Sea Grant Files: The Color of Lake Superior

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Hi, I'm Jesse Schomberg, and you are listening to *The Sea Grant Files*.

Somewhere today a child is opening a box of crayons. Without hesitation, she picks the bluest blue to illustrate water. This natural action is borne of the fact that more red, orange, and yellow wavelengths are absorbed by water than are blue ones. So when sunlight enters the water, it is mostly blue light that is left for us to see. The deeper the water, the stronger the effect. For instance, tap water in a drinking glass looks clear but the same tap water filling a swimming pool looks turquoise. Covering even larger areas, like Lake Superior, water can look exceptionally blue because the surface is also reflecting the color of the sky.

But once in awhile, looking at Lake Superior will have you seeing red. Other times …it's apparently brown. Still others, it seems green. Which begs the question: why?

"Apparent color" is different from "true color" in the language of water. "Apparent color," the color we see on any given day, comes from a combination of dissolved minerals and compounds, plus particles, both living and nonliving, that are suspended in the water. The "true" color of water is the color perceived after it has been either filtered or centrifuged to remove suspended solids, leaving only the dissolved substances such as iron, manganese, and copper, which can produce striking blue-green colors….or dissolved organic compounds, like tannins that tint the water like tea.

While the apparent color of any given lake on any given day isn't set in stone, the science behind it is rather consistent. This how Lake Superior occasionally comes to be red.

In 2012, a one-hundred-year storm event in the western arm of Lake Superior culminated in washed-out roads, overflowing waterways, and a stunning reddish look to the lake. The source of this coloring originates in large glacial-lacustrine red clay deposits that line the southwestern shoreline of Lake Superior. Prone to erosion and found from Duluth to the Apostle Islands, these clay particles can wash into and float in Lake Superior for days to weeks at a time. Especially famous for its clay-laden flow, the Nemadji River alone deposits about 100,000 tons of silt and clay into Lake Superior a year; that's about 17 dump truck loads, or plenty of particles to color the water.

You're most likely to see water colored by clay when massive amounts of runoff or snowmelt dispense clay particles within a short period of time. According to a Minnesota Sea Grant study on the 2012 flood, the storm's runoff carried particles that reduced the clarity of Lake Superior's water for a month after the event occurred. Another instance where you might be "seeing red", is when high winds across Lake Superior create wave action strong enough to churn the water and pull red clay particles resting on the lake bottom to the water's surface. When this happens, the mix of different apparent colors of water can sometimes create

incredible satellite imagery as they swirl together. Some examples of this phenomenon can be viewed online at lakesuperiorstreams-dot-org.

That brown tint to otherwise clear water in some of our Northland waters is worth discussing a bit more. This true color comes from tannic acid. This natural compound, found in the plants that surround our lakes and streams, is useful in **tannin**g hides and making dry wines. Tannins leach from decaying plant material into water as seasons pass, "staining" water to look like tea or root beer. In the context of Lake Superior, the St. Louis River is especially known for its tannin content. Tannic acids are easily broken apart by sunlight. As St. Louis River water flows out to Lake Superior, sunlight slowly breaks down the tannins, causing the water to become clearer and clearer until the tea-colored water flowing into Lake Superior becomes crystalline blue.

Throughout the world, other things may color water a little differently. Green algae can give a distinct apparent blue-green color to the water in rivers. Some bodies of water in the mountains can take on a turquoise color given to them by ground rocks, such as glacial flour.

Oh yes…and don't forget the sky … as I said earlier, the color of the sky can reflect off the water's surface and make a lake like Superior look dramatically different from one hour to the next: blue, green, gray, golden and even purple.

The next time you are asked to draw water, don't be so quick to grab the blue, or even green crayon. Consider the particles and dissolved materials that wash in from the watershed as well as the life within the water column. Think of the sky overhead and the rocks underneath. Ask yourself, "why this color?"; remain curious, seek answers, and continue to do you part in keeping Lake Superior and its watershed the color of … "amazing".

This episode of *The Sea Grant Files* was produced by Russell Habermann, Sharon Moen, Maija Jenson and me, Jesse Schomberg. For more information or to listen to other episodes of *The Sea Grant Files*, visit the Minnesota Sea Grant website at www-dot-seagrant-dot-umn-dot-edu. You can also follow Minnesota Sea Grant on Facebook and Twitter. Thanks for listening.