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## PRESS RELEASE

### **Gigantic crocodile with *T. rex* teeth was a top land predator of the Jurassic in Madagascar**

*Paleontologists document the features of a giant crocodile relative - the largest and oldest known "notosuchian", predating the other forms by 42 million years.*

Little is known about the origin and early evolution of the Notosuchia, hitherto unknown in the Jurassic period. New research on fossils from Madagascar, published in the peer-reviewed journal *PeerJ* by Italian and French paleontologists, begin to fill the gap in a million-year-long ghost lineage.

Deep and massive jaw bones armed with enormous serrated teeth that are similar in size and shape to those of a *T-rex* strongly suggest that these animals fed also on hard tissue such as bone and tendon. The full name of the predatory crocodyliform (nicknamed 'Razana') is *Razanandrongobe sakalavae*, which means "giant lizard ancestor from Sakalava region".

A combination of anatomical features clearly identify this taxon as a Jurassic notosuchian, close to the South American baurusuchids and sebecids, that were highly specialized predators of terrestrial habits, different from present-day crocodylians in having a deep skull and powerful erect limbs. "Like these and other gigantic crocs from the Cretaceous, 'Razana' could outcompete even theropod dinosaurs, at the top of the food chain", says Cristiano Dal Sasso, of the Natural History Museum of Milan.

*Razanandrongobe sakalavae* is by far the oldest - and possibly the largest - representative of the Notosuchia, documenting one of the earliest events of exacerbated increase in body size along the evolutionary history of the group.

"Its geographic position during the period when Madagascar was separating from other landmasses is strongly suggestive of an endemic lineage. At the same time, it represents a further signal that the Notosuchia originated in southern Gondwana", remarks co-author Simone Maganuco.

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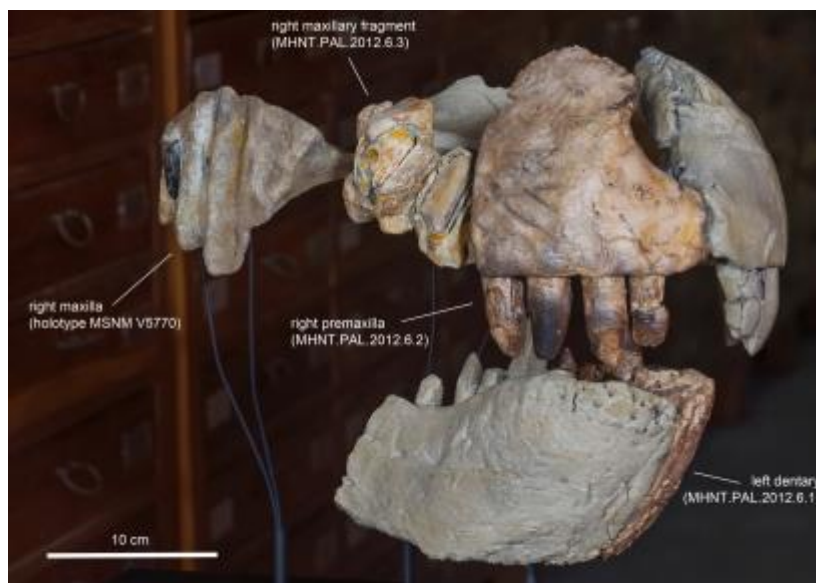
**Full Media Pack including images and videos:**

<https://drive.google.com/open?id=0BzGrFBtalE6wQzl2ZjZpcUx6THM>

**Images:**



**Image 1:** Paleontologists Cristiano Dal Sasso (right) and Simone Maganuco (left) exhibit some skull bones of *Razanandrongobe sakalavae* at the Natural History Museum of Milan. The teeth are enormous, approaching in shape and size those of a *T. rex*. The tip of a shed tooth shows a deeply worn surface caused by contact with hard food, such as bone and tendon: this animal was both predator and scavenger. The origin of the preserved bones from opposite sides of the upper and lower jaws was a hindrance to the study of how they aligned. However, new technologies helped Cristiano Dal Sasso and colleagues solve the puzzle...(see photo 2). Credit: G. Bindellini.



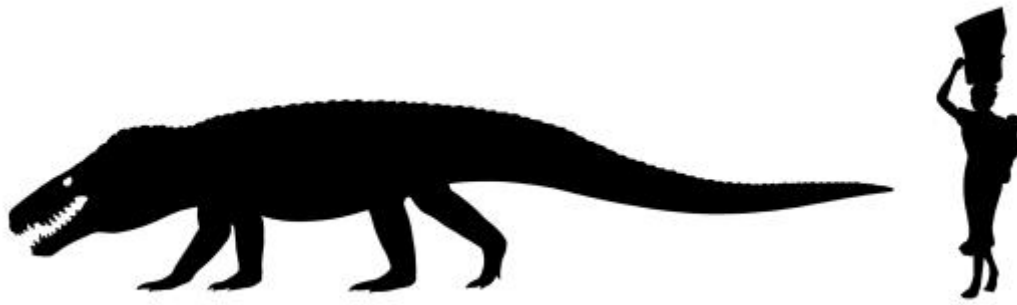
**Image 2:** Reconstruction of the jaws of *Razanandrongobe sakalavae*, including the original left dentary, right premaxilla (courtesy of the Natural History Museum of Toulouse ), and their counterlateral copies (in grey), printed in 3-D from CT data by FabLab Milan, and then mounted at the Natural History Museum of Milan. Credit: Giovanni Bindellini.



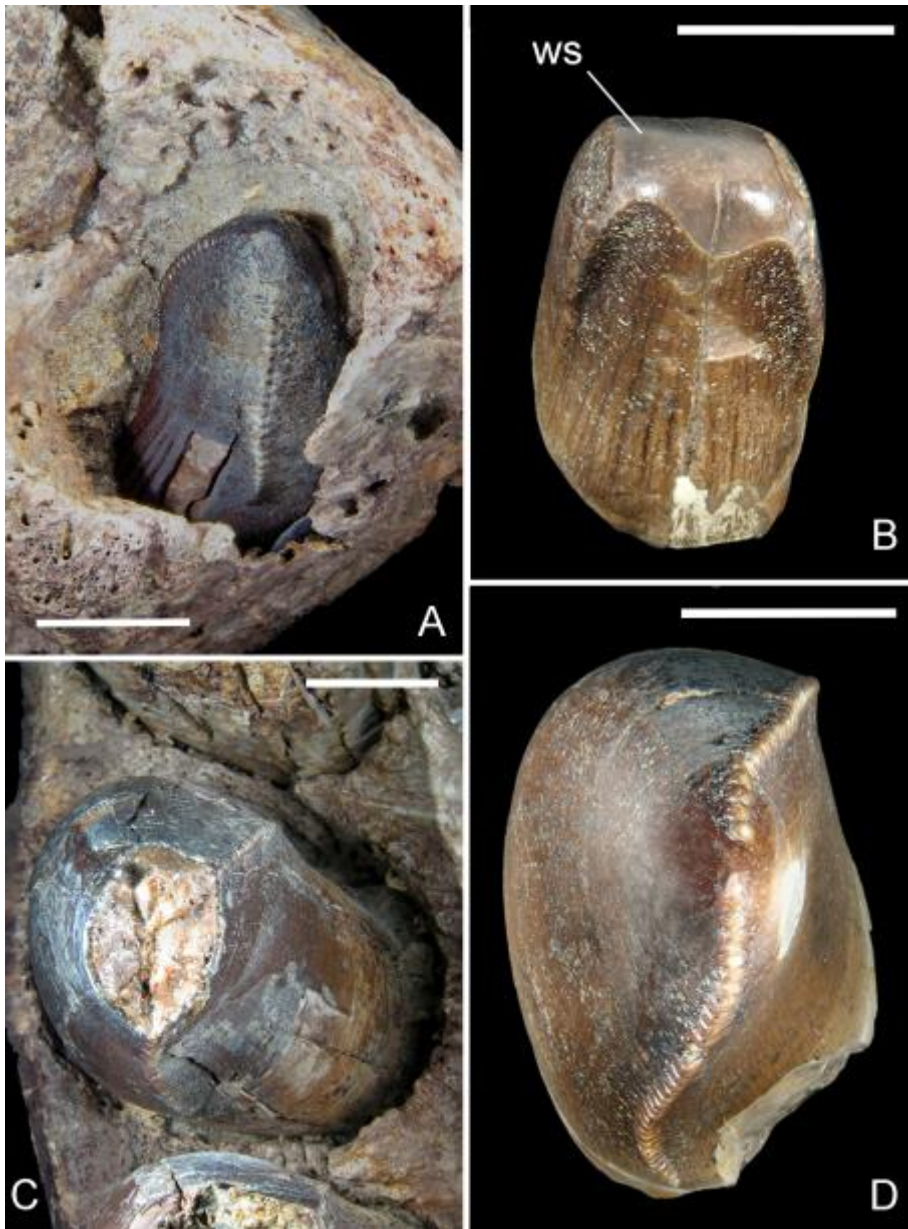
**Image 3:** Paleontologists Cristiano Dal Sasso (left) and Simone Maganuco (right) standing next to the jaws of “Razana” at the Natural History Museum of Milan. Dal Sasso indicates the firmly sutured mandibular bones, Maganuco points to the confluent nares facing to the front of the snout: two anatomical features that indicate crocodylian affinities, in spite of the unusually deep skull. The original left dentary, right premaxilla, and maxillary fragments were rearticulated to counterlateral copies, printed in 3-D from CT data. Credit: Giovanni Bindellini.



**Image 4:** Paleoartistic restoration of *Razanandrongobe sakalavae* scavenging on a sauropod carcass in the Middle Jurassic of Madagascar. Unlike extant crocodylians, this terrestrial predator had a deep skull and walked on erect limbs. Credit: Fabio Manucci.



**Image 5:** Comparison between the estimated body size of the giant notosuchian crocodyliform *Razanandrongobe sakalavae* (nicknamed “Razana”) and a human. Credit: Marco Auditore.



**Image 6:** Unique to *R. sakalavae* are the alveoli with labiolingual diameter larger than mesiodistal diameter, the mesial teeth incisiform, U-shaped in cross-section, and the presence of denticles that are even larger than those of large-bodied theropods, *Tyrannosaurus rex* included. (A), first premaxillary tooth still growing in its alveolus; (B) mesial tooth with apparent wear surface (ws); (C) fourth premaxillary tooth; (D) lateral tooth. Scale bars = 10 mm. Credit: Michele Zilioli.

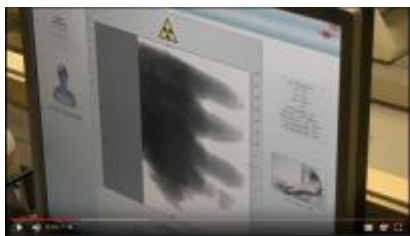
### Videos:



**Video A:** At the Natural History Museum of Milan, living and extinct animals such as a Nile crocodile and a *T. rex* are used for comparison in the study of a new fossil crocodile from the Jurassic of Madagascar, whose banana-like teeth are serrated with apparent denticles, that are even larger than those of *Tyrannosaurus* and other carnivorous dinosaurs. Living crocodylians have conical unserrated teeth. Credit: Cristiano Dal Sasso.



**Video B:** Paleontologists Cristiano Dal Sasso (left) and Simone Maganuco (right) studying the skull bones of “Razana” (nickname for *Razanandrongobe sakalavae*) at the Natural History Museum of Milan. The teeth are enormous; the largest one is the second premaxillary tooth. The tip of a shed tooth shows a deeply worn surface, caused by contact with hard food, such as bone and tendon: this animal was both predator and scavenger. The origin of the preserved bones from opposite sides of the upper and lower jaws was a hindrance to the study of how they aligned. However, new technologies helped Cristiano Dal Sasso and colleagues solve the puzzle... (see video C). Credit: Paolo Magliocco.



**Video C:** Computed tomography of the fossil cranial bones of *Razanandrongobe sakalavae* (this is the name of this Jurassic crocodylomorph) provided information on the tooth replacement process and tooth/root size. The largest dentary tooth is 14 cm long and the largest premaxillary tooth measures 15 cm. CT data also allowed to 3-D print the missing counterlateral bones at FabLab Milan, and so to reconstruct the front of the skull at the

Natural History Museum of Milan. Technician Andrea Passoni mounts the bone pieces.  
Credit: Cristiano Dal Sasso.



**Video D:** Paleontologists Cristiano Dal Sasso (left) and Simone Maganuco (right) standing next to the jaws of *Razanandrongobe sakalavae* at the Natural History Museum of Milan. Unlike present-day crocodiles and alligators, this terrestrial predator had a deep skull. On the other hand, the nares confluent and facing to the front of the snout, and the tip of the lower jaw formed by four firmly sutured bones, indicate that this animal is a crocodylomorph reptile, not a dinosaur. Credit: Paolo Magliocco.

### Full Media Pack including images and videos:

<https://drive.google.com/open?id=0BzGrFBtalE6wQzl2ZjZpcUx6THM>

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