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# High Planktonic Foraminiferal Species Turnover, Enhanced Vertical Ocean Mixing, and “Coolhouse” Climatic Conditions across the Aptian-Albian Boundary Interval

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## ABSTRACT

The planktonic foraminiferal extinction associated with the Aptian-Albian boundary (using the extinction of *Ticinella eubejaouaensis*) is one of the largest and most significant species turnover events in the evolutionary history of planktonic foraminifera. The large-sized species *T. eubejaouaensis* and *Hedbergella trocoidea* and several other species bearing well-developed and distinctive pore mound wall textures went extinct at this boundary. Although the rate of species turnover across this extinction event is poorly constrained, due in large part to widespread taxonomic inconsistencies and incomplete species lists, a dramatic reduction in species diversity associated with decreases in shell size and shell wall thickness among descendants have been widely reported.

Our taxonomic investigation of this turnover event involves study of well-preserved Aptian-Albian foraminifera from five deep-sea sites in the subtropics and southern high latitudes. We estimate that at least 70% of species present in the late Aptian did not survive into the Albian, and lowest Albian assemblages consist almost entirely of two, tiny trochospiral species, one of which is described as new. In addition, stable isotopic analyses of pristinely preserved foraminifera from ODP Site 1049 reveal that the turnover event is associated with a negative shift in carbon isotope values but little change in benthic or planktonic foraminiferal oxygen isotopes. Paleotemperature estimates are quite cool, with middle bathyal temperatures ranging from 9 to 11°C (48 to 51°F) and sea-surface temperatures estimated as 13 to 16°C (55 to 61°F), and the vertical oxygen and carbon isotopic gradients are quite low, ranging between 2 and 4°C (36 to 39°F). A minimum in <sup>87</sup>Sr/<sup>86</sup>Sr values near the time of the Aptian-Albian boundary suggests increased ocean crust production. Furthermore, a sharp drop in foraminiferal Mg/Ca ratios across this boundary suggests increased hydrothermal activity leading to a secular change in ocean carbonate chemistry, which may have been partially responsible for the dramatic planktonic foraminiferal extinction event.