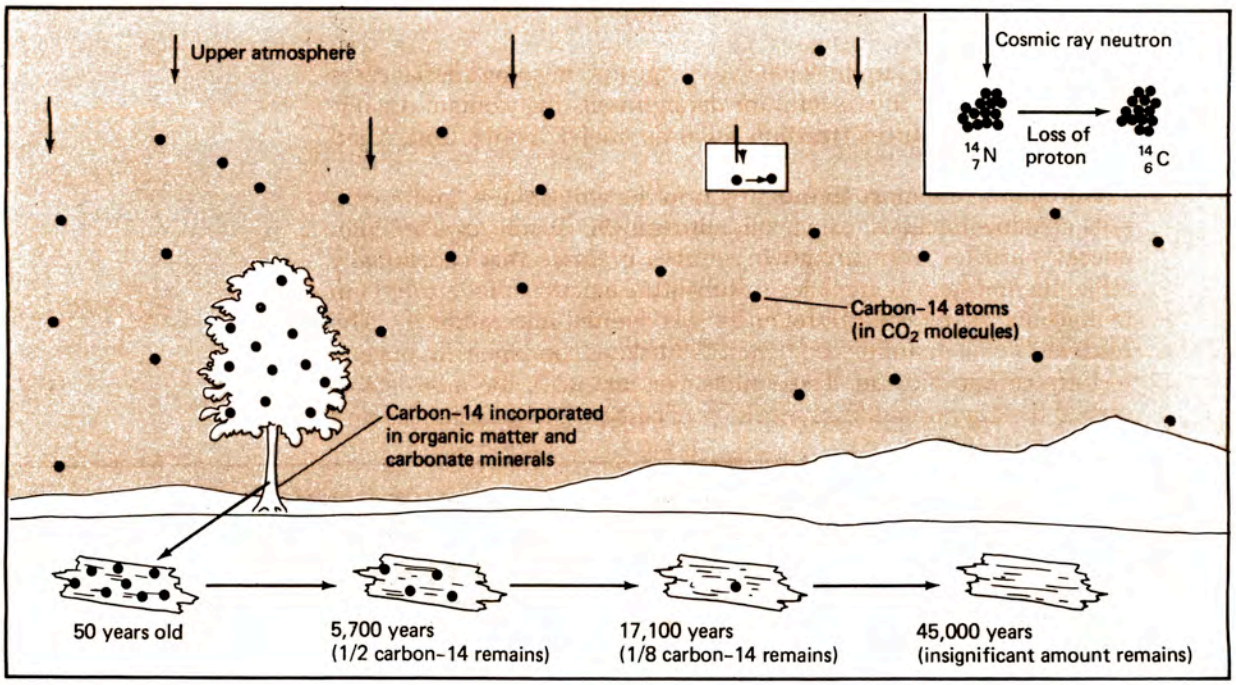

FIGURE A1.5.

The carbon-14 cycle. Radioactive carbon-14 is produced from atmospheric nitrogen by cosmic rays (inset). It then enters into CO_2 molecules and becomes incorporated into carbon-bearing sediments and organic remains. The amount of remaining carbon-14 is used to date such materials.

enter the carbon dioxide cycle of the atmosphere. Some of the radioactive carbon 14 is absorbed into growing plants and animals.

Since carbon 14 is radioactive, it subsequently converts a neutron from atmospheric nitrogen back into a proton and again becomes the stable nuclide nitrogen 14. It does this spontaneously and with great regularity. Carbon 14 has a half-life of only 5,730 years.

It should be noted that unlike the other radioactive methods described, the radiocarbon clock does not utilize the measurement of parent (C-14) and daughter (N-14) material. This is because the nitrogen 14 almost immediately escapes to the soil and atmosphere, so the daughter material cannot be accurately measured. Carbon 14 dating involves the measurement of the radioactivity itself, not the end-products. While age dating by this method may sometimes be imprecise due to unknown rates of carbon 14 formation in the past or contamination by other "dead" organic matter, it is nonetheless considered a useful dating tool.

Amino-Acid or Racemization Dating. While carbon 14 dating is generally useful only in dating organic material no older than 40,000 years, *amino-acid* dating is useful in dating older specimens. In Chapter 6 we pointed out that amino acids can exist in both right- and left-