

**BUILDING A COMPARATIVE MORPHOLOGICAL ATLAS FOR LUNGFISH: NEW INFORMATION ON THE SKELETAL ANATOMY OF *TRANODIS CASTRENSIS***

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The evolutionary relationships of lungfish have long been a subject of debate. To provide more data for use in phylogenetic analyses, I developed a comparative atlas to document the morphology of extant lungfish. Here, I extended the scope of my atlas to incorporate an extinct taxon, *Tranodis castrensis*. *Tranodis* is an Upper Mississippian lungfish that is known from the Buffalo Wallow Formation in Hancock County, Kentucky, and is the oldest lungfish taxon known in which specimens were found preserved inside their burrows. *Tranodis* is represented at other sites from pectoral elements and skull roofing material; however, many elements are still unknown, and the intracranial anatomy is unstudied. I scanned Cincinnati Museum Center (CMC) specimen 8297 using High Resolution X-Ray Computed Tomography (HRXCT). The HRXCT scan has a total of 1125 slices and a 0.0836 slice thickness and interslice spacing. This skull previously was mechanically prepared, leaving many of the skull roof and orbital bones visible. The operculum, pterygoid and prearticular tooth plates, vomerine teeth, and remaining mandibular elements were also exposed. Many elements, however, are only partially visible from the exterior of the fossil. In order to study the bones embedded in matrix, I isolated each recognizable skull bone and digitally disarticulated the skull. This method of preparation eliminated the uncertainty of additional manual preparation, and left the specimen intact for future study. I examined the articulations of the pterygoids and prearticulars within the skull as well as the inner surfaces of the skull roof bones. Previously unknown elements that I examined include the ceratohyal and cranial rib. The ceratohyal has a similar morphology to those of the Permo-Carboniferous lungfish *Sagenodus* but possesses a distinct notch in the posterior margin. The cranial rib is more uniform in thickness than in other taxa and flares less at either end. By studying elements of *Tranodis* that were digitally prepared with HRXCT data, I added valuable morphological data to a growing comparative atlas of lungfish skeletal anatomy that I used to elucidate relationships of extant lungfish.

Technical Session XIII, Tuesday 1:45

**MORPHOLOGICAL DIVERSITY IN EXTINCT SOUTH AMERICAN SPARASSODONTS (MAMMALIA: METATHERIA)**

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The distinctiveness of South America's Tertiary mammal communities has been recognized for well over a century. Not only was the plant-eating guild filled exclusively by endemic groups for most of this interval, so too was the meat-eating one; a clade of metatherians known as sparassodonts (borhyaenoids) were the primary carnivores. Despite their lock on the mammalian predatory niche for 50+ million years, sparassodonts apparently never were as successful as members of the Carnivora on other continents in terms of number of species (taxonomic diversity) or abundance (commonness in the fossil record). Proposed explanations for this include competition with crocodylians and/or large, terrestrial, carnivorous birds (phorusrhacids, also known as terror birds), and developmental constraints on metatherian dentitions. To test these explanations, we compared morphological diversity of South American sparassodonts to North American carnivorans and creodonts over the same interval, based on a data set of estimated body masses plus 16 discrete, taxon-independent characters summarizing functional aspects of the dentition. We included all currently recognized Eocene (Itaborian South American Land Mammal "Age") and younger sparassodonts. Taxa were coded primarily based on the literature. Morphological diversity was assessed using: (1) mean pairwise dissimilarity between species, and (2) volume of occupied morphospace. We predicted that: (1) sparassodonts would be less disparate morphologically than carnivorans if constraint were a significant factor; and (2) sparassodonts would mostly plot outside of hypercarnivore morphospace if competition with non-mammalian meat-eaters (generally assumed to be hypercarnivores) were a significant factor. Our results support the constraint hypothesis and do not support the competition hypothesis. Assuming our taxon-independent characters apply as well to sparassodonts as to carnivorans and creodonts, these results suggest that habitat may have been a more important factor in dietary partitioning among Tertiary South American meat-eaters than diversity of food resources and/or percentage of meat in the diet.

Romer Prize Session, Monday 8:15

**COMPETITIVE RELEASE OR ECOLOGICAL RETREAT: ECOLOGICAL RAMIFICATIONS OF EXTINCTION AND HABITAT TRANSFORMATION FOR MADAGASCAR'S LEMURS**

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Lemurs are a unique and ecologically-crucial part of Madagascar's faunal diversity. In the last 2000 years, at least 17 species have become extinct and the future of the remaining taxa is uncertain. Competitive release may have allowed extant taxa to fill niches left vacant by extinct species. Alternatively, vacated niches may have remained unfilled or have disappeared entirely, or surviving lemurs may have shifted to new niches in response to anthropogenic or climate impacts. Here I use stable isotope biogeochemistry to test among these hypotheses for three extant taxa from the Spiny Thicket Ecoregion in southwestern Mada-

gascar. Stable isotopic ratios reflect both the diet and habitat of an individual. In Madagascar, different types of plants (e.g. C<sub>3</sub> and CAM) have dramatically different carbon isotope ratios, and a negative relationship exists between rainfall and lemur isotope ratios. Accordingly, I use carbon and nitrogen isotope ratios in lemur bone to determine if lemurs lived in drier or moister habitat, and whether or not they fed on predominantly C<sub>3</sub> or CAM plants. I find weak evidence for competitive release in *Propithecus verreauxi*, and no evidence for release in *Lemur catta* or *Lepilemur* spp. Instead I find a dramatic contraction in the isotopic niche breadth of the entire lemur community following the decline and disappearance of now-extinct species, a pattern that is suggestive of ecological retreat. Additionally, I find that modern lemurs from a protected riparian reserve have significantly lower carbon and nitrogen isotope ratios than any subfossil individual, extinct or extant. This finding may have important conservation and management implications. The majority of reserves dedicated to the protection of extant species in southwestern Madagascar are riparian habitat, yet growing evidence suggests that lemurs (particularly *L. catta*) living in riparian reserves can experience health problems. My results suggest that lemurs used to frequent very dry habitats such as dry forest and spiny scrub. These arid habitats are under-protected, and what little habitat remains is disturbed and severely fragmented.

Poster Session IV, (Wednesday)

**EIMER'S ORGANS IN MOLES AND THE RESOLUTION OF OSTEOLOGICAL EVIDENCE FOR SOMATOSENSATION**

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The Eulipotyphla family Talpidae consists of the moles, shrew moles and desmans and are found throughout Europe, Asia and North America. These small insectivorous mammals express a range of behavioural, environmental and dietary preferences, however nearly all members of the Talpidae rely on a highly developed somatosensation system facilitated by Eimer's organs. These complex sensory organs are found exclusively in the nasal epidermis of talpids and their density on the rhinarium of species has been utilized in this study as an index of somatosensory sensitivity. The current research aimed to ascertain the resolution to which the talpid skull records variation in somatosensation between species. This was achieved via investigation of the caliber of the infraorbital foramina (IOF). This foramen is known to scale isometrically with the cross sectional area of the 2nd partition of the trigeminal nerve and this was supported by histological samples of available species. A comparative analysis of IOF size recorded between a large sample of 29 species of talpids (n=205) indicates that foramen size correlates with Eimer's organ quantity on the rhinarium and is related to behavioural and environmental preferences independent of phylogenetic relatedness. Osteological cranial morphology has been extensively used as evidence for the resolution of nervous tissue and, by proxy, sensory adaptation in both living and fossil mammals and this new research indicates that even fine scale differences in the sensitivity of closely related, fossorial/semiaquatic mammals are detectable within the bony anatomy.

Technical Session XVII, Wednesday 1:45

**BEING A THEROPOD ON AN ISLAND: A PECULIAR DROMAEOSAURID FROM THE MAASTRICHTIAN OF THE TRANSYLVANIAN BASIN, ROMANIA**

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Islands faunas are frequently characterized by highly unusual taxa, which are often endemic, relictual, and/or substantially larger or smaller than mainland relatives (the "island rule"). The fossil assemblage of the Maastrichtian 'Hateg Island' (Romania) has long been considered an abnormal island fauna, based on the occurrence of basal turtles and cimolodontan multituberculates, the presence of dwarfed and basal dinosaurs, and high overall endemism. However, little is known about the predatory dinosaurs that inhabited this island, and it is unclear whether theropods were also affected by the island rule. We describe an articulated partial skeleton representing a new dromaeosaurid from the uppermost Cretaceous deposits of the Transylvanian Basin, which allows, for the first time, a detailed understanding of the anatomy and phylogenetic relationships of an island-dwelling theropod. The new taxon is highly autapomorphic and characterized by over 20 peculiar morphological traits, including extensive fusion in the manus and hindlimb, a shortened distal hindlimb, a stocky pelvis with increased femoral extensor muscle insertions, and a modified foot with two hyperextensive claws, as the result of an enlarged, fully functional first digit. Phylogenetic analysis places the new taxon as a derived velociraptorine dromaeosaurid, closely related to contemporary Laurasian taxa such as *Velociraptor*, its sister taxon. Sauropod and ornithomimid dinosaurs from the Hateg island, on the contrary, usually occupy basal positions within their respective clades, and their closest relatives are often considerably older taxa. The close relationship between the new taxon and Asian dromaeosaurids suggests that faunal interchange between Asia and the European islands persisted late into the Cretaceous, contrary to previous suggestions of marked isolation of the European faunas. Finally, as shown by slightly larger referred specimens from the Hateg Basin, the new taxon is approximately the same size as its close relatives. In sum, the new taxon indicates that some island-dwelling dinosaurian predators were morphologically aberrant, but not dwarfed, primitive, or geographically endemic.