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Phases of peatland carbon accumulation in the southern mid-latitudes

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Creating high resolution chronologies in sediment sequences is important for understanding past carbon-climate dynamics, including accurately dating the timing of climate events, and calculating carbon accumulation changes through time. Here we present >100 ¹⁴C dates from UNSW's high-throughput MICADAS (Turney et al. 2021) that help answer key questions about carbon-climate dynamics in the Southern Hemisphere. Peatlands from the southern mid-high latitudes have an important role in the global carbon budget but are underrepresented in global syntheses due to paucity of data. Developing accurate age-depth models from peat sequences is notoriously difficult. Outliers are common, with peat being susceptible to issues such as root penetration and in-wash of sediment. With careful consideration to site selection (Thomas et al. 2019) and material preparation (e.g. sieving out root and rootlet material), the age-depth models presented here demonstrate stratigraphic integrity with no evidence of significant outliers, providing robust and detailed chronologies to enable a range of scientific questions to be answered.

To better constrain the understanding of southern peatland dynamics, we collected and radiocarbon-dated 25 basal peats from across sub-Antarctic islands of the South Atlantic region, doubling the existing available data. We then collated basal peat radiocarbon ages from >35°S and analysed their temporal and spatial distribution. We find two distinct phases of peat formation, at ~16,000 cal years BP and ~13,000 cal years BP, independent of northern hemisphere peat growth. Well-constrained age models from these regions (including a 6 m peat sequence with 55 ¹⁴C dates) show changes in carbon accumulation rates that are consistent with these phases. Potential drivers of these phases include growth disruption via the Antarctic Cold Reversal, and the latitudinal movement of the southern hemisphere westerly winds, with implications for future carbon storage in these under-studied regions.

References

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