VARIATION IN THE MOLARS OF AN OLOCIGNEC RODENT FAUNA

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The Fayum depression of Egypt is a fossil locality of late Eocene to early Oligocene age that exhibits unusually complete preservation. Thirteen rodent species from four genera have been identified from the Fayum that all belong to the infraorder Phiomorpha. These species were diagnosed and are identified primarily based on qualitative differences in molar-cusp patterns. Eleven of these rodent species from the Fayum fauna have large enough sample sizes to allow the study both of variation among fossil species and of morphological change in a phylogenetic sequence. Length and width measurements of the lower first and second molars were used to test for significant differences in size and shape among different species and within lineages through time. Multivariate analysis of variance (MANOVA) tested for size differences and regression for shape differences. Principle component analysis and discriminant analysis further were used to test the patterns of size and shape and determined the utility of length and width measurements to distinguish between species.

Tooth size was found to be significantly different among species, and most species could be identified on the basis of molar size and shape alone. The species could be discriminated from each other based on molar measurements better than 85% of the time, with members of six species identified without error. A trend for an increase in overall size over time was found for the rodent fauna in general, and within the one lineage that allowed for change over time to be studied. Consistency in molar size and shape between the species within each genus was also demonstrated.

AMBER IN THICK LARAMIDE STRATA DATED VIA FOSSIL MAMMALS


New studies of microfossil and mammalian zonations in Wyoming’s Hanna Basin provide opportunity to link Late Cretaceous (Judithian) through Paleocene (Clarkforkian) histories of land plants and vertebrates. These superposed strata, totalling more than 8.5 km in thickness and representing about 20 million years of time, also yielded many samples of amber (former tree resins). We studied eight sample sets of amber from fluvial and paludal parts of the following units, all deposited and deformed during the Laramide orogeny: Allen Ridge, Medicine Bow, Ferris, and Hanna formations. Age of the resin is calibrated via fossil mammals at late Lancelian and late Torrejonian–early Tiffanian levels. This is the first well documented Paleocene amber globally, although a gap in occurrence persists through the Psaron–early Torrejonian section. Inclusions in the amber (e.g., pollen, wood fragments, an insect, carbonized tree leaves) show, at microscopic levels, mechanistically disruptive effects of intense tectonism. Analysis using pyrolysis/gas chromatographic-mass spectroscopic methods allows recognition of specific tree-formed compounds preserved from original resins. Their consistency, as found throughout the stratigraphic column, suggests little diagenetic effect on amber related to depth of burial. With one exception (a Lancelian algal cyst lignite), resins from the entire section (and the Raritan Fm. of New Jersey, Toronian) derived from closely related species of tree, probably taxodaceous conifers despite high overall Late Cretaceous arborescent diversity and Paleocene floristic turnover.

FEMORALONTGENY IN ALLOSAURUS FRAGILIS (THEROPDA: ALLOSAUROIDEA) FROM THE LATE JURASSIC CLEVELAND-LLOYD DINOSAUR QUARRY, CENTRAL UTAH

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The Cleveland-Lloyd Dinosaur Quarry (CLDQ) contains an extensive sample of Allosaurus fragilis, the largest sample known for any large theropod. This assemblage, consisting almost entirely of isolated elements, is particularly significant because several size classes are represented, ranging from juvenile to adult. Previous size classes assigned to this collection assumed isometric growth in the hindlimb of Allosaurus. However, a recent study, based on a partial juvenile skeleton, has called this hypothesis into question, suggesting that juveniles had relatively longer hindlimbs than adults.

A comprehensive reanalysis of the CLDQ collection has been undertaken in order to test this hypothesis and assess functional modifications associated with growth. This study includes both fossil and extant components. Hindlimb elements of Allosaurus and selected extant taxa (e.g., ostrich) are being subjected to gross morphological and histological study, in addition to analysis of cross-sectional geometry. Principles of beam theory are being applied to quantitatively assess ontogenetic parameters. Results based solely upon the femur demonstrate changes in muscle insertions, allometric increases in cortical bone thickness, as well as shifts in cross-sectional geometry. The latter is manifested as a dramatic decrease in circularity, indicating that loading regimes differed at various growth stages. Thus, the present study supports the hypothesis of allometric growth in the hindlimb of Allosaurus. These diverse lines of evidence document the range of ontogenetic modifications in the hindlimb of this large theropod, and will ultimately be used to assess locomotor function.

MYRMECOPHAGOUS MANIRAPTORA? ALVAREZSAURUS AS AARDRAPRORS

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The skeleton of the Alvarezsauridae (Dinosauria: Theropoda) is compared to ant/termite specialists (sardvark, aardwolf, anteaters, armadillos, echidnas, muntz, pangolins, sloth bear, horned toads, Moloch, and Typhlops). Alvarezsaurus shows features common among members of this guild, particularly the pangolins and anteaters: short, robust forelimbs with hypertrophied muscular attachments and in-levers which concentrate force through a strong, compact manus and powerful pincer-like claw. The elongate snout, slender mandible, reduced dentition, ?reduced jaw musculature, and planar jaw hinge are typical of myrmecophages. Unusually, in the mononykines, dorsal vertebrae are opisthocoelous, possess posteriorlyforked neural spines, lack hypopophyseal/leptospondy articulations, and the zygapophyses and intraspinous ligament attachments align with the rotational axes of the vertebrae; these features may have permitted extensive dorsal and lateral spine flexion. Dorsally displaced ribs would improve leverage of pectoral muscles during dorsoflexion, while the rib cage would be stabilized by putting the zygapophyses and diapophyses in the same horizontal plane. Therefore the back might have functioned as a proximal extension of the digging arm, working in concert with it for an up-and-in ripping motion to tear open insect nests. Myrmecophagy appears consistent with the insect fossil record and may explain the high rate of skeletal evolution in alvarezsaurids, which has hindered study of their relationships. A restudy of coelurosaur phylogeny does not strongly support Metornithes, but supports the contention that alvarezsaurids are maniraptoran.

A NEW METHOD FOR A SELF-SKINNING URETHANE FOAM RESIN

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During the last few decades, the mounting of prehistoric animals has taken a new approach. With the advent of advanced welding techniques and urethane resins, more active and life-like mounts have become the norm. Through a fortuitous accident, the Tate Museum has discovered a new technique for the production of lightweight high fidelity replicas. This new method is primarily used for replicas of massive bones (i.e. sauropod limbs and vertebra). Strong molded-mortels are needed to withstand foaming pressures. Unlike the majority of foam resins, this new process allows for a self-skinning foam material with superb detail and little to no bubbles on the surface. There are several advantages to this technique, such as considerable reduction in weight of large replicas, ease of mounting, and wonderful teaching specimens. With a high fidelity cast, the study of large bones, their kinetics, and morphological description becomes much easier.

EOCENE PANTOLESTIDS FROM THE ZAYSAN BASIN, KAZAKSTAN

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Two lower jaw fragments of pantolestids are known from Eocene strata exposed at the Keri'ish antline in the Zaysan basin of Kazakstan. Kliukerellea zaysanii (Gabiuniya & Biryukov, 1978, from the Ergelian (late Eocene) strata of the Aksyir svita, is based on a right dentary fragment with m3. This tooth (L = 4.8, W = 3.5 mm) is peg-like with a large protocoonid, very small paraconid and loop-like talonid basin that lacks a distinct entocoonid. The dentary has a ventral projection of the horizontal ramus below m3 and a horizontally divided masticatory fossa. Oboia argillacea Gabiuniya, 1989, from the Ergelian (late Eocene) Kusto svita, which overlies the Aksyir svita, is based on a right dentary with c4, p4-m1 (p4=m1 = 5.5, W = 3.2, m1 = 6.1, W = 4.2 mm). The large, curved, strongly grooved c is followed by three closely.