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# Coral Proxies in Miocene Palaeoclimatology

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Our present understanding of Cenozoic long-term global climate evolution was reconstructed principally from deep sea sedimentary archives. However, various effects of time-averaging preclude our deciphering of *real* climate variability from these archives. Correspondingly, rates of climatic change and extremes of climatic modes remain largely unknown, and exploring new Neogene high-resolution records on subannual to centennial time-scales remains a principal task of future research. In shallow water environments carbonate secreting biota are highly sensitive to sea surface temperature (SST), salinity (SSS), nutrients and ocean pH and, therefore, have high potential as geological climate archives. However, shallow water deposits suffer from a discontinuous sedimentary record and substantial diagenetic alteration. Nonetheless, zooxanthellate-coral (z-coral) diversity and skeletal calcification rates in modern oceans are a function of the surface environment and controlled mostly by SST. Additionally, the absence of coral frameworks (reefs) in shallow water carbonates is an indicator for temperatures under the lower threshold for reef systems ($\sim$18˚$C_{winter}$). Consequently, z-coral diversity and skeletal extension rate in the Neogene can be considered semi-quantitative climate proxies for SST insensitive to diagenetic alteration. We use a combined data set of generic diversity, annual growth rate and sclerochronological information to back-track Late Miocene environmental changes at a subannual resolution. Low-diversity coral associations (*Porites, Tarbellastraea*) from Crete exhibit rather constant, low annual growth rates (4 mm/yr) indicating winter SSTs near the lower coral threshold of 20-21˚C. Skeletal $\delta^{18}$O in *Porites* and *Tarbellastraea* exhibits a clear long-term trend towards more positive values, and thus increasing salin-

ity. Interestingly, interannual skeletal $\delta^{18}$O variability is surprisingly stable and similar to modern atmospheric perturbations. $\delta^{18}$O seasonality is decreasing in the course of the Late Miocene prior to the Messinian salinity crisis, however, because skeletal $\delta^{18}$O reflects both, temperature and hydrological balance, it is not clear yet if the long-term change in average composition and seasonality reflects local or global (i.e. insolation) changes, however, trace element data demonstrate a conspicuous rainy season during Tortonian winter. Nonetheless, even at this early stage of work our results show that coral sclerochronology represents a powerful new method for documenting *real* atmospheric dynamics during Miocene.