CARNAGES

Critical analysis of the CARNivoran mammal success during the early AGES

DURATION
15/01/2017 – 15/04/2019

BUDGET
148 270 €

PROJECT DESCRIPTION

Why are we surrounded by only one group of placental carnivorous mammals – the Carnivora – today, while at least three other groups of placental mammals were in competition with carnivorans 50 million years ago?

When we look at the present-day placental mammals that are specialized to feed on meat, all belong to Carnivora (e.g., cats, hyenas, mongooses, dogs, bears, seals, skunks). A high taxonomic, morphological and ecological diversity characterizes carnivorans; for instance, this clade includes large hypercarnivorous predators (lions, tigers), semi-aquatic to aquatic species (walrus, fur seals, otters), large and omnivorous taxa (bears), as well as small arboreal hunters (Asiatic linsangs). All these species share an important feature: the presence of specialized teeth that are devoted to cut meat, the carnassial teeth.

This feature is the most remarkable adaptation of these mammals, and can be traced back to Carnivoraformes (Carnivora + closest relatives) discovered in the late Paleocene.

When studying mammal faunas of Paleogene (66-23 Ma) localities of the northern hemisphere, one notes the presence of mammals that also display carnassial teeth, but not in the same position – they are located more posteriorly in the dentition than in Carnivora. These are the Hyaenodonta and Oxyaenidae, two groups that were previously grouped among the term “Creodonta”. Within placental mammals, Mesonychia, were also predators adapted to a carnivorous diet but did not possess carnassial teeth.

The meat-eating niche thus was an arena that hosted an important competition during the Paleogene. Since the 1990’s, paleontologists have investigated the success of carnivoraform mammals and their crucial adaptations in more detail. To analyze this predator group, they focused on the North American fossil record because it is considered to be the most complete. Analysis of the taxonomic and morphological diversification clearly showed that carnivorans outcompeted hyaenodonts and oxyaenids during the Eocene, specifically from around 50 Ma when carnivorans began to dominate “creodonts”.

Studies of the ecomorphology of these taxa revealed that carnivorans may have been successful due to the anterior position of the carnassial teeth compared to “creodonts.” The particular position of the carnassial teeth may actually have allowed the last molars to evolve in different directions, resulting in a broad range of dental adaptations (i.e. a broad variety of diets).

North American paleontologists hypothesized that a similar pattern would be observed in Europe because Europe and North America share numerous carnivorous mammal taxa during the earliest Eocene (around 55 Ma). Since 2006, paleontologists of the RBINS have intensively studied the European carnivorous mammals and have clarified their systematics. As a result, the systematics as well as the phylogenetic relationships of the Paleogene carnivorans, hyaenodonts, oxyaenids and mesonychians are now better established and can be used for broader studies.

In order to test the hypothesis of the North American paleontologists, we have analyzed the species richness of the European carnivorous mammals during the Paleogene. Surprisingly, our initial impression on the taxonomic diversity of the European carnivorous mammals show neither a decline of the hyaenodonts, nor a radiation of the carnivoraforms during the Eocene. Our initial survey thus suggests that the results of this competition are diametrically opposed in North America and Europe: carnivorans were not as taxonomically successful in Europe during the Eocene. All these observations question the paradigm of the carnivorans’ evolutionary success, and lead us to ask why carnivorans, despite their ‘dental plasticity’ did not succeed in Europe as they did in North America.

Therefore, one can question (1) whether European hyaenodonts acquired key adaptations that were not present in North American relatives, and (2) whether they displayed a broad range of dietary adaptations, as observed for the North American carnivorans.

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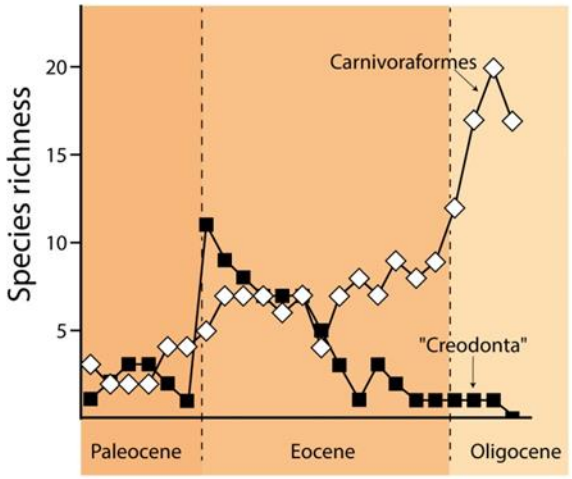
We hypothesize that an analysis of the ecomorphology of the European carnivorous mammals will allow for a clearer understanding of the causes that could explain the greater success of hyaenodonts in Europe compared to North America. Consequently, the present project proposes to document the evolutionary history of the ecology of carnivorous mammals that lived on our continent during the Paleogene. We use the three parameters that are usually employed for describing and comparing the ecology of fossil predators: body mass, inferred diet, and locomotion.

This project is based on federal (RBINS) as well as non-federal (KU Leuven and ULiège) unexplored paleontological collections from the Quercy area (France), and is carried out in collaboration with the MNHN (Paris). The localities where the Quercy Phosphorites are exposed interestingly illustrate the transition from a world that was dominated by endemic hyaenodonts to a world that comprises the first European representatives of the modern carnivorans. This transition corresponds to the major faunal turnover in Europe known as the Grande Coupure.

The results of this project are intended to be published in high-impact journals and presented at various international congresses. Finally, the databases of the specimens studied will be made accessible to the public via the Internet.



Evolution of the species richness of carnivoraforms (open diamonds) and “creodonts” (closed squares) in North America during the Paleogene (66-23 Myr).

Lower mandible of the peculiar carnivorous hyaenodont Quercytherium tenebrosum (MNHN.F.Qu8644) from the Quercy Phosphorites. Note the enlargement of the premolars (black line) compared to the small molars.

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https://www.naturalsciences.be/en/science/do/94/scientific-research/research-projects/project/6763

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