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Coring a global stratigraphic reference section of OAE 2: First results of the Wunstorf drilling project

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The Cenomanian / Turonian boundary event (CTBE), which is globally characterized by the deposition of black shales (Oceanic Anoxic Event 2 = OAE 2), has been studied worldwide for more than 20 years from a broad variety of shallow-marine to deep-sea sections. The dating and correlation of these sections at a high-resolution scale is often difficult due to hiatuses, reduced rates of sedimentation, poor microfossil preservation, and/or the absence of carbonate. All of these factors add up to a poor stratigraphic control of the OAE 2. At Wunstorf (northern Germany), the C/T boundary event is represented by a 25 m thick succession consisting of laminated black shales (OAE2), dark organic-rich marls and marly limestones. These TOC-rich beds allows the geochemical analyses of both organic matter and carbonates. In addition, the Wunstorf section yields abundant and well preserved macro- and microfossils. The Wunstorf section is one of the world's most expanded CTBE successions and thus a classic global key section. A high resolution chemo-, cyclo- and biostratigraphic scheme of the CTBE will, therefore, serve as an international standard.

In spring 2006, a continuous core was drilled, which recovered 80 m of Middle Cenomanian to Middle Turonian sediments. The core shows three lithological units: 1) a lower part (upper Middle – lower Upper Cenomanian; 30 m) with bedding cycles of marls and limestones which commonly occur throughout Europe, 2) a middle part (CTBE, 26 m) that comprises marls, black shales and limestones, and, 3) an upper part (Lower – lower Middle Turonian; 18m) consisting of nodular and marly limestones. The distribution patterns and the thicknesses of the black shales of the CTBE show a distinct cyclicity particularly in the lower part.

High-resolution XRF scans (2-20 mm) for various elements (Al, Si, P, S, K, Ca, Ti, Mn and Fe) suggest several hierarchies of decimetre-thick cycles in the black shale unit. Especially elevated Fe concentrations are related to black-shale horizons, and indicate an elevated terrestrial input during their deposition. High-resolution carbon isotope curves were measured on carbonates and organic matter. The carbonate δ^{13}C curve resolves all known features of the positive δ^{13}C anomaly with high accuracy. In addition, the curve shows numerous small-scaled positive excursions, which appear cyclic throughout the whole middle Cenomanian – middle Turonian succession. Especially in the Turonian part, these peaks are marked features and can be correlated to similar excursions recently recorded from the Oerlinghausen and Gubbio sections in Germany and Italy. Their cyclic appearance suggests that the global OAE 2- δ^{13}C anomaly was modulated by orbitally forced carbon cycle variations.