cortical bone and evaluated the degree of δ18O covariation between bone phosphate, carbonate, and diagenetic calcite. In this study, millimeter-scale sequential microsampling of a core removed from cortical bone in two femora and a tibia of *Tyrannosaurus* increased the known value of intrabone δ18Ophosphate from <1.0‰ to 1.3–3.0‰. These values increase the range in *Tyrannosaurus* body temperature from <4.3°C to 5.2–12.9°C, if the δ18O (or offsets) reflect relative body temperature at the time of hydroxyapatite formation as postulated previously. This range in temperature falls within acceptable levels for a mass homeotherm (endothermic or ectothermic).

A comparison of δ18Ophosphate versus δ18Ocarbonate indicates oxygen isotopic equilibrium is preserved in *Tyrannosaurus*. Oxygen isotope cyclicity and amplitude, and the minimum age of bone deposition estimated from cortical thickness, is suggestive of a seasonal (non-annual) isotopic signal in *Tyrannosaurus*. Interestingly, the Δ18Ocarbonate-phosphate of ~6.0‰ is 2.0 – 3.0‰ less than the theoretical 8.0 – 9.0‰ expected for unaltered modern bone apatite. This offset may reflect taxonomic, behavioral or physiological differences between *Tyrannosaurus* and the limited modern mammal sample from which this regression is calculated. Alternatively, diagenesis has altered the absolute δ18O values, but the ~6.0‰ offset is useful as an indicator of isotopic equilibrium in *Tyrannosaurus*.

δ18Ophosphate vs. δ18Ocarbonate analysis of modern crocodylian and ratite species indicate the Δ18Ocarbonate-phosphate relationship in these extant archosaurs is statistically significant. However, the scatter about the best-fit line is greater than observed in modern mammals. In *Tyrannosaurus,* the regression of δ18Ophosphate vs. δ18Ocarbonate does not correspond to that of modern mammals, ratites or crocodylians. Thermoregulatory strategies may be one of a variety of factors responsible. As an endothermic heterotherm, *Tyrannosaurus* could obtain large size and maintain a variable, but limited body temperature range compared to its environment.

Poster Session II (Thursday, November 3)

A BASAL TITANOSAURIAN FROM THE MIDDLE CRETACEOUS GALULA FORMATION, RUKWA RIFT BASIN, SOUTHWESTERN TANZANIA

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Sauropods reached peak diversity during the Late Jurassic, with a decline in diversity by the Early Cretaceous. Titanosaurians represent the most diverse clade of Cretaceous sauropods, with a near-cosmopolitan distribution. Despite this widespread occurrence, titanosaurians are rare components of Cretaceous African faunas. Two representatives are currently recognized, *Malawisaurus* from the Lower Cretaceous Dinosaur Beds (DB) of Malawi and *Paralititan* from Upper Cretaceous deposits near Bahariya Oasis, Egypt. Recent expeditions in the Rukwa Rift Basin (RRB) of SW Tanzania have resulted in the recovery of a semi-articulated titanosaurian sauropod from the middle Cretaceous Galula Formation. Elements recovered thus far include components of the postcranial axial (e.g., cervical and caudal vertebrae, ribs) and appendicular (e.g. scapula, humerus, ulna, ilium, and pubis) skeletons. Ongoing preparation of this material now allows an initial character evaluation of several key regions of the skeleton. A preliminary phylogenetic analysis incorporating the new specimen with 34 taxa was conducted to assess the relationship of the RRP form among sauropods. The strict consensus tree places the RRB specimen as the sister taxon to a clade consisting of *Malawisaurus* and all other titanosaurians. A suite of characters supports this relationship including procoelous anterior caudal vertebrae, the absence of anterior and posterior projections on the chevrons, and a squared corner on the proximolateral humerus. The RRB specimen differs from *Malawisaurus* in having complex and divided pleurocoels on cervical vertebrae, the absence of a ventral longitudinal groove on anterior and middle caudal vertebrae, and a long proximal anterior condylar process of the ulna. Additional comparative work on materials collected from the RRB and the DB of Malawi is necessary for differentiating these potentially contemporaneous faunas. A detailed survey of these assemblages offers the best opportunity for characterizing sub-equatorial terrestrial faunas and is essential for developing paleobiogeographic comparisons with Cretaceous faunas known from circum-Saharan Africa and elsewhere in Gondwana.

Technical Session III (Wednesday, November 2, 2:45 pm)

THE RATE AND CESSATION OF FACIAL GROWTH IN CARNIVORANS

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Understanding the relationship between allometric growth and morphological diversity is hindered by the paucity of comparative allometric data. One noteable example is the topic of facial allometry in carnivorans, in which the facial growth patterns of carnivorans are primarily extrapolated from studies of domestic species. Here, we present analyses of facial allometry in 52 carnivoran species, represented by 719 juvenile and adult specimens, and including fossil taxa ranging from the Oligocene (e.g. *Hesperocyon*) to Pleistocene (e.g. *Smilodon fatalis, Canis dirus*). Four facial length and four skull length measures were analysed. Results suggest that the common generalisations are inaccurate, as isometric and allometric patterns were found interspersed throughout Carnivora. When family-level clades were compared, Canidae was significantly different from other clades, with all canid species studied showing strong positive allometry. Felidae and Viverridae surprisingly also displayed positive allometry, while the mustelid clade Lutrinae was the only clade to display negative allometry. Ancestral state reconstructions of allometric coefficients suggest that both magnitude and direction of facial allometry are highly variable across Carnivora, but allometry may be the ancestral growth style. These data suggest that hypotheses linking diversity and allometry across Carnivora based on domestic species are likely incorrect.

We also scored timing of suture closure, grossly approximating termination of cranial growth, in 370 extant carnivorans, representing 25 species. Amount of suture closure is negatively correlated with body size, and facial sutures are consistently among the last to close. In contrast to facial allometry, suture closure is relatively conservative across carnivorans. Similarly, previous studies show little heterochrony in onset of cranial ossification across Laurasiatheria, although there is little comparative data within Carnivora. Combined, these results suggest that rate of growth (i.e. allometry), rather than heterochronic shifts in onset or termination, is the key variable for linking development and diversity in the carnivoran cranium.

Poster Session I (Wednesday, November 2)

FIRST FOSSIL RECORD OF A SERRASALMINE TELEOST (PACUS AND PIRANHAS) ON THE WESTERN SIDE OF THE ANDES, FROM THE LATE MIOCENE OF CHILE

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A single well-preserved tooth recovered from an upper Miocene (Tortonian) horizon in the Bahía Inglesa Formation, north-central coast of Chile, represents the first fossil occurrence of a serrasalmine teleost west of the Andes. In overall morphology the specimen resembles the teeth of some iguanian lizards, but analysis of the tooth's ultrastructure confirms a fibrous, branching, non-uniform pattern typical of fish teeth. The tooth has a raised and slightly apically rounded central cusp flanked by narrower, coarsely serrated cutting edges. The labial surface below the crown is somewhat inflated and bulbous. The lingual surface is more trenchant, with a dorsoventrally oriented rounded medial ridge that separates anterior and posterior shallowly concave surfaces. In occlusal view, the tooth is labiolingually compressed, with the cutting edges of the crown curving slightly lingually at the tooth's anterior and posterior margins. The lingual surface of the tooth bears fine crenulations and ridges, while the labial side is relatively smooth. The tooth is somewhat more compressed than but otherwise strikingly similar to mandibular teeth of some pacus (e.g., *Myleus*), particularly in crown and labial view, but like piranha teeth it has sharp, serrated cutting edges. This suggests a morphology intermediate between the two specializations within serrasalmines – herbivory, including tough nuts and seeds, in broad-crowned pacus, and flesh-slicing carnivory in piranhas with blade-like teeth. The presence of the specimen in the Late Miocene of Chile indicates at least some level of biotic exchange between freshwater faunas of Amazonia, where serrasalmines are endemic today, and the western side of the Andes, a contention that is supported by the presence of crocodyliforms and hydrochoerine rodents in the Bahía Inglesa Formation.

Poster Session II (Thursday, November 3)

CONSTRUCTING A ROBUST ECOMORPHOLOGICAL INDICATOR OF LOCOMOTOR MODE FROM THE DISTAL FEMORAL ARTICULAR SURFACE MORPHOLOGY

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To make reliable inferences about the ecology of fossil animals, we need to know which morphological metrics are consistently related to function rather than other factors. The form of a joint surface is the result of different influences on the organism, such as body size, phylogeny and locomotor specialization. I collected six linear measurements from the distal femora of 45 genera of living mammals from the orders Carnivora, Rodentia, Artiodactyla, Perissodactyla and Hyracoidea. Body size range was 0.3kg to about 300kg. Each taxon was placed into one of six locomotor categories (arboreal, scansorial, terrestrial, semi-aquatic, semi-fossorial, and cursorial) based on the literature. Linear measurements were highly correlated with each other and with body size. Thus they were regressed against body size for all taxa and residuals were taken for further analysis. Three ratios were calculated from the linear measurements; none were highly correlated with each other or with body size. Multivariate ordination techniques (principal components analysis, canonical variates analysis) and statistical analyses (MANOVA, discriminant function analysis) were used to test the hypothesis that locomotor mode explains most of the variation in these size standardized metrics. Locomotor mode was a significant predictor of variation in femoral morphology both in the analysis of residuals (λ=0.149, F (30, 666)=13.489, df=30, p=0.01) and the analysis of ratios (λ=0.173, F (15, 527.67)=31.259, p=0.01). The discriminant functions were also highly significant, but success rates in the classification stage varied widely (cursorial taxa 78.6% success rate, semi aquatic taxa 27.8% success rate). Closer examination reveals that those taxa most frequently misclassified are those documented as engaging in several of the identified behaviors, or whose classification is equivocal. Arboreal taxa are also often recovered as scansorial. Linear metrics of the distal femur do reflect locomotor specializations, but are only diagnostic of them for certain specialized behaviors. This has implications for using the distal femur to infer the locomotor behavior of fossil groups.