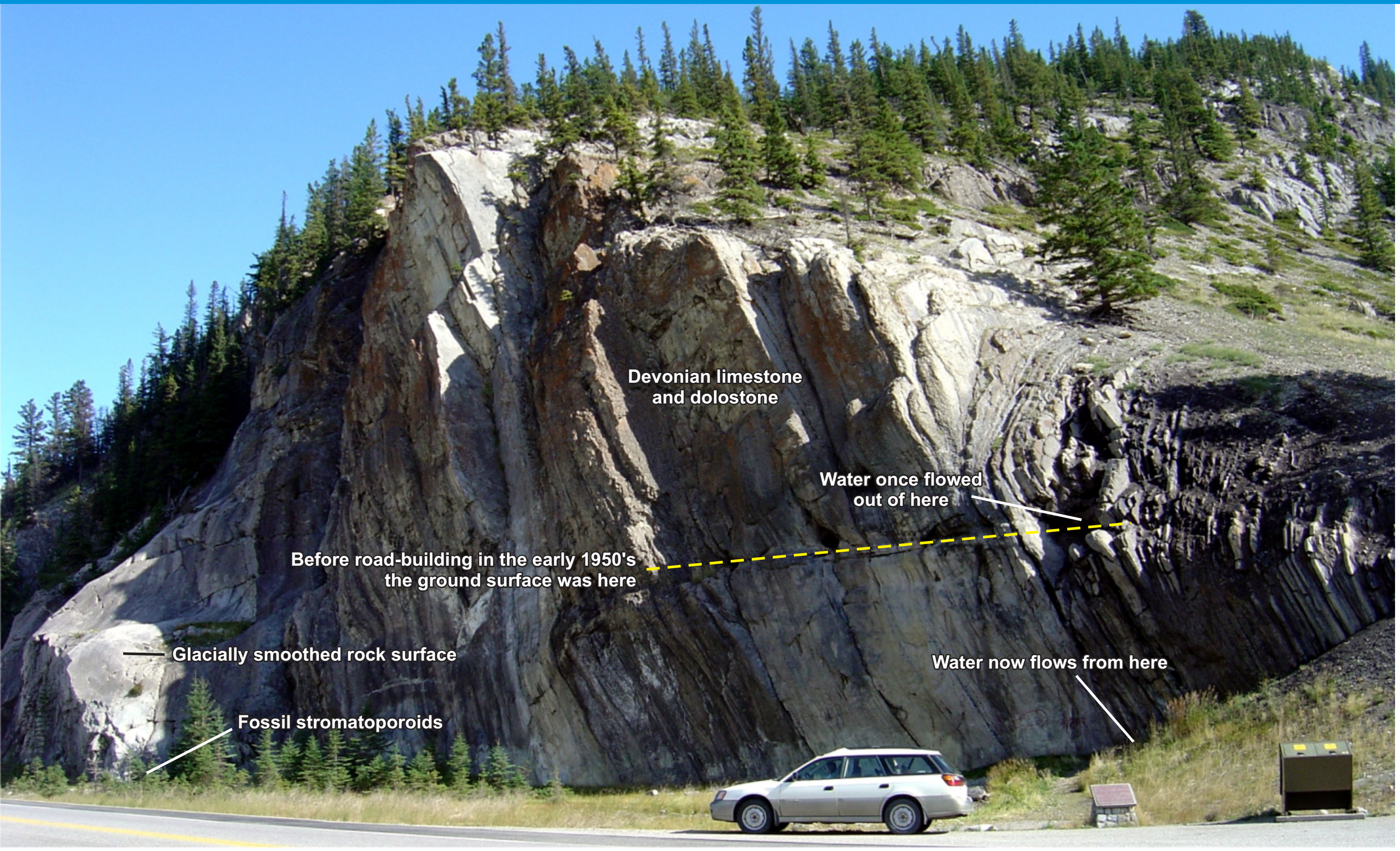


Location and directions:

Watch for a paved pull-off along Highway 16 22.6 km east of Jasper, not far past the bridge over the Athabasca River. The stop is 56.1 km west of Hinton, 29.2 km past the eastern park gate. GPS coordinates: N53° 02.711', W118° 04.950'. Elevation 1021 m above sea level.

The spring, its odour and its denizens

What you are smelling at the spring is **hydrogen sulphide** (H_2S), a poisonous gas that the human nose is very sensitive to. The concentration of H_2S in the spring water is very low and therefore not dangerous, except for persons especially sensitive to the gas. If you feel discomfort as you approach the spring, move away.

The presence of H_2S tells us that this water was once hot enough and under enough pressure to acquire sulphate from sulphur-bearing minerals in the rock here, especially **iron pyrite** (FeS_2) and **anhydrite** ($CaSO_4$). The water originated at least two kilometres down, probably deeper, where the temperature was above 100°C but the pressure was high enough to prevent boiling. The water seems to have moved up along a deep-reaching **fault** (break in the rock), as the flow of other Rockies hot springs does, to issue from Devonian rock here.

How did this hot water get to the surface? And why is it now cold?

Of that we are not completely sure, although it seems likely that the water rose owing either to its own heat-induced buoyancy or by being pushed up by water descending from a higher elevation down another fault, the two faults connecting at depth. Near the surface, the hot water seems to have mixed with normal groundwater—quite cool this far north, only about 5°C—and lost its heat. Because the flow is sulphur-rich, we refer to it as a **mineral spring**.

We can thank **microbes** for the rotten-egg odor and the white filaments in the water. Below the surface, bacteria such as *Desulfovibrio* remove oxygen from the sulphate, producing the H_2S. When the water flows out into the air, bacteria such as *Beggiatoa* and *Thiothrix* use the H_2S in their life cycles, releasing tiny particles of pure yellow sulphur as waste products. The yellow is masked by the white color of the bacteria.

None of these bacteria is harmful to us, nor is the spring water unsafe, but the smell and taste are not most people's cup of (cold) tea. Cold Sulphur Spring and its bacterial colonies represent something rare on our planet: an ecosystem that is not dependent on the sun for its energy source.

Stromatoporoids ruled

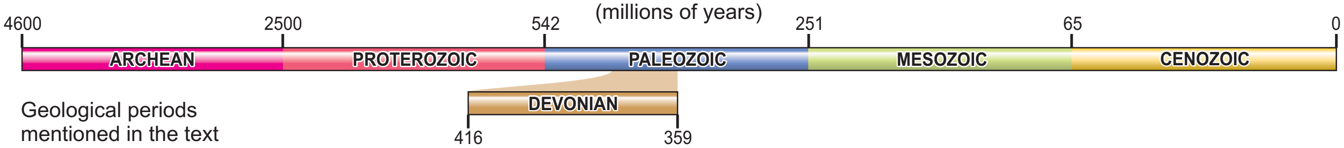
If you walk along the base of the cliff left (east) of the spring, you will come to rock that has been rounded off by glacial ice moving over it during the ice ages. Continue east, watching for the blurry outlines of fossil **stromatoporoids**—in Canada we usually say "strom-uh-TOP-or-oids"—in the rock, which is **dolostone**.

Dolostone begins as limestone. However, in dolostone some of the **calcite** ($CaCO_3$), which is the main mineral in limestone, has been replaced by **dolomite**, chemical formula $CaMg(CO_3)_2$. Dolomite is similar to calcite but contains magnesium as well as calcium.

Much of the rock here was produced back in the Devonian Period by stromatoporoids, which took calcium out of the seawater and encrusted themselves with calcite to form wavy layers of limestone. But fossils of stromatoporoids are nearly always dolomitized and blurry. Figuring out what they were has been difficult. Most of the forms disappeared late in the Devonian. However, we now know that these things were **sponges**.

They excelled at reef-building, which was lucky for us. The porous reefs soaked up **oil and natural gas** from the shaly rock surrounding them. Drilling into those reefs east of the Rockies, where they are deeply buried under younger layers, has made Alberta rich.

Geological time scale
(millions of years)



Bighorn sheep owe much to the geology here

The hoofed animals seen frequently here are often mistaken for mountain goats. But they are bighorn sheep, typically ewes and lambs. Mountain goats are all white rather than brown-and-white as bighorns are. The horns of female bighorns are lighter and narrower than the heavy, curled horns of the rams. ***Warning:*** if the sheep are clambering about above the spring, keep well back. Their hooves dislodge stones.

This location is an excellent example of how geology affects wildlife. The spring and its surroundings have everything the sheep need. They get sulphur from the springwater. Sulphur is an essential element in hair, which the sheep grow and shed in large quantities every year. The silty, gravelly soil here, much of it derived from erosion of rock by glaciers during and after the ice ages, is excellent for growing the grasses and wildflowers the sheep graze on. The cliff provides the sheep with **escape terrain:** a place in which they can find refuge from their predators, mainly wolves. Bighorns are agile climbers, but wolves are not. When a pack is on the hunt here, the sheep can run to the cliff and climb onto ledges too narrow for the wolves to negotiate.

Want to know more?

Consult these publications:

• Gadd, Ben (2008) *Canadian Rockies Geology Road Tours*, pages 418–420 (Cold Sulphur Spring).

• —— (2009) *Handbook of the Canadian Rockies*, pages 171–175 (hot springs) and 199–201 (illustrations of fossils).

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Please refer to this publication as:

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Canada

Jasper National Park
Cold Sulphur Spring

Smelly water, stromatoporoids and sheep

Here we have a hot spring gone cold.
Too bad for us, but the bacteria and the bighorn sheep don't mind.

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