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Dating of a young, subarctic peat deposit using the radiocarbon wiggle-match technique

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The attribution of forcing factors in paleo-environmental and paleo-climatic studies is often hampered by large uncertainties in the chronological control of proxy records from natural archives. Reducing these dating uncertainties therefore remains a continuous challenge to such studies. One way of reducing dating uncertainties is by wiggle-matching high-resolution ^{14}C measurements against past variations in the atmospheric ^{14}C concentrations [1].

Here, we use ^{14}C wiggle-match dating of closely spaced samples in an attempt to obtain a more solid chronological control of a relatively recent shift in vegetation from a poor *Sphagnum* fen to an ombrotrophic vegetation community separated by a peat layer enriched in diatoms in a peat sequence from Stordalen in northern Sweden (68° 21´ N, 19° 03´ E) [2,3]. The major question was whether it is possible to detect even small ^{14}C variations in the calibration curve across significant shifts in vegetation with different trophic status. An age model has previously been constructed based on interpolation between individually calibrated ^{14}C datings below and a ^{210}Pb chronology above the vegetation shift [3].

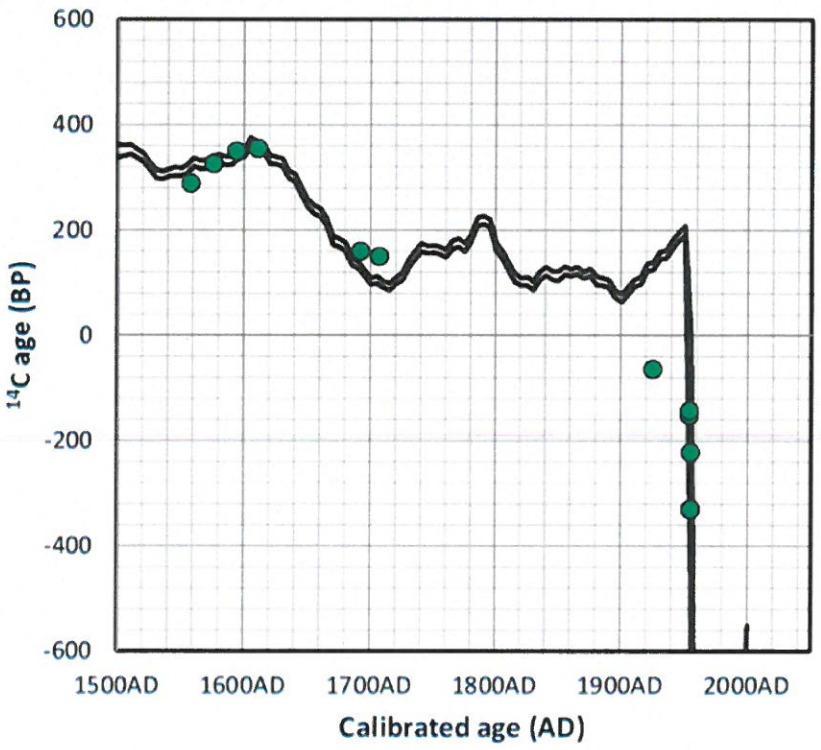

Figure 1. 14C wiggle-match dating (green dots indicate individual 14C dates) obtained on densely spaced samples from a peat sequence in Stordalen [3], against "wiggles" in the IntCal09 calibration curve prior AD1950 [6] and the NH1 calibration curve after AD1950 [7].

12 contiguous peat samples were collected across the vegetation shift and dated with the Lund University SSAMS system [4]. The results were combined with existing ^{14}C radiocarbon datings [3] and processed in OxCal4.1 [5] using the IntCal09 curve before AD1950 [6] and the post-bomb atmospheric NH1 curve after AD1950 [7].

With the wiggle-match approach, we captured a small but distinct "wiggle" in the ^{14}C calibration curve around AD1600, and we also captured the apparent onset of the bomb-induced increase in atmospheric ^{14}C after 1950 (Fig. 1). Although the results show a promising correspondence with the ^{14}C calibration curve, there are also features that call for further attention. The uppermost five dates showed similar results, which may be a result of contamination by bomb-produced ^{14}C through root penetration. Even minute amounts of roots containing increased amounts of ^{14}C from the bomb tests may have caused these similar dates.

Despite these challenges our results demonstrate that the ^{14}C wiggle–match dating technique is indeed a promising tool for obtaining well-constrained chronologies of recent peat deposits in subarctic Sweden. Future work will focus on improved age modeling of the data by taking advantage of our detailed knowledge of paleo-ecological and biogeochemical changes.

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