

ghost lineages and several ecomorphological variables (biometrical, biogeographical and ecological). For this innovative approach we codified variables for terminal taxa as double-state characters and used concentrated changes tests on the phylogeny of all extant species of this suborder of Artiodactyla (Mammalia). In order to test the robustness of the results obtained concerning the extant species, the analyses were repeated for each partial tree generated by cutting the complete tree at ages of 4, 8, 12, 16 and 20 Ma. Although this pruning process entails a significant change in tree length and a consequent shaking of ghost lineages percentages at the tips, it may show whether the trends observed in the previous analysis is maintained thought the evolutionary history of the Ruminants. Our results indicate that the proportion of known fossil record in ruminants appears to be influenced by the preservation potential of the bone remains in different environments. Furthermore, it seems that large geographical ranges of species increase the likelihood of preservation. Finally, body size is shown to be an important factor, increasing the representation of large size taxa in the fossil record, and reducing that of species with lower weight. Nevertheless, this latter variable might be probably important from the Plio-Pleistocene onwards, while it resulted statistically not significant in earlier periods.

Poster Session II (Thursday)

GLYPTODONTINES (XENARTHRA, GLYPTODONTIDAE) AND THE GREAT AMERICAN BIOTIC INTERCHANGE: A NEW INTERPRETATION

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Until recently, the earliest records of Glyptodontidae Glyptodontinae (Xenarthra) were limited to late Miocene-Pliocene ("Araucanense", ~7 Ma) of southern South America (*Glyptodontidium tuberifer* Cabrera). The entrance of this group of glyptodonts to North America during the Great American Biotic Interchange was interpreted as a unidirectional faunal migration with the subsequent differentiation of a new genus (*Glyptotherium*), probably in the late Pliocene. A new comparative study of materials from the Mio-Pliocene of northernmost South America (Venezuela and Colombia) and traditionally included within Glyptodontidae Propalaeophlorinae (*Asterostemma* spp.), suggests these taxa are not Propalaeophlorinae but represent the first stages in the cladogenesis of Glyptodontidae Glyptodontidae; they are currently assigned to a recently established genus, *Boreostemma*. The first records of this clade in southernmost South America coincide with the acme of the "Age of Southern Plains", which probably extended from Venezuela to Argentinean Patagonia during the late Miocene-Pliocene. These great open extensions of savannah habitat may have favored the dispersal of the glyptodontines into more southern areas through "Andean biogeographical corridors." The discovery of *Glyptotherium* sp., cf. *G. cylindricum* (one of the most derived species of the genus and until recently, limited to the holotype, from central Mexico) in the latest Pleistocene (ca 15-12 ka) of Venezuela supports the bidirectional faunal migration during the GABI, probably associated with a biogeographical "corridor" that formed during one of the later glacial periods. The immigration from North America is a new case of re-entrance of a group that emigrated from South America and diversified in North America, as has already been proposed for other xenarthrans (e.g., Cingulata: Pampatheriidae and Phyllophaga: Megatheriinae). Recent reports that postulate the ingress of glyptodontines to North America ~3.9 Ma, prior to the establishment of the Isthmus of Panama as a continuous land bridge, require new interpretations concerning identification of the emigrant taxa and the derived genera in North America.

Edwin H. and Margaret M. Colbert Poster Competition (Thursday)

ARCOSAUR: ARCGIS OPERATIONS FOR SURFACE ANALYSIS USING RASTERS

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The paleontological "digital revolution" has fostered various exaptations of scanning and modeling software for the 3D visualization and animation of extinct organisms; however, such programs are often unsuitable for quantitative analysis. Recently, geographic information system (GIS) software has been used to characterize fossil topology, but this has been limited to relatively planar manifolds (occlusal surfaces of mammalian teeth) and Euclidean geometries (distance, slope, orientation). In order to conduct more comprehensive topographic analyses in ESRI's ArcGIS 9.2 software, I created a suite of automated processing tools called ARCOSAUR (ArcGIS Operations for Surface Analysis Using Rasters) by using the ArcToolbox ModelBuilder visual programming environment and scripting in the Python language. Using the ARCOSAUR toolbox, 3D data acquired via computed tomography (CT) or laser scanning can be converted from computer-aided design (CAD) formats to triangulated irregular networks (TIN) and then rasterized into digital elevation models (DEM). In addition to calculating surface relief and basic Euclidean measurements, the tools can be used to analyze surface convexity and concavity, identify and characterize topographic landmarks such as muscle scars and bone pathologies, and even create 3D "pseudofossils" from 2D digital photographs. Additionally, analyses need not be limited to planar surfaces such as dentition or fossils *in situ*; various trigonometric operations include the identification of centers and axes of rotation along curvilinear joint surfaces; in turn these markers can be exported for use as kinematic references in modeling software. To illustrate the utility of these processing tools, forelimb elements of theropod *Deinonychus antirrhopus*,

alligator *Alligator mississippiensis*, and pigeon *Columba livia* were digitized with a high-resolution laser surface scanner and reconstructed in Maya 5.0. ARCOSAUR was then used to import and process the data, analyze the topology of articular surfaces, and reconstruct cartilaginous tissue for *D. antirrhopus* within an extant phylogenetic bracketing paradigm.

The Cleveland Shale and Beyond: Early Vertebrate Form, Function, and Phylogeny, Wednesday 8:15

THE CLEVELAND SHALE FAUNA REVISITED: IS THE FAUNA THE STANDARD FOR COMPARISON IN THE FAMENNIAN AND LATE DEVONIAN?

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The Late Devonian, punctuated by a number of orogenic events and global extinctions associated with the suturing of Pangaea, represents an important time in the evolution of early gnathostomes. Our understanding of the biotic changes at this time is based on a limited number of faunas. The Cleveland Shale fauna (Famennian) in northern Ohio represents one of the better-known faunas of the Late Devonian. This is based on a history of collecting since the late Nineteenth Century that is augmented by the diligent collecting of Peter A. Bungart in the 1920s to 1940s and finally by the salvage of numerous specimens during the 1966–1967 construction of Interstate-71 through the most fossiliferous horizons. Although 44 taxa are reported in the literature, a survey of the collections housed in the Cleveland Museum of Natural History and a review of unpublished museum documents indicates the presence of 66 taxa (33 chondrichthyans, 28 placoderms, and 5 osteichthyans). The past perception that placoderms dominated the fauna is based in part on the abundance of this group in the collection; however, this numerical dominance is overly represented by a single species, *Dunkleosteus terrelli*. The large size of *Dunkleosteus* with its thick dermal bone presents the potential collector with an obvious size bias. In the Famennian, the Cleveland Shale fauna with its 66 species represents the standard for comparison with the next most speciose locality (Tafilalt, Morocco) possessing 32 species. In the Late Devonian, the Cleveland Shale fauna is comparable in number to the Frasnian Bad Wildungen locality (Germany; 61 species). The implication of these disparities is not that these localities represent pockets of high diversity isolated from adjacent basins, but that the other basins have been under sampled. For example, recent collecting in the Michigan Basin has nearly quadrupled the known fauna suggesting the potential reward with renewed fieldwork. Although we can now consider the Cleveland Shale fauna as a standard to achieve, the fact that only 44 of the 66 taxa have previously been reported demonstrates that despite the history of work on the fauna much still needs to be done.

Technical Session X, Friday 11:15

PATTERNS OF DIVERSITY AMONG LATEST CRETACEOUS DINOSAURS IN NORTH AMERICA

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Latest Cretaceous dinosaur diversity has been a contentious point in discussions of dinosaur extinction, resulting in widely divergent opinions of both the pattern and its relevance. At the local scale, intraformational sampling shows little evidence for a decline in dinosaur diversity immediately prior to the end of the Maastrichtian. Globally, diversity is much higher in the Campanian than in the Maastrichtian, leading to suggestions of longer-term decline. However, comparisons of global, stage-level diversity typically rely on temporal, rather than stratigraphic, correlations when determining how to separate and align samples. This has resulted in the tendency to lump taxa into a single "Campanian" bin, despite the fact that better resolution is frequently available regarding taxon contemporaneity. It is especially important to recognize that superposed formations (e.g. Oldman, Dinosaur Park, Horseshoe Canyon) can provide genuinely sequential diversity estimates. In addition, such comparisons must also account for variations in sampling method and density, paleoenvironment, and taxonomic ranges and resolution. When these factors are addressed, North American dinosaur diversity shows much less variation between formations and time intervals than is documented by raw, stage-level diversity counts. A significant component of diversity tracks changes in how often and how many paleoenvironments are being sampled. In North America, at least, latest Cretaceous dinosaur diversity appears to reflect more complex biotic and anthropogenic patterns, rather than a drawn-out, pre-extinction decline.

Technical Session II, Wednesday 10:45

ASSESSING THE HUMAN IMPACT ON MAMMALIAN SPECIES DIVERSITY DURING THE END-PLEISTOCENE EXTINCTION: CLUES FROM THE LAST 30 MILLION YEARS

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The relative weight of human impacts versus climate change as a cause of the end-Pleistocene extinction in North America has long been debated. Part of the difficulty in assessing the importance of each purported cause has been establishing a natural biodiversity baseline that takes into account the fluctuations of diversity in the presence of climate change but in the absence of humans through deep time. Here we use the MIOMAP and FAUNMAP databases of mammalian occurrences to clarify this baseline, as assessed by species-area curves, for