TAXONOMIC DIVERSITY, GUILD STRUCTURE, AND ONTOGENETIC NICHE SHIFTS IN THEROPOD CARNIVORE COMMUNITIES: IMPLICATIONS FOR PALEOECOLOGY AND LIFE HISTORY STRATEGIES IN TYRANT DINOSAURS

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Well-sampled dinosaur communities from the Jurassic through the early Late Cretaceous show greater taxonomic diversity and morphological disparity among larger (>50 kg) carnivorous theropod taxa than communities of the Campano-Maastrichtian, particularly to those of eastern/central Asia and Laramidia. This study tests the skewness of adult body size within cenograms of theropod guilds and confirms that the large carnivore sizes in Asiamerican assemblages are monopolized by tyrannosaurids, with adult medium-sized (50–500 kg) predators rare or absent compared to earlier communities.
The distribution of carnivore sizes in various communities is compared to the species abundance of potential prey species recorded in these same faunas, to examine if the skewed distribution of Asiamerican popluations reflects a decrease in herbivore taxon abundance. Recent high-quality biostratigraphic studies of several of dinosaur-bearing formations allows for a more precise use of 'instantaneous' biotic diversity that might be inflated by binning successive time intervals. When patterns of theropod diversity are compared to potential prey diversity in these communities, the distinctiveness of tyrannosaurid-dominated faunas is especially apparent.
The 'missing middle-sized' members of these guilds would be alleviated by subadults of tyrannosaurid species serving as the mid-sized predators. Hypothesized growth curves of tyrannosaurids are compared to those of likely prey species and to other large theropod dinosaurs, which suggest that the onset of the rapid growth phase in tyrant dinosaurs may be heterochronically delayed from the ancestral state.

Symposium: Dietary Reconstruction

MASHERS, GNASHERS, OR UNDERWATER SLASHERS? MOSASAUR MICROWEAR AND GEOCHEMISTRY EXPLORED AMONGST TWO DIFFERENT MOSASAUR COMMUNITIES IN THE LATE CRETACEOUS OF THE NETHERLANDS AND CANADA

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Mosasaurs gained marine dominance as apex predators in the last 30 Ma of the Cretaceous. Though most genera are cosmopolitan, regional ecological structures with different taxonomic components existed. Coexistence of genera in a regional setting was likely facilitated by dietary niche differentiation, which was proven in an earlier study on two-dimensional and three-dimensional dental microwear texture analysis on type Maastrichtian mosasaurs from the Netherlands. Therein, large apex predators *Mosasaurus hoffmanni* and *Prognathodon saturator* displayed a mix of piscivorous, sarcophagous, and osteophagous signals in their dental microwear, whereas the smallest mosasaur, specialist *Carinodens belgicus*, showed a durophagous diet. The smaller mosasaur *Plioplatecarpus marshi* also displayed a tendency to durophagy, contrary to what its tooth morphology indicates.
A second group studied for community comparison is the mosasaurs from the Bearpaw Formation, Campanian of Alberta, Canada, on the northern border of the Western Interior Seaway. Here, *Mosasaurus missourensis* and *Prognathodon* sp. are identified as apex predators, showing a similar combination of 'soft' and 'hard' dietary habit traces in their 2D microwear as the type Maastrichtian mosasaurs. Interestingly, also here a plioplatecarpine, *Plioplatecarpus primaevus*, displays durophagous microwear signals, contrary to what its tooth morphology indicates. It is likely that these plioplatecarpines fed on ammonites and other soft invertebrates, besides softer prey (fish and squid), and were thus not solely piscivorous. Indeed, EDX analysis, measuring Sr and Ba elements, shows a distinct dietary niche for *Plioplatecarpus*, with low Ba content overlapping only with values of sharks, indicating near-shore foraging. Meanwhile, the apex predators overlap together with higher Ba rates, indicating more offshore feeding, and lower Sr levels than *Plioplatecarpus*, indicating higher trophic level.
The more common mosasaur at the Bearpaw Formation is *Mosasaurus missourensis*, which shows a difference in 2D microwear between its upper and lower jaws. The upper jaws show more scratches, thus more slashing movements, and lower jaws show more pits, thus more grinding of prey. Compared to *Prognathodon*, their skull kinetics show a higher intraspecific range, which may be why *Mosasaurus missourensis* was more successful in the region. Moreover, its EDX measurements show a higher range overall, indicating coverage of wider hunting grounds.
Funding Sources Femke Holwerda is Dr. Betsy Nicholls Post-Doctoral Fellow at the Royal Tyrrell Museum of

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Preparators

CURATION OF THE MEHRTEN FORMATION

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Collecting efforts throughout the past 50 years by Mr. Dennis Garber yielded a diverse Neogene vertebrate fossil assemblage from the Mehrten Formation in Stanislaus County, California, U.S.A. The collection consisting of well-preserved fish, birds, amphibians, reptiles, mammals, and plant material were donated to both the Natural History Museum of Los Angeles County and the University of California Museum of Paleontology. After limited publication on the material, resurgence in studies of the Hemphillian fossils reveal major insights into the paleoecology of the time. The collection holds the only known Californian occurrence of the *Hesperotestudo orthopygia* tortoise. This species presence supports previous paleobotanical evidence of a warmer Pliocene climate in the region compared to today. Most notably, the collection also includes the first and only fossilized coprolites from Borophagine canids exhibiting the bone-crushing behavior of the hypercarnivore's diet.
Supported by an anonymous donation, the Natural History Museum of Los Angeles County is facilitating future use and availability of this unique assemblage by completing the curation and digitization of newly acquired fossils discovered by Mr. Garber. Additional georeference data supplied by researchers at California State University Stanislaus provide missing contextual information of the Mehrten Formation localities. In order to process the collection, the following goals were established: inventory the material, sort and identify elements and taxonomic groups, catalog and archivally label elements, digitally photograph material, integrate the newly acquired fossils within the existing locality drawers, and supplement locality records.
The project resulted in the identification of over 400 elements from the 49 existing localities which were consequently labeled, stored in archival housing, cataloged, and photographed. Database locality records were updated to reflect accurate and extensive georeference data such as site photographs, GPS coordinates, lithologic descriptions, and collector interviews pertaining to the existing localities. Overall, the collection and its corresponding data are now housed and organized according to current best practices. The completion of the project provides for greater access to specimens and preservation of locality data from the Mehrten Formation so that a deeper understanding of the paleoecology of Stanislaus County throughout the Neogene period can continue to develop.
Funding Sources The work was supported by an anonymous donation to the Vertebrate Paleontology Department at the Natural History Museum of Los Angeles County.

Macroecology & Macroevolution

DEEP-TIME DEMOGRAPHIC INFERENCE SUGGESTS K-PG ECOLOGICAL RELEASE AS DRIVER OF NEOAVIAN ADAPTIVE RADIATION

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Assessing the applicability of theory to major adaptive radiations in deep time represents an extremely difficult problem in evolutionary biology. Neoaves (95% of living birds) is believed to have undergone a period of rapid diversification roughly coincident with and following the K-Pg boundary. We investigate whether basal neoavian lineages experienced ecological release in response to ecological opportunity, as evidenced by density compensation, a metric commonly employed in studies of more recent adaptive radiations. We estimated effective population size (Ne) in basal lineages of birds using insertion/deletion mutations (indels) and gene trees generated from nucleotides, indels, or both in the context of well-understood relationships between gene tree dis/concordance (due to incomplete lineage sorting, 'ILS'), time, and demography couched in coalescent theory. We found that some lineages exhibited unexpectedly high gene tree discordance relative to the estimated number of generations between speciation events near the K-Pg boundary. The simplest explanation for this result is an increase in Ne, notwithstanding the potential effects of homoplasy, generation length, taxon and temporal sampling, tree topology, divergence time estimates, and metapopulation structure on Ne inference. Simply stated, we observed a spike in estimated Ne among some of the basal-most lineages of Neoaves beginning with the K-Pg boundary. This is consistent with density compensation in response to ecological opportunity. It suggests that the K-Pg mass extinction of heterospecific antagonists (e.g., Enantiornithes) spurned an explosive radiation of neoavian birds, whether or not it was adaptive. To the best of our knowledge, such demographic data have never previously been available for the ancestral lineages of major clades because it generally requires population sampling. The relevance of our results to the 'Ecological Theory of Adaptive Radiation' will ultimately hinge on complementary studies of rates of speciation and of