MEETING PROGRAM & ABSTRACTS

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SOCIETY OF VERTEBRATE PALEONTOLOGY

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Poster Session III (Friday, November 7, 2014, 4:15 - 6:15 PM)

TARICHA OR _PALAEOTARICHA_? THE EVOLUTIONARY ENIGMA OF NORTH AMERICAN NEWTS

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The evolution and divergence of North American newts *Taricha* and *Notophthalmus* is poorly understood because we lack a fossil record that shows the morphological transitions between the distinct morphologies of these genera. Our recent morphologic analysis of some previously undescribed salamander fossils from the Oligocene of North America and reexamination of existing fossil *Taricha* indicates that these fossils show a distribution of characters that may imply an ancestral relationship with at least one, and possibly both, genera of North American newts. Features of the skull, scapulocoracoid, vertebrae, and ribs in these partial to near-complete skeletons may warrant a generic distinction from *Taricha* and *Notophthalmus* and answer long-standing questions about the ancestral morphology of these salamandrid genera. We measured several features, including the degree of expansiveness on the dermal caps of vertebrae, height of the neural spine relative to length, amount of sculpturing on the skull, especially the frontosquamosal arch, and the length of uncinate rib processes and found divergent morphologies characteristic of divisions at the generic level. *Taricha* is characterized by a lack of dermal caps on the vertebrae, moderate neural spines, little skull and frontosquamosal arch sculpture, and short uncinate rib processes. *Notophthalmus* differs in possessing small dermal caps, distinctly high neural spines, little sculpturing, and short uncinate processes. The proposed genus exhibits large dermal caps, high neural spines, apparent skull and frontosquamosal arch sculpturing, and long, robust rib processes, but shares a number of other characters with extant *Taricha*. We also examined the Oligocene salamander, *Taricha lindoei*, which may either represent the earliest occurrence of the modern *Taricha* group or a juvenile member of the aforementioned ancestral group. Given the well-known global decline in amphibians due to climate change, human activity, invasive species, and other such factors, even the most successful groups of amphibians are unlikely to escape unscathed. A better understanding of the evolutionary and ecological history of North American salamandrids is therefore necessary to maximize the success of conservation strategies.

Technical Session II (Wednesday, November 5, 2014, 9:00 AM)

CENOZOIC VERTEBRATES OF COASTAL ANGOLA

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The puzzle-like fit of Africa and South America and their subsequent drift have been geophysically modeled to improve the fit and trace their paths. The results have been correlated with patterns of sedimentation and pCO_2 mitigated climatic change, but the effects on vertebrate life and their global context have been inordinately neglected. Coastal Angola preserves a remarkable 85 million year Cretaceous and Cenozoic record of vertebrate life as Africa drifted from South America to form the growing South Atlantic Ocean. Geologic structure and latitudinally changing climatic regimes due to northward drift provide a nearshore record not available elsewhere on either side of the Atlantic. The Paleogene sequence in the northern Angolan province of Cabinda is unique because it produces fragmentary terrestrial mammals, and the southern provinces of Kwanza Sul and Benguela produce Neogene whales. In Cabinda, we have traced the stratigraphy between Landana and Malembo Point, Paleocene to near the Mio–Pliocene boundary, and sampled these deposits for pollen, stable isotopes, detrital zircons, magnetostratigraphy, and for U/Pb dating of bones, teeth, and coprolites. Although the faunas are dominated by sharks and rays, new discoveries from Landana include a complete cheloniid skull, a small snake vertebra, and a bird bone. Discoveries from the Malembo level include a narrow-snouted crocodyliform similar to *Congosaurus* and *Euthecodon*, an arsinoithere anterior tooth, an upper molar similar to that of the ptolemaiidan *Kelba*, an unidentified mammalian incisor, and a large primate-like premolar. Unconformities in the Cabinda section indicate two intervals of fossiliferous ravinement correlated with growth of the Antarctic ice sheet. In the Kwanza and Benguela basins, Miocene and Pliocene localities have produced two taxa of neobalaenid whales.

With the northward drift of Africa since the Cretaceous, latitudinally controlled climatic zones were displaced southward, moving once arid latitudes into tropical climes and restricting temperate latitudes to a small portion of southern Africa. Upwelling, usually considered to have originated with the Miocene Benguela Current, has a much longer history that facilitated an abundance of marine amniotes throughout the Late Cretaceous to the present day. The adjacent arid zones have shaped the distribution of the modern biota through the effects of climatic isolation and restriction.

Poster Session III (Friday, November 7, 2014, 4:15 - 6:15 PM)

BEYOND PHOTOGRAMMETRY: NEW METHODS FOR FOSSIL DIGITIZATION APPLIED TO THE UPPER JURASSIC PTEROSAUR _SCAPHOGNATHUS CRASSIROSTRIS_

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Within the last 20 years, capturing 3D geometry and simple texture has become a standard technique for digitizing fossils. However, texture only describes object surface color. Hence, surface reflectance behavior, which incorporates the change in color values due to variations in viewpoint and lighting conditions, is not adequately captured by current methods although it may provide important insights.

We address this problem by capturing and digitally reproducing soft tissue preservation of the holotype of the rhamphorhynchoid pterosaur *Scaphognathus crassirostris* from the Upper Jurassic Solnhofen lithographic limestone. This specimen is famous for the first description of hair-like structures and wing membrane impressions. While Solnhofen fossils commonly preserve soft tissues, visualization is often challenging. We use two novel methods previously applied to digitizing cultural artifacts. One method is Reflectance Transfer Imaging (RTI), which displays surface appearance and relief under various light directions. The other is Bidirectional Texture Functions (BTFs), which describe the local surface appearance depending on the local surface point as well as direction of view and direction of light. RTI captures surface reflectance behavior by taking multiple photographs with a static camera under varying illumination conditions. This allows inspection of a 2D digital model of the object from a fixed viewpoint using synthetic light source positions, as well as synthetic modification of surface reflective behavior. BTFs additionally visualize surface reflectance properties from variable viewpoints. In our state-of-the-art approach, BTF measurements are typically combined with structured light-based techniques for 3D geometry acquisition. Actively illuminating the physical object is achieved by projecting certain patterns, in our case a series of reflected binary codes (Gray codes), onto the surface. An array of cameras observes these patterns, and correspondence between the different views of the object can be established. The result of BTF computation is a 3D digital model for which both viewpoint and light direction can be varied by the observer.

The advantage of RTI is its relatively low computing power requirements; the disadvantage is the 2D model. BTFs, on the other hand, offer the 3D model of other digital capture methods such as laser surface scanning and photogrammetry and combine them with variable object illumination, but the method requires extensive computing power and is still under development.

Poster Session IV (Saturday, November 8, 2014, 4:15 - 6:15 PM)

3D RECONSTRUCTION OF THE ENDONEUROCRANIAL SHAPE OF A BASAL TYRANNOSAUROID

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The body proportions of the derived tyrannosaurids contrast with those of their predecessors such as the Late Jurassic *Guanlong wucaii* and the Early Cretaceous *Dilong paradoxus* from China. Enormous differences in size might have affected their predatory behavior and locomotion skills controlled and coordinated by the central nervous system. The endoneurocranial (EDN) morphology of *T. rex* is now well known. In this study we have verified the recent interpretation of *T. rex* endocasts using 3D visualization of the complete braincase of the specimen called 'Sue' (FMNH PR 2081). The brain cavity of *T. rex* has rather a tubular form with two major expansions. The first corresponds to the cerebral region that expanded laterally. The other refers to the laterally compressed cerebellar region of the endocast expanded dorsally. While the endocast is well-regionalized rostrally into spaces that accommodated large olfactory bulbs, relatively short tracts, and cerebral hemispheres, the post-cerebral endocast is somewhat amorphous except for tiny floccular protrusions and outlets of the cranial nerves and vascular structures. We also confirm the finding that the olfactory region of the nasal cavity was misinterpreted for olfactory bulbs in previous studies. EDN proportions prior to the evolution of gigantism in tyrannosauroids were studied using coronal micro-CT scans of a *Dilong* specimen with a nearly complete skull (IVPP V14243). Segmentation of the EDN was complicated by dislocation of neurocranial bones, incomplete hypophysial region, and intrusion of cranial bone fragments into the braincase cavity. The rendered endocast reveals numerous deformations due to multidirectional shifts of major brain compartments. Therefore we applied recombination of continuous EDN regions and a mild retrodeformation to restore bilateral symmetry of the objects. We have found that the restored endocast of *Dilong* substantially differs from that of *T. rex* by multiple features. It is rostro-caudally short with expanded hemispheric spaces that partly superimpose on the rest of the endocast. The most striking feature is enormous size of the flocculus. The endocast lacks any tracks of large head veins, and terminates abruptly behind the large cerebellum. We conclude that *Dilong* endocast accommodated a brain with morphology similar to maniraptoran theropods. Funded by a grant from the Czech Science Foundation (P302/12/1207).

Symposium 2 (Thursday, November 6, 2014, 3:00 PM)

LOCOMOTION IN EXTINCT GIANT KANGAROOS: WERE STHENURINES HOP-LESS MONSTERS?

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Sthenurine kangaroos (Marsupialia, Diprotodontia, Macropodiformes) are an extinct subfamily within the extant family Macropodidae (kangaroos, wallabies, and tree-kangaroos). These ‘short-faced’ browsing kangaroos first appeared in the middle Miocene, and radiated in the Plio–Pleistocene into a diversity of mostly large-bodied forms more robust than extant forms in their proportions. The largest (*Procoptodon goliah*) had an estimated body mass of 240 kg, three times that of the largest extant kangaroo, and there is speculation as to whether this animal was biomechanically capable of hopping locomotion. Previously described aspects of sthenurine anatomy (specialized forelimbs, relatively rigid lumbar spine) would limit their ability to perform the characteristic kangaroo pentapedal walking (using the tail as a fifth limb), an essential slow gait as slow hopping is energetically unfeasible. To investigate sthenurine anatomy in comparison with extant kangaroos, we took 94 linear measurements of the hind limb bones of macropodoids (kangaroos and rat-kangaroos), 67 individuals (45 taxa) of extant forms, and 66 individuals (19 taxa) of extinct ones, which were subjected to bivariate and multivariate analyses. The scaling of long bone dimensions indicates that sthenurines are