CLIMATIC VARIABLITY IN MFABENI PEATLANDS (SOUTH AFRICA) SINCE THE LATE PLEISTOCENE

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Introduction

There has long been a quest amongst the paleoclimatology community to establish if a North-South interhemispheric climate relationship existed during the late Pleistocene and Holocene. One of the more popular theories is the bipolar seesaw (Broecker, 1998; Stoker, 1998; Stocker and Johansen, 2003) proposed to be caused by the slow-down or switching off of the oceanic Atlantic Overturning Meridional Circulation (AMOC) that circulates heat from the equatorial and Southern Oceans towards the higher latitudes in the Northern Hemisphere (Chase et al., 2015). Compared to marine records, there is a lack of continuous high resolution terrestrial climate archives, most notably in Southern Africa, due to the regions' overall semi-arid climate and high relief topography not being conducive for sediment archive preservation. The Mfabeni peatland, with its basal ^{14}C age of c. 47 kcal yr BP has been established as one of the oldest known continuous terrestrial archive of its kind in Southern African (Grundling et al., 2013, Baker et al., 2014), and provides a unique opportunity to conduct high resolution glacial and interglacial palaeoecological investigations of past climate in Southeast Africa. In this study we present *n*-alkane leaf wax $\delta^{13}C$ ($\delta^{13}C_{wax}$), bulk $\delta^{13}C$ and total organic carbon (%TOC) records, integrated with information from proximal stratigraphic and palynological studies undertaken in the peatland, to reconstruct peatland hydrology, sedimentation regimes and proportional inputs of C3/C4 plants, and infer the climate controlling these ecological variables.

Results

A significant and strong statistical correlation exists between the $\delta^{13}C_{bulk}$ and $\delta^{13}C_{wax}$ trends in the Mfabeni SL6 core ($r=0.87$, $P=0.01$, $df=35$), suggesting the dominant control on $\delta^{13}C_{bulk}$ values were the relative contributions of terrestrial C3 and C4 plant types into the peat record, and therefore the high resolution $\delta^{13}C_{bulk}$ data set provides a robust record of past proportional inputs of C3 and C4 vegetation into the peatland. When comparing the formerly published Mfabeni palynological (Finch and Hill, 2008) and geomorphological (Grundling et al., 2013) records with our geochemical data sets, they correlate strongly (Figure 1) with respect to boundary and transition ages where major deviations in plant assemblages and peat chronology are recorded. By relating these three diverse records extracted from proximal sampling sites in the peat basin, we were able to reconstruct the palaeoenvironmental changes in the Mfabeni peatland since 47 kcal yr BP.

Conclusions

We found evidence for palaeoenvironmental shifts corresponding to some of the global climatic events since the late Pleistocene (H4, LGM, deglacial period and Holocene). This is consistent with other regional climate records, most notably, the adjacent Indian Ocean SST records (Bard et al., 1997, Schefuß et al., 2011). However, due to the rather muted response of $\delta^{13}C_{bulk}$ record with regard to some of the other shorter climatic events (H5/A2, A1, H3, H2, H1, ACR, and YD), we conclude that the local hydrology of the fen overprinted the signal for the more ephemeral climatic events in the Late Pleistocene. Overall, the Mfabeni

record exhibits a general antiphase trend with climatic events in the northern Hemisphere, underpinning the bipolar seesaw interhemispheric mechanism hypothesis.

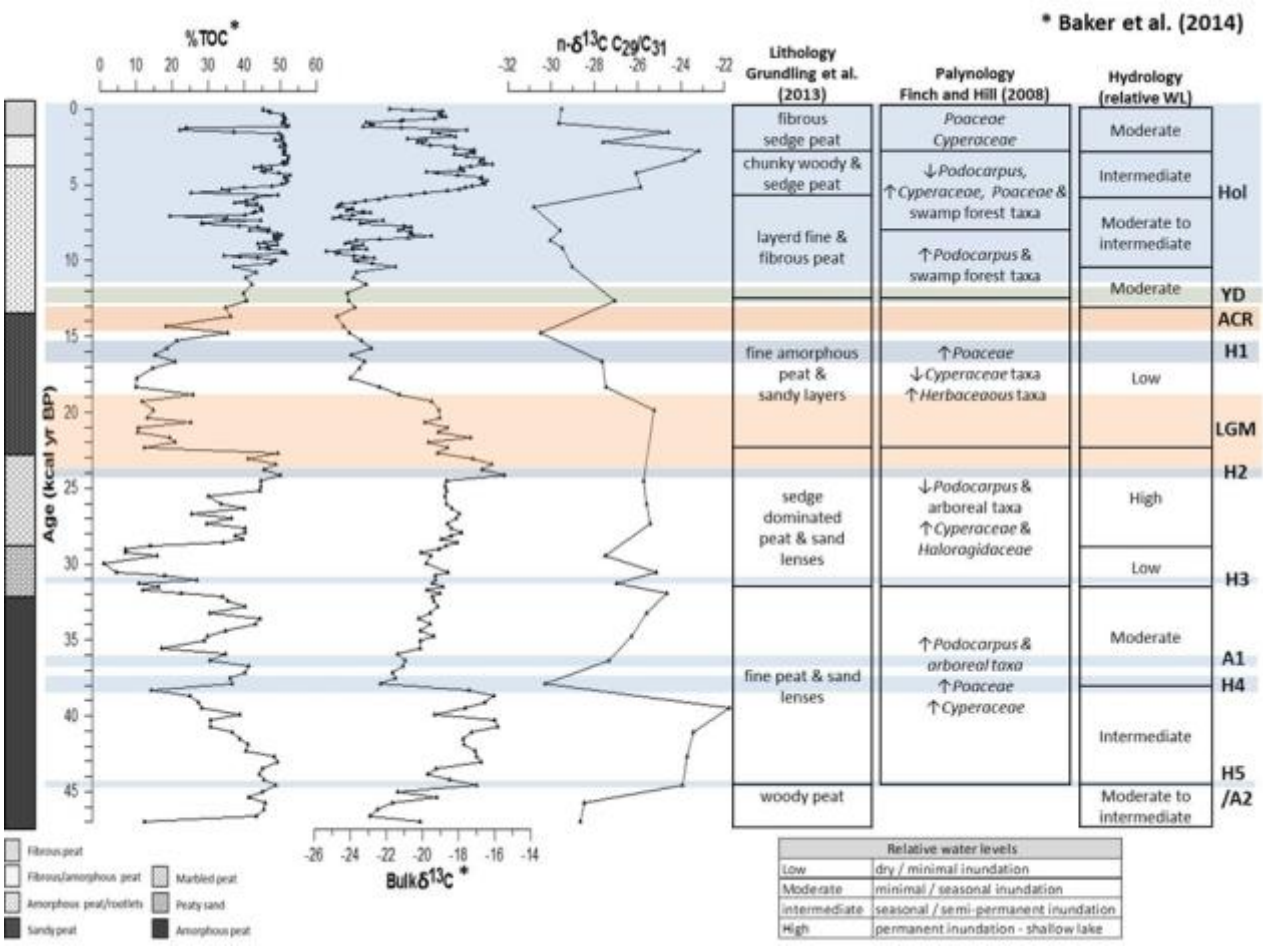

Figure 1: *Core SL6 %TOC (n=198) , bulk carbon (n=198) and leaf wax (n=35) isotope profiles in comparison with peatland development chronology by Grundling et al (2013), palynology record by Finch and Hill (2008) and local hydrology interpretation of the Mfabeni peatland. Core SL6 %TOC and bulk C isotopic data modified from Baker et al. (2014).*

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