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

HYSTRICOGNATHOUS RODENT ASSEMBLAGE FROM A NEW EARLY OLIGOCENE VERTEBRATE LOCALITY: ZALLAH 7, SIRT BASIN, LIBYA

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Several fossiliferous sites have been documented in the Oligocene 'Continental and Transitional Marine Deposits' in the vicinity of Zallah Oasis, southern Sirt Basin, central Libya. The Paleogene sequence exposed in this area corresponds to nearshore to continental late Paleogene sediments overlying the marine Eocene Wadi Thamat Formation. The survey conducted in January 2013 near Zallah resulted in the discovery of several new localities. Our most productive locality, Zallah 7, which is also called the Incision Locality, has yielded a diverse vertebrate fauna including sharks, rays, bony fishes, crocodilians, sirenians, hyracoids, an anthracothere, a parapithecid anthropoid, a miacoid carnivoran and hystricognathous rodents.

About 200 micromammal teeth have been recovered after screenwashing the fossiliferous level. Among the more common mammals represented at Zallah 7 are primitive members of the rodent clade Hystricognathi. Here we document the presence of two genera and species of early phiomorph rodents (*Metaphiomys* and *Neophiomys*) on the basis of numerous isolated teeth. Surprisingly, the Gaudeamuridae, a distinctive clade of early African hystricognaths that is abundantly represented at the nearby Zallah 5R Locality, are not yet represented at our new locality. Zallah 7 has produced isolated teeth of *Metaphiomys schaubi*, which is also known from the Jebel Qatrani Formation in Fayum (Egypt), where it ranges from Lower Sequence Quarries E, B to quarry G of the Upper Sequence. Specimens of *Neophiomys paraphiomyoides*, similar in size and morphological pattern to the Libyan ones, were described at Quarry G of the Upper Sequence in Fayum. A similar assemblage of phiomorphs has been described from the Taqah Locality in Oman and from the nearby Fejfar Locality in the Sirt Basin, dated from the Rupelian based on foraminiferal *(Bolivina meletica, Nummulites fichtelli*) and selachian assemblages.

The new Libyan locality combines taxa (rodents, primates, and others) that are typical of the Jebel Qatrani upper sequence, in particular Quarries G and V (31-32 Ma). Given the regional scarcity of sites of this age, the richly fossiliferous Paleogene terrestrial deposits in the Zallah area may prove critical for understanding the biogeography and evolutionary history of rodents and other vertebrates in Afro-Arabia.

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

DRAG FORCES AND WAKE PRODUCTION IN THE SPINE BRUSH COMPLEX OF STETHACANTHID SHARKS

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The enigmatic "spine brush" projecting from the dorsal surface of Paleozoic stethacanthid sharks is composed of a broad, dentinous spine, and a rigid, dorsally expanded bundle of calcified cartilage fibers supporting a closely-packed platform of monocuspid denticles with extended crowns. Unsurprisingly, this structure has long been a subject of interest and speculation, resulting in suggestions that it might have functioned as a defense mechanism or as a remora-like hitching device, and/or served as a sexual display. Irrespective of these possible roles, it has been hypothesized that this large outgrowth produced considerably more drag than a conventionally shaped dorsal fin, raising questions about the possible handicap to the spine brush bearer. In order to determine how biomechanically costly the spine brush actually was we built models based on the measurements of the spine brush of the stethacanthid shark *Akmonistion zangerli*. These models were propelled through still water in a large towing tank at speeds of one half meter per second and one meter per second. We used a force transducer with four strain gauges to measure the drag forces generated by the spine brush, and compared those measurements to the forces produced by a generalized dorsal fin. The wake generated by the spine brush and the fin was visualized by recording video of the fin models moving through fluorescein and rhodamine dye trails. Unexpectedly, our results refuted the hypothesis: drag measurements were only slightly higher for the spine brush than for the model dorsal fin. The wake generated by the conventional dorsal fin showed asymmetrical vortex production in the form of a Von Kármán vortex street, but the wake of the spine brush complex was wider, comprising simultaneously shed vortex pairs, which is consistent with the higher drag values measured. Stethacanthid fossils are known from deposits ranging from the Devonian to the Permian, suggesting that this clade persisted successfully for approximately 180 million years, despite having a drag-inducing dorsal fin. So although the spine brush does increase drag, the negative effect was not substantial enough to impact the fitness and longevity of this group. This study is the first to actually test the functional consequences of the spine brush, and highlights the potential for empirical tests of function in paleontological specimens.

Technical Session IV (Wednesday, October 30, 2013, 1:45 PM)

NEW SPECIES, LOCAL FAUNAS, AND PALEOENVIRONMENTAL DATA FOR THE MIDDLE MIOCENE QUEBRADA HONDA FAUNA, BOLIVIA

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The late middle Miocene site of Quebrada Honda, Bolivia is one of the few sites in the South American tropics that has produced abundant fossil mammal remains. Our team's ongoing field research in the area has cataloged more than 700 specimens from both traditional collecting areas (Quebrada Honda, Río Rosario) and newly discovered sites. New sites are located north of Río Rosario (closer to Papachacra), 5 km northeast of Quebrada Honda, and near Huayllajara (5 km south of Quebrada Honda). We report the first ichnofossils from the area, including *Pallichnus* and *Coprinisphaera* (dung beetle brood balls) and *Celliforma* and *Cellicalichnus* (ground-dwelling bee/wasp nests), suggesting an open or wooded grassland habitat for Quebrada Honda. We also report the first birds from Quebrada Honda, a phorusrhacid and at least two other species. Sparassodonts are represented by a new very small species and a partial skeleton of *Acyon* that supports previous assertions that this species is the largest hathliacynid. Paucituberculatan remains likely pertain to three species and include the first mandibular remains of *Acdestis maddeni*. Xenarthran specimens include two new dasypodids (one eutatin, one euphractin), at least three glyptodonts (a lomaphorin, a hoplophorin, and a plohophorin), and at least four sloths (a new megatheriine, a nothrotheriid, an indeterminate megatherioid, and a mylodontid). The xenarthrans show high endemicity and appear to be most closely related species from the middle to late Miocene of low and middle latitude Argentina, Chile, and Bolivia. The first remains of chinchilline chinchillids from Quebrada Honda provide a new biogeographic link between this site, Chucal, Chile (late early Miocene), and Nazareno, Bolivia (early middle Miocene?), but chinchillines are much rarer at Quebrada Honda than at either of these other sites. The most abundant rodents at Quebrada Honda are the lagostomine chinchillid *Prolagostomus*, the caviid *Guiomys*, and the octodontoid *Acarechimys*. Among ungulates, no additional remains of the interatheriid *Miocochilius* and only two fragmentary specimens of the mesotheriid *Plesiotypotherium* have been recovered, highlighting the rarity of these taxa in the fauna. Partial macraucheniid litoptern skeletons reinforce the small size of the Quebrada Honda species relative to Santacrucian *Theosodon*. Additional ongoing research focuses on temporal correlations between localities in the Quebrada Honda area and the geological and environmental contexts in which these fossil remains were preserved.

Poster Session I (Wednesday, October 30, 2013, 4:15 - 6:15 PM)

SYSTEMATICS OF THE 32 MY OLD AGGREGATION OF SNAKES FROM THE WHITE RIVER FORMATION: REDEFINING THE ERYCINAE WITHIN BOOIDEA

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A 32 million year old aggregation of snakes from the Oligocene White River Formation includes four largely complete and articulated individuals that have been considered to be erycine snakes. Detailed observations, obtained using a variety of methodologies including light microscopy and computed tomography, have resulted in the collection of invaluable new morphological data on this unique quartet of Oligocene snakes. These data permit precise interrogation of primary homology hypotheses in the current literature, leading to important changes in secondary homology statements arising post-analysis. Recoding of existing characters and character states, specifically those presented in two previous studies, has resulted in conflicting results for several obvious reasons: 1) The first data set systematized all snakes, with a terminal unit referred to as the "Erycinae" that was characterized by a large number of polymorphic character state assignments; coding the fossil taxon (White River Taxon) into this matrix found it to be in the sistergroup position to this uninformative "Erycinae". 2) The second data set was a smaller study focused on New and Old World erycines only, as well as the putative python *Calabaria*; the addition of the White River Assemblage resulted in 26 most parsimonious trees (MPTs), where the White River Taxon was in the sistergroup position to the Old World erycines in 13 trees, versus the 13 trees where the Taxon was in the sistergroup position to both Old and New World forms. Noting important problems with the uncritical inclusion of the White River Taxon into either of these data sets, we elected to modify the first data set by expanding the "Erycinae" to include the two extant genera (*Charina* and *Eryx*) to which the 13 extant species are assigned. Analysis found the Old World genus *Eryx* to be in the sistergroup position to the Booidae (pythonines and boines). A new clade formed by the White River aggregation and *Charina* was found to be the sistergroup to the clade formed by *Eryx* and the Booidae. The two MPTs of this analysis merely rearranged the relations of the two most complete White River specimens with *Charina*. These data, utilizing new information from the White River specimens, support the splitting of the uninformative "Erycinae" into two entities.

Technical Session VIII (Thursday, October 31, 2013, 3:30 PM)

RECONSTRUCTION OF THE NASAL REGION IN NON-MAMMALIAN CYNODONTS AND MAMMALIAFORMES SUGGESTS ABSENCE OF INTRANARIAL LARYNX AND A COMPROMISED COUNTERCURRENT EXCHANGE AT RESPIRATORY TURBINATES

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Extant mammals are characterised by a higher-than-ambient body temperature and regular breathing rate. Ability to breathe while feeding is key to supporting a high metabolic rate, which necessitates respiratory airflow via the nasal cavity. Loss of heat and water in expired air is reduced by maxilloturbinals, which provide a large surface area for temporal countercurrent exchange (CCE). Effective CCE during feeding depends on the intranarial position of the larynx, so that food is not aspirated and air does not exit via the mouth. Speculations on the origin of endothermy in advanced non-mammalian