

Calcareous nannoplankton and stable oxygen isotopes as proxies for paleoenvironmental reconstructions of the Albian–Cenomanian succession in the Mount Carmel Region (northwestern Israel)

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This study is based on calcareous nannoplankton from Borehole CT8 (32.79°N, 34.98°E) in the NW Mount Carmel area. The continuous sequence (225m) is composed of the following formations: Yagur (dolomite limestone), Isfiye (dolomitized chalk, tuffaceous layer, and micritic carbonates), Bet Oren (indurated chalks), and Arqan (chalks with chert nodules). The zonation of Bralower *et al.* (1995) was used for the Albian (NC zones), and that of Burnett (1998) was used for the Cenomanian (UC zones). The following calcareous nannoplankton zones and subzones were recognized: Subzone NC9b (late Albian), Zone UC0 (late Albian-early Cenomanian), Zone UC1 (early Cenomanian), Zone UC2 (early–middle Cenomanian), and Zone UC3 (middle–late Cenomanian).

For the quantitative analysis, 300 calcareous nannoplankton specimens were counted in traverses across 80 samples. In Borehole CT8, 56 bulk sediment samples from were analyzed for $\delta^{18}\text{O}$. The productivity index (PI) was calculated as following: $[(Zeugrhabdotus \text{ spp.} + Biscutum \text{ constans} + Discorhabdus \text{ ignotus}) / (Zeugrhabdotus \text{ spp.} + B. \text{ constans} + D. \text{ ignotus}) + Watznaueria \text{ barnesae}] \times 100$, where *Zeugrhabdotus* spp., *B. constans*, and *D. ignotus* are considered high productivity indicators, and *W. barnesae* is a low productivity indicator (e.g., Gale *et al.*, 2000; Erba, 2004).

The upper Albian-Cenomanian sediments were deposited in an outer shelf environment. A significantly low Shannon diversity index and evenness and species richness in the assemblage indicated unstable environmental

conditions with low fertility. The entire succession was deposited in quite warm (~25–32.5°C), open-marine, oligotrophic conditions with a poor nutrient supply. Five paleoecological phases were recognized through quantitative analysis of the calcareous nannoplankton, the PI, and $\delta^{18}\text{O}$ values. Warming/cooling events of various scales and fluctuations in eutrophication/oligotrophication have been detected in each phase.

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