Minnesota Now (MPR) | Minnesota Now Lake Superior's volcanic origin story
01GCSEK5W96VNPSCKY1WW47MEM

CATHY WURZER: OK. Sit back. Relax. We have a story to tell you about breakups. They can be volcanic, personally and geologically. Professor Jim Cotter teaches geology at the University of Minnesota-Morris, and he is returning to Minnesota now with a story about the near breakup of the North American continent that gave rise to Lake Superior. I'm sitting with bated breath here. Professor Cotter, how are you?

JIM COTTER: I'm good, Cathy. How are you?

CATHY WURZER: Good, thanks. What's this about a near breakup of the North American continent, and what does it have to do with Lake Superior?

JIM COTTER: Yeah, a great story is right. Last time, I talked about how the continent was put together piece by piece 3 billion years ago. But if you move forward in geologic time about a billion years ago, the region that's now Minnesota started to-- what's called rift apart. It started to form an ocean.

That process, of course, is driven by plate tectonics, the movement of the Earth's surface plates. But the driving force is a huge-- technical term-- a blob of magma rising up through the crust. And with that magma came all sorts of interesting things.

First of all, the continent literally splits, and so the low spot that Lake Superior is in is really an ocean that started to form and then stopped. And then as you look around both on the Minnesota side of Lake Superior and the Michigan side of Lake Superior, there's all this evidence of just a fantastic volcanic event that is simply mind boggling.

CATHY WURZER: Wow, I didn't know that. I mean, that explains in part why Lake Superior is so big?

JIM COTTER: That's exactly right. The depth of Lake Superior is amazing in comparison to the other Great Lakes. And the reason is it's underlain by oceanic crust.

CATHY WURZER: And this was how long ago again? More than a billion?

JIM COTTER: About a billion years ago. And the process lasted for 30 or 40 million years and just stopped. And in the interim, you have huge volcanic flows, and you can see those now. Gooseberry Falls is a great place to see them. Everywhere where the water falls, that's another lava flow.

And then underneath those flows, subsequently came-- it's like a broken lava lamp. The wax rises up, but it doesn't fall back down, and so you have these huge igneous bodies underlying the whole northern part of Minnesota, the whole North Shore, that just generated some really interesting igneous features.

CATHY WURZER: Oh, that's cool. Now, I know enough geology to be dangerous. Geologists talk about the Duluth Complex. So what is that, and how is it related to this rupturing of the continent we saw a billion years ago?

JIM COTTER: Yeah. That is a dangerous amount of geologic knowledge, Cathy.

[LAUGHTER]

The Duluth complex is really the kind of heart and soul of the whole event, one really, really large igneous body rises up through the crust. And the Duluth Complex became world famous when it was recognized. It's not just Minnesotans that know about it, not just you.

But the whole world that understands igneous processes looks to the Duluth Complex. Because what happens is A, there's a series of events, and some of them are mineralized. The copper in Minnesota comes in one of the early volcanic rising masses.

But the main one-- and that's the one that's famous and that underlies the whole North Shore of Lake Superior and extends under Lake Superior to Michigan-- that thing was in a body that was tens of miles by tens of miles in surface area. And it lasted so long that crystals started raining out of it.

I don't know if you've ever discovered a honey jar in your cabinet that you forgot about, and you see all the sugar crystals on the bottom. What's happening is the honey is losing water, and so you get supersaturation of sugar, and it falls out. That happens in the Duluth Complex.

You get crystals that fall out, and it stays hot enough to remain a liquid that's loaded with crystals-- almost like a slushy kind of thing-- and it keeps raining out these layered crystals. And the Thompson Overlook is actually a good place to see that.

But one of just amazing things to visualize is that magma chamber. It was large enough to generate currents and even waves. So you would have this magma with waves, and the crystals are being tossed about like sand grains. Really, a cool thing. Amazing.

CATHY WURZER: Wow. Does that explain, then, some of the mineral deposits that we have not only around Duluth, but the range?

JIM COTTER: The iron is a different formation and a little bit older than the Duluth Complex. But the copper, zinc, and, I think, platinum metals are explained by at least one of those several igneous intrusions. And the same thing on Michigan side where Michigan's mining copper and platinum.

CATHY WURZER: Wow. This was so dramatic.

JIM COTTER: I'm sorry. But it's exciting stuff, Cathy.

CATHY WURZER: Yeah. I know. This is why we call you our rock star geology professor, because you tell such great tales, and you just have such a great way of explaining it. I wish I had more time, but I got to run. Thank you.

JIM COTTER: That's OK, Cathy. You're welcome. You're welcome.

CATHY WURZER: Talk to you later. Jim Cotter is Professor of Geology at the University of Minnesota-Morris.