

**LIFE HISTORY OF AN ARCHAIC PLACENTAL
MAMMAL, *PANTOLAMBDA BATHMODON*
(PLACENTALIA, PANTODONTA)**

Funston, Gregory¹, dePolo, Paige¹, Shelley, Sarah¹,
Wible, John², Williamson, Thomas³, Brusatte, Stephen¹

¹The University of Edinburgh School of GeoSciences,
Edinburgh, Edinburgh, United Kingdom, ²Carnegie
Museum of Natural History, Pittsburgh, Pennsylvania,
United States, ³New Mexico Museum of Natural History
& Science, Albuquerque, New Mexico, United States

The rise of mammals after the extinction of the dinosaurs remains one of the most enigmatic intervals in the evolution of mammals. A relatively sparse Paleocene fossil record and confusing relationships between taxa means that little is known of the evolution, ecology, or biology of these animals. Accordingly, the life history of these organisms remains unstudied, despite likely playing a key role in the rapid proliferation and body size increase of these clades in recovering ecosystems. Here, we present results of an in-depth paleohistological analysis of *Pantolambda bathmodon*, an early, possibly gregarious pantodont, using a new ontogenetic series of specimens. Pantodonts were bizarre, herbivorous eutherians of unknown phylogenetic affinity, and were among the first mammal lineages to reach large body sizes in the Paleocene. In examining both dental and skeletal records of growth from the same individuals, including a juvenile still bearing deciduous teeth, our study is among the most comprehensive paleohistological analyses of any fossil mammal, allowing for unprecedented insights into the life history of this species. Neonatal lines in the teeth indicate that the deciduous premolars and the first upper molar erupted prior to birth, similar to precocious, nidifugous mammals today. Daily incremental lines in the enamel and dentine suggest rapid crown formation times (~70–180 days) and a gestation period of at least 20 weeks. A stress line in the teeth and postcranial bones, recording an

anomalous decrease in growth towards the end of this individual's life, may represent weaning. The weanling perished approximately 2.5 months after birth, weighing about 17 kg. Adult individuals exhibiting severe wear on the dentition allow us to estimate maximum longevity in *Pantolambda bathmodon* at about 7 years. In comparison with living mammals, *Pantolambda bathmodon* had gestation and weaning periods below average for a placental of its adult body size (42 kg), but within the range of known variation. However, its lifespan was exceptionally short, falling outside the bounds of comparable living mammals. Together, these lines of evidence suggest a rapid pace of life in *Pantolambda bathmodon*, despite its relatively large body size. Ongoing sampling of more individuals and geochemical analyses should allow for estimation of time to sexual maturity and help to confirm the identity of the weaning line, completing our picture of the life history of this pioneering species.

Funding Sources The Royal Society (NIF\R1\191527); European Research Council Starting Grant (ERC StG 2017, 756226, PalM); National Science Foundation (NSF; EAR 1654952, DEB 1654949)