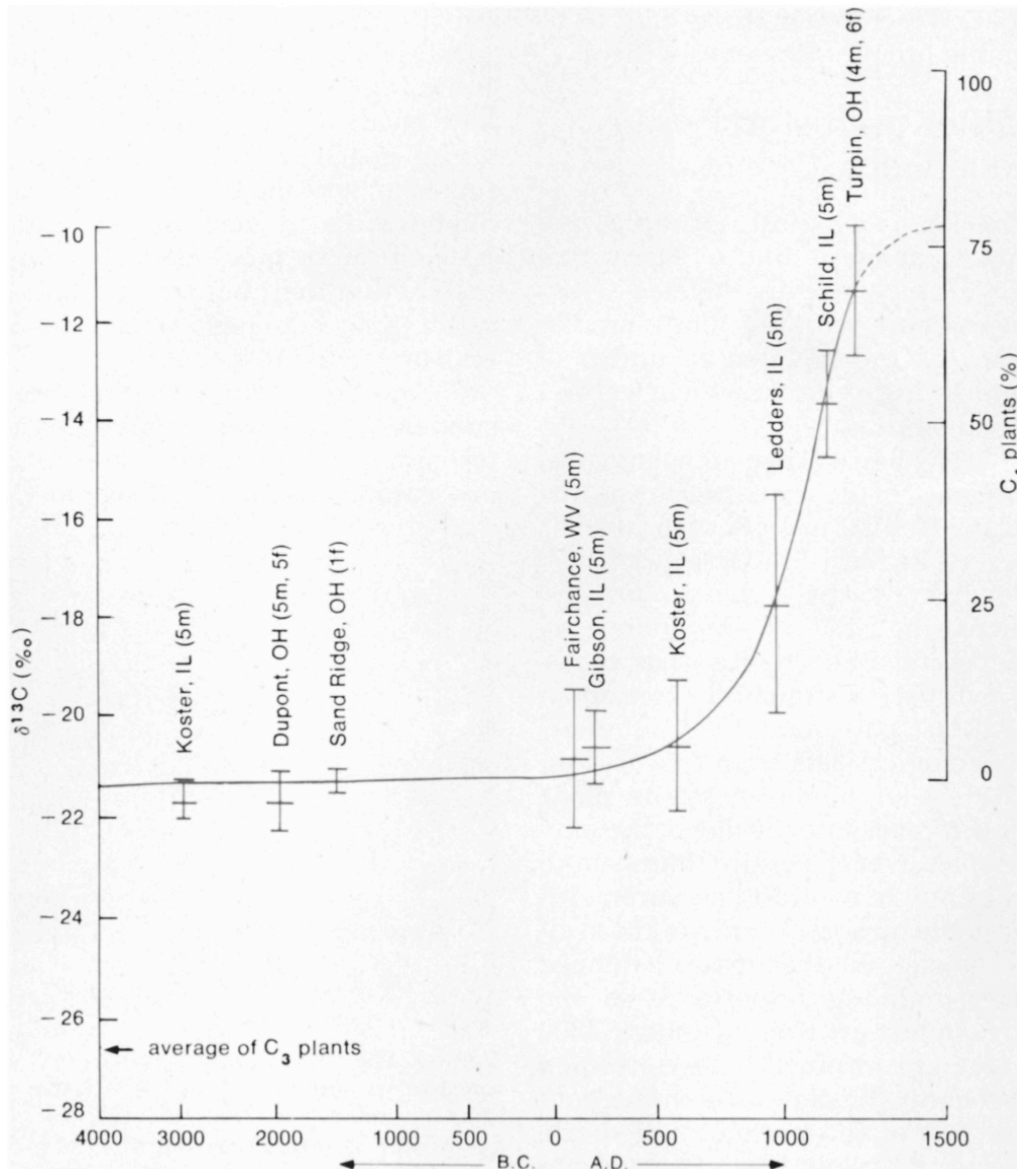




Data Points
Dating Corn Domestication Using Carbon Isotopes



Caption: Carbon isotope ratio data in bone collagen from human skeletons found in Illinois, Ohio, and West Virginia, dated 4,000 B.C. to 1,500 A.D. The number and sex of the individuals found at each location are indicated in parentheses.

BACKGROUND INFORMATION

To study the change in diet as human populations changed lifestyles from hunter-gatherers to agriculturalists, Nikolaas van der Merwe and J. C. Vogel measured carbon isotopes in the collagen tissues of human skeletons from North America dated between 4,000 B.C. and 1,500 A.D. Stable carbon isotopes are different forms of an element with slightly different atomic mass. For example, most carbon



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Student Handout

(^{12}C) has six protons and six neutrons in the nucleus and an atomic mass of 12, but ^{13}C has six protons and seven neutrons and an atomic mass of 13. Different species of plants contain different ratios of ^{12}C and ^{13}C isotopes depending on the pathway they use for carbon fixation during photosynthesis. Most of the native plants in the Americas are classified as C_3 plants, such as small seeded cereal crops like rice, wheat, barley, and oats, which convert CO_2 to an initial three-carbon compound during photosynthesis. C_4 plants, such as corn and sugarcane, convert CO_2 to an initial four-carbon compound. C_4 plant tissues have a higher ratio of ^{13}C to ^{12}C isotopes than C_3 plants. When animals eat these plants, the carbon isotope ratios, or “isotopic signatures,” are stored in their tissues, such as bone collagen. As these tissues are formed, fractionation occurs, which means that the carbon isotope ratios change slightly. For humans who consume C_3 plants, the average fractionation when bone collagen is formed is +5.1‰. Prior to the domestication of corn, C_3 plants were the main food sources for prehistoric humans in North America. The graph above illustrates the change in plant consumption before and after the adoption of domesticated corn as a staple agricultural crop in the American Midwest.