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Palaeoclimate reconstruction within the Palaeogene using fossil plants

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The Palaeogene was a time of extraordinarily strong climate and environmental changes. During this period, the Earth´s climate experienced a major global warming and subsequent cooling and shifting from more or less ice-free greenhouse conditions during the Palaeocene/Eocene turnover towards substantial glaciation of Antarctica during the Oligocene. Most of these remarkable temperature excursions and changes as well as global carbon dioxide levels are estimated from the marine realm. Maximum ocean water temperature curves calculated from oxygen isotopes of benthic organisms are often parallelized with global climate evolution and global atmospheric CO_2 levels. The terrestrial record, however, is not so well understood and indicates partly distinct and different developments, which means global ocean water temperature values and changes not necessarily mirror continental palaeoclimate. Plants, dependent on certain temperature conditions and water availability are excellent proxies which mirror palaeoclimatic and palaeoenvironmental conditions and shifts of those. Despite changes in the floristic composition of the plant assemblages, also morphological and anatomical characters (leaf size, stomatal parameters) of land plants through time give indication of adaptations to distinct climatic and environmental changes. To detect these shifts, we analyse plant assemblages from different stratigraphic ages of the Weisselster Basin, which represents the southern extension of the Mid-German Estuary of the Palaeogene North Sea. Basin's sediments cover marine, tidal, estuarine and fluvial deposits including lignites. To track possible palaeoclimatic changes we (**1**) plot palaeoclimate estimates (mainly MAT, seasonality in the distribution of precipitation) and shifts in leaf traits through time and (**2**) compare them with commonly used palaeoclimate reconstructions derived mainly by marine records. First palaeoclimatic results, covering a time interval from the late Eocene to the Oligocene–Miocene boundary, show no significant temperature trend. In addition to the analysis of plant assemblages using leaf physiognomic methods and nearest living relatives, we also focused on tracing morphological and anatomical adaptions of selected long-lived taxa to track possible adaptation strategies on atmospheric pCO_2-changes (e.g., stomatal density, stomatal index, leaf venation density). The contribution will focus on different possibilities to use the material stored in palaeobotanical collections focusing on modern applied scientific issues such as global climatic changes. We therefore show results derived with different methods: (**1**) the possibility of coupling morphometric traits and stomatal parameters with climate conditions, (**2**) results obtained by quantitative palaeoclimate methods for a variety of sites within the Weisselster Basin (Fig. 1), (**3**) on taphonomic biases due to different palaeoenvironments and thus (**4**) the applicability of different methods to derive palaeoclimatic evidences.

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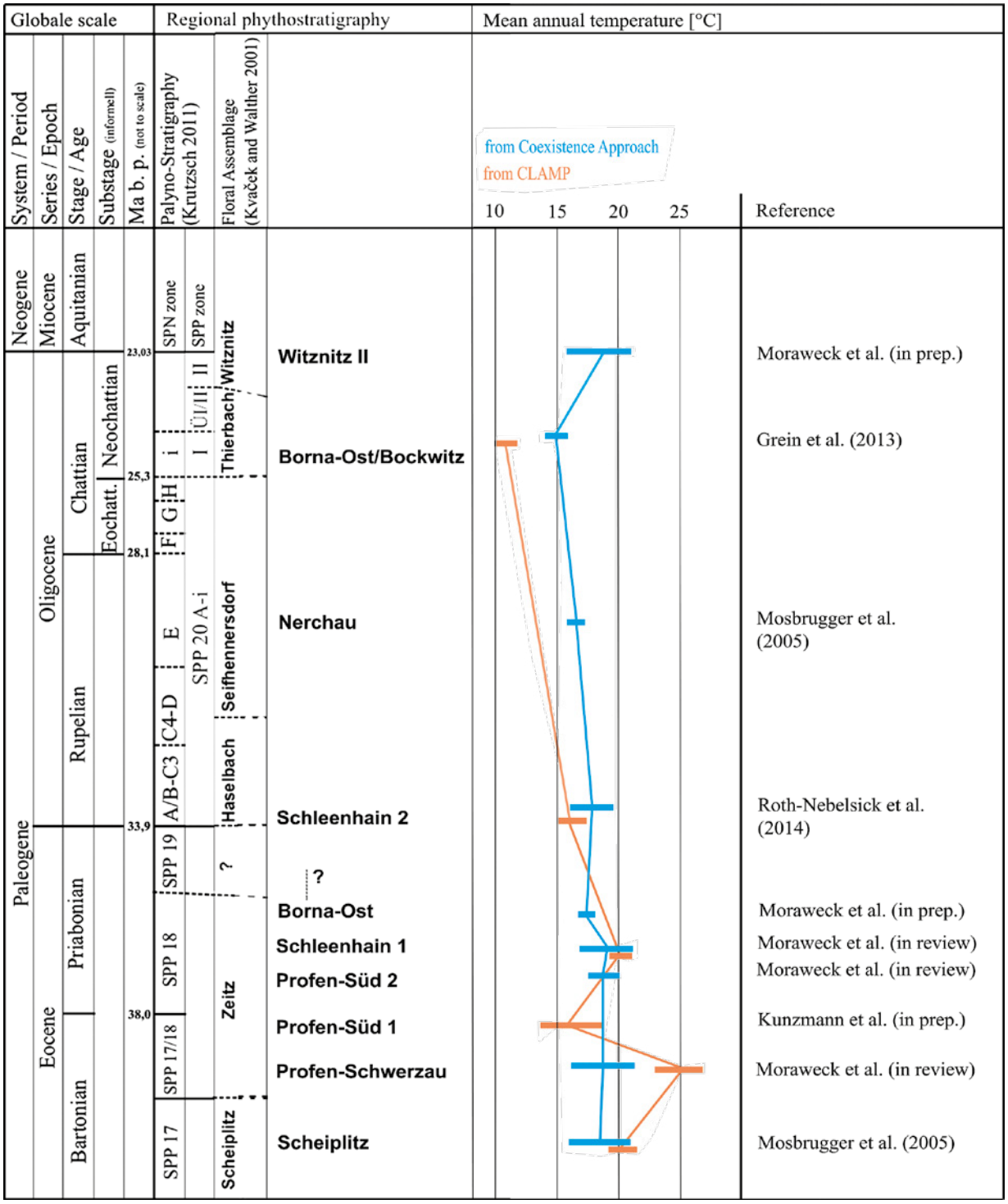

Fig. 1. Palaeoclimate estimates derived by the Coexistence Approach and CLAMP for various sites within the Mid-German Weisselster Basin (modified from Kunzmann et al., in prep.).

References

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