

determined from crossbedding measurements in the quarry sequence indicate that the streams flowed to the southeast.

Within the quarry sandstone bed, the bones tend to be concentrated in the coarse, conglomeratic sandstone that immediately overlies the basal scour surface, and thus were deposited along the bottom of the stream. As a result, our interpretation of the fluvial deposits in the Carnegie Quarry contrasts markedly with earlier interpretations in which the bones were thought to have been derived from carcasses that were stranded on a sand bar at the edge of the stream.

A STUDY OF INCREMENTAL GROWTH LINES IN TEETH OF PALEOCENE EOCENE CORYPHODON

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Coryphodon is a genus of primitive herbivorous mammals placed in the archaic, extinct order Pantodonta. It is found in North America from the Clarkforkian through the Wasatchian. *Coryphodon* has large canines that can be sectioned to study the fine structure of their dentin and enamel. *Coryphodon* canines and molars from the Bighorn Basin of Wyoming were investigated to determine if dentin was deposited periodically in *Coryphodon* teeth, and to use periodic dentin deposition as a possible indicator of climate of the interior of the North American continent during the late Paleocene and early Eocene.

Regularly spaced laminations are found in dental tissues of *Coryphodon*. Fine striae of Retzius are found in the enamel, and are most easily observed in molars. Broad growth bands can be seen in cementum where cementum is preserved. Laminations are also found in the dentin of *Coryphodon* canines. These laminations are manifest as alternating dark and light bands of dentin. Regularly spaced laminations suggest periodic dentin deposition, with each dark/light couplet representing a single cycle of deposition. The number of cycles in the canines indicates that the period of one cycle was probably fortnightly or monthly.

THE STRUCTURE OF THE WING MEMBRANE IN PTEROSAURS

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The structure of the pterosaur wing membrane is currently the subject of much disagreement. Some favour a relatively inextensible structure stiffened by thin fibres and free of the hind limb, while others prefer a more elastic membrane stretched between the fore and hind limbs. Both reconstructions are based largely on examples from the Solnhofen Limestone (Upper Jurassic) of Germany and assume that, spanwise, the wing membrane was of relatively homogenous construction. A comparison of anatomical details exhibited by exceptionally preserved remains from the Karatau Formation (Upper Jurassic) of Kazakhstan, the Santana Formation (Lower Cretaceous) of Brazil and the Solnhofen Limestone, resulted in a new 'non-homogenous' model for the pterosaur wing membrane. The patagia had a very thin epidermis underlain, at least in proximal regions, by a highly vascularised layer, possibly used for temperature regulation. Beneath this was a layer of fibres, each fibre composed of numerous ultrafine filaments. In proximal regions of the patagia, the fibres appear to have been relatively short and elastic; distally they were much longer, stiffer and closely packed in parallel rows. Proximally a relatively thick sheet of striated muscle formed the core of the patagium. Unlike previous models, this reconstruction accounts for all observed anatomical features and variation in preservation of the patagia, both within and between individuals. The pterosaur wing membrane was a complex, multifunctional structure with varying design and mechanical properties, and capable, to some extent, of controlling its own shape. It cannot be directly compared to the bat or bird wing.

TAPHONOMY OF JACK'S BIRTHDAY SITE, A DIVERSE DINOSAUR BONE BED

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Jack's Birthday Site, a diverse vertebrate assemblage from the Upper Two Medicine Formation of western Montana, was taphonomically investigated. Age is roughly 74 mya. The site covers over 3000m², and roughly 100m² were excavated. Lithologies and fossil preservation vary in a regular way from northwest to southeast over a distance of 40m. This variation represents a transition from lake through shoreline to marginal shoreline/floodplain environments. All evidence, including sedimentary facies, plant and invertebrate fossils, and bone orientation and condition, indicates Jack's Birthday Site was a small (<1km²), shallow floodplain lake with periodic, perhaps seasonal fluctuations.

The vertebrate assemblage can be divided into two fractions. The first consists of attritional, predominantly isolated and allochthonous elements and the other of associated, parautochthonous remains restricted to a single sloping horizon. The latter is marked by concentrations of several individuals each of *Prosaurolophus* lakeward, *Troodon* along the shoreline and *Hypacrosaurus* in the shoreline to marginal shoreline area. This fraction is interpreted as the product of drought-related mass-mortality. The *Troodon* assemblage is the first described multi-individual troodontid occurrence. The diverse fauna of Jack's Birthday Site includes at least ten dinosaur taxa and a variety of non-dinosaurians and represents one of the best single samples of the region of that time.

THE OSTEOLOGY, POSTURE, AND MUSCULATURE OF THE HINDLIMB IN PAREIASAURS

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The pareiasaurs, mid-late Permian amniotes of uncertain taxonomic position, show skeletal resemblances to advanced, nonmammalian synapsids. These similarities led early systematists to group pareiasaurs with synapsids though such a grouping is no longer considered valid.

I have followed up earlier, preliminary work on the forelimb in pareiasaurs by looking at the hindlimb and pelvic girdle. Like the pectoral appendage, the pelvic appendage shows both convergent resemblances to that of advanced, nonmammalian synapsids and profound differences from it, reflecting both a different phylogenetic background and different functional attributes.

CRETACEOUS TEMNOSPONDYL

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Mandibular, fragmentary cranial, and postcranial remains from the Early Cretaceous (Aptian) Strzelecki Group of south eastern Australia appear to be from the last known members of the labyrinthodont Amphibia and to belong to the temnospondyl superfamily Brachyopodea. The preservation of these remains is excellent, and they show no signs of being reworked, although some distortion is apparent. This species lived well beyond the documented time of labyrinthodonts elsewhere in the world, perhaps protected by a polar 'safe area'. These late occurring Australian temnospondyls are always associated with a particular coarser grained facies, which may reflect either a preference for fast moving water or a restriction to it by competition. Within this facies are found also isolated bones of lungfish, hyphlodontids, a single vertebra of an ornithomimosaur, and the claw of a large camosaur. Only temnospondyls from the Superfamily Brachyopodea survived beyond the Triassic.

BONE AND IVORY TOOLS FROM LATEST PLEISTOCENE SUBMERGED SITES IN NORTH PENINSULAR FLORIDA

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We summarize extensive evidence from submerged sites in Florida that Paleo-Indians utilized latest Pleistocene megafauna not only for food and hides, but also for diverse specialized tools. The most elaborate such tools are foot-long foreshafts made from *Mammuthus* ivory. Their fabrication and utilization are described. Other bone tools include a beamer from a radius of *Mammuthus*, a stout handle from a tibia of *Equus*, and a dagger-like skinning tool made from a *Mammuthus* rib.

Some of the traditions represented by these tools may be traced to probable trans-Beringian origins. This is especially true of two ivory pieces that bear decorative artwork bilaterally. The elaboration of specialized tools derived from megafaunal elements substantiates the view that Paleo-Indians were primarily involved in a hunting economy. In eastern North America study of shallow sites that preserve mainly lithic artifacts has led to a contrary view. Florida's submerged sites did not sample a different cultural context, but merely overcame a taphonomic bias against bone and ivory preservation.

IS MENISCOEISSUS A CLADE?

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A cladistic analysis of the Cretaceous multituberculate genus *Meniscoessus*, made using commonly employed dental characters, suggests that this genus may not be monophyletic. In an exhaustive search that produces 70 shortest trees, *Meniscoessus* is monophyletic in only three. Strikingly, 26 additional trees present the genus as paraphyletic, including the Lancian multituberculate *Stygimys kuszmaul*. If *Stygimys* were synonymized with *Meniscoessus*, the range of this genus would extend from the early Campanian to the middle Paleocene without loss of species diversity across the Cretaceous-Tertiary boundary.

The evidence provided by this analysis, however, is inadequate to support a serious proposal of this synonymy. The states of two characters are ambiguous for two taxa. When one state is assigned to these characters a single shortest tree is obtained. In this tree *Meniscoessus* forms a clade, within which tree topology agrees with stratigraphic occurrence. Such extreme differences in trees resulting from minor adjustments to a character matrix occur in part because a significant amount of data is missing for the taxa in question. Although the fossil material recovered is adequate for the recognition of taxa, commonly used characters may not be sufficient to determine the relationship of species within genera or even if genera are monophyletic.