



The shape of Maligne Canyon: a clue to its origin

Location and directions:

The main parking lot for Maligne Canyon is a drive of 8.2 km from Jasper. Take Highway 16 eastbound from Jasper's east exit. After 1.5 km, turn right onto the Maligne Road and cross the Athabasca River. Keep left immediately (Jasper Park Lodge is to the right) and follow to the Maligne Canyon turnoff. GPS coordinates: N52° 55.250', W117° 59.975'. Elevation 1150 m above sea level.

Caution: Maligne Canyon is deep, and soft moss overhangs the edges. For your safety, and to protect the fragile environment here, stay on the established trails. **Do not climb over the guardrails.**

Clues

Maligne Canyon has been explained as a classic **gorge**, cut by a waterfall that has eroded its way upstream, as Niagara Falls has done. Maligne Canyon meets the criteria for a gorge, all right. It's deep and narrow, and it has clearly been produced by running water.

If a waterfall is responsible for Maligne Canyon, it must have started running after the last ice age was over some 14,000 years ago. During that great glaciation, the Maligne Valley was buried under ice about a kilometre thick.

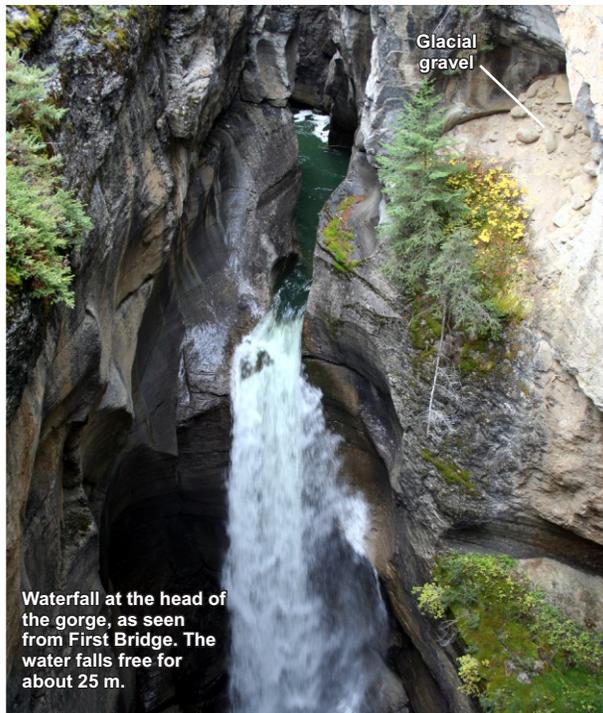
Sounds reasonable, but —

- The gorge is rather long to have been created in only 14,000 years by the small-volume waterfall we see. Further, that waterfall runs only from May to December each year. In winter, there is very little water in the gorge.
- The gorge is narrower at the top than it is partway down. (The boulders wedged across the narrow part are known as **chockstones**.) Widening downward is unusual for a water-carved feature, which usually narrows downward, especially when the rock is harder lower down, as it is here.
- The gravelly deposit beside the waterfall could have got there only if the gorge were filled to that level with this material. The rest has been eroded away.
- The deposit is similar to others in the area that date to the end of the last major glaciation, suggesting that the gorge already existed at that time. If so, it must have been present under the ice.

Can you see how these observations might cause problems for the waterfall-erosion explanation? What other explanations might we consider?

Well, imagine this scenario. We see a large cave passage in the limestone, tall and narrow like many other such passages in the Canadian Rockies. It is closed at the top, of course, and widens downward before narrowing again at the bottom. It could be millions of years old.

Erosion has been deepening the valley above the cave passage. The passage now lies only a few dozen metres below the valley floor.



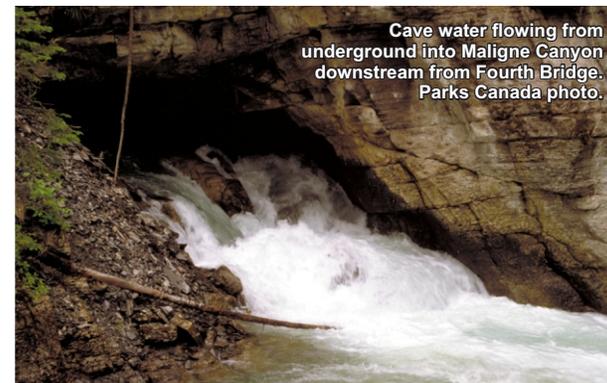
Waterfall at the head of the gorge, as seen from First Bridge. The water falls free for about 25 m.

The time is 23,000 years ago, at the height of the last ice-age glaciation. Above the cave passage we have a glacier that fills the valley nearly to the ridgelines on either side. The ice is very heavy, and it is moving. The base of the glacier is studded with boulders. They act like a rasp, cutting into the bottom and sides of the valley, digging deeper and deeper ...

Near the end of the glaciation, the glacier breaks into the cave. The roof is ripped away. The ice invades the trench created by this de-roofing and soon grinds much of it away. But just as it is about to finish the job, the climate warms and the ice melts. The remaining portion of the de-roofed cave is Maligne Canyon.

This explanation takes the known facts into account, but is it correct? At present we cannot be sure. Maligne Canyon needs more study.

More water flows out of Maligne Canyon than flows in



The extra water in Maligne Canyon comes from a cave system that carries it underground from **Medicine Lake**, 14 km away as the raven flies, to Maligne Canyon's many springs.

We have proved the connection by putting small, nontoxic quantities of red **rhodamine dye** into the lake and detecting it at springs in Maligne Canyon and elsewhere in the Athabasca Valley, including **Lac Beauvert** by Jasper Park Lodge. The dye-containing water flows through in 12–24 hours in summer, 5–9 days in winter.

A region with underground drainage is known as **karst**. This area is known to cave scientists and hydrologists as the **Maligne Karst**. Judging from the large volume of water flowing through it underground, and the speed at which the water travels, the Maligne Karst must include a major cave. We know of several entrances. But in every case the passage is blocked partway in by a collapsed ceiling.

Living in the gorge



American dipper. Photo courtesy U.S. Fish and Wildlife Service



Black swift with its single nestling. Photo by Tom Ulrich



Raven nestlings. Photo by Lee Ciaran

Rushing water, cold mist and spray ... Maligne Canyon seems an unlikely place for baby birds. But three species nest here, on the limestone walls of the gorge.

One of these species is the **American dipper**. It's a small gray bird that feeds underwater, often in rapids, using its wings as fins to maneuver through the currents. It catches water insects and larvae. You may see these birds flying through the canyon, cheeping and burbling as they go.

Any bird needs a safe place to raise its young, and the dipper finds it here. Its nest—a mossy ball—is tucked behind a waterfall, protected from predators by the curtain of water pouring by. The moss is kept damp by constant splashing, but the bird and its nestlings are naturally so oily that the droplets roll off.

Another species that lays its eggs here is the rare **black swift**. The nests are built on ledges, back in recesses where they cannot be seen from above. The parent birds feed on flying insects, sometimes far from the gorge, and they may leave the nestlings—only one per nest—unattended for many hours. The babies lie very still. That way they conserve energy and avoid detection by predators.

Lastly, a bird familiar to all Canadian Rockies residents nests here: the **common raven**. Pairs of ravens find dry places under overhangs high on the gorge walls and raise their young out of reach of predators.

Want to know more?

Consult these publications and websites:

- Gadd, Ben (2009) *Handbook of the Canadian Rockies*, pages 165–170 (gorges, caves and karst).

Check out the interpretive signage at Maligne Canyon and at Medicine Lake related to karst systems.

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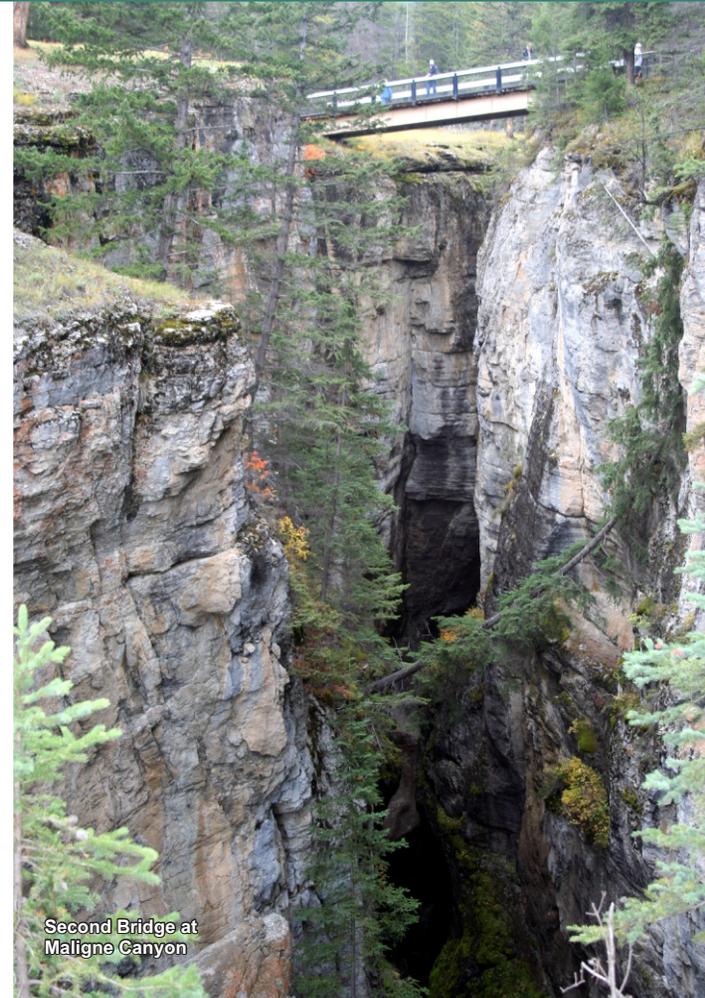
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Second Bridge at Maligne Canyon



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**Jasper National Park
Maligne Canyon**

A spectacular geological mystery

Here is what we know about Maligne Canyon. This slot in the bedrock is up to 55 m deep and 1.2 km long, it's carved in Devonian limestone, and it's a gorge, not a canyon.

What we don't know: how it came to be.

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