Geophysical Research Abstracts,
Vol. 10, EGU2008-A-03115, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-03115
EGU General Assembly 2008

The early Paleogene astronomic time scale - new insights into biological, climatic and tectonic events

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There is especially a need for a complete astronomically-tuned Paleogene time-scale as observed changes related to paleoceanographic events in the Paleogene occur significantly faster than the temporal resolution by classical biomagnetostratigraphy can resolve. Until relatively recently the challenge of puzzling the patterns of published incomplete records into a continuous orbital chronology still existed. But with the records now available from ODP Legs 198, 199, 207, and 208 we have entered a new era in the research of early Cenozoic paleoceanography. Here we present a high resolution, orbitally calibrated cyclostratigraphy for the Paleocene and early Eocene using high-resolution records of elemental concentrations obtained by X-ray fluorescence (XRF) core scanners and also other non-destructive core logging data. Based on the identification of the stable long-eccentricity cycle (405-kyr) throughout the investigated sections it is now possible to acquire a complete high-resolution stratigraphy for the entire Paleocene and early Eocene for the first time. Using this new stratigraphic framework we have refined the magnetostratigraphy, established a high-resolution calcareous nannofossil biostratigraphy and identified the orbital configuration of both already well-known and novel paleoclimatic events: K/Pg boundary, 'Chron 27n event', early-late Paleocene biotic event (ELPE), Paleocene-Eocene thermal maximum (PETM), Elmo horizon, 'X' event, and new 'hypothermal' events. Our results clearly show inconsistencies between astronomical calibrations and radiometric dating. The evolving dating dilemma is related to the uncertainty in the orbital solutions and to the uncertainty in the absolute age of the Fish Canyon Tuff dating monitor.