WHAT REALLY KILLED THE DINOSAURS?

A Princeton geologist has endured decades of ridicule for arguing that the fifth extinction was caused not by an asteroid but by a series of colossal volcanic eruptions. Her fight with the asteroid camp may be the nastiest feud in all of science—but she’s reopened a debate that had been considered closed.

BY BIANCA BOSKER
GERTA KELLER WAS waiting for me at the Munich airport so we could catch a flight to Hydra and go hunt rocks. "You won't die," she told me cheerfully as soon as I'd said hello. "I'll bring you back."

Death was not something I'd considered as a possible consequence of traveling with Keller, a 73-year-old paleontologist and geochemist at Princeton University. She looked harmless enough thin, with a blunt bob, wearing gray nylon pants and hiking boots, and carrying an insulated ShopRite supermarket bag by way of a purse. I quickly learned that Keller felt such reassurances were necessary because, appropriately for someone who studies mass extinctions, she has a tendency to attract disaster. Long before our 90-minute flight touched down, she'd told me about having narrowly escaped death four times—once while attempting suicide, once from hepatitis contracted during an Algerian coup, once from getting shot in a robbery gone wrong, and once from food poisoning in India—and this was by no means an exhaustive list. She has crisscrossed dozens of countries doing field research and can claim near-death experiences in many of them with a tiger in Beliza, an anaconda in Mada- gascar, a mob in Haiti, an uprising in Mexico. Keller had vowed not to return to India after the food-poisoning debacle. But, never one to avoid calamity, she'd traveled to Mumbai—and gotten sick before her plane had even landed; an inflight meal had left her retching. Keller was in India to research a catastrophe that has consumed her for the past 30 years: the annihilation of three-quarters of the Earth's species—including, famously, the dinosaurs—during our planet's most recent mass extinction event eight years ago. She would be joining in Hyderabad with three collaborators: the geologists Thierry Adatte, from the University of Lus- sarde Echard, from the Saint-Germain University, in central India; and Mike Eddy, also from Princeton. They picked us up at the airport in a seat- belt-less van manned by a driver who looked barely older than our teens, and we began the five-hour drive to our hotel in a town so remote, I hadn't confidently located it on a map.

Where I looked out our van's window at a landscape of skeletal cows and charred rice paddies, Keller saw a prehistoric crime scene. She was searching for fresh evidence that would help prove her hypothesis about what killed the dinosaurs—and invalidate the asteroid-impact theory that many of us learned in school as uncontented fact. According to their widely accepted account, the first asteroid or comet struck Mount Etna, slammed into the planet with the force of 10 billion atomic bombs. The impact unleashed giant wildfires, crushed building-size boulders, continent-shaking earthquakes, and suffocating darkness that transformed the Earth. But what if that wasn't the case? couldn't possibly earth the scientific community as described "as an Old Testament version of hell."

Before the asteroid hypothesis took hold, researchers had proposed other, similarly bizarre explanations for the dinosaurs' demise: glutony, protracted food poisoning, terminal charity, acute stupidity, even Paleo-sixth-wave—death by boredom. These theories fell by the wayside when, in 1980, the Nobel Prize-winning physicist Luis Alvarez and three colleagues from UC Berkeley announced a discovery in the journal Science. They had found iridium—a hard, silver-gray element that licks in the bowels of planets, including ours—deposited all over the planet at approximately the same time that, according to the fossil record, creatures were dying en masse. Mystery solved: An asteroid had crashed into the Earth, spewing iridium and pulverized rock dust around the globe and wiping out most life forms.

Their hypothesis quickly gained traction, as visions of killer space rocks sparked even the dullest imaginations, NASA initiated Project Spacewatch to track in space any asteroid likely to be a menace to mankind. But the idea that anything could lead to anything that might dare to approach. Carl Sagan warned world leaders that hydrogen bombs could trigger a catastrophic "nuclear winter" like the one caused by an asteroid's dust cloud. Science reporters cheered having a story that united dinosaurs and extraterrestrialians and Cold War fever dreams—it needed only "some sex and the involvement of the Royal Family and the whole world would be paying attention," one journalist wrote. News articles described scientists rallying around Alvarez's theory in record time, especially after the so-called impact crater was discovered in Mexico. Scientists were completely wrong. The "Crater of Doom," a 1-mile-wide crater near the Mexican town of Chicxulub, on the Yucatan Peninsula. Researchers identified it as the spot where the asteroid slammed into the Earth. They added up the data, identifying the asteroid as the killer. The impact theory provided an elegant solution to a prehistoric puzzle, and it's hard to deny that it's an important clue about the scientific integrity of the scientific community. "This is nearly as close to a certainty as one can get in science," a planetary-science professor told Time magazine in an article on the crater's discovery. In the years that followed, scientists say they have come even closer to total certainty. "I would argue that the hypothesis has reached the level of the evolution of the hypothesis," says paleo-biologist professor of geology at the University of Texas at Austin who studies the Chicxulub crater. "We have it nailed down, the case is closed," Buck Shapton, a geologist and scientist emeritus at the Lunar and Planetary Institute, added. "It's not that any single organism started linking together to form multimolecular creatures. Four hundred and forty-four million years ago, nearly all of those animals were wiped out by the planet's first global mass extinction. The Earth crashed—fish appeared in the seas; four-legged amphibians crawled onto land—and then, 372 million years ago, another cata- strophe destroyed three-quarters of all life. For more than 100 million years after that, creatures thrived. The planet hosted the first reptiles, the first shelled eggs, the first plants with seeds. Forests swarmed with giant dragonflies whose wings stretched two feet across, and crawled with millipedes nearly the length of a car. The last great mass extinction began. When it finished, 95 percent of all species had vanished. The survivors went forth and multiplied—until, 200 million years ago, another mass extinction knocked out half of them."

Over the course of 4.5 billion years, the Earth has occasionally lashed out against its inhabitants. At different times, five mass extinctions ensued. About 250 million years ago, the ocean's single-celled organisms started linking together to form multilayerous creatures. Four hundred and forty-four million years ago, nearly all of those animals were wiped out by the planet's first global mass extinction. The Earth crashed—fish appeared in the seas; four-legged amphibians crawled onto land—and then, 372 million years ago, another cata- strophe destroyed three-quarters of all life. For more than 100 million years after that, creatures thrived. The planet hosted the first reptiles, the first shelled eggs, the first plants with seeds. Forests swarmed with giant dragonflies whose wings stretched two feet across, and crawled with millipedes nearly the length of a car. The last great mass extinction began. When it finished, 95 percent of all species had vanished. The survivors went forth and multiplied—until, 200 million years ago, another mass extinction knocked out half of them."

The age of the dinosaurs opened with continents on the move. Landmasses that had spent millions of years knotted together into the supercontinent of Pangaea began to drift apart, and oceans—teeming with sponges, sharks, snails, corals, and crocodiles—floated into the space between them. It was swimming weather most places on land: Even as far north as the 45th parallel, which today roughly marks the U.S. / Canada border, the climate was humid, subtropical. The North Pole, too warm for ice, grew lush with pines, firs, and palm-tree plants. The stegosaurs roamed, then died, and tyrannosaurs took their place. (More time separate stegosaurs from tyrannosaurs—about 67 million years—than tyrannosaurs from the pachycephalosaurus, which have only 66 million years of history.) It was an era of evolutionary innovation that yielded the first flowering plants, the earliest placen- tal mammals, and the largest land animals that ever lived. Life was good—right up until it wasn't. That's according to the Alvarez theory, which mass- extinction devotees, with their glibly ghoulish humor, refer to as the "bad weekend" scenario: The dinosaurs didn't see the end coming, didn't stand a chance, and by Monday it was all, abrupt. Big rock from sky hits the dinosaurs, and boom they go. (Some of the spec- cies that avoided the dinosaurs' fate are still around today, in a form nearly identical to their ancestors, including gingko trees, magnolia, roses, crocodiles, and tortoises, which Keller keeps as pets.) Alvarez's theory was a boon for the catastrophist school of thought, which maintains that the Earth
is shaped by sudden, violent events—and can turn on its occupants in a heartbeat. The impactors content that the fossils of both marine- and land-dwelling organisms show an abrupt and instantaneous die-off at virtually the same moment, geologically speaking, that the asteroid hit. "If you look at the extinction rate up to the event and you look at the recovery after this, it is the most sudden of all the known extinctions," Sean Gulick says. "This one is like a knife-blade boundary in the geologic record"—consistent with the kind of destruction an asteroid could cause.

Alvarez’s theory initially faced strong opposition from the gradualists, who argue that enormous planetary changes tend to result from slower, less adrenaline-pumping forces. Among those who disagreed with him was Keller.

Keller’s first interaction with the community investigating the dinosaurs’ disappearance took place at a 1988 conference on global catastrophes. She presented results from her three-year analysis of a rock section in El Kef, Tunisia, that has long been considered one of the most accurate records of the extinction. Keller specializes in studying the fossils of single-celled marine organisms called foraminifera—"forams," once you’re on a nickname basis, as Keller is. (She considers these creatures, which include many species of plankton, "old friends.") Because their fossils are plentiful and well preserved, paleontologists can trace their extinction patterns with considerable accuracy, and thus frequently rely on them as a proxy for other creatures’ well-being.

When Keller examined the El Kef samples, she did not see a "bad week," but a bad era. Three hundred thousand years before Alvarez’s asteroid struck, some foramin populations had already started to decline. Keller found that they had become less and less robust until, very rapidly, about a third of them vanished. "My takeaway was that you could not have a single instantaneous event causing this pattern," she told me. "That was my message at that meeting, and it caused an enormous turmoil."

Keller said she barely got through her introduction before members of the audience tore into her: "Stupid. You don’t know what you’re doing. Totally wrong. Nonsense."

Keller’s attacks had by then long characterized the mass-extinction controversy, which came to be known as the "dinosaur wars." Alvarez had set the tone. His numerous scientific exploits—winning the Nobel Prize in Physics, flying alongside the crew that bombed Hiroshima, "X-raying" Egypt’s pyramids in search of secret chambers—had earned him renown far beyond academia, and he had wielded his star power to mock, malign, and discard critics who dared to contradict him. In The New York Times, Alvarez branded one skeptic “not a very good scientist,” chided dissenters for “publishing scientific nonsense,” suggested ignoring another scientist’s work because of his “general incompetence,” and wrote off the entire discipline of paleontology when specialists protested that the fossil record contradicted his theory: “I don’t like to say bad things about paleontologists, but they’re really not very good scientists,” Alvarez told The Times. “They’re more like stamp collectors.”

Scientists who dissented from the asteroid hypothesis feared for their careers. Dewey McLean, a geologist at Virginia Tech credited with first proposing the theory of Deccan volcanism, accused Alvarez of trying to block his promotion to full professor by bad-mouthing him to university officials. Alvarez denied doing so—while effectively bad-mouthing McLean to university officials. "If the president of the college had asked me what I thought about Dewey McLean, I’d say he’s a weak sister," Alvarez told The Times. "I thought he’d been knocked out of the ball game and had just disappeared, because nobody invites him to conferences anymore."

Chuck O’Neill, another volcanologist, whom Alvarez dismissed as a laughingstock, charged that Science, a top academic journal, had become biased. The journal reportedly published 47 pieces favorable to the impact theory during a 12-year period—but only four on other hypotheses. (The editor denied any favoritism.)

That the dinosaur wars drew in scientists from multiple disciplines only added to the bad blood. Paleontologists resented arriviste physicists, like Alvarez, for ignoring their data; physicists figured the stamp collectors were just better because they hadn’t cracked the mystery themselves. Differing methods and standards of proof failed to translate across fields. Where the physicists trusted models, for example, geologists demanded observations from fieldwork. Yet even specialists from complementary disciplines like geology and paleontology butted heads over crucial interpretations: They consistently reached opposing conclusions as to whether the disappearance of the species was fast (consistent with an asteroid’s sudden devastation) or slow (reflecting a more gradual cause).

In 1997, hoping to reconcile disagreement over the speed of extinction, scientists organized a blind test in which they distributed fossil samples from the same site to six researchers. The researchers came back exactly split.

Keller and others accuse the impacters of trying to squash deliberation before alternate ideas can get a fair hearing. Though geologists had bickered for 60 years before reaching a consensus on continental drift, Alvarez declared the extinction debate over and done within two years. "That the asteroid hit, and that the impact triggered the extinction of much of the life of the sea...are no longer debatable points," he said in a 1989 lecture. "Nearly everybody now believes them." After Alvarez’s death, in 1988, his acolytes took up the fight—most notably his son and collaborator Walter, and a Dutch geologist named Jan Smit, whom Keller calls a "crazy 508.

Ground down by acrimony, many critics of the asteroid hypothesis withdrew—including Office and McLean, two of the most outspoken opponents. Lamenting the rancor as "embarrassing to geology," Office announced in 1994 that he would quit research. Though he did ultimately get promoted, McLean later wrote on his faculty website...
As Keller has steadily accumulated evidence to undermine the asteroid hypothesis, the animosity between her and the impactors has only intensified. Her critics have no qualms about attacking her in the press: various scientists told me, on the record, that they consider her "fringe," "unethical," "particularly dishonest," and "a gadfly." Keller, not to be outdone, called one impactor a "crazyball," another a "bully," and a third "the Trump of science." Put them in a room together, and "it may be World War III," Andrew Kerr says.

As the five-hour drive to our rural India turned into a stop to gather rock samples, Keller aired a long list of grievances. She said impactors had warned some of her colleagues not to work with her, even contacting their supervisors in order to pressure them to sever ties. (Thierry Adatte and Wolfgang Stinnesbeck, who have worked with Keller for years, confirmed this.) Keller listed numerous research papers whose early drafts had been rejected, she felt, because pro-impact peer reviewers "just come out and negotiate their hatred." She suspected repeated attempts to deny her access to valuable samples extracted from the Chicxulub crater, such as in 2002, when the journal Nature reported on accusations that Jan Smit had seized control of a crucial piece of rock—drilled at great expense—and purposefully delayed its distribution to other scientists, a claim Smit called "ridiculous." (Keller told me the sample was missing and was eventually found in Smit's duffel bag: Smit says this is "pure fantasy.") Several of Keller's stories—about a past adviser, for example, or a former postdoc who was bashed with variations of the same punch line: "He became my lifelong enemy."
Our Long Stretches

She was returned from a picnic near Sydney’s Suicide Cliffs one day when a bank robber, fleeing the scene of the crime, shot her, puncturing her lungs, shaving her ribs, and landing her in intensive care. “Woman Shot ‘for No Reason,’” announced a headline in The Sydney Morning Herald. “(She looked dead,) a witness told the paper.” A priest came to administer last rites and, as Keller hovered in and out of consciousness, commanded her to confess her sins. Twice, she refused. “I credit that priest with my survival, because he made me so mad,” Keller told me. The experience also cured her of her death wish.

In 1964, at age 19, Keller quit her job in Zurich and hitchhiked through Spain and North Africa for six months. She was detained at the Algerian-Tunisian border amid a coup that deposed Algeria’s president, but says she eventually charmed an army commander into letting her pass and even providing her with an escort—a drug smuggler who happened to be heading the same way. She continued her trek around the globe: Greece, Israel, Czechoslovakia, and Austria, where her phobia continued to on Russia.

in the car provided Keller ample time to continue inventing her own numerous brushes with extinction.

Her childhood could pass for the opening of a Brothers Grimm fairy tale. Keller’s mother was the eldest of 12 children in a wealthy Lichtenstein family. According to stories Keller heard as a kid, their parents had fled from Bolshevism and real estate kept the children wearing Parisian couture and summing in Austria. But the old-money clan grew distant from Keller’s mother after she dismissed Keller’s father, one of 18 children born to Swiss woodworkers, whose dreams of becoming a farmer clashed with the bride’s privileged upbringing. The young couple took out loans to buy a farm, where they raised cows, sheep, ducks, rabbits, vegetables, and their 12 children, the sixth of whom was Keller.

Keller grew up among rocks, in the alpine environs of a Swiss village where the neighbors still believed in witches. Although Keller’s father insisted his home was too remote to be near the brink of bankruptcy. To put meat on the table, Keller’s mother once steamed up one of the cats the family kept on the farm. Another time, she gave an older daughter some fresh “moos” as a gift—in actuality, Keller’s butchered pet dog.

Keller attended a local public school where one teacher oversaw four grades, an arrange- ment Keller enjoyed because it allowed her to tackle the older students’ more difficult assignments. Then, much as now, she rebelled against herself—a league apart from her peers. “I didn’t socialize much with the other kids, because I thought their fortunes from hotels and real estate were too dumb,” Keller told me. “(In school, well, how should I put this? I was very good at whatever I did),” she said another time. “She devoured books, completed her siblings’ homework in exchange for them doing her chores, and fumed that girls had to cook and clean while boys got to practice sex and math.

At age 12, Keller wanted to become a doctor. Her teacher, concerned by these delusions of grandeur, called in a Jungian psych- ologist to administer a Rorschach test and remind Keller that the daughter of such a poor family should aspire to less. Shortly afterward, Keller received a visit from a priest: Keller’s mother wanted him to take her to a nunnery, but Keller refused. Two years later, Keller—given the choice of becoming a maid, a salesgirl, or a seamstress—applied for a dressmaker. Her mother hoped that she would help her siblings. Keller eventually worked for Christian Dior’s fashion house, sewing gowns for 25 cents an hour. In 1963, Keller resolved to die before she turned 25. She had succumbed to reasons she described to me in detail, but attributed generally to frustration with Swiss society—her sense that “options were limited for a kid from a poor family,” plus “the sexual harassment” and “the way women were treated.” “You were just a piece of meat at any time,” she told me. She tried to kill herself by taking sleeping pills, fell, then figured she would live as dangerously as possible and die in the process. “I just never got killed,” she said. “Not completely. Anyhow.”

Keller adds: In 1964, at age 19, Keller quit her job in Zurich and hitchhiked through Spain and North Africa for six months. She was detained at the Algerian-Tunisian border amid a coup that deposed Algeria’s president, but says she eventually charmed an army commander into letting her pass and even providing her with an escort—a drug smuggler who happened to be heading the same way. She continued her trek around the globe: Greece, Israel, Czechoslovakia, and Austria, where her phobia continued to on Russia.

was interrupted when her health failed. It was hepatitis, which she had contracted in New York. “At the hospital, they didn’t think that I would live,” she said.

After a year of recovery, Keller set sail from Genoa to Australia from aboard a Japanese tour ship. “The first time I ever saw a kangaroo,” Keller said. “I was in awe.” She later settled in the United States. In 1995, she traveled to Australia to report for the Discovery Channel’s science series. “We had a blast,” Keller said. “We went to all the places we’d never been before.”

Keller’s mother died in 1998, and Keller felt the loss acutely. “I feel like she’s looking over my shoulder,” she said. Keller now lives alone in a New York City apartment, where she tends to her garden and reads extensively. “I’m going to keep writing,” she said. “I have another book coming out soon.”

Keller adores her work. Never before have I encountered someone so glowing about catastrophe. When we discussed the risk that the Yellowstone supervolcano might blow at any time, Keller’s eyes twinkled. “It’s a fun idea,” she said. “To her, mass extinctions are not nightmares. They’re just challenging questions. They illuminate life’s fundamental questions. “Ask yourself, ‘Where did you come from?’ ‘What are we here for?’” Keller told me. “If you extract all the religious bullshit away from it, you have to go to nature. And the only way to find out is really to study the history.”

Though Keller’s critics accuse her of being ego-driven and publicity-hungry, in the end they have shown little concern for her legacy. Instead, she expressed a dim view of what 54,000 years of human civilization will leave behind, much less her own few years in the living. “If we wipe ourselves out in the next couple of thousand years, there will be no record left,” she said, studying the eroded remains of 66-million-year-old faust that she drove back to the Hydraland airport, from where we would travel to the heart of the Deccan Traps, “I mean, it’s a second. A nanosecond in history. Who will find our remains?”

On June 8, 1783.

Indus’s Deccan Traps were formed.

Estimated 720,000 cubic miles of lava. That’s 337 times the size of France.

India’s Deccan Traps Formed.

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Keller’s deus ex machina arrived in the form of a pencil. She had been sketching the Deccan Traps, trying to visualize the enormity of the eruption. “I was thinking about how much land had been altered by this event,” she said. “I thought about how the landscape would look different from what it was before. I wanted to see what it would have looked like before it happened.”

Keller’s pencil sketches were a revelation. She began to see the Deccan Traps in a new light. “I started to realize that this was not just a giant explosion that occurred in the past,” she said. “It was a moment in time that changed the course of history.”

Keller’s sketches also inspired her to think about the future. “I began to wonder what kind of world we would live in if this event had never occurred,” she said. “I started to see the Deccan Traps as a kind of warning— a reminder of the power of nature.”

Keller’s work is a reminder that we are all connected to the natural world. “We are part of this planet, and what we do to it affects us in ways we can’t even imagine,” she said. “We need to learn to live in harmony with nature, or we will face the consequences.”

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Laki released 3.2 cubic miles of lava; Deccan unleashed an estimated 720,000 cubic miles, eventually covering an area three times the size of France. It took us five hours of driving, and a half-flight from Hyderabad to Pune, and another three hours in the car to France. The lava flows from some of their earliest, flattest reaches back to some of their highest peaks. They have risen in the mountains of Mahabaleshwar, a vertiginous town crowded with the honeycombs of basalt 2.1 miles high—nearly twice as tall as the Grand Canyon is deep—and extended as far as I could see. Even the geologist, who had visited the Deccan Traps multiple times before, gaped at the landscape.

"It's mind-blowing," Eddy said. "Every time.

Keller, who has food poisoning had gone from bad to worse, made the van pull over so we could revisit an outcrop she'd sampled twice before, on previous trips. At the base of an undulating wall of black basalt, Keller ran her hand over a blood-colored layer of rock, humming and in flamed as a scar.

Where we now stood was virtually within a blink of an eye of the mass extinction, she explained. Keller's colleagues had dated this red layer and found that it was deposited tens of thousands of years before the extinction, just before Deccan's largest and most lethal eruptions began.

"This hits the fan for the last 40,000 years," Keller said. "The eruptions really took off. Huge. Absolutely huge. That's when we have the longest lava flows on Earth, into the Bay of Bengal"—more than 600 miles away, practically the length of California.

A drawing that hangs over Keller's desk at Princeton depicts her vision of this apocalyptic, which was heavily informed by accounts of how Laki poisoned Iceland's livestock. "I told [the artist], 'Yellow foaming at the mouth!'" Keller recounted, delightfully. In the illustration, dinosaurs, gorging lime-green vomit, writhe on a hilltop of flames and charred trees. A red-streaked lava flow tears down the side of a mountain, covered with lava and spews dark, swirling clouds. According to Keller's research, while Deccan's lava flows would have devastated the Indian subcontinent, its release of ash, dust, and acid rain (acid rain, Keller notes, would turn the soil alkaline)—the atmosphere and oceans and causing vegetation that land animals needed to survive. The combination of carbon dioxide and methane would have eventually raised temperatures across the world by as much as 46 degrees Fahrenheit, further acidifying oceans and making them inhospitable to plankton and other forams. Once these microscopic creatures disappear from the base of the food chain, larger marine animals follow. At "that point, extinction is inevitable," Keller said.

Rocks elsewhere in the world support the sequence of events Keller has reconstructed for Deccan's pattern of eruptions. Over several thousand years, its volcanic activity stressed the environment, until its largest emissions dealt a final, devastating blow. The Earth's flora and fauna were on the brink of collapse. The story continued, and another 40,000 years afterward—a time period that coincides with Deccan's ongoing bitches. The volcano simmered longer after most species had vanished, keeping the planet nearly uninhabitable.

"HER CONCLUSIONS ARE way off," Jan Smit, the Dutch scientist, told me. After nearly 40 years of arguing, the two sides still cannot agree on fundamental facts. Smits and other impactors counter Keller's scenario with a long list of rebutts. The planet's trees went extinct "almost overnight," Smits insists, too quickly to be caused by Deccan volcanism. India's icecaps melted for hundreds of years, too weakly and for too long to be deadly, Keller's critics contend. They argue that there is no evidence that species suffered while Deccan simmered, and that the biggest volcanic eruptions occurred after the extinction, too late to have been the catalyst. Besides, they add, new-dating places the extant's impact within 22,000 years of the annihilation— as close as a great's "eyedates," says the geochronologist Paul Renne, who led the study.

Some scientists have attempted to find a middle ground between the two camps. A team at UC Berkeley, headed by Renne, has recently incorporated volcanism into the asteroid theory, proposing that Chicxulub's collision unleashed earth-savages that in turn triggered Deccan's most destructive pulses. But Keller rejects this hypothesis. "It's impossible," she told me. "They are trying to save the impact theory by messing it up."

The greatest area of consensus between the volcanists and the impactors seems to be on what insults to stink. Both sides accuse the other of ignoring data. Keller says that her pro-impact colleagues "will listen or discuss evidence that comes to what we believe!" Alan Hildebrand, a prominent impactor, says Keller "doesn't look at all the evidence." Each side dismisses the other as unscientific: "It's not science. It sometimes seems to border on religious fervor," basically, says Keller, whose work Smits calls "fanatical." Both sides claim that the other is so stubborn, the debate will be resolved only when the opposing sides conclude. "You don't convince the old people about a new idea. You wait for them to die," says Keller. "In that way, after 66 million years, when what you think is hilarious, like petrifaction or that, in evicted the eventual demise of the human specie, which Keller argues will be triggered by factors similar to Deccan volcanism. We fear that are filling our environment with the same ingredients—sulfur, carbon dioxide, mercury, and more—that killed the dinosaurs and us, not unchecked, will catalyze another mass extinction, this one of our own devising. "You just replace Deccan volcanism's effect with today's fossil fuel burning," she told me. "It's exactly the same."

Keller sees a bleak future when she looks at our present. Oceans are acidifying. The climate is warming. Mercury levels are rising. Countless species are endangered and staring down extinction—much like the gradual, then rapid, downfall of the forams. Whether or not Deccan volcanism caused the forams' demise, it is clear that our current environment may react to man-made pollutants. If Deccan was not responsible, however, Keller was not quick to dismiss the idea that the asteroid triggered modern day extinctions. That event led to a mass extinction, but how large an event it was and whether it was responsible for the entire event.