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Where a Boundary

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Where a Boundary

So many of us have this idea of what a space mission would look like to another planet or to an asteroid. And it's a crew of mostly men and maybe a woman, you know, because that's what Hollywood tells us these missions look like.

It's fantastic to just turn it upside-down and conceive of an all-female crew. And what would that actually be like? And if it saves money, then maybe it should be worth discussing.

Kate Greene
"For Mars Missions, Sending More Women Might Make Economical Sense"

I remember the engineers trying to decide how many tampons should fly on a one-week flight; they asked, "Is 100 the right number?"

"No. That would not be the right number."

They said, "Well, we want to be safe."

I said, "Well, you can cut that in half with no problem at all." [Laughter]

And there were probably some other, similar sorts of issues, just because they had never thought about what just kind of personal equipment a female astronaut would take. They knew that a man might want a shaving kit, but they didn't know what a woman would carry. Most of these were male engineers, so this was totally new and different to them.

Sally Ride
"NASA Johnson Space Center Oral History Project, Edited Oral History Transcript."

Mid-Atlantic Ridge, Iceland: July 5 2016

The parking lot of the Mid-Atlantic Ridge is set back from the road, filled with pastel teal tourist buses whose side mirrors stick out the front of the vehicle like bug antennae. Iceland's biggest tour destinations are geologic in nature. The blue lagoon. The glacier that Batman filmed on. The Mid-Atlantic Ridge is only visible on land in Iceland. The rest of it is buried under the sea, zipping up the planet.

Walking from the parking lot to the escarpment, I stand on the edge of the ridge that's black with basalt and spotted purple with infrequent flowers. The base of the graben is covered with sand, just as black as the rock I stand on and collect in my backpack. I imagine the Mid-Atlantic Ridge acting as the divergent boundaries I learned in geology class.

I picture lava erupted out, fissure-like, and filling the valley with liquid rock. I imagine the ridge that I'm standing on and the ridge where I see the tourists standing pushed away from each other as new rock fills the area in between. Of course we don't see lava, nor do we feel earthquakes. The only sound besides the wind is people running across the bridge that connects the two sides of the ridge. Sneakers hit the wooden planks as kids exclaim, on one side, "I'm in America!" and, on the other side, "I'm in Europe!"

That's not quite right, but it's close enough. They're recognizing the difference of the divide. How one side is the Eurasia plate and the other is the North American plate. How the world is split apart and moving together all at once.

The other geologists are less concerned about this. They're in the sand looking at the Aeolian erosion on a rock. Nick, professor of geology and Mars expert, tells them that he sees this kind of formation on the red planet. The student geologists and I are amazed, since everything we see in our portion of the world is very, very Earth-like—wet and covered in soil.

One of the first classes that you must take when you decide to be a geologist is mineralogy, where you learn to identify minerals, and where minerals are made in the mantle, and how all of that effects the crust of Earth, among other processes.

The other lesson you must learn as a geologist is how to ask questions. This science is largely observational, and questioning whether a mineral is hematite or goethite could ultimately tell you how much water is available in the area, and even what a different planet might look like.

Q: How does a mineral reflect light?

Luster: *luster, even more so than color, is the best aspect of a mineral to identify first. It describes whether light bounces off the surface more like shined shoes or dirt or a brand new house key.*

Metallic: dark silver
The English classrooms in my high school were
situated in a different building (House 1) than the
science classrooms (House 2). With six minutes
between classes, I would rush with my two best
friends, Xinhui and Zoe, across the school as quickly
as we could to move from Biology to English.
Inevitably, we would hit the traffic of the student body
when we passed through the wide auditorium atrium
and into the narrow hallways that always smelled
faintly of corn chips.
My friends didn't love English. Of course, they were
scientists. They tossed the subject off to me, since I
was one of the few in the class that read the books in
full and didn't mind the essays.

Non-metallic: reddish-brown
Carbon-dated at five and a half years old and
with a speech impediment, I spent weekday
evenings learning how to speak. How to form
words out of the sounds that didn't quite fit in
my mouth. My parents saw my frustration with
my lack of communication.
They hired a speech therapist, who would come
to my house. She would watch me
eat bananas and make faces with me in the
mirror. She'd sit, red nails taking notes, in a
folding chair as I colored at a wooden table
made for kids. Every time I talked it was a
tongue twister.

Iceland's landscape is alien in nature. Besides the volcanoes that cradle the island, all I can see from the rental car's window are plains rubbly with lava rock. The moss, which covers more of the ground in Iceland than grass does, is scarce. Nick, who is driving, tells us that the lava is recent.

"How recent is recent?" I ask most of the questions in the car. It's because I'm in the front seat, and over the hum of the road, most of the other students either can't hear or are lulled to sleep.

"About a few hundred years."

"A few hundred years?"

"Yeah. That's pretty new in terms of geologic time."

"I guess."

"This is actually a good analog for Mars," the professor gestures to the landscape without taking his eyes off the road. "The young basalt. The relatively low amount of vegetation. The climate and surrounding geomorphology. This is not a bad place to train astronauts for missions."

"Mars missions?"

"Yeah. Moon ones, too."

"Huh." The conversation slips back into quiet thoughts, imagining the SUV as a rover, driving us across the red planet's surface. Imagining the basalts and sedimentary rocks we could collect. Imagining how we could construct the planet's history with stones and some scientific know-how.

Students bumped into each other's backpacks, and I tried not to listen too closely to the honors students, who would brag about the hours of sleep they lost over calculus, as they shrugged off another book assignment. I tried not to hear that they bullshitted another paper.

Why is your notebook on your head? Xinhui asked.

I thought maybe, if I put my book on my head, my ideas will get back into my brain via osmosis. I lied. We all knew that's not how osmosis worked.

They laughed. *I should try doing that, too.* Zoe put her binder of science and math onto her head, so that it crushed the blonde flyaway hairs.

Zoe was planning to go to MIT. Xinhui wasn't sure what she wanted to do but leaned toward a science major of some kind. They both ended up at Cornell.

I didn't tell them that the idea of English as a lesser subject was growing in my head. And I certainly didn't want to tell them that, because English was my best subject, I saw myself as lesser than them. Than all the students excelling in the subjects where I struggled. I didn't want them to know that I thought myself a failure.

Distorted vanilla noises. Caesarian cease sensational lips lisp lease. breathe. Epitome blasphemy amphetamine anonymous anemone ominous nimbus cologne. Breathe. Economy caramel laurel laud author arthur whorl wound round word roar worm window women worship swish silver shale. Sorbet. Illinois, ousting jasper jasmine goethite chai. Nominee none see eight; breathe.

Sulfur-yellow feather fallout.

Q: What color powder does the mineral make?

Streak: *streak is the color you get when you rub (or streak) a mineral across a piece of white ceramic. This property is both a function of hardness, (many hard minerals like quartz will have no streak,) and the color of the mineral, (sulfur looks yellow and streaks yellow).*

Reddish-Brown

"I could never do that," my

writing geology

friend says when I mention

the science lab I'm in. the poetry portfolio I have due.

"That's too much

math writing

for me. I'm not

science-y creative

enough to do that."

I used to think I'd find myself in Iceland. That flying across an ocean I had never crossed before, actually seeing the landscapes that were set as my computer background would unlock my insecurities. But then, maybe, I just wanted to hear the language I tried to learn spoken by a barista holding three lemons, who was trying to tell us not to plug our laptops into the outlets on the ceiling, because doing so would short out the entire building.

The food labels in the grocery store in Reykjavik were in Icelandic, which surprised me at first. I mean, a jar of peanut butter looked like a jar of peanut butter regardless of how the jar is labeled. It took a second though—a short time where the jar of peanut butter wasn't peanut butter anymore. It was *hnetusmjör*. In that moment, between when I read *hnetusmjör* and saw the peanut drawn on the jar, I felt like the world and my perception of the world had shifted out of alignment.

As if, you were Schrödinger, lifting up the lid of the thought-experiment box, expecting to find that the cat is either dead or alive, and instead you find that it's still both and the laws with which you observed the world through were wrong.

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An English professor visited my college to give a talk about a volcanic eruption to geologists. I met him in a poetry classroom, where students asked him "how do you write about science?"

And he said, "well, you have to translate it, right? You have to take what the scientists are saying so that the everyday person can understand it and make sense of it.

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I asked Nick what he thought of that, and he said that it's the same way getting new students to understand science. That you have to use analogies, similes, to help students understand topics. You can tell them that the Mid-Atlantic ridge is like a Snickers bar. The crust breaks, while the mantle stretches out forming a caramel rope. Then they learn how to talk about the brittle crust and ductile mantle without the use of similes.

Q: How strong is a mineral?

Hardness: *A mineral's strength is determined by the Moh's Hardness scale, where a mineral is ranked relative to other minerals and objects of known strengths. The scale is written from 1-10 and is logarithmic in nature; however, the way we usually evaluate a mineral in the classroom is by whether you can scratch it with your finger, if it can scratch a penny, and/or if it can scratch glass.*

≤6.5

A list of all the famous male scientists I could think of off the top of my head:

- Albert Einstein
- Thomas Edison
- Alexander Graham Bell
- Sir Isaac Newton
- George Mendel
- Charles Darwin
- Nikola Tesla
- Benjamin Franklin
- Steve Jobs
- Bill Gates
- Steve Irwin
- Neil Armstrong
- Buzz Aldrin
- Edward Jenner
- Harrison Schmitt
- Bill Nye
- Neil D'Grasse Tyson
- Elon Musk

4.5 – 5.5

A list of all the famous female scientists I could think of off the top of my head:

- Marie Curie
- Jane Goodall
- Marie Tharp
- Sally Ride
- Mae Jemison

Q: What shape is a mineral?

Crystal Habit: *crystal habit is the external shape of a mineral. Crystal habits are influenced by multiple factors, but one of the most prominent is the conditions (room, temperature) that the crystal grew in.*

Blocky

Zoe and I sat diagonal to each other in a grouping of 4 desks for AP Biology. Our teacher was wandering around the room with his head hunched over to read names on the tests he was handing back.

Mine was face down on the desk. I had only glanced at the grade before hiding back away. The number in red was satisfying enough.

Zoe asked me what my grade was. I shrugged. I told her it was fine and that I was happy with it.
I didn't ask Zoe what her grade was. She told me it was a 95, anyway. She told me that she was failing. She told me that a 95 wasn't good enough.

And I knew, at the time, that her sense of failure for getting a 95 on a test was just an echo on her own expectations and self-worth.

But also, at that same time, I couldn't shake the feeling that my 93 made me even more of a failure. That I would never be good enough for the sciences. That I would always be a failure.

Earthy

I don't remember when I moved to New York or when the elementary school in the suburban upstate town told me that my speech disorder required no more help.

I do remember, however, doing a reading test in 8th grade. Where all I had to do was read aloud from an essay, and the woman who was testing me looked surprised when I ended.

She didn't need to say anything. She *didn't* say anything. The timer blinked zero: zero zero in digital digits and I had only read 1/3 of an essay I knew in my gut most people had finished.
The rest of the year, my social studies teacher specifically called on me to do readings aloud in class. Each time he did it I was sure it was the test. I was sure he had been told I was a bit slow to transition the words I had read to the sounds I could make.

Skaftafell: July 20, 2016
I was wearing someone else's socks, and I felt the water wring between my river-dipped toes as the mountain trail rose.

Q: do I double major in geology or not?

The geology major is 65 credits large: requiring an introductory class,
The socks didn't quite fit me. They were too tight around the
Historical Geology, Mineralogy, Petrology, Structural Geology,
ankles, and the knit was coarser than my sole was used to. What if these socks weren't
Geomorphology, Paleontology Stratigraphy,
borrowed and really I was someone else walking in my own slog? I was tired of
3 electives, 2 semesters of senior seminar, Chemistry I, Chemistry II,
playing the geologist who separates her poetry and field notes
Biology I, Biology II, Calculus I, Calculus II. My creative
into different notebooks. I was tired of being the scientific voice in workshop to correct tries
writing major is only 44 credits: 4 workshops, 3 literature
at geologic metaphors. Wouldn't it just be easier to stay in someone else's socks
classes, 2 introductory classes, and 1 elective. The Geology minor
and exist as one or the other?
was 33 credits, and I just wanted some balance between the two.

Lanmannalaguar, Iceland:
is filled with banks of rocks colored by hydrothermal alteration from rivers running through the area. Some of the rocks were green, like chlorite, some were purple manganese, and I crossed a stream to pull red from the rock wall. A thin coat of red dust combined with the water on my hands. The mixture sank into the lines in my palms, looking like I was stained with blood.

Mars:
is red because of nanophase mineral dust covering its surface. Some of it is poorly crystalline hematite and maghemite and lepidoctoite that is too small to cling to rock, and the wind plucks it off of basalt and carries it across the planet. All of it is iron oxide, blown from basaltic surfaces and deposited in piles below thin atmosphere.

Rust
oxide & stain my pants
in monthly cycle. if the allotropes
were different if more oxygen
tacked onto iron like egg to uterine
wall, crystals

would soak into my worst pair
of underwear instead of blood.

I curated the narrative about my friends.

Zoe does major in physics, but she was always the most artistic of our group. In her biology notes she'd draw eyes, obsessing over the proportion of the iris to the tear duct, the pupil to the lash line.

I can tell you that her room used to be painted orange. Maybe it still is. And whenever I visited her, the walls were chalked with yellow notes and chord progressions, because she was teaching herself how to play the bass guitar. I think she had oil paints on her desk in a glass jar, and, if she didn't, they wouldn't have looked out of place.

Xinhui is similar. She majors in environmental science, but I know she wants to be a freelance artist. Her drawings are digital or watercolor, and I sometimes wonder if she'd been happier in art school. She likes the science, though.

The same is true for my other friends. Ana is studying to be a nurse, but she photographs landscapes. Kaleb is majoring in theoretical physics, but he almost went to school for ceramics. Hanna will one day be a doctor, and she's double majoring in biology and violin.

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I often think that I am not good enough to learn science, during geology lectures.

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Growing up, my focus was on phonemes, and I think the frustration of language is what made me love it.

The Mid-Atlantic Ridge, July 5 2016

Geologists will tell you in intro classes that divergent boundaries are straight lines, dividing one side of the earth from another. Geologists will also tell you, when you've spent another year or two studying science, that they've lied.

The Mid-Atlantic Ridge isn't a neat line where a bridge can connect two continental plates. It's messy. The boundary jumps across the island, striking it through with valleys. It creates a transition zone. A place where the land is both North American and Eurasian, but also neither one by itself.

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I understand, of course, why science and English have to be separated on school grounds. It would be difficult to teach the concept of birefringence alongside a discussion about the purpose of poetry. It could be done. I know it could be done, but that takes time and planning and work.

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Rocks line the edges of the desk I write on. Icelandic basalt. Pennsylvanian sandstone. Devonian shale. And tucked away in a labeled bag, I have two small rocks from the Mid-Atlantic Ridge. Little baby rocks, whose vesicles are not filled with dry moss. I only take them out occasionally to remember and remind myself of the messiness.

Of the transition zone where two different things are the same, and have been the whole time.

I like to think of hematite as a dual mineral.

Hematite is a mineral that expresses itself one of two ways: 1) as a reddish-brown, earthy mineral and 2) as a dark metallic, somewhat blocky mineral. Other than luster and, occasionally, habit, the two types of hematite act the same. Hematite will streak reddish-brown. Hematite will be around 5-6 on the Moh's Hardness scale. Hematite will always have the same birefringence and chemical formula regardless of how it expresses itself.

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My friend usually has candles burning when I go over to her house at night. I think she likes the light and the petal-soft feeling candles provide. My friend tells me that she's probably psychic, but she says it in the way that makes me believe her, even if I don't necessarily believe people can be psychic.

In the candle light, under the pattering of rain on the skylights above us, she takes out a box of tarot cards, calculates my life path number, and sets to work deciphering the card.

There's a lot of "hums" and "mmms" and she covers her mouth as she thinks.

And finally she says, through all of my reincarnations I have always faced a split of passions.

A: I am metallic and grounded.

A: I am the scientist who writes poems that imagines her body as a rock, and I am the writer who experiments with similes made out of scientific fact.

A: I am the all-female crew of the people best fit for the job.

A: I am tired of my insecurities.

A: I am hematite piling on Mars body.

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The classification of minerals is only helpful in terms of human understanding of a portion of the universe. At the end of the day, hematite doesn't need to be called hematite. Peanut butter doesn't need to be called peanut butter or *hnetusmjör* or anything in particular. There is no inherent good in classifying people by their menstrual cycles.

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We exist as spectra and transition zones.

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I am insecure in science, yet take the classes anyway. I am insecure in speaking, yet decided that my passion will include placing words together on a page, knowing one day I'll have to read aloud in a room to a group of people that do not know me intimately.

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Earth is the only planet not named after a Greek God, which is another way to say that Earth is the only planet not assigned a particular gender, which is to say Earth does not exist on a binary, which is to say, I think that's how it should be.