

NBOHC at 1.89 eV, tetravalent Ti at 2.75 eV and trivalent Al at 3.19 eV. Therefore, an integral intensity of each emission component was employed as an indicator to characterize the eolian sediments in this area. It indicates an availability of quartz CL. The results imply that most of quartz grains are relocated in the same group of the layers, suggesting the formation of eolian sediments with lithologically cognate rocks in similar supply and sedimentary processes during a geological age.

Further application of CL spectral analysis in the present study has been made to identify the locality of illegally collected fossils in the Gobi desert using the quartz grains attached to the fossils. Babies from a nest of *Protoceratops* stored in the Mongolian Paleontological Center can be estimated to be from the area around Tugrikin Shireh, judging from the result obtained by a discriminant function analysis of quartz CL. Therefore, this method employed by CL spectral analysis of quartz grains is expected to be applicable to the study of the fossil provenance as well as stratigraphic investigation.

#### Grant Information

JSPS KAKENHI Grant-in-Aid for Young Scientists (B) (15K21541)

Poster Session II (Thursday, October 15, 2015, 4:15 - 6:15)

#### THE FOSSIL RECORD OF TESTUDINES FROM ANGOLA FROM THE TURONIAN TO OLIGOCENE

MATEUS, Octávio, University Nova de Lisboa, Lisboa, Portugal; JACOBS, Louis L., Southern Methodist University, Dallas, TX, United States of America; POLCYN, Michael J., Southern Methodist University, Dallas, TX, United States of America; MYERS, Timothy S., Southern Methodist University, Dallas, TX, United States of America; SCHULP, Anne S., Naturalis Biodiversity Center, Leiden, Netherlands

The fossil record of testudines from Angola was poorly known prior to the field work conducted by the PaleoAngola Project, with the exception of the bothremiid pleurodiran *Taphrosphys congolensis* collected about a century ago from Paleocene-Eocene strata near Landana (Cabinda enclave).

Recent collecting efforts provided the basal eucryptodiran *Angolachelys mbaxi* from the Turonian of Iembe (Bengo Province) that represents the first marine eucryptodiran from Africa. The holotype is based on a skull and postcranial fragments. Here we report a new specimen from the type locality with well-preserved skull, and more complete carapace and limbs. Outcrops of the upper Campanian to lower Maastrichtian Mucuo Formation at Bentiaba (Namibe Province) preserve a rich assemblage of marine chelonians, including a very large *Protostega* sp. (with humeri, 2 costals, and plastron; estimated carapace width ~2.0 meters), *Toxochelys* sp. (peripherals, costals, carapace), and *Euclestes* (based on skull, jaw, limbs and peripherals) but distinct from other *Euclestes* based on the possession of anteriorly expanded pterygoids, prefrontals much longer than wide, and prefrontal-postorbital contact excluding the frontal from the orbit. Lower Paleocene deposits near Landana have recently yielded a new chelonoid turtle skull.

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

#### A NEW JUVENILE SUBFOSSIL CROCODYLID FROM THE ANJOHIBE CAVE, NORTHWESTERN MADAGASCAR

MATHEWS, Joshua C., Northern Illinois University, DeKalb, IL, United States of America, 60115; SAMONDS, Karen E., Northern Illinois University, DeKalb, IL, United States of America

Madagascar's subfossil record preserves a diverse community of animals including elephant birds, pygmy hippopotamus, giant lemurs, turtles, crocodiles, bats, rodents, and carnivores. These assemblages give us a window into the island's past from ~80,000 years ago to a mere few hundred years ago, recording the extinction of some groups and persistence of others. The crocodylian subfossil record is limited to two taxa, *Voay robustus* and *Crocodylus niloticus*, found at several localities throughout the island. *V. robustus* is extinct while *C. niloticus* is still found on the island today. Whether these two species overlapped in time or *Voay* was driven to extinction by *Crocodylus* remains unknown. While their size and presumed behavior was similar to each other, little is known about their growth and development, as the overwhelming majority of specimens represent mature adult individuals.

Here we describe a nearly complete juvenile crocodylian specimen from Anjohibe Cave, northwestern Madagascar. The specimen is tentatively referred to *C. niloticus* based on the lack of squamosal horns, oval shaped internal choana, and long narrow snout. However, as there are no juvenile specimens known of *Voay robustus*, it is difficult to eliminate the possibility that some of the defining characteristics of that genus may have changed through time. Fossils include a nearly complete skull and many postcranial elements (cervical, thoracic, sacral, and caudal vertebrae, pectoral elements, pelvic elements, forelimb and hindlimb elements, osteoderms). *C. niloticus* currently inhabits Madagascar but is locally extinct from this region; radiometric dating indicates an age of ~460–310 years BP. This specimen is clearly a juvenile based on the extremely small size and open sutures/detached neural arches. Based on the size of the skull, total body length is estimated to be ~1.1 m in length (modern adults of this species range from ~4–6 m). This fossil represents the only juvenile subfossil crocodylian specimen reported from Madagascar, and helps reconstruct details of crocodylian growth and development that would otherwise be unknown.

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

#### QUANTITATIVE ANALYSIS OF AQUATIC ADAPTION IN OLFACTORY AND OPTIC CHARACTERS IN THE SKULL OF CARNIVORA

MATSUI, Kumiko, the University of Tokyo, Tokyo, Japan; KAWABE, Soichiro, Gifu Prefectural Museum, Seki, Japan; ENDO, Hideki, University Museum, the University of Tokyo, Tokyo, Japan; KOBAYASHI, Sara, University Museum, the University of Tokyo, Tokyo, Japan; TSUIHJI, Takanobu, the University of Tokyo, Tokyo, Japan

Carnivora includes several clades adapted to aquatic lifestyles. Such clades show various habitats, ranging from fresh water river to deep sea. Previous studies have shown that the skull morphology of aquatic carnivorans is influenced by their lifestyle, which produces variation in the size of sensory organs. Some studies found several features reflecting adaptations to aquatic environments, such as the decreased size of the olfactory bulbs and enlarged optic organs, although most such studies lacked a rigid statistical

analysis. A quantitative evaluation of such features in extant carnivorans, especially the correlation between the sizes of these sensory organs and habitats, provides key information on the degree of aquatic adaption in extinct carnivorans. Accordingly, we quantitatively analyzed the relationship between the sizes of the olfactory bulbs and optic organs and the degree of aquatic adaption in extant carnivorans including 43 species of terrestrial, semi-aquatic, and aquatic clades. Based on CT data of skulls of these species, virtual skulls and brain endocasts were constructed using the software Amira. The volumes of the olfactory bulbs relative to the entire brain, the area of the orbit, and the area of the optic nerve canal were measured. The correlation between these morphological parameters and habitat environments was assessed using a statistical method.

As a result, the volume of the olfactory bulbs, orbital area, and area of the optic nerve canal were significantly different between the terrestrial and aquatic species. The olfactory bulbs of aquatic and semi-aquatic species were significantly smaller than those of terrestrial species. Furthermore, the olfactory bulbs of aquatic species were smaller than those of semi-aquatic species. Additionally, the more adapted to an aquatic environment these species were, the smaller their orbital area and area of their optic nerve canal became.

These results demonstrate that the volume of olfactory bulbs, orbital area, and area of optic nerve canal all significantly reflect adaptations to the aquatic environment, with the size of these morphological features becoming increasingly smaller in more aquatic species. Accordingly, the sizes of olfactory and optic organs can be used as reliable proxies of the degree of aquatic adaptations in extinct carnivorans.

Technical Session V (Wednesday, October 14, 2015, 3:45 PM)

#### BAYESIAN TIP-DATING WITH CONTINUOUS CHARACTERS USING BEASTMASTER

MATZKE, Nicholas J., Univ. of Tennessee, Knoxville, TN, United States of America, 37919

Bayesian 'tip-dating' is a method for simultaneously inferring the topology and dating of a phylogeny by including fossils as dated tips and conducting a total-evidence analysis, for example in the program BEAST2. Tip-dating is being actively explored, but all work to date has only used discrete (qualitative) characters for fossil tips. However, continuous (quantitative) characters are often available for fossil specimens, and ideally tip-dating analyses would include these as well. To enable such analyses, continuous-data capabilities were added to the R package BEASTmasteR. BEASTmasteR takes a data table of continuous traits and converts them into BEAST2 XML format, adding these characters to any DNA, amino acid, and/or discrete morphological data that is available. The likelihood of continuous traits on the tree is calculated using the Brownian motion model available in BEAST2 through modification of BEAST2's two-dimensional continuous phylogeography model into a one-dimensional model for any trait. Each trait is given a separate rate parameter that is also estimated. To test the validity of the model, continuous characters were simulated on an assumed tree (derived from a dated canid tree) with 22 tips (both fossil and living) under a Brownian motion model. Sets of 10, 25, or 100 continuous characters were generated and BEAST2 XML files were constructed using BEASTmasteR. Each BEAST2 inference was run for 50,000,000 generations. Inference on 10- or 25-character datasets converged quickly on the true tree, with the 25-character dataset showing higher posterior probabilities for many clades (only 4 branches with <50% posterior probability, PP) than the 10-character dataset (10 branches with <50% PP). Dating uncertainty also decreased by about 30%. However, the 100-character dataset failed to converge, perhaps because of the difficulty of jointly searching tree space and 100 rate parameters. The implications for practical analysis will be discussed, including the importance of the assumptions of independence between characters and independent rates. BEASTmasteR performance indicates that it should be helpful to researchers exploring continuous data: BEAST2 XML setup with continuous data takes <1 minute in BEASTmasteR, but at least 4 hours for an experienced user constructing the XML input by hand.

Technical Session VI (Thursday, October 15, 2015, 9:15 AM)

#### VERTEBRATE DIVERSITY AND OCEANIC ANOXIA IN THE POSIDONIA SHALE OF THE SOUTHWEST GERMAN BASIN (LOWER TOARCIAN, LOWER JURASSIC)

MAXWELL, Erin, Staatliches Museum für Naturkunde, Stuttgart, Germany; DICK, Daniel, Staatliches Museum für Naturkunde, Stuttgart, Germany

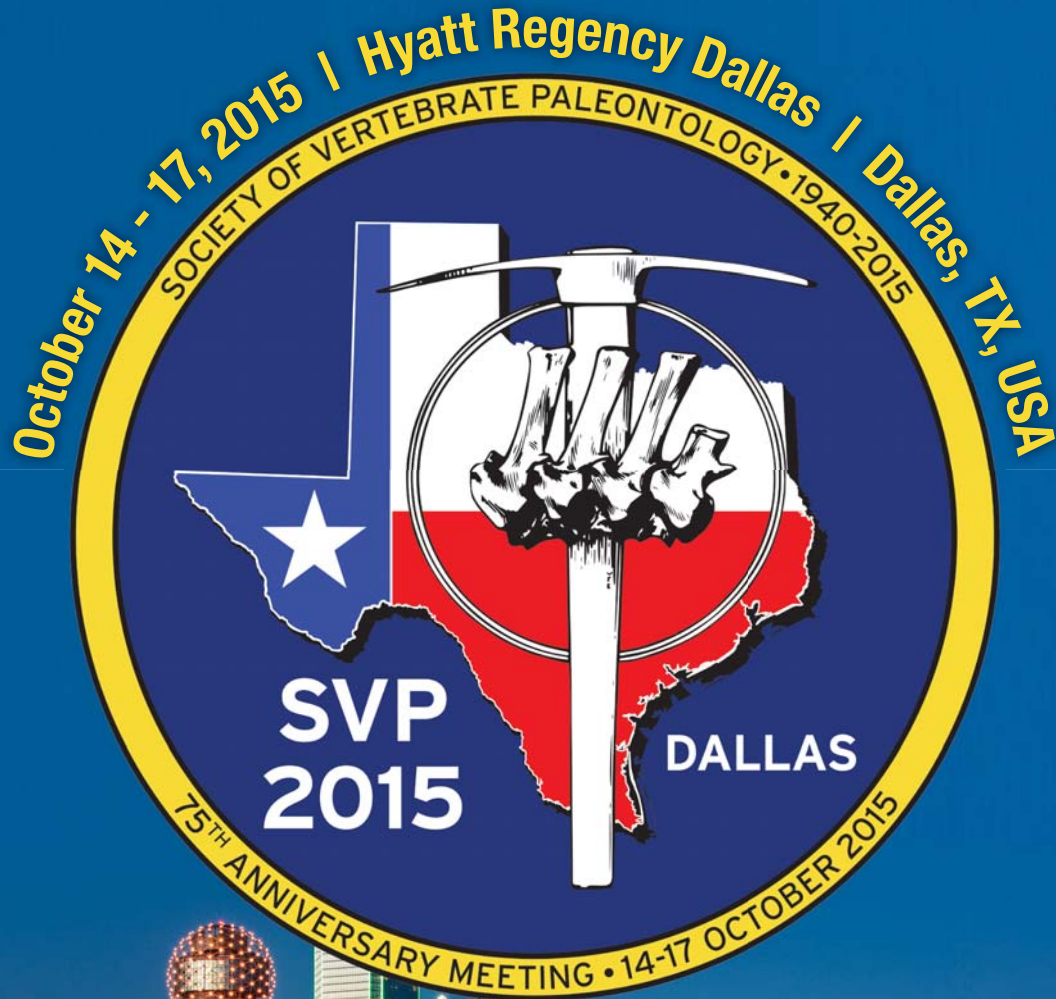
The early Toarcian Oceanic Anoxic event (e-TOAE), a minor invertebrate extinction event, coincided with the deposition of black shales in epicontinental basins and a marked rise in seawater temperature among other abiotic changes. In the Southwest German Basin, the Posidonia Shale provides a record of this event in marine sediments. We surveyed existing museum collections in the context of a regional stratigraphic framework to examine major biases and assess the relationship between the vertebrate fossil record and documented abiotic changes in the Posidonia Shale of the southwest German Basin. We hypothesize that the e-TOAE will be marked by changes in both the fish and marine reptile faunas, and will have a greater effect on these faunas than the development of benthic anoxia.

The development of oceanic anoxia is positively correlated with preservation potential, and varies through the section. In order to account for this bias, we report changes in the relative abundance of fish rather than absolute number of individuals. A museum acquisition bias in favour of rare genera makes this correction unreliable for the marine reptiles. Throughout the Posidonia Shale, few fish smaller than 50 mm in length have been recovered, implying a bias against either collection or preservation of small individuals. In spite of excellent preservation, systematic biases are present in preservation and recovery of Posidonia Shale vertebrate fossils.

The composition of the fish fauna appears to have been strongly affected by oxygen availability, with changes corresponding to measures of benthic anoxia rather than to the e-TOAE. Larger predators, such as most pachycormids and the shark *Hybodus*, become rare during maximum anoxia. In contrast, small fishes (< 100 mm length) and the small pachycormid *Euthynotus* become proportionately abundant suggesting higher tolerance for dysoxic conditions, possibly related to adult body size. Marine reptiles (ichthyosaurs



# SVP 75th Annual Meeting



## Meeting Program & Abstracts