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# Calcareous nannofossil and $d^{13}C$ records from the Early Cretaceous of the western Atlantic Ocean: Evidence for enhanced fertilization across the Berriasian–Valanginian transition

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## ABSTRACT

Sediments of late Berriasian–Hauterivian age have been analyzed from DSDP holes 534A and 603B in the western Atlantic Ocean with respect to calcareous nannofossils and bulk-rock geochemistry ($d^{13}C_{carb}$, $CaCO_3$). The aim of this study was to obtain a detailed reconstruction of the paleoceanographic conditions in the western Atlantic during the Valanginian positive $d^{13}C_{carb}$ excursion. The well-constrained stratigraphic framework for both sites allows for a supraregional comparison with previous studies in Western Europe. At both sites, the Berriasian-Valanginian boundary interval is characterized by a 20% increase in the relative abundance of calcareous nannofossil species that are indicative of elevated surface-water nutrient levels. These changes in the trophic system coincide with the turning point toward more positive $d^{13}C_{carb}$ values at the M15–M14 magnetochron boundary, leading to the well-known Valanginian positive $d^{13}C_{carb}$ excursion. These changes also correspond with an increase in bulk-rock Sr/Ca ratios, enhanced burial of organic matter, and, at hole 534A, a decrease in rock-forming nannoconids. Calcareous nannofossil data do not support a substantial cooling in the western Atlantic, as previously suggested by the geochemistry of belemnite rostra, but the observed increase in nutrients is consistent with enhanced upwelling during the Valanginian. Owing to controversial placement of the Valanginian-Hauterivian boundary and different absolute ages for the Valanginian stage, it is still unclear to what extent the Paraná-Etendeka volcanism might have caused the biotic and carbon-cycle perturbations. Our data suggest that the changes documented in the marine plankton system are at least concomitant with the initial, minor phase of the Paraná-Etendeka volcanism.