

6117-V) collected in the Cenomanian Alcântara Formation at the locality known as Laje do Coringa, Cajual Island, Maranhão State. This fossil concentration consists of hundreds of isolated elements that probably were reworked from previous deposits. The preserved part of the premaxilla is about 201mm long and 103mm high. It bears 7 alveoli on each side and is expanded laterally forming the typical terminal rosette reported in spinosaurid theropods. No tooth is complete but the preserved portions clearly lack serrations, a condition observed in the spinosaurids *Angaturama*, *Irritator*, and *Spinosaurus*, but differing from the finely serrated carinae of *Baryonyx*, *Cristatusaurus*, and *Suchomimus*. In ventral view, the rosette is more expanded than in *Angaturama* and has an almost circular shape, similar to *Spinosaurus*, but differing from the more oval shaped distal end of *Baryonyx*, *Suchomimus* and *Cristatusaurus*. In the third alveolus on each side two replacement teeth were observed, a feature that, to our knowledge, was not reported in theropods before. The new material from Maranhão further differs from *Angaturama* and *Irritator* by the lack of a sagittal crest (assumed to be present on the distal end of the latter). Up to date the new specimen represents the largest theropod recorded in the country and indicates a more diverse spinosaurid fauna in the Brazil coast during the Upper Cretaceous. The assignment of some putative spinosaurid teeth from the Bauru Basin that we have questioned before, are really unlikely to represent this distinct group of dinosaurs, limiting the spinosaurid record in Brazil to the middle part of Cretaceous.

Technical Session IV, Wednesday 4:30

#### THE EFFECTS OF EXTERNAL AND INTERNAL MORPHOLOGY ON LOAD DISSIPATION IN HOMININ CAPITATES: IMPLICATIONS FOR INTERPRETING HOMININ BEHAVIOR.

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Bone morphology is known to be phylogenetically and ontogenetically constrained, while trabecular architecture is generally considered to be more plastic and to better reflect the habitual loads encountered by that bone. A combined analysis of internal and external bone structure thus promises to shed light on evolutionary processes as well as on the behavioral repertoire of individuals/species. This was explored for a number of extant primates with known locomotor and manipulatory behavior and compared with results derived from analyses of extinct australopithecids. Finite element models of primate capitates were created from high resolution mCT. For one set of analyses bones were given homogenous properties of bone, while for the other different properties derived from CT values were inputted into the models, thus mimicking the effects of trabeculae. Capitates were scaled to the same size and loaded at their heads. The proportion of total load directed towards the ulnar and radial aspect of the distal surface were recorded and the differences were compared. In arboreal species, trabeculae tend to re-direct the load applied towards the ulnar aspect, whereas in terrestrial species the re-direction was towards the radial aspect. The latter trend was further exacerbated in species with marked manipulatory capabilities, such as *Theropithecus oswaldi* and *Australopithecus afarensis*. Conversely, earlier hominins do not yet show this trend towards radially directed loads despite their somewhat derived external morphology. This finding suggests that a decreased dependence on arboreal behaviors and increased manipulatory capabilities only began with *A. afarensis*.

Poster Session I, (Wednesday)

#### TWO NEW EARLY DEVONIAN (LOCHKOVIAN) SPECIES OF THE ACANTHODIAN GENUS *BROCHOADMONES* FROM THE MOTH LOCALITY, NWT, CANADA, AND SIGNIFICANCE OF DENTAL VARIATION IN THE GENUS

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The Early Devonian (Lochkovian) acanthodian *Brochoadmones milesi*, with its elaborated series of pre-pelvic spines and reduced pectoral fin and spine, was previously thought to be the only species in the family Brochoadmonidae, in the traditional but probably paraphyletic order Clamatiiformes. Two new species of *Brochoadmones* have been discovered at the extraordinarily diverse MOTH locality, Mackenzie Mountains, Northwest Territories, Canada, and presently, this is the only location where undoubted specimens of *Brochoadmones* have been recovered. There are multiple specimens for each new species, ranging from partial to nearly complete body fossils. The new species are distinguished from *B. milesi*, and from each other, by the structure of their scales, the length and ornamentation of their fin spines, and by the number and shape of their pre-pelvic paired spines. The new species, together with further study of specimens of *B. milesi*, demonstrate additional features of dentition. All three species of *Brochoadmones* possess tooth whorls lining the upper and lower jaw margins as well as pharyngo-branchial denticles. The three species differ in tooth whorl and denticle structure allowing isolated whorls to be identified to species. The common feature of their whorls and denticles reinforce the distinctions between dentitions of primitive acanthodians and that of other early eugnathostomes such as putative stem-group chondrichthyans.

Poster Session II, (Thursday)

#### THE POSTCRANIAL ANATOMY OF PROCONSUL MAJOR

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Four species of the catarrhine Proconsul are known from Early Miocene sites in Kenya and Uganda. Body weight estimates are ca. 10-20 kg for both *P. heseloni* and *P. africanus*, 30-40 kg for *P. nyanzae*, and 60-90 kg for *P. major*. Previous studies of the three smallest species have found the postcrania to be similar, and compatible with above branch quadrupedalism. However, *P. major* postcrania are sparse and locomotor adaptations are poorly known. It has been argued on the basis of its large size that it may have been either more terrestrial, or more suspensory, than the smaller species. Here we report on a new distal humerus and proximal radius, and functionally interpret a distal tibia, of *P. major* from the ca. 20 Ma Napak localities, Uganda. The radial head is posterolaterally flattened, as in extant quadrupeds, and so differs from *P. africanus* and extant hominoids. The lateral lip is wide. Both these features maximize surface area contact between the radius and humerus during quadrupedal weight bearing. However, the articular facet for contact with the humeral capitulum is wide as in extant hominoids. Correspondingly, the capitulum is spherical, and the zona conoidea is deep, suggesting more stability during forearm rotation than found in typical quadrupeds. Of extant anthropoids, the elbow morphology most resembles that of *Nasalis*. Previous work on the Napak distal tibia has found that it may be a scaled-up version of smaller Proconsul tibiae. However, a resampling approach comparing the tibial morphology in extant catarrhines shows it to be distinct from other Proconsul tibiae in possessing a thick medial malleolus and a wide anterior aspect of the talar surface. These differences are functionally related to loading the ankle in positions of dorsiflexion and inversion. Kinematic studies of extant primates have found that these foot positions are important during orthograde vertical climbing bouts. These new fossils and analyses, when integrated with data from other postcranial remains, suggest that *P. major*, while still using above branch behaviors, may have had a different locomotor repertoire than the smaller Proconsul species.

Poster Session I, (Wednesday)

#### EVOLUTION OF THE NEUROCRANIUM IN CAECILIIDAE (GYMNOPHIONA)

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The debate regarding the origin(s) of Lissamphibia remains a contentious issue in paleontology, as the results from several of the most recent phylogenetic analyses continue to yield conflicting hypotheses. Several factors pertaining to the nature of these datasets have been identified as the causes of this conflict, including the need for new sources of data, and the large amounts of missing data and uncertainty surrounding the polarity of characters for poorly known taxa. Among the most relevant groups that suffer from these weaknesses is Gymnophiona (caecilians). Historically caecilians are rare components of museum collections, often being known from only holotype material or very few specimens, thus limiting the extraction of character data to accessible anatomy in a subset of abundant taxa. The application of non-destructive imaging techniques, such as high-resolution CT (hrCT), has facilitated the investigation of previously inaccessible skeletal anatomy, thereby permitting its use in addressing this paleontological issue. As the vital first step towards gaining a more complete understanding of neurocranial evolution in Gymnophiona as a whole, a survey of the neurocranium and its associated anatomy in representative members of the most derived and taxonomically diverse caecilian clade, Caeciliidae, is conducted using hrCT. Thirteen new characters pertaining to the neurocranium are identified. These characters are analyzed within the context of caeciliid phylogeny, and the plesiomorphic state of the caeciliid neurocranium is inferred. The relevance and utility of each of the new characters is discussed as each applies to the lissamphibian origin(s) debate. Notably, it is revealed that details of the caeciliid sphenethmoid appear to more closely resemble those of microsaurians, whereas the overall pattern of cranial nerve foramina lies within the range of variation seen in frogs, salamanders, and other dissorophoids. The new information gained here provides a foundation for future study of more basal caecilian taxa, which, taken together, lead to the ultimate goal of determining the plesiomorphic condition of the neurocranium for the entire Gymnophiona.

Poster Session I, (Wednesday)

#### CARNIVORA FROM THE LATE EARLY PLEISTOCENE OF CAL GUARDIOLA (TERRASSA, VALLES-PENEDES BASIN, CATALONIA, SPAIN).

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We report the carnivoran faunal assemblage from the late Early Pleistocene site of Cal Guardiola (UTM 31T DG1702), which is situated in the western bank of the Torrent de Vallparadís, within the town of Terrassa (el Vallès Occidental, Catalonia, Spain). This locality was discovered in 1997, during the construction of a socio-sanitary building next to the Mútua de Terrassa. Paleontological excavation of 691 m<sup>2</sup> led to the discovery of abundant macro- and microvertebrate remains, as well as fossil wood and pollen, which were recovered from fossiliferous beds caused by massive mud-flow and debris-flow catastrophic events. The composition of the fauna and flora enables to infer the existence of a warm-temperate and humid riverine/rivermarsh ecosystem. The large mammal

remains recovered from Cal Guardiola include well-preserved carnivoran specimens of the following taxa: *Ursus deningeri*, *Canis mosbachensis*, *Vulpes praeglacialis*, *Pachycrocuta brevirostris*, *Homotherium latidens* and *Panthera cf. gombaszoeensis*. On the basis of magnetostratigraphic data, these sediments are clearly situated below the Brunhes-Matuyama geomagnetic boundary, so that an age older than 0.8 Ma can be inferred. This agrees with the rodent fauna recorded at the site, which includes *Mimomys savini*, *Allophaiomys chalinei* and *Allophaiomys cf. burgondiae*. As such, Cal Guardiola records the latest Epiplafanchian carnivores from the Iberian record, just before the arrival of true Galerian elements, such as *Crocuta crocuta*, *Panthera pardus* and *P. leo*. Among others, the faunal assemblage from Cal Guardiola includes one of the latest records of *Pachycrocuta* in Western Europe. It is also noteworthy that the ursid from Cal Guardiola is one of the earliest representatives of the cave-bear lineage, first recorded in the Vallonnet Cave.

Technical Session I, Wednesday 8:15

#### MAXIMUM LIKELIHOOD ESTIMATION OF BIOGEOGRAPHIC HISTORIES USING THE FOSSIL RECORD

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A new historical biogeographic method, Likelihood Analysis of Geographic Range Evolution (LAGRANGE), addresses assumptions and problems associated with current parsimony methods used in paleontology by modeling ancestral ranges in a likelihood framework. Here we demonstrate the use of this new method by using it to examine the diversification of equids in North America during the Miocene. LAGRANGE represents a breakthrough in paleobiogeography because it uses a character evolution approach that infers the biogeographic range of an ancestral node based on the branch lengths of its daughter species. Paleontologists have traditionally used biogeographic methods that employ a cladistic framework and parsimony methods to determine repeated patterns of area relationships and/or to reconstruct ancestral ranges (e.g. Tree Recognition Analysis, Brooks Parsimony Analysis). Unlike previously used methods, LAGRANGE does not assume vicariance as the primary mode of speciation and includes dispersal and local extinction rates that can be modified *a priori* based on known historical events. This new method was originally developed to determine the ancestral ranges of extant species. Here we modify LAGRANGE to incorporate extinct species by including fossil occurrences. To do so, fossil occurrences are added to the phylogeny as terminal taxa with short branch lengths. Each fossil occurrence is added to the phylogeny based on its stratigraphic age. Including fossil occurrences in ancestral range reconstructions confines the time period and areas in which a species diversified, resulting in more accurate analyses of geographic speciation patterns. The reconstructed ancestral ranges from the LAGRANGE analysis are compared to parsimony methods. In addition, dispersal and extinction parameters are adjusted to determine how including or excluding historical events influences the results, and the analysis is run including and excluding species occurrences with uncertain identifications.

Technical Session XVII, Saturday 1:45

#### INTERNAL CRANIAL ANATOMY OF BRASILDONTIDS AS DETERMINED BY MICRO-CT

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An as yet undescribed specimen of *Brasilitherium* spec. (no. 1043) from the Late Triassic of Rio Grande do Sul (Brazil) was studied by means of Micro-CT (RaySan 200). This specimen showed relatively well preserved structures of the nasal and brain cavities, which were analyzed with the software VGStudio Max 1.1 and Amira 3.1.1-4. In the anterior nasal floor the gutter-like medial palatal process of the premaxillary indicates the presence of an elongated vomeronasal organ of the mammalian type. For the first time, delicate remnants of maxillo-, naso- and ethmoturbinals are demonstrated in a member of the stem-group of mammaliaforms. The two ethmoturbinals are housed in a paired ethmoturbinal recess slightly expanding posteriorly at the side of the olfactory bulbs. Although the epipterygoid / alisphenoid and the orbitosphenoid are fairly broad, the lateral fontanella of the braincase is still wide. A new interpretation of the pterygoid process and fossa with respect to the origins of the muscles of the soft palate is suggested. The basicranial joint between the alisphenoid and the prominent basitrabecular process shows a peculiar transversal orientation. The hypophyseal fossa is well pronounced. The posterior fossa of the braincase is anteriorly bound by very prominent, though delicately built antotic pillars; laterally these pillars show concave and rounded dorsal margins which are interpreted as relatively large trigeminal incisures leading into the wide and open epipterygoid cavities. The size of the trigeminal nerve seems to be in accordance with the well differentiated nasal and rostral, nasal and buccal systems of these animals. The reconstruction of the endocast of the petrosal labyrinth is characterized by a short and stout cochlear recess. The anterior semicircular canal frames a marked subarcuate fossa. A displaced stapes was discovered in the orbital area, and it appears to be of the primitive type of advanced cynodonts. The presented new anatomical data are a contribution to improve our understanding of the groundplan and the functional adaptations of the stem-group of mammaliaforms.

Poster Session III, (Friday)

#### JURASSIC & CRETACEOUS PALEO GEOGRAPHIC CONNECTIVITY, DINOSAUR BIOGEOGRAPHY & THE PALEO BIOGEOGRAPHIC INDEX MAIN, Derek, University of Texas at Dallas, Richardson, TX, USA; SCOTSESE, Christopher, University of Texas at Arlington, Arlington, TX, USA; NOTO, Christopher, Grand Valley State University, Allendale, MI, USA

As Pangea broke apart in the Jurassic, expanding ocean basins separated terrestrial ecosystems in tropical and temperate latitudes. However, at the Polar Regions, land areas remained connected throughout most of the Jurassic and Cretaceous. In the northern hemisphere, terrestrial migration routes can be traced eastwards from Greenland to Europe and northern Asia throughout the Jurassic and Cretaceous via Barentsia. Connections between western North America and northeastern Eurasia, through Beringia, were more sporadic, but a good case can be made that Arctic Canada and Siberia were connected continuously from the Albian. In the southern hemisphere, migration pathways were more complex. South America, Africa, Madagascar, India, Antarctic and Australia were interconnected throughout the Jurassic and the Cretaceous. However, in the Albian, India and Madagascar became isolated from Gondwana. A paleobiogeographic connectivity index was developed to predict the availability of land bridge connections and the probability of terrestrial dispersal. Over time, the paleobiogeographic score decreases with increased separation of the continents. In order to investigate the effect of paleogeographic connectivity on dispersal and paleobiogeographic patterns, dinosaur distributions were plotted on 2-D rectilinear and 3-D polar projection maps of the Late Jurassic (Oxfordian, Kimmeridgian, Tithonian) and Early Cretaceous (Berriasian and Hauterivian, Albian, Cenomanian). The maps were created utilizing Arcmap 9.2, Point Tracker 4.0 and dinosaur localities from an updated Dinosauria database. In this paper we present 16 paleobiogeographic maps of dinosaurs that illustrate the polar paleobiogeographic pathways that connected the continents during the Late Jurassic and Early Cretaceous.

Technical Session XV, Saturday 11:00

#### TWO NEW COELUROSAURS FROM THE EARLY CRETACEOUS XINMINPU GROUP OF GANSU PROVINCE, CHINA.

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Joint fieldwork by Chinese and American institutions in rocks of the Aptian-Albian Xinminpu Group in the Yujingzi Basin, Gansu Province, China, has yielded several new dinosaur taxa including a tyrannosauroid and an ornithomimosaur. The new tyrannosauroid, *Xiongguanlong baimoensis* represents a phylogenetic, morphological, and temporal link between the disjunct Late Jurassic-Barremian and Campano-Maastrichtian parts of the tyrannosauroid fossil record. *Xiongguanlong* is the sister-taxon to Tyrannosauridae plus *Appalachiosaurus* and marks the earliest appearance of several tyrannosaurid traits, such as a parietal sagittal crest, a boxy basicranium, a flared quadratojugal dorsal ramus with a flexed caudal edge, premaxillary teeth with median lingual ridges, and an expanded axial neural spine with dorsolateral processes. *Xiongguanlong* has a long and narrow muzzle like those of *Alioramus* and juvenile tyrannosaurids, although its nasals are unornamented.

Three specimens of a new ornithomimosaur, *Beishanlong grandis*, were discovered. *Beishanlong* is similar to *Harpymimus*, with which it shares a phylogenetic position as more derived than *Shenzhousaurus* and as sister to a clade uniting all Late Cretaceous ornithomimosaur. Autapomorphies of *Beishanlong* include dorsally notched anterior caudal neural spines and ventral keels on mid-caudal centra. It is one of the largest ornithomimosaur yet described, though histology reveals that the holotype individual was still growing when it died.

The new taxa are part of a fauna also comprising therizinosaurs, hadrosauroids, neoceratopsians, and small and large deinonychosaurs. Most Cretaceous faunas of China and Mongolia comprise members of these, but very few other, dinosaur lineages. Neoceratopsian and maniraptoran dinosaurs tend to dominate xeric red-beds across Cretaceous localities of the Gobi Basin, whereas tyrannosauroids, hadrosauroids, and ornithomimosaur are prevalent in more mesic deposits. The fauna of the Yujingzi Basin represents one of the earliest instances of both environmentally mediated faunal sorting and the very stable, but depauperate, lineage composition of Cretaceous Central Asian dinosaur faunas.

Poster Session IV, (Saturday)

#### ALLOSAURUS FRAGILIS FROM THE PORTUGUESE UPPER JURASSIC MALAFAIA, Elisabete, Laboratório de História Natural da Batalha, Batalha, Portugal; ORTEGA, Francisco, Fac. Ciencias. UNED, Madrid, Spain; ESCASO, Fernando, Fac. Ciencias. Universidad Autónoma de Madrid, Madrid, Spain; DANTAS, Pedro, Laboratório de História Natural da Batalha, Batalha, Portugal; GASULLA, José Miguel, Fac. Ciencias. Universidad Autónoma de Madrid, Madrid, Spain

The description of *Allosaurus fragilis* in the Andres quarry (Pombal, Portugal) has been used as an argument to support the hypothesis about dispersion events of continental vertebrate faunas between North America and Iberian Peninsula during the Upper Jurassic. However,