RELATIONSHIP BETWEEN SEQUENCE BOUNDARIES AND THE EVOLUTIONARY HISTORY OF PLANKTONIC FORAMINIFERA, CALCAREOUS NANNOFOSSILS, AND REEF COMMUNITIES IN THE MID-CRETACEOUS (BARREMIAN-CENOMANIAN)

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Planktonic foraminifera first evolved in the middle Jurassic but did not experience a major radiation until the mid-Cretaceous. The mid-Barremian to late Aptian was characterized by a steady increase in species richness and by the appearance of new morphological forms including planispiral coiling, clavate and radially elongate chambers, and culminating in the first appearance of taxa with complex apertural structures and the keeled morphotype in late Aptian time. This broad interval of radiation was abruptly ended by evolutionary turnover and low diversification rates in the latest Aptian and early Albian prior to a second explosive episode of radiation in the middle and late Albian. The evolutionary history of mid-Cretaceous calcareous nannofossils generally parallels the trends observed in planktonic foraminifera, although the latest Aptian-early Albian turnover event is not as pronounced. Reef communities in the Caribbean/Gulf of Mexico and Mediterranean provinces show a change in dominance from coral-algal-rudist reefs in the Barremian-early Albian to rudist domiance by the late Albian time. These changes in calcareous plankton and reef communities are related to complex oceanographic changes of the mid-Cretaceous including structure of the upper water column, productivity, sea level, atmospheric and oceanographic circulation, and changes in the chemistry of the ocean.

Changes in eustatic sea level influenced many of these factors including nutrient delivery to the oceans, climate, sites and rates of deep water formation, and ocean chemistry. What is the relationship between changes in sea level, as expressed by major seismic sequence boundaries, and the changes observed in marine biota? We have compared major changes of eustatic sea level within this interval of generally rising global sea level (Scott et al., 1988), with equivalent sequence boundaries (Haq et al., 1988) and the records of calcareous plankton (Roth, 1987; Leckie, 1989) and reef communities (Scott, 1988). What is most striking about these relationships is the apparent lack of direct correlation between sequence boundaries and turnover events in the marine biota. The calcareous plankton alternate in phase between relatively high rates of diversification and low rates of diversification, with the major sequence boundaries falling *within* intervals of change rather than *at* intervals of change. However, we acknowledge the potential of missing or condensed intervals in deep sea settings which may influence the record of evolutionary rates (e.g., Loutit, et al., 1988). Only the basal Albian sequence boundary appears to correlate with a major turnover event in the planktonic foraminifera, and the rapid change in Gulf Coast reef communites between the middle and upper Albian may correlate with a eustatic sea level change and a major sequence boundary. Based on high-resolution calcareous nannofossil, planktonic foraminiferal, sedimentologic, and geochemical data of Bralower et al. (submitted), the lower Aptian, basal Albian, and lower upper Albian sequence boundaries appear to correlate more closely with widespread oceanic dysoxic/anoxic events OAE1a, OAE1b, and OAE1c, respectively. The correlations between evolutionary events, anoxic events, and sequence boundaries must be considered tentative at this time because major disparities exist between the correlation of calcareous plankton zones and mid-Cretaceous chronostratigraphic units used by Haq et al. (1988) and Bralower et al. (submitted).

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