

SCIENCE PAGE



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EARTH-SHAKING RESEARCH

Study reveals huge Sumatran quakes were part of tectonic plate breakup

By MONTE MORIN
LOS ANGELES TIMES

Planet Earth may be 4.5 billion years old, but that doesn't mean she can't serve up a shattering surprise now and again.

Such was the case on April 11 when two massive earthquakes erupted beneath the Indian Ocean, far from the usual danger zones. Now scientists say the sea floor ruptures are part of a long suspected, yet never before observed, event: the slow-motion splitting of a vast tectonic plate.

The first of the quakes, a magnitude 8.7, was 20 times more powerful than California's long-anticipated "big one" and tore a complex network of faults deep in the ocean floor. The violence also triggered unusually large aftershocks thousands of miles away, including four off North America's western coast.

"It was jaw-dropping," said Thorn Lay, a professor of Earth and planetary sciences at the University of California, Santa Cruz. "It was like nothing we'd ever seen."

At first, Lay wondered whether the computer code he used to analyze earthquakes was wrong. Eventually, he and other scientists realized that they had documented the breakup of the Indo-Australian plate into two pieces, an epic process that began

roughly 50 million years ago and will continue for tens of millions more. Lay and other scientists reported their findings online Sept. 26 in the journal *Nature*.

Most great earthquakes occur along plate borders, where one plate dives beneath the adjoining plate and sinks deep into Earth's mantle, a process called subduction. The April 11 quakes, however, occurred in the middle of the plate and involved a number of strike-slip faults, meaning the ground on one side of the fault moves horizontally past ground on the other side.

Scientists say the 8.7 main shock broke four faults. The quake lasted 2 minutes and 40 seconds — most last just seconds — and was followed by a second 8.2 main shock two hours later.

Unlike the magnitude 9.1 temblor that struck in the same region on Dec. 26, 2004, and created a deadly tsunami, the April 11 quake did not cause similar destruction. That's because horizontally moving strike-slip faults do not induce the massive, vertical displacement of water that thrust faults do on the borders of plates.

The type of interplate faults involved in the Sumatran quakes are the result of monumental forces, some of which drove the continent of India into Asia millions of years ago and lifted the Himalayan Mountains. As the Indo-Australian plate continues to slide northward, the western portion of the plate, where India is, has been grinding against and underneath Asia. But the eastern portion of the plate, which contains Australia, keeps on moving without the same obstruction. That difference creates squeezing pressure in the area where the quakes occurred.

The study authors say that over time, as more quakes occur and new ruptures appear, the cracks will eventually coalesce into a single fissure.

"This is part of the messy business of breaking up a plate," said University of Utah seismologist Keith Koper, senior author of one of the studies. "Most likely it will take thousands of similar large quakes for that to happen."

The quake was also notable for triggering powerful aftershocks thousands of miles away. While major quakes have been

known to trigger aftershocks at great distance, they are usually less than 5.5 in magnitude. The April earthquake triggered 11 aftershocks that followed the main shock, including one as big as magnitude 7. Remote shocks were felt 6,000 to 12,000 miles from the main quake.

Fred Pollitz, a geophysicist with the U.S. Geological Survey in Menlo Park, Calif., and lead author of one of the studies, said the quake was extremely effective in transmitting seismic wave radiation around the world. Though the magnitude of the Sumatran quake is No. 10 on the list of historic quakes, Pollitz said no other quake has triggered so many strong aftershocks so far away.

"It's the most powerful earthquake ever in terms of capability of putting stress on other fault zones around the world," he said.

Pollitz said the quake is likely to teach seismologists about the physics of earthquakes, particularly those along strike-slip faults. That knowledge, he said, would certainly apply to the San Andreas fault, which is also a strike-slip fault. Lay said that the quake was most surprising in that it was completely unanticipated by seismologists.

Nature Watch / By GERRY RISING

Birder's enthusiasm is infectious

Sue Barth is a website developer who works at her Orchard Park home. From where she sits at her computer, she has an excellent view of her attractive yard and several bird feeders. Always interested in nature, Sue decided in 2010 to formalize that interest. She developed a blog titled "Chirps and Cheeps" and began to keep a life list of the birds she saw, photographing them as well.

I first was led to her website a few days ago and have been captivated. I'll draw upon her writing to introduce it — and incidentally to let Sue write this column. An interesting feature of Sue's blog is its progression as she becomes a more confident birder. Here are two of her first entries:

"Oct. 8, 2010: I ventured off to Tiff Nature Preserve today. It's been about 15 years since I've been there. It's still a terrific place to view nature in its untouched form, although there are a few indications of man's intervention — all for the good of the preserve.

"I hadn't even gotten into the park when I spied my first warbler, and I mean my very first, life-list warbler. As an examination of my photos later showed, this guy was a yellow-rumped warbler. He was perched up in a pine tree near the entrance of the park, flitting from branch to branch. I'm thrilled I got at least one identifiable photo.

"Nov. 16, 2010: What a treat today brought. I've been preparing my bird friends to eat from my hand by leaving a gardener's glove of seed out on our deck railing. It's close to the feeders and eventually, birds began to accept that purple glove as a regular feed accent and pick at the seeds in its palm. (This was all my son Tom's idea.)

"So the next step was to try enticing the birds to eat from my hand with the glove on. But today, impatient as I am, I



This red-headed woodpecker was one of two spotted near the sledding hill in Como Park over the summer.

Sue Barth

just went ahead and skipped that step, anxious to see if they would comply. Sure enough, a little male red-breasted nuthatch obliged — and not only once, but he came back to my bare hand several times. I had expected a chickadee to be first."

And here are two recent entries: "June 14: Joe Mitchell reported a pair of red-headed woodpeckers at Como Park the other day. I decided to take advantage of the late daylight and head out there this evening to see if I could find them. I was rewarded with some lovely views of the pair. They were just where he said they'd be, near the sledding hill. Thanks, Joe.

"Sept. 3: How to get these little guys to come to me? They're not seed eaters, so what can I offer them? I had an inspiration: water. It's been such a hot summer, why not provide a little sprinkler action and a makeshift pool? So the next day I got the hose and sprinkler, a big pan lid, and some stones to make my little bird 'pool.' I also set up my photo blind close by and sat down to watch what would happen.

"Wow, I hadn't sat for more than 10 minutes when the first warbler showed up: a young Wilson's warbler — a lifer. Soon to follow was a black-throated green warbler, and then another life-list addition, a Philadelphia vireo. What fun."

One of the great pleasures senior birders have is watching beginners develop their life lists. In doing so, we can replay our own early experiences. We can see this in Sue's posted list. Like many beginners, she started with a number of birds she already knew like robin, Baltimore oriole and crow. But the third species she added, startling, identified her as a beginning list keeper. Her latest entry, an ovenbird, already brings her total to 128 species. Sue's enthusiasm is infectious. Her children, Tom and Kate, and now even her young grandchildren, Josh and Will, are "into birding." Visit her blog at www.chirpsandcheeps.com. But beginners beware: She'll soon have you compiling your own life list.

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Science Notes / Engineering, psychology



Leonardo da Vinci, who was interested in flight, drew detailed plans for a human-powered ornithopter in 1485.

Staying grounded

Way back in 1485, Leonardo da Vinci sketched out plans for a human-powered aircraft. Even now, engineers are having a hard time getting such a device off the ground.

The main problem is that sustained flight requires more lift and power than the human body can generate for itself. But that hasn't stopped people from trying.

In the September issue of *Popular Science*, Rebecca Boyle writes about recent efforts to take flight without engines and jet fuel. Engineers have been trying to alleviate the limitations of human-powered craft by tweaking their designs — adding larger wings to get more lift or interconnected rotors to allow for helicopter-style flight.

Some of these devices work, but don't expect to be cruising to work in them anytime soon. Most of these machines can attain only limited altitudes and fly only short distances. In 2010 a pedal-powered ornithopter made it only 11 feet into the air.

— Washington Post

Exploring evil

When people do terrible things to other people, we label them as evil. But doing so does not explain their actions. In "The Science of Evil," psychologist Simon Baron-Cohen attempts to find a more concrete explanation for horrible deeds.

He defines evil as the absence of empathy — when people treat others like objects rather than like thinking, feeling individuals. How does empathy get whittled down? Baron-Cohen offers a host of explanations, from environmental factors to neurological and psychiatric problems such as Asperger's syndrome, which impairs social interactions.

Examples of severe human cruelty abound in this book, which is not for the faint of heart. At least Baron-Cohen is up front about it: "You can't write about human cruelty in a cheerful way," he writes in the introduction to the book. "So if you're looking for a fun read, proceed no further."

— Washington Post