



A chironomid-based temperature reconstruction for the Younger Dryas - Holocene transition from a palaeo-channel of the Niers-Rhine, Germany

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A palaeo-channel of the Niers-Rhine containing Younger Dryas and Early Holocene sediments was studied for fossil chironomid assemblages. A 1.5 m core obtained from this locality (57°10' N; 3°23' E) consisted mainly of calcareous gyttja (>70% authigenic carbonate). Based on palynological analysis from the same core, these sediments are dated to ~12,000 to 10,500 cal BP. Chironomid and other aquatic invertebrate assemblages and aquatic pollen indicate that shallow lacustrine conditions prevailed in the palaeo-channel, with only occasional overflows from nearby rivers. This is also supported by the lithology of the sediments which contain only low amounts of clastics. Mean July air temperatures were reconstructed from chironomid assemblages using a Central European reference dataset and transfer function. Chironomid-inferred July temperature shows a gradual increase during the latter part of the Younger Dryas (~12,000 to 11,650 cal BP) from ~12.3 to ~14.5 °C. The aquatic flora during this phase consisted of submerged aquatic plants and algae, mainly Characeae. A major shift in chironomid and invertebrate assemblages is apparent at the Younger Dryas to Holocene boundary. Orthocladiinae and Tanytarsini dominate in the Younger Dryas section, whereas Chironomini are more abundant in the Preboreal (~11,650 to 10,500 cal BP), which suggests an increase in temperature. Similarly, a sudden increase

in temperature of $\sim 3.1^{\circ}\text{C}$ is reconstructed with the chironomid-temperature transfer function at the onset of the Holocene. Temperatures around 17°C are inferred for the Preboreal and one or possibly two minor fluctuations are apparent during this episode. However, additional data is needed to confirm the duration and the amplitude of these events. From the start of the Preboreal, the previously dominating submerged macrophytes are replaced by floating leaved plants (mainly *Nymphaea alba*). The uppermost sediment layers ($< 10,500$ cal BP) consist of peat, thereby indicating a complete aquatic succession. This study suggests that palaeo-channels, such as those found in the Niers-Rhine valley, are well suited for chironomid-based temperature reconstruction and that the warming at the Younger Dryas - Holocene transition had a distinct effect on the aquatic ecosystems in these shallow lakes.