Point of Impact: The Indian Ocean?

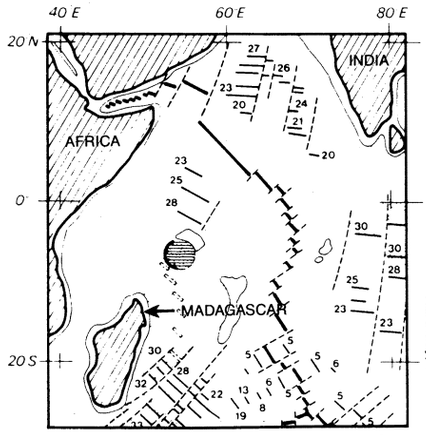
If an asteroid or comet crashed into the earth during the last days of the dinosaurs, as many scientists believe, it must have punched a gigantic hole in the ground. Finding that hole today would be like discovering a buried treasure. It not only would lend convincing evidence for the impact, but it also would provide a wealth of data on the size and speed of the projectile, the way it formed a crater and how the impact distributed dust and debris around the globe.

Now, a geologist from the University of Cape Town in South Africa reports finding what may very well be the impact site — a 300-kilometer-wide, circular depression that appears to be mostly intact at the bottom of the Indian Ocean off the east coast of Africa. In the May GEOLOGY, Christopher J. H. Hartnady suggests that the impact site is the Amirante Basin, about 500 km northeast of Madagascar. The basin dates from about 65 million years ago — the border between the Cretaceous and Tertiary periods, when the asteroid is believed to have hit.

Geologists have doubted whether they ever could find the crater, because most of the ocean crust from the time of the alleged impact has since been buried as plates have moved underneath one another. The Amirante Basin is one of only a few specific sites that have been suggested. The others include a crater 35 km in diameter that underlies the town of Manson, Ia., and a 25-km-wide crater in the southern Soviet Union. The Amirante Basin is the first specific ocean site ever suggested, and it is drawing interest from many geologists who believe the impact must have occurred in the ocean.

Hartnady began thinking of the basin as a possible impact site while trying to figure out why ridges on the Indian Ocean floor had shifted suddenly at the Cretaceous-Tertiary (K-T) boundary. He learned that the Amirante Basin had been at the center of an unusually massive continental shift at the time, in which the Seychelles Bank separated from the Indian subcontinent. "Suddenly, at the K-T boundary, the mid-ocean ridge between the Seychelles Bank and Madagascar jumped more than 500 km to the northeast and came to be situated between the Seychelles and India," Hartnady says. "And no one has really tried to explain that before."

He suggests the jump was caused by the force of the asteroid, which, according to the impact theory, was large enough to shoot vast clouds of dust and debris into the air, blocking light to the entire planet and causing or contributing to the demise of about three-fourths of the world's animal species, including the dinosaurs.



The Amirante Basin lies on the southern edge of the Seychelles Bank, about 500 kilometers northeast of Madagascar.

As additional evidence, Hartnady points to a massive sediment slide covering 20,000 square kilometers on the east coast of Africa, and suggests it may have been created by tsunamis at the time of impact.

"There is this evidence to make the case for the hypothesis," Hartnady says. "But I would say, for the time being, all of this is still very much a hypothesis."

One possible problem with Hartnady's idea is the size of the Amirante Basin, 300 km in diameter. Geologists have long considered the impact crater to be about 100 to 200 km wide, and the projectile that created it about 10 km wide.

But Richard A. F. Grieve of the Geological Survey of Canada in Ottawa, who has studied the relative size of meteorites and craters, says past estimates of the size of the K-T impact could be wrong. Impact craters usually are 20 times larger than the meteorites that make them, Grieve told SCIENCE NEWS, and it is conceivable that a 15-km projectile formed the Amirante Basin.

Hartnady's hypothesis also raises the issue of whether the K-T impact occurred on land or in the ocean. The evidence for both sides comes from the clay layer that was laid down over the entire planet 65 million years ago. It is this layer that first led scientists to develop the impact theory, because it contains a high concentration of iridium, a metal usually rare on the earth's surface but plentiful in meteors and asteroids (SN:6/2/79,p.356).

The evidence for an ocean impact comes from the layer's isotopic signature, which suggests the clay was formed largely of material similar to the ocean crust. The evidence for a continental impact, on the other hand, comes from the tiny bits of shocked quartz and feldspar in the layer. Hartnady says the Amirante Basin — lying in the ocean, but close to a continental shelf — may be able to reconcile the two kinds of evidence.

But Glen A. Izett of the U. S. Geological Survey in Denver argues that because the pieces of shocked quartz and feldspar are largest and most plentiful in the western United States and Canada, the impact must have occurred on the North American continent. Izett is among those who suggest the impact occurred at Manson, Ia. "The rock type at the Manson site is right, it's in the right age range and it's in the right place to account for the large size of the quartz grains in the western United States," Izett says. "The only way there could have been an impact in the Indian Ocean is if there was more than one impact."

Indeed, there might have been, says Eugene M. Shoemaker of the U. S. Geological Survey in Flagstaff, Ariz. Shoemaker suggests that the asteroid split up when it entered the earth's atmosphere and hit the planet in at least two places. "Of course, the problem with that idea is that the Indian Ocean and Manson are nearly on opposite sides of the world from one another," Shoemaker notes, but he says such a widely scattered split is conceivable. It is less likely that two different objects hit the earth at different times, Shoemaker says, because the oceanic material and the continental material are right next to one another in the clay layer.

Hartnady notes in his paper that the Seychelles Bank, when it was part of India, was very close to the area of the Deccan traps, a great lava flow that also occurred 65 million years ago. Scientists who believe the K-T clay layer was deposited by great volcanoes, rather than by a meteorite impact, have hypothesized that the volcanoes erupted in the vicinity of India (SN:3/16/85,p.172). Hartnady suggests that an impact in the Amirante Basin could have caused the volcanoes.

The next step, Hartnady says, is to do magnetic and seismic surveys of the area to find out if the seafloor was formed by some process other than the usual seafloor spreading. After that, scientists should get core samples from the basin to check for melt-related features, he says.

Already, many geologists support Hartnady's call for a closer look at the Amirante Basin.

Princeton (N. J.) University geologist Robert B. Hargraves says, "It's obvious something special happened at that spot 65 million years ago, and it could very well have been an impact." Hargraves says it's intriguing just to think the K-T impact site still exists. "It's my own personal feeling that it [does]," he says. "Because if this K-T extinction is due to meteor impact, I just simply do not think that the dear Lord above would have gotten rid of the site." — *M. Murray*