

IntCal

The raw isotopic ratio of $^{14}\text{C}/^{12}\text{C}$ in the atmosphere has varied over time due to the changes in ^{14}C production (cosmic ray flux), carbon cycle dynamics (e.g., uptake by the ocean), and anthropogenic inputs (burning fossil fuel and above ground nuclear weapons testing). Since the calculation of a radiocarbon date assumes a constant proportion of $^{14}\text{C}/^{12}\text{C}$ in the atmosphere over the past 50,000 years, a radiocarbon date must be calibrated. Thus, the international calibration curve "IntCal" was created, and it is built on ^{14}C measurements on records with independent dates such as tree rings, banded corals, and varved lake sediments. IntCal is updated every few years with the discovery of new records, improvements to measurement techniques, and changes to the statistical treatment of the data. The latest curves, IntCal20, SHCal20, and Marine20, were ratified by the radiocarbon community in December 2020 (Reimer et al. 2020). This does not include samples >Modern (AD 1950).

Calibration using OxCal

<https://c14.arch.ox.ac.uk/login/login.php?Action=Logout&Location=%2Foxcal%2FOxCal.html>

1. Create an account and login
2. Enter Sample Name (UOC#)
3. From the drop-down menu select F14C and enter values
4. Select curve from drop-down menu:
IntCal 20 for Northern Hemisphere
SHCal 20 for Southern Hemisphere
5. Click 'Calibrate'
6. Click through the tabs to edit things like units (calAD/BC, calBP), or statistics (median)

The image shows two screenshots of the OxCal web interface. The left screenshot shows the main calibration form with fields for Name (UOC-XXXXX), F14C (0.3423), and error (± 0.0015). The Curve is set to IntCal 20. Buttons for Calibrate, View Curve, and Projects... are visible. The right screenshot shows the Options tab, which includes sections for Output (Likelihood, Posterior, Indices), Ranges (Range 68.2, 95.4, 99.7), Summary statistics (μ, σ, Median), Style (Date reporting: cal BP, Round by: 1, Reversed), Table (Whole range, Controls), and a Show/Plot/Style/Adjust menu.

Marine Samples

The ocean contains a vast pool of old carbon due to slow exchange of atmospheric carbon through the surface of the water. This is known as the marine reservoir effect and it causes a discrepancy up to several hundred years between atmospheric and marine ^{14}C signatures. The marine reservoir effect is accounted for by applying a localized reservoir correction, ΔR .

1. Determine ΔR value from <http://calib.org/marine/>
2. Under Options, open the curve tab
3. Select the Marine20 curve, set Marine % to 100, and enter ΔR and error
4. Enter the F14C values into the @ tab.
5. Click Calibrate.

The image shows a screenshot of the OxCal Options tab, specifically the Curve section. It displays the 14C Calibration Curve settings. Under '14C Calibration Curve', the Atmospheric curve is set to IntCal 20, and Reservoir τ is 0 ± 0. Under 'Marine/mixed curve', the Marine curve is set to Marine 20, Atmospheric % is 0, Marine % is 100 ± 0, and Delta_R is 70 ± 20.

References

The 2020 calibration issue of Radiocarbon is open source and can be found here:

<https://www.cambridge.org/core/journals/radiocarbon/issue/E4F797FE1EF62148836A0EC13A8E9892>

Reimer, P., Austin, W., Bard, E., Bayliss, A., Blackwell, P., Bronk Ramsey, C., . . . Talamo, S. (2020). The IntCal20 Northern Hemisphere Radiocarbon Age Calibration Curve (0–55 cal kBP). *Radiocarbon*, 62(4), 725–757. doi:10.1017/RDC.2020.41