

MEETING PROGRAM & ABSTRACTS



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allow us to appraise the plausibility of bird-like display behaviors in *Citipati*. Our methodological framework therefore has exciting potential applications in assessing tail function within theropods (including early birds) and other dinosaurs and vertebrates.

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

REVEALING THE UNSEEN: COMPUTED MICRO TOMOGRAPHY SCANNING AND 3D RECONSTRUCTION OF A LOWER CRETACEOUS (BARREMIAN) SYMMETRODONT SKULL

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We present the 3D reconstruction of a partial skull of a zhangheotheriid symmetrodont from the Yixian Formation (Jehol Group) in Northeastern China. The exact locality of the three-dimensionally preserved specimen which is housed in the Yizhou Fossil & Geology Park (Guangxi, China), is not known. The right mandible including eight teeth, the right maxilla with two teeth and fragments of the cranium are preserved and were transferred to a plastic matrix during preparation. We used x-ray computed micro tomography (μ CT) and virtual image rendering software (Avizo) to study and reconstruct the partial skull in detail. The anterior tip of the mandible including the incisors and the canine are not present as well as the dorsal tip of the mandible's coronoid process. The maxilla is almost complete with only the anterior tip missing and all teeth except for two broken molars are not preserved. Using the software Polyworks, broken and dislocated elements of the mandible, maxilla and teeth were reoriented and gaps were closed. The cranium is fragmentary and only a part of the right squamosal bone could be identified with certainty.

The dental formula is $I^1 C1 P2 M4/i^0 c1 p3 m5$. There is no indication for developing teeth inside the mandible or maxilla and deciduous teeth were not detected. According to the almost unworn teeth, the specimen is a young adult one.

Regarding the tooth morphology and shape of the mandible, the specimen can be attributed to Zhangheotheriidae. Three synapomorphies indicate that it is closer related to *Maothierium* than to *Zhangheotherium*. These are: (1) the position of the incisura mandibular above the alveolar margin as in *Maothierium sinense*; (2) the anterior position of the dorso-posterior end of the coronoid process relative to the dentary condyle; and (3) the deep ectoflexus of the upper molars as in *M. sinense* and *Maothierium asiaticum*. Except for one lower molar position less the new specimen closely resembles *M. sinense*.

Symposium 3 (Friday, November 7, 2014, 9:00 AM)

EFFECTS OF NON-RANDOMLY DISTRIBUTED MISSING DATA IN PARSIMONY AND BAYESIAN ANALYSES

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The use of Bayesian analyses of paleontological data matrices has increased in recent years and the potential advantages of this approach have been advocated in the literature, such as statistical properties of the estimates and its natural integration with Bayesian molecular clock estimates. Sample cases have been discussed given they resulted in disparate topological results in comparison with parsimony analyses, such as the recently discussed phylogenetic position of *Archaeopteryx* and its affinities with basal avialans. All these applications of Bayesian phylogenetic analyses of morphological data are based on the assumption that all characters evolve through a homogeneous Markov model, the Mk model that is a generalization of the simplest model used for nucleotide substitutions (Jukes-Cantor model).

Despite the adequacy of this model for treating morphological data, paleontological datasets are characterized by the presence of abundant missing data. The distribution of missing data in paleontological data matrices is non-random, and is usually concentrated on highly incompletely scored taxa and highly incompletely scored characters. Recent studies using both empirical and simulated data matrices have shown that probability-based methods (including Bayesian analysis) can be affected by the presence of abundant missing entries. However, the impact of these problems for paleontological matrices has not been thoroughly studied yet.

Here I present a study on the effect that non-randomly distributed missing entries have on a set of empirical data matrices of morphological characters and assess the impact on the type and quantity of missing data for Bayesian analysis in comparison with parsimony analysis. The sensitivity of both methods is compared in terms of the topological results obtained under different regimes of quantity and distribution of missing entries, as well as on their support measures (posterior probabilities in Bayesian analysis and bootstrap frequencies for parsimony analysis). The results of these analyses show that both methods can be highly sensitive to the presence of non-randomly distributed missing entries, in particular for the case of highly incompletely scored taxa. However, a major difference in the results of both methods is found in the obtained support measures, which indicate an overestimation of credibility measures for the position of highly incomplete taxa in Bayesian analyses.

Technical Session IX (Thursday, November 6, 2014, 2:00 PM)

GEOLOGY AND PALEOECOLOGY OF A MARINE VERTEBRATE BONEBED FROM THE LOWER MAASTRICHTIAN OF ANGOLA

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A spatially and temporally restricted horizon at Bentiaba, Angola (14.3°S) preserves a concentration of skeletons and isolated elements representing sharks, rays, bony fish, at least three species of turtles, two species of plesiosaurs, at least five species of mosasaurs, and rare volant and terrestrial vertebrates. The concentration formed on a narrow

continental shelf that evolved as a passive margin along transform faults associated with the opening of the South Atlantic. The locality formed at a paleolatitude of 24°S, predicted by paleomagnetic data, a latitude that falls today along the coast of northern Namibia, an area of intense upwelling along a hyperarid coastal desert. Massive bedding with no hummocky cross-bedding indicates deposition below storm wave-base. Sediment at the locality is an immature feldspathic sand, derived from nearby exposed granitic shield rocks, based on detrital zircon ages. Temporal control is provided by magnetostratigraphy and stable carbon isotope chemostratigraphy anchored by an Ar^{40}/Ar^{39} radiometric date on basalt, constraining the age of the deposit to chron C32n.1n, between 71.4 and 71.64 Ma. $\delta^{18}O$ analysis of bivalve shells indicates a water temperature of 18°C. Nearest neighbor distance between fossils peaks at 5 m ($n=192$, range = 0 to 35 m, mean = 8.487, $\sigma = 6.475$), and fossils lack linear orientation as in a strand or concentration by transport agent, but instead display a scattered distribution over the sea floor. Specimens vary in completeness and degree of scavenging, but none show evidence of prolonged exposure on the sea floor. The bonebed is attritional, evidenced by rare dinosaur and pterosaur elements in an otherwise marine assemblage. Gut contents, scavenging marks, and associated shed shark teeth indicate biological association due to feeding activities among marine species. Short time duration and taxonomic stability of the fauna indicates accumulation at ecological, as opposed evolutionary time scales. Tooth form, body-size disparity, and $\delta^{13}C$ values of tooth enamel indicate a variety of foraging areas and dietary niches. Relative abundance of taxa based on shed teeth and carcasses contrasted with $\delta^{13}C$ data shows the area was a foraging ground for diverse species, including the durophagous *Globidens phosphaticus*, small piscivorous forms such as *Halisaurus* sp. and *Platecarpus ptychodon*, and abundant *Prognathodon kianda*, which fed on other mosasaurs at the locality, while other taxa such as *Mosasaurus* sp. and two elasmosaurid species were transient opportunistic feeders in the area.

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

SELECTION OR GEOGRAPHIC SORTING IN THE ESTABLISHMENT OF ECOMETRIC PATTERNS: INTRASPECIFIC VARIATION AND ENVIRONMENT IN CARNIVORAN ANKLE MORPHOLOGY

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Species distributions are influenced by geographic heterogeneity in environments: organisms must have traits appropriate for local conditions in order to persist. Arboreal limb specializations, for example, function well in wooded landscapes but not in open grasslands; consequently, locomotor morphology in mammalian carnivore assemblages is geographically correlated with vegetation cover at continental scales. The mechanisms by which such trait-based sorting arises are poorly understood. In principle, correlations between trait and environment can arise by three non-exclusive processes: (1) natural selection of local populations toward a local optimum; (2) geographic sorting of species into local environments compatible with their traits; (3) geographically selective extinction in environments that become incompatible with traits. The first process produces trait changes after exposure to a local environment, and it is therefore expected to generate intraspecific variation in the functional traits of species that are distributed across more than one environment. The other two processes sort species only into compatible environments and thus do not promote intraspecific trait heterogeneity.

We studied intraspecific variation in the locomotor morphology of the carnivoran calcaneum to determine whether local selection is likely to be a factor in species sorting. We collected data from five widespread modern species: *Canis latrans* ($n = 117$), *Urocyon cinereoargenteus* ($n = 134$), *Lynx rufus* ($n = 46$), *Mustela frenata* ($n = 60$), and *Procyon lotor* ($n = 141$). Intraspecific variation was compared to average ankle morphology in carnivoran assemblages across North America. The total variation within these species was, on average, about half as much as the variation among species ($SD = 0.04$ and 0.07 respectively). Ankle morphology differed regionally in *L. rufus* ($p = 0.01$) and marginally so in *P. lotor* ($p = 0.09$) and *U. cinereoargenteus* ($p = 0.08$), but not in *C. latrans* ($p = 0.96$) or *M. frenata* ($p = 0.53$). In no species was there a significant correlation between intraspecific variation and variation in the average morphology in the assemblage. These data suggest, therefore, that ecometric sorting is a process that does not involve selection in local populations within species, but rather sorting of species as wholes. These results are consistent with previous data which suggested that geographic reorganization of species in the Quaternary has happened at a more rapid pace than evolutionary change in their morphology.

Poster Session II (Thursday, November 6, 2014, 4:15 - 6:15 PM)

TRACKING DINOSAURS ON THE ISLE OF WIGHT

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Dinosaur footprints have been reported from the Lower Cretaceous rocks of the Wessex Sub-basin of the Isle of Wight, England for over 150 years. In the past, documentation of both tracks and sites has been sporadic, and as a consequence the context of these ichnofossils is poorly understood. However, recent research has set out to record tracks and trackways using both traditional techniques and new methodologies including photogrammetry, which allow the accurate and permanent recording of tracks, trackways and sites as 3D data - ichnites that might otherwise be lost due to natural processes such as weathering, erosion, the action of the dynamic marine environment they are found in or human activity. Here we present a review of the dinosaurian ichnological resources of the Isle of Wight including the sites and ichnotaxa that can be found within the formations of the Wessex Sub-basin.

This research draws on data collected over several years from the Wealden outcrops at Compton and Brighthelm Bays on the south-east coast of the island and at Yaverland on the west coast, and includes tracks from both the Wessex and Vectis Formations.