Poster Session I, (Sunday)

INCONGRUENCE BETWEEN MORPHOLOGICAL DATA PARTITIONS: AN EXAMPLE FROM THE FOSSIL RECORD OF THE ARCHOSAUROMORPHA

BENNETT, S. Christopher, Fort Hays State University, Hays, KS, USA

Testing morphological and molecular data sets against one another for incongruence has become commonplace; however, testing for incongruence can also be done with partitioned morphological data sets from fossil taxa. As a demonstration a published data set of 126 morphological characters from 14 archosauromorph taxa, in which most taxa are known only from fossils, was partitioned into five partitions: one with characters associated with digitigrade bipedal cursorial locomotion, and the other four with characters from the skull and mandible, postcranial axial skeleton, forelimb, and hindlimb, respectively. Homogeneicity testing using PAUP showed that the Cursorial partition is incongruent with other partitions and with all other characters at the P=0.01 probability level. In order to identify the source of the incongruence, each taxon was deleted and the partitioned data set from the remaining 13 taxa was tested for homogeneicity. Significant incongruence remained after deletion of 13 of the taxa, whereas deletion of one taxon, the Pterosauria, removed all significant incongruence, demonstrating that the incongruence resulted from the coding of that taxon for the cursorial characters. The cause of the incongruence was interpreted as homoplasy in hindlimb morphology, and after reevaluating and revising the characters of the Cursorial partition, a revised data set was tested for homogeneicity and had no significant incongruence between partitions.

Poster Session III, (Tuesday)

MORPHOMETRIC ANALYSIS OF CRANIAL SHAPE IN FOSSIL AND RECENT EUPRIMATES

BENNETT, Verity, University College London, London, United Kingdom; GOSWAMI, Anjali, University College London, London, United Kingdom

Quantitative analysis of morphology can recognize subtle patterns in morphological evolution and identify convergences that can aid ecological interpretations of extinct taxa. Here, we use geometric morphometrics to analyse skulls from 28 modern and extinct genera of euprimates, including the Eocene adapiforms *Adapis* and *Leptadapis*, and the Quaternary lemurs *Archaeolemur, Palaeopropithecus*, and *Megaladapis,* to test if fossil primates occupy the same regions of morphospace as their extant relatives and to identify any convergence in cranial morphology across fossil and extant primates. 33 landmarks were gathered with a Microscribe 3-D digtizer from a total of 382 specimens. Data were treated with Procrustes superimposition to remove all non-shape differences and then subjected to Principal Components Analysis. PC1 (25.7% of the total variance) divided haplorhines, with wide and short skulls, at the negative end from strepsirrhines and most fossil taxa, with long and narrower skulls, at the positive end. *Megaladapis* defines the positive extreme of this axis, while howler monkeys and *Archaeolemur* overlap in the middle. PC2 (16.5%) involved a shift from a long vault and short, wide face towards a shorter vault and longer face. Haplorhines, strepsirrhines and adapiformes overlap at the negative end of PC2, whilst haplorhines such as *Gorilla* and *Pan* defined the positive end. PC3 (7.2%) chiefly showed widening and ventro-dorsal shortening of the vault with tarsiers at the positive extreme, *Archaeolemur* and *Cacajao* at the negative extreme and adapiformes overlapping with most haplorhines and strepsirrhines in the middle. On PC4 (5.2%) *Alouatta* and *Megaladapis* lie at the positive end, with a narrower and shorter cranial vault, while the other strepsirrhines and some haplorhines overlap at the negative end of PC4. Although strepsirrhines and haplorhines are generally distinct in morphospace, there is some overlap along the major axes of variation. Most adapiforms fall within or close to strepsirrhine space, while Quaternary lemurs deviate from extant strepsirrhines, either exploring unique regions of morphospace or converging on haplorhines.

Poster Session III, (Tuesday)

QUANTIFYING COLLECTION BIAS AND ASSESSING PALEOECOLOGICAL UTILITY OF MICROVERTEBRATE FOSSILS FROM ANTHILLS

BENNETT, III, George, Shenandoah Valley Discovery Museum & George Mason University, Winchester, VA, USA

Throughout the semiarid and arid portions of North America the harvester ant (*Pogonomyrmex*) is known to collect pebbles and debris in order to coat the surface of its mounds, and in the process can concentrate vertebrate microfossils enabling easy surface collecting or screen washing. It is intuitively apparent that collecting from such anthills will yield smaller skeletal elements than general surface collecting as a result of the limited strength of the ants. But how much collection bias results from anthill mining? Is there useful paleoecological information to be gleaned from such sites when compared to conventional screen washing and surface collecting? A series of localities in the upper Hell Creek Formation of eastern Montana have been evaluated by surface collecting, screen washing anthills, and conventional screen washing. The conical, shed teeth of fish, lizards, champsosaurs, dinosaurs, and crocodilians (n=395), were measured and used to analyze the size-class distribution and taxonomic diversity recovered by these three collection methods. Data show that conventional screen washing consistently does not sample the smallest (<5mm) skeletal elements and that anthill recovered specimens make up over 80% of specimens in that size category. Likewise, fossils over 15mm are underrepresented not only on anthills but also when using conventional screen washing. At a single site well-sampled by all three methods, anthill screen washing produced the greatest taxonomic diversity (n=10). Overall, anthill collection yielded nearly two thirds of the teeth (n=248) and the only record of the theropod dinosaur *Troodon*. Although fossils gathered by ants are out of stratigraphic context, they expose a portion of the thanatocoenose that is commonly underrepresented. Detecting the smallest taxa or assessing size-class structure by recovering the smallest individuals of a taxon is best accomplished by combining anthill screening with traditional screen washing where possible.

Preparators' Session, Monday 8:30

LONG TERM DOCUMENTATION OF THE CONATA PICNIC GROUND SITE (BIG PIG DIG) BADLANDS NATIONAL PARK, SOUTH DAKOTA

BENTON, Rachel, Badlands National Park, Interior, SD, USA; WEILER, Matthew, University of North Dakota, Grand Forks, ND, USA; THOMPSON, Wayne, South Dakota School of Mines & Technology, Rapid City, SD, USA

In August of 2008, the Conata Picnic Ground Site (Big Pig Dig) was closed after itsfifteenth and final field season. All known paleontological accumulations had been mapped and excavated.Because of its scientific significance and unique occurrence, park management felt it was important to establish some type of long term documentation of the site. The goal was to choose a site and grid marker system that future research groups could easily locate and possibly use if a new quarry were to be established. Several different types of monuments were evaluated based on their composition and their position above or below ground. Issues that were considered included the highly corrosive alkaline soils, snow plow and construction activity along a nearby county road, potential flooding at the site and the ability to locate the monuments in the next 50 to100 years. A final decision was made to use stainless steel engraved survey markers with 3 inch tops and 18 inch spikes encased in a 12 inch diameter concrete cylinder. The top of each stainless steel monument was engraved with the words origin, backsite and easting respectively. The word Pig Dig was written into the surrounding concrete. A magnet was also inserted in the concrete so the monuments could be located with a metal detector. The monuments were set 2 feet below grade to ensure that they would not be disturbed by any future surface activity. Information about the monuments will be included in the final report summarizing the site, all associated publications, and in thefield notes archived in the park collections facility. Several challenges were encountered during the monument installation. An *Archaeotherium* cranium was discovered directly under the origin stake and had to be excavated before the origin stake could be replaced. A total station was needed to complete the replacement of the origin, backsite and easting rebar stakes with the stainless steel monuments.

Evolution of the Modern African Fauna, Wednesday 11:30

EVOLUTIONARY HISTORY OF THE AFRICAN EQUIDAE

BERNOR, Raymond, Howard University, Washington, DC, USA; GILBERT, William, California State University, East Bay, Hayward, CA, USA; WOLF, Dominik, Howard University, Washington, DC, USA

African Equidae are known from localities of late Miocene to Recent age. Three-toed equids of the tribe Hipparionini first appear in the earlier late Miocene and persist well into the middle Pleistocene. The first appearance of *Equus* in eastern Africa is in the Omo Shungura sequence (lower Member G) at ca. 2.36 Ma. This is somewhat later than in Eurasia, where *Equus* first appears at 2.6 Ma. We recognize a diverse assemblage of African hipparions, including the following supraspecific groups: *"Cormohipparion,"* ?*"Sivalhippus," Eurygnathohippus*, *Cremohipparion*, and possibly *Hipparion* s.s. (the last two in northern Africa only). The earliest equid in Africa, *"Cormohipparion,"* is a descendant of the North American genus *Cormohipparion* that first occurred in the Old World at 11.2 Ma and is first known to occur at 10.5 Ma in North Africa. The taxon ?*"Sivalhippus"* refers to a late Miocene (ca. 9 Ma) group of African and South Asian hipparions currently undergoing systematic revision. The Eurasian genera *Hipparion* s.s. and *Cremohipparion* apparently made a successful range extension into northern Africa during the late Turolian, ca. 7 Ma, where they are reported from Sahabi, Libya. *Eurygnathohippus* is a genus of African Hipparionini that first appears in the late Miocene Nawata Formation, Kenya, and successfully radiated throughout unforested Africa in the late Miocene-Pleistocene. The last occurrence of *Eurygnathohippus* is at circa 1.0 Ma when the most derived form, *E. cornelianus* occurred in eastern and southern Africa. Extant Old World *Equus* includes caballine horses, hemionines, and the African asses and zebras. Late Pliocene-early Pleistocene African *Equus* (*E. oldowayensis* and *E. koobiforensis*) is large and similar to Eurasian *Equus stenonis*. Smaller forms are present in Africa by the later early Pleistocene. Several African Pleistocene localities are shedding new light on the origin of African asses and zebras, but their relationships to earlier clades of Old World *Equus* have not been established. We update our understanding of later Neogene African equid systematics and biogeography including recently published genomic data on Holarctic and African *Equus*.

Poster Session IV, (Wednesday)

DESCRIPTION OF THE OLDEST CAVIOMORPHS AND A PHYLOGENY OF THE GROUP'S INITIAL RADIATION

BERTRAND, Ornella, University Montpellier II ISE-M and American Museum of Natural History, New York, NY, USA; FLYNN, John, American Museum of Natural History, Division of Paleontology, New York, NY, USA; CROFT, Darin, Case Western Reserve University, Department of Anatomy, Cleveland, OH, USA; WYSS, Andre, University of California, Department of Earth Science, Santa Barbara, CA, USA

South America was an isolated island continent during most of the Cenozoic, resulting

in highly endemic land mammal faunas. Traditionally, the beginning of G.G. Simpson's "Stratum 2", the Deseadan SALMA (late Oligocene) had marked the sudden appearance of hystricognath (caviomorph) rodents. The oldest known caviomorphs were from sequences in Patagonia and Bolivia, and arguably the recently described fauna from Santa Rosa (Perú). Since the late 1980s, the Andean Main Range of Chile has become recognized as one of the continent's best archives of Cenozoic mammal evolution. The Tinguiririca Fauna (Chile) forms the basis for the Tinguiririan SALMA (spanning ~33-31 Ma), a biochronologic interval interposed between the Mustersan and the Deseadan of the classical SALMA sequence. Including the oldest caviomorphs, this may be the most important transitional Eocene-Oligocene fauna known from South America.

The timing of the split between New and Old World hystricognaths as well as the source area and dispersal mechanisms for the arrival of caviomorphs in South America have not yet been resolved. We describe two caviomorphs recovered from the Tinguiririca Fauna, each represented by a single lower jaw with a complete tooth row. We place these taxa within a phylogenetic context via a parsimony analysis of a newly created matrix containing over 30 taxa and more than 120 dental characters. This is the first attempt to elucidate phylogenetic relationships among Deseadan and Tinguiririan caviomorph genera. This analysis confirms that the new Chilean caviomorphs each represent new species, a chinchillid and a dasyproctid. These results further demonstrate that Caviomorpha in general, and these two clades in particular, had already begun to diversify prior to the earliest Oligocene (31-33 Ma). Therefore, the initial immigration of this group to South American was older than previously documented and most likely occurred during the mid-late Eocene—i.e., probably at some point after the poorly dated Mustersan SALMA, an interval during which rodents are entirely unknown.

Technical Session V, Sunday 3:15

MIO-PLIOCENE FAUNAL EXCHANGES BETWEEN EURASIA AND AFRICA: THE RECORD OF RARE BOVID TAXA

BIBI, Faysal, Institut de Paléoprimatologie et Paléontologie humaine: Evolution et Paléoenvironnements, Poitiers, France

Three fossil bovid taxa previously known only from Eurasian deposits are newly documented from the Mio-Pliocene assemblages of the Middle Awash (Afar Region, Ethiopia). These are *Prostrepsiceros vinayaki*, *Pachyportax latidens*, and ?Caprini cf. *Protoryx/Pachytragus*. All three constitute first records for these taxa in Africa, *Pr. vinayaki* and *Pa. latidens* otherwise known only from the Siwaliks (Pakistan and India) and the Baynunah (United Arab Emirates). The probable caprin is indeterminate to genus or species but bears strong resemblance to *Protoryx* and *Pachytragus*, documented from the Greco-Iranian province. These three bovids significantly augment the record of sub-Saharan fossil taxa of Eurasian affinities, demonstrating stronger biomic connections between sub-Saharan Africa and southern Asia in the Mio-Pliocene than later in the Pliocene and Pleistocene. The three Middle Awash taxa are also very rare, being represented by only one or two specimens each from otherwise rich assemblages, highlighting the importance of an attentive specimen-based approach to fossil assemblages for elucidation of past evolutionary and biogeographic trends. The record of East and southern African fossil bovids of Eurasian affinities is reviewed, including the reduncin *Kobus porrecticornis* and species of "Boselaphini" (*Tragoportax* spp.).

Poster Session II, (Monday)

MODELING THE MANDIBULAR MORPHOLOGY AND MASTICATORY MECHANICS OF EOCENE MAMMALS: A 3D LASER SCANNING APPROACH

BILLIAN, Joseph, Western Michigan University, Kalamazoo, MI, USA; ANEMONE, Robert, Western Michigan University, Kalamazoo, MI, USA

Along with their characteristic differences in dentition, modern carnivores and herbivores have evolved strikingly distinct mandibular morphologies related to their different means of acquiring and masticating food. Modern carnivores utilize a powerful, slicing bite between carnassial teeth (upper fourth premolar and lower first molar) powered by the large temporalis muscle, which inserts into a tall mandibular coronoid process. The dentary- squamosal joint of carnivores is low, essentially in line with the maxillary tooth row. In contrast, modern herbivores chew with a side-to-side grinding motion that is dominated by the masseter muscle, have little or no coronoid process, and have a dentary-squamosal joint that is placed high above the maxillary tooth row. When these functional adaptations first appeared can only be answered by a consideration of the morphology and mandibular mechanics of fossil mammals. We used a desktop laser scanner to develop three dimensional models of the mandible of two extant mammals (cat and rabbit), and compared these with a fossil carnivore (*Miacis latidens)* and perissodactyl (*Lambdotherium popoagicum)* from early Eocene deposits in Wyoming's Great Divide Basin. We used Greaves' biomechanical model for estimating bite force mechanics in order to determine whether the Eocene taxa had evolved mandibular morphology and masticatory mechanics that were comparable to modern carnivores and herbivores. Our results indicate that early Eocene *Lambdotherium* already closely resembled modern herbivores with respect to the main direction of bite force that it was able to exert during mastication. *Miacis*, on the other hand, had not yet developed a posteriorly oriented bite force similar to that seen in modern carnivores.

Technical Session VIII, Monday 2:45

TOOTH-LIKE LIP AND CHEEK SCALES IN EARLY GNATHOSTOMES FROM THE MACKENZIE MOUNTAINS, NORTHWEST TERRITORIES, CANADA

BLAIS, Stephanie, University of Alberta, Edmonton, AB, Canada; MACKENZIE, Lindsay, University of Montana, Missoula, MT, USA; WILSON, Mark, University of Alberta, Edmonton, AB, Canada

The Man On The Hill (MOTH) fossil assemblage from the Mackenzie Mountains, Northwest Territories, has yielded hundreds of specimens of Early Devonian (Lochkovian) vertebrates, including numerous species of agnathans, chondrichthyans, and acanthodians. These specimens are incredibly well preserved and may exhibit features that are not preserved in other localities to the same degree. One such feature, common in MOTH specimens of ischnacanthid acanthodians, is the presence of modified head scales in the region of the lips and cheeks, the scales becoming more tooth-like in morphology with proximity to the mouth. The specimens are laterally compressed, and the scales are preserved superimposed over the labial surfaces of the palatoquadrate and Meckel's cartilages, as well as over the labial surfaces of the tooth-bearing dermal jaw bones unique to ischnacanthids. Although there are three distinct morphological types of cheek scales, they all conform to a general pattern: beginning labial to the outer edges of the jaw cartilages, the rows of scales gradually transition from enlarged head scales to compound structures resembling small tooth whorls that have been unrolled, with the cusps all pointing toward the cleft of the mouth. The upper and lower scales converge at a point approximately halfway along the length of the jaw bones, where a tooth whorl is often preserved. Anterior to this point, the scales are modified above and below the margins of the lips, transitioning from head scales to smaller, needle-like, asymmetrical scales pointing toward the cleft of the mouth. At the front of the mouth, there are large, parasymphyseal tooth whorls. The different cheek and lip scale types vary in the morphology of their cusps. The close similarity of these cheek and lip scales to the actual tooth whorls of these ischnacanthids suggests that they share a common developmental program that is expressed in and near the mouth.

Technical Session III, Sunday 3:45

DISTAL PHALANGES OF EOCENE NORTH AMERICAN NOTHARCTINES (MAMMALIA, PRIMATES): IMPLICATIONS FOR PRIMATE AND ANTHROPOID ORIGINS

BLOCH, Jonathan, Florida Museum of Natural History, University of Florida, Gainesville, FL, USA; RANDALL, Zachary, Florida Museum of Natural History, University of Florida, Gainesville, FL, USA; SILCOX, Mary, University of Toronto at Scarborough, Toronto, ON, Canada; CHESTER, Stephen, Yale University, New Haven, CT, USA; BOYER, Doug, Brooklyn College, New York, NY, USA

Presence of nails instead of claws on some or all digits, associated with specialized grasping behaviors, has been recognized as a diagnostic trait of Primates. Discovery of a nail-bearing distal phalanx on the hallux of Paleocene plesiadapiform *Carpolestes simpsoni* suggests that this feature originated earlier in primate evolution than previously supposed. Morphology of the *C. simpsoni* hallucal distal phalanx is not identical to that of extant primates, suggesting the possibility of convergence. When the morphology of Eocene adapoid euprimates is taken into account, this contrast is less marked. Some of the non-hallucal distal phalanges of Eocene notharctines are similar to the hallucal distal phalanx of *C. simpsoni* in being dorsoventrally deeper at the proximal end and recurved towards the tip. Lateral profiles of these phalanges are more "claw-like" than in living primates, suggesting that they may represent a transitional claw-to-nail morphology. Furthermore, partial skeletons of notharctine euprimates from the Bridger Basin, Wyoming, show that distal phalangeal morphology is more variable than previously appreciated. Some elements are short, wide, dorsoventrally compressed and easily recognizable as the hallucal distal phalanx based on their similarity to those of extant lemurs. Others are shorter and less compressed, similar to those of the non-hallucal distal phalanges of lemurs. Still others are elongate, narrow, and somewhat curved in lateral profile, similar to the distal phalanx for the grooming claw in extant strepsirhines and the non-anthropoid haplorhine, *Tarsius*. The range of variation in distal phalangeal morphology of *N. tenebrosus* is similar to that found in lemurs. This variation is consistent with previous observations of one species of European adapoid *Europolemur*, which was interpreted to have a grooming claw. In contrast, the adapoid *Darwinius masillae* was interpreted to have a nail-like structure on all digits, including the second toe. If true, this condition may have been inherited from a common ancestor with living anthropoids that excludes notharctines and *Europolemur*, or have evolved independently.

Poster Session III, (Tuesday)

THREE-DIMENSIONAL DIGITAL RECONSTRUCTION OF FOSSIL BIRDS AND NON-AVIAN THEROPODS PRESERVED IN SLAB AND COUNTERSLAB USING LASER SURFACE SCANNING

BLUMHAGEN, Emalee, College of the Holy Cross, Worcester, MA, USA; DRAKE, Abby, College of the Holy Cross, Worcester, MA, USA; ZHANG, Fucheng, Institute of Vertebrate Paleontology and Paleoanthropology, Beijing, China; XU, Xing, Institute of Vertebrate Paleontology and Paleoanthropology, Beijing, China; CLAESSENS, Leon, College of the Holy Cross, Worcester, MA, USA

Many vertebrate fossils preserved in thin bedding planes split with fossil bone and impressions thereof distributed irregularly between a slab and counterslab. The unequal distribution of anatomical data over two slabs often confounds straightforward interpretation. In this