appears to prefer high-energy environments.

This study undermines LVF dating of mid-Late Triassic continental deposits. Further strengthening of biostratigraphical criteria are needed if questions of faunal/floral turnover at this crucial point in Earth history are to be rigorously addressed.

AN ASSESSMENT OF CHANGE IN MAMMALIAN DISPARITY ACROSS THE CRETACEOUS-TERTIARY BOUNDARY USING DENTAL MORPHOSPACE

WILSON, Gregory, Univ.of California, Berkeley, CA.

The mammalian faunal turnover at the Cretaceous-Tertiary (K-T) boundary has long been recognized as the dramatic beginning of the Age of Mammals. Some workers, using an extensive database from North America, recognized rapid and significant increases in both taxonomic diversity and morphologic disparity (measured in estimated body size) within the first million years of the Paleocene. The current study takes an alternative approach by concentrating on the well sampled faunas from the terrestrial sediments of the Hell Creek and Tullock Formations in a single geographic area, northeastern Montana (Garfield County). The high-resolution chronostratigraphic framework in this study system places the Flat Creek local fauna within the last 400,000 years of the Cretaceous and places the Hells Hollow local fauna within the first 200,000 years of the Paleocene. Using these faunas, the taxonomic diversification and change in body size of mammals across the K-T boundary have been previously described, but explicit characterization of their morphologic disparity has not been attempted. Here, I use dental morphology as a proxy to examine patterns of morphologic disparity within these faunas and across the K-T boundary.

Using landmark-based geometric morphometrics, this study quantifies the dental morphospace occupied by therians in both faunas. The lack of homology between multituberculate and therian molars currently precludes the inclusion of the former, but future studies will address this aspect of the fauna using alternative methodologies. Standardized two-dimensional projections of upper and lower molars were digitized for sets of homologous landmarks and superimposed using Procrustes-based methods. Procrustes distances between taxa were used to arrive at morphologic disparity in each fauna. The resulting increase in morphologic disparity across the K-T boundary is significant, but not as dramatic as the results reported by other workers. The discrepancy suggests that peak morphologic diversification lagged at least several hundred thousand years behind the K-T extinction, as some have hypothesized for peak taxonomic diversification.

ARE MANUS-ONLY SAUROPOD TRACKWAYS EVIDENCE OF SWIMMING, SINKING, OR WADING?

WILSON, Jeffrey, FISHER, Daniel, Univ.of Michigan, Ann Arbor, MI.

"Manus-only" and "manus-dominated" sauropod trackways, which exclusively or preferentially preserve forefoot impressions, have been recorded from Middle Jurassic to Lower Cretaceous localities in many countries. Since their initial description in 1944, manus-only trackways have been interpreted as direct evidence of swimming behavior in sauropods. The absence of pes impressions has been explained as a partially buoyant trackmaker propelling itself with its forelimbs. A more recent interpretation suggests that manus-only trackways are "undertracks" produced by a walking animal whose relatively small forefeet sink through an exposed substrate, deforming underlying sediment layers. Neither explanation, however, is consistent with the posteriorly positioned center of mass implied by sauropod osteology.

We present a new interpretation of manus-only trackways that invokes a partially submerged, but otherwise typical sauropod trackmaker. A sauropod in shoulder-deep water experiences a forward shift in its center of mass by virtue of its body shape, which allows the tail to be submerged while the head and neck are held out of water. Although partial submersion decreases effective weight, a much larger proportion of the load is borne by the manus, which in all sauropods has less than half the surface area of the pes. Measurements of partially submerged scale models confirm that the manus experiences more than twice the pressures felt by the pes; this may lead to the manus creating impressions where the pes does not. This effect applies generally but is most pronounced in *Brachiosaurus*, the sauropod with the most forwardly positioned center of mass. Asymmetry of manus prints or occasional preservation of pes prints can be explained by variations in water level, substrate consistency, or neck/tail carriage. Our results do not imply that sauropods could not swim or create undertracks, but that these do not best explain the manus-only sauropod trackway pattern.

HOMOLOGIES OF PAIRED FINS AND TEETH ACROSS THE AGNATHAN-GNATHOSTOME TRANSITION

WILSON, Mark, Univ.of Alberta, Edmonton, AB, Canada; HANKE, Gavin, The Manitoba Museum, Winnipeg, MB, Canada

Studies on vertebrates from the Early Devonian (Lochkovian) MOTH site, Mackenzie Mountains, Canada, along with recent work by others, suggest revision of homologies previously taken for granted. Among these are that pectoral and pelvic fins are serial homologs, that pelvic fins characterize only gnathostomes, and that marginal jaw teeth are homologous in bony fishes and chondrichthyans.

Brochoadmones and *Kathemacanthus* show that pectoral and pelvic fins are end members of separate paired-fin series, not part of a single series. The pectoral series is maximally expressed near its posterodorsal end, continuing anteroventrally as a series of paired prepectoral spines. The pelvic series is maximally expressed posteriorly, continuing far anteriorly as a series of paired prepelvic spines. In these fishes and in early bony fishes such as *Cheirolepis*, pectoral and pelvic fins differ, the pectoral being lobate and slightly dorsal and the pelvic being long-based and ventral. Studies of thelodonts and a revised interpretation of osteostracans and anaspids further suggest that precursors of both pectoral and pelvic fins occurred in jawless vertebrates. Osteostracans and conventional thelodonts have supra-branchial pectoral-fin precursors, while anaspids and fork-tailed thelodonts have posteroventral pelvic-fin precursors. Märss and Ritchie showed evidence that at least one thelodont had precursors of both pairs.

Claims of the existence of true teeth among primitive craniates and of homology between teeth and the internal denticles of thelodonts are not supported by the distribution of undoubted teeth among early gnathostomes. Recent papers by Young and by Smith and Johanson show that tooth-like structures are found in some highly derived placoderms, yet teeth have not been reported from primitive members. Acanthodian-like fishes preserved at the MOTH locality include many species that were completely toothless. There is, moreover, no fossil record for undoubted chondrichthyan teeth until later in the Early Devonian. It now seems possible that the marginal jaw teeth of chondrichthyans and those of bony fishes are not homologous.

THE FUNCTION OF GASTROLITHS IN DINOSAURS—NEW CONSIDERATIONS FOLLOWING STUDIES ON EXTANT BIRDS

WINGS, Oliver, Institut Für Palaeontologie Universität Bonn, Bonn, Germany

Many living birds swallow stones regularly to aid in trituration and mixing of foodstuff in their stomach. This behavior and function has been proposed for several groups of dinosaurs too, but it is unclear if the mere presence of gastroliths alone is sufficient evidence for such a function. A comprehensive survey of gastroliths was therefore undertaken in the largest living bird, *Struthio camelus*, and placed in a phylogenetic context relative to other living birds. The analysis of stomach contents of more than 300 free-ranging ostriches from farms in South Africa and Germany indicates that gastroliths amount to 20% to 50% of the stomach contents by weight and constitute about 1% of the body mass.

The abrasion rate of different rocks was examined in several in vivo experiments. Most rock types disintegrate in the gizzard within a few days to weeks. Only vein quartz is more resistant and therefore accumulates in the gizzard. As a result of the continuous grinding action and high abrasion rates, ostrich gastroliths almost never develop any surface polish, the vast majority of the examined stones being dull. In this they differ from alleged sauropod gastroliths found in Jurassic and Cretaceous formations in the United States.

A literature survey of 19 extant species of birds (Anseriformes, Galliformes, Columbiformes, and Passeriformes) indicates a mean gastrolith mass of 0.5% of body mass. These values agree with those for several non-avian theropods, such as ornithomimids or *Caudipteryx*, suggesting that the extensive use of stones in digestion is not an autapomorphy of the crown group birds, but rather evolved much earlier along the avian stem lineage. In contrast, the record of gastroliths associated with sauropods is patchy, and in all confirmed cases the stones weigh significantly less than 0.1% of estimated body mass. The role of gastroliths in sauropod food processing must therefore have been minimal, or at least was not analogous to that in living birds.

NEW SMALL MAMMAL RECORDS FROM THE EARLY MIOCENE OF UGANDA

WINKLER, Alisa, Southern Methodist Univ., Dallas, TX.

Field work at the Napak CC and Bukwa localities (Uganda), under the direction of L. MacLatchy and R. Kityo, has yielded new specimens of rodents and a lagomorph. Napak CC has a provisional radiometric date of 19 Ma, and Bukwa a date of 22 Ma. These sites are currently being redated. Napak CC has produced a mandible fragment with the lower incisor of large sciurid. The incisor is deep and slender, as is characteristic of the late Miocene Kenyan taxon *Kubwaxerus pattersoni*, and the extant African Giant Squirrels, *Epixerus* and *Protoxerus*. The Napak CC squirrel is distinct from the only other known taxa of early Miocene African sciurids, *Vulcanisciurus africanus* (from Kenya and Uganda) and an undescribed taxon from Kenya. The Ugandan sciurid is likely a new taxon of African Giant Squirrel. Screen-washing at Bukwa has produced molars of a tiny phiomyid rodent and a single lagomorph tooth. The phiomyid is morphologically distinct from phiomyids previously illustrated by R. Lavocat from excavations at Bukwa in 1968. The new Bukwa taxon has not been reported from early Miocene collections from Kenya or Namibia. The Bukwa lagomorph is an incomplete cheektooth. Size suggests assignment to *Kenyalagomys minor*, an ochotonid previously described from the early Miocene of Kenya. The Bukwa lagomorph cannot be assigned confidently to either the Family Ochotonidae or Leporidae, but is significant because it is the only fossil lagomorph reported from Uganda.

REVIEW OF EARLY CRETACEOUS (APTIAN/ALBIAN) BOREOSPHENIDAN MAMMALS FROM TEXAS

WINKLER, Dale, JACOBS, Louis, Southern Methodist Univ., Dallas, TX.

CT evaluation of the Early Cretaceous primitive boreosphenidan mammal *Slaughteria eruptans* disclosed a permanent tooth hidden beneath a deciduous premolar in the lower jaw and prompted revision of tooth assignments. What had been considered m1 is now known to be a deciduous premolar, the tooth following being m1. These changes necessitate revised comparisons among the Trinity Group boreosphenidans *Holoclemensia, Pappotherium, Kermackia, Trinititherium*, and others from Texas, including undescribed specimens, and with other boreosphenidans such as *Montanalestes*. Prior to its designation as a holotype, the jaw of *Slaughteria* was referred to *Pappotherium*, a taxon described from a partial maxilla. The jaw was thought to be compatible with the maxilla based on size and occlusal relationships. The tooth now shown to be the only permanent molar of *Slaughteria* differs from some isolated lower molars from the Trinity Group that have been referred contentiously to *Pappotherium* and *Holoclemensia*.

NARIAL ANATOMY OF ANKYLOSAURIAN DINOSAURS: OSTEOLOGY AND