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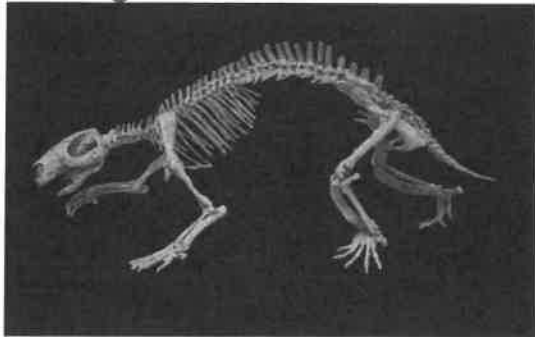


How Island Evolution Forged a Bizarre Mammal in Ancient Madagascar

Back when reptiles were all the rage, *Adalatherium* really stood out.

BY ISAAC SCHULTZMAY 4, 2020

How Island Evolution Forged a Bizarre Mammal in Ancient Madagascar



The skeleton of *Adalatherium*, the oldest mammal that's been found south of the equator. COURTESY TRIEBOLD PALEONTOLOGY

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Madagascar

IN JULY 1999, DAVID KRAUSE was enjoying the balmy winter weather of Madagascar as he dug in the dirt for dinosaurs. The island's soil was fertile ground for life in ancient times. At the end of the Cretaceous period, 66 million years ago, Madagascar—already an island at that point, having chipped off of a drifting India some 20 million years prior—crawled with the legendary reptiles of the age, from meat-eating theropods to a 20-foot-long constrictor snake. Which is why three years later, when Krause opened a plaster jacket that contained the fossils from the dig, the last thing he expected to find was a mammal.

Yet there it was. Tucked into the mold, along with a small, ancient crocodylian, was *Adalatherium hui*—a stubby-tailed mammal from the Cretaceous, preserved exquisitely after its demise in a mudslide. The oldest mammal yet found south of the equator, *Adalatherium* had a unique set of characteristics that set it apart from all other living animals at the time, as well as Gondwanatheria—the mysterious mammals that evolved as the supercontinent Gondwana broke apart.



David Krause and his team haul a plaster containing *Adalatherium hui* from the field site in 1999. He wouldn't find what was inside for three more years. COURTESY NATIONAL GEOGRAPHIC SOCIETY / MARIA STENZEL

“Once the jacket was open, I recognized an elbow joint and knew it was mammalian,” says Krause, a paleontologist at the Denver Museum of Nature and Science and lead author of the paper. “I didn't sleep for two days, I was that excited.”

Studying the fossil remains of *Adalatherium* took nearly 20 years, as researchers tried to decipher every twist and turn in its strange morphology, from its toes to its teeth. Last week a new paper was published in the journal *Nature*, describing the find.

Scrawnier and more modern looking than their giant, scaly contemporaries, Cretaceous mammals were few and far between—especially in the Southern Hemisphere, which has fewer, and less scrutinized, fossil deposits than the Northern Hemisphere. The mammals that preceded an asteroid's impact in modern-day Mexico, catalyzing the mass extinction event that killed off the dinosaurs, were generally eensy—a trait helpful for hunkering down to survive a

global cataclysm, but troublesome when it comes to finding fossils. *Adalatherium* was a clear exception to that rule.



Madagascar was, and remains, a hotbed of biodiversity. COURTESY MACALESTER COLLEGE / RAYMOND ROGERS

“It was a giant in its time, in the sense that during the Cretaceous, most mammals were shrew- or rat-size,” Krause says. “This thing is about 100 times larger than your standard house mouse.”

Adalatherium was a product of the island effect, which posits that large creatures shrink on isolated landmasses, while little critters get big. Perhaps inspired by a couple of reptilian goliaths that resided on Cretaceous-era Madagascar, *Adalatherium* grew to the size of a small dog.

Besides its unusual size, *Adalatherium* had a bevy of traits that make it an “outlier” on the evolutionary timeline, even when compared to the oddball fossas, lemurs, and aye-eyes that now inhabit the island nation. With forelimbs tucked close together underneath its body but hind limbs that splayed out on either side, it was a walking paradox. Among other things, it had a hole in its skull just above its nose that paleontologists still don’t fully understand—even after two decades of study and analysis. *Adalatherium* also boasted two pairs of upper incisors—and back teeth that defy explanation.



The animal's stubby legs and stumpy tail resemble a badger's. The rest of its anatomy raises more questions than it answers. © DENVER MUSEUM OF NATURE & SCIENCE / ANDREY ATUCHIN

“The teeth are the standard thing to look at across early mammalian evolution,” Krause says. “These teeth are truly weird. There’s just nothing like them in any living or extinct mammal.”

When the asteroid hit, *Adalatherium* was among the many mammals wiped from the Earth. But Madagascar’s unique modern fauna evolved nonetheless.

How, you ask? Krause suggests that life may have found a way on large rafts of vegetation, drifting over from Africa—a theory that’s been floated for various combinations of species and continents. Madagascar is a particularly appealing subject given its close proximity to Africa, and the amount of flotsam that still washes off the east coast of the continent after heavy storms.

“If this happens within our puny lifetimes, what are the chances of success over 65 million years?” Krause says. “The improbable becomes much more probable with the passage of time.”



THE DAILY CHRONICLE

WEDNESDAY, MAY 13, 2020

On This Date

1637 – French Cardinal Richelieu invented the table knife. Until that time, daggers were used to cut meat as well as to pick one's teeth. Richelieu had the points rounded off all of the knives for his table.

1938 – Louis Armstrong and his band recorded "When the Saints Go Marching In." He had been playing it at jazz funerals for years.



1940 – In his famous first speech as British Prime Minister, Winston Churchill declared, "I have nothing to offer but blood, toil, tears, and sweat."

You Don't Say!

After the Norman Conquest in 1066, the French language quickly replaced English in all domains associated with power. French was used at the royal court, by the clergy, the aristocracy, and in law courts. Even so, the population continued to speak English.

Quote of the Day

"I'm 5-feet-9, I have a deep voice, and I have a way with a line. What can I do about it? I can't stay home waiting for something different."

~ *Bea Arthur*

Happy Birthday!

Bea Arthur (1922–2009) was an actress who began her career on the Broadway stage. She won a Tony Award for *Mame* in 1966. Arthur



was best-known for the title role on the sitcom *Maude* in the 1970s and for *The Golden Girls* in the 1980s. In 2002, she made a triumphant

return to Broadway starring in *Bea Arthur on Broadway: Just Between Friends*, a collection of stories and songs based on her life. Arthur was a champion for women's rights and an active member of PETA.

The Dazzling Bioluminescence of Waves in California

As beaches started to reopen, locals came to see the light show from a distance.

BY MARIO KORAN MAY 8, 2020

The Dazzling Bioluminescence of Waves in California

Bioluminescent waves crashed onto Venice Beach on May 6, while California was starting to relax shelter-in-place restrictions. AMANDA EDWARDS / GETTY IMAGES

This piece was originally published in The Guardian and appears here as part of our Climate Desk collaboration.

Mother nature has provided a radical gift to nighttime beach-goers in southern California, in the form of bioluminescent waves that crash and froth with an otherworldly light.

The event occurs every few years along the coast of southern California, though locals say this year's sea sparkle is especially vibrant, possibly related to historic rains that soaked the region and generated algal bloom.

For some, this year's light show was especially meaningful, coming just as beaches began to reopen after an almost month-long closure due to coronavirus.

Dale Huntington, a 37-year-old pastor at a church in southeastern San Diego, got up at 3 a.m. after beaches reopened to surf the iridescent waves. "I've been surfing for 20 years now, and I've never seen anything like it," Huntington says.

Beautiful and Associated With Toxic Blooms

And scientists are making new discoveries about them using satellite imagery.

The neon waves owe their color to blooming microscopic plants called phytoplankton. By day, the organisms collect on the water's surface to give the water a reddish-brown hue, known as the red tide. By night, the algae put on a light show, dazzling most brightly in turbulent waters.

One photographer off the coast of Newport Beach, where crowds in recent weeks have protested against closures, recorded a dolphin jetting through bioluminescence like a sea specter.



This kind of bioluminescence, shown here at Hermosa Beach on April 25, is associated with a red tide, or an algae bloom, filled with dinoflagellates that glow when jostled by the moving water. JAY L. CLENDENIN / LOS ANGELES TIMES VIA GETTY IMAGES

The phosphorescent display has captured the attention of locals in southern California, with many emerging from shelter-in-place restrictions to catch a glimpse of the surreal scenery.

One San Diegan, who lives in a neighborhood along the coast, implored local officials to restrict access to the beach, complaining that the red tide has drawn large crowds comparable to a “Fourth of July on steroids.”

For surfers like Huntington, the spectacle has provided joy and relief amid the challenges of the pandemic. “My favorite part was paddling out—it was almost like there was a glow stick around your hand,” he describes. “My board left a bioluminescent wake. There were a few of us out there and we were giggling,

grown men shouting ‘this is so cool’ and splashing around like kids in the bathtub.”

Swimming, surfing, kayaking and paddleboarding are allowed under San Diego’s recently amended shelter-in-place restrictions.

Red tides, which stretch from Baja California up the coast to Los Angeles, have been observed since the early 1900s and can last from a few days to a couple of months. Scientists at the Scripps Institution of Oceanography at UC San Diego, who study the phenomenon, say the glow shows are most lively at least two hours after sunset.

Scientists don’t know exactly how long this year’s red tide will last, but for Huntington, this year’s light show was doubly welcome. “I think we’re all looking for light in a dark time,” he says. “And this sweet moment was an opportunity to find joy amidst struggle.”

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Sudoku Puzzle #E456VM

Presented by Puzzle Baron

Rated: Easy

Sudoku Puzzle #Z257ON

Presented by Puzzle Baron

Rated: Medium

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