Like pancake batter on a griddle, a mammoth glacier spreads through an Ellesmere Island valley. Smaller rivers of ice from the mountains feed the glacier, applying pressure on the "tongue" — as scientists call its leading edge.
ICE

Glaciers grind and gouge with massive force, advancing and retreating, relentless as time itself.
When a glacier moves, it picks up earth and rock, freezing it into a thick band of debris at its base, as in this glacier on Ellesmere Island (ABOVE). Advancing ice riding up and over the base may have produced the additional layering.

Anyone foolhardy enough to hike on the Salmon Glacier near Stewart, B.C. (FAR RIGHT), would be risking a fatal plunge into a crevasse. These cracks form where glaciers stretch over hills or other obstructions. They funnel water from the surface, through the glacier’s internal plumbing system, then out through icy culverts (RIGHT). The velocity of this meltwater stream in Jasper, Alta., demonstrates how water can often be a more erosive force than ice itself, carving channels and flushing out rocks and sediment.
Ice-blue water meanders wildly within a depression on the surface of an ice-sheeted island glacier, in search of an escape route. Such depressions can be up to 10 metres deep. Fed by tiny, trickled rivulets draining downslope, the channel was formed by repeated summer melting. Though beautiful, it is also treacherous anything slipping into such a stream—lined with nothing but ice smoothed by rushing water—would be whisked away as fast as an Olympic luger.
FEATURES

ENVIRONMENTS

RIVERS OF ICE  34
Glaciers gouge and grind with a force as relentless as time

ADVENTURE

ASCENDING ATHABASCA  40
Following in the footsteps of two gentlemen explorers
By Sid Marty

POSTER-MAP

GLACIERS OF CANADA  51
Mapping our ice-covered reaches

HISTORY

ANCIENT WHALER  55
Parks Canada restores a 400-year-old Basque boat
By Mary Vincent with photography by Pierre St. Jacques

ENERGY

POWER STRUGGLE  58
Plans for a joint Labrador-Quebec hydro project heal old wounds and re-open others
By Michael Clugston with photos by Patrice Halley

REMEMBRANCE

WAR AND PIECES  78
A stained-glass memorial from bomb-shattered cathedrals
By Roberta Avery with photos by Ted Shaw
Alpine glaciers have carved out some of Canada's steepest and most rugged terrain. Meltwater from them provides vital late-summer water resources for irrigation, drinking and hydroelectric power in communities throughout the western provinces.

Rivers cut narrow channels between mountains as glaciars made their final retreat into polar and alpine regions after the last Ice Age, they left in their wake the dramatic and diverse landscape of modern Canada.

Glaciers moving over uneven land form crevasses, or cracks (Horn, Arete, Hanging valley).

**BEFORE GLACIATION**

- Outwash plain: mud, sand and gravel deposited by meltwater
- Glacial lake plain left when lake drained
- Eskers formed in sub-glacial streams (sand and gravel pit)

**END OF GLACIATION**

- Continental glaciers:
  - Advancing and retreating continental glaciers altered many of the country's drainage systems, re-routing some rivers and damming others to create lakes.
  - When the ice sheets retreated, the lakes drained and became plains. The nutrient-rich soils of some Canada's best agricultural land.

- Like conveyor belts, glaciers carried rock and sediment to their margins to create moraines.
- These ridges and gently rolling hills may be used for golf courses and housing developments with scenic views.

- Serpentine eskers provided high, dry travel routes for aboriginals and migrating animals. Cutting into an esker reveals neatly sorted layers of sand and gravel deposited by a rushing stream beneath a glacier - ideal fodder for the sand and gravel industry.

**CONTINENTAL GLACIERS**

As glaciers moved, they shaped the land, creating new features and altering existing landscapes. Their movement left a lasting legacy on the landscape, including:

- Ice caps
- Ice sheets
- Ice blocks
- Icebergs

**DURING GLACIATION**

- Ice sheet
- Ice cap
- Ice block

- Glacial lakes (lake meltout lakes and glacial lakes)
- Glacial lake plains
- Glacial moraines
- Glacial outwash plains

**TODAY**

- Today, these features continue to shape the landscape, offering unique ecosystems and recreational opportunities.

*This poster-map was made possible through the generous sponsorship of Columbia Sportswear Company.*
ICE WORLD

Glaciers are among nature's greatest monuments, a record of the Earth's history — a store of ice carved out by the force of gravity, the weight of time, and the untiring cycle of snow and melt. Generally, ice sheets are the monuments of the North Pole, the retreat of glaciers is a symbol of the world's changing climate. Scientists are uncertain whether the retreat is a result of the warming climate or natural fluctuations. If a warming is in fact caused by natural and man-made processes, it is a cause for concern. The retreat of Canada's ice sheets is occurring with a speed reminiscent of the last Ice Age, the period when the world was covered by vast ice sheets.

THE GLACIERS OF CANADA

On or near the continent's southern 10% of the landmass — the vast ice sheets that extended eastward to the Atlantic coast of Labrador and westward to the Pacific and Arctic oceans — most of the ice melted back, leaving behind a pattern of meltwater channels that feed Canada's major rivers. Plains and rich soils were left behind, the most dramatic feature of our post-Ice Age landscape. Glaciers have repeatedly advanced and retreated over most of Canada during the last 350,000 years. These advances and retreats were driven by changes in the Earth's climate. Over the past 10,000 years, glaciers have been retreating, reaching their minimum size about 18,000 years ago.

THE BIG FREEZE

During the last Ice Age, the Pleistocene, between about 1.5 million to 50,000 years ago, vast regions of the Earth were covered by glaciers. These glaciers were driven by the expansion of continental ice sheets to melt back to all but the highest and coldest regions. Some scientists believe that global cooling allowed the glaciers to expand. Others believe that warming allowed them to retreat. The climate was fluctuating, with alternating periods of glacial expansion and interglacial warming periods — called interglacials — and cooling, called glacial periods.

The eastern Arctic houses by far the biggest and most extensive glaciers in Canada, and contains three-quarters of all the continent's ice. The Barrier Ice Sheet, or the Greenland Ice Sheet, which covers about 1.7 million square kilometres, is the world's largest ice sheet. It is the product of glacial expansion and interglacial warming periods. The ice sheet is thought to have reached its maximum size about 18,000 years ago. It started to retreat after 13,000 years ago, as the climate began to warm. Today, the annual mean temperature is approximately 6 degrees Celsius, and the surface temperature is about 2 degrees Celsius higher. The summer temperatures in the interior of the ice cap can reach 5 degrees Celsius.

LIFE BELOW ZERO

A tiny world exists below the ice, which acts like a barrier to the environment on the surface. It is a unique and dynamic environment with its own flora and fauna. Some plants and animals are unable to survive in this environment, while others are adapted to thrive in the extreme conditions. The ice provides a natural laboratory for scientists interested in studying climate change.