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Investigating annually-resovled natural climate variability during MIS 11 using lacustrine records

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Marine isotope stage 11 (MIS 11, ca 410,000 yrs BP) is considered to be one of the best analogues for current and future climate change due to the similarity of orbital forcing patterns during these two interglacials. Marine and ice-core records suggest that MIS 11 was a particularly long interglacial, characterised by stable climates. The investigation of high-resolution climate records from MIS 11 can, therefore, allow us to understand how the climate of a Holocene-like interglacial might evolve in the absence of anthropogenic modification. MIS 11 sediments preserved in the palaeolake basin at Marks Tey, eastern England, offer the potential for such a study as they are considered to be annually-laminated (varved) throughout a large part of the interglacial (Turner, 1970, 1975). The lamination sets appear to be comprised, primarily, of three regularly occurring laminae types; 1) authigenic carbonate, 2) diatom blooms, and 3) organic detritus, although there appears to be some variability in the microfacies of these laminations. The carbonate laminations are the key to the study of climate variability during MIS 11, as they represent authigenic carbonate precipitation, consistent with temperature/biologically driven changes in lake chemistry during the summer months. Oxygen isotopic analysis of the carbonate therefore gives a proxy for summer temperature. A period of key interest in the MIS 11 sequence at Marks Tey occurs during the early part of the interglacial, where there is a short-lived increase in grass pollen relative to tree pollen, termed the Non-Arboreal Pollen Zone (NAPZ). The cause of this shift in pollen has been subject to debate, with natural wildfire (Turner, 1970) or climatic deterioration (e.g. Kelly, 1964) being suggested as possible forcing mechanisms. In this study, as well as discussing the main characteristics of the MIS 11 sequence at Marks Tey, we will focus on the sedimentary, micromorphological and geochemical record of the NAPZ. In particular we discuss the potential role of abrupt, sub-Milankovitch, climate cooling in its genesis, whilst highlighting the complexity of ecological and landscape response that such a climatic event may generate. The study concludes by discussing the potential occurrence of 8.2ka-like events in pre-Holocene interglacials.

References

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