Big Hill Springs Provincial Park – An Environmental and Geological Treasure

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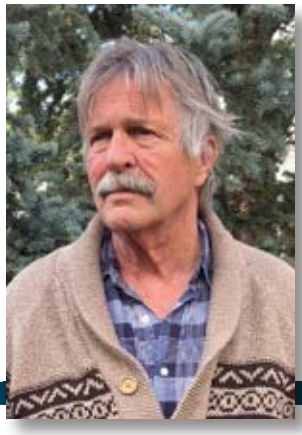

Big Hill Springs Provincial Park was established in 1957 and is one of Alberta's oldest provincial parks. The park was created due to its outstanding natural beauty and because it has cold-water springs which flow year-round. The springs in the park are a valuable Alberta natural resource and must be treated with respect by its many visitors. The springs should also be protected from nearby resource and gravel mining that could affect the springs water flow and chemistry.

The spring water has a constant temperature of about 6°C, so the water flows continuously even in the depths of winter when temperatures can get a low as minus 40°C. Big Spring Creek is small, only a few metres wide, but at tufa dams the width can be up to 10 metres. The creek is shallow with a depth of one metre, although some pools in the creek are more than two metres deep.

Big Hill Springs Provincial Park takes its name from the small spring which enters the valley of Big Spring Creek from the west. The spring originates from groundwater that flows from sandstones of the underlying Paleocene-age Paskapoo Formation bedrock and also from overlying preglacial sands and gravels. The actual spring outlet is located nearby on private property beside the west boundary of the park. Several small springs also enter the valley near its downstream end.

Tufa Coats Everything

The spring water contains an abundance of calcium carbonate in solution, coming from dissolved calcite cement and limestone shell fragments in the bedrock of the Paskapoo Formation. As the springs emerge at the surface, carbon dioxide (CO_2) is released from the water as it cools, causing the water to become supersaturated with calcium carbonate ($CaCO_3$). This precipitates into multiple layers of a limestone deposit called tufa.

Tiny crystals of calcite precipitate as stream riffles, waterfalls, and where there is splashing water to stick onto coatings of algae and bacteria. Aquatic mosses, algae, lichen, bacteria, plants, sticks, and insect larvae create a framework for the tufa to build up. The tufa coats everything in and along the water course, forming a series of rock dams with several waterfalls in the park.

An impressive aspect of the park is several older and inactive dams that measure up to 110 metres across and six metres high, constructed of tufa which has encrusted vegetation and cobbles. The dams have been locally breached or have small waterfalls that are up to two metres high. Turbulent carbonate-saturated water cascading over the waterfalls and shallow rapids, constantly splashes the banks of the creek. Mossy hummocks grow luxuriantly along the stream banks in the splash zone of the well-aerated water causing calcium carbonate to precipitate as tufa that coats and stiffens the moss.

Elsewhere along the stream, where the water is calmer, calcium carbonate precipitates on cobbles, pebbles, logs and leaves. Vegetation rots to leave holes or porosity in the tufa. Along the length of the creek, long filaments of blue-green algae, also called cyanobacteria, drape the fossil tufa dams.

Significant research has been done on the geology and hydrology of Big Hill Springs Provincial Park. In his 2007 thesis *Establishing a Recharge Area for Big Hill Springs, Alberta, Canada*, for the University of Calgary's Department of Geology and Geophysics, Soren Poschmann noted that water in the springs originates from rain and snow melt that makes its way into a buried pre-glacial valley filled with gravel and sand, located to the northwest of the park. There is likely a contribution from the underlying Paleocene-age (~60 million years old) Paskapoo Formation consisting of non-marine sandstones, siltstones and shales. Sandstones of the Paskapoo Formation are water-bearing throughout the area with the porosity occurring between the sand grains. It is also naturally fractured with horizontal and vertical fractures due to the effect of the uplifting of the foothills and Rocky Mountains to the west. The emerging spring water is relatively young, taking only 5 to 10 years to make its way from its rainfall and snowmelt origin to where

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Tufa deposits at Big Hill Springs Provincial Park. Photo © H. Koning

it emerges from the springs. The flow of water out of the springs over thousands of years has resulted in the spectacular outcrops of tufa which occur in the park.

Two recent guidebooks for the public have described the geological history of Big Hill Springs Provincial Park. Calgary geologists Philip Benham and Yingchun Guan in 2019 described the springs in *Go Take a Hike – the Geology of Trails in the Canadian Rocky Mountains and Surrounding Areas*. They say that the springs are active year around and create a microclimate that extends the growing season. They describe the tufa deposits and emphasise that the deposits are limited and fragile. They also point out that dendritic growth patterns in the tufa are related to tufa formation on mosses. Growth of tufa may be aided directly or indirectly by microbes that coat mosses, cyanobacteria (blue green algae) and other organic materials. Benham and Guan write that, as the springs surface, the supersaturated waters degas carbon dioxide (CO_2), triggering an increase in pH and then the precipitation of carbonates.

Dale Leckie, in his 2021 book *The Scenic Geology of Alberta* describes the origin of the springs and also highlights the fragility of the biological environment in the park.

In 2004, Marie-Eve Garon wrote a thesis titled *Hydrology of Big Hill Springs* for a post-graduate course in Environmental Studies at the University of Calgary. She described the springs as having the highest water flow rates of the region with a range of 20 – 1600 litres per minute.

The Need for Protection

With the exception Fish Creek Provincial Park, there are few if any publicly-accessible natural areas close to Calgary that are heavily treed and have a picturesque creek running through the park year-round. Big Hill Springs Provincial Park is one of the closest parks to Calgary at a distance of only 27 km from the city's western boundary. Its beauty and accessibility are the reason why it receives 250,000 visitors per year. The water in Big Spring Creek is shallow and children love to wade and play in the stream. However, the heavy visitation by the public should be regulated to ensure that visitors stay on the existing trails to prevent damage to the springs and the unique tufa deposits. Provincial government regulators should ensure that the springs are not affected by farming and ranching near to the park, or from nearby gravel mining. We owe it to our children and grandchildren and future generations to preserve these beautiful springs and park.

Tako Koning, P.Geol. is Holland-born and Alberta-raised and lived and worked worldwide as a petroleum geologist. He leads field trips for the AWA as part of its Adventures for Wilderness program.

Dale Leckie, Ph.D., P.Geol. has written two best-selling books on the geology and landscapes of Alberta. His recent book The Scenic Geology of Alberta: A Roadside Touring and Hiking Guide *encourages people to get out and explore the natural beauty of the province. A portion of this article was excerpted from his book.*