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Siliceous microfossils as late Quaternary paleo-environmental indicators at Braamhoek wetland, South Africa

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A core from a peat-sequence covering the last 16 ka (16,000 calibrated years before present) from the Braamhoek wetland, eastern South Africa, produced siliceous microfossils, SiO2, (phytoliths and diatoms). Phytoliths are minute silica particles precipitated within or between plant cells and can be found among many plant families. They are, however, particularly common in the Grass family (Poaceae). The peat core was rich in phytoliths, while diatoms were less prominent, probably due to degradation during wetland plant growth associated with silica uptake.

The Braamhoek wetland is located in the grassland biome of southern Africa and the vast majority of the phytoliths found in the Braamhoek wetland are interpreted as being derived from grasses growing in and around the wetland. Phytolith analysis presents a possibility to extract more detailed information regarding grass sub-family/species distribution than other methods to date and can thus be used to gain new insights to ecological and climatological changes in grass dominated environments.

Of the twelve Poaceae sub-families, eight are present in South Africa. We focussed on phytolith morphology and paleo-environmental applications of especially three of them, viz. Pooideae (C3), Panicoideae (mainly C4) and Chloridoideae (C4). These sub-families create rather distinct morphological phytoliths and all have different climatic preferences. The high abundance of grasses from the Arundinoideae (C3) sub-family in the Braamhoek wetland, however, called for a new approach to phytolith methodology in our study. Further, a small-scale phytolith study of modern soil samples yielded additional information of how to interpret fossil assemblages in terms of moisture availability.

With this study we present the first continuous phytolith and diatom record from South Africa for the late Pleistocene and Holocene. The phytolith assemblages indicate a clear dominance of C3-grasses within the wetland throughout the sequence. Two phytolith indices (Iph and Ic) interpreted as indicators of climatic change, show periods of increased wetness and possibly minor temperature fluctuations during the late Quaternary.

The fossil diatom record infer changes in past moisture conditions. Unlike the modern wetland, which is dominated by benthic and aerophilic diatoms, the late Pleistocene-early Holocene wetland favoured growth of planktonic species requiring deeper water. Abundance of planktonic diatoms suggests three main phases of greater water depth than today at c.13.6 ka, 11.3 ka and 10.4-10.0 ka.

As part of a multi-proxy comparison, siliceous microfossil indications of past fluctuations in humidity in the Braamhoek wetland generally accord with the results from previous studies of pollen, charcoal fragments and stable isotopes in the same core.