Atmospheric radiocarbon calibration curve beyond 12.4 cal kyr BP

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Radiocarbon dating method is based on the beta decay of ^{14}C originally produced in the upper atmosphere by secondary neutrons from cosmic-ray protons (Libby, 1952). It differs from most other radiochronnological method (U-Th, Rb-Sr, Sm-Nd, K-Ar, Lu-Hf, Re-Os, etc.) and is not possible to determine the ratio among the parent isotope (^{14}N), ^{14}C and its daughter product (radiogenic ^{14}N) because ^{14}N is undistinguishable from common nitrogen in the earth system.

For the calculation of radiocarbon age, the initial ^{14}C concentration ($^{14}C_o$) in samples is assumed to be constant with time. The possible causes of the ^{14}C variations in the different carbon reservoirs have been discussed by many researchers. The atmospheric ^{14}C concentration can vary with solar activity (Stuiver et al., 1961; Stuiver and Quay, 1980), geomagnetic field (Elsasser et al., 1965; Lal, 1988; Bard et al., 1990; Guyodo and Valet, 1999; Laj et al., 2000, 2002, 2004) and carbon distribution in the earth system (Siegenthaler et al., 1980; Edwards et al., 1993; Goslar et al., 1995; Bard, 1998; Hughen et al., 2000). To convert the radiocarbon age into calendar age, the radiocarbon calibration curves showing the temporal $^{14}C_o$ changes are necessary.

The latest radiocarbon calibration curves for terrestrial and marine samples covering the last 26 cal kyr BP (IntCal04 and Marine04) have been constructed based on the datasets from dendrochronologically-dated tree-ring samples, and marine samples consisting of U/Th dated corals around the world (Edwards et al., 1993; Bard. 1998; Buur et al., 1998, 2004; Cutler, 2004; Fairbanks et al., 2005), planktonic foraminifera in layer-counted varve sediments from the Cariaco Basin (Hughen et al., 2000). Beyond the end of tree-ring data at 12.4 kyr BP, the data form marine samples were used for the extension of terrestrial radiocarbon calibration curve (IntCal04) with a hypothesized relationship on the ^{14}C difference between atmosphere and marine reservoirs.

Although a quantitative assessment of the hypothesized relationships is hardly possible at present, the assessment of a geochemical box model of global carbon cycles would be give some insights of the hypothesized relationship. Based on some experimental results of a simple global carbon cycle model, the uncertainty of IntCal04 induced will be discussed in this presentation.