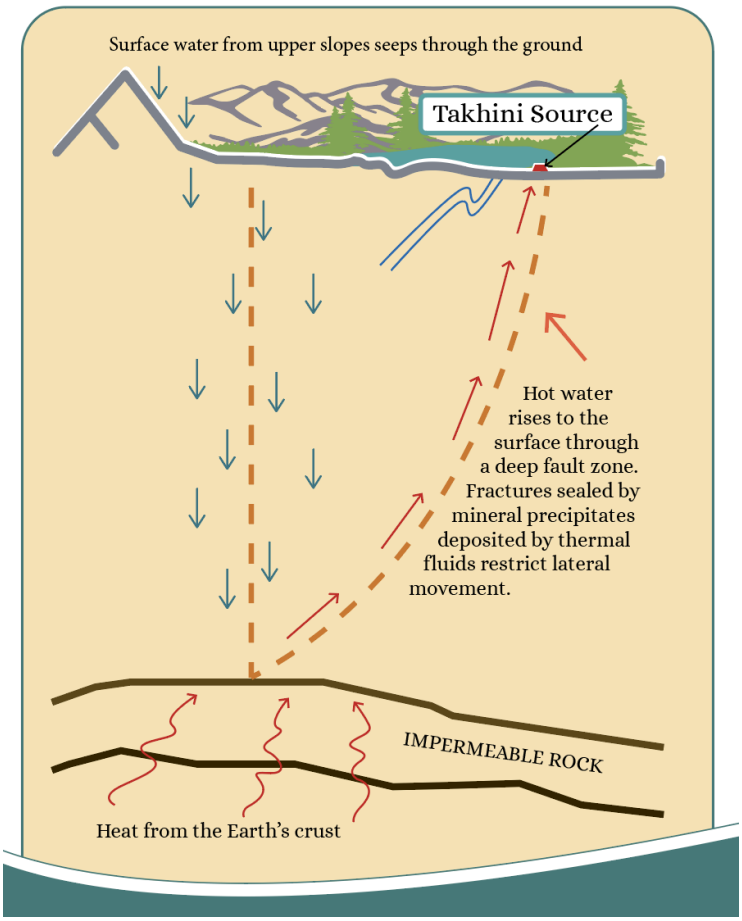
How are Hot Springs Created?

200 million years ago, the region where the Yukon now sits was submerged under an ancient ocean. Over time, mud layers accumulated on the ocean floor and compressed to form shale, while sand layers compacted to become sandstone. These sedimentary rocks are the foundational materials of this area.

The Yukon was also an active volcanic zone, part of the famous Pacific Ring of Fire. Approximately 60 million years ago, the Yukon saw a surge of volcanic activity with over 100 volcanic centers becoming active. In the vicinity of the current hot springs, molten lava crystallized beneath the Earth's surface, and tectonic movements pushed various igneous and metamorphic rocks, including granite, upwards.

The Miner's Range Mountains, located near the hot springs, were sculpted by glaciation over the past million years, with the last glaciers receding approximately 18,000 years ago. The terrain we see today in the Miner's Mountain Range is a result of this glacial activity that shaped the landscape.

The thermal waters of the hot springs originate from precipitation in the Miners Range mountains. The water seeps into the ground at higher elevations, flows through fractured sedimentary rocks to a depth of 4-5 km, and finds its way back to the surface through permeable pathways. This underground journey through various rock formations contributes to the water's unique characteristics and temperature.



What Causes the Water to be Hot?

The hot springs' water temperature is influenced by two main factors. Firstly, the natural thermal gradient of the Earth plays a role in heating the water. The ground temperature in the Takhini area rises by around 15° to 25 °C per kilometer depth, from the heat generated within the Earth's crust.

Secondly, the water can acquire warmth as it passes through granite rocks that have been heated by radioactive decay. Granite formations in the region contain radioactive elements like potassium, uranium, and thorium, which emit heat as they decay. The combination of the Earth's thermal gradient and the radioactive decay within the granitic rocks contributes to the overall warmth of the groundwater feeding the hot springs.

Studies have shown that the Takhini Hot Spring water reaches a maximum temperature of 96 °C (205 °F) during its underground journey. This information was gathered using geo-thermometry techniques, which indicated that the dissolved minerals present in the hot springs water could only exist if the water had reached that temperature.

⬅️GRANITE FORMATIONS 2KM WEST OF THE HOT SPRINGS.

Langevin, H., Fraser, T., and Raymond J., 2020. “Assessment of thermo-hydraulic properties of rock samples near Takhini Hot Springs, Yukon.”
In: Yukon Exploration and Geology 2019, K.E. Macfarlane (ed.), Yukon Geological Survey, p61.

Artesian Spring

Geologists tell us that the hot springs sit atop intersecting fault lines with inclined sedimentary rock, which form permeable pathways for hot groundwater to make its way back to the surface. Pressure is created by water at higher altitudes, propelling it towards the surface where it exhibits artesian characteristics, akin to a continuous gush from a hose. This flow of water cannot be turned off and flows from the ground at 386 liters (86 gallons) per minute. Despite cooling on its journey upwards, the hot springs water maintains a toasty 46.6 °C (116 °F) as it surfaces, a consistent temperature for over 120 years.

If you look into the hot spring crater, you can see the spring bubbling to the top in several places. From here, the water is gravity-fed to the bathing pools, which continually drain into the large pond in front of Eclipse. This unique “flow-through” system ensures fresh hot springs water constantly flows with a turnover rate of about three hours.

We are fortunate that the alignment of tilted rocks at intersecting fault lines allows the hot springs to exist here. The next closest hot springs accessible by roadway is the Liard Hot Springs, 650 km away on the BC Yukon border.

Water Predating Nuclear Testing

The water from the spring has been underground since before 1945. Scientists know this because our hot springs water does not have more than the natural background level of the radioactive isotope called tritium. This isotope is present in water all over the surface of the earth, and all surface waters today have an enhanced level of tritium as a result of nuclear weapons testing starting in 1945.

⬅️Eclipse architect Rob Sieniuc, from Broadway Architects, pointing out the white ash layer in the tufa deposits. Photo Eclipse collection.

How Much Water is Stored Underground?

Here is an interesting calculation regarding the amount of water underground in the Takhini area. We know the water flow at the source is a constant 386 liters per minute. We also know that the water has been underground since at least 1945, or 80 years ago.

A calculation as to the minimum amount of water underground goes as follows: 386 litres per minute (0.386 m.3) X 60 minutes per hour X 24 hours per day X 365 days X a minimum of 80 years = 386 X 60 X 24 X 365 X 80 = 16,230,528 cubic meters. This is equivalent to a lake 16.23 km long, 1 km wide and 1 meter deep. And this is only the minimum amount of water underground… it could be 10 times this size or even 100 times this size if the water has been underground 10 times or 100 times longer! We can be certain that there is a vast network of underground water storage in the area.

How Long has Takhini Hot Springs been flowing?

The Takhini Hot Springs source has probably been flowing for thousands of years. The orange earth, or tufa, covers a large area around the hot springs. This tells us the spring moved a few times as mineralisation built up, causing it to create different channels in different directions. The spring has likely moved a few kilometers over the millennia.

The tufa here is about 2 meters (7 feet) thick. There is an ash layer in Yukon soils from the White River volcanic eruptions 1500 years ago. Paddlers on Yukon rivers see this ash about a half foot deep in the soil on the river banks. Here on the property, we see this ash at the same depth in the undisturbed tufa layers. However, the tufa continues down another 6 feet, suggesting an accumulation of tufa for the past 15,000 years. This coincides with the end of glaciation, suggesting a theory that the hot springs started to flow as the glaciers retreated and the land began to slowly lift. The land lifted after the weight on it from the glaciers disappeared. This then made the land “lighter” and created open pockets and fissures in the underground.

Overall, the Takhini Hot Springs stand as a testament to the complex geological processes and natural forces that have shaped the Yukon region over millions of years, offering a unique and fascinating glimpse into the Earth's history and its thermal wonders.