Title

Western Association of Vertebrate Paleontology Annual Meeting Abstracts

Journal

PaleoBios, 43(2)

ISSN

0031-0298

Authors

Farke, Andrew
Balisi, Mairin
Santos, Gabriel-Philip
et al.

Publication Date

2026-08-19

DOI

10.5070/P9.68701

PaleoBios 43(2):1–22, 2026

PaleoBios

OFFICIAL PUBLICATION OF THE UNIVERSITY OF CALIFORNIA MUSEUM OF PALEONTOLOGY

WESTERN ASSOCIATION OF VERTEBRATE PALEONTOLOGY ANNUAL MEETING

Cover Image: WAVP 2026 logo

Citation: Farke, A., Balisi, M., Santos, G., and Jørgensen, B. (organizers). 2026. Western Association of Vertebrate Paleontology Annual Meeting Abstracts. *PaleoBios* 43(2):1-22.

.

DOI: https://doi.org/10.5070/P9.68701

WESTERN ASSOCIATION OF VERTEBRATE PALEONTOLOGY ANNUAL MEETING

HOSTED BY

Raymond M. Alf Museum of Paleontology at the Webb Schools

Claremont, California

The Anatomical Record

EARLY CAREER/STUDENT/POSTDOC AWARDS
(SPONSORED BY THE ANATOMICAL RECORD)

BEST ORAL PRESENTATIONS:
HARRISON BRAND
MILA LEVITIN-SHILMAN

BEST POSTER PRESENTATIONS
ANDREW HUANG
JESSIE SILVERSTEIN

FEBRUARY 13-15, 2026

Host Committee:

Andrew Farke, Mairin Balisi, Gabriel-Philip Santos, and Bailey Jørgensen

ABSTRACTS

Alphabetically by first author

PORTABLE X-RAY FLUORESCENCE (XRF) FOR MUSEUM VERTEBRATE PALEONTOLOGY

Isaac N. Aguilar Rivera[1], Nicolas S. Anderson[1], Claire E. Bucholz[1], George R. Rossman[1], and Julia V. Tejada[1]
[1]Division of Geological & Planetary Sciences, California Institute of Technology, Pasadena, CA, USA.

Portable, non-destructive geochemical techniques provide diagnostic insight into fossil provenance, diagenetic history, and mineralization regimes preserved within museum collections and field localities. We conducted a comparative survey of vertebrate fossils using portable X-ray fluorescence (pXRF) to evaluate relative abundances of Ca, P, Fe, and Mn as elemental proxies for bone mineral integrity, redox conditions, and post-burial alteration. Elemental ratios (Fe/Ca, Mn/Ca, Ca/P) were used to distinguish fossilization pathways, resolve intra-site heterogeneity, and differentiate site-specific geochemical signatures. Field investigations in the Barstow Formation (California) and the Pebas Formation (Peru) integrated pXRF measurements of fossils and surrounding sediments to contextualize paleoenvironmental conditions and mineralization processes. Our results demonstrate that pXRF enables rapid, non-destructive discrimination of fossil provenance and preservation regimes, even among visually similar specimens, supporting its utility for museum-based research, field prospecting, and paleoenvironmental reconstruction.

Funding: NASA Jet Propulsion Laboratory President's & Director's Research & Development Fund, Caltech Division of Geological & Planetary Sciences

A NOVEL GEOEMYDID TURTLE FROM THE JEBEL QATRANI FORMATION (FAYUM PROVINCE, EGYPT)

Brent Adrian[1] and Heather F. Smith[1,2]
[1]School of Human Evolution and Social Change, Arizona State University, Tempe, AZ, USA; [2]Department of Anatomy, Midwestern University, Glendale, AZ, USA.

Part of Grant Meyer's scholarly legacy as second director of the Raymond M. Alf Museum of Paleontology stems from his participation in Yale University paleontological expeditions to Egypt's Fayum Depression during the 1960s, led by Elwyn Simons. These efforts resulted in Meyer's 1973 description of a new hyrax from the Jebel Qatrani Formation, which preserves a continuous record of late Eocene–early Oligocene terrestrial vertebrates during the interval that includes the European Grand Coupure. Meyer also reposited several partial shells of an unidentified turtle from this formation at the Alf Museum, perhaps for teaching purposes. We examined these specimens in 2022, which constitute the museum's only Egyptian turtle material. Although their provenance is limited to formation-level data, the well-preserved shells represent at least three adult individuals of a single medium-sized taxon (~32 cm straight carapace length). The presence of musk ducts and a cervical scale distinguishes the material from the pleurodiran turtles that dominated the Fayum. Morphological documentation and maximum parsimony phylogenetic analysis place the taxon within the cryptodiran family Geoemydidae, as sister to the modern Asian river turtle *Batagur*. Expedition records suggest an origin in the upper, early Oligocene portion of the Jebel Qatrani Formation, though a late Eocene age cannot be excluded. This taxon is the only known Paleogene geoemydid from Afro-Arabia and substantially predates most African turtle lineages. Its Asian affinity establishes a greater antiquity for the *Batagur* clade and suggests dispersal enabled by regional tectonic uplift, eustatic sea-level fall, and the emergence of Proto-Nile hydrological systems.

A MIDDLE MIOCENE FAUNAL HORIZON STRATIGRAPHICALLY ABOVE THE SHARKTOOTH HILL BONEBED IN KERN COUNTY, CALIFORNIA

Lawrence G. Barnes[1], Austin Hendy[1], Debora D. Lee[1], Michael E. Persion[1], and Howell W. Thomas[1]
[1]Natural History Museum of Los Angeles County, Los Angeles, CA, USA.

A previously unreported fossil marine faunal horizon of Middle Miocene age occurs in the Kern River region in Kern County, California. It lies within the Upper Member of the Round Mountain Silt, approximately 1 m above the well-known Sharktooth Hill Bonebed. Characteristic outcrops of this faunal horizon, approximately 20 cm thick, are in the north-facing Kern River Palisades, east of Kern River State Park and south of Alfred Harrell Highway. The horizon also occurs north of Kern River in the area of the Sharktooth Hill National Natural Landmark. This faunal horizon differs from the underlying Sharktooth Hill Bonebed by representing a different type of depositional environment, being thicker, lacking a well-defined base, and containing a different faunal assemblage, including mollusks and large mammals (at least two pinnipeds, two baleen whales, a platanistoid dolphin and a sperm whale), but very few sharks. This stratigraphic interval is here named the Kern River Palisades Faunal Horizon,

a new stratigraphic name, and its fossil content characterizes the Kern River Palisades Local Fauna, new faunal name. Fossil bones occur in this horizon both singly and as associated or articulated partial skeletons, primarily in concretions, and these are frequently associated with clusters of mollusks. This contrasts with the underlying Sharktooth Hill Bonebed, which has at its base a well-defined depositional hiatus, is a winnowing deposit, represents a very long time interval, and has a mixture of items of various sizes, high species diversity, and only rare mollusks.

VERTEBRAL FUNCTIONAL ANATOMY OF AN OLIGOCENE FALSE SABERTOOTHED CAT (CARNIVORA: NIMRAVIDAE) FROM THE BRULE FORMATION OF SOUTH DAKOTA

James Base[1], Bailey Jørgensen[1,2], and Mairin Balisi[1,2]
[1]The Webb Schools, Claremont, California, USA; [2]Raymond M. Alf Museum of Paleontology, Claremont, USA.

Felids, during graceful descents and ascents, perform instinctual aerial acrobatics with ease, stretching their bodies to reduce limb impact and injury. To what extent this flexibility is present in extinct feliforms, including false sabertoothed cats (Carnivora: Nimravidae), is unknown. The Alf Museum of Paleontology (RAM) collected a nimravid skeleton from Pennington County, South Dakota, USA. The skeleton originated from the Scenic Member of the Brule Formation, dating to the Orellan North American Land Mammal Age (ca. 34–32 million years ago), and was assigned to the genus *Dinictis*. While fragmentary and incomplete, the specimen (RAM 280) includes the axis, one cervical, nine thoracic, and seven lumbar vertebrae. To better understand the function of the nimravid spine, we measured centrum dimensions and other intact features (e.g., lever arms) on the fossil specimen, comparing them to vertebrae of modern felids (ocelot, bobcat, snow leopard) from the Mammalogy collections of the Natural History Museum of Los Angeles County. Previous studies have predicted *Dinictis* to be an ambush predator that lived in a savannah grassland, hunting early horses, sheep-sized oreodonts, and antelopes by pouncing and grappling with them. To hunt these smaller, more agile prey in patchy grassland/savannah biomes, nimravids would have needed comparative agility resultant from flexible spines to survive. Thus far, the genus *Lynx* (bobcat) may be most similar in its vertebrae among our modern specimens, although work is still in progress.

Funding: The Rogers Peccary Scholars program at The Webb Schools, supported by the Mary Stuart Rogers Foundation, supported James Base's participation in this research.

POST-CRANIAL REMAINS OF A 30-MILLION-YEAR-OLD HORNLESS RHINOCEROS FROM THE GREAT PLAINS, WYOMING, USA

Sydney Becker[1,2], Nathan Michaelson[3,4], Bailey Jørgensen[1,4], and Mairin Balisi[1,4]
[1]The Webb Schools, Claremont, CA, USA; [2]Scripps College, Claremont, CA, USA; [3]Science Illustration Certificate Program, Department of Science Illustration, California State University — Monterey Bay, CA, USA; [4]Raymond M. Alf Museum of Paleontology, Claremont, CA, USA.

Subhyracodon is an extinct genus of hornless rhinoceroses (Rhinocerotidae) from the Oligocene of North America. Here we describe post-crania preserved in a *Subhyracodon* bonebed from the Brule Formation (ca. 33–30 Ma) of Niobrara County, Wyoming, now reposited at the Alf Museum of Paleontology, to better understand the taphonomy of the bonebed and the natural history of the species.

The 378 specimens are pale pink, characteristic of fossils from the Scenic Member of the Brule Formation. The most abundant long bones are the humerus (Number of Identified Specimens (NISP) = 27, Minimum Number of Elements (MNE) = 20) and femur (NISP=25, MNE=17). Based on the left humerus, we calculate a minimum of 11 individuals; further, assessing age using epiphyseal fusion, we identify at least four juveniles based on femora and tibiae and at least nine adults based on humeri.

The resulting adult-to-juvenile ratio is ~2.25:1. This ratio differs from modern rhinoceros populations, which typically show a 1:1 ratio due to solitary adults and single-calf reproduction. We infer either cohabitation of adults with juveniles, or preferential predation or scavenging of juveniles. The latter is supported by much fewer juvenile forelimb elements than juvenile hindlimbs, consistent with differential disarticulation by predators or scavengers. The Brule Formation represents an environment where streams meandered through cool and dry grasslands and marshes: a complex ecosystem that included carnivores, like amphicyonids and nimravids, that likely preyed upon juvenile *Subhyracodon*. Preliminary body size estimations of the *Subhyracodon* assemblage show no clear evidence of size dimorphism (median ≈ 295 kg ± 132 kg; range 126–573 kg), which

may indicate weak or absent sexual dimorphism or reflect non-coexistence of males and females within the sampled population. Future work will incorporate analysis of cranial material.

Funding: The Rogers Peccary Scholars program at The Webb Schools, supported by the Mary Stuart Rogers Foundation, supported Sydney Becker's participation in this research.

EVERYONE LOVES RIBS! DUROPHAGY PREFERENCES OF *EPICYON HAYDENI* AT THE MILK CREEK SITE - INTERPRETING SKELETAL ELEMENTS WITH BOROPHAGINAE ACTIVITY

Jeb Bevers[1], Ian Bevers[1,2], and Giovanni Hernandez[1]
[1]Yavapai College, Prescott, AZ; [2]Northern Arizona University, Flagstaff, AZ.

Surveys of the fossilized mammalian fauna at the Milk Creek locality have taken place since 1949. A biochronologic estimate of the mammalian taxa supports a Clarendonian age range (9.0–12.5 Ma) for the fossil deposits.

The most abundant fossil materials located in the Milk Creek deposits are from two taxa of camelids (*Protolabis coartatus* and *Michenia yavapaiensis*). In the 1956 collections for the AMNH, 91.7% of identified specimens were from these two camelids.

Among the other taxa noted from the Milk Creek site is the large canid *Epicyon haydenii*. Direct ecological interactions between the Borophaginae and Camelidae at Milk Creek were unknown until coprolites of Borophaginae were located in 2023 (I. Bevers) and 2024 (G. Hernandez and J. Bevers).

A Minimum Number of Elements (MNE) for identifiable taxa and bones were determined from a subset of Milk Creek collections with comparisons to the predicted number of bone elements. These results, and extensive gaps in predicted bone elements, are assumed to be influenced by the durophagy activities and preferences of *Epicyon haydeni* at the Milk Creek site. As the Borophaginae were a widespread North American group of canids, we propose that similar durophagy preferences will be supported at other sites.

THE BRACHIOSAURID SAUROPOD FROM THE DRY MESA QUARRY (MORRISON FORMATION, UPPER JURASSIC, COLORADO, USA) REPRESENTS A NEW TAXON

Colin Boisvert[1], Gunnar Bivens, Tom T.P. van der Linden[2], Daniel Vidal[3], Ray Wilhite[4], Brooks Britt[5], and Brian Curtice[6]
[1]Oklahoma State University Center for Health Sciences, Tulsa, Oklahoma, USA; [2]Freie Universität Berlin; [3]University of Chicago, Chicago, Illinois; [4]Auburn University, Auburn, Alabama, USA; [5]Brigham Young University, Provo, Utah, USA; [6]Arizona Museum of Natural History, Mesa, Arizona, USA.

The Upper Jurassic Morrison Formation Dry Mesa Quarry in Colorado has yielded six sauropod genera, including a brachiosaurid. The brachiosaurid is represented by a single individual consisting of cervical, dorsal, and caudal vertebrae, a sacrum with both ilia, and a scapulocoracoid, most of which are disarticulated and cataloged as separate specimens at Brigham Young University (BYU). Our analysis suggests the specimen represents a new taxon based on autapomorphic wide, triangular anterior dorsal neural spine apices in anterior/posterior views due to spinopostzygapophyseal laminae arising from the lateralmost margin of the postzygapophyses. Other differentiating characters include shallowly bifurcated neural spines on the anteriormost dorsal vertebrae and prespinal laminae on the anteriormost dorsal vertebrae. The BYU brachiosaur differs from *Brachiosaurus altithorax* in having spinopostzygapophyseal laminae in all preserved dorsal vertebrae, anteroposteriorly short dorsal centra, and broad aliform processes on the neural spines of middle and posterior dorsal vertebrae. It differs from *Giraffatitan brancai* in having broad lateral triangular (aliform) processes that, in anterior view, taper dorsally onto the rounded neural spine apices of middle and posterior dorsal vertebrae. Phylogenetic analysis retrieves the specimen as closest to the Tendaguru Formation (upper Middle Dinosaur Member) "Migeod brachiosaur" (NHMUK PV R5937). The BYU brachiosaur indicates the Morrison Formation macronarians are more diverse than previously recognized.

NEW OCCURRENCE OF THE PHYLLODONT *PARALBULA* FROM THE MENEFEE FORMATION-CLIFF HOUSE SANDSTONE TRANSITION OF NEW MEXICO

Harrison Brand[1], Benjamin Spencer Goode[1], Benjamin F. Mohler[2], Heather F. Smith[3,4], and Brent Adrian[4]
[1]Southwest Paleontological Society, Mesa, AZ, USA; [2]Department of Geosciences, University of Arizona, Tucson, AZ, USA; [3]Department of Anatomy, Midwestern University, Glendale, AZ, USA; [4]School of Human Evolution and Social Change, Arizona State University, Tempe, AZ, USA.

This study presents an updated inventory of actinopterygian fossils from marine sediments in the Menefee Formation-Cliff House Sandstone Transition in the San Juan Basin of New Mexico. Material was collected from sandstone talus rocks beneath an overhanging cliff face along the northeastern wall of Tsaya Canyon. Here, we report isolated teeth of the phyllodont *Paralbula*. The tooth caps of *Paralbula* are hemispherical and have distinct wrinkled enameloid surfaces. This robust dentition was ideal for crushing hard-shelled invertebrates. The co-occurrence of *Paralbula* with the closely related cf. *Albula* and durophagous batoids within the Menefee Formation-Cliff House Transition suggests a paleoecosystem in which shelled invertebrate prey was foundational for the diet and diversity of vertebrates. This diversity of shell crushing predators may also indicate niche separation among the fish communities preserved at Tsaya Canyon, with different taxa specializing on different shelled prey. While *Paralbula* belongs to the extinct family Phyllodontidae, it was related to the extant Albulidae, which feed primarily on benthic invertebrates. *Paralbula* is a common component in Cretaceous assemblages of Laramidia and Appalachia, frequently inhabiting a variety of habitats including freshwater, brackish, and coastal marine environments. The addition of this taxon to the Tsaya Canyon assemblage is consistent with its characterization as a shallow coastal ecosystem with possible influences from proximate brackish water environments. Although additional material is needed for finer resolution, the growing list of actinopterygians at Tsaya Canyon offers critical evidence for tracing the development of aquatic ecosystems during marine transgressions in the uppermost Menefee Formation.

INTERSPECIFIC LIMB ALLOMETRY IN LATE MIOCENE TO EARLY PLIOCENE CAMELS OF NORTH AMERICA

H. Cruz Oganesyan[1], Donald R. Prothero[1,2], and Scarlet Parod
[1]Department of Geological Sciences, California State Polytechnic University, Pomona, CA; [2]Department of Vertebrate Paleontology, Natural History Museum of Los Angeles County, Los Angeles, CA, USA.

As an animal grows larger and subsequently heavier, it must also have limbs suitable enough to support its weight, so the thickness of the limb should increase allometrically relative to the length of the limb. Normal-sized Miocene camels like *Procamelus occidentalis* evolved to giant camels like *Megacamelus merriami* and *Gigantocamelus spatulus* during the late Miocene-Pliocene, growing from approximately 1.5 m at the shoulder, to over 3 m, and from an estimated 70 kg to over 4,000 kg. We collected measurements from the limb bones (humerus, radius, metacarpal, femur, tibia, and metatarsal) of three different species of giant camels and plotted the slopes of their size change compared to *P. occidentalis*. The slopes were negatively allometric and supported our hypothesis that the limbs became more robust as they evolved.

ET TU, UTTE (TITAN)? THOUGHTS ON *ALAMOSAURUS* AND VARIATION

Brian Curtice[1] and Robert McCord[1]
[1]Arizona Museum of Natural History, Mesa, AZ, USA.

Alamosaurus sanjuanensis Gilmore 1922 is a consequential yet problematic North American sauropod because it is routinely applied as the default label for Late Cretaceous titanosauriform material across the American Southwest, influencing diversity estimates, biogeographic narratives, and specimen referrals. The holotype is an incomplete scapula (USNM 10486), with a nearby ischium (USNM 10487) as the paratype, despite uncertain association. Gilmore (1946) referred a far more informative North Horn Formation partial skeleton (USNM 15560) to *Alamosaurus*, stabilizing usage in practice while deepening reliance on scapular characters vulnerable to deformation, restoration, and individual variation.

The question isn't simply whether multiple latest Cretaceous titanosaurs existed in Laramidia, but whether current diagnoses justify genus-level separation. Qualitative descriptors ("prominent," "moderately concave," "robust") are difficult to test against expected variation and become especially fragile when supported primarily by line drawings. Reassessment of published figures indicates that apparent "diagnostic" differences can be amplified, or manufactured, by idealized historical illustrations, viewing-angle/parallax effects, tracing and redrawing artifacts (including mismatched views and scaling), and unrecognized preparation or reconstruction. Under these conditions, subtle divergences among the holotype, USNM 15560, and other material may not be separable from distortion/variation without better documentation resulting from direct specimen evaluation; tighter geochronologic constraints further weaken stratigraphy as a stand-alone lever for splitting.

Because taxonomy is a communication tool, not a discovery in itself, nomenclatural changes should be

conservative and evidence-driven. Diagnoses need to be based upon repeatable, explicitly defined character states (ideally quantitative), photographic/video/3D documentation of holotype-critical elements, and explicit assessment of deformation/restoration.

NEW MATERIAL OF A LARGE-BODIED HADROSAURIFORM FROM THE CRETACEOUS WAYAN FORMATION OF IDAHO

Robert J. Gay[1], Brandon R. Peecook[1,2], and LJ Krumenacker[1,3]
[1]Idaho Museum of Natural History, Idaho State University, Pocatello, ID, USA; [2]Department of Biological Sciences, Idaho State University, Pocatello, ID, USA; [3]College of Eastern Idaho, Idaho Falls, ID, USA.

The Aptian-Cenomanian Wayan Formation of eastern Idaho preserves a unique semi-upland environment dominated by the thescelosaurid *Oryctodromeus cubicularis*. The Early–Late Cretaceous boundary is a critical, and poorly-known, stage of ornithischian evolution rich with the recent recognition of several distinct clades in North America: Thescelosauridae, Ceratopsia, and rhabdodontomorph and hadrosauriform lines of Iguanodontia. More fragmentary remains (isolated teeth and bones) of other ornithischians are known from the formation, including: tentative neoceratopsians, a *Tenontosaurus*-like animal, and a large indeterminate iguanodontian. Indeed, the first described Idaho dinosaur is a complete "ornithopod" proximal caudal centrum.

Focused collections work within the Idaho Museum of Natural History and renewed fieldwork have yielded new specimens that all bolster our knowledge of at least one large iguanodontian within the Wayan Formation, known from additional teeth, a partial dentary lacking the anterior ramus and the coronoid process, a partial neural spine, a mid-caudal centrum, and two partial ribs >50 cm in length.

Comparisons with coeval Utah taxa (the hadrosauromorph *Eolambia caroljonesa*) are limited due to the fragmentary nature of the Idaho material, with the dentary as the most informative element. Laterally, it possesses three prominent nutrient foramina and measures 5 cm dorsoventrally. The tooth row, with at least four alveoli present, curves medially in relation to the lateral surface of the dentary, and a lateral shelf appears to be forming. These features compare favorably with those seen in *Eolambia*, though about 50% of the holotype's size.

MAMMAL TEETH FROM OYSTER GULCH, A MARGINAL MARINE SITE IN THE "MESAVERDE" FORMATION OF THE BIGHORN BASIN, WYOMING, USA

Miriam Ghobrial[1] and Andrew A. Farke[1,2]
[1]The Webb Schools, Claremont, CA, USA; [2]Raymond M. Alf Museum of Paleontology at The Webb Schools, Claremont, CA, USA.

The "Mesaverde" Formation in the Bighorn Basin of Wyoming holds a rich Campanian-aged (Late Cretaceous) vertebrate fossil record, particularly in the vertebrate microfossils of the "Case sites" collected during the 1970s and 1980s. Discovered during fieldwork by the Raymond M. Alf Museum of Paleontology (RAM), the Oyster Gulch locality (RAM V2022016) in Washakie County of the eastern Bighorn Basin, is notable in being positioned stratigraphically below the historic "Case sites" that have yielded most of the vertebrate microfossils in that area. Oyster Gulch yields abundant oysters as well as vertebrates consistent with a marginal marine environment. Screenwashing has recovered a rich representation of the vertebrate faunal assemblage, including three mammal teeth. The first specimen is a nearly complete M1, referred to the multituberculate *Filikomys primaevus* based on its small size (1.5 mm maximum length), three longitudinal rows of cusps, and a 5:6:?4 cusp count. A second multituberculate tooth is identified as P4 and also referred to *Filikomys primaevus* based on a maximum crown length of 2.0 mm and a cusp count of 2:?5. Finally, a partial left M1 is referable to Metatheria, with a maximum crown width of 1.5 mm. The instance of these three mammal teeth in a marine site is unusual, but not unheard of in Late Cretaceous exposures. Identification of these mammal teeth adds a record of a previously unsampled stratigraphic interval for the "Mesaverde" Formation of Wyoming.

Funding: David B. Jones Foundation, Mary Stuart Rogers Foundation

A QUANTITATIVE COMPARISON OF FORELIMB MORPHOLOGY IN AMERICAN BADGERS (*TAXIDEA TAXUS*) FROM PLEISTOCENE TO PRESENT-DAY IN SOUTHERN CALIFORNIA

Fionn Graham[1], Austin Lawrence[2], and Mairin Balisi[1,3]
[1]The Webb Schools, Claremont, CA, USA; [2]Department of Medical Anatomical Sciences, Western University of Health Sciences, Pomona, CA, USA; [3]Raymond M. Alf Museum of Paleontology, Claremont, CA, USA.

While most research on the last Ice Age focuses on extinct megafauna, little is known about the smaller animals that survived the extinction. One such species, American badger (*Taxidea taxus*), offers insight into survival mechanisms that shaped present-day ecosystems. Badgers are fossorial, a trait associated with forelimb structure; consequently, their morphology likely responded to post-extinction environmental change. Previous research demonstrated that fossil specimens exhibit larger humeri and muscle attachments than modern ones, which is commonly associated with increased digging strength. Here, we further evaluate potential behavioral differences between modern and fossil badgers by comparing humeral torsion, which is ontogenetically plastic and plausibly linked to variation in fossorial behavior. We predicted that fossil badgers will exhibit larger humeral torsion angles, indicating greater reliance on fossorial behavior than their modern counterparts. We quantified humeral torsion in a sample of 6 modern humeri from Kern County, CA, USA, and plan to examine 8 fossil specimens from La Brea Tar Pits, Los Angeles, CA, USA. We measured humeral torsion from three-dimensional surface scans using Geomagic Design X by calculating the angle between proximal and distal vectors projected onto a plane orthogonal to the humeral long axis. Thus far, modern females have displayed larger torsion angles, possibly due to differences in feeding and nesting behavior. Increased humeral torsion in fossil specimens may reflect harder soil conditions or decreased surface prey availability during the Ice Age, illuminating adaptability and ecosystem resilience through environmental upheaval. Future analyses will also consider the morphology of the ulnae and radii.

Funding: The Rogers Peccary Scholars program at The Webb Schools, supported by the Mary Stuart Rogers Foundation, supported Graham's participation in this research.

ONTOGENETIC ANALYSIS OF *PARASAUROLOPHUS* BRAINCASES (ORNITHISCHIA, HADROSAURIDAE) FROM THE KAIPAROWITS FORMATION (UPPER CRETACEOUS) OF UTAH, USA: COMPARING JUVENILE AND ADULT MORPHOLOGY

Billie Guerrero[1] and Bailey Jørgensen[2]
[1]California State University, San Bernardino, San Bernardino, CA, USA; [2]Raymond M. Alf Museum of Paleontology, Claremont, CA, USA.

This study documents the ontogenetic development of the braincase in *Parasaurolophus*, a lambeosaurine hadrosaurid dinosaur best known for its distinctive cranial crest. While the crest has been extensively studied for its roles in communication and display, the braincase remains comparatively understudied despite its close structural and functional association with the crest. This research examines braincase morphology across ontogeny by comparing a juvenile specimen (RAM 14000, "Baby Joe"), a subadult specimen (RAM 17000), and an adult *Parasaurolophus tubicen* (NMMNH P-25100). The goal is to assess how developmental changes affected neurocranial architecture, sensory systems, and biomechanical support through growth.

Morphological analysis reveals progressive transformations from juvenile to adult stages, including elongation of the basisphenoid and parasphenoid processes, expansion and fusion of the exoccipitals, and anterior migration of cranial nerve foramina. RAM 14000 displays a bulbous basioccipital and widely spaced neurocranial elements, consistent with early-stage neurocranial flexibility. RAM 17000 exhibits an intermediate morphology, characterized by a notably tall parasphenoid process and a more angular basisphenoid than either the juvenile or adult specimens, indicating active remodeling during adolescence. In contrast, *P. tubicen* shows the most derived condition, with a reinforced occipital region, a smoothed supraoccipital, and extensive neurocranial integration likely associated with supporting a fully developed dorsal crest.

These findings support a peramorphic growth model for *Parasaurolophus*, marked by accelerated development and exaggeration of adult traits. Comparative evidence suggests that *Parasaurolophus* diverged from other lambeosaurines through earlier and more pronounced neurocranial modification, shedding new light on the developmental mechanisms underlying its highly specialized cranial morphology.

ACCESSING AMINO ACIDS FROM DENTAL ENAMEL: IMPLICATIONS FOR DEEP-TIME ECOLOGY AND EVOLUTION OF DIETARY ADAPTATIONS

Yuanyuan He[1] and Julia Tejada[1]
[1]Division of Geological and Planetary Sciences, California Institute of Technology, Pasadena, CA, USA.

Diet is a powerful driver of evolution, shaping gene regulation, metabolic pathways, and phenotypic traits across deep time. Reconstructing feeding ecologies at macroevolutionary timescales is therefore essential for understanding how resource availability, ecological function, and selective pressures have interacted to

shape organismal evolution. Yet, for extinct taxa, dietary inference is necessarily indirect and typically relies on proxies such as craniodental morphology.

Nitrogen isotope ratios ($\delta^{15}N$) of amino acids provide a robust and mechanistically grounded means of tracking feeding behavior in both extant and extinct animals. However, applications to the fossil record remain limited because the proteins most analyzed in paleontology and archaeology degrade rapidly (<100 ka). Dental enamel has shown to preserve endogenous proteins over deep time and therefore holds unique potential for directly reconstructing ancient diets. However, the extremely low protein content of dental enamel (~0.5–2 wt%) has so far precluded amino-acid-specific isotope analysis, as conventional gas chromatography–isotope ratio mass spectrometry (GC-IRMS) requires milligram quantities of purified protein.

Here, we present methodological advances using Orbitrap-based Fourier-transform mass spectrometry that overcome these limitations. This approach enables isotope ratio measurements at natural abundance from sample sizes as small as ~1 ng. We report the first measurements of amino acid $\delta^{15}N$ in modern dental enamel using GC-IRMS (requiring >20 g enamel) and establish GC-Orbitrap precision better than 1‰ using amino acid standards. Together, these results lay the groundwork for extending amino acid specific nitrogen isotope analyses to fossil enamel, opening new avenues for reconstructing diets and trophic ecology deep time.

Funding: Shurl and Kay Curci Foundation; California Institute of Technology (Division of Geological and Planetary Sciences and Center for Evolutionary Sciences).

OSTEOMYELITIS DISTRIBUTION ACROSS *SMILODON* METAPODIALS REFLECTS INJURY PREVALENCE RESULTANT OF GRAPPLING BEHAVIOUR

Andrew Huang[1] and Mairin A. Balisi[1,2]
[1]The Webb Schools, Claremont, CA, USA; [2]Raymond M. Alf Museum of Paleontology, Claremont, CA, USA.

Osteomyelitis is a form of bacteria-induced bone infection characterized by bone deformation and degeneration following physical injury. However, while the presence of osteomyelitis in isolated fossil specimens has been thoroughly examined, osteomyelitis distribution has yet to be correlated with injury prevalence resultant of behavioural strain. This study maps the distribution of osteomyelitis across forelimb and hindlimb elements of the sabertoothed cat *Smilodon fatalis*, an apex predator of the Pleistocene. As ecomorphological studies suggest that *S. fatalis* was an ambush predator that wrestled with large prey, we predicted that osteomyelitis would be concentrated on its manus and forelimbs relative to hindlimbs due to increased strain resultant of grappling behaviour. We examined forelimbs and hindlimbs from the Pathology collection of the La Brea Tar Pits and Museum, Los Angeles, CA, USA, for osteopathological markers such as cloacae, involucrum, and sinus tracts that indicate infection. Visual examination revealed increased osteomyelitis pathology in the metacarpals and forelimbs of *S. fatalis* relative to metatarsals and hindlimb elements, indicating potentially increased injury prevalence that can be attributed to established hunting behaviour. As an obligate hunter of prey larger than itself, *S. fatalis* would have grappled and sustained physical injury from megafaunal herbivores such as bison, camels, and horses. We plan to scan pathological specimens using computed tomography to confirm osteomyelitis through examination of internal bone surfaces.

Funding: The Rogers Peccary Scholars program at The Webb Schools, supported by the Mary Stuart Rogers Foundation, supported Andrew Huang's participation in this research.

A BRACHYLOPHOSAURIN HADROSAUR JUGAL FROM THE TEAPOT SANDSTONE OF THE "MESAVERDE" FORMATION, WESTERN BIGHORN BASIN, PARK COUNTY, WYOMING, USA

Sakeena S. Hussain[1] and Andrew A. Farke[1,2]
[1]The Webb Schools, Claremont, CA, USA; [2]Raymond M. Alf Museum of Paleontology at The Webb Schools, Claremont, CA, USA.

The Campanian-aged Teapot Sandstone is the highest unit of the "Mesaverde" Formation. Although it is noted for abundant vertebrate microfossils in the eastern part of the Bighorn Basin, Wyoming, the fossil record in the western outcrops is virtually unknown. Fieldwork by the Alf Museum in the Oregon Basin exposures of Park County have yielded an increasingly rich vertebrate fossil assemblage of the Teapot Sandstone in this area. Hadrosaurid dinosaurs are abundant, but represented largely by postcrania and teeth that are non-diagnostic beyond the level of Hadrosauridae. In 2025, a subadult hadrosaurid right jugal was collected at RAM locality V2025018, approximately 5 m below the top of the Teapot Sandstone. The maximum preserved length of the jugal is 118 mm, although part of the quadratojugal process is missing; the maximum dorsoventral height of the rostral process is 57 mm. The jugal is referable to Brachylophosaurini by the straight ventral margin of the

rostral process and the pronounced caudoventral flange on the ventral margin of the jugal. The shape of the rostral process is most similar to the condition in *Acristavus gagslarsoni*. This find is notable as the first confirmed occurrence of Brachylophosaurini in the "Mesaverde" Formation, and consistent with a middle or early late Campanian age for the Teapot Sandstone in the Oregon Basin. Ongoing work focuses on other cranial elements of hadrosaurs recovered from the "Mesaverde" Formation.

Funding: David B. Jones Foundation

VARIATION IN COLUMBIAN MAMMOTH MOLARS AND ITS IMPLICATIONS ON MAMMOTH SPECIES IN NORTH AMERICA

Victor M. Jimenez Gonzalez[1] and Donald R. Prothero[2]
[1]Cal Poly Pomona, Pomona, CA, USA; [2]Natural History Museum of Los Angeles County, Los Angeles, CA, USA.

During the late Pleistocene, mammoths migrated to North America. The latest research indicates that this species later gave rise to *Mammuthus columbi*, the Columbian mammoth. We studied the teeth and jaws of *Mammuthus columbi* from both La Brea tar pits and from Diamond Valley Lake Reservoir. There once were multiple different species of mammoths recognized in these regions of North America, such as *M. jeffersonii* and *M. imperator*, but they have all been synonymized with *Mammuthus columbi*. This research was mainly conducted on mammoth molars, specifically their third molars, both uppers (M3), and lowers (m3) or more mature teeth, which were analyzed since they are commonly fossilized and have the most diagnostic features necessary to differentiate them from other mammoth species. Measurements were taken on their lamellar frequency, enamel thickness, plate count, and overall tooth size as well as width. We compared our data on plate count and lamellar length index in a mammoth's upper M3 with the data published by Widga et al. (2017).

Both the La Brea and the Western Science Center specimens plot in very different parts of the same graph compared to other mammoths. Even though they had the same plate density as other mammoths from the southwestern U.S. and Mexico, on average they showed a lower plate count when compared to other *M. columbi* specimens reported by Widga et al. (2017). As previously reported, specimens from the Great Plains, as well as latest Pleistocene specimens labeled "*M. jeffersonii*", have an even higher plate count than other *M. columbi*, even though their plate density is more like that of woolly mammoths (*M. primigenius*). This could be signs of possible *M. columbi* variation, with western mammoths possibly being a more primitive version of the species, while the Great Plains *M. columbi* could be seen as a more derived version. Genetic evidence shows that there was interbreeding between *M. columbi* and *M. primigenius*, possibly leading to *M. jeffersonii* hybrids. Research will also be conducted on pygmy mammoth (*M. exilis*) molars from the Channel Islands in Santa Barbara, California. This research is for the purpose of better understanding the transitional effects of dwarfism on pygmy mammoth molars and how they compare to *M. columbi* molars. These data will help assess intrapopulation and interspecific variation in molars and suggest a reconsideration of the idea that all late Pleistocene North American mammoths can be lumped into a single species, *M. columbi*.

IDENTIFICATION, PATHOLOGY, AND BODY SIZE ESTIMATION OF A FUSED CROCODYLOMORPH HEMIPELVIS FROM THE "MESAVERDE" FORMATION, PARK COUNTY, WYOMING, USA

Mila Levitin-Shilman[1] and Andrew A. Farke[1,2]
[1]The Webb Schools, Claremont, CA, USA; [2]Raymond M. Alf Museum of Paleontology at The Webb Schools, Claremont, CA, USA.

The "Mesaverde" Formation (Campanian) of the Bighorn Basin in Wyoming yields abundant crocodylomorph material, including *Deinosuchus* and a variety of non-diagnostic teeth and other bones from smaller forms. In the summer of 2025, the Alf Museum (RAM) excavated the Kung Fu locality, RAM V2022023, in the "Mesaverde" Formation of Park County, Wyoming. This is a multi-taxon bonebed at the base of a channel sandstone. Alongside various crocodylomorph bones and teeth, we identified a crocodylomorph hemipelvis, with the ilium and ischium fused; these elements normally remain unfused even in the largest and oldest individuals. Within modern crocodilians, pelvic fusion may result from disease, trauma, or genetics.

The specimen's ilium has an anterior-posterior length of approximately 14.9 cm, and the ischium is broken distally but nearly complete. The ilium is somewhat "wasp-waisted" at its posterior end, with a shallow dorsal indentation. The ilium and ischium are firmly fused, with no visible evidence of abnormal bone texture.

To estimate the size of the individual, we compared iliac measurements of modern and fossil crocodylomorphs with total body length. With an ilium length to

body length ratio of 1:24.5, this suggests a maximum body length for the Kung Fu locality individual of approximately 3.8 to 4.7 m. The fossil represents the first reported pathology from the "Mesaverde" Formation. The cause of the fusion remains unknown and will require further investigation. Comparison with modern crocodilians will allow us to evaluate potential causes.

Funding: David B. Jones Foundation

ECOMORPHOLOGICAL CHANGES IN BOBCAT MANDIBLES OF SOUTHERN CALIFORNIA FROM LATE PLEISTOCENE TO MODERN-DAY

Sophie Lin[1] and Mairin A. Balisi[1,2]
[1]The Webb Schools, Claremont, CA; [2]Raymond M. Alf Museum of Paleontology, Claremont, CA.

The Late Pleistocene is an interval that documents megafaunal extinction alongside a rapid increase in human impacts. Bobcats (*Lynx rufus*) survived the extinction, suggesting resilience through massive ecological and environmental change. Their role as mesopredators and ability to thrive in the modern-day prompt investigation of how their dietary resource use may have changed from the Last Ice Age to the present. We hypothesize that, because of the extinction of large prey animals, bobcat diets became restricted to smaller prey, and this change will be reflected in gracilization of their jaws.

Here, we quantify mandibles using 3D geometric morphometrics, a landmark-based method of shape analysis. Currently, our sample includes mandibles of Pleistocene bobcats from the La Brea Tar Pits & Museum, compared to historic samples from rural Kern County in the Mammalogy collections of the Natural History Museum of Los Angeles County. We digitized specimens using an EinScan Pro HD surface scanner (Shining 3D), selecting 12 landmarks on the resulting 3D models focused on mandibular depth and tooth spacing from canine to molar. While previous linear-morphometric work on this project found smaller body size and marginally smaller tooth size in modern-day than Pleistocene bobcats, 3D analysis may illuminate other functional differences by better separating shape from size. We expect fossil bobcats to have thickened jaws, especially under the carnassial, since all cats are hypercarnivores and the primary function of carnassial is to slice through meat. Such a difference may reflect adaptation to change in prey structure across the Ice Age extinctions.

Funding: The Rogers Peccary Scholars program at The Webb Schools, supported by the Mary Stuart Rogers Foundation, supported Sophie Lin's participation in this research.

HIGH PHYLOGENETIC DIVERSITY IN NEW TURTLE RECORDS FROM THE GANNETT GROUP, IDAHO, USA

Joshua Lively[1], Brandon R. Peecook[2,3], LJ Krumenacker[2,4], and Robert J. Gay[2]
[1]Prehistoric Museum, Utah State University Eastern, Price, UT, USA; [2]Idaho Museum of Natural History, Idaho State University, Pocatello, ID, USA; [3]Department of Biological Sciences, Idaho State University, Pocatello, ID, USA; [4]College of Eastern Idaho, Idaho Falls, ID, USA.

Turtle fossils from the Lower Cretaceous of western North America are rare compared to other components of the vertebrate assemblage. Taxa currently recognized from units such as the Cedar Mountain Formation of Utah are limited to the genus *Naomichelys*, indeterminate members of Baenidae, and specimens referred to *Glyptops* that are also likely early baenids. We describe new records of turtles from the Aptian-Albian Gannett Group of southeastern Idaho.

Turtles are best represented by fossils from IMNH locality 1127, the best-sampled locality within the Gannett Group. An associated turtle including a partial left plastron preserves key apomorphies. Thickening of the posterolateral plastron, separation of the extragular scales via contact of the gular and humeral scales, and a smooth texture are consistent with paracryptodires, specifically some early-diverging members of Baenidae. A separate morphotype is characterized by a distinct, pustulose surface consistent with Helochelydridae, with *Naomichelys* being the only member of that clade recognized from North America.

A third morphotype from locality 1127 is represented by two thin (1.8 mm) carapace fragments with deep scale sulci and a finely sculptured surface. Though very little of this morphotype is preserved, it is reminiscent of members of the Chelydroidea. This would be the oldest member of that clade and in line with genomic divergence estimates of modern snapping turtle and mud/musk turtle lineages. This specimen underscores the importance of even fragmentary remains from the Gannett Group in helping understand the evolution of the North American turtle fauna, including the origin of modern clades.

NIGHT AND DAY: ILLUMINATING THE SCLERAL RING ANATOMY AND DIEL ACTIVITY PATTERNS OF STEM REPTILES

Cy J. Marchant[1], Xavier A. Jenkins[2], and Brandon R. Peecook[1],[3]
[1]Department of Biological Sciences, Idaho State University, Pocatello, ID, USA; [2]American Museum of Natural History, New York, NY, USA; [3]Idaho Museum of Natural History, Idaho State University, Pocatello, ID, USA.

Diel activity patterns are a critical aspect of reptile ecology and behavior. However, the ancestral condition in stem reptiles is poorly understood and empirical data is absent. Correlations exist between the scleral ring and diel activity in extant species: scleral ring apertures in nocturnal taxa are generally larger, while diurnal taxa tend to have smaller apertures. As such, the scleral morphology of fossil reptiles can be used to reconstruct their diel activity based on the anatomy and behavior of living lepidosaurs and birds. We used CT scans of three stem reptiles from the late Permian of South Africa (*Milleropsis pricei*, *Youngina capensis*, and a new species of younginid) to reconstruct their scleral rings. All have minimally distorted and nearly complete rings visible in the scans, representing the first reported instances in stem reptiles. These allow for direct measurements of orbital geometry. The taxa quantitatively assessed here have distinct scleral anatomies; *Youngina* and the new younginid have narrower scleral apertures, strongly implying photopic diel activity, while *Milleropsis* has a proportionately larger aperture, but ambiguous modeled activity.

At this stage it is premature to draw evolutionary conclusions for the ancestral crown reptile condition, but it is worth noting that Permian stem reptiles likely exhibited both diurnal and nocturnal diel patterns, a pattern also reported in stem synapsids and stem amniotes. These preliminary data suggest that the sensory repertoire of early reptiles was more diverse than previously recognized, in agreement with recent studies highlighting the prevalence of impedance-matching hearing in this grade.

Funding: European Synchrotron Radiation Facility; The David B. Jones Foundation; Idaho State University

MY *GLYPTOTHERIUM* HAS FLEAS? ICHNITES AND PARASITES IN NORTH AMERICAN GLYPTODONTS

Robert D. McCord[1] and Gavin McCullough[1]
[1]Arizona Museum of Natural History, Mesa, AZ, USA.

Bioerosional structures have been noted from a variety of glyptodonts from South America. Interpretation and attribution have been greatly aided by the occurrence of similar structures in other cingulates, including living examples. These studies suggest that the ichnites were formed by the formation of the neosome from a tungid flea. Distribution of the ichnites on the osteoderm suggests a preference for occurrence on sulci or especially the junction of sulci, perhaps because of easier penetration. Distribution of the ichnites on the carapace may suggest a preference for occurrence on difficult to groom or protected locations.

Although widely reported in South America, these ichnites have not been reported from North American glyptodonts. We do not know if this is because they are not present, or if no one has looked for them. This study consists of a survey of a population of *Glyptotherium* from the Blancan NALMA 111 Ranch fauna of Arizona. Everything from single osteoderms to near-complete carapaces were examined for: simple occurrence of ichnites; position on osteoderm noted for single osteoderms; and additionally, position on carapace noted on more complete specimens.

Examination and documentation are on-going but the answer to the question posed in the title is yes, 111 Ranch, and, by extension, at least some North American glyptodonts, do.

DESCRIPTION OF ARIZONA'S FIRST REPORTED HADROSAURID DINOSAUR MAXILLA FROM THE LATE CRETACEOUS FORT CRITTENDEN FORMATION

Gavin M. McCullough[1], Robert McCord[1], and Brenden Bannon[2],[3]
[1]Arizona Museum of Natural History, Mesa, AZ, USA; [2]Mesa Community College, Mesa, AZ, USA; [3]Southwest Paleontological Society, Mesa, AZ, USA.

The Late Cretaceous (?Campanian) Fort Crittenden Formation in southeastern Arizona records a montane ecosystem that has yielded a diverse record of dinosaurs including tyrannosaurs, the centrosaurine *Crittendenceratops*, an ankylosaurine, smaller theropods, dinosaur eggshell, and fragmentary ornithopods. Of the ornithopod material, the best-preserved representation is a partial right hadrosaur maxilla (MSM P7725), the only reported maxillary material currently known from the state. X-ray imagery reveals the hadrosaur synapomorphy of batteries of median-ridged, densely packed teeth within a robust maxillary body. The diamond-shaped teeth exhibit various states of eruption

and completeness visible along the alveolar margin. Preservational shortcomings such as the absence of much of the dorsal process and all the bone forward of the ectopterygoid shelf limit our ability to identify MSM P7725 precisely. Fortunately, the specimen appears to be mediolaterally intact and undeformed, which allows us to see that it is notably wide relative to its craniocaudal length. External anatomical features typically used to discriminate between lambeosaurine and saurolophine subfamilies are absent, incomplete, or ambiguous on MSM P7725; however, the diamond shape of the tooth crowns is indicative of a saurolophine. Circumstantially, coeval sediments in neighboring Sonora, Mexico, have produced kritosaurin-grade saurolophine fossils (cf. *Gryposaurus*).

FIRST REPORT OF COPROLITES FROM THE UPPER CRETACEOUS MENEFEE FORMATION, NEW MEXICO, USA

Benjamin F. Mohler[1], Brent Adrian[2], and Heather F. Smith[2,3]

[1]Department of Geosciences, The University of Arizona, Tucson, AZ, USA; [2]School of Human Evolution and Social Change, Arizona State University, Tempe, AZ, USA; [3]Department of Anatomy, Midwestern University, Glendale, AZ, USA.

Exploration of Menefee Formation outcrops in the San Juan Basin of northwestern New Mexico by multiple teams over the past 15 years has produced a wealth of fossil evidence; however, despite extensive study, no coprolites have been recovered from the formation. The Menefee Formation is early to middle Campanian and represents the stratigraphically lowest terrestrial unit in a sequence that includes more extensively studied Cretaceous and Paleogene deposits, several of which have yielded coprolites. In 2024, the first unambiguous sample of coprolites from our study area in the Juans Lake Beds of the Allison Member was collected; this constitutes the first report of coprolites from anywhere in the Menefee Formation.

This sample consists of 37 coprolites and coprolite fragments, all found within approximately 20 cm^3 of sediment. Many of the best-preserved examples were surface collected, with additional coprolites buried beneath the surface set. While each coprolite varies in precise morphology, they display a consistent pattern of elongate shape, with a bulbous termination (maximum circumference 5-6 centimeters) and tapering along their length. Only one example includes both terminations and is anisopolar. Several coprolites display at least one angular bend, and one features a possible inclusion (which, if organic, likely represents a conical tooth or long bone fragment in cross-section). Internal composition of the coprolites was observed in fragmented specimens with exposed cross-sections. While it is difficult to directly attribute coprolites to their producers, overall shape and lack of visible bone inclusions suggests that these specimens may have been defecated by crocodylians.

FRESHWATER FISH DISCOVERIES FROM PALEONTOLOGICAL MONITORING IN THE MIOCENE-PLIOCENE IDAHO GROUP, MALHEUR COUNTY, OREGON

Brandon A. Nguyen[1], Larkin McCormack[1], Garrett R. Williamson[1], and Stephanie M. Grossart[1]

[1]Eocene Environmental Group, Meridian, ID, USA.

The Miocene-Pliocene Idaho Group has historically yielded an abundant array of fish, mammal, and crustacean faunas from the Poison Creek, Chalk Hills, and Glenns Ferry formations. While providing paleontological resource monitoring during construction of a utility project in Malheur County, Oregon, Eocene Environmental Group paleontologists discovered three microfossil localities preserving thousands of fossils.

These localities were identified both on the surface prior to ground disturbance and by construction equipment disturbing in situ fossiliferous layers. Paleontological monitors worked alongside construction crews to ensure the preservation and collection of significant fossils found at each site. Intensive fossil collection involved dry-screening thousands of pounds of sediment on site using 1/8-inch mesh screens to efficiently process large volumes of material. Hundreds of pounds of sediment were also collected for screening in the lab using smaller mesh sizes (1/12 and 1/20-inch) to capture smaller specimens. To date, fossil identifications include fish mandibles, cranial elements, vertebrae, and fin spines from Cyprinidae genera *Mylocheilus* and *Ptychocheilus* (minnows), Salmonidae genus *Oncorhynchus* (trout and salmon), Ictaluridae (catfish), Catostomidae (suckers), and Cottidae (sculpins).

Project monitoring locations were determined using the Bureau of Land Management Potential Fossil Yield Classification system recently released for Oregon and Idaho. Our discoveries were made in areas classified as having unknown potential, emphasizing the importance of monitoring in these areas to improve knowledge of paleontological potential and protect paleontological

resources from impacts from construction. Without collaboration between resource monitors, land management agencies, and construction personnel, important paleontological data could be lost or irrevocably damaged.

THREE-DIMENSIONAL PRESENTATION OF AN UNUSUAL STAPES OF *DIMETRODON* FROM THE EARLY PERMIAN CLEAR FORK FORMATION OF NORTH-CENTRAL TEXAS

Keely Nicholas[1], Michael Malone[1], and Stuart Sumida[1]
[1]California State University–San Bernardino, San Bernardino, CA, USA;

Dimetrodon has benefited from thorough documentation of its external cranial anatomy, and more recently, scans of its internal middle ear. Now, a well-preserved stapes from the north-central Texas Craddock bonebed adds to our knowledge and diversity of stapedial structure. The bonebed is interpreted as early Permian, lowest Clear Fork Formation (formerly "Arroyo" Formation), Leonardian in age. The size of the complete right stapes compares most closely with mature specimens of *Dimetrodon*, and isolated teeth with denticulate mesial and distal carina associated with the specimen conform to the condition recently assigned to *D. grandis*. The stapes is complete, isolated, and undistorted—facilitating examination in all views as well as three-dimensional surface scanning allowing presentation in unlimited views. The condition of the dorsal and ventral processes are markedly different from previous reconstructions of the stapes. Unique features include: (1) the dorsal process is extremely large and has an articular surface that appears to extend as much as 25% down the length of the posterior surface of the stapedial shaft; (2) a distinct ridge extends from the articular surface of the dorsal process down the posterior surface of the shaft; (3) there is evidence of an enlarged stapedial foramen associated with or near the ventral process; and most significantly (4) a distinct bridge of bone extends between the dorsal and ventral processes. Since most interpretations of *Dimetrodon* stapes are based on *D. limbatus*, it is unknown if these features are unique to this single specimen.

Funding: David B. Jones Foundation

ANURAN MAXILLAE FROM THE "MESAVERDE" FORMATION (CAMPANIAN: LATE CRETACEOUS) OF WYOMING, USA

Keely Nicholas[1] and Andrew A. Farke[2]
[1]California State University San Bernardino, San Bernardino, CA, USA; [2]Raymond M. Alf Museum of Paleontology at The Webb Schools, Claremont, CA, USA.

Frogs (anurans) from the middle to late Campanian of the Late Cretaceous (~80.6–72.1 Ma) in Laramidia are rare and often incomplete, primarily represented by isolated elements. Within the Teapot Sandstone of the "Mesaverde" Formation in Washakie County, Wyoming, we have identified multiple anuran maxillae from screenwashed samples collected by the Alf Museum. These are the first anurans reported from these exposures. Two of the most complete maxillae differ from each other in their ornamentation on the labial surfaces, suggesting at least two different frog species in the sample. The smallest maxilla (~2.1 mm tall from oral margin to orbit) expresses pronounced labial pitting, with each pit bounded by a ridge that produces a bumpy texture. The largest and most complete maxilla (~5 mm from oral margin to orbit), in contrast, shows smaller and more irregular pitting. Both are further distinguished by differing anatomy in their crista dentalis; the larger maxilla has shorter and narrower grooves for the teeth compared to the larger grooves found on the smaller specimen. Despite their differences, the two maxillae are most comparable to specimens referred in recent literature to "Anuran Indeterminate Morph 1," with penecontemporaneous occurrences in the "Mesaverde" Formation of the Wind River Basin, as well as the Judith River (Montana), Wahweap and Kaiparowits (Utah), Aguja (Texas), and Dinosaur Park (Alberta) formations. The Teapot Sandstone in Washakie County produces a large range of marine, freshwater, and terrestrial taxa, signifying a possibly estuarine locality.

Funding: David B. Jones Foundation

NEW FAUNAL ASSEMBLAGE FROM THE SONORAN DESERT OF SOUTHEASTERN CALIFORNIA

Danielle E. Oberg[1], Travis Stone[1], Evan Doughty[1], Alexander Smith[1], Aimee Montenegro[1], Andrew Vasquez[1], Michael George[1], Erik Pino[1], Chase Anderson[1], Chris Shi[1], Sarah Rieboldt[1], and Amy Ollendorf[1].
[1]Applied EarthWorks, Inc., Pasadena, CA, USA

The Sonoran Desert fossil record is best known from Arizona and Mexico; however, recent discoveries in southeastern California provide new palaeoecological and paleoclimatic insights. Newly identified fossil localities near Blythe, California, have yielded an extensive microvertebrate assemblage. More than 1,000 sediment samples have been collected, screened, and processed, resulting in the recovery of over 10,000 Pleistocene-aged fossil specimens to date.

Most recovered vertebrate remains closely resemble

extant taxa that inhabit the region today. Common elements of the assemblage include lagomorphs (rabbits and hares [Leporidae]); rodents, such as mice and packrats (Cricetidae), kangaroo rats (Dipodidae), and ground squirrels (Sciuridae); artiodactyls (Antilocapridae, Cervidae); carnivorans (Canidae); reptiles, including snakes (Colubridae, Viperidae), lizards (Iguanidae, Phrynosomatidae), and tortoises (Testudinidae); amphibians (frogs and toads [Anura]); and birds (Aves: Falconiformes). In addition, the assemblage includes previously undocumented vertebrate taxa from the region, notably pikas (Ochotonidae).

These discoveries fill a major geographic gap in the Sonoran Desert fossil record. The southeastern California assemblage provides rare, well-sampled microvertebrate data that improve reconstructions of Pleistocene ecosystems and climate in the region. The large sample size enables robust ecological comparisons with modern faunas, clarifying patterns of faunal continuity, environmental stability, and change through time. The presence of previously undocumented taxa, such as pikas, further refines interpretations of past habitat conditions and indicates more complex Pleistocene environments than those observed in the region today.

NEW RECORDS OF TOOTH PATHOLOGIES IN FAUNIVOROUS REPTILES, AND THE DEVELOPMENT OF SPLIT AND ACCESSORY CARINAE IN AMNIOTES

Ezekiel V. O'Callaghan[1]
[1]Department of Biology, Northern Arizona University, Flagstaff, AZ, USA.

A pathological mosasaur tooth and a pathological phytosaur tooth showing split and accessory carinae respectively are reported. Split carinae have been found across disparate taxa outside of these two clades, including tyrannosaurids, large allosauroids, the therizinosaur *Segnosaurus* and the nimravid mammal *Dinictis*. A literature review of earlier surveys examining split and accessory carinae found no occurrences in small theropod taxa or in any extant reptilian or mammalian taxa. These pathologies may be linked to high bite forces (at least >150N) and thecodont dentition. All taxa but one with records of these pathologies have both high bite forces, carinae, and thecodont dentition. The exception, *Segnosaurus*, is the only herbivorous taxon with such an occurrence, and may have developed accessory carinae in conjunction with herbivory. Additionally, the bite forces of *Segnosaurus* are unknown, but are low in related taxa. Stress on the tooth during development, from feeding, or an unknown genetic signal could be causes for split carinae development. Of modern taxa, only *Crocodylus rhombifer* may serve as a suitable analogue, due to carinae on some teeth, high bite force, and thecodont dentition, a combination of which is not found in any other extant animal. Additionally, these occurrences cast doubt on the validity of *Stelladens mysteriosus*, which may simply be a pathological specimen of a known mosasaur species, though without further work on the development of split carinae *S. mysteriosus* does still display a unique presentation of split carinae when compared to other examples, and may remain valid.

FOSSIL CAMELS FROM THE MIOCENE PUNCHBOWL, CROWDER, AND CAJON VALLEY FORMATIONS OF THE TRANSVERSE RANGES, CALIFORNIA

Scarlet O. A. Parod[1], Donald R. Prothero[1,2], and Scott Kottkamp[3]
[1]Natural History Museum of Los Angeles County, Los Angeles, CA, USA; [2]Department of Geological Sciences, Cal Poly Pomona, Pomona, CA, USA; [3]Division of Earth Sciences, San Bernardino County Museum, Redlands, CA, USA.

Fossil camels from the middle-late Miocene units of the Transverse Ranges have never been precisely identified beyond "Camelidae" in the literature, because the alpha-taxonomy of Miocene camels was poorly understood. With the complete revision of North American Camelidae now completed, it is possible to identify them for the first time. The type Punchbowl Formation in Devil's Punchbowl State Park has produced Clarendonian mammals like *Borophagus*, *Plioceros*, and *Pliohippus*. Its fragmentary camel jaws and teeth closely match the distinctively hypsodont Barstovian-Clarendonian *Procamelus occidentalis*. The Cajon Valley Formation (long misidentified as the "Punchbowl Formation") has produced a diverse fauna that ranges from the late Hemingfordian to the early Barstovian. The camels recovered from this unit include a skull and jaws of *Protolabis saxeus* (typical of the late Hemingfordian) and a skull of *Miolabis fricki* (previously only known from the late Hemingfordian of the Cuyama Badlands of Ventura County, California). In addition, it produces limb bones of a giraffe-like camel, probably "*Aepycamelus*" *priscus* of the late Hemingfordian. The Crowder Formation along Highway 138 east of the Cajon Pass is thought to be late Hemingfordian based on fossil rodents. It produces fragmentary jaws of a small camelid that best matches the late Hemingfordian taxon *Paramiolabis tenuis*. There

was extensive sedimentation in these fault-bounded basins during the late Hemingfordian and Barstovian, and many of the camels found in the Cajon Valley and Crowder formations are similar to those of the Barstow Formation and Cuyama Formation, as well as taxa best known from the High Plains.

THE OLDEST-KNOWN SHUVOSAURIDAE (POPOSAUROIDEA, PSEUDOSUCHIA) ARE FROM THE SOUTHERN MID-LATITUDES OF PANGEA

Brandon R. Peecook[1,2]
[1]Idaho Museum of Natural History, Idaho State University, Pocatello, ID USA; [2]Department of Biological Sciences, Idaho State University, Pocatello, ID USA.

The Triassic Period contained remarkable anatomical experimentation amongst reptile lineages, leading to the origins of major crown lineages today (lepidosaurs, turtles, crocodilians, and birds), as well as numerous ecologically important clades existing only within the Triassic. The patterns and processes surrounding the early evolution of clades like Dinosauria have been rigorously studied (i.e., high confidence that dinosaurs originated in the mid-southern latitudes of Pangea during the early Late Triassic and expanded to equatorial and northern Pangea after climatic shifts allowed for dispersal around the Carnian/Norian boundary), but coeval clades likely experienced similar influences. Poposauroidea are a clade of pseudosuchian archosaurs with high bauplan disparity mostly known from the Early and Middle Triassic, with the only Late Triassic representatives being the independently bipedal *Poposaurus* and Shuvosauridae.

Here we report on the stratigraphically oldest shuvosaurid material, known from a succession of Middle-Late Triassic-aged rocks (Ladinian/Carnian) in the Luangwa Basin, Zambia: femora with diagnostic posteromedial fossae in place of a fourth trochanter from the Ntawere Formation, and waisted dorsal centra from the overlying Red Marl. We posit that the bipedal Shuvosauridae evolved in the same ecological and temporal context as the first dinosaurs, and display similar patterns of biogeography, alluding to shared drivers of terrestrial dispersal. The three named species provide a rough outline: *Sillosuchus longicervix* alongside the first dinosaurs in the Carnian mid-southern latitude Pangea; *Shuvosaurus inexpectatus* alongside herrerasaurs and neotheropods in the Norian equatorial zone; and *Effigia okeefeae* in the Rhaetian of the equatorial zone.

Funding: National Geographic Society: 158R-18

ANATOMICAL DESCRIPTION OF A NEW SQUAMATE FROM MARICOPA BREA AND ITS IMPLICATIONS FOR LATE PLEISTOCENE ENVIRONMENTS IN INLAND SOUTHERN CALIFORNIA

Michael A. Pino[1], Bailey Jørgensen[2], Jared Heuck[3], and Mairin Balisi[1,2]
[1]The Webb Schools, Claremont, CA, USA; [2]Raymond M. Alf Museum of Paleontology, Claremont, CA, USA; [3]Yale Peabody Museum, New Haven, CT, USA.

Today, California's Central Valley is known for agriculture and oil fields, but fossils from asphaltic localities indicate a different environment in the Late Pleistocene. One such locality is Maricopa Brea (36,000–13,860 years before present), with a depositional context and fauna matching better-documented Late Pleistocene asphalt assemblages (e.g., Rancho La Brea; McKittrick).

Housed at the Raymond M. Alf Museum of Paleontology (RAM) is a squamate jaw (RAM 29064) from a portion of the Maricopa Brea (RAM VI-2024001) currently on privately owned land. The objective of this research is to describe the specimen and identify its taxonomic placement to evaluate Late Pleistocene environmental conditions in inland southern California. The specimen is a left dentary with 21 tooth positions, intact except for the coronoid process. The dentition is pleurodont and heterodont: the anterior nine teeth are unicuspid, and the posterior teeth are tricuspid with a taller central cusp. The labial side has six anterior foramina in a row. Lingually, the Meckelian fossa extends from the symphysis posteriorly, remaining open for part of its length.

To evaluate taxonomic affinity, we are comparing the specimen with a reference dataset of extant squamates representing five families: Phrynosomatidae, Crotaphytidae, Anguidae, Scincidae, and Teiidae. These families still live in the Maricopa region today and feature prominently in squamate occurrences at other Pleistocene localities (e.g., Rancho La Brea; Hall's Cave, TX). If RAM 29064 represents a taxon no longer living at Maricopa Brea, its presence would indicate different Late Pleistocene environmental conditions and faunal turnover in regional squamate communities.

Funding: The Rogers Peccary Scholars program at The Webb Schools, supported by the Mary Stuart Rogers Foundation, supported Michael Pino's participation in this research.

INTRASPECIFIC VARIATION OVER 10 MILLION YEARS SHOWS POTENTIAL EFFECTS OF SEX ON EXTINCTION IN PERMIAN STEM-MAMMAL *DIICTODON FELICEPS*

James L. Pinto[1]
[1]Department of Earth Sciences, University of Southern California, Los Angeles, CA, USA.

Intraspecific variation through time can result from environmental adaptation and/or reproductive selectivity. Anagenesis and demographic changes (e.g., percent of younger/older or male/female individuals) are how species respond to long-timescale ecological factors, such as environmental stress and faunal turnover during mass extinctions. A sample of the Middle-Late Permian (~262–252 Ma) South African metapopulation of the dicynodont stem-mammal *Diictodon feliceps*, comprising >700 measured crania, shows intraspecific, sex-unique variation over 10 million years, with sexes diagnosable by presence of canines. *Diictodon* crosses the Capitanian Mass Extinction (CME) and subsequent full recovery of surrounding ecofauna, with pre-/post-extinction and post-recovery submetapopulations represented. Relative abundance of *Diictodon* changes throughout its range, increasing from ~10–40% of collected fossils over biozones following the CME, and decreasing from ~40–10% after faunal recovery, indicating a "disaster taxon" species history. Average body size (basal skull length) increases by ~10% following the CME and decreases by ~20% at the abundance decrease. Individuals from smaller body size assemblage zones have relatively larger orbits, tentatively indicating these size shifts are ontogenetic, with individuals from larger body size assemblage zones also being older. Finally, there is strong evidence for sexual size dimorphism, with toothed individuals (presumed males) being ~18% larger than toothless ones (presumed females). Despite maintaining stability in average relative size and morphology through time, the ratio of males to females is not constant, with the percentage of males decreasing through time. All of these results indicate that in stressful periods near extinction, larger, older, and male individuals may be selected against.

Funding: Geological Society of America Graduate Student Research Grant; National Science Foundation Graduate Research Fellowship, University of Southern California

THE EVOLUTION OF NORTH AMERICAN CAMELS: IMPLICATIONS FOR PALEONTOLOGY DATABASES

Donald R. Prothero[1,2], Daniella Balassa[3], Kristin Watmore[2,4], and Ed Welsh[5]
[1]Dept. Earth Sciences, California State Polytechnic University, Pomona, CA, USA; [2]Natural History Museum of L.A. County, Los Angeles, CA; [3]Dept. Earth Sciences, California State University, Long Beach, CA; [4]Dept. Geological Sciences, USC, Los Angeles, CA; [5]Badlands National Park, 25216 Ben Reifel Road, Interior, SD.

After almost 180 years of collecting, the sample of North American camel fossils is enormous, yet they were poorly studied with no complete and comprehensive systematic revisions covering all the Camelidae. We have completely updated the systematics of the North American Camelidae. The old literature had almost 200 named species, and over 60 named genera. By contrast, we recognize only 40 valid genera of North American camels, with 79 valid species. Camels were very rare in the late Uintan (late middle Eocene), completely unknown in the Duchesnean (latest middle Eocene), and relatively rare and low in diversity in the late Eocene (Chadronian). Only a handful of genera are known from the early Oligocene (Orellan to Whitneyan). By the late Oligocene (early Arikareean), camels began to diversify with *Miotylopus*, the gazelle-like Stenomylinae, plus primitive nothokemadines. Then in the early Miocene (latest Arikareean-Hemingfordian), camels underwent a big diversification, with *Oxydactylus*, several genera of floridatragulines, miolabines, protolabines, and primitive aepycamelines, resulting in 15 genera in the late Hemingfordian, and 19 genera of camels in the late Barstovian-Clarendonian, before reducing in diversity in the late Clarendonian-Hemphillian (late Miocene) and Pliocene. Only three genera remained in North America by the end of the Pleistocene, all of which vanished during the end-Pleistocene megafaunal extinction. This research also demonstrates that online databases, such as the Paleobiology DataBase (PBDB) or MIOMAP are grossly outdated in places, with many invalid taxa. As long as research is drawn from these outdated taxonomic studies, the results are "Garbage In, Garbage Out".

A LATE PLEISTOCENE COLUMBIAN MAMMOTH SITE IN THE ANTELOPE VALLEY OF KERN COUNTY, CALIFORNIA, AND ITS IMPLICATIONS FOR REGIONAL PALEONTOLOGICAL MITIGATION

Jesse K. Shelmire[1], Patrick J. Sena[1], Gino Calvano[1], Thomas A. Deméré[1,2], Kesler A. Randall[2], and Katie M. McComas[1]
[1]Department of PaleoServices, San Diego Natural History Museum, San Diego, CA, USA; [2]Department of Paleontology, San Diego Natural History Museum, San Diego, CA, USA.

Recent paleontological mitigation efforts conducted during construction of a new solar facility in the Antelope Valley of Kern County, CA, resulted in the discovery and recovery of a late Pleistocene-age fossil assemblage at depths of only two to four feet below the existing ground surface. SDNHM paleontologists were contacted to evaluate the initial discovery, which turned out to be a well-preserved and nearly complete mandible of a Columbian mammoth (*Mammuthus columbi*) with left and right 3rd molars. The site was initially excavated using archaeological methods until the potential for an early human component was eliminated. The approach then shifted to a paleontological salvage utilizing a one-meter grid layout and plaster jacketing techniques, which resulted in recovery of additional mammoth skeletal elements. Screenwashing of bulk matrix samples from two coeval localities produced isolated teeth of rodents (*Dipodomys* sp., *Thomomys* sp., and *Microtus* sp.) and shells of the freshwater snail *Planorbella* sp. and the freshwater pea clam *Euglesa* sp. cf. *E. casertana*. It is suggested that the depositional environment of the fossils can be correlated to the terminal Pleistocene transgression of pluvial Lake Thompson that occurred between approximately 16,200 and 12,600 years ago. The occurrence of late Pleistocene vertebrate and invertebrate fossils at this site indicates that shallower depth thresholds for paleontological monitoring should be employed for this part of the Antelope Valley. The potential for the presence of paleolithic artifacts in these younger sediments also suggests that inclusion of an archaeological approach should be considered as part of regional paleontological mitigation research designs.

FOSSIL TURTLE SHELL TAPHONOMY IN THE UPPER CRETACEOUS (CAMPANIAN) MENEFEE FORMATION OF NEW MEXICO, U.S.A.

Jessie Silverstein[1], Harrison Brand[1], Merlyn Heck[1], Benjamin F. Mohler[2], Heather F. Smith[3],[4], and Brent Adrian[4]

[1]Southwest Paleontological Society, Mesa, AZ, USA; [2]Department of Geosciences, University of Arizona, Tucson, AZ, USA; [3]School of Human Evolution and Social Change, Arizona State University, Tempe, AZ, USA; [4]Department of Anatomy, Midwestern University, Glendale, AZ, USA.

Recent field work in the Middle Campanian Menefee Formation has expounded turtle evolution in southern Laramidia. Turtle fossils have been the basis of taphonomic studies at fossil sites where they are abundant, widely distributed, and potentially better preserved than other taxonomic groups. To characterize the taphonomic regime in our study area and test environmental control on size, we measured and categorized Menefee turtle fossils using published criteria for taphonomic variables. Fragmentation was classified as present or absent, articulation was categorized in four stages of increasing disarticulation, while abrasion and weathering were each coded in five stages. Maximum dimensions were measured for each specimen along primary, secondary, and tertiary axes.

All sampled turtle specimens were fragmented and highly disarticulated. Consistently low abrasion scores across the study area suggest minimal transport, and low levels of weathering suggest rapid burial rates. Multivariate analyses reveal that taphonomic effects are mostly similar among collection areas, indicating a homogenous taphonomic overprint at square-mile resolution. These discoveries are consistent with published descriptions of depositional patterns in the upper Menefee Fm., which is dominated by fine-grained sandstones and mudstones. In addition to bite marks, three ichnotaxa were identified, including small circular pits of *Karethraichnus lakkos*, shallow depressions identified as *Gunnellichnus akolouthiste*, and ring-shaped *Thatchtelithichnus holmani* marks. *Karethraichnus lakkos* was most prevalent and is typically associated with ectoparasites such as leeches. These preliminary results inform reconstructions of paleoenvironments at a coarse scale, but future work will examine taphonomic variability at smaller scales to aid in parameterizing fossil-bearing localities.

Funding: Western Interior Paleontological Society

CAMPANIAN TURTLE PROVINCIALITY IN SOUTHERN LARAMIDIA: COMPARING THE MENEFEE AND AGUJA FORMATIONS

Heather F. Smith[1],[2]*, Brent Adrian[1], and Benjamin F. Mohler[3]

[1]School of Human Evolution and Social Change, Arizona State University, Tempe, AZ, USA; [2]Department of Anatomy, Midwestern University, Glendale, AZ, USA; [3]Department of Geosciences, University of Arizona, Tucson, AZ, USA.

Recent fieldwork in penecontemporaneous middle Campanian Menefee and Aguja formations has yielded rich and diverse turtle faunas, enabling evaluation of turtle distribution in southern Laramidia. Both units preserve a broadly overlapping core assemblage of turtle taxa, including baenids *Neurankylus baueri*, *Denazinemys*

nodosa, and *Thescelus*, Asian immigrants *Basilemys* and *Adocus*, and multiple pan-trionychids. The Aguja pan-trionychid assemblage comprises several taxa—*Aspideretoides*-like forms and indeterminate plastomenids—that show affinities with Menefee material. However, the two turtle assemblages differ in several informative ways. The Aguja Formation contains fully marine taxa, including the endemic bothremydid *Chupacabrachelys complexus* and the protostegid *Terlinguachelys fischbecki*, whereas the sole purported Menefee bothremydid was recently reevaluated and discredited. Additionally, the relict stem turtle *Naomichelys* is present in the Menefee, while additional derived cryptodires (e.g., kinosternids and chelydrids) have been tentatively reported from Aguja. *Scabremys* is not known from Aguja, although some of the isolated nodose baenid fragments could potentially belong to this taxon. *Thescelus* material from the Menefee was not referred to species level, but the verified presence of *T. rapiens* at Aguja broadens its known range and favors a similar specific attribution for the Menefee *Thescelus* fossils. Similarities in taxonomic composition between Menefee and Aguja assemblages reinforce the distinctiveness of a southern endemic Campanian turtle fauna. However, the proximity of Aguja to the Gulf of Mexico allowed inhabitation by fully marine turtles (bothremydids, protostegids), whereas the more inland, fluviodeltaic Menefee Formation supported a broader diversity of large baenid taxa and the persistence of the relict stem turtle *Naomichelys*.

Funding: Western Interior Paleontological Society

EXCEPTIONALLY PRESERVED SKELETON FROM THE LOWER PERMIAN OF SOUTHEASTERN UTAH CLARIFIES EARLY SYNAPSID PHYLOGENY AND SHOWS POSSIBLE CLIMBING ADAPTATIONS

Megan P. Sodano[1], Sylvia J. Czerkas[2], Randall B. Irmis[3],[4], and Adam K. Huttenlocker[1],[5]

[1]Division of Integrative Anatomical Sciences, Keck School of Medicine at the University of Southern California, Los Angeles, CA, USA; [2]The Dinosaur Museum, Blanding, UT, USA; [3]Natural History Museum of Utah, University of Utah, Salt Lake City, UT, USA; [4]Department of Geology and Geophysics, University of Utah, Salt Lake City, UT, USA; [5]College of Veterinary Medicine, Western University of Health Sciences, Pomona, CA, USA.

We report on an articulated synapsid skeleton from the lower Permian Cedar Mesa Sandstone of Indian Creek in San Juan County, Utah, U.S.A. This site is an interdune deposit containing several permineralized conifer logs and abundant vertebrate remains, which may indicate a 'log jam' depositional setting. The skeleton consists of several cranial elements, including a partial maxilla with recurved dentition, caniniforms, and a secondary caniniform region, a dorsal vertebral column displaying dorsal centra bearing a ridged ventral surface and tall, slightly anteriorly inclined, and squared-off dorsal neural spines, portions of both limb girdles, two partial forelimbs and a complete hindlimb, and portions of an articulated caudal vertebrae series. We input this specimen into two matrices, both indicating that our animal is likely to be an early-diverging synapsid, and one indicating it's a relative of the varanopid *Eoscansor cobrensis*, which it closely resembles. Overall, our specimen and *E. cobrensis* lack important diagnostic skull characters. However, the postcrania suggest greater affinity with varanopids than other early diverging synapsid groups. *E. cobrensis* is proposed to be arboreal, citing several specializations, such as elongation of the penultimate phalanges, long, gracile limbs, and curved unguals. Our specimen appears less specialized, with lower ungual curvature and more robust metapodials, though the elongation of the penultimate phalanges is still present. Comparing the proportion of the pes in our specimen to extant mammalian and non-avian reptilian taxa reveals placement between terrestrial and arboreal/climbing clusters near taxa that can climb but tend to occupy the ground.

Funding: NSF-2219902 to A.K.H.; NSF-2219947 to R.B.I.

UNCOVERING ANCIENT AMAZONIA: RECONSTRUCTING PLEISTOCENE PLANT-CLIMATE INTERACTIONS AND FOREST RESILIENCE DURING THE LAST INTERGLACIAL-GLACIAL

Elena Stiles[1],[2], Liliana Londoño[2], Miles Stone[1], Sebastian Patiño[3], Isabelle Vergnaud[3], Diana Karen Pérez[3], Camila Martínez[3],[2], Carlos Jaramillo[2], and Julia Tejada[1]

[1]California Institute of Technology, Pasadena, CA. USA; [2]Smithsonian Tropical Research Institute/Instituto Smithsonian de Investigaciones Tropicales, Panama; [3]Universidad EAFIT, Medellín, Colombia

Amazonian forests are Earth's most diverse ecosystems, yet their evolutionary history remains poorly understood. The late Pleistocene represents a critical interval for evaluating the relationship between climate, forest structure, and community composition; however, high resolution paleobotanical and paleoclimate records are strongly biased toward the eastern Amazon, leaving the western Amazon with no records older than ~45 ka.

Here, we address this gap through the analysis of two exceptionally preserved late Pleistocene floras (100–150 ka) from the Peruvian Amazon to reconstruct the composition, structure, and ecophysiology of western Amazon forests during the last interglacial glacial transition. Preliminary analyses of leaves, fruits, and flowers identify 15 distinct leaf, 3 fruit, and 22 wood morphotypes with proposed affinities to Bignoniaceae, Fabaceae, Lauraceae, Myrtaceae, Combretaceae, Euphorbiaceae, Leguminosae, Rutaceae, and Sapotaceae. Leaf Margin Analysis yields a mean annual temperature estimate of 26.4 °C, consistent with modern tropical lowland forests. However, relatively small average leaf sizes, together with abundant *Alnus* pollen recovered from the same deposits, suggest drier conditions than those observed in the region today. Although taxonomic analyses and geochronological constraints are ongoing, these results support hypotheses of western Amazon forest restructuring under increased aridity during glacial intervals. Notably, we find no evidence for grassland expansion, providing no support for the classical forest refugia hypothesis as a primary driver of Amazonian hyperdiversity.

δ^{15}N OF AMINO ACIDS FROM THE EGGSHELL CRYSTAL LATTICE: A GATEWAY TO MESOZOIC TROPHIC NETWORKS?

Mattia Tagliavento[1] and Julia Tejada[1]
[1]Department of Geological and Planetary Science, California Institute of Technology, Pasadena, CA, USA.

Stable nitrogen isotopes are a powerful proxy for reconstructing trophic structure in ancient ecosystems. δ^{15}N data can be measured as bulk values or through compound-specific isotope analysis of amino acids (CSIA-AA), which enables simultaneous tracking of primary producer baselines and trophic position. However, both approaches are typically applied to proteins such as collagen, which degrade rapidly, precluding nitrogen isotope analyses in Mesozoic ecosystems.

A potential workaround is provided by intracrystalline organics, a fraction of organic material occluded within the eggshell mineral lattice. Because this material is trapped within a closed system (i.e., it is isolated from the external environment) we hypothesize that its isotopic integrity might persist into deeper time.

Here, we evaluate nitrogen isotope preservation in eggshell intracrystalline organics through experimental alteration and fossil analyses. Thermal alteration experiments on modern ostrich eggshells show that CSIA-AA δ^{15}N signals remain reliable until the material is degraded into a form of insoluble organic material (e.g., kerogen). In contrast, bulk δ^{15}N values remain measurable and reliable, even when amino acid specific signals are no longer retrievable.

We then applied this framework to fossil eggshells of sauropods (Maastrichtian, France), *Maiasaura*, and *Troodon* (Campanian, Canada). While CSIA-AA δ^{15}N could not be recovered from these specimens, bulk δ^{15}N values were preserved. Sauropod eggshells are consistent with herbivory, whereas *Maiasaura* and *Troodon* eggshells indicate participation in distinct trophic systems. Elevated δ^{15}N values in *Maiasaura* may reflect aridity, low-protein diets, starvation, or a combination of these factors. *Troodon* values suggest a more flexible feeding ecology than strict carnivory.

Funding: Palaeontological Association Research Grant number A-RG202402

AN ONGOING STATEWIDE INVENTORY OF IDAHO'S FOSSIL VERTEBRATES

Tut Tran[1], Robert J. Gay[1], LJ Krumenacker[1,2], Gary A. McGaughey[1,3], Indah B. Huegele[1], and Brandon R. Peecook[1,3]
[1]Idaho Museum of Natural History, Idaho State University, Pocatello, ID, USA; [2]College of Eastern Idaho, Idaho Falls, ID, USA; [3]Department of Biological Sciences, Idaho State University, Pocatello, ID, USA.

The State of Idaho hosts numerous fossil vertebrates owing to its complex geologic history and the efforts of many researchers over the last 130 years. Iconic Idaho vertebrate taxa include: the Permian "buzzsaw shark," *Helicoprion*, Pliocene mammals of Hagerman Fossil Beds National Monument (HAFO), and Pleistocene megafauna at American Falls. Recently, Idaho's Mesozoic record has grown due to increased fieldwork, especially in the Cretaceous Wayan Formation. These taxa, occurring in southeast Idaho, comprise the bulk of in-state paleontological research by the Idaho Museum of Natural History (IMNH). Even so, other fossil vertebrates have been recorded from elsewhere in the State, and the last statewide surveys were compiled almost thirty years ago. This new inventory aims to update those publications and increase education on Idaho's overall paleontological record.

Out of 950 inventoried vertebrate occurrences, 93% come from the Cenozoic, due to abundant Quaternary sediments and the high species richness at HAFO; whereas 5% and 2% represent Mesozoic and Paleozoic

occurrences, respectively. 70% of reports represent mammals, consistent with the temporal spread. 56% comes from southeast Idaho, thanks to exposures of sedimentary sequences within complex Basin and Range geology. Southwest/south-central Idaho has produced 29% of records, due to work at HAFO other Neogene sites in the vicinity. East-central Idaho (12%) hosts lesser-known but species-rich Miocene and Devonian strata, and northern Idaho has the fewest reports (2%). These results, along with numerous invertebrate and plant records, contribute to a comprehensive overview of Idaho's entire fossil record.

DENTAL MEASUREMENTS AND HORNCORES REVEAL INTERSPECIFIC AND INTRASPECIFIC VARIATION OF MERYCODONTS (MAMMALIA: ARTIODACTYLA: ANTILOCAPRIDAE: MERYCODONTINAE) WITH IMPLICATIONS FOR PRONGHORN SYSTEMATICS

Kristin I. Watmore[1,2] and Donald R. Prothero[3,4]
[1]Department of Earth Sciences, University of Southern California, Los Angeles, CA, USA; [2]Dinosaur Institute, Natural History Museum of Los Angeles County, Los Angeles, CA, USA; [3]Department of Geological Sciences, California State Polytechnic University, Pomona, Pomona, CA, USA; [4]Department of Vertebrate Paleontology, Natural History Museum of Los Angeles County, Los Angeles, CA, USA.

Merycodonts represent a paraphyletic subfamily of antilocaprids present throughout North America during the early to middle Miocene and included five genera (*Cosoryx*, *Merriamoceros*, *Merycodus*, *Paracosoryx*, and *Ramoceros*) with nearly two dozen species described between them. Previously, merycodont taxonomy placed a large emphasis on differences between horn morphologies to diagnose species, but it has long been recognized that standard measurements of dentition (premolar and molar row lengths) can be less variable and more biologically informative of differences between species than widely variable, display characters like horns.

Here we examined the degree of dental row and horncore morphological variation in merycodont species, by comparing their range of variation to that of the modern antilocaprid, *Antilocapra americana*. We used a large sample of horncores and jaws from the AMNH and a single population from the Siebert Fm., Tonopah, Nevada, from the LACM for qualitative examination of interspecific and intraspecific variation of horncores in the context of less variable, quantitative traits like tooth row ratios. Our MANOVA and post-hoc (Tukey) results emphasize the importance of utilizing more static characters, like those in tooth rows, for support in systematic decisions, while our calculated Coefficients of Variation reveal that molar and premolar length dimensions for *Antilocapra* and each merycodont genus are similar, suggesting that a similar degree of species variability may be expected for merycodonts. Ultimately, this research presents the range of horncore variation and statistically significant dental measurement overlap among many merycodont species and provides support for only 7 out of the originally recognized 22 species.

PRIMITIVE, OR JUST UNDERSTUDIED? PNEUMATICITY IN JURASSIC DIPLODOCIDS PARALLELED THAT OF CRETACEOUS REBBACHISAURS AND TITANOSAURS

Mathew J. Wedel[1,2], Julia B. McHugh[3], Anne Weil[4], Jessie Atterholt[1], Jean-Pierre Cavigelli[5], Brian Curtice[6], John R. Foster[7], and Rick Hunter[8]
[1]College of Osteopathic Medicine of the Pacific, Western University of Health Sciences, Pomona, CA, USA; [2]College of Podiatric Medicine, Western University of Health Sciences, Pomona, CA, USA; [3]Museums of Western Colorado, Grand Junction, CO, USA; [4]Department of Anatomy and Cell Biology, Oklahoma State University Center for Health Sciences, Tulsa, OK, USA; [5]Tate Geological Museum, Casper College, Casper, WY, USA; [6]Arizona Museum of Natural History, Mesa, AZ, USA; [7]Utah Field House of Natural History State Park Museum, Vernal, UT, USA; [8]Museum of Ancient Life, Lehi, UT, USA.

Pneumatic bones were a key adaptation in the evolutionary success of sauropod dinosaurs. Many pneumatic characters, including costal and caudal pneumaticity, evolved in parallel in the diverse clades Mamenchisauridae, Diplodocoidea, and Macronaria.

Our team identified numerous pneumatic features previously thought to be apomorphic for derived subclades of Cretaceous rebbachisaurs and titanosaurs in well-known Jurassic diplodocids. Vertebrae of *Apatosaurus* from the Mygatt-Moore Quarry (MMQ; CO) have internally pneumatized transverse processes and tiered internal chambers, as in saltasaurine titanosaurs. Pneumatic chevrons, only reported in a single saltasaurine, are present in specimens of *Barosaurus* from the Cleveland-Lloyd (UT), Bone Cabin (WY), and Nail (WY) quarries. Pneumatized dorsal ribs, not previously reported in diplodocines, are present in *Barosaurus* from

all those quarries and from the Homestead Quarry (OK), and in additional specimens of *Apatosaurus* from MMQ. Interestingly, prominent pneumatic fossae are present in many of the dorsal ribs of the *Diplodocus carnegii* holotype but have escaped description for 125 years.

That pervasive dorsal rib pneumaticity in the *D. carnegii* holotype was not described or coded for over a century suggests that pneumaticity in otherwise well-documented specimens has been systematically under-recorded. The developmental potential to pneumatize dorsal ribs and chevrons was likely present in ancestral eusauropods, considering the presence of pneumatic ribs and caudal pneumatic fossae in some mamenchisaurids. We expect continued research to reveal a higher degree of pneumatization throughout the tree than currently recognized. Current inferences regarding the origins and phylogenetic distributions of many pneumatic characters may fall well short of reality.

EVOLUTION OF FORELIMB SHAPE IN ICHTHYOSAURIFORMES

Audrey E. Weeks[1], Echo M. Malinowski-Cunningham[1], Mrdah Murali[1], Nathan B. Weinstein[1], and Lars Schmitz[1,2]

[1]Kravis Department of Integrated Science, Claremont McKenna College, Claremont, CA, USA; [2]Dinosaur Institute, Natural History Museum of Los Angeles County, Los Angeles, CA, USA.

Ichthyosauriformes are a clade of secondary marine reptiles that rapidly diversified in the Early Triassic. Initially characterized by an anguilliform locomotory mode, ichthyosauriforms subsequently evolved carangiform and thunniform swimming. Ichthyosauriform forelimbs are transformed into flipper-like paddles, with some paddles being short and wide while others are long and narrow. While axial locomotor evolution in ichthyosauriforms has been well studied, the evolutionary drivers of forelimb shape variation remain poorly understood. Based on observations in extant sharks and teleosts we hypothesized that thunniform ichthyosaurs, with presumably the fastest swimming speeds, had pectoral fins with the highest aspect ratio (AR). High AR has previously been shown to reduce transport costs.

We quantified forelimb AR (AR = span^2/planform area) across 31 ichthyosauriform taxa using 60 flippers measured from published literature and museum collections databases. Bony flipper outlines were tested as hydrodynamic proxies through a scaling relationship with exceptionally preserved soft-tissue specimens. Ichthyosaur forefins span a wide AR range, from 1.9 in *Grendelius alekseevi* to 6.3 in *Temnodontosaurus* sp.

High-AR forelimbs occur in phylogenetically and ecologically disparate taxa, including in the thunniform *Temnodontosaurus* and *Eurhinosaurus*, but also in *Xinminosaurus* and *Qianichthyosaurus*, Triassic non-thunniforms. These findings indicate that ichthyosauriform forelimb shape is not solely driven by locomotory mode. Additionally, similar high-AR morphologies arose through distinct osteological configurations (e.g., elongate radius/ulna and extreme hyperphalangy), suggesting potential convergent evolution via different anatomical pathways. Future phylogenetic comparative methods will clarify the co-evolutionary signals between morphological variation and specific ecological variables.

Funding: Claremont McKenna College

HIATAL CONTROL ON THE TURNOVER OF MAMMALIAN ASSEMBLAGES IN THE EOCENE WASHAKIE FORMATION, WY

Melissa C. Wood[1,2]

[1]Department of the Geophysical Sciences, University of Chicago; [2]Department of Paleontology, San Diego Natural History Museum.

One of the long-standing concerns of paleobiologists is in identifying major faunal turnovers in the fossil record, which are generally thought to arise as a response to exceptional climatic or environmental stress. However, prior to evaluating such possibilities, one should be confident that the stratigraphic pattern of taxonomic first and last appearances does not simply arise from hiatuses, or gaps in sediment accumulation, which can concentrate range endpoints along a single horizon. This challenge is especially pronounced for vertebrate fossil records in terrestrial settings, where fossil remains are typically scarce and, unlike marine settings, the sedimentary records are subject to long phases of sediment starvation or bypass and subaerial weathering. Here, I develop a framework for estimating the relative magnitude of hiatuses and test for the extent to which major hiatuses coincide with mammalian faunal turnovers in the Eocene Washakie Formation of Wyoming. I find that, while the formation contains signatures of high-magnitude, seasonally-variable flooding regimes that result in rapid deposition, nearly all range endpoints of mammalian genera are still associated with major hiatuses. In addition, some of the faunal turnovers that previously appeared to have occurred suddenly actually proceeded in a more stepwise and gradual fashion. The significance

of these findings extends beyond the Washakie record and creates a model for re-evaluating fossil records in other intermontane basins in the western United States.

Funding: Paleontological Society, Society for Sedimentary Geology

THEROPOD DINOSAUR TEETH FROM THE "MEGA MICRO SITE" IN THE "MESAVERDE" FORMATION (CAMPANIAN) OF PARK COUNTY, WYOMING

Claire Yu[1] and Andrew A. Farke[1,2]
[1]The Webb Schools, Claremont, CA, USA; [2]Raymond M. Alf Museum of Paleontology at The Webb Schools, Claremont, CA, USA.

Theropod dinosaur teeth are an important component of fossil assemblages from the Campanian-aged (~81–72 Ma) deposits of western North America, with notable occurrences in Alberta, Montana, Utah, Texas, and New Mexico. Recent fieldwork by the Raymond M. Alf Museum of Paleontology (RAM) in the "Mesaverde" Formation in Park County, Wyoming, adds new data on theropod distribution. In 2023, the "Mega Micro Site" (RAM locality V2023003) was discovered in the Bighorn Basin of the "Mesaverde" Formation, with a rich assemblage of vertebrate microfossils. Based on stratigraphy and the presence of helochelydrid turtles, the locality is likely middle Campanian in age. A large sample of matrix was screenwashed for microfossils; because processing is still underway, preliminary results are presented here.

Teeth are identified using overall shape, size and denticle count per millimeter. Tyrannosauridae and Dromaeosauridae Morphotype A (per terminology used for the San Juan Basin) dominate the overall assemblage, with three of each identified so far. One tooth was identified as *Richardoestesia gilmorei*. Both mesial and distal denticles were noted on all teeth, except for one dromaeosaurid tooth lacking mesial denticles. No troodontid teeth were observed in this sample, which is consistent with similarly aged sites elsewhere in North America. *Richardoestesia isosceles* has not yet been recovered, unlike the nearby "Quick Pocket" locality, which is slightly higher in section. Further research on theropod teeth from the "Mega Micro Site" will fill knowledge gaps about the temporal and geographic distribution of theropods in the Western Interior of North America.

Funding: David B. Jones Foundation; The Rogers Peccary Scholars program at The Webb Schools, supported by the Mary Stuart Rogers Foundation, supported Claire Yu's participation in this research.

ACKNOWLEDGMENTS

The Host Committee extends its gratitude to the following individuals and organizations who contributed to the success of the 2026 Western Association of Vertebrate Paleontology conference.

We are grateful to the staff of the Raymond M. Alf Museum of Paleontology (Andrew Colón, Diana Huizar, Iann Islas, Robert Schaefer) for their behind-the-scenes coordination.

Our thanks to the leadership of The Webb Schools and the teams in Facilities, Marketing & Communications, Security, and Tech for logistical support.

We are grateful to the Baganz Fund for supporting our keynote speaker and to *The Anatomical Record* for sponsoring the presentation awards.

Thanks to our symposium moderators (Robert Gay, Austin Lawrence, Brandon Peecook, Heather Smith) and presentation judges (Peter Kloess, Danielle Oberg, Lindsay Walker, Mathew Wedel) for volunteering their time and expertise.

We thank the Bureau of Land Management for granting the permit (CA-25-03P) for this year's WAVP field trip to Rainbow Basin, Barstow Formation.

A shout-out to every staff member and student who stepped in at the end of the evening to clear the venue and fold chairs, including but not limited to Andrew Huang, Cullen Townsend, and Stuart von Firley-Butler.

Our thanks to the Webb Security team for keeping the local bears at a safe distance throughout the event.

Finally, thanks to all the presenters for sharing their research, and to all attendees for their community spirit and participation.