

CONFIRMATION OF CENOMANIAN-TURONIAN BLACK SHALES AT HIGH-LATITUDE ODP SITE 1138 ON THE KERGUELEN PLATEAU

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Periods of deposition of black shales containing 1 to 30 wt% organic carbon occurred widely in epicontinental seas and ocean basins from the Aptian (125-112 Ma) through the Coniacian (89-86 Ma) stages of the middle Cretaceous. A particularly extensive and well-developed black shale sequence was deposited close to the Cenomanian-Turonian boundary (93.5 Ma) and is often called the “Cenomanian-Turonian Boundary Event” (CTBE: Thurow et al., 1992). CTBE black shales are found throughout North Atlantic, South Atlantic, and western Tethyan settings and in a few Pacific Ocean settings. Furthermore, CTBE black shales typically contain an apparently synchronous intensified depositional interval that is collectively termed Oceanic Anoxic Event 2 (OAE 2: Schlanger and Jenkyns, 1976). In marked contrast to their near ubiquity in Atlantic and western Tethyan settings, CTBE black shales were rarely deposited in the eastern Tethys, part of which is now the Indian Ocean. To date, they have been found only at Ocean Drilling Program (ODP) Site 763 on the Exmouth Plateau off northwestern Australia (Meyers and Dickens, 1992), and they are absent in complete Cenomanian-Turonian boundary sequences at nearby Site 765 on the Argo Abyssal Plain and Site 766 on the Gascoyne Abyssal Plain (Thurow et al., 1992).

On the basis of the shipboard measurement of 2.2 wt% organic carbon concentration in a late Cenomanian-early Turonian dark-colored claystone from Site 1138 on the Kerguelen Plateau, ODP Leg 183 shipboard scientists speculated that they had found evidence of the CTBE at this southern Indian Ocean location. We have conducted elemental, isotopic, and Rock-Eval analyses of organic matter in samples of Cenomanian through Santonian sediment from ODP Site 1138 that confirm the existence of Cenomanian-Turonian black shales at this high-latitude location. Total organic carbon (TOC) concentrations range between 1 and 20 wt% in black to medium-gray sediments deposited around the Cenomanian-Turonian boundary, and $\delta^{13}\text{C}_{\text{org}}$ values that increase 4 ‰ over background values suggest the presence of OAE 2 in the boundary sequence. Rock-Eval pyrolysis results show that the organic matter is algal Type II material that has experienced modest alteration. Important contributions of nitrogen-fixing bacteria to the amplified production of organic matter implied by the high

TOC concentrations is recorded in $\delta^{15}\text{N}$ values between -5 and 1 ‰, and the existence of a near-surface intensified oxygen minimum zone that favored organic carbon preservation is indicated by TOC/TN ratios between 20 and 40. This finding doubles the Indian Ocean locations at which CTBE black shales have been found, and it expands the range of paleoceanographic settings in which CTBE black shales were deposited, which is particularly significant in light of the relative isolation of the high-latitude Kerguelen Plateau from the world ocean during the middle Cretaceous. In contrast to the marine nature of the Cenomanian-Turonian boundary section, deeper sediments at Site 1138 contain abundant land-derived organic matter that records the presence of nearby forests on the Kerguelen Plateau until the earliest Cenomanian.

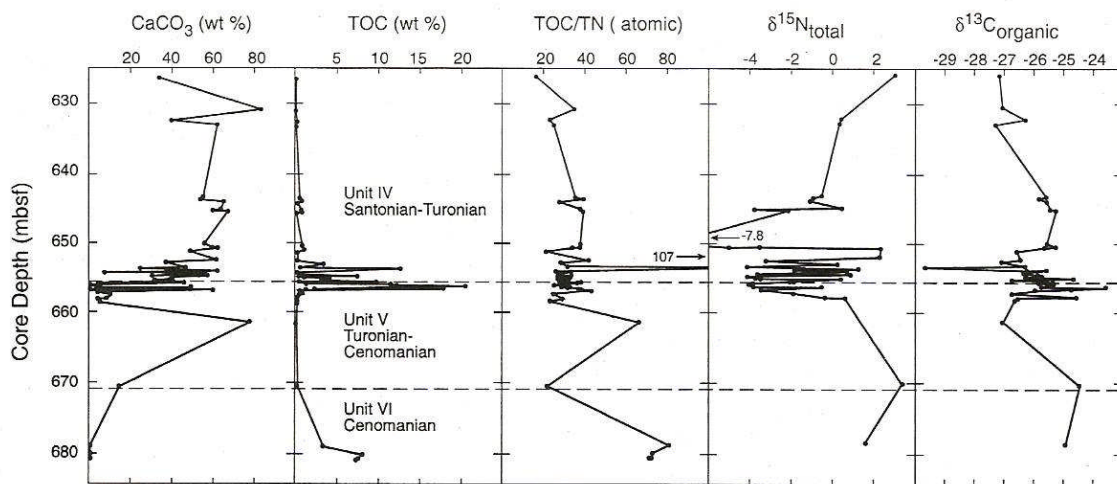


Figure 1. Concentrations of CaCO_3 and total organic carbon (TOC), total organic carbon to total nitrogen atom ratios (TOC/TN), and $\delta^{15}\text{N}_{\text{total}}$ and $\delta^{13}\text{C}_{\text{org}}$ values of sediment samples from mid-Cretaceous lithostratigraphic Units IV, V, and VI at ODP Site 1138 on the Kerguelen Plateau.

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