Paleocene-Eocene Epoch Boundary: Closure on a Century of Disagreement

by Philip D. Gingerich

Those of us who study earth history of the early Cenozoic have been divided for more than a century. In the early days, paleobotanists and vertebrate paleontologists recognized a Paleocene epoch separate from the preceding Late Cretaceous and following Eocene, and marine paleontologists generally did not. In more recent times, the Paleocene-Eocene boundary on land was more or less a million years older than the boundary in the sea. This was expressed in the empty million-year box so conspicuous on the 1995 Paleocene-Eocene time scale of William Berggren and others. I thought I would be teaching students forever to be careful because the Paleocene-Eocene boundaries of continental and marine geologists are different.

This all changed in 1991 and 1992 when James Kennett and Lowell Stott found evidence of a sharp spike in oxygen isotopes coincident with a similar spike in carbon isotopes at ODP site 690 in the South Atlantic. The associated warming was soon dubbed the Late Paleocene Thermal Maximum or LPTM. At the same time, U-M graduate student **Paul Koch (PhD '89)** was surveying carbon and oxygen isotopes in the continental Paleocene-Eocene record on Polecat Bench in northwestern Wyoming. Paul found a carbon isotope spike here too, but this one was right in the brief interval at the continental Paleocene-Eocene boundary where some mammals are mysteriously dwarfed and other modern mammals like horses characteristic of the Eocene first appear. I had just documented the unusual mammal changes here, **James Zachos (Post-doc, '91-'92)** helped make the connection to Kennett and Stott's discovery, and the marine and continental Paleocene-Eocene boundaries began, slowly, to snap together.

Professor **Philip Gingerich** *pointing to the centimeter-scale condensed interval marking the beginning of the Paleocene-Eocene carbon isotope event where the epoch boundary is defined at Dababiya in Egypt. Photo credit: Iyad Zalmout, 2004.*

The slow snap is chronicled in the progress of the IUGS International Commission on Stratigraphy's Paleogene working group 308 chaired by Marie-Pierre Aubry. This group was dominated by marine stratigraphers at first, who struggled to agree on a correlatable biotic event appropriate to signal a new epoch boundary. The working group was, in a sense, saved from itself as the carbon isotope excursion (CIE) of Kennett and Stott and of Koch et al. was found more widely and became recognized as a global event. I was added to the working group in 1999 and we agreed to place the Paleocene-Eocene boundary at the base of the CIE at a meeting in Paris in 2000. We met in Luxor in Egypt in 2002 to consider a marine stratotype section at Dababiya where Christian Dupuis had documented the CIE. Our proposal was ratified by the ICS in 2003, and Marie-Pierre Aubry and Khalid Ouda drove the 'golden spike' at Dababiya in February 2004 (see photo). I no longer have to teach that there are separate Paleocene-Eocene boundaries in marine and continental rocks. More importantly, this boundary and the accompanying chemical and biotic events on land and in the sea have become an important case study of a natural global greenhouse climate event and its consequences.

GEOSCIENCE NEWS

for the Alumni and Friends of the
Department of Geological Sciences
University of Michigan, Ann Arbor, Michigan

Spring 2004

Landforms of the Conterminous United States: A Digital Shaded Relief Portrayal, by Gail P. Thelin and **Richard J. Pike (PhD '68)**, *USGS, 1991. See article on page 3 for the history of this geo-cartographic classic.*

In This Issue: