A new peat bog testate amoeba transfer function and quantitative palaeohydrological reconstructions from southern Patagonia

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Testate amoebae have been extensively used as proxies for environmental change and palaeoclimate reconstructions in European and North American peatlands. The presence of these micro-organisms near the peat surface is generally significantly linked to the local water table depth (WTD) and therefore preservation of the amoeba shells downcore allows for water table reconstructions over millennia. In the last decades, attention for the palaeoecology of the southern Patagonian peat bogs has increased, partly because of the particular climatological setting under the influence of the southern westerlies. These atypical peat bogs are characterised by a wide range of water tables, from wet hollows to hummocks exceeding 100 cm above the water table, and a dominance of *Sphagnum magellanicum* on low lawns up to the highest hummocks. Here we present the first transfer function for this region that allows for reliable WTD reconstructions, along with 2k-year palaeorecords from local peat bogs.

A modern dataset (155 samples) was sampled along transects from five bogs in 2012 and 2013. Measurements of WTD, pH and conductivity were taken for all samples. Transfer function model was based on the 2012 dataset while the 2013 samples served as an independent test set to validate the model. Besides the standard leave-one-out cross-validation we applied leave-one-site-out and leave-one transect-out cross-validation, which are effective means of verifying the degree of clustering in the dataset. To assure the environmental gradient had been evenly sampled we quantified the root-mean-squared error of prediction (RMSEP) individually for segments of this gradient.

Ordinations showed a clear hydrological gradient in amoeba assemblages, with the dominant *Assulina muscorum* at the dry end and *Amphitrema wrightianum* and *Difflugia globulosa* at the wet end. Taxa as *Nebela certesi* and *Nebela cockayni*, possibly exclusive to the southern hemisphere, were identified and their optima and tolerances were determined. Canonical correspondence analysis showed that WTD was the most important environmental variable, accounting for 18% of the variance in amoeba assemblages. A weighted averaging-partial least squares model showed best performance in cross-validation and using the 2013 data as an independent test set. Any spatial autocorrelation was minimal although the model still appeared less effective in predicting WTD for sites not included in the training set. The segment-wise RMSEP showed that the WTD gradient was generally evenly sampled with RMSEP below 15 cm for most of the gradient, much lower than the standard deviation of the mean of all WTDs (26 cm).

Preliminary results from peat cores sampled from the same peat bogs show surprisingly stable water tables over the last 2k years in Andorra bog but more variation in nearby Tierra Australis bog. Peat accumulation rates in Andorra bog are among the highest recorded in temperate bogs with around 4 m of peat accumulated during the last 2000 years.