American Ceratophryidae, thus continuing to pose difficulties with both biogeographic reconstruction and prior molecular divergence dates.

Romer Prize Session (Thursday, October 31, 2013, 9:15 AM)

EMPIRICAL AUTHENTICATION OF OUR UNDERSTANDING OF FLUVIAL TAPHONOMIC PROCESSES

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For decades analytical techniques like Voorhies Groups, bone orientation, and equivalent spherical quartz diameters have been used to interpret paleontological and archaeological skeletal assemblages. However, these methods incorporate untested assumptions concerning how bones behave in fluvial systems. A validation study was performed to determine if bones in rivers behave as predicted and determine if any of these techniques accurately predict skeletal assemblages moved and deposited by rivers. Over 7000 modern bones and 3686 bone casts were seeded in three rivers over four years, and bone movement and burial were tracked over time and space. Bone long axis orientations did not correlate with flow direction, though 75% of concave bones did orient concave down, and bones did not display Voorhies Group like transport behavior. Bones deposited in rivers were not found on sediment with equivalent grain sizes, and no consistent relative transportabilities (R) of bones were observable. Bone shape and density showed no consistent relationship to transport. Individual bone bulk density varied wildly as they became waterlogged, causing bones to float, hydrate, sink, and move stochastically. In addition, 56% of bones were deposited with woody debris, and many more were found in conjunction with bed obstructions. Field data suggests bone transport is governed by bone density (floating and hydration) while deposition is governed by bed interactions, demonstrating that existing analytical techniques are inadequate to describe fluvial bone transport behavior. Consequently, our existing understanding of fluvial taphonomic processes is incomplete suggesting that present fluvial taphonomic analytical techniques should be updated before use.

Poster Session III (Friday, November 1, 2013, 4:15 - 6:15 PM)

TRAUMATIC PATHOLOGIES IN THE POSTCRANIUM OF AN ADULT *ALLOSAURUS* SPECIMEN FROM THE MORRISON FORMATION OF THE HOWE QUARRY, WYOMING, U.S.A.

EVERS, Serjoscha, Ludwig-Maximilians-University Munich, Munich, Germany; FOTH, Christian, Bayerische Staatssammlung für Paläontologie und Geologie, Munich, Germany; RAUHUT, Oliver, Bayerische Staatssammlung für Paläontologie und Geologie, Munich, Germany; PABST, Ben, Sauriermuseum Aathal, Aathal, Switzerland; MATEUS, Octavio, Universidade Nova de Lisboa, Faculdades de Ciências e Tecnologia-CICEGe & Museo da Lourinhã, Lourinhã, Portugal

Adult large-bodied theropods are often found with numerous pathologies. A large, almost complete, adult *Allosaurus* specimen (Sauriermuseum Aathal [SMA] 0005) from the Howe Quarry, Morrison Formation (Late Kimmeridgian–Early Tithonian), Wyoming, shows a number of pathologies. Pathologic bones include the left scapula, several left dorsal ribs, the right ischium, and a left pedal phalanx.

A complete, transverse fracture occurs in the proximal part of the left scapula. The distal fragment is displaced and distorted in relation to the proximal fragment. The fracture does not show a callus structure as expected for a healed injury, but some secondary osseous connection to the distal fragment is apparent at the rupture point of the proximal fragment, resulting in a weak attachment. This is consistent with the formation of a pseudoarthrosis, which occurs as a delayed healing response in fractures that lack adequate stabilizing and are subject to frequent movement.

The distal part of the left scapula is fractured incompletely and transversely. The bone around the fracture is slightly thickened and roughened. The fracture is at approximately the same level as a series of transversely fractured left dorsal ribs. The presence of calli around the rib fractures and the alignment of the scapula and rib pathologies suggest that all may have been caused by a single traumatic event.

The right ischium suffered a complete, oblique fracture. Rough bone tissue covers the fracture on one side completely, while the other shows no sign of reactive growth.

A pedal phalanx has a hyperostosis at the dorsal and lateral sides of its proximal end, forming an ovoid callus, unlike the large irregular exostoses in phalanges of other *Allosaurus* specimens, including Museum of the Rockies specimen MOR 693 from the same quarry. The bone surface is roughened, but not rugose, and lacks lesions indicative for infections. This indicates bone resorption in an advanced healing stage of the injury.

All the pathologies show signs of healing, suggesting that none of them directly caused the death of the individual. This again underlines that large-bodied theropods experienced frequent traumatic injuries during life, an indication of an active lifestyle as a predator.

Technical Session I (Wednesday, October 30, 2013, 11:45 AM)

THE PERMIAN ARCHOSAUROMORPH RECORD REVISITED: A NEW SPECIES FROM TANZANIA AND THE POTENTIALLY OLDEST ARCHOSAURIFORM

EZCURRA, Martin D., School of Geography, Earth and Environmental Sciences, University of Birmingham, Birmingham, United Kingdom; BUTLER, Richard, School of Geography, Earth and Environmental Sciences, University of Birmingham, Birmingham, United Kingdom; SCHEYER, Torsten M., Paläontologisches Institut und Museum, Universität Zürich, Zurich, Switzerland

Archosauromorphs include all diapsids closer to crocodiles and birds than to lepidosaurs. The group has a very rich Mesozoic and Cenozoic fossil record, but the Paleozoic record is restricted to a handful of Late Permian specimens. The most informative Permian archosauromorph so far discovered is *Protorosaurus speneri* from the middle Late Permian of Western Europe. In addition, there are several less well-known putative archosauromorphs from Russia and Africa. We review these records here and include several of them in a quantitative phylogenetic analysis for the first time. This phylogenetic analysis included a broad taxonomic sampling of basal synapsids, basal diapsids and saurians. We could not find archosauromorph apomorphies in a supposed Late Permian proterosuchid cervical vertebra from South Africa (Bernard Price Institute for Palaeontological Research specimen BP/1/4220), and consider this specimen to belong to an indeterminate amniote. BP/1/4220 possesses striking features that are not present in other amniotes of which we are aware, such as posteriorly extended, wide and almost horizontally oriented accessory processes between the postzygapophyses. A problematic reptile (University Museum of Zoology, Cambridge specimen UMZC T836) from the Late Permian of Tanzania, first described in the 1950s, was recovered in the phylogenetic analysis as a protorosaur at the base of Archosauromorpha and is probably diagnosable as a new species. The position of UMZC T836 within Archosauromorpha is supported by the presence of three well-developed laminae in the cervico-dorsal neural arches and the absence of a humeral entepicondylar foramen. The supposed protorosaur *Eorasaurus olsoni* from the middle Late Permian of Russia was recovered within Archosauriformes, being more closely related to crown archosaurs than to proterosuchids, implying that this species may be the oldest known archosauriform. However, the fragmentary nature of the known material of this taxon and the low character support for this position means that this identification is currently tentative. *Archosaurus rossicus* from the latest Permian of Russia was found to be more closely related to *Proterosuchus fergusi* than to other archosauromorphs and represents a valid species. The revision conducted here suggests a minimum fossil calibration date for the crocodile-lizard split of 254.7 Ma. The occurrences of *Protorosaurus speneri* close to the paleo-Equator and UMZC T836 in high paleolatitudes of southern Pangea imply a wider paleobiogeographic distribution for archosauromorphs during the Late Permian than previously appreciated.

Poster Session IV (Saturday, November 2, 2013, 4:15 - 6:15 PM)

ONE FITS ALL: USING PHOTOGRAMMETRY TO SOLVE DIVERSE PROBLEMS WITH LARGE-SIZED PALEONTOLOGICAL OBJECTS

FAHLKE, Julia, Museum für Naturkunde, Berlin, Germany; MALLISON, Heinrich, Museum für Naturkunde, Berlin, Germany; WINGS, Oliver, Niedersächsisches Landesmuseum Hannover, Hannover, Germany; SCHWARZ-WINGS, Daniela, Museum für Naturkunde, Berlin, Germany

Photogrammetry is a method for creating three-dimensional (3D) surface models by aligning photographs of an object, originally used in architecture and mapping. With increasing computing power it has become a versatile method with a wide array of applications in paleontology. Several freeware or low-cost programs are available. Vertebrate paleontologists at the Museum für Naturkunde Berlin use Agisoft PhotoScan Professional and collaborate to enhance efficiency in using photogrammetry. Research examples presented here reflect typical paleontological problems and provide solutions for accurate 3D model production that can easily be adapted by colleagues facing similar problems. (1) Specimens that must remain in the field: dinosaur tracks from Münchehagen (Germany) show that rapid photo acquisition in consistent light conditions is required when covering large specimens outdoors. Sufficient surrounding surface should be covered to avoid model warping for long tracks. For precise mapping of large excavation sites (i.e., Dana Quarry) and documentation over several field seasons it is important to define and retain field markers over the entire documentation time. To limit file size, model creation can be split into chunks. (2) Specimens that are too large for manual measurements, immobile, and cannot be scanned using other equipment: photogrammetry of mounted skeletons for whole-body modeling illustrates the importance of post-processing. Thin bones require higher resolution than thicker ones, thus model creation settings need to be adapted individually. With elongate large objects like baleen whale skulls, depth of field can be problematic. One should avoid head-on photographs and pay particular attention to focusing. Creating partial surfaces and aligning them during post-processing can help. Surface smoothing is not recommended as it blurs morphological features used, e.g., in landmark-based analyses. (3) Specimens that are physically inaccessible: photogrammetry of a forelimb of *Janenschia* (Sauropoda) on exhibit behind glass allowed generation of 3D models for character analysis. Application of polarizing filters and directional light helped to minimize reflections. Bones of *Steneosaurus* (Crocodyliformes) from Holzmaden (Germany) that had to be protected from contact contamination could also be measured using a 3D model. Generally, one should avoid changes in lighting or white balance and use accuracy settings that match photograph resolution. Sufficient computing power is required to keep calculation times tolerable.

Poster Session II (Thursday, October 31, 2013, 4:15 - 6:15 PM)

EARLY SAUROPODOMORPH JAW APPARATUS ANATOMY: A COMPARATIVE STUDY WITH IGUANIAN LIZARDS

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Various genera of early sauropodomorph dinosaur, or "prosauropod", are argued to have ranged from omnivorous to herbivorous based on a ventrally offset jaw joint articulation, neck length, skull size, and a gastric mill, among other characters. One key analogy that has been used to infer omnivory and herbivory in early sauropodomorphs, however, is the shape and orientation of their dentition and their similarity to that of iguanian lizards, which are also known to range from omnivorous to herbivorous. To test the validity of the comparison, this study examines the temporal fenestrae and jaw musculature in herbivorous, omnivorous, and insectivorous iguanian models to predict jaw musculature for the plateosaurid *Plateosaurus engelhardti* and the anchisaurid *Anchisaurus polyzelus* with respect to diet. Dissections and skeletonization of the

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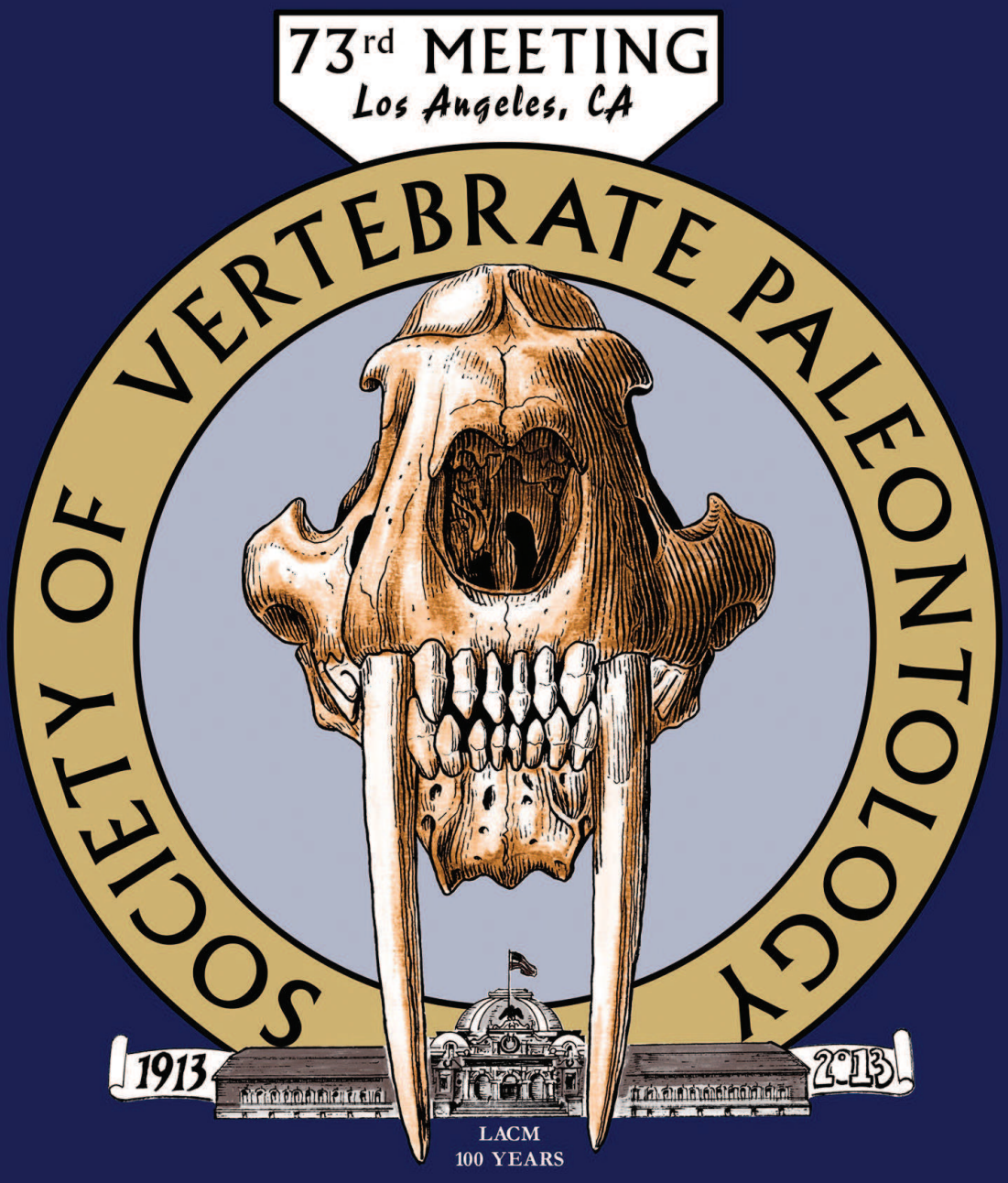
PROGRAM AND ABSTRACTS



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