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During Sea-Level Highstands:
A Global Synthesis with implications
for management of future coastal change

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Age-Model devolopment for salt-marsh sequences

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Abstract

A critical component in the reconstruction of (sub-) centennial changes in sea level and environmental conditions from Holocene salt-marsh deposits is the development of a reliable and detailed chronology, or age model, for the accumulation history of the deposit under study. The Figure shows three different age models (created from a suite of radiocarbon dates sub-sampled from a core collected in Big River marsh, Port au Port Peninsula, SW Newfoundland) based on: (1) individually calibrated 14C-dates, (2) sequentially calibrated dates, and (3) wiggle-match dating, all combined with stratigraphic data for hiatus identification. In the first age model, individual 14C-dates have been calibrated using INTCAL98 (Stuiver et al., 1998) and error boxes (paleo-marsh surface estimates) define an error envelope with two hiatuses. The disadvantage of this model is large error margins especially where plateaus occur in the 14C-calibration curve.

Programs such as OxCal (Bronk Ramsey, 1995) can take advantage of the close (4-8 cm) vertical sampling strategy employed to improve age-model precision.

Based on the principle of stratigraphic superposition, each sample should have a younger calibrated age than the sample immediately below it and an older age than the one immediately above it. Thus, the higher the sampling resolution, the more 'constrained' the calibrated ages become, resulting in a narrower age envelope, especially where 14C plateaus occur. This second age model accentuates possible variations in the rate of marsh accumulation. Mean averaging, weighted averaging or wiggle-match dating can be used to objectively obtain linear or non-linear rates of change within the two age-model envelopes. Here we used wiggle matching of multiple 14C samples to the calibration curve (Blaauw, 2001), a process which ultimately places a series of straight lines through the data set. The three age models represent a proxy for relative sea-level rise, but include sediment compaction.

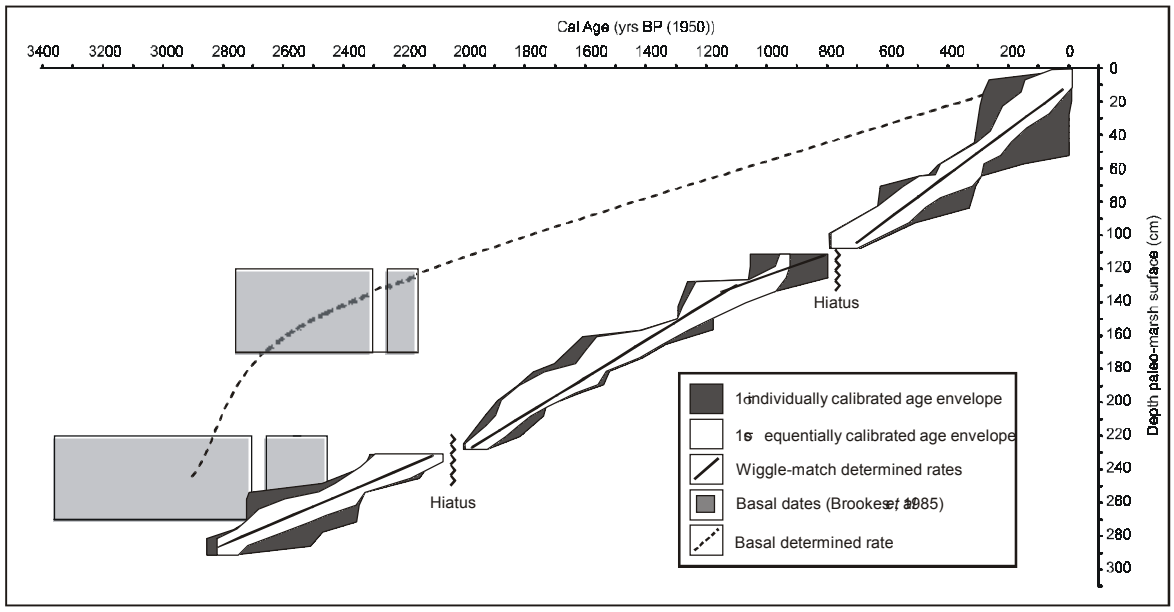

Figure 1. Age models created from a suite of radiocarbon dates sub-sampled from a core collected in Big River marsh, Port au Port Peninsula, SW Newfoundland

Comparison with the age model based on two basal peat samples from the area highlight this effect. A calculated accumulation rate between these two basal dates is in the order of 2.2 mm/yr; the compacted record spanning the same period produces a wiggle-matched rate of only 0.8 mm/yr.

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