

Wrinkle Face

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"First wrinkle face" Rugops had a short, round snout and small, delicate teeth. The head of Rugops had a tough covering of scales or surface armor and was riddled with arteries and veins, leaving a crisscross of grooves on the skull. There are two rows of seven holes along the dinosaur's snout perhaps they were used for ornaments. Rugops was probably a scavenger.

www.dinodata.net

Scientists have found new evidence to help piece together the history of plate tectonics. A dinosaur called "First Wrinkle Face" has been found in Africa. Previously, remains were only known in South America and India.

This newly-discovered First Wrinkle Face (the translation of its Latin name *Rugops Primus*) is about 95 million years old. According to the theory of plate tectonics, this means that the continents of Africa and South America must have joined together until around then. Previously, scientists thought that separation had begun at an earlier date, based upon existing fossil remains for species such as *Mesosaurus* and *Lystrosaurus*.

The theory of plate tectonics only gained widespread acceptance after the 1960s, when the weight of evidence used to support it started to become very substantial. The work of palaeontologists – scientists who study dinosaur fossil remains – is a cornerstone of this body of work. However, plate tectonics is an imperfect science that is continually being refined. This latest discovery does not fit with the previous paradigm, and appears to require that changes be made to previously accepted dates for the breaking apart of Africa and South America.

This important new discovery of First Wrinkle Face was found in the Sahara desert by Paul Sereno from Chicago University and his report is included in the latest copy of the journal *Proceedings of the Royal Society of London, Biological Sciences*. Mr Sereno is an accomplished dinosaur hunter who also recently discovered an eight-tonne, 12-metre long "supercroc" ([The Guardian, 02 June 2004](#)).

What is the evidence for sea-floor spreading / plate tectonics?

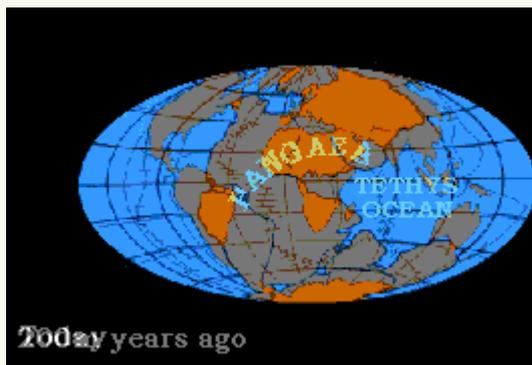
- *Continental fit* The east coast of South America and the west coast of Africa fit together with very few gaps.
- *Common geology* Rare Devonian violet quartzites are found in parts of Brazil and South Africa. These areas would have been adjacent when the two continents were joined.
- *Flora and fauna fossil record* Similar fossil remains may be found in both the Americas and in Africa and must therefore share a common descent; the distances separating them preclude migration as an explanation. For instance, remains of *Lystrosaurus*, a sheep-sized reptile that lived around 200 million years ago, are found throughout all of the southern continents.
- *Palaeomagnetic explanation* The earth's magnetic polarity has reversed in the past and the parallel magnetic "striping" of sections of sea-floor either side of the mid-Atlantic ridge allows dates to be compared. The basaltic ocean floor also ages with increasing distance from the ridge in either direction, further suggesting that the floor is spreading apart.
- *Ice Ages* The northern limits of ice sheets extending from the South Pole for both continents during past ice ages broadly coincide. We would expect to see this if they were previously joined.

When did South American and Africa really split apart?

Originally, all of the earth's land masses are thought to have been joined together in a single supercontinent named *Pangaea*. This later split into *Gondwana* (southern continents) and *Laurasia* (northern continents), anywhere between 200 and 135 million years ago. The date of the subsequent division of Africa and South America occurred some time later, but the exact date has remained a subject of much debate. Before this discovery, Wrinkle Face and other similar dinosaurs known as *abelisaurids* had been found only in South America and India. This led some experts to suggest that Africa had fully split from the rest of Gondwana by as early as 120 million years ago.

Animation showing the break-up of the Pangaeon

Supercontinent



Break-up of the supercontinent Pangaea over the last 200 million years, involving the separation of the African and American continents from Antarctica, the closing of the Tethys Ocean and

the opening of the Atlantic, Indian and Southern Oceans (from www.geolsoc.org.uk Animation: Noel Ford).

However, this latest Wrinkle Face from Africa is only 95 million years old. We can therefore deduce that separation may actually have occurred much later than previously thought, probably no later than 100 million years ago. The situation is quite complicated, though. Land bridges could have persisted long after the main bodies of the continents diverged. For this reason, debate is likely to continue about the exact date of separation for a little while longer!

How does plate tectonic theory work?

Plate tectonics is a scientific concept developed in the 1960s to explain the pattern of the Earth's land masses and the mechanisms by which they have changed position over time (its origins lie with Wegener's theory of Continental Drift from 1912). Seven major crustal plates and twelve smaller plates have been recognised, each of which extends down into the earth's upper mantle. These plates are thought to be moved by large scale thermal convection currents in the asthenosphere, generated by residual primary heat and radioactive decay in the earth's core. Plates are composed of continental or oceanic crust or a combination of both (*sial* and *sima*, respectively). They are bounded by plate margins, which may be subdivided into three types:

1. **constructive**, where new ocean floor is accumulated on either side of a mid-oceanic ridge
2. **destructive**, where ocean floor is lost by engulfment along a subduction zone
3. **conservative margin**, where plates move past each other laterally without adding or destroying ocean floor. Such margins are marked by transform or transcurrent faults.

It has been claimed that many of the Earth's major landforms can be explained by plate tectonics, especially mobile belts, island arcs and ocean trenches. Global patterns of earthquakes and volcanoes can also be explained through the hypothesis of sea-floor spreading, in which magma rises at the mid-oceanic ridges to form new crust which is moved laterally towards the plate margin, as if on a conveyor belt, where it is destroyed by subduction, or causes the ocean to increase in width (e.g. the Atlantic or the Red Sea). When the plate movements lead to the rate of construction being exceeded by that of destruction the ocean will begin to close (e.g. the Mediterranean).