with data from other gnathostome models, that the sclerotome plays a key ancestral role in vertebral development.

Colbert Prize (Wednesday - Saturday, October 14-17, 2015, 4:15 - 6:15)

TEMPORAL VARIABILITY IN THE DIETARY BEHAVIOR OF *CANIS DIRUS* AT THE RANCHO LA BREA TAR PITS

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The dire wolf, *Canis dirus*, ranged from Canada to South America during the Pleistocene and is one of the most frequently preserved carnivorans at the Rancho La Brea tar pits. As recovered specimens range from approximately 40,000 to 11,000 years before present (YBP), it is possible to assess how the morphology and diet of *C. dirus* changed over time, potentially in response to interglacial warming. Previous work documented a reduction in *C. dirus* skull size at Pit 13 (mean calibrated age of 16,192 YBP), potentially coinciding with or shortly after the Last Glacial Maximum. Understanding if and how the diet of *C. dirus* may have fluctuated in response to past climate change can help clarify carnivoran responses to long-term climate change and potentially reveal extinction implications.

Prior work has suggested that changes in morphology, especially skull proportion and size, may have been related to a decline of resource availability. Using dental microwear texture analysis (DMTA), a three-dimensional analysis that quantifies microscopic wear patterns on the chewing surface of teeth, we quantified the textural properties of food consumed by *C. dirus*. Specifically, we analyzed *C. dirus* teeth from three depositional units (Pits 61/67, Pit 13, and Pit 77, with mean calibrated ages of 11,581, 16,192, and 35,370 YBP, respectively) to test the hypothesis that the diet of *C. dirus* was more generalized during cooler glacial periods. Further, we clarified how the textural properties of food consumed by *C. dirus* may have correlated with changing climates, morphology, and tooth breakage throughout the late Pleistocene. Our data demonstrate that complexity is significantly greater at Pit 77 than at Pit 13 and 61/67, with no significant differences in complexity between Pits 13 and 61/67. These data suggest that *C. dirus* may have consumed more brittle objects (potentially including bone) ~35,000 YBP, as compared to the past ~11,000 to 16,000 YBP. In addition, we find that textural fill volume is significantly lower at Pit 13 as compared to Pit 77 and Pits 61/67, and that variances of individuals from each pit are all significantly different from one another (with Pit 13 having the greatest variance). Collectively, DMTA data suggests that *C. dirus* may have been more generalized in its dietary behavior during cooler glacial periods, while individuals from ~35,000 years ago likely consumed more brittle food items, such as bone.

Grant Information
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Technical Sesion XV (Saturday, October 17, 2015, 8:00 AM)

NEW MAMMAL FAUNAL DATA FROM CERDAS, BOLIVIA, A LOW LATITUDE NEOTROPICAL SITE THAT CHRONICLES THE END OF THE MIDDLE MIOCENE CLIMATIC OPTIMUM IN SOUTH AMERICA

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Many groups of South American mammals apparently underwent northward range contractions following the Middle Miocene Climatic Optimum (MMCO) including primates, porcupines (Erethizontidae), palaeothentid marsupials (Paucituberculata), and astrapotheres (a native ungulate group). Determining the precise timing of these shifts has been hampered by a scarcity of (1) early middle Miocene (Langhian) sites from tropical latitudes, and (2) late middle Miocene (Serravallian) sites from the Southern Cone. Cerdas, Bolivia (ca. 21° S) is one of only three sites of Langhian age that documents Neotropical mammal distributions near the end of the MMCO. Our team's recent fieldwork at the site recovered specimens from low in section that represent three groups previously undocumented at the site: a meat-eating metatherian (Sparassodonta), a proboscis-bearing ungulate (Astrapotheria), and a megatheriid sloth. Paleosols from this portion of the section are weakly to moderately developed, have compound and composite profiles, and preserve several types of ichnofossils including lined and unlined burrows, rhizohaloes, and rhizotubules. The sparassodont remains include the basicranium and most of the mandible of a species comparable in size to the hathliacynid *Cladosictis patagonica* from the late early Miocene of Santa Cruz, Argentina. However, several features suggest borhyaenoid rather than hathliacynid affinities including a jugular fossa, a non-pneumatized squamosal, and the lack of a hypoconulid on m4. The astrapothere remains consist of many tooth fragments with an unusual combination of features not typical of late early Miocene *Astrapotherium magnum* nor late middle Miocene members of the Uruguaytheriinae; these include relatively smooth premolar ectolophs and very large upper molar cingulae. A partial megatheriid sloth dentary preserving the last molariform likely pertains to a Megatheriinae, which suggests that this subfamily could have originated in lower latitudes and later spread into Patagonia. A newly discovered specimen of a horned armadillo (Peltephilidae) from Cerdas includes a partial articulated carapace that supports its identification as a new species. The osteoderms of this specimen are characterized by a surface texture of small tubercles and pits, a central longitudinal elevation (acute in cross section) surrounded by a deep, wide groove extending over most of the osteoderm, and depressions along the border arranged in a unique, radial pattern. Ongoing studies at Cerdas aim to place these mammals in a refined paleoenvironmental context.

Grant Information
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Poster Session III (Friday, October 16, 2015, 4:15 - 6:15)

HOW CONSERVED IS NEUROANATOMY IN SNAKES? COMPARING THE ENDOCASTS OF A 32-MILLION-YEAR-OLD SNAKE AND ITS EXTANT RELATIVES

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Exceptional preservation of a 32-million-year-old snake from the White River Formation, WY, allows for the first thorough investigation of internal morphological details in a fossil snake skull. Here, the first endocast of a fossil ophidian is rendered using digital preparation of a high-resolution CT scan. The digital endocast provides a unique opportunity to observe brain evolution of a branch of boid snakes through direct comparison of an extinct taxon with two closely related extant species. With reference to the extinct White River taxon, the endocast morphologies of both *Lichanura* and *Ungaliophis* are remarkably similar. All of these endocasts exhibit classic snake-like features, including relatively large olfactory bulbs, cerebral hemispheres, optic tecta, and medullae, as well as a highly reduced cerebellum. There is also extensive mediolateral narrowing of the endocast at the level of the endolymphatic duct, which is a characteristic byproduct of the relatively large and internalized otic capsules in snakes. The cerebral hemispheres are well defined and little dorsoventral flexon of the endocast is present, giving it a true "reptilian" appearance. Notably, the dural venous sinus pattern is virtually identical in the fossil and extant endocasts. The near lack of change between these taxa over the last 32 million years indicates that the endocast morphology in this branch of Boidae is remarkably conserved.

Technical Session VII (Thursday, October 15, 2015, 1:45 PM)

FOCUSING ON THE FLOODPLAIN: VARIATIONS IN HADROSAURID BEHAVIOR, SOIL PROCESS, AND FOREST STRUCTURE OVER THE LATE CRETACEOUS LANDSCAPE OF WESTERN NORTH AMERICA

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Extensive terrestrial deposits of Late Cretaceous age provide a window into this greenhouse world that has allowed for detailed descriptions of past environments and ecosystems. In western North America, low-relief river and floodplain environments were located in basins to the east of Sevier Orogeny highlands and west of the Western Interior Seaway (WIS), with these environments extending north–south from Alaska to Mexico. Living in these river and coastal areas was a very diverse assemblage of plants and animals, including the most diverse dinosaur ecosystems described to date.

Despite all that is known about this time in western North America, there are some critical questions that remain unanswered. Focusing on ecosystems, a major question is how these forests were able to support such diverse associations of animals, particularly large herbivorous dinosaurs, given the absence of evidence for migratory behaviors. Considering climate, there is the question of how these environments are linked to the global carbon cycle, and what role they play in maintaining greenhouse climate conditions.

In this study, stable isotope ratios ($\delta^{13}C$ and $\delta^{18}O$) of hadrosaurid dinosaur teeth collected from a number of Campanian-aged localities along the WIS are used to investigate dinosaur niche partitioning, possible surface methane production, and the nature of the forest canopies. Isotope ratios of tooth dentine are altered by diagenetic processes taking place in soils/sediment, and thus provide information on these processes. In contrast, isotope ratios of tooth enamel preserve primary biological signals, and can be used to study animal diets, which in the case of hadrosaurids are trees of the floodplain forest.

High $\delta^{13}C$ of dentine (> +5 ‰) indicates that CH_4 production took place in certain soils on the floodplain and that this CH_4 was emitted to the atmosphere. This likely played an important role as a climate feedback that helped maintain greenhouse conditions. The existence of hadrosaurid tooth enamel with similarly high $\delta^{13}C$ suggests that these gases were incorporated into low-level forest vegetation before being eaten by the animals, thus providing evidence for the presence of closed-forest canopies on the floodplain. In addition, offsets in $\delta^{13}C$ of enamel for co-existing populations of hadrosaurids within the Kaiparowits Formation of southern Utah reveals significant offsets, which provides evidence of dietary niche partitioning amongst hadrosaurid sub-families within low-lying fluvial environments of southern Utah.

Poster Session IV (Saturday, October 17, 2015, 4:15 - 6:15)

ULNAR BUMPS OF *CONCAVENATOR*: QUILL KNOBS OR MUSCULAR SCARS? MYOLOGICAL RECONSTRUCTION OF THE FORELIMB OF *CONCAVENATOR CORCOVATUS* (LOWER CRETACEOUS, LAS HOYAS, SPAIN)

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The *Concavenator corcovatus* holotype (MCCM-LH 6666) is a skeleton of a carcharodontosaurid from the Las Hoyas fossil locality (Lower Cretaceous, Spain). This specimen shows unusual features, such as elongated neurapophyses of the dorsal vertebrae and a series of small bumps on the ulna.

The right ulna is completely preserved and all sides are visible, except for the medial side, which is hidden. The bumps are present on the posterolateral surface of the ulna. Three of them, located more laterally, are the most marked, and their separation is 6 mm. The two most distal bumps are posteriorly directed and their separation is from 10.6 to 16.7 mm.

These bumps are topologically homologous to the quill knobs of birds. Although quill knobs are generally situated on the posterior surface of the ulna, some taxa, such as *Gallinula,* develop these knobs on the lateral surface. Altenative hypotheses to explain