

FROM ICEHOUSE TO SUPERGREENHOUSE: CRETACEOUS CLIMATE CHANGE ON LONG AND SHORT TIME SCALES

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Oxygen isotope records from well preserved Cretaceous foraminifera in the subtropical North Atlantic characterize an ~40 m.y. climate cycle, with coolest deepwater and high latitude temperatures during the late Aptian and mid-Maastrichtian and extremely warm deepwater and high latitude temperatures during the Turonian. This climate cycle parallels a global sea level rise that began in the late Aptian and culminated during the early Turonian with the highest global sea level of the past 250 m.y. It also parallels a shift from predominantly organic carbon-rich claystone and black shale deposition in the Tethyan basins to carbonate rich deposition along flooded continental margins and in the widely expanded epicontinental seas. These changes in the ocean-climate system and concomitant opening of the gateway between the North and South Atlantic basins led to a significant alteration of global ocean circulation patterns and reorganization of the marine biosphere.

Questions regarding the predominant modes of ocean circulation, the causes for long- and short-term climate shifts, and whether or not polar ice sheets existed during the Cretaceous are still largely unanswered because of an insufficient amount of data. Nonetheless, our understanding of the Cretaceous ocean-climate system is dramatically improving with discovery and study of sequences yielding trustworthy geochemical data.