Episode 212-Dendrites

As a general rule, I don't like window seats on airplanes. I like the aisle, where I can get up when I want to, without disturbing the people sitting next to me. So, it was kind of annoying when a flight last summer got cancelled due to weather and by the time they got it sorted, I ended up reassigned to a window seat. Annoying, that is, until I got over myself and looked outside.

I was flying from Los Angeles to Denver, on my way to give a talk there, and our route took us over southern Utah and the Canyonlands area—Antelope Canyon, Zion, Bryce Canyon, Grand Staircase Escalante National Monument and Capitol Reef, to name a few of the formations that call the region home. So, when I looked out the window, to steal a term from my friends in South Africa, I was gobsmacked. First, the airplane window was crystal clear. Second, the sun was low in the sky and oriented at an angle so that there was no glare. In fact, it was that magical, ephemeral time that nature photographers love called golden hour, when the sun is getting close to setting and everything is briefly washed with a warm, golden tone.

There were great, yellow plateaus, with shadows washing stripes across their faces; deep canyons, banded with swaths of gold, and red, and ochre, and olive, and white, and pink, the work of ancient rivers; black volcanic intrusions; and wave upon wave of folded rock, evidence of the great tectonic pressures that shape the land.

I photographed all of this; in fact, I wrote a book about this, called Tectonic Tapestries, but if you'd like to see some of the images I took, I'll put a link in the show notes that will take you to a document with the images in it, along with a transcript of this program.

The landforms that we passed over were stunning, but what really caught my eye were the tracks of the rivers. Emerging from the canyons they had created, the rivers flowed wide and dark, but as they passed over the flatness of the desert, they became narrower and branched—a shape known as dendritic. The word comes from Greek and it means, 'tree-like,' because of its spreading, branched shape. You may recall the word 'dendrite' from biology class, the name for the branched structure of the nervous system.

Okay, now let me invite you into the Wayback Machine for a moment, and we're going to travel forward in time to today, late March, in northern Vermont where I live. We had a major storm over the weekend that dumped a lot of snow on the ground. I cleared the driveway and walkways and made a path to the trash cans. Then, the weather got all schizophrenic on us, as it often does this time of year. The sun came out yesterday and it warmed up into the 40s. The snow melted, and water washed across the driveway and into the street. I knew what was coming, so last night, I salted the driveway. Sure enough, the temperature dropped overnight to well below freezing, and had I not salted, the driveway would have become a skating rink.

I told you all that so I can tell you this. A little bit of the snowmelt compound always makes its way into the garage. And sure enough, when I went out this morning to run a few errands, I noticed that a small puddle of water on the floor behind my truck had evaporated, leaving a stunningly beautiful dendritic pattern of salt crystals that looked just like the riverbeds of Canyonlands. The entire structure was small, scarcely two inches across, but gorgeous.

Well, my curiosity kicked in. Why? Why this structure? If you visit the SoundCloud site for this episode, you can see a photo of the salt crystals, and I've also included it in the episode transcript with the other photographs I've referred to here. Anyway, I dug in.

It turns out that while the dendritic pattern looks the same in both situations—the river flow and the crystal formation—the reasons are different. In the case of flowing water, the dendritic pattern develops because the river is flowing across a geographic surface that has a long, gentle slope to it. The smaller branches don't flow OUT of the river; they flow INTO it. They're tributaries, approaching and joining the main river at angles that are less than 90 degrees.

Okay, that take care of the dendritic pattern that mesmerized me on my flight to Denver. But what about the crystals on the floor of my garage? Well, that's a little bit more complicated.

We talk about the stuff that we scatter on driveways and sidewalks and roadways as salt, but that's not technically accurate. Pure salt—sodium chloride, for the chemists in the audience—forms crystals that are little cubes. You can see this by looking at a few table salt crystals under a magnifying glass—little square boxes.

BUT: If you add impurities to the salt, especially metallic impurities, then you get different crystalline shapes—flat, wide flakes, and dendrites, like the ones growing across my garage floor. It turns out that dendritic salt crystals form when concentrated salt solution—brine—contains small amounts of ferrocyanide ions, which road salt contains. In fact, it's added deliberately, because it prevents the salt from caking and clumping before you scatter it on the driveway. Ain't science cool.

If you'd like to see this process in action, you don't have to move to Vermont and sit through an endless winter. You can grow beautiful crystals in your own kitchen. Here's how. Grab a piece of paper and write this down, or go to the Web site and download the transcript.

Here's what you need:

- 2 TBSP ammonia
- 2 TBSP laundry bluing
- 2 TBSP water
- 1 TBSP salt

Mix those all together and set them aside. Be careful, because the bluing can stain.

Next, take a small kitchen sponge and cut it into one-inch pieces. Put the pieces in a small paper bowl, the kind that ice cream is served in at kid's birthday parties. You can also use a jar. By the way, you don't have to sacrifice a sponge; you can also use small rocks, pieces of brick, and so on, but the sponges hold more of the solution and usually yield bigger crystals.

Next, pour the mixture you just created all over the sponge pieces or whatever you're using for the substrate. Set the bowl aside and let it stand for a few days or perhaps a week, depending on your local humidity. Large, delicate crystalline fans, dendrites, will form.

The reason this works is because laundry bluing contains a high concentration of iron ferrocyanide, so it forces the salt to crystallize into dendrites instead of little cubes. How cool is that?

Professor proton, signing off.

Images from Tectonic Tapestries to Accompany *The Natural Curiosity Project* Episode 212: Dendrites

All of the images in this document, which includes the transcript of Episode 212 and is intended to illustrate it, were taken from my book, *Tectonic Tapestries.* The only exception is the last image, which is a close-up shot of the salt dendrites that formed on the floor of the garage behind my truck.

Hope you enjoy them. Cheers!