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# GLACIOLOGY IN PATAGONIA

## WHAT IS ICE?

Ice is the solid state of water (H<sub>2</sub>O molecule). In a glacier, ice is mixed with air bubbles, making it 0.9 times denser than water. For that simple reason, ice floats on water.

## GLACIER ICE FORMATION

During winter, snow piles up and compresses. Its hexagonal crystals start to deform due to compaction, releasing air, giving crystals a more granular shape. This brings us to the second stage of snow: névé. As new layers of snow accumulate, the weight of said layers compresses the snow into glacial ice.

## HOW LONG DOES IT TAKE TO FORM A GLACIER?

It varies considerably from one glacier to another. It can take just a dozen years for temperate glaciers like the Patagonian glaciers, up to hundreds of years for cold glaciers like the ones in Antarctica. Contrary to popular belief, the warmer the glacier is, the quicker the ice forms, because the snow crystal needs moderate temperatures (above 0° or 32°F) in order to fuse into glacial ice. In Antarctica, temperatures are so low that the snow compaction process takes much longer.

## MOVEMENTS

There are two causes of movement: sliding and internal deformation:

- Sliding is produced by friction between the base of the glacier and the rocky substrate, which creates a thin film of water that allows movement. It can also be caused by water leaking from the upper layers down to the base of the glacier.
- Internal deformation is produced by the pressure exerted by the weight of the ice (approximately 650 tons per cubic meter). This tension leads to deformation, which causes the glacier to move.



*Sarmiento, Magdalena Channel*



*Pía Glacier, Beagle Channel*

## ANATOMY OF A GLACIER

The accumulation zone is the top of the glacier, where snow accumulates.

The ablation zone is the bottom of the glacier, where there is a loss in glacial mass.

The equilibrium line separates the accumulation zone from the ablation zone.

A moraine is an accumulation of rock, sand or clay that is picked up and transported by glaciers as they advance.

There are several kinds of moraines:

Lateral Moraine: as its name states, it consists of sediment deposited on the sides of a glacier.

Medial Moraine: the junction of two glaciers merging their lateral moraine deposits.

Terminal Moraine: this moraine marks the furthest advance of a glacier and the point where it starts to recede.

Internal Moraine: an accumulation of sediment which falls into crevasses and is trapped in the ice, giving the ice a “dirty” appearance.



2006..... Central moraines of the Nena Glacier, Alacalufe fjord ..... 2010

-*Crevasses* are mainly formed due to the differences in velocity between the center of a glacier and its lateral affluent.

-*Seracs* are blocks of ice normally found at the front of glaciers, and they are prone to crumbling apart.

-*Nunataks* are exposed rocky elements not covered with ice or snow within an ice field or glacier. They are like islands of rock amidst the ice and sometimes contain plant life.

-*Icebergs* are blocks of ice that have broken off from the ablation zone of a glacier towards a lake or the ocean. The area of an iceberg underwater is approximately nine times larger than the portion one can see poking above the waterline.

## THE COLOR OF ICE

Glaciers' peculiar color tone is due to the following optical effect: the white sunlight that strikes the ice is split into three main colors, red, green and blue. Ice tends to absorb red and green waves of color, causing the blue appearance of ice; conversely, it looks whiter when the amount of air bubbles in the ice increases.

## THE COLOR OF WATER

Meltwater from a glacier is commonly known as "glacial milk". The unusual color of this water is due to the presence of mineral sediments (especially quartz particles) that remain in suspension or cannot be deposited at the bottom of the lake, sea or river.

## PRESENT-DAY GLACIERS

Worldwide, most glaciers are in a receding period or are in equilibrium, although there are exceptions of glaciers that are still advancing in Alaska, Greenland, The Himalayas and even here in Chile, represented by the Pío XI glacier, near Puerto Edén. The most accurate theory on glacier recession is that there has been a warming effect on the Earth and temperatures have risen considerably. In order for a glacier to advance, there has to be a positive mass balance: this means that the amount of snow that falls during the winter must be greater than the amount of the snow that ablates or melts during the summer.

In conclusion, we can safely say that currently glaciers are merely relics of the vast glaciers from the past ice ages, yet they still play a key role on planet Earth. They represent 10% of submerged soil and 90% of Earth's freshwater. In addition, as they create air and water currents, they contribute to balancing Earth's climate; which would be asphyxiating without them.

## EXPEDITION TEAM



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