

Can Alana use clues from geology to clear her name after she's accused of stealing a volcanic stone on her tour of Mauna Loa in Hawai'i?

Pele's Tears

by

D.A. Xiaolin Spires



Divya stood up next to me and opened the window, while I fanned myself with a glossy book I’d brought to read on the bus. It had a photo of sapphires and rubies below the title, *Rocks, Gems and Crystals-Geoscience for*

Amateurs. It was my third time reading it, but I couldn’t

focus. It was hot in May at the Visitor Center at Kīlauea. My thighs were sticking to the school bus seats. Parked in front of Kīlauea Visitor Center, my classmates and I couldn't wait to get out and check out Hawai'i's famous Big Island volcanoes. Divya wiped sweat from her forehead with her sleeve. I took a sip of water from the bottle I carried in my backpack.

I reached into my pocket to compare my Pele's tear to a photo of a jet black arrowhead I saw in my book. It occurred to me that they looked a bit similar.

"What's that?" asked Divya. She pointed at my fist.

I passed my Pele's tear to Divya.

She felt the weight of it in her palm. Obsidian black, long and shiny, it glimmered in the sun.

"It's a Pele's tear. But, maybe it should be called Divya's hair," I said, pointing at her gleaming hair.

"Funny. Thanks Alana, I conditioned it this morning. But, I think your Pele's tear looks more like a finger than a teardrop. Where'd you get this again?"

“It was passed down from generation to generation within my family, when they used to live in Hawai'i. My mom tells a story about having an ancestor being resistant to heat, grabbing molten lava and throwing it into the air to cool, sizzling up the atmosphere. She says she heard it from great-grandma. My aunt says it's a teardrop from the fire goddess Pele from long ago. I can't say what's true or not, but at least I get a cool keepsake. My mom gave it to me when she heard I was coming here. 'To protect me during the trip,' she said.”

“Where's it from?”

“It's supposed to be from Mauna Kea, north of here. The volcano's now dormant, mostly a place to ski and there's an observatory up there.” I heard an *ahem* and cough from behind my chair but ignored it. I bet it was Jesse trying to get attention.

“Cool that your parents brought it to Japan with them,” Divya said, rummaging through her purse.

“It was a nice decoration at our Hawaiian restaurant,” I said. “But, Mom was always scared someone might take it

by accident, thinking it was only a cheap paperweight for take-out menus.”

“It’s really made of lava, huh.”

I nodded.

Divya stopped digging in her purse and pulled out her phone. “My mom has something made of lava, too: a Mt. Fuji lava stone plate.”

“A Mt. Fuji... *lava stone plate?*”

“Yeah. The plate’s really made of lava stone from the mountain.”

“But, Mt. Fuji’s not active.”

“It used to be. The pizza she makes with the lava stone plate is really good. The crust is amazing and the cheese burbles like lava.” She showed me a photo of the stone plate in the oven, then a mouthwatering slice of mushroom pizza.

Before my stomach could growl, Mrs. Klein hollered, “Time to get off the bus.”

On the way out, Jesse bumped me with her shoulder bag. Knowing her, it was probably on purpose.

I bet she overheard my conversation and was jealous I had something she didn't. She always wanted to be the center of attention. That's not too bad in and of itself, but she took pleasure in making up rumors about me.

Like the time when Saki asked me about hula dancing moves and I said, "Not everyone hula dances in Hawai'i. I actually like yoga." Nosy Jesse had heard me with sharp ears. She spent the next two weeks telling others how my parents left Hawai'i because I was too stupid to learn to hula.

When we got off the bus, Divya whispered to me, "What does Jesse have against you?"

"I think it all started that time at lunch, with her diamond gem," I said.



We were at lunch at school when someone complimented me on my ruby bracelet.

Jesse swooped in and showed off her diamond gem.

“It’s so much more expensive than Alana’s ruby.”

Annoyed, I quipped, “Actually I’m pretty sure your stone is cubic zirconia. It looks too perfect.” I was pretty confident since I read up on gems all the time.

“It’s a diamond. Of course it’s perfect,” she said. “If you think it’s fake, prove it.”

I picked up the “diamond” and weighed it in my palm. The gem felt heavier than diamonds should be. Confident I was right, I blew on it.

“See, the stone fogged up. Diamonds don’t.”

“No, it really is a diamond,” Jesse started to say. Her friends gave her a weird look, then walked away.



“Since then,” I said, “she has hated me and made up a dozen rumors about me.”

“Including the one about the hula dancing,” said Divya.

I groaned. “You know about that, too?”

“Yeah, everyone does. But, don’t worry, we know it’s just a rumor,” she said. “Oh, look everyone’s filing in. Let’s go.”



At the visitor center, our tour guide, Ranger Tua showed us around Kīlauea. He walked us down Old Crater Rim Drive, explaining to us in his deep, booming voice that Kīlauea Volcano erupted in 1959 for five weeks, gushing out a lava fountain as high as 580 meters tall.

“Taller than the Sears Tower. And one and half times the height of the Empire State Building,” he said, his hands raised in the air.

“Pretty cool,” said Divya.

Ranger Tua then explained that the explosion created a lava lake deep enough to fill six million dump truck loads. I imagined what swimming in there might be like. Probably unpleasantly hot, to say the least.

Walking through the regrown forest, he pointed out aerial root plants, like octopus tentacles reaching towards the dirt. He also showed us pioneer plants, hardy vegetation

that grew out of lava flow. It reminded me of what my mom said.

She told me when I graduated elementary school, “Our family is as hardy as pioneer lichen. We thrive in any environment. I’m proud you could do so well transplanted to Japan.”

I didn’t have the heart to tell her about the bullies.

Ranger Tua shook me out of my reverie by mentioning Pele’s tears and Pele’s hair. These were all made of solidified lava drops (tears) or strings (hair) after volcanic eruption. I played with my own Pele’s tears in my pocket, as he spoke. I couldn’t believe the Pele’s hair was really made of rock, it looked just like cotton candy.

With gloves, Ranger Tua picked up a wispy strand of Pele’s hair stuck to giant lava rock to show us. Someone joked that he needed a lint brush.

He passed around some tephra, rock fragments, but told us that we couldn’t keep any as souvenirs because this was a national park. He also brought out several Pele’s tears from Mauna Loa and passed those around.

Eventually, we broke for lunch.

I was safe at lunch, but it was after lunch that the big drama happened.



I had just finished my peanut butter sandwich and taro dessert when Divya's mom, Aunty Chettiar, came to me with a baffled look. Next to her, Jesse looked smug.

Divya delivered a quick warning elbow and then turned to her mom. "Hi mom, what's up?"

"Hi honey, I need to talk to Alana," said Aunty.

"Sure, Aunty," I said.

"Jesse told me you have a Pele's tear," she said.

"I do. You wanna see it?" I took it out of my pocket and gave it to her.

"It's exquisite," Aunty said, feeling the weight of the rock.

"How did you get it?"

"I brought it here from Japan," I said.

"I see," said Aunty. "Jesse told me you pocketed this from the tour today."

She gave it back to me and folded her arms.

What?

I raised my brows at Jesse, shooting daggers from my eyes. She pretended not to notice me. I looked back at Aunty, shaking my head.

Aunty can't be serious. She really believes her?

But, Aunty just continued to stare at me, her eyes crinkled with concern. She frowned.

My shoulders tensed. I clenched my fist hard around the heirloom, my knuckles turning white.

"No, I didn't," I said, trying to keep my voice calm.

"She did!" Jesse said, exclaiming. She had a gleam in her eyes. "It was when Ranger Tua passed out Pele's tears from Mauna Loa. I saw her put one in her pocket when no one else was looking."

“No,” Divya said, backing me up. “She showed it to me before we got off the bus, even before we entered the visitor center.”

Aunty glanced between Jesse and Divya. She furrowed her brows.

“Oh, dear, well it seems like there’s conflicting stories here. I’ll have to get Mrs. Klein. Since you’re involved Divya, I’m afraid I can’t be a neutral arbiter.”

Aunty hurried off to find Mrs. Klein. Jesse turned to me, curled her lips into a smile and gave me a smug look of triumph. She whipped her head around and followed Aunty out the cafeteria doors.

The cafeteria doors shut with a bang, making me jump. I stared down at the sandwich bag I held crushed in my hand. *How could she?*

I looked to Divya. "No way they'll believe her. Right?"

"No way," Divya agreed, but she looked uncertain. She gave a half-hearted smile.

I got up and trailed after Aunty. At the garbage bin, I pitched away my trash, my hands shaking. When I pulled open the cafeteria door, it let out an ominous screech.



Everyone had finished up their lunches and were moving on to the worksheets that had questions about our day's trip. As our classmates scribbled down the day's events, Mrs. Klein took me aside to ask me for my account.

"Alana, I want to trust you. But, if you took this by accident, then we'll have to ask you to put it back. Or give it to Ranger Tua to take care of. We'll be disinvented from future trips if our students take volcanic glass and rocks."

Mrs. Klein looked more serious than I'd ever seen her. I drew in my breath. There was no way I was giving up the Pele's tear. It was a touchstone to my mom's past and heritage—and the fact it meant so much to my mom made it important to me.

"It's a family heirloom. I swear I didn't take it."

Ranger Tua happened to walk by. Seeing the heated discussion, he asked what the problem was. Mrs. Klein explained.

Ranger Tua looked me in the eyes and asked if he could see it.

He glanced at the Pele's tear and said, "Well, if it's really an heirloom, then it's an heirloom."

But, he didn't sound convinced. Was it just me or were Mrs. Klein and the chaperones now looking at me with suspicious eyes?

A bead of sweat rolled down my back. *How could people believe Jesse's lies?*

But, thinking about it, I knew her lies sounded plausible. On the flip side, my version started to sound fake even to my ears. *Bringing a Pele's tear, all the way from Japan?* I could hear my own words, feeling silly. It made me sound desperate, grasping at straws for any explanation.

I piped up, "If there's any way to prove I didn't take it, I'll do so."

“Well, I’m not sure what video cameras we have up on the trail. And it really takes a bigger crime for security to look into it,” Ranger Tua said.

Suddenly, I had an idea.

“Remember, Ranger Tua, you said we could visit the geoscientists in their lab if we have time? Can we go?”

Mrs. Klein said, “Well, if everyone can finish their worksheets, then...”

“Can’t we do them on the bus while waiting for our dorms to get set up?” I asked. “There’s free time listed in the schedule...”

“Okay, I guess that works, we’ll go to the lab if Ranger Tua thinks it’s okay,” said Mrs. Klein.

I explained my idea to Ranger Tua.

His eyes lit up and he nodded.

“Let me call the lab,” he said, with his booming voice. He jogged to the office.

Within a nerve-wracking five minutes, he came back.
“Yes, let’s do the tour and we can try your experiment.”

I smiled.

Moments ago, my reputation was on the line. But, now I felt better. My shoulders sagged with relief. Everything should be fine now—as long as Jesse didn't try to pull something else.



What I had said to Ranger Tua was “fingerprinting.” I had read about it in the *Rocks, Gems and Crystals* book. Once Ranger Tua heard that, he knew what I meant.

Dr. Sonya Mahi’ai greeted us at the lab. The lab was bright with fluorescent lights and many machines. Ranger Tua told us not to touch anything.

“At our geochemical testing lab, we analyze composition of samples. That means we look at the composition of lava samples to learn more about how the lava formed and changed deep in the crust. Here in Hawai’i, we sometimes look at the stratigraphy of the lava by looking

at the compositions of different lava layers, kind of like stratigraphers look at rock layers or strata in the Grand Canyon, although most of the rocks at the Grand Canyon aren't lava. Also, we can learn more about steep-sided composite volcanoes closer to your school in Japan such as Mt. Fuji or Mt. Unzen in Kyūshū, or the more gentle-sloping shield volcanoes here on the Big Island.”

“How do you test samples?” asked Divya. She looked at the twisted forms of hardened molten specimens on display in the glass case against the wall.

“Well, we use these giant state-of-the-art machines you see here,” she said.

I could hear the purring of the fans.

“We use two methods for analyzing. One is called paleomagnetic remanence direction and the other rapid X-ray fluorescence spectroscopy. These are big terms, but they're not that hard to understand.

“When magma or lava cools to form igneous rock, individual minerals align with the earth's magnetic field and point in a certain direction.”

“Is it like sticking a popsicle stick in a certain direction in juice before freezing it?” asked Saki.

“I guess you could look at it that way. That’s paleomagnetism.”

“Long word,” said Mrs. Klein. I spotted her jotting this down in her notebook. I imagined she might include it in our finals.

“But, there’s a second way. Does anyone know? I just mentioned it a moment ago,” said Dr. Mahi’ai, smiling.

I raised my hand.

“Yes, Alana?” Dr. Mahi’ai eyes glittered.

“Does it have to do with X-rays?”

“Bingo! We call it rapid X-ray fluorescence spectroscopy. We take a sample and shoot it with an X-ray. The specimen will emit another X-ray in response, which we call a secondary X-ray. We analyze this emitted secondary X-ray, which gives us an idea of the chemistry of a sample. Spectroscopy is the study of the electromagnetic

radiation, in this case, the electromagnetic radiation that is generated by the interaction between matter—the lava—and X-rays.

I nodded. Divya pointed at a chart that shows the type of secondary X-rays that each element generated hanging up in the lab. Mrs. Klein kept scribbling in her notebook.

“Let’s do a demonstration,” said Dr. Mahi’ai eagerly. “Alana, I hear you have something special in your pocket.”

I took out my Pele’s tear. Its smooth sides shone in the fluorescent lights. My classmates “oohed” and “ahhed.”

She gave it to one of the lab technicians, who prepped it by cleaning it with water and solvents and started the machine. Then Dr. Mahi’ai said she’d give us the rest of the tour while we waited for the results.

After we looked at a few more high-tech gizmos and invaded the snack room, where we ate Li Hing sour watermelon gummies and King’s Hawaiian sweet rolls, Dr. Mahi’ai took us back to the lab.

She said they had the results of the experiment.

“Who remembers the name of the volcano we saw today?” she asked.

Some of us chimed “Kīlauea” while others scratched their heads.

“Yes, today we went to Kīlauea. Does anyone know other volcanoes on this island?”

Jesse said, “Diamond Head?”

“Good guess, but that’s on Oahu island. Any other takers?”

“Mauna Kea,” I said.

“Yes, good. Mauna Loa, Kīlauea and Mauna Kea,” said Dr. Mahi’ai. “One of the discoveries made by geoscientists was that Mauna Kea and Kīlauea get their magma from a different source than Mauna Loa. They have different plumbing systems.”

David, our class clown, snorted. “Plumbing systems?” he squeaked between laughter. “Like a volcanic toilet?”

“Yes, believe it or not, volcanoes on Earth aren’t too different from your bathroom. We’ve got the volcanic hot spot, the supply source, leading into volcanic conduits, much like bathroom pipes. The summit in this case would be like a sink or the toilet bowl, with pipes or conduits branching vertically.”

“So, Mauna Kea and Mauna Loa have different plumbing systems?” asked Divya.

“Yes, exactly. And where the magma comes from is distinct. Remember lava comes from the shallow mantle shooting up.

“And rocks are not always as solid as people like to think. If they get hot enough, rocks can partly melt. That’s what magma is. Lava is molten rock expelled from the volcano.

“You can learn a lot about the composition of the Earth’s mantle through fingerprinting lava rocks. What’s interesting is what the fingerprinting tells us—Mauna Loa and Mauna Kea are so different. But, why are they different? It’s been a huge mystery.

“Has anyone figured it out?” I asked.

Dr. Mahi'ai scratched her head. "Ah, well, some earth scientists think they've got the answer. They think that there was a significant change in motion in the Pacific tectonic plates three million years ago."

"Change in motion? Sounds like a dance," said David. He started doing the moonwalk.

Dr. Mahi'ai chuckled and put a hand on David's shoulder, turning him. "Actually, the plate suddenly shifted north. On my call, your heels have to face that way. But, wait for it."

David continued to moonwalk until Mrs. Klein stopped him just as he was about to run into the glass display case. He returned to his original spot.

Dr. Mahi'ai continued. "The two magma zones were stacked on top of each other but the movement of the plates, which your classmate, the human tectonic plate, has demonstrated nicely for us, created separate magma zones heated under different pressures and feeding into independent volcanoes."

“Magma zones?” asked Divya. She whispered to me, “Are those like areas of magma flow?”

“Sounds like it. And stacked? Reminds me of a sandwich,” I said, speaking into her ear. My stomach growled.

Dr. Mahi'ai must've heard us. “Yes, put it this way. Imagine two coins lodged in a flexible pipe so that they're stacked flat inside the pipe and the pipe is connected to your classmate here.”

Mrs. Klein said, “David.”

Dr. Mahi'ai gestured at David. “Kind of like a tail coming out of David here and taped to the floor. The tail-like pipe starts out vertical. When David slides away in a dance, the pipe bends and stretches, as it drags with him and the coins slide inside it, so that the two coins are no longer on top of each other, but tilted, uncovered as two different layers. The coins here are the different melting magma zones, low and high pressure.”

“What do I do now?” asked David.

"Imagine it's 3 million years ago. Now, a sudden change in plate tectonic direction. Go north now," Dr. Mahi'ai commanded.

David started moondancing again and then shifted his feet to move at an angle towards due north.

Dr. Mahi'ai clapped her hands together. "Yes, the sudden shift north extends out two distinct volcano groups that pull magma from these two different coins. If the hypothesis is correct, then the volcanic rock of the Kea group from the 'bottom coin' forms at a higher pressure than that of the Loa group from the 'top coin.' These differences are the differences that you see in the chemical composition in lava fingerprinting."

David turned around, "Too bad I don't have a pipe tail that connects to the floor as a demo. It would be a nice addition for the dance costume."

"Maybe for the science fair," said Mrs. Klein. She smirked.

I turned to David and said, "I'll lend you two quarters to represent the magma zones. I won't need these coins once I'm back in Japan."

Dr. Mahi'ai pursed her lips. "Well, it's actually a bit more complicated than that, with mantle flows and all, but that's the basic point." She looked thoughtful. "Imagine," she said, her voice soft, "these differences started about three million years old and they're still present now."

We fell into a hush. I thought about the difference created three million years ago that might just clear my name.

"How about the test result?" I asked.

"Oh, yes, another earth-shifting moment, right? Here it is," said Dr. Mahi'ai. A technician passed a paper print-out and my Pele's tear to her.

"Through lava fingerprinting, it looks like your Pele's tear is in fact from Mauna Kea. It doesn't match the rest of the specimens from Mauna Loa that Ranger Tua passed around. This means, if the hypothesis is right, it would've been formed at higher pressure than one from Mauna Loa. It's where you say it came from."

I let out a whoop and picked up Divya's hands. We shuffled around dancing, Divya awkward and I in absentminded happiness.

"Mauna Kea is a sacred place for us," I said. "Especially the summit and the upper areas, home to some of our gods."

"That's right," said Dr. Mahi'ai. She gave me a strange smile and winked, as she handed over my Pele's tear.



I found out later she arranged for Ranger Tua to take me on a private expedition to near the top of Mauna Kea. I was allowed to invite one friend and had to bring one adult, so I asked Divya and Aunty, who said they were thrilled to join me. Aunty had one condition for me though, if I wanted her to go, I had to bring one other person: Jesse.

Ranger Tua agreed, saying it was a great idea. I groaned. My only consolation was at least Jesse still had extra homework every day for trying to get me in trouble.

As I packed up my camera and put on a jacket, I thought about it. Even though Jesse just tried to set me up and I was still fuming mad, I thought Aunty was right about one thing: if there was one place we could patch up our rivalry, it would be near the sacred top of Mauna Kea.

In the dead quiet darkness, Ranger Tua's car sputtered accelerating noises as he drove us up 9,200 feet in altitude in less than two hours. Being under sixteen, we were only allowed to go up to the Visitor Information Station rather than the summit. It was a beautiful, clear night and the stars surrounded us, dotting the sky.

My mom told me the maps of the heavens guided our ancestors in sailing the seas, navigating across the wide expanse of the Pacific. I felt as bold as them, standing on top of the world, as we peered through telescopes and gazed into these sparks of lights dancing in the heavens. The air was thin but smelled fresh.

Even Jesse couldn't ruin the moment. Usually, Jesse would take the chance to show off something, maybe talk about someone she knows owning expensive telescopes,

but maybe the stars really were on my side. She stayed silent the whole time.

Even though we couldn't go to the very top, I enjoyed perusing the Visitor Information Station. I flipped through books about the observatory located just a few thousand feet further up in altitude. I watched a film about the delicate wekiu bug which only lives on the summit.

Behind a glass case at the register, I saw a brooch in the shape of that same wekiu bug glittering in the light. I asked to see it. The clerk took it out. Its tag said its center stone was a real diamond. I saw Jesse in the corner, looking at a stuffed animal and thought of that first day she started to hate me. I discretely gave the diamond a blow.

It fogged up. I gasped.

I gave it back to the clerk. "Is this really diamond? I heard they're not supposed to fog up."

The clerk smiled. "You know, I heard that the fog test is unreliable. A myth. Better to get things appraised to know for sure. But, yes, this one's a diamond."

She blew on the diamond herself and it fogged up for a few seconds before starting to clear. There was something in my mind clearing up, too.

I was wrong. That day Jesse took out the diamond, I showed her up, so sure of myself. I saw the way her friends looked at her after I “proved” it was a fake. It might still be a fake, but there’s a chance I was wrong.

My anger towards Jesse diminished a little. I was still upset, but I knew I had an apology to make. I gritted my teeth. It wouldn’t be easy.

I walked over to her, telling myself to breathe.

Jesse was staring into the glassy eyes of the wekiu bug stuffed animal, her mouth frozen in a frown.

“Hi Jesse,” I said.

She looked at me. She gripped one of the stuffed animal’s legs tightly, squishing it. I wanted to leave right there, but I stood still.

“Nice bug, huh?” I said. Her expression didn’t change.

I looked away from her hard, disdainful eyes. I had to say it before I changed my mind. I stared instead at the stuffed animal in her hands. Its exoskeleton shone with iridescence. It reminded me of the glow of Jesse's gemstone that day and how self-righteous I was. I cleared my throat.

"Look, I came to apologize. I thought about why you might be upset at me all this time. I remember that day when you brought your diamond to school and I called you out on it. I said it was a cubic zirconia. It wasn't my finest moment. I shouldn't have showed off like that. It turns out I don't know everything about gems, like I thought. The breath test doesn't really work. And it was messed up of me to do that in front of your friends."

I paused. My eyes flickered up to her. She wasn't looking at me but at somewhere beyond. I followed her eyes to the register, where the cashier clerk was polishing off jewelry.

"I'm sorry," I said, mumbling. I shuffled my feet.

A wave of something, maybe guilt, washed out of me. I felt lighter. I looked up at Jesse's eyes. They softened.

She smiled a little, but this time it didn't look so smug. She put down the stuffed animal. She picked up a blue lace agate from a bin of gems next to the stuffed toys and held the stone in her palm. She absently rubbed it.

"I'm sorry, too. For what I did." Her voice sounded soft but hoarse. She looked up at me. She dropped the blue agate back into the bin. The sound of it clattering reminded me that it was a stone often associated with encouragement and support. She dug her fingers into the blue stones. She looked like she wanted to say more. She opened her mouth, but before she could continue, Ranger Tua came to get us, interrupting us with his booming voice.

"Hi, kids, what are you up to?"

"Hi," I mumbled. Jesse stayed silent. Without waiting for a response, Ranger Tua absently patted the head of the wekiu bug stuffed animal and said that the Visitor Information Station was closing. He promised that if we

visited again after we turned sixteen, he'd take us up to the summit and give us a tour of the Astronomy Precinct at the Mauna Kea Science Reserve.

In the expanse of the hush dark, Divya and I pointed out Venus, so ethereal and bright. Ranger Tua also showed us luminous Vega and the horned goat Capricornus. Even Jesse made a few observations, finding the archer Sagittarius.

Ranger Tua took out his green laser and shined it at Ursa Minor, Little Dipper. He said that in Babylonian star catalogues, it was called the "Wagon of Heaven."

I took out my lustrous black Pele's tear and put it against the night sky, letting it ride the wagon. I imagined Pele's tear riding the wagon from inside the Earth, through the mantle and up volcanic pipelines, ascending towards the Hawaiian Islands and then carried all the way to Japan and back. I thought about my ancestors, who sailed the seas, possibly also holding these Pele tear's charms. The stars shone high above, guiding them. Maybe they guided me, too. I felt humbled and awed, seeing how small I stood underneath those majestic stars.



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D.A. Xiaolin Spires counts stars and sand, residing currently in Hawai'i. Her work appears or is forthcoming in various publications such as *Clarkesworld*, *Analog*, *Grievous Angel*, *Nature: Futures*, *Fireside*, *Terraform*, *Reckoning*, *Factor Four*, *Liminality*, *Galaxy's Edge*, *LONTAR*, *Star*line*, *Andromeda Spaceways* (selected for the Year's Best issue), *Eye to the Telescope*, *Atlas Poetica*, *Outlook Springs*, *Gathering Storm Magazine*, and *Story Seed Vault*; as well as anthologies of the strange and delightful, such as *Sharp & Sugar Tooth*, *Broad Knowledge* and *Ride the Star Wind*. She can be found on her website daxiaolinspires.wordpress.com or on Twitter: @spireswriter.

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