

Ripple Effect

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Ctein**

Ctein dedicates this novel to Laura Majerus
David Gerrold dedicates this novel to Sean and Alyce Friedman

Prologue

The sea sparkled.

Phil Hardie shaded his eyes against the dazzle and grinned a stubbly grin. To his right lay the green southern slopes and black sand beaches of Hawai'i's Big Island, and to his left the incredible cobalt of the Pacific ocean. His newly christened boat, *The Hardie Way*, rocked gently in the swells. This was it. Success. Everything a man could want. Phil didn't waste his breath bragging that he'd made his fortune the hard way. He let his boat do that for him.

Jared came up to the top deck, bringing a yellow sun hat and an icy cold beer, condensation still on the bottle. "Dad, you are not getting a sunburnt skull again," he said. "You look like a stoplight." He plopped the hat carelessly onto Phil's head.

"Laugh it up, junior, you're looking at your future. You have my genes."

"Maybe. But I might have gotten Mom's." Too late, Jared realized that was not the best response. His dad frowned at a memory. "Too soon?"

"Nah," said Phil, smiling suddenly. "We're here in paradise. She isn't."

Phil was proud of Jared. Dartmouth. Alpha Delta fraternity, just like his dad. Jared was Phil's only son and the two of them shared the bond of masculine privilege. Phil had left his wife and two spoiled daughters behind on the mainland. Little girls were cute, but they turned into big girls, and one thing Phil was certain of, he did not like the shrill demands of women. The divorce had not been amicable.

"Look," Phil pointed. They'd come around the last cliff to where the dark lava shelves rolled into the sea. Ahead, a towering cloud of white steam rose bright against the blue morning sky. At the base, an orange glow reflected the fires beneath. "That's it," Phil said. He turned the boat toward it.

"That's so awesome," Jared said.

Everything was "awesome" to Jared. (Phil's vocabulary wasn't that much larger. Jared was a chip off the old block.)

Living alone for the first time in years—after the divorce—Phil had been annoyed that he couldn't use his Mastercard or Visa for any of his favorite porn sites on the internet, so he created a partnership with two old Alpha Delta buddies, a smart coder and a financial geek, and created a service company designed to take payments for disreputable websites. He spent the next few months proving his value as a salesman, signing up the sites that were struggling and desperate. Their income doubled, tripled, then rose exponentially. After that, it was easy to sign up the most popular. In less than a year, all three partners were millionaires. Eventually, noticing the size of the market, other service companies began accepting online payments from porn sites. At age forty-two, Phil looked at the way that profits were leveling off and recognized the business had reached a point of diminishing returns. Phil's personal conviction, often-repeated for the public benefit, was that size mattered. Especially the size of his bank account. When it's time to get out, you cash in and get out. His partners didn't share that conviction, so they were happy to buy his share for a very reasonable twenty-five million and quickly replaced him with a much more manageable unpartnered sales staff.

Phil spent three million on his second yacht and moved to Hawaii.

Now, slightly drunk on beer and arrogance, he steered *The Hardie Way* directly toward the roiling column of flame and steam. "Isn't this dangerous?" asked Jared. He pointed to a distant boat. "The tourist boats never get this close."

"Tourists," Phil shorted. "They pay for the privilege of mass-produced mediocrity just so they can say they've been someplace. *The Hardie Way* is a lot faster than those tubs. I'm going in close to get some real photos." His expensive Canon was mounted just forward of the wheel. He reached ahead to switch on the camera's automatic video capture.

The camera survived. Phil and Jared did not.

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The Hawaiian Coast Guard cutter kept its distance, waiting until *The Hardie Way* had drifted well away from the still-expanding tower of steam.

A chopper—an AW109 painted in bright Hawai'ian colors, yellow, green, and blue leaves, like a flying luau shirt—circled above. The owner, Harry Sullivan, was familiar to most of the services on the big island, an unofficial adjunct to the occasional search and rescue missions. Today, he was broadcasting video of the gaping new fissure that had opened without warning. Below, fiery rivers of lava poured into the boiling ocean. Driven by the winds, huge towers of steam tilted across the sea, shadowing the waves beneath—a vast wall of warning.

"Madam Pele is grumpy today," Harry reported drily.

"Thank you for pointing that out, Harry." Lt. Commander Castro adjusted his new headset, it still didn't fit right. "We're going in now." He brought the cutter around behind *The Hardie Way* and came up on its starboard side where the paint was blistered and peeling, and where he could see—

“Anybody alive?” Harry asked.

Castro took a second look to confirm. “Two bodies. The steam caught ‘em head on. They’re parboiled.”

“Sorry about that. Had to ask.”

“It’s a bad one, Harry. Don’t do any closeups.”

“Wasn’t planning on it. Broadcast standards. Very touchy. Don’t want to scare the tourists.”

“Yeah, well—no way to keep this one quiet.”

“It’s already on the news,” said Harry. “At least a dozen tourists got it on their cellphones, and I’ve got three offers already for my footage.”

“You could make some big bucks on this one.”

“Not this time. Not this one. I’m not a ghoul. I like happy endings. Give me a dog on a surfboard any time.”

“Copy that.” Said Castro. “Stick around, get footage of us attaching a tow line.”

Two crewmembers on the cutter were already pulling on their gear. “Don’t touch anything you don’t have to,” Castro said. “Just fasten the line and get off.”

Securing the tow line didn’t take long. The men were experienced. One of them waved to Castro from *The Hardie Way*. “All done here, brah. Coming back.” Then he pointed. “Big camera up top. Looks like it’s still running. Want us to grab it?”

Castro considered it. “Yeah, get it.” He picked up his mic to check with Harry. “We’re retrieving the camera. Might be something useful on the card. What do you think?”

“I know a man,” said Harry. “Studies volcanoes. I’ll call him.”

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Emmett Barnes set the camera on the table in the conference room of the Hawai’i Volcano Observatory. “Well, here it is.” Several assistants gathered around, but only Freddy eagerly leaned forward to examine the camera. The others knew better.

Freddy poked the Canon with the eraser end of a pencil, turning it so he could read the device ID on the back. “Nice,” he said. “It’s the pro model.”

“Can you get anything out of it?”

“Well... It’s built on the same chassis as the cameras we use on the drones that we send down to shoot the lava lake in Halema’uma’u. But we’d use this if we could afford it. This unit is top of the line. If you have a fast enough SD card, 4 terabytes at least, it can shoot 8K at 120 frames per second—”

"Freddy," interrupted Emmett. "How many times do I have to tell you? If you're going to stay on our planet, you have to speak our language."

"Sorry, boss. But yeah, it's a really good camera."

"Yes, you said that. Now answer my question. Can you get anything out of it?"

Freddy shrugged, frowned, shook his head, considered. "Depends on how long it was in the steam, but the damn thing is supposed to be heat resistant and water-tight to thirty fathoms, so yeah, the chances are um, maybe good. I dunno. Maybe."

Emmett fixed him with his best stare. It made him look like a mahogany Mr. Clean with indigestion. "Harry got us this. He said we were the ones he trusted to pull the data. Don't let him down. Or me."

Freddy blew out his cheeks. "Okay, boss. Whatever's there, I'll get it out." He carried the camera carefully to his work station.

Emmett turned to Kendra Malloy. "You're our best at field studies and running models. See what Freddy pulls off the card. See what matches with the seismo array and your simulations. Could be useful."

"Already planning on it."

"Okay, next. What are we going to say to the press?"

"How about nothing," she said.

"I wish, but no. We have to issue a statement. I promised the governor."

She shrugged. "How about the same thing we always say? 'It's a natural part of the Big Island's volcanic nature. At the current rate of lava flow, the big island is adding three acres a day. The pressures on the edge of the flow are constantly shifting. This morning's event was a small underwater quake. These are very common, but unpredictable, so caution is always advised.' The same old, same old, right?"

"And the two men in the boat?"

"They were too close. They didn't listen."

"Ken..." Emmett pinched the bridge of his nose. "You *know* we need to be a little more tactful than that. We regret the loss of life, etcetera, etcetera."

"They *were* too close. They *didn't* listen. But okay, fine—tragic loss of life and all, yeah yeah." Ken's tone changed, becoming as dry as a bored PR flack. "We at the Volcano Research Lab regret the loss of life. This is a terrible reminder that all boats need to maintain a safe distance from the lava flow, at least a kilometer away from the shore. Something like that?"

"Yeah, but without the sarcastic tone."

"Which matters, because?"

Emmett sighed. "Because you're going to be the one reading the statement to the press. God knows why but they *like* you."

"Not mutual and not my fault. I try to discourage 'em. They ask too many stupid questions. 'Sides, you're the HVO's Director."

"Be kind, Ken. Not everybody is as smart as you. Regardless, you're point on this. I've got a governor to deal with. So write it up. I'll polish it. Oh, one more thing—" Emmett looked to the entire group. "Everybody, listen up. Let's stay close on this. If you get any questions, refer them to me. Or Ken, since she *is* point on this." Emmett ignored the grimace. And the stuck-out tongue. "This'll be a big story for a few days, at least until the next distraction. We're going to get reporters nosing around looking for an angle. In the meantime let's not have any leaks. No gossip, nothing. I don't have to tell you how much this island depends on tourism and we need the good will of the governor. Can I have your agreement on this?"

"And, Ken? I saw that look. And the tongue." Emmett turned back to the others. "Also, I want charts and maps for the press conference. Lots of them. Everything. Give me the geological history of the islands all the way back to Gondwanaland. I promised the governor we'd make this thing boring."

He waited for nods from everyone, then sent everyone except Ken back to their stations. He grumbled, "God, I hate politics."

"No, you don't," said Ken. "You just hate politicians. And meetings with politicians."

"They get in the way of the work," he said. "But they control the budget, so—"

He was interrupted before he could finish the sentence. "Boss? You're gonna want to see this." That was Freddy, waving from his workstation. Already a small crowd was gathering. "Some really good stuff here."

Emmett and Ken joined the crowd, the assistants stepped aside so they could see the display on Freddy's oversized monitor. It was a point-of-view shot from *The Hardie Way*, accompanied by the steady sound of waves, the distant roar of lava and steam, punctuated by occasional ignorant observations from the late Phil Hardie and Jared.

"Looks like they were heading straight in," Freddy said.

"What the hell were they thinking?" asked Emmett of no one in particular. .

"They did us a favor," said Ken. "There. Look at that, right there. See that bulge in the crust, how it's rising? That's bad news. They should have turned away right then."

"But they didn't," said Freddy. "Watch." He tapped his keyboard. "I'm gonna slow this down. You can see exactly what happened—"

Afterward—after the screen went white with steam, after the last of the gurgling screams went silent, after the silence stretched uncomfortably long, Emmett spoke first. "I don't think we want to share this with anyone."

Ken said, "Well, no. Not the last part. But the rest of it? It's good."

Emmett looked to her. "If we share it, we're gonna take flack."

"Yeah, I know—but it's great footage. We don't have anything like it. We need it. Look, there is—or was—a known reservoir of lava under that crust. It flowed into a lava tube running under the shelf to the southwest. The flow kept the pressure from increasing. Now, this part is speculation, but we know there's a bench there holding the shelf in place. There was a small quake, yesterday, nothing worth making note of. But if that quake dropped the bench just below this outcrop, the shelf could have settled, plugging the tube. Pressure builds, crust splits. Dumps an effin' ton of crust and molten lava into the sea all at once. Blooey."

Emmett considered it. "Run it again, Freddy. Let's have another look. But uh, stop it before the steam hits the boat."

Freddy bent to his keyboard.

After the third replay, Emmett said, "We have a problem." The staff looked to him. "The press. Some of those reporters are smart. They know their geology. They're going to ask about the Holina Slump, all seven thousand cubic kilometers of it. Is that one going to collapse next?" He looked to Ken.

"Well, if they ask me, I'll say yes. It's inevitable. That whole shelf is going to slide into the sea. Eventually."

"Which is why I don't want you answering that question. If anyone asks, refer them to me. I'll pull out the charts and talk geology until they gnaw off a leg to escape."

"I wasn't finished," Ken said. "It's going to need a much bigger quake than the one we had today to crack that bench open."

"And they're going to ask," Emmett said. "How likely is that? They love doom and gloom stories."

She shrugged. "How likely? Anywhere from tomorrow to a couple thousand years. Right now, the best answer is 'I don't know.'"

"Right," said Emmett. He faced the small crowd of assistants. "And that's why I want all of you to stay away from reporters. At least until we can say 'a couple thousand years' with confidence."

Ken said, "Let me sink a few more monitors into that shelf, That'll give us a better idea. Let me have the ones we planned for Haleakala. It ain't going anywhere."

Emmett considered it.

"It's proactive," she said.

"It's also what you've been nagging me for, for how long now?"

"Eighteen months. No, twenty-four. Now, do you want to be able to answer the question when it comes up?"

Emmett conceded. "That's a winning argument. Okay, take those monitors and I'll order more for Haleakala. I'll call the governor, see if she can pull it out of state funds. It'll be a lot faster than

pushing on the USGS in Washington. She won't like it, but she'll okay the expense. It'll look like she's doing something useful. And if she won't—I'll fudge the budget somewhere. How soon can you get out there?"

"Tomorrow. I'll lay out an extension of the array tonight and get out there first thing in the morning."

-end of chapter-

Chapter 1

“Paradise, my ass.”

Somewhere else on the Big Island the morning was cool, filled with the pleasant fragrances of oleander and plumeria, a tropical heaven. Not here. The sun baked the chunky lava fields of the Hilina Slump on the south end blistering hot. Between the temperature, humidity, and the whiffs of sulfur and other volcanic gases—this was not paradise. More like the other place.

Ken was usually good with the tropical heat, but the end of the Twenties was setting all kinds of temperature records. “Effin’ global warming,” the vulcanologist grumbled. February shouldn’t be this hot.

Still, it was better than being back in Boston, where Mum and Da were enjoying a comfortable eight inches of snow. Tomorrow there’d be slush. And ice. All right—95 degrees and 95% humidity were preferable. That didn’t make it *fun*.

Ken’s personal pack mule, a cherry-red Tesla Model 5 was parked two kilometers away at the Hilina Pali Road Overlook. It had been a strenuous ninety minutes, hiking down the trail that descended the Pali cliffs to the flatlands of the Slump. It was a hard slog. The Slump’s terrain was a jagged slope of hard brown lava, all smashed and broken chunks, all sizes from pebbles to large boulders. A’a was what Hawai’ians called it, and it didn’t make for an easy hike. You had to pick your way carefully. Even a casual stumble could result in painful scrapes, bruises, even broken bones.

Overhead, the sky was cerulean blue, subdued by the humidity. A line of cumulus clouds on the horizon promised the slight possibility of an afternoon shower. She wasn’t counting on that, just more heat. Ten pucks placed, another half-dozen to finish the day’s quota. And none too soon. Ken bent to the lava, ready to place the next puck and already thinking about lunch.

“Excuse me?” A man’s voice, thick with a London accent. Ken looked up, annoyed at the interruption.

He was a sweaty sunburnt tourist, mopping his face with a handkerchief. He wore a straw hat, a garish Hawai’ian shirt, and a confused expression. His even more sweaty female companion stood behind him, wearing shorts, a halter, and a look of impatience. “Come on, Donnie—I’m hot! I wanna see something!”

“Give me a minute Millie. I’m asking directions like you wanted!”

Ken left the puck half-placed and stood up, wondering how the hell these two had gotten all the way down here. They had to be lost. She looked from one to the other. "Can I help you?"

"The Fountains? Which way to the Fountains? They told us we'd see molten lava. I just see rocks."

Yup, lost. And, of course they were looking for the Fountains. Kilauea, the Greatest Volcanic Show on Earth—also the longest running.

Something had shifted deep underground, closing off some magma conduits and opening others. The Halemaumau pit at Kilauea's summit, which had drained of lava in 2018, had filled again with fiery-orange molten rock.

Then it paused. Madame Pelé, the Fire Goddess who reigned over Hawai'i, rested. A simmering lava lake glowed incandescent at night and emitted noxious fumes, but didn't do much else.

But one hot summer morning, she awoke again.

The lava mix in the lake became more volatile, gassier, frothier. Pelé turned the cauldron from simmer to full boil. Lava erupted upwards from the lake in displays that climbed hundreds of yards and glowed cherry-red in broad daylight, brilliantly orange at night. It was a nonstop display that rivaled those of the 19th Century.

The Fountains brought the tourists to the Big Island in record numbers and held them at bay at the same time. Nobody had seen anything like it in living memory. Everyone wanted to. At once.

"No," she said. "You're nowhere near them. You should have stayed on Chain of Craters Road. You'll have to go back to the fork."

Millie smirked. "I told you, Bonnie. We were supposed to go right."

Bonnie ignored her. He pointed at the insignia on Ken's cap. "You're a park ranger, aren't you?"

"No. I'm a vulcanologist."

"You study Vulcans? Oi!" He gave the *Star Trek* Vulcan salute, grinning.

Ken ignored it. It was an old joke. Stupid, too. "No, I work for the Hawai'i Volcano Observatory and study volcanoes. This one is particularly dangerous. Especially the lava fountains."

"But other people are—"

"Statistics. Other people are statistics. Do you want to be a statistic? Go that way. If you want to have a vacation, take your girlfriend back to the hotel, order the mahi mahi, and watch the Fountains from the deck."

The woman tugged at her companion's arm. "Come on, Donnie. My feet are burning up."

"Millie, it's not that hot!"

Ken pointed. "Tennis shoes. Not the best footwear for walking on a'a."

"What-what?" Donnie didn't wait for an answer. "So what are you doing out here, anyway?" He pointed to the bag slung over Ken's shoulder. He craned his neck and leaned forward as if trying out his X-ray vision.

"Planting pucks," she said brusquely. "Interfering or tampering with them is a federal crime."

The tourist ignored the implied warning. "Eh? What's a puck?"

Ken sighed. This tourist was not going to be put off easily. Striving for opaqueness as well as intimidation, she added, "It's a solar-powered, GPS equipped, multi-sensor listening device, designed specifically for monitoring positional shifts and seismic events on the lava shelf. They are federal property and tampering or removing them will result in arrest and substantial civil and criminal penalties."

It went right over the Brit's head. He latched onto the one bit he thought he'd understood. "Like if the volcano's going to blow up? Like Krakatoa? Can it do that?"

Ken considered several possible answers, among them, a warning of immediate danger and a recommendation to evacuate quickly. Amusing...but no, that's how you start panics.

"Not this one."

"But you're looking to see if it could happen—?"

"No, we're measuring stress," Ken said, wishing the man would just shut up and go away. The needle on her own stress meter was beginning to jiggle.

Instead, the man blathered on. "Oh, it's like writing science fiction, isn't it? I do that. I'm going to write a novel. This trip is research for a story I want to do, where Hawai'i blows up like Krakatoa."

Right, thought Ken. Not sharpest marble in the box. But the thought remained unspoken. Donnie hadn't noticed that the soles of his shoes were starting to stick to the a'a. She considered when it might be necessary to tell him.

"Sorry. That's not possible. Not here."

Donnie shrugged it off. He didn't care. "But it's going to be a great story. I'll sell it to the movies." He peered closely at Ken's ID badge. "Malloy, innit? That sounds Irish. You look Hawai'ian."

Ken suppressed a sigh. This, again.

Millie nudged him. "Donnie you're being a bother."

"I'm just making conversation!" Donnie protested. Turning back, "It's no bother, innit?" He didn't wait for an answer. "So, not Hawai'ian? Irish?"

Ken was getting fed up. "No. Half Hawai'ian, on my mother's side. Father Boston Irish. I grew up there. If you must know. Is that a problem?"

"No, no, not at all. We just haven't met any real Hawai'ians yet." Donnie barely paused for breath. "So, about this volcano blowing up—"

Ken gave up, pointed again at the woman's shoes. Millie was hopping from one foot to the other now. "If you don't start moving, you're going to have to carry her." She added, "And you're about to stick to the rock. Crepe soles. Bad choice, this stuff gets hot in the sun. Just keep walking and you'll be okay."

Donnie looked down. "Bloody hell, they nicked me a hundred quid for these. Said they'd be perfect for Hawai'i."

Ken suppressed the urge to laugh. "Sure. If you're on the Kona Coast. Listen, you really need to start hiking back. For your own safety. And I need to finish my work here."

"So, no molten lava here?"

"Donnie, I see the ocean! Let's go look at the ocean!" Millie pointed south.

Donnie must have finally begun feeling the heat in his shoes. And perhaps he'd finally realized that this conversation was over. He nodded to Millie and the two of them began picking their way across the cobbled terrain toward the shore.

She called after them, "Don't go too far. The shelf is unstable."

Donnie paused, called back over his shoulder, "Oi! I know. The rangers warned us. I'm not stupid!"

Ken did not reply to that. Discretion was the better part of wisdom. An electrolyte pill, a swig of lukewarm water, and a renewed focus on the job at hand was more important. Still, it was annoying. The tourists had wasted at least fifteen minutes with their chatter. If they hadn't interrupted, she could have already been placing the last few pucks out at the end of the shelf—as far out as it was safe, anyway.

Another puck and another and a third, Ken planted each one carefully, pushing them deep into crevices between blocks of a'a. To each was attached three mandatory warning tags, cautioning hikers that if they were this close they had already been photographed.

The tags prevented serious vandalism, although on weekends drunken teens would sometimes make faces at the cameras or expose various parts of their anatomy. Publishing the photos on Instagram and Facebook (with the caption, "Hawai'i's native baboons, mating displays") was usually embarrassing enough to deter additional efforts.

Finally, this set of pucks was finished, and only the final shelf line remained, but first the line had to be checked. She put down a thin foam pad (the rock was *really* hot) and sat on it, took another drink of water, and pulled a tablet from the backpack. A productive morning, despite the heat and the interruption. The a'a was deserted other than the two annoying tourists off looking at the sea. The huge waves that broke below the rocks were always an awe-inspiring sight—at least to naïve tourists. Locals understood the danger they represented.

The tablet's display flashed with green markers. The connection was good. A constant stream of positional information now flowed from these latest placements to the computers at the Hawai'i Volcano Observatory.

Three times as many pucks would have been better, to monitor how this seemingly static landscape was actually shifting and stretching and straining, but that would have required another three million dollars, not to mention at least a half dozen lab assistants to place them all.

Just getting *this* had been hard enough—but if the HVO ever managed to get a forecasting model to hold up, they might be able to say with some degree of certainty when and where the strain might snap. This effort was merely the latest in a long history of volcanic studies—but the success rate for prediction so far wasn't much better than reading goat entrails.

Ken liked goats. They didn't ask stupid questions.

And then—the ground bounced. A jolt, not large, but sharp enough to be immediately noticeable. Ken's butt bounced on the pad. The ground settled in a few seconds.

The joke in the office—not around Ken, but she was not unaware of it—was that Ken's butt was the best seismic monitor on the island. Legend had it that wherever she was sitting when a quake struck, her marvelous magical butt would identify the magnitude and the location simply from the characteristics of the tremors—and Ken would call it without looking up.

Right now, butt, brain, and gut were having their usual conversation. This one? The shaking lasted only a few seconds, not too intense but awfully close. A medium-small quake, maybe a 3+, but which direction? Off the southern coast, they opined.

Ken's phone went off—the ring tone was a bosun's whistle. That would be Emmett. Calls from assistants baaahhhed like sheep. Ken had never shared that with them.

“Answer.”

A man's head appeared on the screen.

“Kendra,” he said.

“Uh-oh. You only call me by my full name when it's serious,” she said. “Yeah, I felt it. Close, right?”

“That sixth, ummm, sense of yours?”

“Yup. New pucks are in place. We should be getting some good readings. What does EQUUS say?”

EQUUS was the nickname for the Early Quake Warning System. It was just too many syllables for common conversation, and it wasn't any faster to say “EE-QUE-DOUBLE-U-ESS.” Therefore, EQUUS.

The system was a long way from complete, but it was already working well enough to provide useful analyses. Someday, she hoped it would be more than that, a reliable warning tool. Right now, though—still mostly goat entrails.

“EQUUS did good. Picked up microtremors from the stress five seconds before the main break and sent out alerts just like it was supposed to. Not too many. It guessed the magnitude pretty well.”

“So? Why the call?”

"It was right off the end of the Hilina Slump. Just a heads-up to be careful."

As if Ken needed reminding. Ken's Vulcanology 301 professor had drilled a mantra into his students. "There are old geologists. There are bold geologists. There are goddam few old, bold geologists and there is not a single FUCKING old, bold vulcanologist."

Doctor Nakahara, an otherwise genteel white-haired old man, thought that punctuating his lectures with profanity would help keep the students awake. No one argued; he might have been right. If he wasn't, he was still handing out the grades.

Ken had no intention of challenging the mantra.

"Is it okay for me to keep laying pucks? I've still got the shelf line to do."

Em looked to the left, reading an off-screen display. "Displacement hasn't changed... Yeah, should be okay."

"Have Selina squirt me the air quality map for here out past the Pali?"

"Already done. Let's be careful out there."

"Always do." That was Em's standard sign-off, and Ken's standard response. Ken didn't need reminding. "Not a single FUCKING old, bold vulcanologist."

"Hang up," she told her phone. Maybe I should check on those twits, make sure one of them didn't fall and sprain something. They were bothersome, but that didn't change the fact that you could get hurt out here. They didn't seem like "survival" types.

Ken stood up and squinted into the glare. Yeah, she could see them half a mile off, standing and looking out at the ocean, about where she wanted to put the last line of pucks, a couple of hundred yards back from the edge. Okay, maybe they weren't entirely stupid. She hoped they wouldn't want to chat again, she had work to do—

The ground moaned. A strange deep sound, something she'd never heard before. Then it quivered. And rumbled. A slow bumpy motion. Not an aftershock—it felt wrong. "What in 'effin...?"

The Brits were trying to run. One of them stumbled. Donnie? Millie? Ken couldn't tell from this far away. And then, the ground lurched. Hard. The chunk of shelf the tourists were on tilted, then it—and the Brits—dropped out of sight.

If they screamed, Ken didn't hear it. Her own scream of horror was louder.

Dust and spray thrown by the collapse blocked her view. If they were still on shore, she couldn't see them. She knew they weren't. Madame Pelé had claimed her sacrifices.

Kendra Malloy, shocked and horrified, turned and ran, almost stumbling, back toward the safety of the Pali, away from the broken edge of the lava shelf. Out of Madame Pelé's reach.

-end of chapter-

Chapter 2

Ken swiped her phone to life, still navigating her way across the uneven a'a. "Call Barnes!" she told it. The moment he answered, she started talking. "Em, the Hilina, the shelf, it broke! I'm okay. But I'm pretty sure two tourists were killed. They were on the piece that fell."

"Goddammit—" Em hesitated, at a loss for an appropriate way to continue. Finally, he just gave up and said, "Um, yeah. Two tourists. Shelf broke. Are you all right?"

"I just told you, I'm fine."

"You sound shaky."

"Yeah, I can't imagine why. Call the Coast Guard. Have them send out a chopper. Just in case I'm wrong."

"Right—"

Before he could go on, Ken said, "What did EQUUS say? How big was the event?"

"Big enough that an automatic tsunami alert got triggered. I'm looking at the numbers now. Looks like a two-meter runup at Hilo and Kona, max." He added, "Do you want to come in? Or do you need some time to... you know?"

"I'm coming in. I want to know what happened. And I need distraction."

"Hmmm," Em thought about it. "Okay, but if you need to take off to chill, just say so."

Ken slowed down now, she was close enough to the car to feel safe. And she was starting to feel the after-effects of her adrenaline surge. "I'll be okay. I promise, I won't bite anyone. Unless they deserve it. Hanging up now."

She looked back toward the shelf, feeling like she'd set a new land-speed record for traversing the a'a. From here, though, it was a serious uphill hike. "Okay, easy," she said, aloud. "The whole shelf is not going to go. It's not."

She forced herself to focus.

She heard the voice of her father, that time the car broke down and they had to hike all those miles through the snow. She'd been only nine, and terrified. "One step at a time,

Kenny-girl," he'd said, "just think about the next step. Breath and step, kiddo, we'll be just fine." Da's words were had been her endurance ever since.

Today, much easier said than done. She nearly panicked, thinking about how precarious her situation had been. Reaching the top, she scrambled to the Tesla and sank into the driver's seat. "Tess, air conditioning, set to 75."

The first blast of cold air was a shock to her system, a good one, like going from sauna to snow. It had been plenty hot on the Hilina; she was even hotter after force-marching herself the miles back to the car. I'm probably pushing hyperthermia, she thought to herself, as she grabbed for another Gatorade. That's why I'm shaking.

"Yeah," she told herself. "That's it. I'm just dehydrated." But even as she said it, she knew she was lying. She could still see Donnie and Millie dropping out of sight, and the shelf disappearing, probably coming down on top of them. Their bodies might never be recovered.

"Okay, okay, okay, Kenny-girl. Stop it. Stop. Just stop. This is going to take a while, isn't it? Crap. I am not going to sleep well tonight, am I? Not for a long time. This is—ugh." She realized she was trembling, too wobbly to drive, even with autopilot. She needed to calm down. Distract herself, that's what she'd said to Em. She grabbed her tablet, booted it up, and started checking her pucks, one by one, to see if were still online.

Most days weren't like today. Amend that, she thought, *no* day had been like today. Maybe she should think about a move back to Boston. She'd be close to Ma and Da again.

OK, she was nowhere as good as she'd told Em, if she was even entertaining that notion. Moving back there would mean putting up with the cold and wet winters that Ken had held a deep and abiding hatred for ever since she was a toddler. It's why she'd been thrilled when she got the job offer for Hawai'i. No snow, no icy muck dribbling into her galoshes and soaking her socks, not ever again!

Besides, Kendra Malloy was a vulcanologist—and there was a distinct shortage of volcanoes in Massachusetts.

The job offer from the HVO had come with the opportunity for lots of fieldwork, a lot more than she'd have had in academia. A faculty position would have meant too many hours with students, colleagues, and administrators. Too many hours with people, with no break. It's not like she was misanthropic. She just got fed up after a while and needed to get away from them.

Hiking the lava flows of Hawai'i was great for that. Mostly she worked where tourists didn't wander. There was the occasional serious hiker, but they were after much the same thing she was. Solitude.

Placing pucks wasn't a job that required any special expertise—read a map, consult a GPS tracker, and hike across broken lava. Any of the assistants could have done it, even any of the college interns, once they'd been trained in field safety. But it was one of Ken's job perks, getting out onto the lava fields herself, amid the the dreadful splendor of the tortured, hardened surfaces. Here, where slow-moving rivulets of syrupy fire had hesitated, solidified, and then ultimately broken themselves apart in their relentless push to the sea. There was nothing else on the planet like this and Ken loved it. Normally.

When it wasn't 95 degrees and when people didn't die.

Ken was fine with writing algorithms and debugging code, fiddling with simulations, and comparing the measured data with predictive models—but that was vicarious. Real vulcanologists got out on the rocks, stood on the edge of the crater, where the heat and the stench of sulfur and boiling magma is the closest one could get to the raging turmoils hidden inside the Earth. Once a person had looked into this abyss, they would never feel the same again about the ground beneath their feet. It was a glimpse into the heart of Hell.

It wasn't about the danger. She knew some who were attracted to the danger (a lot of them were dead). Not her—she wanted to understand the danger, maybe even predict it. Make it less dangerous.

The rock spoke to her best when there weren't other people wandering around on it, chattering, taking pictures, completely misunderstanding the violent beauty that had created it. It was a hard thing to explain, but hiking over the fields of frozen lava was close to a mystic experience for Ken, and it was better as a solitary one.

The landscape only looked chaotic, but Ken's years of experience were a map, an awareness, a recognition of all the multiple processes. The overlapping patterns of the flows were as readable as a history book. But more than that—you had to stand on the hot rumpled surface, you had to smell the stink in the air, you had to feel the heat, you had to be here to *understand*. Anything else was a big piece of insufficient.

Despite resembling Hell, Kilauea was usually Heaven for Ken. At least if there wasn't *too* much of the heat and the humidity and the stink.

But, so long as "Heaven" was on earth, people would die. Ken learned early to respect Madame Pelé's power. Whenever she went out on the lava fields, she took a fanny pack that held a full-face gas mask and scrubber. Her knapsack always held water, Gatorade, electrolyte pills, a first aid kit, a satellite-link phone, military-grade GPS, her tablet, and a camera.

Tess's trunk was packed with a variety of emergency supplies. Extra facemasks and rebreathers, a case of bottled water, several more bottles of Gatorade, a box of MREs,

multiple changes of clothes, a fully-equipped first-aid kit, toilet paper, tampons, a satellite transceiver, spare batteries, hiking and camping gear, three pairs of boots, and even a hazmat suit, gloves and booties.

Also a pyro suit. Ken had no plans ever to use it—it was Just In Case. Ken planned to be one of the old ones, not one of the bold ones.

There—that was it. *That* was what was bothering her. She should have ordered them to stay away from the shelf. Yes, she had warned them to stay back, but she knew that the whole area might be unstable. Maybe they wouldn't have listened, but she should have tried.

But she had gone out onto the a'a herself, and if she had felt it was safe enough, how could she blame those two unfortunate Brits for making the same mistake? She was the one who was suppose to know better, wasn't she? That was it—not that she hadn't warned them off the shelf, but that she'd been so stupid when she prided herself on being so smart.

What was that again about old ones and bold ones?

"Fuck," she said. "I do not need that in my head." And even as she said it, she knew that wasn't going to go away, not entirely. Ever.

But for now—distract. Focus on the meaning of this small collapse.

The instability of the outer shelf had been known, so the collapse wasn't unexpected. That's why there were warning signs. But what did it say about the stability of the rest of the field? What do we know today that we didn't know yesterday? Was stress released or made worse? Maybe the new pucks would provide enough data to make a better forecast than goat entrails. The goats'd appreciate that.

A joke? Now? Well, maybe that was a good sign. She looked at her hands. They weren't trembling. Okay, I can drive now. And maybe not bite anyone's head off.

She knew Em'd be keeping close tabs on her when she got back to the lab. She knew she had a short fuse, she'd never pretended otherwise. It started in grade school, always being teased as one of those "others." Mixed-marriage kids still had it tough. That led to shoving and skinned knees, which led to visits to the principal's office. But, so far as she was concerned, she'd won—afterwards they left her alone.

Kendra didn't see this limited her. She saw challenges to surmount. Other people, though, they were the biggest challenge.

Despite all that, she learned to get along. She could be courteous, even gracious. It was a survival skill—say "please" and "thank you" and "tell me more." Listen hard—or at least

pretend. By the time she hit college she was perceived as kind and thoughtful and considerate of the needs of her friends, who were numerous.

She just blew up every so often. Her outbursts weren't predictable. Sometimes people were just... well, just too much. Shanna, her roommate at Boston U, had once taped a sign to their door. "Don't poke the bear." Kendra had seen the sign and nodded. She kept it and regularly hung it on the door.

Shanna, who was a first-year psych major (and consequently fancied that she understood everything about everyone's psyches) informed her once over dinner, "Ken, you have unresolved anger issues. You need to deal with them."

Kendra considered using her fork as a catapult to launch a glob of mashed potatoes across the table—it was a passing fantasy, one she had never acted on, but a recurring one ever since childhood exposure to the Three Stooges.

She put her fork down carefully. "Yes, Shanna. I have a temper. I know what people call me behind my back—'The Honey-Badger.' And yes, it's fairly earned."

"Really?" said Shanna. "I'm not sure that is the point."

Kendra shook her head. "When was the last time I went off on someone?"

Shanna thought about it. "Oh," she said. "When Lilith said science wasn't important. She was only here to grab a rich husband."

"You don't think I was justified? Someone needed to warn Bob. He's a good guy. He deserves better!"

"And they both blame you now."

Kendra shrugged. "I'm not waiting for a thank-you note. But I'm right"

Shanna didn't answer immediately. She studied Kendra across the table. "Soooo. Is this about being right? Or keeping people at bay?" She gestured towards the sign by the door.

Kendra felt her face flush. "Maybe... both. Sometimes I need, I dunno, space. Is that a bad thing?!"

"Mmhphm," Shanna said, noncommittally through a mouthful of hamburger. "Maybe if you had a steady—"

"No! Don't start with that again. Too much work, not enough reward. I'm happy with what I've got!"

"Mmhphm," Shanna said again.

Kendra was who she was, pop psych notwithstanding. Right now she was a vulcanologist who was winding down from a traumatic experience. Right now she wanted to be anywhere but here. She wanted to get back to her desk. Her nice safe desk. Where the routine of algorithms and models and simulations wouldn't shake the ground beneath her—and wouldn't dump hapless tourists into the sea.

The Tesla routed itself towards the HVO, so familiar a trip that Ken barely noticed the road. Ken didn't see any cars coming the other way. Traffic info reported that the Park Service had cut off access to the road again. Dead tourists were bad publicity, and there would be some political grandstanding about public safety. If the uproar were prolonged enough, jobs would be at risk. Perhaps even her own? Because she hadn't warned them off. Something else to worry about? Probably not, but Ken didn't much trust politicians. She thought they always seemed more concerned with the next election.

The outside air cooled as Tess hummed up towards Chain of Craters Road, gaining altitude. It never got too hot at the HVO. "Tess, get me Freddy on the line." The car's phone pinged agreeably and 15 seconds later the semi-transparent image of her grad student intern appeared on the heads-up display. With his round-face, freckles, and a short reddish-blonde crewcut he looked like he'd stepped out of a 1950s beach movie.

"Hi, Doctor Malloy, what do you need!"

Freddy reminded Ken of a puppy who had figured out that doing tricks would get him treats, so he was always anxious to perform. It was not a compliment. He was on loan for six months from the University of Hawai'i, part of his training on the way to a PhD in geology—and way too excited about getting to do Real Geology.

Ken stifled a sigh. "Freddy, just Ken. Please. We're not that formal in the lab. Save the titles for my boss. If he'll let you."

"Oh yeah, right. Sorry."

They'd had this exchange at least a half-dozen times. Ken thought about the definition of insanity and wondered if it was worth continuing to try. Still, the guy needed to develop some backbone, and part of her job was teaching him how to be a Real Geologist.

"About today's quake and shelf break. EQUUS should have grabbed the data, including the new pucks. We just updated the slump forecaster. Route the seismic data into it, and let's see if this version of the software can backcast the collapse. Hold the results for my return."

"Sure Doc, umm, Ken. I'll have it by the time you get here."

Tess's nav system alerted her that they were approaching the gate at the turnoff for Crater Rim Road. "Good, hanging up now."

The Park Service had closed most of Crater Rim Road to non-official traffic back when the lava lake filled up. Unpredictable wind shifts made it unpredictably hazardous. After the Fountains started, the Park Service even closed the south loop road most days. Today had been a rare exception.

The best safe and legal vantage point for any of Pelé's current labors was the observation patio at the Volcano House. Good luck with that. For the first time in its 140-year history, the hotel had instituted a reservation system just to park there, with strict time limits unless you had a hotel room. The parking lots were booked weeks in advance. Forget about getting a room for a year. Casual visitors had to come in on the scheduled shuttle buses.

Ken had a pass to park in any open space in the employee lot. She'd made friends with the hotel staff by her willingness to give occasional presentations to the crowds of tourists. The hotel management liked having a real vulcanologist drop in to answer questions. Having to deal with endlessly repetitive tourists' questions sometimes took a toll on the staff's patience, as much as they appreciated the increased business. Ken actually enjoyed giving the lectures—the questions not so much, but if her talk was thorough enough, she'd have answered the worst before they were asked. And, she had to admit, once in a while, it was fun to be the expert.

But there was a more important reason for her visits. The tourists needed to be warned of the dangers of going off trail by someone other than a hotel concierge. The Park Rangers could only do so much, especially with the influx of new and naïve sightseers. They weren't a police force and they couldn't be liable for visitors' injuries once they'd been properly warned.

So, whenever the crowds grew too much or the winds were just wrong, she'd point the Tesla towards Volcano House—and take advantage of the hotel buffet afterward. Ken still loved Musty, her '66 Mustang convertible, but it most days it stayed in the garage. It had been her vehicle of choice until a year ago.

Until the idiots.

There were three of them, and they were reckless, and they were stupid, and then they were dead.

It had happened only a few months after the Fountains had become a must-see attraction. The view from the Volcano House's patio was spectacular, one of the best viewing spots on the rim, but the queue for a spot on the patio was always long and it moved slowly, if at all. Those with patience eventually made their way to the railing, where they were awed by what was an awesome sight. But after waiting an hour or longer in line, many just parked themselves at a table and ordered drinks or a meal. The hotel kitchen had to expand its hours to a 24/7 schedule.

On one particularly crowded day, three impatient mainlanders grew tired of waiting in line. They hopped into their rental convertible, grabbed some tools, and sometime after midnight headed out for the far side of Crater Rim Road.

They hadn't been entirely stupid. They'd picked a destination that was as close to the Fountains as the road would take them, so they wouldn't have to walk too far and they'd picked a full-moon night, so driving without the giveaway of headlights was safe. It was the only safe part of their plan.

They cut the chain on the road gate, swung it open and drove out around the rim and they found a fine vantage point. The fiery spectacle must have been stunning. It would have been totally worth the hefty fine, even having their car confiscated, if caught.

They would have gotten away with it, except for the wind shift that blew a choking cloud of volcanic effluvia across the road. Even then they likely could have ridden it out, just by staying in the car with the top up and the windows rolled tight until the wind shifted again. Instead they got frightened and tried to drive out of the cloud. The car's air filter wasn't designed for eruption-spun volcanic fiberglass and acid droplets. Neither were the fuel injectors. They got a few dozen yards before the engine died and refused to be resurrected.

They still could have waited it out until the clouds of fumes passed. The dawn Park Service patrol would've found them. Instead they panicked and tried to make a run for it.

The patrol found their corpses the next morning.

Almost immediately, the National Park Service was given funding for radio-controlled steel blockades that only vehicles with authorized transponders, like Tess, could pass through.

So... whenever she spoke at Volcano House, Ken always made a point of sharing the incident with the visitors. It was unpleasant, yes, but that was the point. These were the people who'd come thousands of miles to see the Fountains and therefore the people most likely to get themselves in trouble.

Ken usually finished her presentation by saying, "Everyone is entitled to one fatal mistake, but please don't have yours here. The Park Service hates the paperwork, and your heirs will be liable for all expenses including the cost of shipping your body back to the mainland. And frankly, whenever a tourist chokes to death in a cloud of acid fumes, it just ruins my whole day. So do me a favor and just give serious attention to all the safety instructions, okay?"

The black humor was shtick, but it worked. The tourists laughed, but it also made them more aware of consequences. It was usually enough to give pause to the more perilous impulses, and that made them safer. That hadn't been Ken's original goal, but after those deaths, she took on the responsibility. It was too late to do anything for those dead, dumb

tourists, but their painful deaths could save other lives. She couldn't make Kilauea safe, but she could make it a little safer.

Those three fatally foolish souls were also the reason that Ken decided it was time to garage her Mustang. Pelé was an unpredictable goddess and Tess was simply safer. And Tess wasn't a standard Tesla.

An electric vehicle made a hell of a lot more sense. An eruption's fumes are fatally corrosive an air-breathing engine. Sealed electrics don't care. Still, humans had to breathe. The Tesla already had the Bioweapon Defense Mode. Add some extra filters for the airborne mix of volcanic effluvia, some scrubbers for the toxic and acidic gasses, and the odds of survival went way up. Nonstandard, but the HVO made the request, and Elon Musk had been amused by the idea of upgrading a car from mere Bioweapon to full CBW Volcanic Defense Mode.

Not for free, of course.

The twenty-five grand upgrade was a big wad of money for Ken, but the extras were worth it. Especially if being one of those old vulcanologist was on your bucket list. Even so, it wasn't until she added the hazmat suit, the rebreathers, and a gas-mask to the car's emergency kit, that Ken began to feel that she had prepared herself for whatever Madame Pelé might throw at her. Pelé had her moods, but if you respected them, you could survive.

Ken had ordered the cherry-red paint job, as close as a match as possible to the Mustang, and named this new vehicle Tess for the same reason the Mustang had been named Musty. Names were hard. There were probably 50,000 "Tess"s on the road, but hers was the only vulcanologist's special. It was the perfect car for Kilauea. Smooth, quiet, efficient, powerful.

It wasn't the same as driving the Mustang, top down. Just wasn't.

The car's nav system spoke, then alerting Ken that they were approaching the HVO parking lot.

Time to face people.

-end of chapter-