Strong terrestrial influence on the Late Cretaceous Tethyan–Atlantic epeiric sea in the Upper Benue Trough, northeastern Nigeria

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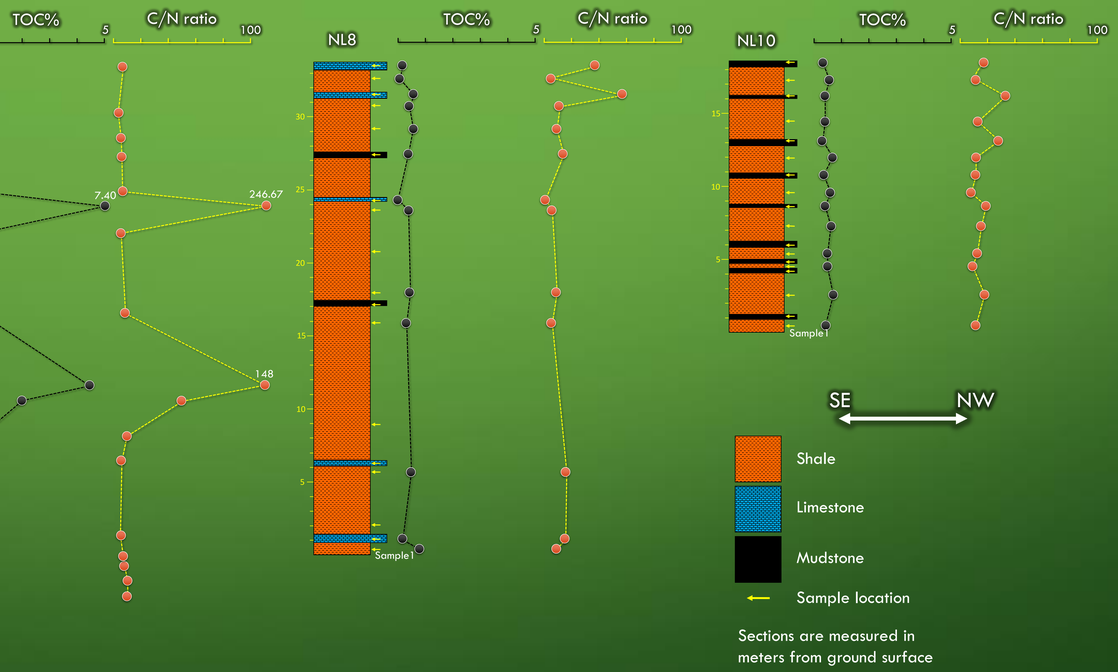
Abstract

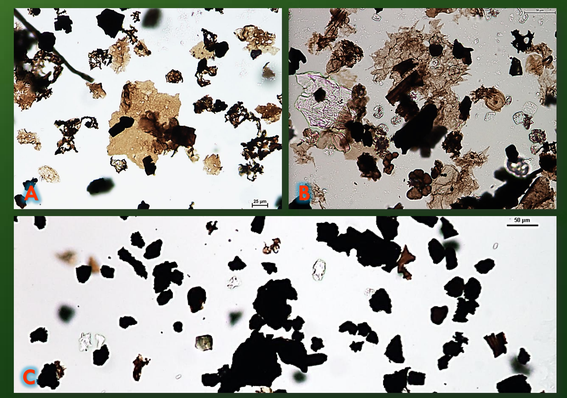
A multi proxy investigation was carried out on three outcrop sections (NL4, NL8, NL10) in the Upper Cretaceous Numanha Formation in the Yola Arm of the Upper Benue Trough, northeastern Nigeria. The Numanha Formation is a predominantly shale sequence that preserves the Turonian–Coniacian depositional history of a rift basin influenced by both the Tethyan and Atlantic oceans. Thirty-eight samples from two sections (NL4 and NL10) were analyzed for palynofacies characterization of the sedimentary organic matter contents, while the total organic carbon (TOC) and carbon-to-nitrogen (C/N) ratios were analyzed in 44 samples from all three sections. Palynofacies data confirm an overall marginal marine (estuarine) depositional setting for the Numanha Formation which was strongly impacted by terrestrial and freshwater sources of sedimentary organic matter. This interpretation is based on the following observations: 1) near constant presence of marine dinoflagellate cysts and/or benthic planispiral microforaminiferal inner test linings; 2) abundant vascular plants fragments such as opaque, structured, and degraded phytoclasts with fluxes of cuticles at certain intervals; and 3) near constant presence of the freshwater alga Pediastrum which was also recorded in high proportions at certain intervals. TOC contents in the majority of the analyzed samples were generally low (<1%), indicating poor organic matter preservation potential probably due to high energy and well oxygenated conditions. C/N ratios were mostly below 20 in the samples from all sections, and confirm the inferred marginal marine depositional setting. There were, however, two exceptionally high C/N anomalies in all three sections. The anomalies were especially pronounced in the NL4 section, and were also associated with elevated TOC contents. It appears that these anomalies represent periods of increased terrestrial input, which were also associated with selective diagenetic consumption of nitrogen by microbial degradation.



Total organic carbon (TOC) and carbon-to-nitrogen (C/N) ratios from the three measured sections (NL4, NL8, NL10) in the Upper Cretaceous Numanha Formation in the Yola Arm of the Upper Benue Trough, northeastern Nigeria.

A: Location map of the study area.

B: Paleogeographic reconstruction showing the approximate location of the studied sections during the Late Cretaceous (90 Ma) — Paleogeographic base map is after Ron Blakey, Colorado Plateau Geosystems Inc, Arizona, USA (http://deeptimemaps.com).



Photomicrographs of example sedimentary organic matter facies found in the studied sections. A- Section NL4, sample 9; B- Section NL10, sample 9; C- Section NL10, sample 14.

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