

"*Merychippus*" n. gen. is recognized by a large, pocketed DPOF which includes the infraorbital foramen, and has no malar fossa. The upper cheek teeth of "*M.*" *intermontanus* have an unworn crown height of ~50 mm. The enamel fossettes are more complex than those of *A. styliodontis*, and the protocone unites with the protoconule by 30% of wear (~35mm). "*M.*" *sumani* is differentiated from "*M.*" *intermontanus* by an unworn crown height of ~40 mm, more complex enamel fossettes, and a protocone that is isolated up to 60% wear (~18 mm).

A. styliodontis has a range from the Green Hills Division Fauna through the Second Division Fauna. "*M.*" *intermontanus* occurs in the Second Division Fauna, but does not become abundant until well into the Barstow Fauna. "*M.*" *sumani* is found in the Green Hills Division Fauna, the Second Division Fauna, and the Barstow Fauna, but decline in abundance with increased occurrence of "*M.*" *intermontanus*. The decline of "*M.*" *sumani* coupled with the increased abundance of "*M.*" *intermontanus* up section suggests a speciation event recorded within the Barstow Formation.

DINOSAUR DEPOSITS OF KOREA: STRATIGRAPHY, PALEOENVIRONMENTS AND PRESERVATION

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Dinosaur remains including bones, tracks and eggs, are common in the Cretaceous non-marine deposits of Korea. Among the remains the tracks are predominant. The dinosaur bones occur mostly in the Lower Cretaceous floodplain calcic or vertic paleosols and channel deposits. The dinosaur tracks occur mostly in the Upper Cretaceous deposits, and one of the track sites is found in the Campanian to Maastrichtian deposits. The tracks are usually preserved in dry mudflat deposits which experienced calcareous pedogenesis. The widespread preservation of pedogenic calcaretes in the dinosaur track deposits indicates that climate during their formation was seasonal and arid. It is thus inferred that repeated deposition by sheet-floods on mudflats of a perennial lake, which was used by dinosaurs as a persistent water source during droughts, and the subsequent development of calcareous pedogenesis were the main causes of the extensive preservation of dinosaur tracks. Recently, dinosaur eggs and clutches have been discovered from the Cretaceous deposits in Boseong, Sihwa, and Goseong. Among them Boseong sites are distinguished by the preservation of intact clutches. The general depositional environment of the Boseong egg-bearing deposits is a distal alluvial fan. Dinosaur eggs are preserved in vertic and calcic paleosols. In summary, the Cretaceous dinosaur deposits in Korea show selective occurrences in stratigraphy and depositional environments according to the fossil types. The dinosaur tracks are preserved mostly in the Upper Cretaceous marginal lake deposits. The bones occur mostly in the Early Cretaceous floodplain deposits. Most of the eggs are present in the Late Cretaceous alluvial fan deposits. Regardless of fossil types, most of the dinosaur remains in Korea are preserved in calcic paleosols. Consequently, dinosaurs inhabited alluvial fan, fluvial plain, and lake margin environments of Korean Peninsula throughout the Cretaceous under semi-arid climate, and the calcareous pedogenesis is deemed to have resulted in the preservation of the dinosaur remains.

A JUDITHIAN MICROFAUNAL LOCALITY IN ELK BASIN, PARK COUNTY, WYOMING

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Lithostratigraphic correlatives of the Montana Group are recognizable in Elk Basin, Park County, Wyoming. The Crosby Site, in the uppermost Judith River Formation equivalent, has produced *Myledapinus*, *Lepisosteus*, Theropoda, Hadrosauridae, Ceratopsidae, Crocodylia, and Chelonina, along with small amphibian, reptilian, and mammalian specimens as yet poorly identified. The fossiliferous stratum is a coarse dark-colored sandstone at the top of a thick sequence of strata dominated by cross-bedded sandstones typical of the marginal marine deltaic deposition of the Judith River Formation. The overlying Bearpaw Formation equivalent (marine) is approximately ten meters thick at the site.

The site provides a faunal sample from a southerly location, but typical of Judith River lithology, for comparison with the type area and other Montana localities and their Canadian correlatives. Contrasts to the Ellisdale Site (Marshalltown Formation of New Jersey) which is also marginal marine and of Campanian age, are attributed both to the subcontinental separation and the position of the latter site on a continental margin.

EVOLUTIONARY HISTORY OF THE ANKYLOSAURIA (DINOSAURIA: ORNITHISCHIA)

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Recently, there has been much discussion on ankylosaurian phylogeny, and several cladistic analyses have been published. However, the resulting cladograms all differ in their topologies and there is little consensus on the interrelationships of several taxa and on the monophyly (or otherwise) of several ankylosaurian ingroups. In addition the majority of these analyses contain only a limited number of taxa, mostly coded from the literature, and often consider only a small selection of the available character data (e.g. inclusion of cranial material only). The analysis presented here included all valid ankylosaur taxa, the majority of which have been examined firsthand, and is based on cranial, postcranial and dermal armour characters. These data were analysed using PAUP*4.0b10, producing 156 MPSTs (CI=0.5382, HI=0.4618, length 288). Character re-weighting (using the RC index) reduced this to 15 MPSTs. A reduced consensus analysis was then conducted in order to prune unstable taxa, and decay and double decay analyses were also undertaken. The Polacanthidae was found to be only very weakly supported and the enigmatic Gondwanan taxon *Mimiv* was placed outside

of the clades Ankylosauridae + Nodosauridae. Concordant with some recent analyses, the basal ornithischian *Scelidosaurus* is the sister taxon to the Ankylosauria. At present *Cedarapelta* falls outside of the Ankylosauridae + Nodosauridae: this is probably partly due to the immature nature of the specimens and to a large amount of missing data. The resulting trees were examined to assess the phylogenetic distribution and evolution of various character states, including the appearance and arrangement of dermal armour and the form of the scapulocoracoid, and to comment on the palaeobiogeography of various ankylosaurian clades. The 50% majority-rule tree was fitted to a stratigraphic range chart and this was compared to palaeogeographic maps of the Mesozoic. From this it can be seen that the earliest members of the Ankylosauridae are Asian and that there was a dispersal event to North America sometime in the middle Cretaceous.

GEOCHEMISTRY OF DINOSAUR BONES FROM THE CRETACEOUS HASANDONG FORMATION OF THE GYEONGSANG BASIN, KOREA

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Numerous Cretaceous dinosaur fossil bones, eggs, and footprints have been found in Korea during the past several years, demonstrating that the Korean peninsula was one of the most densely populated dinosaur habitats. We have conducted various geochemical analyses to test the possibility of direct age determination from the bone fossils, to determine the required conditions for bone preservation, and to evaluate diagenetic alteration of the bone chemistry and report some of the results here.

Electronprobe x-ray compositional maps reveal that porous original bone textures are well preserved, frequently filled with calcite. However, such spaces within the Galsari bone sample remain unfilled with calcite. Instead, thin films of aluminosilicate minerals are coated on the inner surfaces of the pores and filled the micro-fissures. It seems early diagenetic precipitation of aluminosilicate minerals made the bone less permeable and prevented them from calcite filling.

Sr-Nd-Pb isotopic compositions obtained from the bone fossils and their host sedimentary rocks show systematic variations. Even though the bulk analyses of host sedimentary rocks reveal relatively wide range of Sr isotopic compositions, reflecting diverse proveniences, acid leachates show far less variations with relatively low $^{87}\text{Sr}/^{86}\text{Sr}$ values very similar to the bone fossils. Such low Sr isotopic compositions cannot be explained by the derivation of sediments only from the Precambrian basement gneisses and the Jurassic granites exposed wide around the Gyeongsang basin, but need a component with lower $^{87}\text{Sr}/^{86}\text{Sr}$ such as volcanics with significantly depleted mantle signatures. Isotopic compositions of Nd and Pb also support the addition of such depleted mantle component. It is noteworthy that there are closer similarities of isotopic compositions between the bone fossils and leachable components of their host sedimentary rocks than among bone fossil themselves, which strongly suggest that Sr isotopic compositions of the fossil bones reflect diagenetic alterations.

REVISED TAXONOMY OF THE LATE TRIASSIC AETOSAUR *DESMATOSUCHUS* (ARCHOSAURIA: CRURROTARSI) FROM THE SOUTHWESTERN UNITED STATES

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Episcoposaurus haplocerus was first described by E.D. Cope in 1892 from Carnian deposits of the Tecovas Formation in Texas. Twenty-eight years later E.C. Case described *Desmatosuchus spirensis* from the same area and horizon. Gregory synonymized the two taxa in 1953 resulting in the creation of the combination *Desmatosuchus haplocerus*. Since this time numerous specimens from the Late Triassic of the southwestern United States have been assigned to this taxon including specimens from the Norian age Post Quarry of Texas described by Small in 1985. This has led to the speculation that *D. haplocerus* has an extended temporal range, appearing in the late Carnian and extending to at least the mid-Norian (the Adamanian and Revueltian LVF). In Arizona *Desmatosuchus* has only been found in Carnian age deposits equivalent to the Tecovas Formation.

A new specimen of *Desmatosuchus* from the Lower Petrified Forest Member (Chinle Formation) of northeastern Arizona shows that the lateral dermal armor of all *Desmatosuchus* specimens from Arizona is identical to that of the Texas specimens from the Tecovas and distinct from Norian specimens of Texas and New Mexico. Thus the *Desmatosuchus* specimens from the Post Quarry appear to represent a new species. This new taxon can be distinguished from the Arizona/Tecovas specimens by the increased spinescence of the lateral armor with the lateral spikes of the cervical and posterior dorsal region being more elongate and recurved.

"*Desmatosuchus*" *chamaensis* from Upper Chinle deposits of New Mexico is not a valid species of *Desmatosuchus*. Instead it is a *Paratyphorax*-grade aetosaur akin to *Paratyphorax andressorum* and several undescribed taxa from Arizona and Texas and represents a new genus. As a result the temporal range of *D. haplocerus* is not as extensive as previously believed and is constrained to the Carnian (Adamanian LVF). Suggested occurrences of *Desmatosuchus* in North Carolina, Algeria, and Madagascar are based on scrappy, undiagnostic material and cannot be substantiated.

MAPPING ECOMORPHS ONTO SAUROPOD PHYLOGENY

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Contemporary cladistic analyses, the discovery of numerous new taxa, and advances in the functional inferences of locomotion, cervical mobility, and feeding have