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Cretaceous benthic foraminiferal assemblages of the tropical proto-North Atlantic: long-term change versus short-term events

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We used continuously laminated early Cenomanian to early Campanian sediments from ODP Sites 1258, 1259, 1260, and 1261 at Demerara Rise (Leg 207, western tropical Atlantic) to decipher long- and short-term changes of benthic foraminiferal assemblages within the Atlantic Ocean. Studied sediments include the Mid-Cenomanian Event (MCE) and the Oceanic Anoxic Events (OAE) 2 and 3 and consist of black shales with mean TOC values between 5 and 10% (up to 29% during OAE 2). Thereby, the continuous sedimentation at Demerara Rise provides a unique opportunity to produce a long-term record for tropical Cenomanian to Campanian benthic foraminiferal faunal data. The development of benthic foraminiferal diversity and abundances is mainly characterized by five steps: (1) a sudden drop to almost zero around the MCE, paralleled by a pronounced positive shift in oxygen isotopes, interpreted as the influence of warm, saline water-mass formation in the restricted proto-North Atlantic, (2) water-depth dependent changes across the OAE 2 interval indicating anoxic to dysoxic bottom waters, (3) a short-term increase in the middle Turonian, (4) an increase during the middle Coniacian, and (5) a significant increase in diversity and abundances in the early Campanian, associated with the introduction of several new species typical for well-oxygenated bottom-water environments.
The latter three steps are paralleled by a significant drop in bottom-water temperature from over 20°C in the Turonian towards 14°C in the lower Campanian. These decreasing temperatures are proposed to reflect the ongoing opening of the Equatorial Atlantic Gateway (EAG), allowing cooler bottom waters from the south to mix with warmer waters within the tropical Atlantic. Increasing diversity and abundance of benthic foraminifera support this theory. However, a significant increase in diversity and oxygenation of bottom waters occurs not before the middle Coniacian. The final opening of the EAG and presence of continuously well-oxygenated bottom-waters are indicated by diverse benthic assemblages and a thick glauconitic layer in the early Campanian.