

The specimen is interpreted as a very young individual, perhaps a hatchling or even embryo, on the basis of its size and on the presence of apparently unremodeled, strap-like, parallel strips of bone making up the nasal process—the texture of which is similar to that on some skull elements of embryonic hadrosaurids recently discovered in Alberta.

This find suggests nesting sites were nearby since there is no evidence of abrasion on the fragile bone and it is unlikely that individuals of this size engaged in migration. This points to the possibility of future discoveries of sauropod nesting sites in the Morrison.

## 14

**ESCONICHTHYS AOPYRIS BARDACK, 1974, AN ENIGMATIC LUNGFISH?**

BRUNER, John Clay, Dept. of Zoology and Laboratory for Vertebrate Paleontology, University of Alberta, Edmonton, Alberta T6G 2E9, Canada

*Esconichthys apopyris* Bardack, 1974, was first described as a possible larval dipnoan from the Essex fauna of the Francis Creek Shale (Middle Pennsylvanian, Westphalian D, Carbondale Formation). In 1977 Schultze was unsure about the systematic placement of *Esconichthys* within the chordates but indicated it might be an amphibian because of its reduced number of gills. In 1979 Bardack questioned *Esconichthys*' referral as a lungfish because it possessed 2 pairs of external gills. In 1985 a figure was published of *Esconichthys* as a larval agnathan fish. Examining over 500 specimens of *Esconichthys*, I discovered the presence of scales on at least two specimens. The possession of scales indicates *Esconichthys* is probably not a larval amphibian. Since some of the living African lungfishes can have only two pairs of external gills, *Esconichthys* could still possibly be a larval lungfish.

## 15

**PHYLOGENETIC RELATIONSHIP BETWEEN THE OLIGOCENE NIMRAVIDAE AND THE BARBOUROFELINAE, AND THEIR POSITION WITHIN THE CARNIVORA**

BRYANT, Harold N., Department of Zoology, University of Toronto, 25 Harbord St., Toronto, Ontario, Canada M5S 1A1

Morphology of the crania, dentitions and postcrania of the cat-like Oligocene and Miocene carnivores that are typically referred to the Nimravidae suggests that these taxa form a monophyletic group. Monophyly of the Nimravidae is supported by synapomorphies associated with the skull (length of the palate, shape of the nasopharynx, cerebral sulci), dentition (large  $dC^1$ , shape of the serrations), and postcrania (short metacarpus). In contrast, the auditory region provides more equivocal evidence regarding the monophyly of this group.

The Nimravidae is divided into the Nimravinae (taxa of Oligocene age) and the Barbourfelinae (taxa of Miocene age). Each group is probably monophyletic and the latter did not originate among the more derived Oligocene taxa.

Cladistic analysis of the major clades within the Carnivora, using characters from all portions of the skeleton, suggests that the Nimravidae are either most closely related to the Feloidae at a high level or are a separate clade derived from early carnivorans. A closest relationship to caniforms is unlikely.

The potential in the study of the dentition and the postcrania for the resolution of higher level relationships within the Carnivora is reaffirmed.

## 16

**NEW MIOCENE VERTEBRATE LOCALITIES AND MARINE-NONMARINE CORRELATIONS IN THE EASTERN FLORIDA PANHANDLE**

BRYANT, J. Daniel, Florida State Museum and Department of Geology, University of Florida, Gainesville, FL 32611

Renewed field investigations in the Dogtown Member of the Torreya Formation, eastern Florida Panhandle, have discovered new Hemingfordian vertebrate localities exposed in Fuller's earth strip mines. These discoveries are stratigraphically the same as Simpson's classic Midway locality, the type locality of *Merychippus gunteri*, a poorly known species at the base of the adaptive radiation of hypsodont horses. In addition to *M. gunteri*, specimens of the heteromyid *Proheteromys floridanus*, an oreodont, a dromomerycid, and at least two other species of horses have been collected. An associated marine fauna correlates to Zone N.6 or early N.7. Marine-nonmarine correlations therefore indicate a late Hemingfordian age for this unit. Vertebrate fossils found throughout the exposures indicate that the Dogtown Member of the Torreya Formation was deposited in a relatively short time interval, supporting the finds of Tedford and Hunter (1984) and Simpson (1932). Paleomagnetic and strontium isotopic analyses currently in progress will further refine the ages and correlations in this classic marine-nonmarine sequence.

**A NEW PURGATORIUS-LIKE MAMMAL FROM SIMPSON QUARRY (PUERCAN), CRAZY MOUNTAINS BASIN, MONTANA**

BUCKLEY, Gregory A., Dept. of Geol. Sci., Rutgers Univ., Piscataway, NJ 08854

A new taxon closely related to *Purgatorius* has been recovered from the early Paleocene (Puercan) Simpson Quarry in the eastern Crazy Mountains Basin of south-central Montana. The new taxon shares many plesiadapiform-like features with *Purgatorius unio*, such as a mesiobuccally tilted protocone, slightly anteriorly leaning trigonids, and relatively widened talonids. Several specimens of both taxa also possess an incipient nannopithec fold, although it is never strongly developed. The reduced and lingual paraconid is undifferentiated from a strong, shelf-like paracristid; an apparently uniquely derived character. Both *P. ceratops* and *P. unio* have a slightly stronger developed entocristid notch than is seen in the Simpson Quarry form.

The combination of many primitive features with the apparent development of several plesiadapiform characters makes this taxon important in understanding plesiadapiform origins as well as their relationships with possible closely related sister taxa.

Supported by a GSA grant to GAB and NSF grant BSR-8722539 to D. W. Krause.

## 18

**TAXONOMIC AND ECOLOGIC DIVERSITY OF EARLY ICHTHYOSAURS**

CALLAWAY, Jack M., and MASSARE, Judy A., Department of Geological Sciences, University of Rochester, Rochester, NY 14627

Contrary to the impression from the literature, the systematic diversity of Triassic ichthyosaurs is as great as that of the Jurassic. Generic diversity, in fact, exceeds that of the Jurassic and Cretaceous combined. Clade diversity underwent an initial rapid radiation followed by a gradual decline until the end of the Triassic when the group suffered a bottleneck crisis prior to rediversification in the Early Jurassic.

Triassic ichthyosaurs, nothosaurs, placodonts and trematosaurs represent the first tetrapod invasion of the large marine predator adaptive zone. The ichthyosaurs were the dominant reptilian pelagic predator, whereas the other reptiles were nearshore forms. Triassic ichthyosaurs were mainly ambush predators, although some of the Late Triassic forms may have tended towards a pursuit mode of attack. Ichthyosaur feeding guild diversity, as suggested by tooth form, was greater than that of the post-Triassic ones. Thus, ecologically and taxonomically, the Triassic ichthyosaurs show the typical "bottom heavy" diversity pattern of a clade radiating into a new adaptive zone.

## 19

**VERTEBRATE TAPHONOMY OF A MARINE BLACK SHALE: SHARON SPRINGS MBR., PIERRE SHALE**

CARPENTER, Kenneth, Dept. of Geology, University of Pennsylvania, Philadelphia, PA 19104

Vertebrate remains occur throughout the Sharon Springs, but are most common in the lower third. Marine reptiles and fish dominate the assemblage, although *Hesperomys*, *Pteranodon*, a ?carnosaur, and hadrosaurs have also been found. Specimens range from single bones to completely articulated skeletons, although partial skeletons are the most common. Fish skeletons are sometimes contorted. Most bones occur in shales and occasionally in concretions, including cone-in-cone. Bone in shale is usually coated by selenite, but never is in concretions. Evidence of predation is common and includes regurgitated masses of fish bones and crushed invertebrate shells; coprolites with fish bones, the squid *Tusoteuthis*, baculites, and gastropod; fish skeletons with heads or tails bitten off (terminal vertebra severed); fish within mosasaurs, including *Cimolichthys* within *Clidastes*; *Tusoteuthis* within the body of *Ichthyodectes*; severed *Tusoteuthis*; *Tusoteuthis* mangled by mosasaurs; possible healed mosasaur bite on the skull of *Platecarpus*; and fish, pterosaur bones and scaphites (*Trachyscaphites?*) within polycotyliids.

## 20

**A REANALYSIS OF HEINTZICHTHYS GOULDII**

CARR, Robert K., Museum of Paleontology, Univ. Michigan, Ann Arbor, MI 48109

*Heintzichthys gouldii* is an eubranchytheracid arthrodire (family Dinichthyidae) from the Cleveland Shale (Famennian) of Ohio. This species is reanalyzed based on undescribed material recovered from the Cleveland

Museum of Natural History Paleontological Salvage Project of 1965-1966. This material is unique in its preservation of perichondral bone and the preservation of juvenile specimens. Juvenile material reveals an ontogenetic transition for the inferognathal (lower jaw) from one having a denticulate functional margin to one with an obtuse cutting edge.

The systematic position of the Dinichthyidae and the interrelationships within the family are poorly known. The study of *Heintzichthys gouldii* allows for a critical review of published systematic analyses and for the discussion of the systematic position of *Heintzichthys* relative to other known Dinichthyidae (*Golshanichthys*, *Dinichthys*, *Dunkleosteus*, *Eastmanosteus*, *Hadrosteus*, and *Holdenius*). Additional species of *Heintzichthys* are reviewed.

## 21

### CARBONIFEROUS ADELOGYRINID AMPHIBIANS

CARROLL, Robert L., Redpath Museum, McGill University, 859 Sherbrooke St. West, Montreal, P. Q. H3A 2K6, Canada; and ANDREWS, S. Mahala, Department of Geology, Royal Museum of Scotland, Chambers St., Edinburgh EH1 1JF, Scotland

Adelogyrinids are among the oldest known tetrapods. Their remains are restricted to the Carboniferous of southern Scotland. Four genera have been described from the Viséan and Namurian. Contrary to previous descriptions, these genera lack limbs although the dermal shoulder girdle is retained. What had been described as limb bones are elements of a greatly elaborated hyoid apparatus. The most complete specimen, a juvenile only 10 cm long, has 70 vertebrae, none of which are caudals. Derived characters common to other lepospondyls are shared by adelogyrinids, but no unique derived characters have been identified that support sister group relationship with any specific lepospondyl group. The occipital articulation appears to be formed entirely by the basioccipital without exoccipitals, in contrast with microsaur and neotridaens. The first cervical centrum is convex anteriorly, in contrast with aistopods. It remains difficult to establish whether the similar derived characters that are observed in different lepospondyl groups are strictly homologous.

## 22

### HOMOPLASY IN THE DEVELOPMENT OF STYLAR CUSP C AMONG MARSUPIALS

CASE, Judd A., Dept. of Earth Sciences, University of California, Riverside, CA 92521

The presence of a stylar cusp C occupying a central position along the stylar shelf has long been considered as the primitive upper molar morphology among marsupials. However, in the last decade both Clemens and Fox have questioned whether this condition is in fact plesiomorphic for the Marsupialia.

Examination of stylar shelf morphology reveals the presence of twinned stylar C cuspules among early members of most of the major marsupial clades. At this time, there is some uncertainty if the twinned C cuspules or no cuspules at all is actually the plesiomorphic state. This region of the stylar shelf is very plastic in its variety of forms and three different pathways can be demonstrated for the formation of a single, centrally positioned stylar cusp C.

A single C cusp can develop from a hypertrophication of either the anterior or posterior of the twinned C cuspules, or by a coalescence of the two cuspules. Thus the presence of a single stylar cusp C must be investigated in each clade to determine its precise origin before this character state can be used in defining a specific clade.

## 23

### FUNCTIONAL SIGNIFICANCE OF THE SEMILUNATE CARPAL IN ARCHOSAURS AND BIRDS

CHATTERJEE, Sankar, The Museum, Texas Tech University, Lubbock, Texas 79409

The joint possession of the semilunate carpal bone in certain coelurosaur and *Archaeopteryx* is generally considered as a unique synapomorphy. However, its presence in the Late Triassic pseudosuchian *Postosuchus* clearly demonstrates that this feature was acquired independently in different lineages of bipedal archosaurs owing to similarity of function (homoplasy). Proximally the semilunate carpal has a pulley-like groove for sliding of the radius and ulna. This trochlear joint allows increased flexion and extension of the hand in the plane of the forearm, but restricts any movement perpendicular to this plane. The development of a semilunate carpal may be critically linked with the folding of the forelimb into a rigid, collapsible structure against the body when not in use.

There seems to be two basic structural types of semilunate carpal. In both archosaurs and *Archaeopteryx*, the distal articular surface shows two

distinct sockets for articulation with two metacarpals. In an undescribed Triassic bird from Texas and embryonic living birds, on the other hand, there is one distal socket for a metacarpal. The topographic relationship of the semilunate carpal with the corresponding metacarpals may shed light into the homology of the tridactyl manus of coelurosaur and birds.

## 24

### MARINE VERTEBRATES FROM THE DUWI PHOSPHORITES, DAKHLEH OASIS, WESTERN DESERT OF EGYPT

CHURCHER, Charles S., Zoology Dept., Univ. Toronto, Toronto, Ontario M5S 1A1, Canada

The Upper Cretaceous Campanian Duwi Formation is composed of variegated colored shales interbedded with 4 or 5 phosphoritic lenses containing chondrichthyan, teleost, chelonian, plesiosaur and mosasaur teeth and bones. Taxa identified are *Squalicorax pristodontus*, *Squali. kaupi*, *Scapanorhynchus rapax*, *Scap. raphiodon*, *Cretolamna appendiculata*, *Schizorhiza stromeri*, *Onchosaurus cf. maroccanus*, *Rhombodus binkhorsti*, *Stephanodus libycus*, cf. *Xiphactinus*, *Enchodus libycus*, *E. bursauxi*, ?cf. *Thalassocheilus*, ?*Dyrosaurus*, *Elasmosaurus* sp., *Mosasaurus beaugei*, *M. cf. anceps*, and *Globidens aegypticus*.

Specimens are isolated, disarticulated and concentrated in submarine 'wind-drifts' in lows parallel to the shoreline. Many coprolites and other biologically derived detritus compose most of the phosphorite units. The fauna represents a near shore environment of active predators and scavengers in a major gulf of Tethys in which salinity was high and rivers entered from the south. The Equator lay to the south at about the present Egyptian/Sudanese border, about latitude 22°N, and the environment was similar to that of the present-day Persian Gulf or Red Sea.

## 25

### DINOSAUR NATIONAL MONUMENT: PALEONTOLOGY IN THE PUBLIC EYE

CHURE, Daniel J., Dinosaur National Monument, Box 128, Jensen, UT 84035; and MCINTOSH, John S., Wesleyan University, Middletown, CT 06457

Discovered in 1909 by Earl Douglass of the Carnegie Museum, the Dinosaur Quarry (DQ) at Dinosaur National Monument (DNM) has proven to be one of our best windows onto the large vertebrate community of the Upper Jurassic Morrison Formation. To date, the remains of several hundred individuals belonging to sixteen species of dinosaurs and other reptiles have been found. In addition, the DQ has produced more species, skulls, juveniles and complete skeletons than any other Morrison quarry.

Between 1909 and 1925, the DQ was actively quarried and over 700,000 lbs. of fossils were collected. In 1958 the National Park Service enclosed the unexcavated area of the DQ within a building with both exhibits and research facilities. Since that time, over 2,000 bones have been uncovered and left *in situ*, just as they were deposited. The concept of an enclosed quarry with an *in situ* exhibit of fossils has been copied in several other localities in the U. S. and the People's Republic of China.

## 26

### STRUCTURE AND AFFINITIES OF THE MIOCENE SOUTH AMERICAN UNGULATE MEGADOLODUS

CIFELLI, Richard L., Oklahoma Museum of Natural History and Department of Zoology, University of Oklahoma, Norman, OK 73019

The poorly-known Santacrucian or Friasian genus *Megadolodus*, of the Colombian La Venta fauna, has long been regarded as a relictual condylarth belonging to the Didolodontidae, a group otherwise restricted to South American (SA) Paleocene and Eocene faunas. Newly-collected specimens, including nearly complete dentitions and a partial skeleton, indicate that *Megadolodus* is a dentally conservative member of the Litopterna, an order of ungulates indigenous to SA. Litoptern synapomorphies are present in both the manus and pes, which are tridactyl, mesaxonic, and bear well-developed hooves on all digits. Although posterior premolars are well-molarized, the cheek teeth are bunodont and thus contrast with those of all other post-Oligocene SA ungulates; canines are laterally compressed and sabre-like. In limb proportions, dental structure, and probable habits and diet, *Megadolodus* most closely resembles conservative living suoids. Funding was provided by NSF and NGS.