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Causes and consequences of short-term sea-level changes in the Cretaceous green- and "hothouse": Topics and context of IGCP Project 609

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In contrast to the well-understood process of glacial eustasy, controlled mainly by waxing and waning of continental ice sheets, significant short-term, i.e. 10s kyr to a few myr (3rd to 4th order cycles) sea-level changes during the Cretaceous major greenhouse episode remain enigmatic. Such cyclic changes are often explained by the presence of ephemeral ice sheets even during the hottest greenhouse phases ("hothouse periods"), such as the mid-Cretaceous. Though Cretaceous global eustasy involves processes like brief glacial episodes (glacio-eustasy) for which evidence was given – at least for the Early Cretaceous and the late Late Cretaceous – other mechanisms have to be taken into consideration for the "hothouse periods" during which continental ice shields are highly improbable, like the storage and release of groundwater (termed "limno-eustasy" or "aquifer-eustasy"), the possible effect and magnitude of which might have been highly underestimated.
Investigation of the timing, the causes, and the consequences of significant short-term (i.e. mainly kyr to 100s of kyr) sea-level changes during the last major greenhouse episode of Earth history, the Cretaceous, is the ultimate goal of the UNESCO IGCP (International Geoscience Programme) project number 609 "Climate-environmental deteriorations during greenhouse phases: Causes and consequences of short-term Cretaceous sea-level changes" (2013-2017; http://www.univie.ac.at/igcp609/). This also comprises the global versus regional correlation and extent of the sequences, their cyclicities, as well as the processes and triggering mechanisms for these, and marine to non-marine correlations.
Recent refinements of the geological time scale have made major advances for the Cretaceous to yield a resolution comparable to that of younger Earth history. It is now for the first time possible to correlate and date short-term Cretaceous sea-level records with a resolution appropriate for their detailed analysis. Recognized Cretaceous sea-level changes will be tied to the new, high-resolution time scales, using sea-water isotope curves and cyclostratigraphic records reflecting the major astronomical (405, 100 kyr eccentricity) cycles. This will determine whether the recognized sea-level changes are of regional or global significance and will also indicate their possible relation to climate and/or tectonic events.
Within the scope of the project, a wide range of research questions is addressed, such as: 1) Are sea-level changes regional (tectonically induced) or global (eustatic)?; 2) How fast are rates of (short-term) sea-level changes during the Cretaceous super-greenhouse period?; 3) Are specific sea-level peaks associated with glacial episodes - or other climate and environmental events such as ocean anoxia and oxidation events? Geophysicists, structural geologists, stratigraphers, geochemists and sedimentologists from all over the world are working together towards advances in the understanding of the processes behind Cretaceous short-term sea-level changes.