

degree than might generally be inferred in the literature. Our study emphasises the importance of quantifying the relationships between these two integrated systems, and may assist in interpreting extant and extinct bony morphology to make more informed inferences of the potential musculature.

Grant Information:
Murdoch University

Regular Poster Session I (Wednesday, October 9, 2019, 4:15 - 6:15 PM)

LATE JURASSIC SYNAPSIDS AND MAMMALS FROM THE LANGENBERG QUARRY (NORTHERN GERMANY)

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The Langenberg Quarry near the town of Goslar yielded the first Jurassic mammal assemblage of Germany. The fossil bearing marls and limestones belong to the Süntel Formation that is well-dated as late Kimmeridgian by marine invertebrates. It was accumulated in a near shore area of the Lower Saxony Basin with influx of terrestrial sediments.

The diverse vertebrate assemblage of Langenberg Quarry includes chondrichthyan and osteichthyan fishes, marine turtles, a paramacellid lizard, the small atoposaurid crocodylomorph *Knoetschkesuchus* and marine crocodyliforms, a pterosaur, the dwarfed sauropod *Europasaurus*, several theropod dinosaurs, two non-mammaliaform synapsids, mammaliaforms, and mammals.

The non-mammaliaform synapsids are represented by two postcanine teeth attributed to Trirachodontidae and Traversodontidae. The teeth represent the youngest record of non-mammaliaform eucynodonts worldwide, extending the range of Trirachodontidae and Traversodontidae by about 90 myr. For Trirachodontidae this is the first reliable record outside sub-Saharan Africa. Morganucodontans are represented by a large upper molar of a new genus, being less than 10% smaller as the largest known morganucodontan specimen (lower molar of *Paceyodon davidi*). Docodontans are represented by upper and lower molar fragments and possibly one premolar. Multituberculates are most abundant and are represented by about two dozen isolated teeth. Three taxa occur, Paulchoffatiidae indet. (p4), the pinheirodontid *Teutonodon langenbergensis* (I3, M1, M2), and a new more derived paulchoffatiid (P3, ?4, P5, p3, and p4). The specimen formerly assigned to Eobaataridae indet. more likely belongs to the paulchoffatiid lineage. Cladotherians are represented by small dryolestid upper and lower molars resembling the teeth of *Amblotherium*.

Two phenomena of the Langenberg synapsid assemblage are recognizable caused by the paleogeographic situation of island isolation within the Late Jurassic European archipelago: (1) The late survival of trirachodontids and traversodontids (island relics) and (2) the large size of the new morganucodontan (island gigantism). Pinheirodontid and paulchoffatiid multituberculates represent endemic European clades that probably evolved on the Rhenish-Bohemian Massif and reached the Iberian Plate only in the Early Cretaceous.

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Technical Session VII (Thursday, October 10, 2019, 11:30 AM)

A NEW, THREE-Dimensionally PRESERVED MONOFENESTRATAN PTEROSAUR FROM THE MIDDLE JURASSIC OF SCOTLAND AND THE COMPLEX EVOLUTIONARY HISTORY OF THE SCAPULO-VERTEBRAL ARTICULATION

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The Middle Jurassic was a critical time in pterosaur evolution – a series of major morphological innovations underpinned radiations by, successively, rhamphorhynchids, basal monofenestratans, and pterodactyloids. Frustratingly, however, this interval is also one of the most sparsely sampled parts of the pterosaur fossil record, consisting almost exclusively of isolated fragmentary remains.

Here we report on the most complete individual found to date, a three-dimensionally preserved, partial pterosaur skeleton recovered in 2006 from the Bathonian-aged Kilmaluag Formation, near Elgol, Isle of Skye, Scotland.

Micro-CT scanning, segmentation, and 3D-reconstruction using Avizo has revealed multiple elements of the axial column, fore-, and hind limbs, many of which were fully embedded within the matrix and inaccessible via traditional preparation and imaging techniques. Unique features of the coracoid distinguish the Skye pterosaur from all other species, indicating that it represents a new taxon. The new specimen was included in phylogenetic analysis that was conducted using maximum parsimony in PAUP on a data matrix consisting of 61 taxa scored for 136 morphological characters. This analysis generated 544,320 MPTs. The 50% majority rule tree places the Skye taxon as a basal monofenestratan in a clade with *Darwinopterus*, *Wukongopterus*, and, for the first time, *Allkaruen*, which was previously identified as non-monofenestratan. The Skye pterosaur, one of the earliest, most complete records for Monofenestrata, provides critical new insights into pterosaur evolution.

The distal end of the Skye pterosaur's scapula is expanded and articulated with the vertebral column, a feature shared with other basal monofenestratans. Comparisons across Pterosauria show that this type of bracing was far more widespread than previously realized and seemingly present in many clades, with the exception of basal-most (Late Triassic) forms. The development of a notarium, providing additional stability and support, is confined to derived and often large and giant species and forms only part of the complex evolutionary history of the scapulo-vertebral contact.

Technical Session I (Wednesday, October 9, 2019, 10:45 AM)

MIOCENE BALEEN WHALES FROM THE PERUVIAN DESERT

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The Pisco Formation exposed in the Ica Desert of Peru is one of the most fossiliferous Mid-Late Miocene lagerstätten for marine mammals worldwide. A long-term field programme has produced a diverse and disparate assemblage of extinct toothed whales and dolphins (odontocetes), but only a relatively small number of baleen whales (mysticetes). Here, we provide an overview of the known baleen whale assemblage, and report several new forms representing at least three separate families.

Including our new material, the Pisco Formation has yielded at least 4 different roquals, including *Balaenoptera siberi*, *Incakujira anillodefuego*, and two undescribed species; 5-6 cetotheriids, including *Piscobalaena nana*, *Tiucetus rosae*, *Cephalotropis* sp., one undescribed large-sized species, and the only named extinct neobalaenine, *Miocaperea pulchra*; and at least one stem balaenopterid, *Pelocetus* sp. Both roquals and cetotheriids occasionally show signs of exceptional preservation, including phosphatised baleen and stomach contents. Despite the relatively young age of the Pisco deposits, right whales are curiously absent.

Together, the three allomembers of the Pisco Formation reveal considerable faunal turnover. Archaic cetotheriids and stem balaenopteroids dominate the lowest levels (P0 allomember), followed by large cetotheriids (lower P1 allomember) and finally a mix of small cetotheriids and abundant balaenopteroids (upper P1 and P2 allomembers). Cetotheriids seem to decrease in size and relative abundance over time, and in concert with the rise of roquals, mirroring similar patterns in the North Atlantic. Roquals include a wide range of body sizes, including some latest Tortonian (7.55 Ma) and Messinian (6.93–6.71 Ma) specimens approaching 15–16 m in length. This size is comparable to that of most extant species, and suggests that modern gigantism arose gradually and relatively early, even though small species continue to dominate the overall assemblage.

Technical Session V (Wednesday, October 9, 2019, 3:15 PM)

A NEW LOOK AT THE LATE OLIGOCENE PLATYDYPTES PENGUINS OF ZEALANDIA

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The dense bones of penguins are predisposed to fossilise, producing an excellent record of fossil penguins in ancient shelf sediments of Zealandia - proto-New Zealand. Of note is the endemic *Platydyptes*, one of the few described later Oligocene genera, which has been recovered mostly from the bioclastic Otekaike Limestone of Hakatarama, Waitaki region. Other studies have identified *Platydyptes* as one of the most crownward of the stem penguins, showing it as a precursor for the crown radiation of penguins. First named by Marples in 1952 the genus was last reviewed by Simpson in 1971. Since then new material including partially articulated skeletons, as well as