Athabasca Glacier and the Columbia Icefield

Location and directions:

From Jasper, take the Icefields Parkway (Highway 93) south for 102 km to Icefield Centre, the large visitors' centre for this world-famous place. To reach the toe of the glacier, take the side road one kilometre to the parking lot and walk half a kilometre (uphill, steep in places) to the ice.

GPS coordinates for Icefield Centre, elevation 1975 m above sea level: N52° 13.179', W117° 13.465'. For the toe parking lot, elevation 1940 m: N52° 12.748', W117° 13.944'.

Snow to ice, flakes to flow, river valley to glacial trough

At high elevations in the Canadian Rockies, not all of the snow that falls in winter melts in summer. Despite the strong sunlight up there, the air is so cool that at the end of August there are usually a few centimetres of snow remaining from the 5–10 m that fell the previous winter.

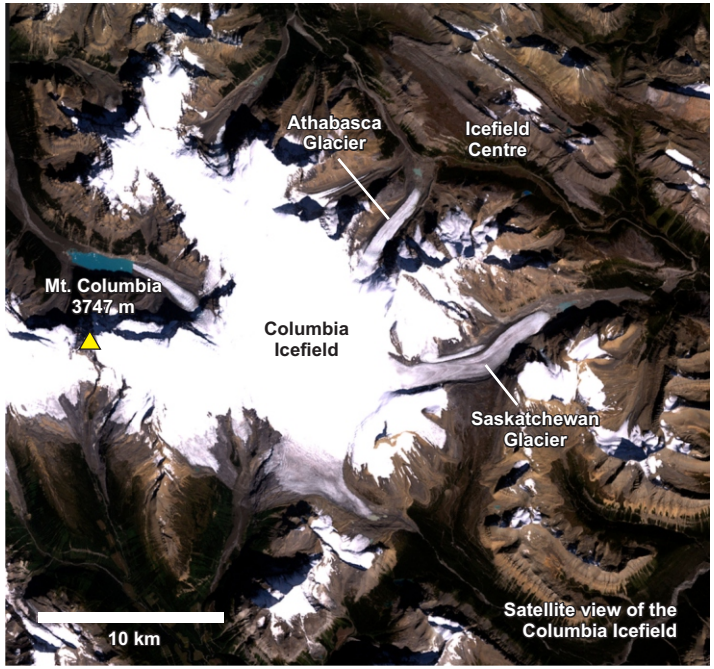
Let those left-over layers build up year after year. The snowflakes compact and intergrow. They form hard, crystalline ice, and pretty soon you have a glacier.

Let that glacier grow for thousands of years on the largest upland area in the Rockies, and you have the **Columbia Icefield**, currently 215 square kilometres in size. It lies on a high, rolling plateau, average elevation 2800 m, edged by huge cliffs and ringed by some of the higher peaks in the Canadian Rockies, including Mt. Columbia, second-highest at 3747 m. This icefield is dwarfed by those to the west, in the Coast Mountains of British Columbia and Alaska (the Juneau Icefield covers over 3000 square kilometres), but it's still the largest glacier in the Rocky Mountains, 28 kilometres across.

When glacial ice builds up to a thickness of about 30 m, it starts to spread out and creep downhill. The ice accumulating on the Columbia Icefield's plateau extrudes over the edges. Blocks the size of buildings break off in booming avalanches.

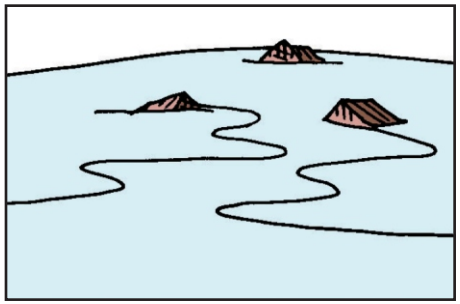
The ice also flows down valleys extending from the icefield, pulled by gravity just as river water is, but much more slowly, moving downhill between 15 m and 125 m a year. In the Athabasca Glacier, a snowflake requires 150–200 years to go from fluttering out of the sky onto the icefield to melting out at the front of the glacier, 6.2 km away and 820 m lower in elevation.

A flowing glacier is a powerful erosive force. The undersurface of the ice is studded with boulders and coated with smaller rock fragments, all being dragged across the bedrock under the enormous weight of the ice. It may take a river millions of years to erode a winding, V-shaped valley into the landscape, but a glacier can carve the curves away and change the cross-section to U-shaped in less than a hundred thousand years.



Satellite view of the Columbia Icefield

How the Canadian Rockies might have looked before the ice ages. Slopes are rounded, and streams flow along winding, V-shaped valleys.



How the Rockies might have looked at the height of glaciation, when the ice was so thick it overtopped all but the higher peaks.

Rockies terrain today, with only scattered glaciers remaining. The landscape is rugged, and streams now flow through straight, U-shaped valleys.

Athabasca Glacier: going, going
Forefield ecosystem: growing, growing

The Athabasca Glacier is impressive, and many park visitors assume that they are looking at the Columbia Icefield. Not so. The Athabasca is but one of seven named **distributary** glaciers that carry ice away from the icefield proper, which is up on the plateau and out of sight from the highway.

Climate change is conspicuous here. The front of the glacier, called the **toe**, is currently retreating (melting back faster than the ice is moving forward) between 10 m and 25 m each summer. In 1844, at the height of the **Little Ice Age**—a minor glacial advance recorded worldwide—the glacier was 8 km long, reaching all the way to where Icefield Centre is now. Now the glacier is nearly 2 km shorter. It was once thicker, too, as shown by the height of the **lateral moraines** on each side. The ice was once level with the tops of those moraines.

Right now the maximum thickness is about 320 m, as measured two-thirds of the way up the glacier by radar-sounding. This part of the glacier's bed is a large rock basin. As the front retreats into the hollow, we expect to see a lake appear there, between the ice and the shore, and get wider.

Will the Athabasca Glacier melt away altogether? It's possible. Some 5000 years ago, during a period not much warmer than the present, the middle of the Columbia Icefield was forest, not ice.

As you approach the glacier from Icefield Centre, you can see how plants are filling in the **forefield**, meaning the melt-back area. Farthest from the glacial front, the **terminal moraine** has been ice-free for well over a hundred years. Trees several metres high are growing on it, and there are lots of willow shrubs. Closer to the ice the trees are shorter and the shrubs are smaller. Along the trail to the toe, you see mainly scattered patches of wildflowers, and close to the ice there is no vegetation at all.

The position of the Athabasca Glacier's terminal moraine shows that in the mid-1840s the ice front was where Icefield Centre is now. The moraine is made of glacial **till**, rock debris that has been carried here by the moving ice.

Warning: Unless Parks Canada has marked out a safe area in which to walk on the glacier, or you are part of an authorized tour of the glacier, stay off the ice! You could slip into a **crevasse** ("kreh-VASS," a deep crack in the ice) or drop into one unexpectedly through thin snowcover. People have been killed here.

The best way to experience the glacier is to go on a walking tour led by a professional guide. Enquire at the Parks Canada desk in the Icefield Centre building.

Want to know more?

Consult these publications:

• Gadd, Ben (2008) *Canadian Rockies Geology Road Tours*, pages 335–342 (Columbia Icefield, Athabasca Glacier).

• —— (2009) *Handbook of the Canadian Rockies*, pages 159–163 (glaciers).

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Jasper National Park
Athabasca Glacier and the Columbia Icefield

This is what happens when snow takes over

Snow may be soft and fluffy, but if it builds up into a glacier it can utterly change the landscape.

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