



Press Release

Martens, wolverines, skunks and red pandas – Germany was once a paradise for small carnivorans

Team from Tübingen's Senckenberg Centre for Human Evolution and Palaeoenvironment discovers diverse ecosystem 11.5 million years ago at Hammerschmiede clay pit

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An international team of researchers reports that at least 20 species of carnivorous mammals lived 11.5 million years ago in what is now the Hammerschmiede fossil site in southern Germany. The site has been a focus of attention since the 2019 discovery of the first known ape to walk upright, *Danuvius guggenmosi*. The current Hammerschmiede team includes Nikolaos Kargopoulos and other colleagues from the University of Tübingen, researchers from Zaragoza and Barcelona, and Professor Madelaine Böhme from the Senckenberg Centre for Human Evolution and Palaeoenvironment at the University of Tübingen. Their study has been published in the journal *PLOS ONE*.

The recent excavations, led by Professor Madelaine Böhme, have uncovered an extraordinary diversity of fossil animals and plants, including more than 350 individual finds of mammalian carnivores. Many of them were semi-aquatic, living and hunting on land and in the water; or they spent much of their time in trees. "The species were adapted to the river surrounded by forest that was present in the region at the time," Böhme says.

Various ecological niches

Among these animals (belonging to the order "Carnivora") recorded at the site are four marten-like species, two relatives of today's wolverine, four species of otter, three species of skunk, two species from the red panda family, three different genets, and several species from groups of which there are no living representatives today. For the doctoral researcher Nikolaos Kargopoulos, the first author of the study, a very well-preserved skull of a marten ("*Martes sansaniensis*") is one of the most impressive specimens. "This one will definitely help establishing new genus of large extinct marten," he says.

University of Tübingen
Public Relations Department

Dr. Karl Guido Rijkhoek
Director

Janna Eberhardt
Research reporter

Phone +49 7071 29-76788
+49 7071 29-77853

Fax +49 7071 29-5566
karl.rijkhoek[at]uni-tuebingen.de
janna.eberhardt[at]uni-tuebingen.de

Senckenberg Nature Research
Society
Press Office

Dr. Sören Dürr
Director

Judith Jördens
Phone +49 69 7542 1434
judith.joerdens[at]senckenberg.de

pressestelle[at]senckenberg.de
www.senckenberg.de/presse

The researchers also discovered a previously unknown species of weasel – one of the smallest predators from the site, estimated to have weighed just 1–3 kilograms. Special adaptations in the teeth reveal that this species fed exclusively on meat. The researchers named it *Circamustela hartmanni*, in honor of the Hartmann family, on whose property the Hammerschmiede site is located and who have provided access to it for all these years.

According to Madelaine Böhme, wolverines, skunks and even red pandas are to be expected in Europe’s fossil record of 11.5 million years ago, but not in such high concentration and variability of species. "Such an exceptionally large diversity of small carnivorans, with 20 species at the same site, suggests that the ecosystem at the time was thriving and could support all these different forms," she says. "Based on an analysis of body mass, feeding and the manner in which they moved around, each of the species discovered appears to have assumed a different role in the ecosystem. They used different natural resources and were thus able to avoid competition," according to Kargopoulos.



The elongated skull of a marten dubbed "*Martes*" *sansaniensis* from the Hammerschmiede site (left) compared with the skull of today's pine marten (*Martes martes*). Images: Nikolaos Kargopoulos



Lower jaw of the new weasel species, *Circamustela hartmanni*, which ate only meat. Images: Nikolaos Kargopoulos

Publication:

Nikolaos Kargopoulos, Alberto Valenciano, Juan Abella, Panagiotis Kampouridis, Thomas Lechner, Madelaine Böhme: The exceptionally high diversity of small carnivorans from the Late Miocene hominid locality of Hammerschmiede (Bavaria, Germany). *PLOS ONE*, <https://doi.org/10.1371/journal.pone.0268968>

Contact:

MSc. Nikolaos Kargopoulos
University of Tübingen
Phone +30 69 80 17 01 72
nikoskargopoulos[at]gmail.com

Professor Dr. Madelaine Böhme
University of Tübingen
Geosciences – Terrestrial Palaeoclimatology and
Senckenberg Centre for Human Evolution and Palaeoenvironment
Phone +49 7071 29-73191
m.boehme[at]ifg.uni-tuebingen.de