

Evolution & Behaviour

The crocodile that crossed an ocean

by Massimo Delfino¹ | Associate Professor

¹: Department of Earth Sciences, University of Torino, Italy

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ABSTRACT

*The study of a forgotten crocodile skull collected in Libya back in 1939 suggests that the extinct *Crocodylus checchiai* may be the link between the Nile and the American crocodiles. This discovery would support the hypotheses of crocodiles' journey across the ocean from Africa to America.*



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How many times have you been thinking about a crocodile while swimming in the sea or in the ocean? Probably not a single time. For most of us, the chance of meeting a crocodile while swimming in salt water is unlikely. However, in some areas of the planet such encounters are not impossible.

The saltwater crocodile, *Crocodylus porosus*, is a species mostly inhabiting river deltas and estuaries - an area where a freshwater river or stream meets the salty ocean, resulting in brackish water - in a broad region of south Asia and north Australia. However, this particular type of crocodile can venture into the open sea and survive there for a long time, thanks to its special tongue glands that can expel the salt excess from the blood system. It is

specifically because of these little, hidden but well-developed glands that the saltwater crocodile is the only extant crocodilian species that can spend a considerable amount of time in the sea.

If we take the example of other crocodilians like alligators, caimans and gharials, since they do not possess functional glands, their distribution is generally restricted to a single continent. On the other hand, "true crocodiles" - the 13 species belonging to the group of *Crocodylus* - have salt glands and have colonized four continents: Australia, Asia, Africa and America.

If we consider the fossil record, we should also add the fifth continent, Europe, because fossils of

Crocodylus have been discovered both in Italy and in Spain.

Fossil crocodiles are represented exclusively by bone remains that do not tell us if their former owner had salt glands or not. Nevertheless, if the current distribution of true crocodiles spans four continents we have to assume several dispersal events, and some of them across salt water.

In the last years, molecular biologists as well as morphologists and palaeontologists understood that true crocodiles probably arose in Asia and that the Nile crocodile from Africa is the closest relative of the American true crocodiles. How is this transcontinental link possible? Because the evolution of true crocodiles occurred when South America and Africa were already separated, we suspect a dispersal across the Atlantic Ocean. The saltwater crocodile teaches us that thanks to marine currents an individual can passively travel for very long distances in few weeks: about 500 kilometres in a month!

The dispersal of an African crocodile across the Atlantic Ocean therefore seems likely, but when did it occur and which is the species that undertook such a journey? An old fossil from Libya provides some answers and new evidence for the origin of the American crocodiles. This finding dates back to the late Miocene, about seven million years ago, and it was discovered in 1939 in As Sahabi before being brought to Italy and studied in a museum in Rome. Thanks to this nearly complete skull, in 1947 a new species was described, the so-called *Crocodylus checchiai*.

Many years later, a recent revision of the collections of the Museo Universitario di Scienze della Terra della Sapienza Università di Roma has allowed the restudy of this forgotten fossil in order to obtain information about its inner morphology.

The analysis of the relationships between *Crocodylus checchiai* and the extinct and extant crocodilians, based on nearly 200 morphological characters, places it in-between the Nile crocodile from Africa and the American species.

Interestingly, this species is a bit older than the oldest American fossil and, therefore, older than the only American extinct species described so far: *Crocodylus falconensis* from Venezuela. Its age predates or is coincident with the dispersal from Africa to America. In particular, the Libyan fossil shares with the extinct and extant American species a marked convexity on the snout, just anterior to the orbits that extant African, Asian and Australian crocodiles do not have. Even if we do not know when and where an African crocodile - maybe a pregnant female or few individuals - crossed the Atlantic Ocean, the fossil from Libya strengthens the idea that the American species derive from the transcontinental dispersal of an African crocodile, maybe *Crocodylus checchiai* or a still unknown species close to it.

This discovery underlines the value of museum collections, representing not only a bank of objects but also an endless source of information for present and future discoveries.

The seven million year-old *Crocodylus checchiai* skull also reminds us that the exceptional natural and cultural heritage of Libya deserves to be properly safeguarded for future generations, especially in this critical age of social and political uncertainty.