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Prospects for an extension and update of the IntCal04, Marine04, and SHCal04 radiocarbon calibration curves

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Radiocarbon calibration beyond the end of the tree-ring chronologies has been difficult and contentious. In the strictest sense a *bona fide* calibration archive must have obtained its carbon directly from the reservoir of interest (e.g. the atmosphere) and the calendar age must be known absolutely (e.g. dendrochronologically dated). However, there are few such archives of purely atmospheric ^{14}C beyond the end of the European tree-ring chronologies. Terrestrial macrofossil data from the Lake Suigetsu 2006 Project and the floating kauri tree-ring chronologies, which are expected to provide calibration data sets sometime in the future, are still incomplete. In the meantime, earth scientists and archaeologists require a reliable way to estimate calendar age ranges for older radiocarbon dated samples and there is considerable pressure to use data available from non-atmospheric archives for atmospheric calibration. A distinction should be made, however, to indicate that such calendar age estimates are not equivalent to calibration. The IntCal Working Group recommends that the term comparison (or common) timescale be used, abbreviated as 'com BP' or 'com BC'.

The potential comparison records which come closest to meeting the known age criteria are U/Th dated corals and speleothems and varved sediments, provided specific criteria are met. Additional marine and terrestrial datasets are available, which have timescales transferred through climatic correlation with an independently dated record (such as δ^{18}O of ice cores or speleothems). For such a timescale transfer to be justified, a reasonable mechanism is necessary to explain why the two records should be synchronous. There also must be sufficient resolution to confidently make the match and the uncertainty in the match must be carefully estimated in realistic terms (and not inappropriately minimized or overlooked).

Marine records, such as coral and planktonic foraminifera, provide a regional record of the surface ocean radiocarbon, but short-term fluctuations in atmospheric ^{14}C are attenuated and may be overprinted by ocean circulation changes. Atmospheric ^{14}C variations are less attenuated in speleothems but there is also an offset due to the incorporation of old or 'dead' carbon in the carbonate depositions. To use these marine and speleothem records as proxies for atmospheric ^{14}C, we have to make assumptions that the reservoir age or 'dead carbon fraction' has been constant or have independent means to develop time-varying corrections, within an estimated uncertainty, and, if possible, verify the assumptions through comparisons to independent ^{14}C production estimates.

Progress has been made in our understanding of the various systems, which produce the potential comparison archives and in statistical techniques, which account for the various sources of uncertainty and co-variance in both the radiocarbon ages and the calendar age estimates in combining data. These advances will allow the IntCal Working Group to integrate new and previously published data sets into calibration/comparison curves for atmospheric and marine samples back to 50,000 com BP, which we believe will be more realistic and robust than many of the curves that have been prematurely proposed and utilized.