Exciting new perspectives on the Paleocene-Eocene boundary events and the Early Eocene warm period

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The transition from the Paleocene to the Eocene is marked by a major reorganization of both terrestrial and oceanic ecosystems and an abrupt, but ephemeral pulse of global warming. Most of the modern groups of mammals first appeared at this time, at about 55 Ma, synchronous with a significant turnover of plankton and extinction of benthic foraminifera. The transition is marked by a sharp decrease in the carbon isotopic composition of terrestrial soils and ocean sediments that has tentatively been linked to rapid dissociation of oceanic deposits of gas hydrates, which released methane - a greenhouse gas - into the atmosphere. Unfortunately, the momentous events surrounding this transition are still poorly known since most geologic deposits from this time interval are punctuated with gaps in the sedimentary and fossil records.

The good news is that recent drilling at Site 1051 in the Atlantic Ocean, about 300 miles off northern Florida, has recovered one of the most complete sedimentary layer cakes of this time period. The sequence consists of alternating beds of gray and green nannofossil chalks and clays, but it does not contain the interval of erosion or complete dissolution of calcareous fossils so common at other deep-sea sites. The isotopic event in the core is about 75 cm thick, wider than in any previous deep-sea record. The entire section contains a well-expressed magnetic polarity record, which together with biostratigraphy will provide a clear tie to other deep-sea sites as well as absolute age. Notably, both the Paleocene and Eocene portions of the record display pronounced color cycles, from light gray to olive green, that may represent orbital cycles of precession and obliquity (with periodicities of 21,000 and 41,000 years, respectively). If so, the these cycles can be used to provide a much more precise chronology of events than has previously been possible. The color cycles also suggest that there may have been a fundamental change in Earth's climate because the oscillations increased in amplitude and duration shortly after the carbon isotope and biotic events. This shift in oscillation suggests that the extreme warmth of the early Eocene may have been inherently more unstable than the relative cool climate of the Paleocene.