# Mink's Ice Palace

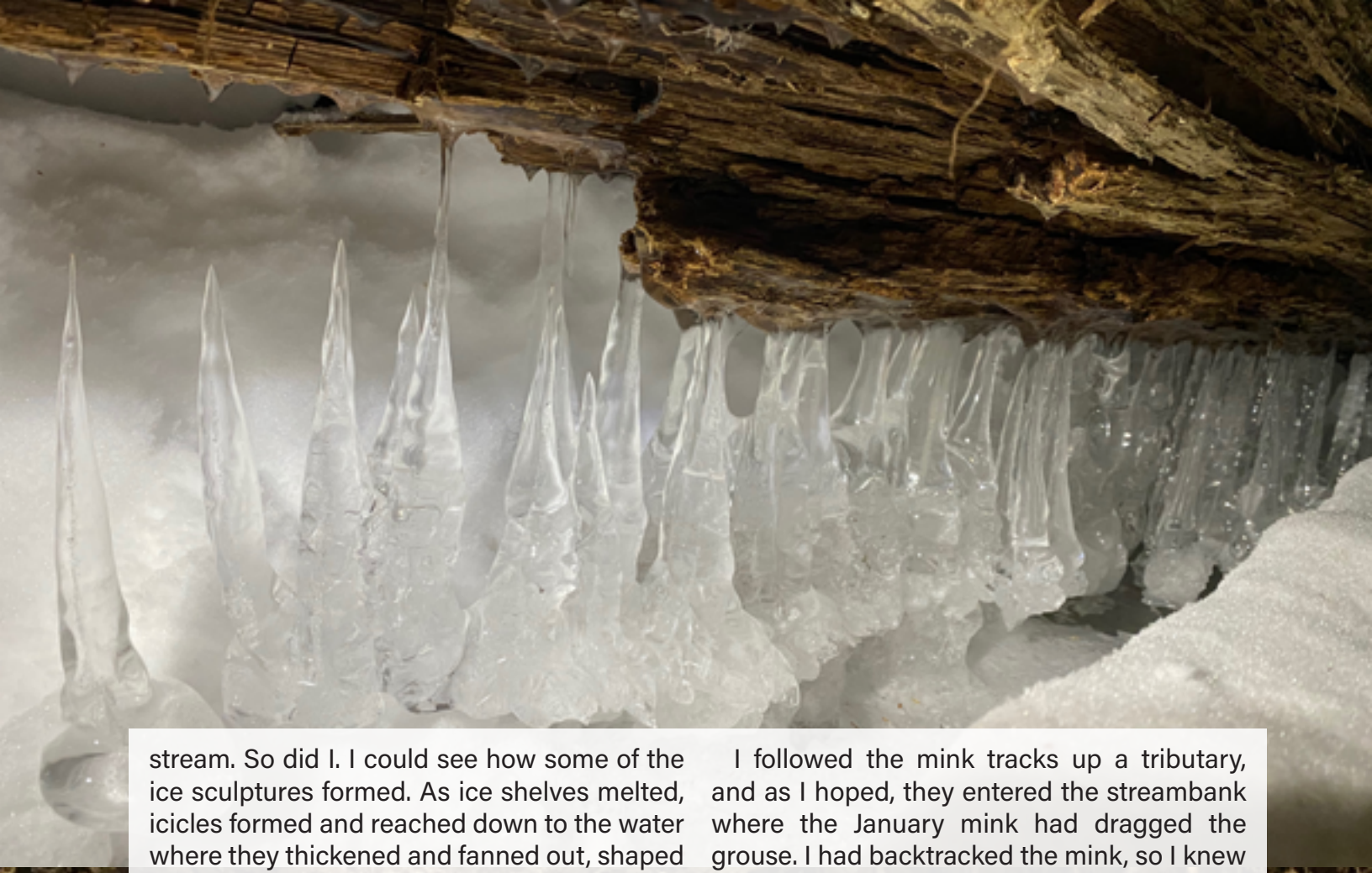
ONE NIGHT in January, I found a story written by mink paws in the snow. The mink had traversed a spruce thicket, towing a prize to his lair under a streambank. When I read the story backward, I found the wing prints and feathers that described the last moments of the life of a grouse. I usually feel the suffering of the prey more than the satisfaction of the predator, but on that night, I felt the joy of the mink. I am well acquainted with mink joy. Max, a baby mink I raised several years ago, embodied the liquid grace and wildness of a mountain stream, and how he thrilled to play chasing games. When the time came for him to go, he headed off into the woods where I followed mink tracks that night.

I have followed the tracks of this mink often since, and there is no better winter tour guide. The trails invariably lead to the brook, and in winters with frigid nights and spells of thaw, the stream is transformed into an ice palace just the scale for a mink. This ephemeral architecture gets me wondering. How, for example, does ice form on turbulent water? How does it form at a level above the flow of the brook? Why are the icicles that form along a stream often fattest at the bottom?

I turned to the internet to review the chemistry and physics involved. Here is a refresher: Each water molecule has two hydrogen atoms strongly bonded to an oxygen atom. The hydrogen atoms maintain a weak negative charge while the oxygen atom is positively charged, thus the molecules of water are attracted to each other. When water is warm, the molecules flirt with each other, recognizing their attraction without creating lasting bonds. As the water cools, molecules slow, and the attractions become more compelling. At the freezing point, these molecules can resist no longer, and bind together in a hexagonal lattice. The spaces in this rigid structure make ice lighter than water.

Ice forms on quiet water in contact with cold air. Because it is less dense than liquid water, it stays on top, insulating the water below. In a brook, turbulence cools the water evenly. When the water gets cold enough, tiny ice crystals called frazil form. These crystals freeze to each other and to the banks and bed of the stream. On cold, clear nights, when heat radiates back into space, frazil formations grow quickly on the bottom of streams. This "anchor ice" raises the water level. A friend who keeps a close eye on his creek reports that the water level rises a foot on cold nights. The heat of the next day is often enough to weaken the ice bonds and release the anchor ice to float downstream. This dynamic environment helps explain the multiple layers of ice along the shores.

When I looked for explanations for the embellishments of the mink's palace, I went down an icicle rabbit hole and emerged dissatisfied. I decided to go back to the stream and consult the mink. Sure enough, a fresh trail followed the



stream. So did I. I could see how some of the ice sculptures formed. As ice shelves melted, icicles formed and reached down to the water where they thickened and fanned out, shaped by near-contact with the almost ice-cold water.

Rocks above the stream surface wore thick caps of ice and snow that fanned out into delicate lacy skirts. Flowing water, slowed by the rock, would rise to the level of the icy cap. While most then flowed around the rock, some would sheet out to the edge of the skirt to reshape its frilly edge. As I followed upstream, however, I encountered formations I couldn't explain— beaded curtains and chandeliers. In one place, crystalline pendants the size of tablespoons dangled from icy threads.

I followed the mink tracks up a tributary, and as I hoped, they entered the streambank where the January mink had dragged the grouse. I had backtracked the mink, so I knew he wasn't home. Still, I couldn't help but call out hopefully, "Max?"

Perhaps one of you can help me better understand the physics of the mink's streamscape. In the meantime, I will content myself with the words of Nan Shepherd from her book, *The Living Mountain*: "But the struggle between frost and the force in running water is not quickly over. The battle fluctuates, and at the point of fluctuation between the motion in water and the immobility of frost, strange and beautiful forms are evolved."

**Take a virtual tour of the mink's ice palace.**