

Variation in $\delta^{13}\text{C}$ of dissolved inorganic carbon in the oceans

Bicarbonate (HCO_3^-) is the most abundant form of dissolved inorganic carbon (DIC) in the oceans, and from it forms the CaCO_3 of the tests and shells of many marine organisms. Values of $\delta^{13}\text{C}$ for the carbon of seawater bicarbonate reflect interaction with biological use of carbon. For example, values of $\delta^{13}\text{C}$ in surface water are commonly elevated because of preferential removal of ^{12}C by photosynthesizing organisms. On the other hand, where sinking organic matter has been oxidized, or "remineralized", to CO_2 at depth, values of $\delta^{13}\text{C}$ are less because of the return of ^{12}C -rich carbon to dissolved inorganic carbon.

This return of low- $\delta^{13}\text{C}$ carbon to DIC also results in geographic trends, as well as depth trends, in the $\delta^{13}\text{C}$ of DIC. Deep

water that has only recently left the sea surface, such as North Atlantic Deep Water (NADW), will have inherited little recycled carbon and thus have $\delta^{13}\text{C}$ values near that of the surface water from which it came. On the other hand, older deep water, such as that of the Pacific, has had more time to accumulate low- $\delta^{13}\text{C}$ carbon from oxidation of organic carbon and therefore has lower values of $\delta^{13}\text{C}$. The result is the distribution shown below in a joined pair of cross-sections passing southward down the west side of the Atlantic, around Antarctica, and then northward through the western Pacific. This cross-section is derived from Figures 3 and 5 of Kroopnick, P.M., 1985, The distribution of ^{13}C of ΣCO_2 in the world oceans: *Deep-Sea Research*, v. 32, p. 57-84.

