Abstract Environmental and depositional changes across the Late Cenomanian oceanic anoxic event (OAE2) in the Sinai, Egypt, are examined based on biostratigraphy, mineralogy, $\delta^{13}C$ values and phosphorus analyses. Comparison with the Pueblo, Colorado, stratotype section reveals the Whadi El Ghaib section as stratigraphically complete across the late Cenomanian–early Turonian. Foraminifera are dominated by high-stress planktic and benthic assemblages characterized by low diversity, low-oxygen and low-salinity tolerant species, which mark shallow-water oceanic dysoxic conditions during OAE2. Oyster biostromes suggest deposition occurred in less than 50 m depths in low-oxygen, brackish, and nutrient-rich waters. Their demise prior to the peak $\delta^{13}C$ excursion is likely due to a rising sea-level. Characteristic OAE2 anoxic conditions reached this coastal region only at the end of the $\delta^{13}C$ plateau in deeper waters near the end of the Cenomanian. Increased phosphorus accumulations before and after the $\delta^{13}C$ excursion suggest higher oxic conditions and increased detrital input. Bulk-rock and clay mineralogy indicate humid climate conditions, increased continental runoff and a rising sea up to the first $\delta^{13}C$ peak. Above this interval, a dryer and seasonally well-contrasted climate with intermittently dry conditions prevailed. These results reveal the globally synchronous $\delta^{13}C$ shift, but delayed effects of OAE2 dependent on water depth.

Keywords Cenomanian–Turonian · OAE 2 · Paleoclimate · Shallow shelf environments · Egypt