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Holocene development of Amazonia's oldest peatland

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Peatlands represent some of the most carbon-dense ecosystems of Amazonia. However, little is known about the mechanisms of Amazonian peatland development and their ecohydrological dynamics over time. We present a comprehensive multiproxy dataset from Aucayacu peat dome, the oldest peatland yet discovered in Amazonia (peat initiation occurred between 8.9 and 5.8 ka cal. BP). Our dataset includes analyses of peat physical properties, carbon and nitrogen, humification, organic matter characteristics, macrofossils, pollen, charcoal and testate amoebae. Sedimentological techniques were applied to minerogenic deposits underneath the peatland to understand the nature of the floodplain environment before peat initiation. A transfer function was used to reconstruct past hydrological conditions from subfossil testate amoeba assemblages and carbon accumulation (CA) rates were determined from bulk density and percentage carbon data. A robust chronology was achieved using 210Pb and 14C (14 radiocarbon dates on a 3-m core) determinations, modelled using a Bayesian approach.

We used the datasets to investigate the long-term ecohydrological development and controls on carbon accumulation in an Amazonian peat dome. The peatland developed in three distinct stages; (i) abandoned river channel with standing open water and aquatic plants; (ii) inundated forest swamp; and (iii) ombrotrophic bog ($\sim$3.9 ka cal. BP). Local burning occurred twice during the peatland's development as evidenced by macroscopic charcoal but appears to have become more pronounced in the last $\sim$100 years. We present a conceptual model of the role of autogenic and allogenic (climate, floodplain) processes on the long-term development of the peatland and the marked variations in carbon accumulation rates over the Holocene. Amazonian peatlands are important carbon stores and ecosystems, and represent important archives of past climatic and ecological information. They should form key foci for conservation efforts.