Technical Session XV (Friday, August 25, 2017, 3:00 PM)

EXPLORING THE EVOLUTION OF DUROPHAGY IN STAGODONTID METATHERIANS USING RELATIVE MANDIBULAR BENDING STRENGTH

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The Stagodontidae includes some of the largest metatherian mammals known from the Cretaceous of North America. Two genera, *Eodelphis* and *Didelphodon*, are indisputably assigned to this family. Among the two known species of *Eodelphis*, *E. cutleri* is larger, has a more robust jaw, more inflated premolars, and third premolars more specialized for crushing than those of *E. browni*. These dental differences led to the hypothesis that an *Eodelphis cutleri*-like ancestor gave rise to *Didelphodon*, another, mostly younger, stagodontid genus with more robust dental and mandibular morphology.

Previous analysis of the craniodental morphology of *Didelphodon* led to the interpretation that this taxon was a predator-scavenger with adaptations towards durophagy. If *Didelphodon* arose from an *E. cutleri*-like ancestor, then we might expect *E. cutleri* to exhibit adaptations toward durophagy relative to the condition in *E. browni*. To explore such possible trends within Stagodontidae beyond the dental evidence, we investigated mandibular bending strength using beam theory. We made estimates at six interdental gap locations along the jaws of seven *Didelphodon* specimens, four *E. cutleri* specimens, three *E. browni* specimens, and two *Eodelphis* sp. specimens, as well as various other metatherian taxa.

The mandibular bending strength profiles of *Eodelphis* differ from those of *Didelphodon*; dorsoventral and labiolingual bending strength increase linearly from the symphysis to below the ultimate molar, suggesting that the jaw of *Eodelphis* is better suited to handle those forces posteriorly than anteriorly. It is also about twice as deep as it is wide, indicating it is better suited to withstand dorsoventral loads than it is labiolingual loads. Dorsoventral loads generally reflect bite forces. In contrast, jaws of both *D. vorax* and *D. coyi* are relatively wider than those of *Eodelphis*, and their labiolingual bending strength varies little from the symphysis to below the ultimate molar. Higher labiolingual bending strength is associated with greater resistance to lateral movements of struggling prey or from torsional stresses induced by hard-object feeding. The low labiolingual bending strength values anteriorly in the jaw of *Eodelphis* suggest that, among the morphological changes associated with durophagy in stagodontids, the inflated premolar morphology evolved prior to the broad anterior mandibular morphology for large labiolingual loads.

Technical Session X (Friday, August 25, 2017, 9:15 AM)

NEW SILESAURID (ARCHOSAURIA: DINOSAURIFORMES) SPECIMENS FROM THE UPPER TRIASSIC CHINLE FORMATION OF NEW MEXICO AND THE PHYLOGENETIC RELATIONSHIPS OF *EUCOELOPHYSIS BALDWINI*

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The recent discovery of the dinosaurian sister taxon Silesauridae has revolutionized our understanding of the early evolution of dinosaurs and their closest relatives. Silesaurids were predominantly herbivorous and quadrupedal taxa that were geographically widespread during the Middle and Late Triassic. One silesaurid taxon, *Eucoelophysis baldwini,* was described from a single fragmentary postcranial skeleton in the Petrified Forest Member of the Upper Triassic Chinle Formation near Ghost Ranch in northern New Mexico, USA. This limited material has hampered the ability to properly diagnose *Eucoelophysis* and determine its phylogenetic relationships among silesaurids. However, since 2006, our team has recovered abundant silesaurid material at the nearby Hayden Quarry (HQ) from a similar stratigraphic level of the Petrified Forest Member as the *Eucoelophysis* holotype. This material includes a maxilla, dentaries, isolated teeth, humeri, and both associated and isolated pelvic and hindlimb material. Our examination of all available specimens indicates that the *Eucoelophysis* holotype and the HQ pelvic/hindlimb material share a unique combination of character states which distinguish them from all other silesaurids, including a reduction in the size of the fourth trochanter of the femur and an appressed surface along the lateral margin of the tibia. Although the isolated HQ cranial material cannot be directly compared to the holotype of *Eucoelophysis*, it does possess silesaurid synapomorphies (e.g., leaf-shaped teeth ankylosed with the jaw), and there is no evidence to suggest more than one silesaurid taxon in the HQ. Taken together, these data all support the referral of the HQ material to *Eucoelophysis*. Our parsimony phylogenetic analysis (294 characters, 35 taxa) recovers a monophyletic Silesauridae, with a polytomy of *Eucoelophysis* (including HQ specimens), *Diodorus*, *Lutungutali*, *Sacisaurus*, and *Silesaurus*. When *Lutungutali* is omitted as a wildcard taxon, *Eucoelophysis* is recovered as the sister taxon to a clade comprising (*Diodorus* + *Sacisaurus*) and *Silesaurus*. *Eucoelophysis* shares several features with those taxa, such as a Meckelian groove restricted to the ventral margin of the dentary, a Meckelian groove that extends anteriorly through the dentary symphysis, and an enlarged iliac brevis fossa which opens laterally. The results of our study indicate that the diversification of most Late Triassic silesaurid lineages occurred by the Carnian, which is approximately coincident with the initial radiation of dinosaurs.

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Poster Session I (Wednesday, August 23, 2017, 4:15 – 6:15 PM)

PRECISE 3D PHOTOGRAMMETRY REVEALS NEW INFORMATION ON PTEROSAUR ICHNOTAXONOMY AND TERRESTRIAL LOCOMOTION: REVISITING THE ICHNOHOLOTYPE OF *PTERAICHNUS SALTWASHENSIS*

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For all the prehistoric beasts, the terrestrial locomotion of pterosaurs may be themost complex, controversial, and least well understood. For 170 years followingthe discovery of the first pterosaur fossils in Germany's Solnhofen Limestone,the debate on pterosaur terrestrial locomotion relied solely on studies of theskeletal anatomy. This changed in 1952, when geologist William Lee Stokesdiscovered an enigmatic trackway in the Saltwash Member of the Upper JurassicMorrison Formation of northeastern Arizona. The footprints (preserved on afluvial sandbar) were careful documented, collected, examined, and comparedwith known fossil tracks at the time. Stokes realized that these traces werenot only new to science, but were the first direct evidence of pterosaurswalking on land. In 1957, he established the ichnotaxon *Pteraichnus saltwashensis* for these distinctive tridactyl manus and tetradactyl pes impressions. Sincethis discovery, thousands of similar traces have been found on nearly everycontinent; yet Stokes' description of the 9 consecutive pairs of quadrupedalmanus and pes prints has remained the "gold standard" for all pterosaur trackstudies. Reexamination of the original specimen with new digital documentationtechniques, allows errors from the 1957 paper to be noted and corrected in anobjective manner. Unfortunately, those initial errors have been propagatedthrough the literature, especially when researchers failed to make firsthandobservations on the original specimen. These inaccuracies, combined with thelack of standardized measurements and paucity of 3D digital comparisons, putmany locomotor and taxonomic studies in question. Recent photogrammetricdocumentation of the ichnoholotype at the University of Utah allows for thesubtle details of pterodactyloid locomotion and ichnotaxonomy to be teased outof this unique ichnite. GIS Raster analysis (e.g., exaggeration of the verticaland mapping of slope and curvature) assists in the visualization andquantification of the morphologic variation of this and other digitallydocumented specimens. In addition to ichnotaxonomic revisions, high resolutionanalyses allow for better insights into the kinetics of movements of pterosaurson land and in shallow water.

Poster Session IV (Saturday, August 26, 2017, 4:15 – 6:15 PM)

INFERENCE OF FEEDING BEHAVIOUR IN A MORPHOLOGICALLY UNIQUE EXTINCT BIRD, THE DODO (*RAPHUS CUCULLATUS*)

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The dodo (Aves: Columbidae: *Raphus cucullatus*) is a striking example of island endemic evolution and secondary flightlessness in birds. Despite becoming extinct relatively recently (late 17th century), only a few, highly fragmentary osteological specimens exist. Compared to extant columbids, dodos have highly modified skeletal anatomy, including changes to the skull. This suggests a distinct ecology for the dodo, but historical observations of living dodos are variable in both their assertions and their quality. The dodo therefore remains an enigmatic creature, and is perhaps best treated as a paleontological taxon. If we are to understand its biology, it must be subjected to the same quantitative analysis as any other extinct animal. A remarkable feature of dodo anatomy is the uncommonly large beak, especially when compared to other pigeons, the family within which dodos are nested. Dodo jaws are deep and robust, with a long mandibular symphysis, suggesting that dodos were capable of strong bites. In contrast, most extant pigeons have particularly slender jaws and engage in very little biting, primarily using pecking and "throw-and-catch" methods to feed. It is therefore of interest to consider how dodos used their beaks to acquire and process food. Using high-resolution CT scanning and Finite Element Analysis (FEA), we compared the lower mandible of the dodo to that of its closest extant relative, the Nicobar pigeon (*Caloenas nicobarica*). We demonstrate that dodos experience lower and more evenly distributed mandibular feeding stresses than Nicobar pigeons, especially during unilateral biting. While this indicates that dodos were capable of forceful bites along the entire length of the jaw, stresses are particularly low when biting at the back of the jaw where lever mechanics dictate that bite forces will be highest. This suggests that dodos were well adapted for crushing, asymmetrical bites. Our results are therefore consistent with isotopic and palaeobotanical evidence that dodo diets comprised mostly fruit and large seeds.

Technical Session I (Wednesday, August 23, 2017, 10:45 AM)

MORPHOGENESIS OF THE EGG TOOTH IN THE LEOPARD GECKO AS A MODEL FOR THE DEVELOPMENT OF DENTAL SIZE VARIATION IN AMNIOTES

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Tooth size can vary along a tooth row in an individual organism, and can also change through ontogeny as the organism grows. However, little is known about the developmental controls regulating tooth size in amniotes. This lack of data makes a comprehensive understanding of the origin of tooth size differences within and among species difficult, and hampers interpretations of the acquisition of heterodonty over evolutionary timescales. In this study, we examine tooth development through embryonic growth in the leopard gecko *Eublepharis macularis* to understand the timing of tooth mineralization and its contribution to sizing differences in teeth. The embryonic leopard gecko has greatly enlarged egg teeth that are shed a few days after hatching, and show a dramatic phenotype for studying size variation. In this study, we aimed to: 1) quantify differences in tooth size at the very earliest stages of tooth development, 2) determine the timing of tooth development in the context of skull development, and 3) visualize the mineralization pattern in egg and marginal teeth in ovo. To do this, 40 specimens were fixed at different developmental stages: 14 days post-oviposition to hatching. Specimens were examined with microCT, histology, and immunofluorescence. Cells in developing tooth buds were counted as a proxy for the size of the tooth germ at all developmental stages. Results show that the cranial ossification pattern is not typical of squamates, as the neurocranium is the first to ossify rather than the dermatocranium. The egg teeth

