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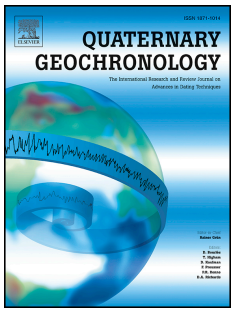


High-resolution age modelling of peat bogs from northern Alberta, Canada, using pre- and post-bomb $^{14}C$, $^{210}Pb$ and historical cryptotephra

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Abstract: High-resolution studies of peat profiles are frequently undertaken to investigate natural and anthropogenic disturbances over time. However, overlapping profiles of the most commonly applied age-dating techniques, including $^{14}C$ and $^{210}Pb$, often show significant offsets (>decadal) and biases that can be difficult to resolve. Here we investigate variations in the chronometers and individual site histories from six ombrotrophic peat bogs in central and northern Alberta. Dates produced using pre- and post-bomb $^{14}C$, $^{210}Pb$ (corroborated with $^{137}Cs$ and $^{241}Am$), and cryptotephra peaks, are compared and then integrated using OxCal's *P_Sequence* function to produce a single Bayesian age model. Environmental histories for each site obtained using physical and chemical characteristics of the peat cores, e.g. macrofossils, humification, ash content, and dry density, provide important constraints for the models by highlighting periods with significant changes in accumulation rate, e.g. fire events, permafrost development, and prolonged surficial drying. Despite variable environmental histories, it is possible to produce high-resolution age-depth models for each core sequence. Consistent offsets between $^{14}C$ and $^{210}Pb$ dates pre-1960s are seen at five of the six sites, but tephra-corrected $^{210}Pb$ data can be used to produce more coherent models at three of these sites. Processes such as permafrost development and thaw, surficial drying and local fires can disrupt the normal processes by which chronological markers and environmental records are incorporated in the peat record. In consequence, applying standard dating methodologies to these records will result in even greater uncertainties and discrepancies between the different dating tools. These results show that using any single method to accurately date peat profiles where accumulation has not been uniform over time may be unreliable, but a comprehensive multi-method investigation paired with the application of Bayesian statistics can produce more robust chronologies. New cryptotephra data for the Alberta region are also reported here, including the historical Novarupta-Katmai 1912 eruption, White River Ash (East), and glass from Mt. St. Helens, Mt. Churchill, and probable Aleutian sources.

Keywords (<6): Peat, chronology, Anthropocene, Bayesian age modelling