The Warm Spring Ranch dinosaur quarries are located in Hot Springs county near the town of Thermopolis on the southern shoulder of the Big Horn Basin in north central Wyoming. The quarries date to the Upper Morrison Formation (Late Jurassic). Since 1993, approximately sixty individual sites, including three major quarries, have been discovered on approximately 700 acres of the ranch. Three major quarries, Bone Bed (BB), Beside Sauropod (BS), and Something Interesting (SI), are discussed relative to lithology, dinosaur taxa, and taphonomy. The predominant dinosaur remains found on the ranch are sauropods, including up to six fairly complete skeletons of Camarasaurus, Apatosaurus, and Diplodocus. Preadapted remains (cf. Allosaurus) are present on one site. Although theropod shed teeth are found in several sites, no strong evidence of scavenging is recognized. Fragmentary remains of Stegosaurus are also found at another site. Generally, the majority of bones are found in a disarticulated state but well preserved. There is a paucity of non-dinosaurian vertebrate fossils (e.g., fish, turtles, crocodylids) on the ranch. Stratigraphically, the three quarries lie within a 10 to 12 m vertical span relative to each other. The lithology of each quarry exhibits slightly different facies, including various types of mudstone, fine to medium grain-sized sandstone, and thin lenses of carbonate nodules. The amount of plant material varies throughout each quarry and consists mainly of lignite. Abiotic and biotic factors of the quarries suggest various depositional environments ranging between fluvial and lacustrine systems in the Thermopolis area during this time.

WHAT PNEUMATICITY TELLS US ABOUT “PROSAUROPODS”, AND VICE VERSA
WEDEL, Matthew, UCMP, Berkeley, CA
Diveritcula of the lungs and air sacs pneumatize parts of the postcranial skeleton in most birds. Birds are the only extant vertebrates with postcranial skeletal pneumaticity (PSP). PSP is also present in most other theropods, sauropods, and pterosaurs, but absent in ornithischians and most “prosauropods” (non-sauropterygian sauroptodromorphs). What “prosauropods” tell us about pneumaticity: 1. PSP originated in sauropodomorphs in the Late Triassic, at about the same time that it appeared in theropods. 2. The only “prosauropod” with pneumatic cavities in its vertebral centrum is Thecodontosaurus caducus, one of the earliest and smallest sauropodomorphs. All “prosauropods” have vertebral laminae, but it is not clear whether these laminae were associated with pneumatic diverticula. 3. Pneumatic cavities are confined to the cervical vertebrae in T. caducus, basal sauropods, and basal theropods, and in the earliest ontogenetic stages of pneumatization in extant birds. 4. T. caducus was small and only pneumatised a few elements. The same is true of the earliest theropods with PSP. Pneumaticity probably did not evolve to lighten the skeleton (although it became important in that regard later in the evolution of sauropods and theropods).

What pneumaticity tells us about “prosauropods”: 1. The pattern of pneumatization in T. caducus indicates the presence of a diverticular lung and cervical air sacs similar to those of birds. The same holds for basal sauropods, basal theropods, and pterosaurs. 2. In terms of evolutionary change, respiratory mechanisms are highly conserved, PSP is highly labile, and diverticula seem to be somewhere in between. In the case of dinosaurs without PSP, such as ornithischians and most “prosauroopods”, our null hypothesis should be that they had air sacs (since they are bracketed by taxa with PSP) but lacked either PSP or diverticula, not that they lacked air sacs.

Wednesday, Preparator Poster
PREPARATION OF UNIQUELY PRESERVED VERTEBRATE FOSSILS FROM THE NINEVAH FORMATION IN BADLANDS NATIONAL PARK, SOUTH DAKOTA
WEILER, Matthew, JOHNSON, Shawn, SHELDON, Matthew, TATE, Allen, HERBEL, Carrie, South Dakota School of Mines & Technology, Rapid City, SD
Fossil preservation from the Pig Dig varies widely within a 36 square meter area. Thus the variable preservation (well-indurated to friable matrix) presents problems that are not commonly seen with other Badlands fossil beds. Pig Dig bones are collected from a damp environment that dries quickly and flakes apart. This is problematic as the matrix varies from one extreme to another throughout the quarry. Preparation using water as a solvent cannot be used on these clay-covered specimens as the smectite swells, thus making bone preservation unstable. The best tool for the loose friable clay is a pick and brush to remove matrix, followed by consolidation using thin Butvar B-76 to permeate the bone. Consolidating with thin Butvar specimens represent only the second- and third-known articulated series of vertebrae of M. agostini and contribute significantly to knowledge of the species in that the short caudal series bears haemal arches.

Ontogeny and osteohistology of the ornithiodop dinosaurus Tenontosaurus tilletti (Cretaceous, North America)
WERNING, Sarah, Sam Noble Oklahoma Museum of Natural History, Norman, OK
The ornithiodop dinosaur Tenontosaurus tilletti is represented by a large number of specimens from several North American formations of Aptian-Albian age. The Antlers Formation of Oklahoma and the Cloverly Formation of Montana and Wyoming have each yielded excellent specimens representing two nearly complete ontogenetic growth series. Areas where these formations now outcrop were separated geographically by approximately twelve degrees of paleolatitude, and were deposited on different sides of the Hadley cell boundary. Paleontological data suggest differences in both aridity and seasonality between the two formations. In addition to these factors, T. tilletti is ideal for a comparative growth study because it is better sampled than most dinosaurian taxa.

I performed an ontogenetic study of this species using histological methods, and observed variation in bone histology and growth rate at the individual, population and species levels. This variation may be explained in part by differences in paleoclimate between the two populations. Additionally, the results of this study are compared to previously published growth curves and histological data for other dinosaurian taxa. Because of the systematic placement...
of this basal iguanodontian, as well as the broad ontogenetic and populational sampling, this study provides improved basis for evaluating variation in other, more advanced ornithopods.

Poster Session A

NEW RODENT FAUNAS SPANNING SEVERAL SALMAS FROM THE LAGUNA DEL LAJA REGION, ANDEAN MAIN RANGE, CENTRAL CHILE

WERTHEIM, Jill, UC Santa Barbara, Santa Barbara, CA; CROFT, Darin, Case Western Reserve Univ. School of Medicine, Cleveland, OH; FLYNN, John, American Museum of Natural History, New York, NY; WYSS, Andre, Univ. of California, Santa Barbara, Santa Barbara, CA

Most South American Land Mammal “Ages” (SALMAs) are based on well-sampled but geographically restricted faunas from the high latitudes, or less well known temporal “snapshot” localities from elsewhere on the continent. Abundant fossils have recently been recovered from a previously unsampled region, the primarily volcanic and volcanioclastic Cura-Mallin Formation (CMF) near Laguna del Laja (LdL) in the Andean Main Range of central Chile. Preliminary 40Ar/39Ar dates spanning the unit’s entire thickness at LdL and the base of the overlying Trapa-Trapa Formation (TTF) indicate ages ranging from −21-9 Ma, potentially spanning five SALMAs. LdL thus represents one of very few examples of superposed mammal faunas in South America.

The extra-Patagonian location of LdL is reflected in the strong dissimilarity of the rodents to all known coeval species, with the exception of those from the geographically near Cañadon del Tordillo (CdT) fauna of Neuquén, Argentina (middle Miocene Colloncuvio SALMA). Although some LdL rodents exhibit generic affinities to Patagonian taxa, most are new at the species level, and several likely represent new genera. The degree of distinctiveness of the LdL rodents relative to Patagonian contemporaries is notable given the proximity of LdL to the northern edge of Patagonia, undoubtedly reflecting differences in age, habitat, topographic isolation, paleoenvironment, and depositional setting. In contrast, the similarities between the LdL and CdT rodents demonstrate the strong effect of geography, potentially even stronger than age, on taxonomic composition and morphology.

The broad temporal range of the LdL deposits is reflected in associated changes in composition of the rodent fauna. Forms closely related to taxa typical of at least four different SALMAs appear sequentially; a Colhuehuapian aff. Neurolemmys n.s.p. is overlain by taxa of Santacrucian aspect (Steinomyx, cf. Acerachmus, aff. S. n., sp., cf. S. et lemur, aff. Hymenomyx n. sp.), Terna taxa typical of the Colloncuvio (e.g. Protagostomus, Marichius) occur highest in the CMF and a remarkably high-crowned Alloiolemmys has been recovered from the overlying TTF.

Wednesday 1:45

ECOMORPHOLOGICAL STRUCTURE OF MODERN CARNIVORAN DIVERSITY AND THE IMPACT OF ENVIRONMENT

WESLEY-HUNT, Gina, WERDELIN, Lars, Swedish Museum of Natural History, Stockholm, Sweden

We test the hypothesis that the ecomorphological structure of carnivoran diversity is not significantly different among a set of environmental categories regardless of taxonomic makeup. Similar structure would infer that the ecological structure of modern carnivoran diversity is constant and not dependent on the environment. To test this, we compiled a database of morphological information for 237 fissiped carnivora (91% of known species). Characters used to calculate a distance matrix describe the entire dentition and capture the variety of functional units found within the carnivorant tooth row. Diversity and environmental data from 197 localities worldwide were obtained from a database of modern mammal communities, compiled by a working group at NCEAS. Morphological disparity was calculated among the taxa found in each of seven environmental categories: Bushland, Grassland, Temperate Forest, Tropical Forest, Wooded Grassland, and Woodland.

We found that only Temperate Forest can be distinguished from other environments by average disparity. Average and maximum disparity is lower in this category than in all others. Therefore, maximum disparity between any two taxa is less, and taxa are generally more tightly packed. However, the structure of the taxonomic morphospace distribution in Temperate Forest is very similar to that in other categories; this is especially evident when individual localities are compared. To further explore the structure of morphospace we used the minimum spanning tree (MST). We found that the MST and its descriptive statistics provide a useful compliment to average disparity in describing the morphological distribution of a group. Knowledge of how modern carnivoran diversity is organized in different environments allows for a better understanding of the structure of fossil carnivoran diversity and the diversification of carnivorans into new environments and ecological roles.

Friday Fishes Symposium poster

PRELIMINARY SURVEY FOR CARCHARODON MEGALODON AND OTHER FISHES FROM THE MIocene Of PANAMA

WESTGATE, James, Lamar Univ., Beaumont, TX; BROWN, R., Instituto Nacional de Antropología E Historia, Chihuaahua, Mexico; COPE, Dana, College of Charleston, Charleston, SC; STRINGER, Gary, Univ. of Louisiana-Monroe, Monroe, LA

Recent field surveys near the Canal Zone and in the Darien Province of Panama have yielded new evidence of the Miocene ichthyological community that inhabited the region prior to the closing of the Straits of Panama. A diverse assemblage of chondrichthyan teeth and teleost otoliths was collected from the Miocene Gatun Formation at two localities near Barriada San Pedro, between Colon and Sabanitas. Specimens from these localities comprise the Cerves local fauna. Callorhinus sp., Hemioprismis serra, Myliobatis sp., Rhinoptera sp., and Sphyraena sp. are represented by teeth. An otolith assemblage is dominated by sciurid (drums) with 53% of the total taxa and 51% of the total specimens. A sciurid, Eutrigia sp.,daviddandrewi, is the dominant taxon based on otoliths, comprising almost 24% of the otoliths. Three species of arids (marine catfish) constitute 24% of the total specimens. The otoliths represent forms that are found mainly in the present-day Caribbean Sea and Gulf of Mexico.

The community represented by otoliths is comprised of species which prefer tropical and sub-tropical climatic conditions, normal marine salinity (with some indications of reduced salinities), and soft, muddy bottoms.

Two teeth of the great white shark Carcharodon megalodon represent the first records of this species from the Darien Province. One tooth was recovered on the Membrillo River near the village of Membrillo in outcrops of the uppermost Oligocene/lowest Miocene Topalizo Formation. The other specimen was collected in the Tuira River drainage basin, probably from the upper Miocene Tuiria Formation, Gatun Group, near the Colombian border.

Wednesday 9:00

PHYLOGENY OF THE RHYNCHOSAURIA

WHATLEY, Robin, Smithsonian Institution, Washington, DC

Rhynchosaurids are a group of Triassic terrestrial archosauromorphs that developed a mosaic of increasingly distinctively cranial features over −40 million year long history. Previous analyses of this group have treated Early, Middle, or Late Triassic taxa in isolation such that a single unified phylogeny was available. Morphological characters based upon first-hand examination of all taxa and most specimens known worldwide inform a comprehensive phylogenetic hypothesis for the Rhynchosauria, including basal members Mesosuchus browni and Howesia browni and all species of the Late Triassic genus Hyperodapodon. This study produces the first well-supported phylogenetic placements of Stenaulorhynchos stockleyi (Manda Formation, Tanzania) and Isalorhynchos genovefae (basal Isalo II unit, southwestern Madagascar). Stenaulorhynchos is distinct from Rhynchosaurus articeps in possessing a number of derived postcranial features shared with other large-bodied rhynchosauroids. The relationship between ‘Rhynchosaurus’ spenceri and ‘Rinchossaur marianae’ remains unresolved, but these two taxa together herald major changes in the skull and dentition, an evolutionary trend that is continued in later-diverging rhynchosauroids.

Isalorhynchos does not belong to the Late Triassic clade Hyperodapodon as previously proposed, but instead possesses a mosaic of plesiomorphic and derived cranial features supporting its position basal to all species of Hyperodapodon, including H. huenei + 'Scaphonyx' scaphognathus. Many features shared by Isalorhynchos and Hyperodapodon are plesiomorphic for the latter. Resolution is lacking among the Late Triassic taxa H. gordoni, H. huxleyi, H. sanjuanensis, and other species of Hyperodapodon, and placement of the closely related taxa H. huenei and ‘S. scaphognathus’ differs from that in previous analyses. The phylogenetic position of Isalorhynchos indicates that its lineage must have diverged by the earliest Late Triassic, prior to the diversification of Hyperodapodon.

Wednesday 11:45

TABULATION AND SIGNIFICANCE OF LIMB PROPORTIONS OF PANTHERA ATROX FROM THE LATE PLEISTOCENE OF NORTH AMERICA

WHEELER, H. Todd, George C. Page Museum, Los Angeles, CA; JEFFERSON, George, Colorado Desert District Stout Research Center, Borrego Springs, CA

The long-limbed cursorial proportions of late Pleistocene Panthera atrox were first presented in detail by Merriam and Stock in the form of limb proportions based upon the sample of 90 some individuals from Rancho La Brea, California. That these observations apply to a contiguous species of P. atrox throughout the Americas, south of the Laurentide and Cordilleran ice sheets, has not been seriously challenged, since assignment of all lions to P. atrox, P. leo, and P. spelaea, with allowance for the pronounced sexual dimorphism. This seemingly obvious conclusion however should have evidence. Identification of individual large Panthera without soft tissue is a difficult and subjective process; but distinguishing populations of the different lion species can be accomplished by objective criteria such as limb proportions. The other population of Panthera atrox is from Natural Trap Cave (NTC), Wyoming, with a sample of five or six individuals. The (NTC) lions have the following limb ratios: radius/humerus .93, metacarpal III/humerus .36, and tibia/femur .88, metatarsal III/femur .34, and humerus/femur .86; very similar proportions to \( P. atrox \) of the Rancho La Brea sample. The (NTC) lions are smaller, with the males being about the same size as the females; the females average a femur .93, metatarsal III/femur .34, and humerus/femur .86; very similar proportions to those of the Late Triassic taxa. Resolution is lacking among the Late Triassic taxa H. gordoni, H. huxleyi, H. sanjuanensis, and other species of Hyperodapodon, and placement of the closely related taxa H. huenei and 'S. scaphognathus' differs from that in previous analyses. The phylogenetic position of Isalorhynchos indicates that its lineage must have diverged by the earliest Late Triassic, prior to the diversification of Hyperodapodon.