SEXY TETRAPODS: AMPLEXUS AND THE ORIGIN OF LIMBS

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Recent studies of the morphology of the Late Devonian tetrapod *Acanthostega* by Jennifer Clack shows that this animal was exclusively aquatic, retaining internal gills and a complete lateral line system. Available evidence suggests that other Late Devonian and Early Carboniferous tetrapods were likewise primarily aquatic. A terrestrial acoustic system, with a slim, freely movable stapes, has not yet been identified in these animals. These observations throw serious doubt on the hypothesis that limbs evolved to aid in the process of terrestrialization. Another idea is provided that tetrapod limbs evolved to promote a higher probability of egg fertilization through the mating behavior of amplexus. Although briefly mentioned in a paper by Jennifer Clack in 1995, this explanation has been basically ignored since that time. The amplexus model is compared with other hypotheses (e.g., enhanced locomotion in various aquatic habitats, increased foraging ability) and, based on available circumstantial evidence, is favored because of its widespread appearance in living Amphibia and its closer and more obvious connection to fitness, as measured by potential reproductive success. Testing any of these ideas will be difficult, but perhaps not impossible.

DESCRIPTION OF *MAMMUT AMERICANUM* AND *MAMMUTHUS COLUMBI* OF THE LATE PLEISTOCENE OF MEXICO

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Taxonomic revisions are made of the systematics of *Mammut americanum* (Proboscidea: Mammutidae) and *Mammuthus columbi* (Proboscidea: Elephantidae). Inside the original localities (Palpan State of Morelos, Apaxtla, Guerrero State and Axamilpa, Puebla State, México), the age of the consistent deposits of lacustrine and alluvial units, dissected for rivers, contains flora and faunal remains of Pleistocene. The pattern of those reported specimen, reflective environments of forests and prairies of that epoch.

Since the nineteenth century, the classification of the fossil Proboscidea of México has been confused. Starting from the reappraisal of the historical species, is possible to recognize the relationship of the valid taxa. The present reclassification, includingthe phylogeny, age, and distribution, documents part of the evolutionary development of the group.

The recorded specie, reach the variation indices comparable with other described populations. This way, a specimen of *M. americanum* (var. rough) was carbon-14 dated at 13,710 ± 430 years b.p) suggests a telative sge of the late Pleistocene. Adapted by selection through their teeth, the mastodon inhabited a great variety of environments. During the late Pleistocene, *M. columbi* is the most advanced evolutionary state in wider distribution and abundance.

THE MONOPHYLY AND INTERRELATIONSHIPS OF PROSAUROPODA

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Although the monophyly of Prosauropoda has been accepted in the most recent cladistic analyses, character evidence supporting this hypothesis has not been decisive, and the interrelationships of prosauropod genera remain obscure. A cladistic analysis of 46 cranial and postcranial characters in sixteen basal sauropodomorph taxa is presented here that identifies synapomorphies defining Prosauropoda and its principal lineages.

The results of the cladistic analysis strongly support the monophyly of Prosauropoda on the basis of five diagnostic characters: loss of contact between the lacrimal and maxilla on the dorsal margin of the antorbital fenestra; axial centrum length exceeding the distance separating the pre- and postzygapophyses; dorsal neural arch height subequal to that of the centrum; manual digit I at least 40% wider than the others; and reduction of metatarsal V. In addition, the presence of a horny beak in several prosauropods suggests extra support for their monophyly.

Although the majority of relationships within Prosauropoda are only weakly sustained, some ingroup structure was recovered. Specifically, this analysis provides support for a basal split between the two main prosauropod lineages, melanosaurids and plateosaurids. The monophyly of plateosaurids, which include *Massospondylus* (*Sellosaurus* (*Lufengosaurus* + *Plateosaurus*) is supported by two diagnostic characters: reduction in skull size and increase of the anteroposterior length of the external naris. The melanorosaurid clade (*Anchisaurus* + *Riojasaurus*) is supported by one synapomorphy: increase of the length of the dorsal vertebral column relative to hindlimb length.

A NEW MAP FOR THE LATE TRIASSIC CANJILLON QUARRY (PETRIFIED FOREST MEMBER, CHINLE FORMATION), AND THE ONTOGENY OF *TYPOTHORAX COCCINARUM* (ARCHOSAURIA, STAGONOLEPIDIDAE)

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Charles Camp and his assistants excavated Canjillon Quarry in north-central New Mexico in 1933, yielding a large collection of aetosaur (*Typothorax coccinarum*) remains. Careful perusal of the field notes and maps made at the time of the excavation, combined with the field numbers of specimens in the UCMP collection, yields considerable information about the placement of material in the quarry. Many elements with different specimen numbers may be plausibly assigned to the same individual. This information is used to examine ontogenetic allometry of the femur and tibia in *Typothorax*.

A partial skeleton of a sub-adult *Typothorax coccinarum* is known from the Post Quarry, located in the Cooper Canyon Formation of west Texas. The specimen's immaturity is evidenced by incompletely fused neural arches, and an incompletely ossified laterosphenoid. The Post Quarry specimen shows several differences from material of *T. coccinarum* collected from Canjillon Quarry, which are probably due to ontogeny. During ontogeny, the dorsal paramedian scutes of *T. coccinarum* become relatively larger, lose a faint longitudinal ridge at the center of ossification, and those of the dorsal region develop lateral edges that are straight rather than curved. The lateral flanges of the lateral scutes develop weaker ornamentation, which consists of elongate grooves with minor pitting. The length of the tibia relative to the length of the femur decreases, and all limb bones become more robust.

Comparison of *Typothorax coccinarum* scutes with those assigned to *Redondasuchus reseri* indicates that the alleged differences between these taxa are questionable. Flexion at the center of ossification and a discontinuous ventral keel are present in both taxa. Moreover, the interpretation of downward-turned lateral edges of the paramedian scutes of *Redondasuchus* is based on a misinterpreted orientation of the holotype scute. *Redondasuchus* is therefore referable to *Typothorax*, though its consistently smaller size indicates it may be a separate species from *T. coccinarum*.

JUVENILE ENANTHIORNITHINE SKELETON FROM MONTSEC (CATALONIA, SPAIN) LOWER CRETACEOUS REVISITED: TAPHONOMY AND MORPHOMETRICS TO ASSESS ONTOGENETIC STAGE

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The fossil bird from the lithographic Limestones in the Sierra El Montsec (province of Lleida) is revisited in order to cope with a detailed recognition of each bone element that it is preserved. Accounting for significant absences of elements within the preserved skull, pectoral girdle and wings will lead to either taphonomic or ontogenetic assumptions in order to get a close approach on its biological age. This will be accomplished with a comparative study on the periosteal architecture of avian embryos and posthatchling individuals. The density and pattern of grooves and foramina present in several bones on the Montsec fossil will be estimated (i.e. proximal, distal and mid diaphyses of ulna and humerus, coracoid, articular area of the scapula, inner part of the mandible, quadrate, and ventral side of the cervical vertebrae). Since the Montsec enanthiornithine displays a clear pattern of juvenile skull proportions, a morphometric approach over skull and wing will be also contrasted with the ontogenetical trajectories of modern forms.

TOUGH STUFF: THE CHEMICAL AND MECHANICAL CHALLENGE OF PREPARING A DICYNODONT FROM KINGORI SANDSTONE OF TANZANIA

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Specimens of dicynodonts have been described since 1845. These fossils have greatly expanded our terrestrial ecological knowledge of the Permo-Triassic boundary, a remote time with notoriously poor preservation. Dicynodont material commonly resides in sandstones and mudstones that are highly indurated and have a large quartz component.

Early preparation on such specimens was done with hammer and chisel, grinders, and other mechanical means; this was exceedingly labor intensive and often poorly or incompletely performed. Acid etched specimens—-which require constant vigilance to prevent future deterioration—-were not always successful. Current techniques include air scribes, separating discs, angle grinders, electric engravers with gramophone needles, and chemical means.

I am exploring a combination of new and old tools and techniques with UMZC specimen T 761, which is imbedded in very resistant Kingori Sandstone from Tanzania. Initial heavy consolidation with reversible ButVar and a cushioning jacket of layered colored wax, foil, and FGR plaster, spares the specimen during the considerable rock and roll that occurs during preparation and offers protection to already exposed bone. Use of a MicroJack air scribe under a microscope removes the bulk of the matrix. I am currently working with DMSO (Dimethylsulfoxide) to disaggregate and soften the remaining matrix for removal with a needle. The DMSO is painted on the matrix and exposed to a heat lamp for several hours. This procedure is repeated until the matrix moves with the needle. In this manner the bone will be exposed with minimal stress to the fossil and preparator.

ADDING STRENGTH TO REAL AND CAST FOSSIL SPECIMENS BY THE USE OF VACUUM IMPREGNATION OF ACRYLIC RESINS

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For the last twenty years the automobile industry has been using a low viscosity liquid sealant designed for sealing micro voids and porosity in metal castings. This is applied with a vacuum impregnation process that removes the air from the porosity and then saturates the part with a NON-REVERSIBLE cross-linked sealant. Parts processed are sealed internally, but remain cosmetically and dimensionally unchanged. This technology has made its way into modern paleontology as a way to 1. Strengthen fragile and brittle fossil material, 2. Substantially strengthen Plaster of Paris castings.

Shipping a plaster cast, no matter how much care is taken to ensure its safe arrival, usually results in a damaged specimen. In a recent exchange of cast specimens with the Shanghai Natural History Museum in June of 2001, the Science Museum of Minnesota treated a plaster cast of *Thescelosaurus neglectus* (SMM P 69.18.1c) with this technique in preparation for shipment to China. The cast took 15% resin by volume, increasing its strength twelvefold. In contrast the plaster cast of *Lufengosaurus huenei* arrived severely damaged and in need of extreme repair and restoration. This technique has been used successfully by the University of Kansas to prepare a *Camptosaurus* specimen for mounting. By adapting proven techniques that have strengthened and prolonged the life of automotive castings, you can render the most fragile specimens virtually indestructible and breathe new life into humble plaster casts.