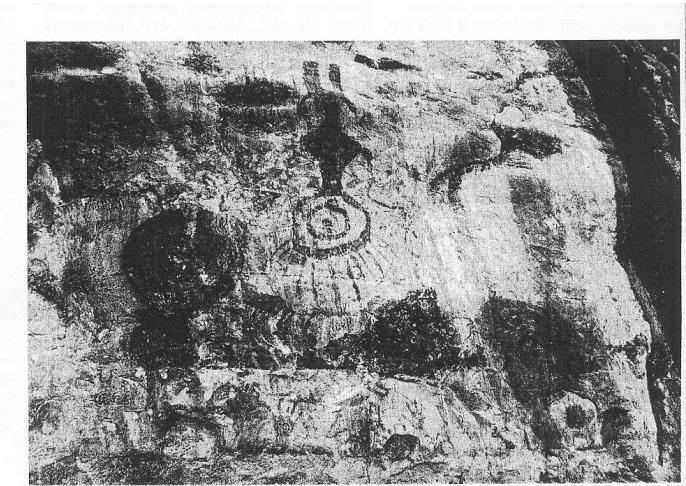
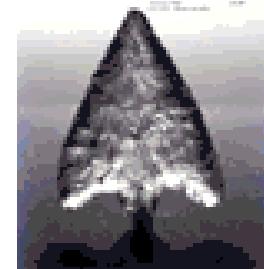
A Coastal Route?

What is really Important about Monte Verde



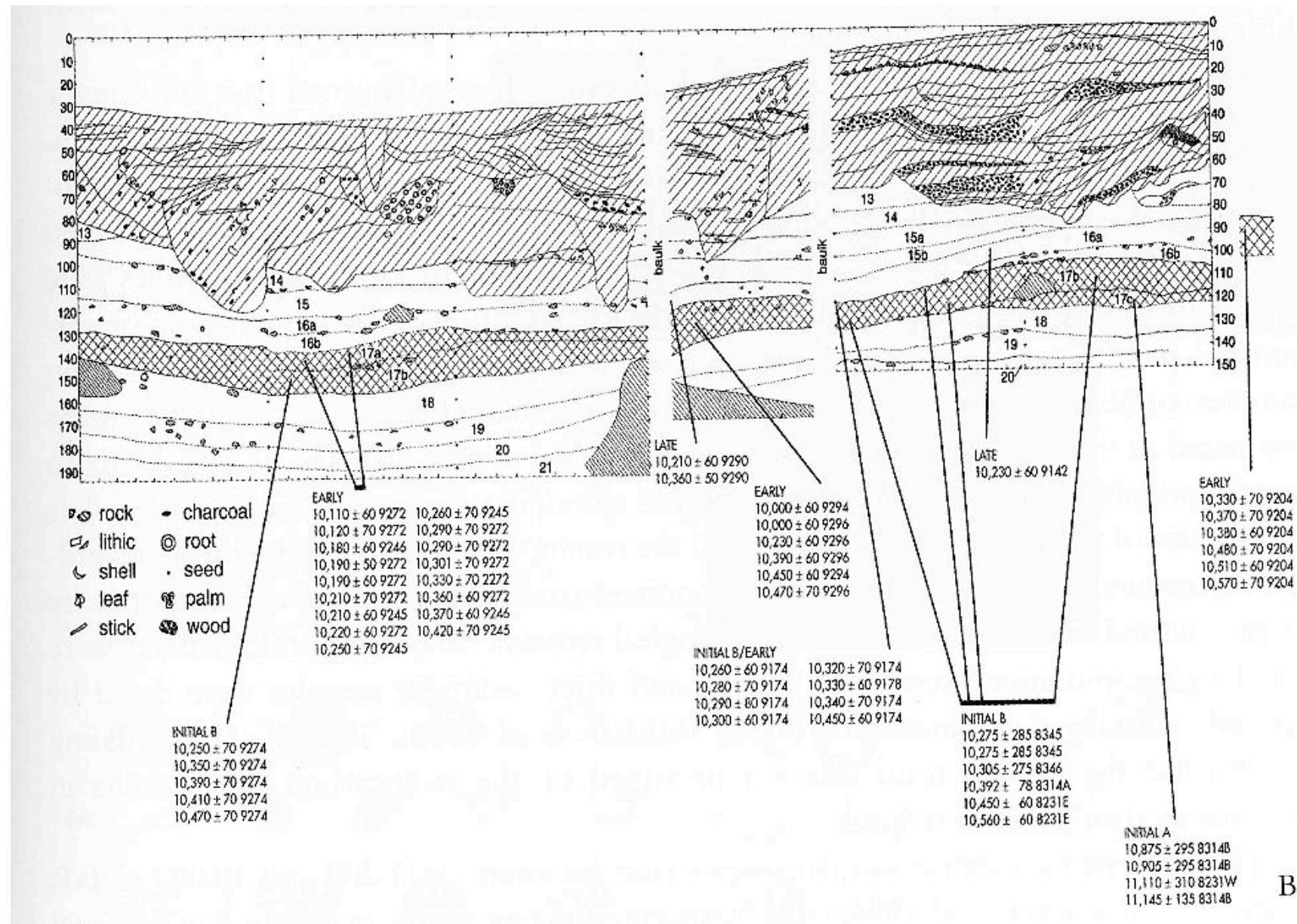


Science

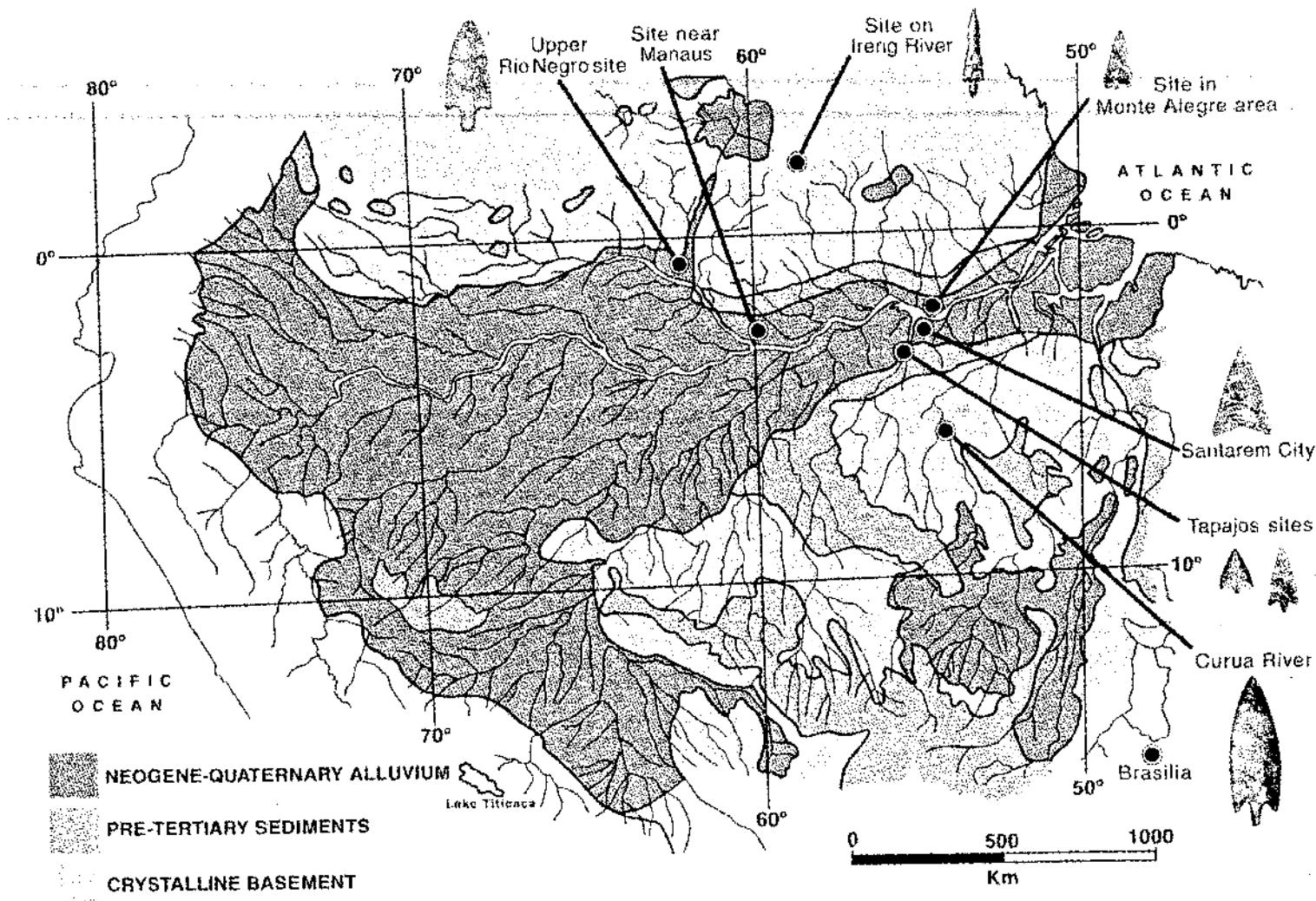


- 10,000-11,000 BP
- ◆ 11,000-12,000 BP
- >12,000 BP

Temporal Relationships within a site



Temporal relationships between sites



Painted Caves from the Ice Age

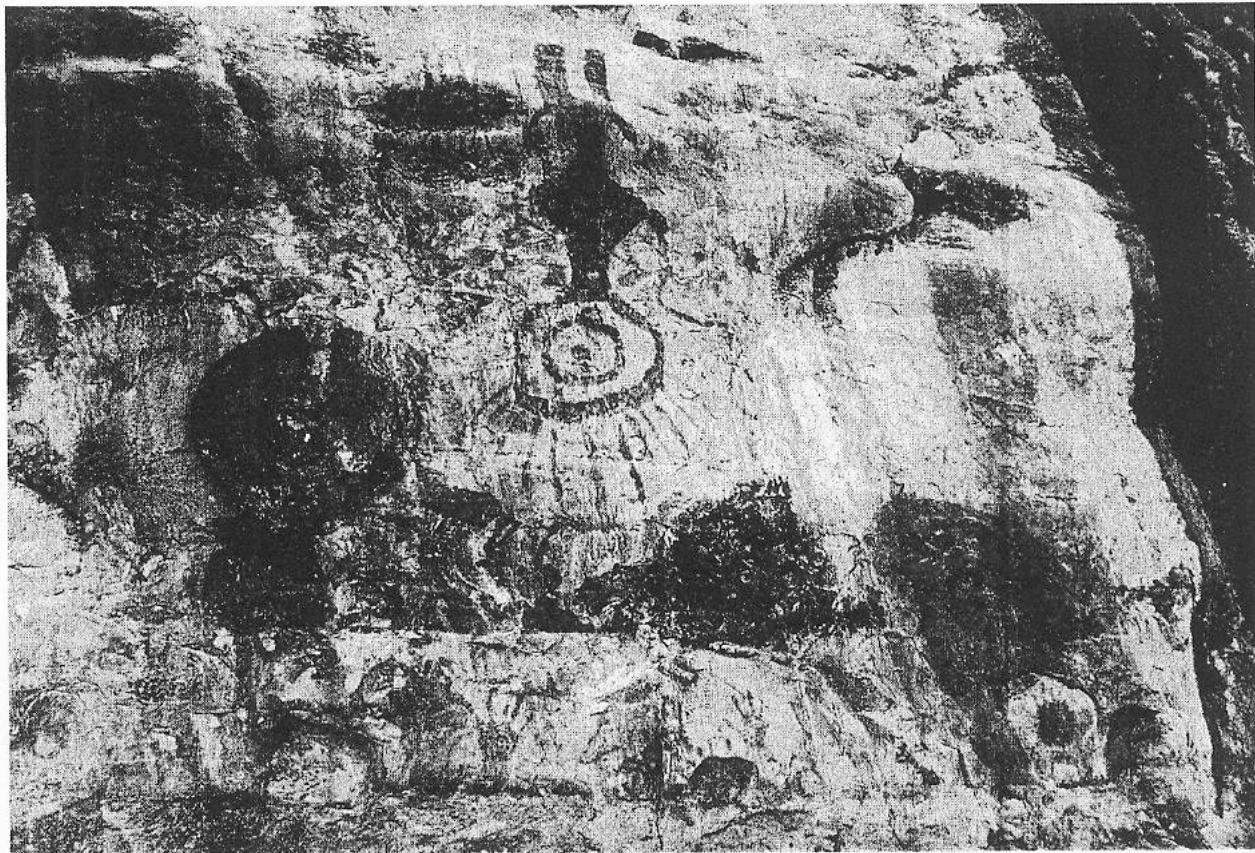


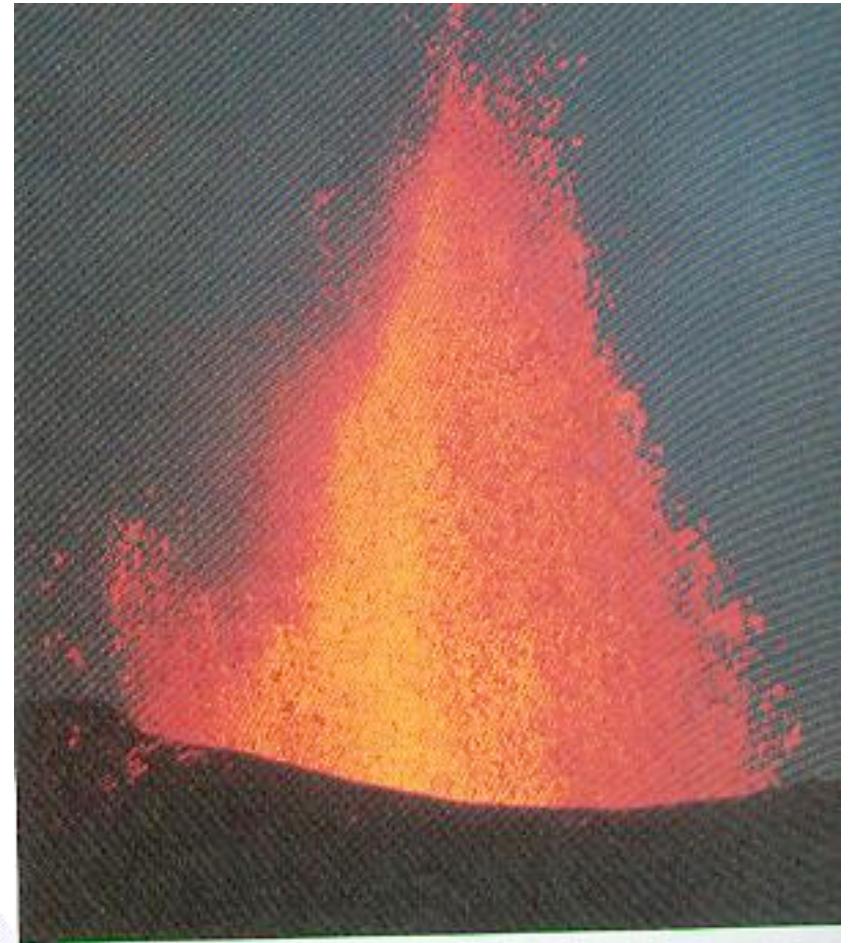
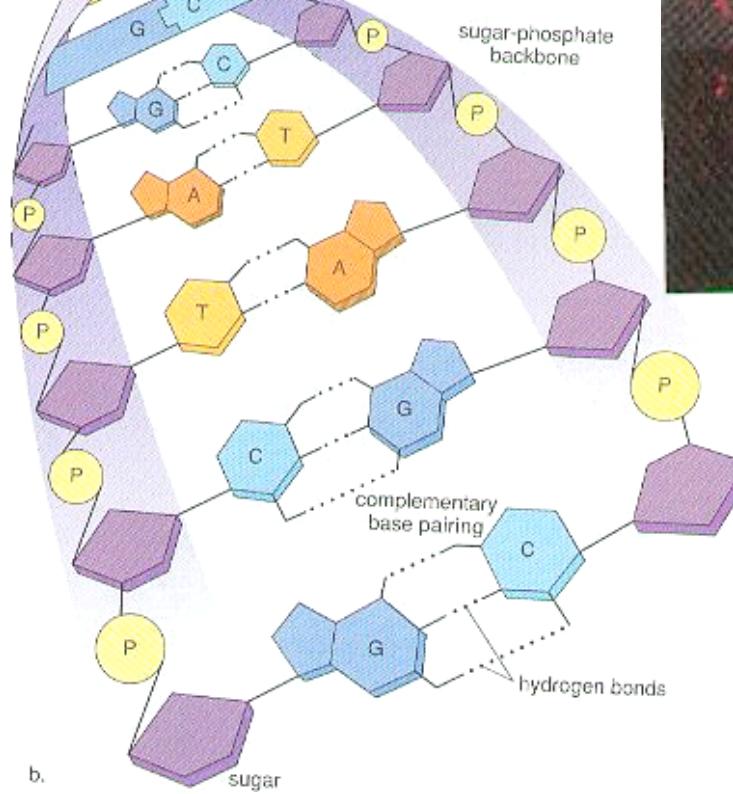
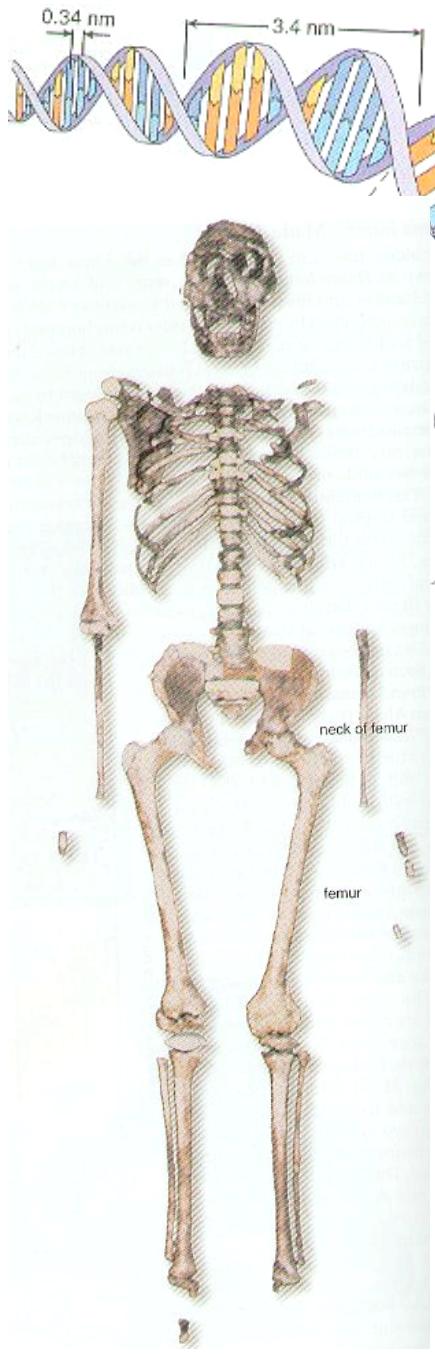
Fig. 1. A photograph of the painted rock surface at the back of the sheltered basin with rounded head, Corro do

Rather than:
**How did people get
into the New World?**

**How did people live
in the New World?**



Next Time



**Potassium, Argon,
Genes and
Walking Upright**