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# Amphibians and Squamates from the Late Pleistocene of Caverne Marie-Jeanne (Belgium)

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# Meeting Program

## SVP 2019 ANNUAL MEETING

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Although the Rancho La Brea (RLB) tar pits assemblages of *Smilodon fatalis* and *Canis dirus* have been extensively studied for over a century, little is known about the hyoids of these species. Composed of nine small bones (in most carnivorans), these bones function as the skeletal support of the vocal production system. The focus of this study is to examine these bones to determine the types of vocalizations these extinct species were able to produce. We hypothesize that *S. fatalis* and *C. dirus* produced vocalizations similar to their living relatives (lions/tigers and wolves respectively). To test these hypotheses, we measured and photographed of 155 *S. fatalis* hyoids and 239 *C. dirus* hyoids from RLB and a comparative sample of extant carnivoran hyoids as well. As in the roaring pantherines, we observed an absence of *S. fatalis* epihyoids suggesting that sabertooths also may have roared. The hyoids of *C. dirus* were similar in their proportions to those of the modern wolves, although significantly larger in several metrics, which suggests that, like wolves, they likely howled, but perhaps at deeper frequencies. Furthermore, we found greater variability within the size and shape of the hyoids of *S. fatalis* than those of *C. dirus* or other living carnivoran species. Although the significance of this variability is hard to interpret, it could imply that individual sabertooths may have made more individually distinctive vocalizations than is seen in other modern large carnivoran taxa.

Romer Prize Session (Thursday, October 10, 2019, 8:15 AM)

#### DIETARY AND HABITAT PARTITIONING OF JURASSIC MARINE REPTILE ECOSYSTEMS

FOFFA, Davide, National Museums Scotland, Edinburgh, United Kingdom

Niche partitioning is a fundamental ecological concept that enables ecosystems to support diversified trophic networks. In modern oceans, diverse predator sympatry is facilitated by cranio-dental morphological differentiation, which is intrinsically linked to diet preferences. This notion offers the framework to investigate assembly rules and ecology across geological time. However, to date paleoecological studies of large marine predators have largely been speculative, primarily based on qualitative evidence, and superficial analogies.

In this study I investigate the ecology of an exceptionally diverse Jurassic marine reptile fossil assemblage (from the Sub-Boreal Seaway of the modern United Kingdom) across a ~18 million-year interval of significant environmental perturbations. I developed a quantitative approach that complements morphological data with direct dietary observations on extinct and extant species. This approach allows assigning extinct species to ecologically meaningful "Feeding guilds" based on shared cranio-dental morphology. Then, using a combination of multivariate analysis and comparative biomechanics, I investigated the taxonomic and ecological evolution of the marine reptile fauna through time, and habitat changes.

The results reveal unprecedentedly detailed evolutionary patterns, and demonstrates that a conserved set of ecological assembly rules regulates marine tetrapod ecosystems through evolutionary time. The lack of overlap amongst groups in the multivariate ordination spaces suggests multiple instances of convergent evolution, indicating that morpho-functional differentiation may have enabled niche specialization. Successive time-binned disparity analyses show that specific guilds-habitat combinations characterized ancient ecosystems. The decline and success of different clades and guilds strongly correlates with sea-level fluctuations. Specifically, sea level deepening favored the diversification of large-bodied, macrophagous pelagic clades, and decline of small-bodied, piscivorous coastal groups.

These parallels between ancient and modern aquatic tetrapod faunas show how comparative approaches constitute a powerful tool to investigate the long-term evolution of ecosystems, and predict how they can adjust to climatic and habitat perturbations.

#### Grant Information:

School of Geosciences (University of Edinburgh); Small Grant Scheme '2015 Wood Award' (PASW201402); Systematics Research Fund; Richard Owen Research Fund.

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

#### AMPHIBIANS AND SQUAMATES FROM THE LATE PLEISTOCENE OF CAVERNE MARIE-JEANNE (BELGIUM)

FOLIE, Annelise, Institut Royal des Sciences Naturelles de Belgique, Brussels, Belgium; MARTÍNEZ MONZÓN, Almudena, Institut Català de Paleoecologia Humana i Evolució Social, Tarragona, Spain; LÓPEZ-GARCÍA, Juan Manuel, Institut Català de Paleoecologia Humana i Evolució Social, Tarragona, Spain; LOZANO-FERNÁNDEZ, Iván, Institut Català de Paleoecologia Humana i Evolució Social, Tarragona, Spain; BLAIN, Hugues-Alexandre, Institut Català de Paleoecologia Humana i Evolució Social, Tarragona, Spain

Archaeological sites usually provide important information about the past distribution of the small vertebrate fauna, and by extension about past terrestrial environments and climate in which human activities took place. In this context, Belgium has an interesting location in North-western Europe between the well-studied zooarchaeological record of Germany and England. The Late Pleistocene (Marine Isotope Stages 3 and 2) locality of Caverne Marie-Jeanne (southeast of Belgium, Ardennes region) yielded a large collection of disarticulated bone fragments and numerous plant, mollusk, and archaeological remains. They have been collected during the first field campaign in 1943 and stored in the Quaternary collections of the Royal Belgian Institute of Natural Sciences. A recent revision of the rich micromammal fauna (31 taxa of insectivores, bats, and rodents among 9897 identified specimens, corresponding to a minimum of 4980 individuals) revealed the presence of the steppe lemming and the European pine vole. We present here the revision of the herpetofauna based on the 1970 Jean-Claude Rage's study and the revision of the "indeterminate" small vertebrate specimens. It is now by far the largest Late Pleistocene collection of the Belgian institute with more than 20,500 recognized bones of amphibians and reptiles and covering the last 60,000 years. The herpetofaunal list now comprises two urodeles (*Lissotriton* gr. *L. vulgaris* and *Salamandra salamandra*), four anurans (*Bufo* gr. *B. bufo-spinosus*, *Epidalea calamita*, *Rana temporaria* and *Rana* cf. *R. arvalis*), three lizards (*Lacerta* cf. *L. agilis*, *Zootoca vivipara* and *Anguis* gr. *A. fragilis*) and three snakes (*Natrix* gr. *N. natrix-astreptophora*, *Coronella austriaca* and *Vipera berus*). This study highlights the first fossil record in Belgium for *L. gr. L. vulgaris*, *R. arvalis*, *Z. vivipara*, *N. gr. N. natrix-astreptophora* and *C. austriaca*. This assemblage suggests a patchy humid landscape under colder and dryer climatic conditions in comparison with present ones. The study also underlines the importance to carefully reexamine old collections.

#### Grant Information:

Grant 2017-SGR-859 (Gov. of Catalonia, AGAUR), CGL2016-80000-P (Spanish Min. of Econ. & Comp.), RYC-2016-19386 (Ramón y Cajal), Synthesys BE-TAF-4385, -5469, -5468, -5708.

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

#### A ZIPHIID-LIKE PLATANISTOID DOLPHIN FROM THE OTEKAIKE LIMESTONE (WAITAKIAN STAGE, LATEST OLIGOCENE), HAKATARAMEA VALLEY, NEW ZEALAND

FORDYCE, Robert E., University of Otago, Dunedin, New Zealand

A new dolphin from the Otekaike Limestone, Hakataramea Valley, has specialised jaws and a reduced dentition, consistent with a suction-feeding life mode – the first such odontocete from the New Zealand mid-Cenozoic. The dolphin is convergently similar in skull form to living, suction-feeding, beaked whales (Ziphiidae). Dolphin OU 22540 is from the bioclastic upper Otekaike Limestone, just above a mollusc-rich shellbed (Waitakian, latest Oligocene). Massive bedding, well-preserved para-autochthonous macroinvertebrates, and associated skeletons of vertebrates, suggest a mid-shelf setting with limited traction currents below storm wave base.

OU 22540 has a beak-like rostrum with massive maxillae, but no alveoli. Each mandible is straight-edged with an alveolar groove but lacks teeth in situ. The face around the nares is strongly asymmetrical and elevated, consistent with well-developed nasofacial muscles. Similar features occur in beaked whales (Ziphiidae), albeit constructed differently. Other features differ from those of Ziphiidae: the lacrimojugal is fused; the curved parabullary sulcus on the periotic matches archaic platanistoids; the periotic has a prominent articular process; the bulla lacks an enlarged posterior process; and the pterygoid sinus fossa is not enlarged and has a rod-like hamulus. Phylogenetic analysis with 88 OTUs and 284 characters (parsimony, unordered, equal weights) gave a consensus tree with OU 22540 at the base of the Platanistidae + Squalodontidae + Waipatiidae.

Dolphin OU 22540 is from a broad shelf setting facing the Southern Ocean and surrounding the archipelago of Zealandia. Given this setting, was the dolphin a neritic species? Or might its ziphiid-like skull form imply pelagic foraging beyond the shelf break, and perhaps deep-diving?

Technical Session IX (Thursday, October 10, 2019, 2:30 PM)

#### REASSESSING THE MOSASAUR PECTORAL GIRDLE AND ITS ROLE IN SWIMMING FUNCTION: NOT ENTIRELY WHALE-LIKE AFTER ALL

FORMOSO, Kiersten K., University of Southern California, Los Angeles, CA, United States of America; HABIB, Michael, Keck School of Medicine of USC, Los Angeles, CA, United States of America; BOTTJER, David, University of Southern California, Los Angeles, CA, United States of America