Geology Part 2 with Schmitty Thompson
Ologies Podcast
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Oh hey, it's the rock in your pocket, Alie Ward, back with Part 2 of Geology. Have you listened to Part 1? ... Why not? ... If you haven't, go back, listen to Part 1; it's linked in the show notes. It covers everything from what the hell is a rock, to what's a boulder, is sand rocks, what's a mineral, how do we read rocks, why are they different colors, and what is the most low-stakes, free hobby in the world involving a gravel driveway? Okay, so listen to 1, and now, let's get to Part 2.

So, this guest is, once again, beloved by all, getting their PhD at Oregon State, studying paleoclimate and glacial geology. And this follow-up episode will answer questions from hundreds of listeners who left their queries via Patreon.com/Ologies, where you can join for a dollar a month. That gives you the heads up on upcoming episodes and it lets you leave questions for the ologists. So, thank you patrons for supporting this show from day one; thank you also to any listener who rates and subscribes and especially leaves reviews, I read them all. This week I picked Clifton's to read, and they said:

> *Ologies is a Magic School Bus reboot none of us knew we wanted - but better because it includes real scientists, social scientists, audio memes, and cursing.*

Clifton Thornton, I'll take it. Also, if you don't want cursing, you can check out the G-rated *Smologies* episodes which are linked in the show notes.

Okay, Part 2, Geology. Pull up a petrified stump and get ready for geodes, long hikes, lab-grown diamonds, fossilized trees, space rocks, lead poisoning, puns, and their favorite-ever rock with lifelong lithophile and your new favorite geologist, Schmitty Thompson.

Alie: Do you have some time for me to keep you a little bit longer?

Schmitty: Yeah, absolutely. I've got nowhere to be.

Alie: You're the best! [*sings*] You're the best! There's part of me that's like, "Can we make it a two-parter? We shall see!" [*laughs*]

Aside: And we did.

Alie: Thank you for being so patient of my very uninformed questions.

Schmitty: Oh my gosh. No, no, no, no. It's great if someone comes to me like, "Tell me about rocks." Why is that not a great thing that I get to be the person to tell them, because that's why I love talking about geology, just because I think it's neat.

Alie: All right, I thought this was a great question. Amanda McClendon, Aeriel Belk, and Radha Vakharia wanted to know: Is ice a rock?

Schmitty: Ice a rock, that's a good question and I don't think I have a good definitive answer on that because if you look at the very technical definition of what is a mineral, ice fits a lot of those properties.

Aside: So, as we covered in Part 1, a mineral is a naturally occurring, inorganic element or compound, that has an orderly internal structure, it has a crystal form, and physical properties. So, ice kind of checks out.

Schmitty: But the thing that's different about ice is about what kind of states that exists in, relative to other rocks. So, for the most part, when you're thinking about when does a rock become a liquid rock, that happens at very, very high temperatures. When rocks are moving through our earth systems, they're going to be behaving very differently than when ice would be moving through the same range of temperatures. If you heat up a rock until it became lava or magma, ice would just be vapor by that point.

So, I think it makes sense in some ways if we're looking at technicality, like, yeah this fits into a lot of the same categories. But then in terms of thinking about, how does this material interact in earth systems, how does it behave? How does it influence the nature of our planet? Ice is kind of in its own category.

Aside: Y'all, there is debate about this and I triple-checked and if it seems d*icey*, it's because it is. But here's the lowdown. So, a mineral needs to be composed of solids and water is not a solid. So no, the ice cubes in your freezer are not minerals, or rocks. *Hooowever*, if it is naturally occurring ice, like a snowbank that has solidified, or a glacier... them's a rock. A glacier is a rock!

Alie: How hot does rock have to be to melt? Or does that really depend on the rock?

Schmitty: It really depends on the rock. Part of the reason we're not just surrounded by one rock is that different minerals crystalize at different temperatures. So, when you have a blob of magma moving up through the Earth's crust, it's going to be cooling and as it's cooling, some minerals might cool, and drop out, and sit at the bottom, and be left behind. So, that means that that's one way for our Earth's system to sort. Like, maybe a lot of the minerals that are deep in the center of the earth are going to be really rich in things like iron and magnesium, but as different kinds of minerals are crystalizing, cooling, and being left behind by magma moving, that's a way to concentrate different amounts of elements in different kinds of rocks.

So, that's part of the reason that Earth is the way it is, is because we have all these tectonic plates moving around and we have this mantle that is moving material around. And as rocks and minerals are moving through igneous, and sedimentary, and metamorphic rocks, it's acting like… it's sorting out different concentrations of elements into different parts of the planet.

Aside: So yes, rocks and water are acting like colanders and sorting heavier elements and minerals which then link up in crystalline structures. Sometimes in the cracks and spaces of other rocks, which is why there might be, for example, a vein of quartz in granite. Now, if there is a lot of silica dissolved in water, quartz rocks like amethyst might form, or agates. And if the water has just a boatload of copper in it, years and years down the line, turquoise or malachite might form. And gems and rocks can form 60 feet to 25 miles deep in the earth. But some, like diamonds and peridot, are a little bit more shy, they crystallize as deep as 125 miles below the surface of Earth! 125 miles deep in volcanic tunnels called kimberlite pipes.

And weird fact: All diamonds are roughly 1 to 3 billion years old, all of them. They're old, they're special... Mmm, but historically, diamond mining can come with a true human cost, and they've been mined in war zones and some of the money is used to fund more wars. Russia is a huge diamond exporter and recent sanctions mean fewer diamonds on the market which means Millennials and Gen Z folks are looking to get hitched using other gems, or lab-grown diamonds, which are actual structural diamonds, totally legit

diamonds, but up to 73% cheaper and they're more sustainably made. The resale value is less but, nnhh, so are the ethical bummers.

But the lesson here is that the only thing we can really rely on, the only constant is change. So yes, your life might feel like it's melting under the boiling hellish pressure of the entire Earth, but something new, and shinier, and stronger is on its way. Just give it a few billion years.

Schmitty: And that allows us to get all of the beautiful variations of rocks that we have. So, if you were to go to other planets, they're not going to have as many different kinds of rocks as we do because they don't have the tectonic system that allows the different kinds of rocks to develop. The rocks we have today were very different from the rocks that first formed 4.5 billion years ago.

Alie: Does that mean that there might be completely different rocks that don't exist now, in the future?

Schmitty: That's a really good question. I don't know the answer to that, but I know who I would ask about that, [*laughs*] so I might get back to you.

Aside: So, Schmitty asked a friend who said that the planet will settle at a lower temperature but have the same pressure, which will stabilize the kind of rocks produced. So, same. But Schmitty's friend wasn't sure if that would produce any minerals we don't already have... to be determined, by a time machine and a pickaxe.

But what about on other planets? So, this next question was asked by patrons GG, Katie King, Will Kingan, Ron Dagdag, and...

Alie: Gina Woolsey and a bunch of other people wanted to know, Gina says: Space rocks are cool. What are some of the coolest things found via space rocks, either ones that have landed on the earth or ones that are still in space? And then Stephen Woo wants to know: How do we know if a rock is from space? And Alice Rubin chimed in: All rocks are from space, technically we are also from space. Do you have thoughts on space rocks?

Schmitty: Absolutely, thoughts on space rocks. So, space rocks are really cool because, depending on where it formed, that can tell us a lot about parts of the solar system that are really hard to reach. And so, a lot of our space rocks are from... I'm not an expert on meteorites, this is just a very broad overview, but a lot of the space rocks formed when the rest of the planets, rocky planets were forming, so they're just space dust that hasn't been through the formation of a planet before. But we can also get space rocks from the moon [*"Back at the earth." "From the planet moon, from the planet moon." "Isn't the moon a star?"*] sometimes landing on our planet. We also have rocks from Mars that have made it to the earth.

Alie: Augh, love that.

Schmitty: So, we actually have rocks from Mars that we can study because at some point Mars got hit by a meteor and some Martian rocks got ejected into space and they landed on Earth.

Aside: For more on this you can listen to the Areology episode about Mars with Dr. Jennifer Buz, which covers not just Martian rocks, but also the time Dr. Buz got to handle moon rocks and it didn't go well, and she lost her marbles. Also, the Selenology episode with Raquel Nuno is all about the moon and we have it as a *Smologies* episode in case you have small, young people who want to learn about the moon. *Smologies* episodes are linked in the show notes, they're friendly for all ages, they're free.

Speaking of ages, Schmitty says that Iowa-born geochemist, Dr. Clair Patterson had a bright idea to figure out how old the planet is. How old is this thing we're living on?

Schmitty: But actually, I think one of the coolest things to come out of studying space rocks is not necessarily about the space rocks, but that's how we first figured out how old our planet was, was using space rocks. When we were starting to figure out the age of the Earth, someone had the idea that a lot of these space rocks probably formed at the same time that the Earth did. And one of the really cool things that you can do if you're doing chemistry on a rock is you would use little, tiny bits of radioactive elements inside a rock to tell how old it is. A lot of the rocks will incorporate tiny trace amounts of radioactive elements like uranium into them and when the rock is still a blob of magma, or it's space material, that uranium is decaying and it's producing things like lead and that's just getting mixed up. When a rock hardens and becomes a rock, that crystal structure is going to trap anything the decaying radioactive uranium produces inside it, and so it's kind of like a timer.

And so, if you can get a piece of a rock that has little, tiny bits of radioactive uranium in it and you can look, how much uranium is there and how much lead is next to it? You can get an idea of how long it's been since that rock formed and that timer started, and that would be about how old the Earth is. So, a while back we were able to get the age of 4.5 billion years from a meteorite and that age of the Earth has stood the test of time. Like, that's a pretty darn good estimate. [*"Aces."*]

When we were trying to figure out how much uranium and lead there was in these meteorites, I think this was in the '30s or the '40s, you had to measure how much lead there was in the sample. This was back when we still had lead in gasoline, and so the scientist who was trying to measure this lead was getting weird results. [*Alie gasps*] So, he was trying to figure out, "Where is this lead coming from?" And so, he developed a lot of modern cleanroom procedures because lead was in the air, it was in his hair, it was in his clothes. [*Alie shudders*] And so he went on to be a really active voice against environmental lead because he became so aware that that was in everything because it was contaminating all of his samples. [*"So get the lead out! That is all."*]

Aside: So yes, Dr. Clair Patterson, well done, high fives. So, we covered this in the Ludology episode about video games with Dr. Jane McGonigal. And why were we chatting about Atari and lead toxicity in the same episode? Because of something called the lead violence hypothesis. So, lead poisoning affects developing brains in ways that can lead to aggression, and impulsivity, and impaired executive functions. And what do you know? Lead in gasoline post World War II meant a baby boom that was maturing into individuals more likely to commit violent crimes. A 2018 *Mother Jones* article explains, "Every year, the population of teenagers with lead poisoning increased and violent crime increased with it. This is why the '70s and '80s were eras in which crime skyrocketed." So, why is this?

Neuroscientists have found that because lead is chemically similar to calcium, it displaces the calcium needed for normal brain development and the data is just staggering. Bans of leaded gasoline and lead paint correspond to these huge drops in violent crime. Again, well done Dr. Clair Patterson, you also had to work on the atom bomb too, but thanks for figuring out the lead stuff and that Earth is 4.543 billion years old, give or take 50 million years.

Alie: I liked Benjamin's question. Benjamin wants to know: Geology seems like a big deal! My question is: How do you think chocolate candy rocks look? Do they do a good job?

Schmitty: I actually have a funny story about that. I had some really amazing chocolate rocks, they were probably the size of an egg, painted with these beautiful metallic edible paints and I was like, "This looks pretty convincing." It's really hard to identify a rock by picture because a lot of rock ID is picking it up, and feeling it, and moving it around, and looking at the crystals, looking at it under a microscope, licking it. [*"Delicious."*] And so, it's really hard. A lot of people send me pictures of rocks and I oftentimes can't give them an answer of what it is. But I thought, let's try this. So, I sent a picture of this chocolate rock to some geology friends and was like, "What do you think this is?" And they all gave rock answers [*Alie laughs*] and then I sent back a picture of the rock chopped in half, showing it was chocolate and they were all pretty surprised. So, a lot of chocolate rocks do a pretty good job.

Aside: Mischief. Good-natured fun with just a dash of endearing evil. Schmitty, I love it.

Alie: Miranda Panda wants to know if you saw the news story about the large boulder the size of a small boulder on the side of the road, and if you had thoughts on that?

Schmitty: I did see that; I didn't ever read the article about it because that's really funny to me because I feel like 'boulder' is one of those many funny words that a lot of people in science interact with. It has a technical definition, like, there is a size of rock that above which a rock is a boulder, but 'boulder' is a very common colloquial term. So, I would love to track down that article and see exactly who was using the word boulder and should they have known better?

Alie: I know, I want to reach out to them and see if they meant, "A large boulder the size of a small car"? Or what they were thinking, if it was just a brain fart?

Aside: Okay, side note. If you are blissfully just off of the internet, you may have missed when a Colorado sheriff's office tweeted a photo of a geological road obstruction with the caption, "Large boulder the size of a small boulder is completely blocking eastbound lane Highway 145 at Silverpick Rd. Please use caution." This was in January 2020 when pre-Pandemic Twitter was still sometimes used for things like silliness and chuckling at typos. And yes, in a subsequent interview, I went and found this; I dug around. The public information officer who drafted that tweet, Susan Lilly, admitted that she definitely meant, "A large boulder the size of a small car." But that large boulder-sized small oopsie was just cute as hell. And anyway, language has a real plasticity to it. Oh! Speaking of that...

Alie: Mohammed Fakhro and also Jules Clement, first-time question-asker Jules says: We have the Bronze Age, the Iron Age, are we now in the Plastic Age? And Mohammed wants to know: Okay, I read there's a new type of rock that consists of plastics called plastiglomerates, and my questions are how does that happen and what does it mean in the larger scheme of things? Also, eek! Are there plastic rocks?! I know there's chocolate rocks but are there plastic ones?

Schmitty: There are. So, there is something that we consider plastic rocks. Just like how sand, and silt, and clay move through the Earth's system, you can get little bits of plastic that are really, really, *really* resistant to degrading that are going to be moving through our rivers and our oceans and they're going to glomp together the same way that sand does. [*Alie squirms*] And so, that's going to become part of our geologic record.

Alie: How do you feel about it?

Schmitty: I don't feel good about it. [*Alie laughs*] Plastic is... If you're thinking geologically about the things that humans are going to do that are going to leave an impact on our planet, plastic is a big one because everything in our Earth is constantly cycling. So, I think there's a lot of real advantages to using products that will eventually go back into the cycle of materials moving through the earth, and plastic very much is not one of them.

Alie: When you're sitting on the beach, you're looking at sand, do you see plastics in there?

Schmitty: I do see plastic. And if I can reasonably assume that it's not something that was gross, I try to pick it up. I'm a habitual trash picker-upper. I always have to empty my pockets before I do the laundry.

Alie: That happened with me today and I found some garbage in the pocket that I forget where I even picked it up, but it was in there.

Schmitty: Yeah, I always have to do that.

Aside: Let's all aspire to find trash in our pockets on laundry day. Or even better, throw the trash away and wash our disgusting hands as soon as we see a garbage can, okay?

Alie: Chandler Witherington and Corrie Francis Parks want to know, first-time question-asker, Corrie: Where do you even start as an amateur geology fan? Chandler wants to know: Are there any apps that you recommend to help identify rocks? I mean, I guess unless the app licks the rock, are you just fresh out of luck?

Schmitty: Yeah, I don't know of any good apps to identify rocks, but the two things I would recommend would be you can go to a local bookstore, sometimes they'll have local rocks guides, or you can get like, a paper... I still have various 'field guide to rock and minerals' books that I've been carrying around with me for many years. And then there's a website I'd recommend if people are really interested in learning about rocks there's a website called MinDat that you can look up. It's this really comprehensive database and you can spend a lot of time there. Along with having all sorts of chemical information about the rock, you can look at pictures of them, and there's oftentimes pictures of both what this rock looks like in everyday situations, then also just these beautiful pictures you can spend hours staring at.

Aside: So, that was MinDat.org, and I just accidentally went on and looked at citrines for 45 minutes, and then I fell down a hole looking at different types of corundum, which can be rubies and sapphires. Thanks, MinDat. I fucked up my deadlines, but rocks are pretty.

Schmitty: So yeah, I recommend going to a local bookstore and just seeing what field guides are available there. Some areas also will have… sometimes there will be rock counting groups. Rock counting is a practice where you specifically go out into the field to collect rocks. Sometimes they'll have a geological society. Try to find a local resource for what kind of rocks are in your area and then just going out, picking them up, and using your field guide to try to identify them because really, the best way to get to know the rocks and figure out how to identify them is to just practice.

Alie: Well, we did have a lot of people who asked about rock collecting and rock hounding, and I'll list their names.

Aside: Delaney, Lizzy Carr, Jessie Dragon, Nikki DeMarco, Ronja, Shai Clai, Catherine Griffith, Jodi Pierce, Jessi B, Jenn 'Squirrel' Alvarez, Nina Giacobbe, Kelly Semon, Becks Woodruff, Aminah, Abi Dardas, Kristen Rosenblum, Anastasia Doherty, Jenna Congdon, and first-time question-asker, Amy Vanko, and...

Alie: Briauna Armendariz, first-time question-asker, wants to know: Why do you think humans are fascinated with rocks? Why, when we see a cool rock, are we like," I got to announce this?" Why do you think people love them so much?

Schmitty: That's a good question, if I'm speaking from my own heart, it's just because they're so cool. It's really fun to just be out in the environment and look down at the ground and see something beautiful. Whether it's a really smooth, gray river pebble that you can touch and feel, or it's a more quartzy and more gemstoney crystal, or a geode that you can find, it's really amazing to just be out in the world wherever you go and find something beautiful. And I think once you start to learn more about them, it's amazing to be able to go literally anywhere and pick up a rock and get to know a little bit more about the place that you're in.

Alie: Well, I'm so glad you mentioned geodes by the way...

Aside: On that note, Paige McLachlan, Meghan A, Jodi Pierce, Jeanette Moss McCurdy, Frederick Raymond-Coursol, Harper Thomas, Delaney, Amy DuCre all had geode questions and they were not the only ones.

Alie: ... because I've got to ask, E-Veh-Lease Sanchez wants to know: What's up with geodes? Are they rocks? Are they crystals? Both? Grace Robisheaux wants to know: Are the amethyst geodes sold at museums even real? What is a geode?

Schmitty: Yeah, a geode! I don't know the technical definition off the top of my head, but my best understanding of geodes is you have an empty cavity or some kind of empty space in a rock and usually water is moving through that and that's going to allow crystals to grow from the outside in. So, they are a rock.

One way to maybe go looking for them is if you can understand the layers, like what rocks in general, what are the rocks in the area. A lot of the times, different layers of rocks get really well documented and so you can know if you're going into the field, "The rocks in my environment are going to be this kind of rock, they formed at this time, and they have the right conditions for forming geodes." But yeah, geodes are so beautiful, getting all those crystals that have grown in from the outside, I just love them.

Amethyst is a very common form of quartz, so a lot of times if you see them being sold, there's a good chance that they naturally grew like that but I do know sometimes if you go to, for example a gift shop, and you see brightly neon-colored gemstones, I'm pretty sure there are processes with which you can dye minerals, so not everything you can go buy at the store is going to be naturally colored.

Aside: So yes, remember how a lot of citrine points you see are really heated amethyst? Well, if you ever spot a citrine geode in a shop, it's probably an amethyst one, with a little help from an oven, to turn it yellow, which is still amazing and beautiful but natural citrines don't usually geode.

So, geodes are rocks that form with a pocket in them, kind of like a pita. And maybe it was a bubble in volcanic ash, maybe it was a tree root, or a dead prehistoric rat. Either way, that thing dissolves over time, and water gets in, and the minerals in that water

allow the crystalline rocks to form in the empty pita pocket. Deserts are a good place to find geodes, and so is Iowa, a state at one point known as the "Geode Capital of the World."

And this led me down a hole to learn about some solid rocks that have an agate in the center, and they're called rhyolite spherialites professionally, but you can also call them thundereggs, so named by some because Pacific Northwest Indigenous tribes considered them to be tossed around by thunder gods. And it's Oregon's state rock, the thunderegg. Florida's is agatized coral, which is like a thunderegg but it's a little more oceanic. Utah's state rock? Coal... okay. But Mississippi has an interesting, a good state rock, which was on the minds of patrons Cole Robertson, Emily Krieger, Rachel Kendrick, and Sonjabird, which we're going to talk about next. But at this point I was just petrified of taking too much of Schmitty's time.

Alie: Sorry, we're just throwing so many questions at ya!

Schmitty: No please, I have nowhere to be. I love this.

Alie: Okay. Alex Suarez and so many other people want to know: What's up with petrified wood? Is it wood? Is it rock? I need answers.

Schmitty: That's great, I love petrified wood. So, petrified wood happens when you have wood in an environment where it's been separated out from things, like biological processes that will decay it away. And what happens is, as water is moving through wood that has, for example, been buried in sediment, that organic structure is going to be replaced with minerals. So, in the end, when petrified wood, when all that organic material has been replaced with rock material, then that's become petrified wood. And so, that is a rock [*"*Hello *I'm Dee, I'm a rock."*] to my best understanding and typically once that process is complete, there's no organic material left, but it's the same process by which fossils form. And so, all of that original material has been replaced with rock and it's preserved the structure.

So, petrified wood is really cool, and I think, going back to the question of collecting things, I think when it comes to collecting petrified wood, probably that's something you really want to be careful about because rocks like petrified wood are not the most common ever and oftentimes they can be a really important scientific resource. There's a national, either a park or a monument, that's this whole petrified forest and that's going to be somewhere where you really want to make sure you're leaving these beautiful rocks like petrified wood behind. That way future generations can enjoy them.

Alie: Can you lick petrified wood the same way you can a fossil? Will it stick to your tongue?

Schmitty: I don't believe it will stick to your tongue.

Alie: Ohh, good to know.

Schmitty: I have a piece of petrified wood I could go lick but I don't think it will stick to my tongue.

Alie: [*laughs*] Report back, let me know.

Schmitty: I will report back... at some point.

Aside: Apparently, tongues do not stick to petrified wood. So, you heard it here. Let's lick petrified wood but let's not steal it. Have a respectful look at it if you'd like, maybe saunter over to the Petrified Forest National Park in northeastern Arizona, which even has a spot called the Rainbow Forest, which has what looks like tie-dyed, fossilized,

fallen trees. But if you're hellbent on owning petrified wood, I did find in my Google adventure that for $79 plus tax, Crate & Barrel will ship you a slab of petrified wood that you can use as a cheese board. I read the reviews for this item, and they were full of disappointment such as:

I just received this and it looks nothing like the picture, not a single grain of wood color, just pure black. I understand that there are variations, but I could have spray painted a block black and it would look like this.

So, you know, human beings. We purchase a slab of fucking majestic, fossilized wood, just for the purpose of serving cheese, we have it shipped to our doorstep, and it's never good enough. And I'm not saying that we're the worst species, buuut...

And a reminder that if you own cool stuff that is in limited supply on Earth that takes millions of years to form, specify in your will who gets it when you die, write it on a Post-it note somewhere, avoid it going in a landfill. You can do it, it's not that hard.

Oh! Speaking of easy street, a bunch of you wrote in with a similar question, looking at you, first-time question-asker Corrie Francis Parks, Maria Delgado Gomez, Lorri Fishman, and Carsyn.

Alie: A lot of people mentioned this phrase that I had never heard, Erika Storvick, first-time question-asker, so naturally they had a few but they said: Why is "rocks for jocks" a thing? I had never heard this term before. Is this what people call Intro to Geology class? What is that?

Schmitty: That's actually really interesting, I hadn't heard that term until a couple of months ago and my best understanding is in some environments, introductory-level geology classes are seen just as not rigorous, or not enjoyable, or not important [*"How dare you?"*] and I think that is a really... It makes me really sad and I think it's kind of dangerous because learning about Earth science is really important for not only being able to appreciate the world around us but a lot of what's happening in today's society, whether it's about climate change, or natural resources, mining, deforestation. Understanding a lot of what's going on today, it's really important to have the geologic context for it. And it's not that everyone needs to go become a geologist but having environments where people can go learn about Earth science in a way that leaves them with an appreciation for it, I think is really, really important.

Alie: Yeah, it also seems hard! It seems like a hard field.

Schmitty: Yeah, it's not easy. [*Alie laughs*] I really don't think geology is any more or less rigorous than physics, or sociology, or psychology. It is its own science with its own complexities and it's really interdisciplinary, it lives at the edge of a lot of fields and it's really deeply painful to see geology looked down on. It's what I do for work, and I love it dearly, and I think it deserves as much of a place as any other science in the public understanding.

Aside: Because context is everything and after listening to Schmitty's love of rocks, will you ever see a rock the same? I think you will not. Okay, so onto more questions of yours, but first before that we donate to a cause of the ologist's choosing. This week we'll split the donation to, first, Skype a Scientist, which is currently celebrating Squidtember with some gorgeous squid stickers, available at the link in the show notes, And you can find out more about their mission to bring scientists into classrooms and other gatherings at SkypeAScientist.com.

We'll also throw a donation to MinDat.org, the world's largest open database of minerals, rocks and meteorites, and the localities they come from. So, MinDat.org is run by the not-for-profit Hudson Institute of Mineralogy, it's linked in the show notes. Those donations were made possible by sponsors of the show, thank you very much.

[*Ad Break*]

Okay, let's get back to a *very* popular question. Anne Barnes, Lizzie Marr, Jeanette-o-saur, Geo.Sassie, Lee T, Dave Schuster, Anna Thompson, Nancy Kay Clark, Cassafrass, Hannah Matousek, Haley Beaupre, Claire Irvine, Mo Casey, Sidney, Gina Woolsey, Michelle Dempsey, Matt Thompson, Abby Cox, Argiope17, Jamie Kishimoto, and Kel C all asked about seeing geological formations, including patron GeoKrissy who wrote: From one geologist to another, I tell people I have a high visibility vest in my car for changing car tires, but it's really for stopping at road cuttings to take a look. So, overall, where should a person go to see some cool-ass rocks?

Alie: Oh wait... [*whispers*] Gosh, I have so many questions for you.

Schmitty: This is great.

Alie: I mean, let's talk rock spotting, because there's so many times on the side of the road where you're like, "Why is that side of the road striped?" What am I not knowing as I pass this? When it comes to rock spotting, what are some monuments that people might be familiar with or should be familiar with, and what are they seeing? If you're in Moab or something, or you're driving past the Grand Canyon, are there places that we can put geology in our heads just by looking out the window?

Schmitty: Yeah, so one basic thing that almost anyone can do is when you're passing by a roadcut, you can look at the layers. So, the idea of things forming in layers is really fundamental to a lot of science and it's very, very, *very* fundamental to a lot of geology. One thing anyone can do is if you pass by a road cut you can look at the layers of rock. And if the layers are flat, you know that they are still in the way that they formed because when rocks form, they form in flat layers and it's always that the newest rocks are the ones on top. So, you're always going younger as you go up and older as you go down.

And then a lot of the times, if you're passing a roadcut and you see a roadcut and you see the layers are tilted or folded some way, you know that that whole section of rocks has somehow been lifted up, either as the tectonic plates are moving around, as mountains are being built. Sometimes you can see roadcuts where rocks have been folded, so that means that they've been uplifted and squished around. A solid rock that you can put your hand on has moved around in such a bendy way. So yeah, even just by looking at the way that rock layers are tilted in a roadcut, you can tell something about the history of that place.

Aside: Okay, for more on this, we need a geomorphology episode and I need to find a geomorphologist, so I'm just going to ask anyone pulled over on the side of the road, staring at a hill.

Alie: Do geologists do a lot of their work in sites that have already been excavated for industry? What does a geologist's job look like?

Schmitty: Yeah, that does happen. There's a lot of geology that goes on in national, state parks, pretty much anywhere you get exposed rocks, you can do geology, and that definitely includes mined areas. I know for one of the sites that I used for my PhD work is the site

where we had these old corals exposed that formed 80,000 years ago. When I was updating myself on the literature, I found a reference that, "This site was mapped 10 years ago, but it's flooded now, you can't go back there because of industrial stuff." [*"Bummer."*]

I think any way that rocks get exposed, there's going to be someone out there who wants to study them. And road cuts are a really unique way because oftentimes, you can't necessarily study what's going on in a hill because it's a hill, it's hard to dig straight down into bedrock. [*Alie laughs*] But when you get a roadcut coming through, that's a really unique opportunity to get to see the interior structure of the crust exposed.

Alie: Have you ever been looking at a roadcut and saw something that shocked you?

Schmitty: Actually, one of the rocks that I brought with me today, I can describe it, I picked it up at a roadcut. There's a classification scale of igneous rocks, and one of the categories I called an ultramafic rock, which means it's really high in iron and magnesium. Ultramafic rocks are typically rocks where the composition is really, really close to what they were when they were deep in the earth's mantle, hundreds of kilometers beneath the surface of the earth. One of my favorite rocks is called an enstatite peridotite, it's this really dense, beautiful, bronze-colored rock with these huge square crystals in it, and this rock, again, it's very similar in composition to what's deep, you can look down right now, it's deep below the surface of the earth, and I found this rock at the top of a mountain! It had no business being there!

Alie: What?! How?

Schmitty: This rock, this blob of magma, cooled in the crust, and eventually over millions of years, it got lifted up and excavated, and lifted up to the top of the Bighorn Mountains in Wyoming. So, it's just really amazing to me getting to look at this rock and say, "You formed under the surface of the earth, and I found you 8,000 feet above sea level. You have no business being there." It's just, so fun, love it dearly.

Alie: Is there any way someone had that in their pocket and brought it to the top of the mountain on purpose?

Schmitty: No, this was part of a 40-foot-tall cliff of this stuff.

Alie: [*laughs*] Okay, then probably no one had that in their...

Schmitty: Probably not. I have heard of people pranking geologists by, I read this somewhere on the internet, by bringing a rock from somewhere else with them and saying, "Hey, I found this." No one's ever done that to me, and I don't know if I'd catch it, but put that idea out there for anyone who wants to mess with a geologist friend.

Alie: Apparently all it takes is some chocolate pebbles.

Schmitty: Exactly, some chocolate pebbles, exactly. That's a great way to prank them because you get a snack at the end.

Alie: Yes. [*laughs*] What about rock names? Becks Woodruff wants to know: What are the most ridiculous rock names?

Aside: Katie King also had this question and patron V.E. Griffith divulged their favorite was cummingtonite. And Batman Flight asked if cummingtonite was...

Alie: The best name of all geological terms? Simon Bonisteel said: I look forward to your podcast, I wish it was cummingtonite... As in dropping tonight. But what about names of

things, who are rocks named after? How do they get these names? What ends in an -ate versus an -ite?

Schmitty: Yeah, so a lot of rocks, the recent ones have been named by scientists who discover them, a lot of names have what's called "grandfathered in," which means they're just names in popular use and when geologists sat down to make official guidelines of what these rocks are called, they were like, "Well this is what everyone calls it, it's what we'll call it." [*Alie laughs*]

But my personal favorite rock name is a classic, it's gneiss and it's pronounced "nice." There's a lot of really great geology puns. Geology is rife with puns, and I used to do this thing, people hated it, where I carried this piece of gneiss around with me [*Alie laughs*] and anytime someone would say, "That's pretty nice," I would whip it out of my pocket and say, "That's pretty *gneiss."* [*Alie still laughing*] The other good one is there's a metamorphic rock called schist, and that's also rife for puns and I deeply appreciate anytime someone makes a geology pun around me.

Aside: Many patrons Paul Smith, Amy Narimatsu, Leah E Anderson, Specs Owl, Robin Stumbo, Jaclyn Iwanicha, Laura Springer, Amy Jane Joy, Gwen Kelly, and Diana Teeter wanted to know if Schmitty enjoys geology puns, great questions. I mean, your questions keep getting *bolder*, and it really helps me *cobble* together an interview. You're all *gems*.

Alie: Speaking of things that end in -ite. Let's talk about one type of rock, your favor-ite.

Schmitty: My favor-ite, oh gosh.

Alie: Yes, what is your favor-ite? So many people, I'm going to say their names so fast in an aside...

Aside: Amanda Spinosa, Hannah Reilly, Shelby Smith, Rebekah Fitchett, Jodi Pierce, GermanSil, Buhbrie, Kaylee Dyer, Delaney, Bex, Mira Simantov, Kendall Hargis, Aeriel Belk, Julia Fisher, Simon Bonisteel, Megan Wedal.

Alie: Need to know: Schmitty, you're a geologist, we love you, you love rocks. What rocks do you love the most? [*Alie laughs*]

Schmitty: Awesome. Okay, there's a few ways to answer that question. Probably my favorite individual rock that I have with me is a piece of gneiss [*"Noice!"*] So, it's just this beautiful, smooth rock with layered white crystals and white iron and magnesium-rich crystals and then lighter quartz-rich crystals on it. This rock, it's really fun because this specific rock has a long history.

It forms as a diorite, deep beneath the surface of the earth. So, this magma moved up through the crust, and crystals fell out of it, and eventually it cooled, and then that diorite got put under intense heat and pressure and all those crystals rearranged themselves into stripey layers and became a gneiss. And then eventually this rock, somewhere in the northern part of North America, was at the surface of the earth and a glacier, one of the ice sheets that used to cover North America, picked it up and brought it to northern Wisconsin, where I found it. Because where I picked up this rock in northern Wisconsin, it could not have come from around here, so the only way it got there was if it had been brought there by a glacier. So, it's very personally very near and dear to me because it tells a long history, not only about the planet but also about the amazing ice sheets that have shaped so much of the North American landscape.

Aside: Schmitty was holding up a round, flattish rock, about palm-sized that had a dark top and bottom with what looks like a crystalized white wafer smashed between. Gneiss can have that *nice* banded texture. I can see why this one is pocket worthy.

Schmitty: So, I think that's my personal favorite.

Alie: That's your personal favorite. Do you name rocks, or no?

Schmitty: I don't name rocks. I think… They already have names.

Alie: Yeah, it's already got such a *nice* name also.

Schmitty: Exactly! It does have a nice name. Good pun.

Alie: It also 100% looks like a whoopie pie. It definitely looks edible.

Schmitty: It does look like a whoopie pie. And it's also… I have a few rocks I'll carry around with me as something to, you know, fidget with. Rocks can be really great things to carry with you because they're very dense, so they have a nice weight to them. This one has a perfect little indent that I can rub my thumb against.

Alie: When you go to different parts of the world where they have dry stacked walls, rock walls, do you always have to stop and look at those too?

Schmitty: Always. Anytime I see a rock in a wall or on the ground. I'm a terror walking through neighborhoods because I'm like, "That's a cool rock in someone's rock wall." [*Alie laughs*] And the person in the house is probably like, "Why are you paying attention to my garden wall?"

Alie: What about something that sucks? Something must suck about rocks. Something's got to suck, Schmitty, come on! Or about being a geologist.

Schmitty: Okay, something's got to suck about rocks. Slightly left turn but something that I think has very much plagued me in my science journey is something that I know a lot of people deal with in science which is imposter syndrome. So, especially when you're a younger scientist in training, I feel like a lot of people struggle with the feeling that, "I don't belong here, they're going to find out any day that I don't belong here, they're going to kick me out." And I think, you know, a lot of people experience it, and not a lot of people talk about it.

I've definitely struggled with it myself, feeling like I'm not smart enough, I don't know enough about this material to be talking to you today, I don't belong here. And that can be really hard and painful to deal with. Having an amazing community of other scientists and friends around you can really help with it, but I think that's something that we need to acknowledge because it's a really deeply painful thing to deal with. That's the worst thing I can think of, I can't really think of anything bad about rocks.

Aside: And just a serious side note, geosciences haven't always been the most inclusive of fields. And a 2020 study published in *Nature*, "Barriers to fieldwork in undergraduate geoscience degrees," stated that, "These barriers are especially felt by disabled students and those from racial and ethnic minorities, all of whom are critically under-represented in the discipline." And other historically excluded minorities in geosciences have pointed to concerns about being targeted doing fieldwork, a safety issue that was highlighted in 2020 when Christian Cooper, a Black birder, was targeted and threatened in Central Park. There are also physical barriers for some, sexual harassment and field sites have been reported, and locations that are less than friendly to LGBTQ folks.

So, Schmitty says that finding community is especially important and pointed to organizations like URGE, Unlearning Racism in Geoscience which is working to help geoscientists unlearn racism and improve accessibility, justice, equity, and inclusion in the discipline, which is so needed. And if you're part of a historically excluded group, finding a mentor can also be key.

Alie: It seems like all the wrong people have imposter syndrome. [*Schmitty laughs*] I think if you have imposter syndrome, chances are you belong there more than anyone. [*both laugh*]

Schmitty: Thank you.

Alie: What about your favorite thing about geology or about rocks?

Schmitty: I think my favorite thing is what we're doing today, talking to people about geology and the world around us. Because I can spend all my time as a graduate student, time as an undergraduate, learning all these amazing things about the Earth, and being excited about it on my own, but getting to share that with other people and see other people from all walks of life get excited about geology is the *most* fun thing.

So, it's really fun going out and telling people, "I'm a geologist," because a lot of people whether they're a little kid, or they're a grandparent, a lot of people are like, "Oh my gosh, that's so exciting!" And they'll ask me questions. Or for example, getting to volunteer with organizations like Skype a Scientist, a lot of people are really interested in this stuff but they may have never had an opportunity to get to talk to a geologist or gotten to take a geology class. Just yeah, getting to share all these amazing stories about how the world around us works, getting to share that with people is just the most fun thing I can think of.

Alie: Do you have any advice for someone who thinks they want to be a geologist, or a type of geology field where they need more people?

Schmitty: Yeah, I think if you want to be a geologist, if you're going to college, connect with your geology department. I think the best advice I could give is talk to people. If there's other students studying geology, talk to them, see what classes they're taking, see if there's any field experiences, clubs you can join. If there's faculty members that are available, reach out to them and let them know that you're passionate about this and you want to learn more. I think making personal connections in the field is something that is really helpful for both getting advice, getting mentorship, figuring out "Where's the right way for me to go?" Yeah, I think just talking to people in the field because a lot of us, we love what we do and we're really excited to talk about that and get to share that with people.

Alie: This has been a joy.

Schmitty: This was so much fun.

Alie: Everyone loves you and I understand why! [*laughs*]

Schmitty: Thank you, I admit I was... I was kind of nervous, but I had a lot of fun.

Alie: [*laughs*] You rock.

Schmitty: See, you're picking it up already.

So, as per usual, ask smart people not smart questions such as, what the fuck is a rock? Because they love it, and they will love telling you. Schmitty is not on social media because they are smarter than us, but we are @AlieWard on Instagram and Twitter , we're @Ologies on both. There are links right in the show notes to the charities we supported this week, MinDat.org and Skype a Scientist. There are tons of links up on my website at AlieWard.com/Ologies/Geology as well as links to other episodes you might like that we mentioned.

Smologies are kid-friendly, shorter versions of classics, you can find those in our feed or up at AlieWard.com/Smologies. Zeke Rodrigues Thomas and Mercedes Maitland of Mindjam Media edit those. Merch is available for your body and soul at OlogiesMerch.com, thank you Susan Hale for handling that and so much more. Thank you, Erin Talbert, for adminning the *Ologies* Podcast Facebook group with assists from Shannon Feltus and Boni Dutch from the comedy podcast *You Are That*. Thank you, Noel Dilworth for all the scheduling. Emily White of The Wordary makes our professional transcripts, Caleb Patton bleeps episodes and those are available at AlieWard.com/Ologies/Extras. Kelly R. Dwyer does the website. Nick Thorburn wrote and performed the theme music. And the lead editor, who puts all the pieces together each week, and has a sparkly heart like a geode, Jarrett Sleeper of Mindjam Media.

And if you stick around to the end of the episode, I tell you a secret. This week's secret is that a few weeks ago I divulged that I had given my dad a haircut while he was in hospice before he passed away, and I saved a lock of hair and I happened to go to Disneyland, and I decided to drop a few strands off at the lawn in the front entrance. I don't know why, it just, it seemed like a cosmically fun place to people watch, and it was just sweet knowing it was there and was going to turn into, you know, a worm and a bird or something. Anyway, that was in mid-August.

I went back to Disneyland two days ago, and y'all, the lawn changed. That lawn is different! For the first time in 50 years, they changed the lawn at the gates of Disneyland and it's AstroTurf now, to save water. [*laughs*] The first time in 50 years! So, I'm considering that some sort of practical joke from an astral plane from my dad because I feel like he would laugh at that. Truly, of all the places... two weeks later. Anyway, hilarious Dad, good one. Okay, go have fun today, all right? You deserve it, I say so. Berbye.

Transcribed by Aveline Malek at TheWordary.com

Links to things we discussed:

Donations went to Mindat.org and Skype a Scientist
Schmitty's bio
Schmitty's published papers:
A Global Database of Marine Isotope Stage 5a and 5c Marine Terraces and Paleoshoreline Indicators
3D MANTLE VISCOSITY STRUCTURE IN GLACIAL ISOSTATIC ADJUSTMENT MODELS RESOLVES DISCREPANCIES IN MARINE ISOTOPE STAGE (MIS) 5A AND 5C GLOBAL MEAN SEA LEVEL PREDICTIONS
Skype a Scientist After Hours Trivia for Adults
Squid Stickers!
USGS explains metamorphic rocks
Cat-eye marble road sign
More history on cataphotes
Losing one's marbles
Some marble history

The Volcano Eruption in 4K HDR | Jurassic World: Fallen Kingdom
Trailer for The Wave
You can watch The Wave (but with ads) via YouTube
Bocquet, L. (2003). The physics of stone skipping. American Journal of Physics, 71(2), 150–155.
2016 Stone-skipping documentary “Skips Stone for Fudge”
2004 paper in Nature, "Secrets of successful stone-skipping”
Swift Stone Skippers Could in Theory Skip 100s of Skips
Bone metabolism and evolutionary origin of osteocytes: Novel application of FIB-SEM tomography
More on YaraHaridy: Sassy Palaeontologist
This guy tumbles a lot of rocks!
The work of philosopher Simon Caney
Climate change, human rights, and moral thresholds
Ultimate disintegration products of the radioactive elements; Part II, Disintegration products of uranium
Biographical Memoir Of Bertram Borden Boltwood 1870-1927
Mother Jones: An Updated Lead-Crime Roundup for 2018
Large boulder the size of a small boulder tweet
Indeed a large boulder sized small oopsie
MinDat.org
Cummingtonite
Silicon carbide aka Moissanite
Petrified wood vs. fossilized bone
Dark crystals: the brutal reality behind a booming wellness craze
Morton Salt Substitute
The Great Filter
Do Intelligent Civilizations Across the Galaxies Self-Destruct? For Better and Worse, We’re the Test Case
Glass is a mineral!
Top-Down and Bottom-Up Mechanisms in Mind-Body Medicine: Development of an Integrative Framework for Psychophysiological Research
2009 Stone Skipping Professionals piece on CBS
Mining in Madagascar
Crate and Barrel Petrified wood cheese board
Glacier ice: a mineral?
Ice and minerals, cont.
Prospecting geodes
Rainbow Forest
More photos of the Petrified Forest National Park in Arizona
Rhyolite spherulites aka THUNDER EGGS
Geode vs Thunderegg
“No progress in diversity in 40 years”
Barriers to fieldwork in undergraduate geoscience degrees
Protecting BIPOC scholars in the field