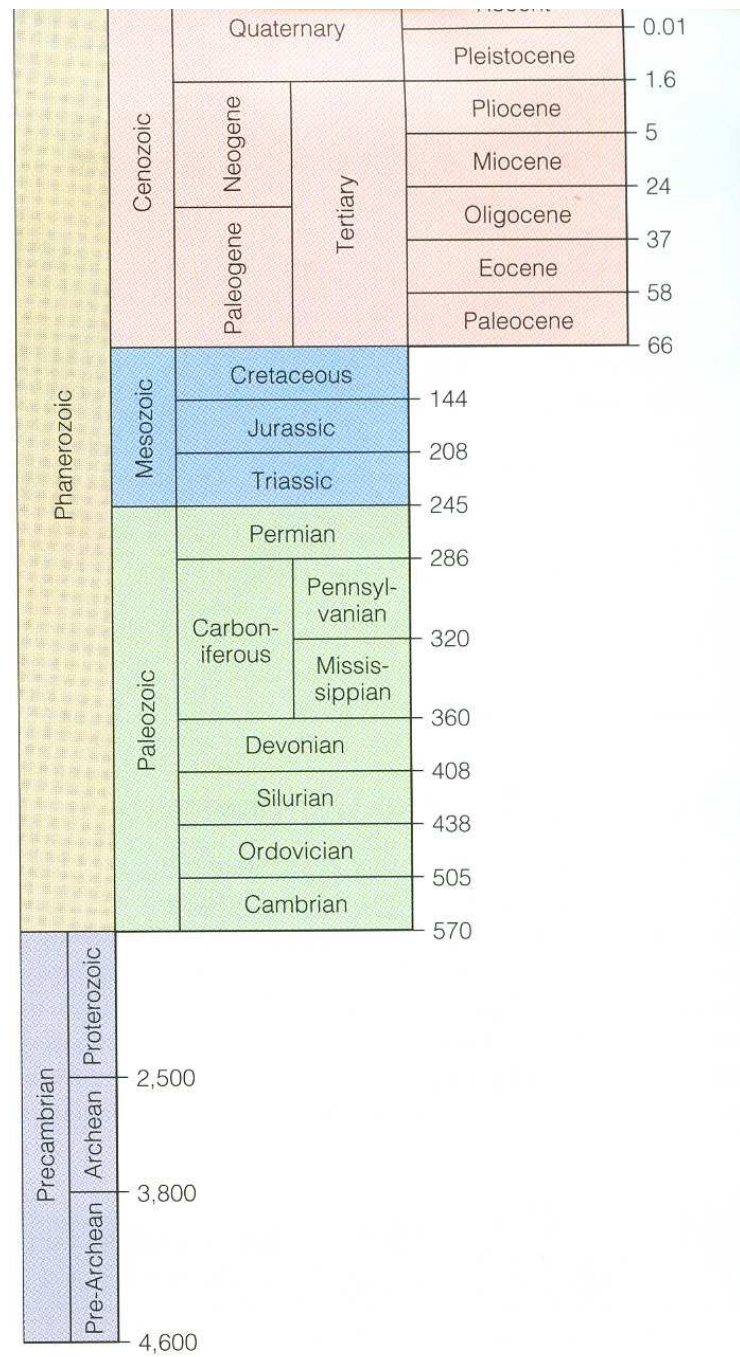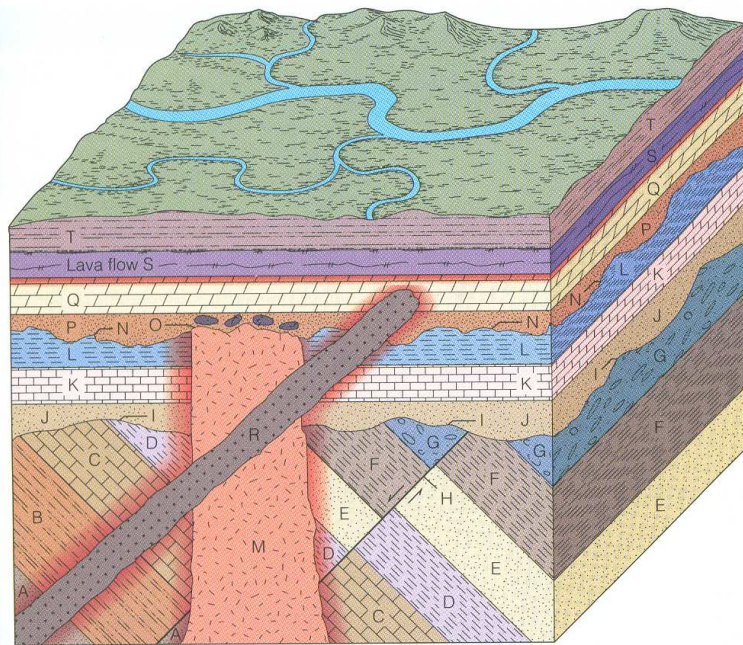## TABLE 1-2 Geologic Time and Significant Events in Earth History Condensed into One Calendar Year

Years before Present	Event	Days since January 1	Date and Time
10,000	Ice Age ends	364.9	December 31, 11:58:51 P.M.
1.6 million	Ice Age begins	364.9	December 31, 8:57:11 P.M.
4 million	First humans	364.6	December 31, 4:11:29 P.M.
53 million	First horses	360.8	December 27, 7:04:10 P.M.
66 million	Dinosaurs become extinct	359.8	December 26, 6:18:47 P.M.
115 million	First flowering plants	355.9	December 22, 9:00:00 A.M.
145 million	First birds	353.5	December 20, 11:52:10 A.M.
222 million	First mammals	347.4	December 14, 9:14:05 A.M.
230 million	First dinosaurs	344.8	December 11, 7:08:52 P.M.
360 million	First amphibians	336.4	December 3, 10:26:02 A.M.
430 million	First land plants	330.9	November 27, 9:07:50 P.M.
510 million	First fish	324.5	November 21, 12:46:57 P.M.
700 million	First multicellular animals	309.5	November 4, 10:57:23 A.M.
3.6 billion	Oldest fossils	71.0	March 13, 1:08:52 A.M.
4.6 billion	Earth formed	0	January 1, 12:00:00 A.M.

Quaternary		Recent	0.01
		Pleistocene	
			1.6

The geologic time scale chart:

Phanerozoic

Cenozoic

			Recent	0.01
Quaternary			Pleistocene	
				1.6
	Neogene		Pliocene	
				5
		Tertiary	Miocene	
				24
	Paleogene		Oligocene	
				37
			Eocene	
				58
			Paleocene	
				66

Mesozoic

Cretaceous	
	144
Jurassic	
	208
Triassic	
	245

Paleozoic

Permian		
		286
Carboniferous	Pennsylvanian	
		320
	Mississippian	
		360
Devonian		
		408
Silurian		
		438
Ordovician		
		505
Cambrian		
		570

Precambrian

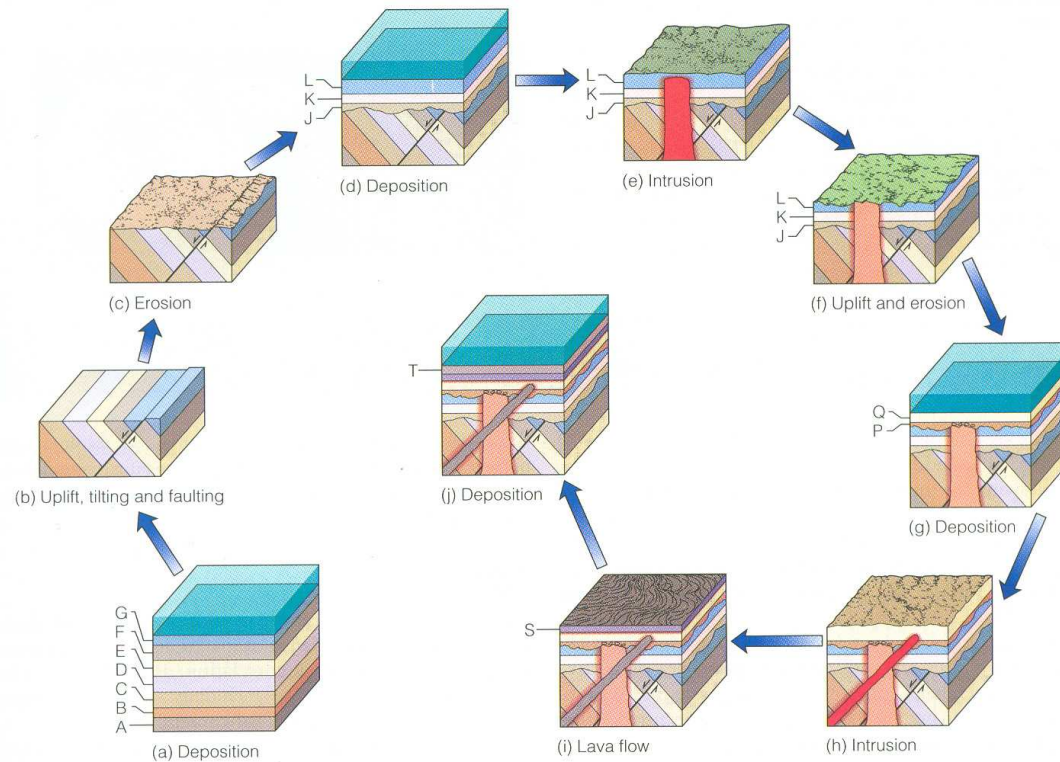| Proterozoic	
	2,500
Archean	
	3,800
Pre-Archean	
	4,600

➤ **FIGURE 1-19** The geologic time scale. Numbers to the right of the columns are ages in millons of years before the present.
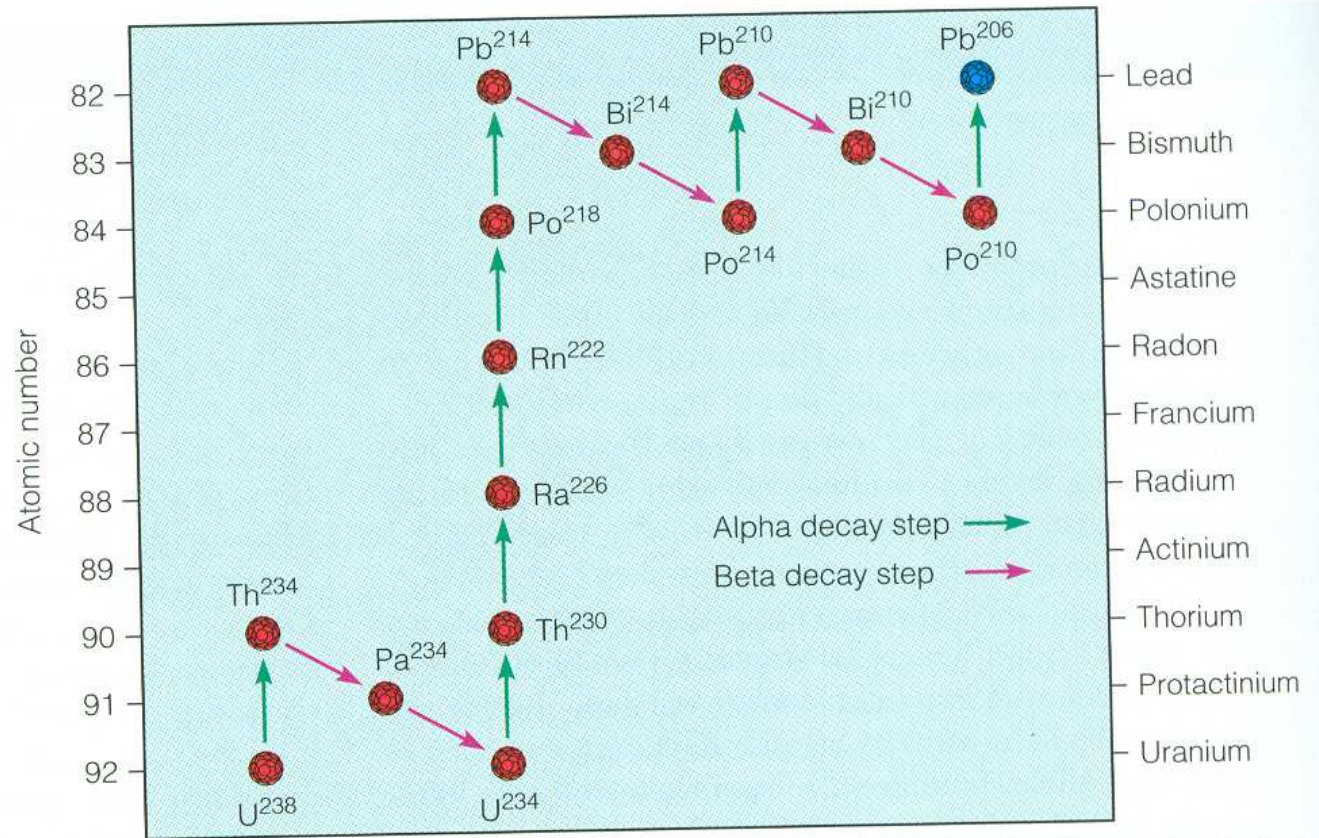
▶ **FIGURE 8-12 (left)** A block diagram of a hypothetical area whose geologic history can be reconstructed by applying the various relative dating principles.

▶ **FIGURE 8-13 (below)** (*a*) Beds A, B, C, D, E, F, and G are deposited. (*b*) The preceding beds are tilted and faulted. (*c*) Erosion. (*d*) Beds J, K, and L are deposited, producing an angular unconformity. (*e*) The entire sequence is intruded by a dike. (*f*) The entire sequence is uplifted and eroded. (*g*) Beds P and Q are deposited, producing a disconformity (N) and a nonconformity (O). (*h*) Dike R intrudes. (*i*) Lava (S) flows over bed Q, baking it. (*j*) Bed T is deposited.

(a) Deposition

(b) Uplift, tilting and faulting

(c) Erosion

(d) Deposition

(e) Intrusion

(f) Uplift and erosion

(g) Deposition

(h) Intrusion

(i) Lava flow

(j) Deposition

> **FIGURE 8-19** Radioactive decay series for uranium 238 to lead 206. Radioactive uranium 238 decays to its stable end product, lead 206, by eight alpha and six beta decay steps. A number of different isotopes are produced as intermediate steps in the decay series.
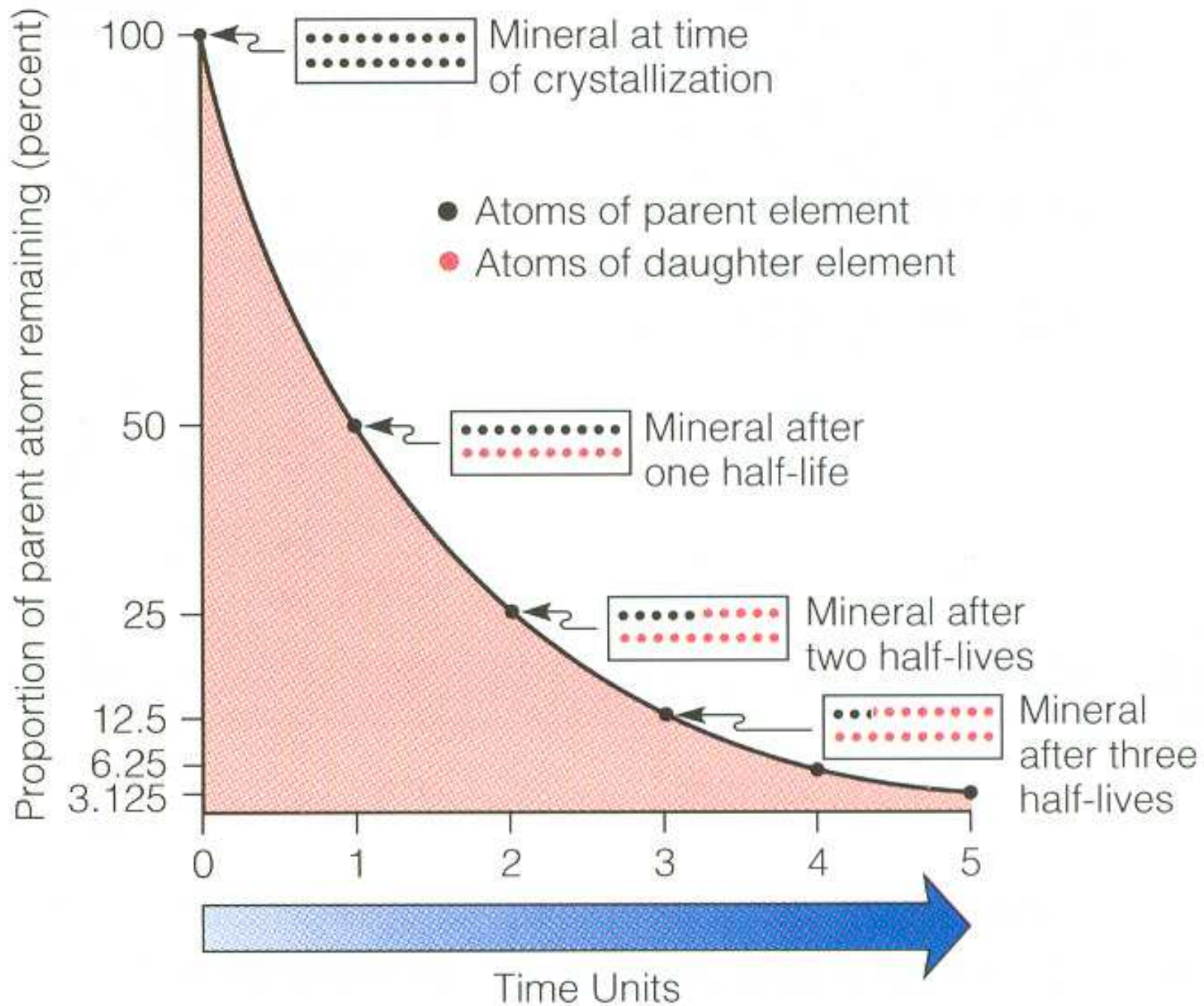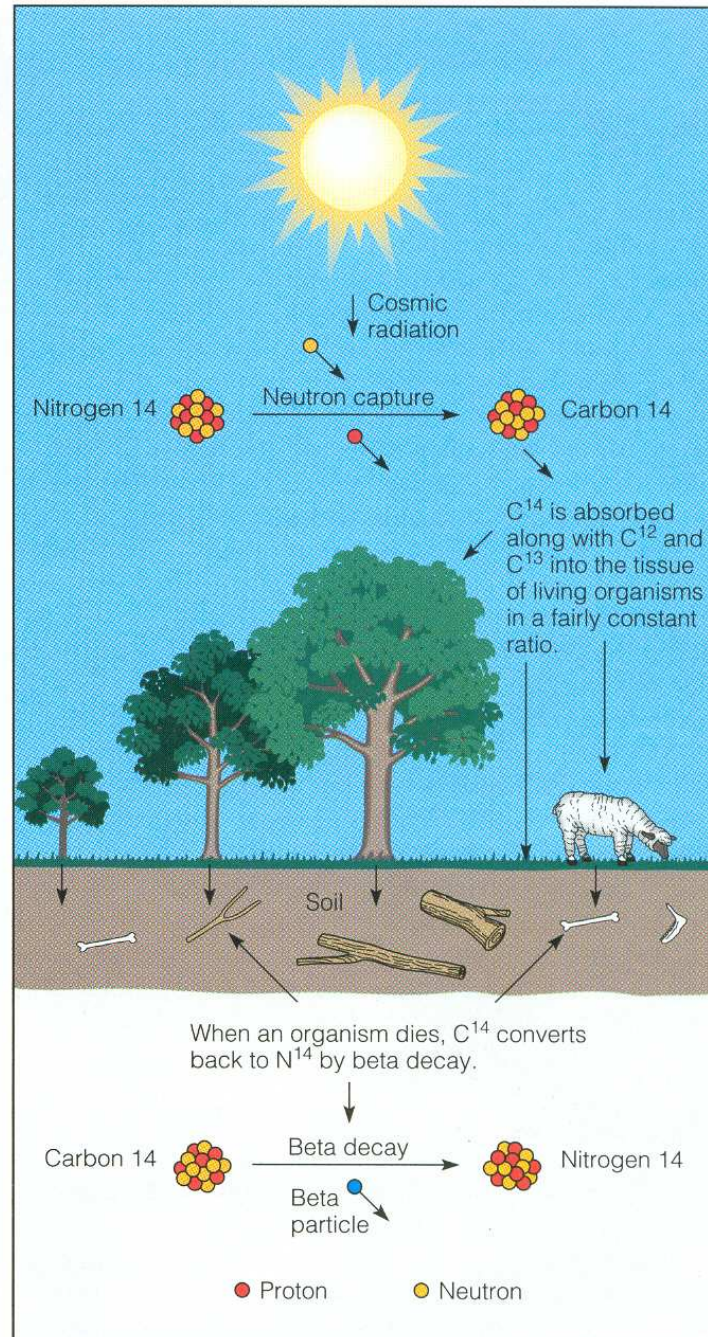
TABLE 8–1 Five of the Principal Long-Lived Radioactive Isotope Pairs Used in Radiometric Dating

Isotopes		Half-Life of Parent (Years)	Effective Dating Range (Years)	Minerals and Rocks That Can Be Dated
Parent	Daughter			
Uranium 238	Lead 206	4.5 billion	10 million to 4.6 billion	Zircon Uraninite
Uranium 235	Lead 207	704 million		
Thorium 232	Lead 208	14 billion		
Rubidium 87	Strontium 87	48.8 billion	10 million to 4.6 billion	Muscovite Biotite Potassium feldspar Whole metamorphic or igneous rock
Potassium 40	Argon 40	1.3 billion	100,000 to 4.6 billion	Glauconite Hornblende Muscovite Whole volcanic rock Biotite

➤ **FIGURE 8-24** The carbon cycle showing the formation, dispersal, and decay of carbon 14.

> **FIGURE 8-26** In the cross-dating method, tree-ring patterns from different woods are matched against each other to establish a ring-width chronology backward in time.

C. This beam came from an old house

B. This beam came from a house

A. This was a living tree when cut by us

The ring patterns match and overlap back into time

Date of last ring is that of year when we cut tree

This date obtained by counting back from bark of A

This date obtained by counting back from bark of A through B

Specimens taken from ruins, when matched and overlapped as indicated, progressively extend the dating back into prehistoric times.