

# In praise of glaciers, those dragons of ice viewed with concern and fascination

November 16 2020, by Olivier Dangles

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The Perito Moreno glacier in Patagonia. The sheer number of seracs gives the impression that the glacier's surface is covered in dragon scales. Credit: Olivier Dangles/IRD, [CC BY](#)

As global temperature records are set one after the other, we are becoming increasingly concerned about the fate of our glaciers, these emblematic victims of climate change. We are worried by the sudden change in the colour of the ice, and there have even been attempts made to [cover the ice](#) to protect it, while French president Emmanuel Macron visits Mont Blanc and is *Mer de Glace* (sea of ice).

The concerns are entirely justified: in just half a century, [the world's glaciers have lost 9,000 billion tons of ice](#), an amount representing three times the volume of ice in the European Alps.

And yet not so long ago, [glaciers](#) were a thing of fear. Up until the end of the Little Ice Age (circa 1300-1860), the inhabitants of the Alpine valleys would regularly complain to the civilian authorities about the damage glaciers were causing to crops and housing. At that time, glaciers were compared to [open-jawed dragons clinging to the cliffs](#), slithering down through the narrow valleys and threatening to descend into the villages.

Dragons and glaciers may well share a number of similar features in terms of their "relations" with humans, but anecdotes aside, the image of dragons highlights the necessity to tackle the announced disappearance of glaciers in an interdisciplinary way, bringing together the physical, ecological and philosophical sciences.

## **Scheduled extinction**

After using terms such as "retreat" or "shrinkage" to describe glacier dynamics in past decades, we must now dig into an entirely new semantic field, that of "extinction."





Imaginative illustration by Henry George Willink (1892) portraying the Mer de Glace as a dragon. Credit: Henry George Willink

The process has already begun in many regions around the world, especially in tropical mountain ranges, where small glaciers located at borderline altitudes (between 4,800 and 5,000 meters in the Ecuadorian

Andes) have already entirely disappeared. In the same way, the mythical glaciers of [Kilimanjaro \(Tanzania\)](#) and the [Puncak Jaya \(Indonesia\)](#) will have completely disappeared within the next 10 years.

A few centuries after the [extinction of dragons](#), glaciers will also have disappeared, exterminated by humans and the harmful consequences of their lifestyles.

## **Black ice**

On a physical level, glaciers (like dragons) are huge living, mobile masses, often covered in seracs, big blocks of broken ice shaped like scales. They comprise an accumulation, a transport and an ice ablation zone, meaning that their survival is threatened when their mass balance shows a deficit, i.e. the accumulation of ice is insufficient to offset its ablation.

In many regions around the world, the extinction of glaciers has accelerated because of the [darkening of the ice](#). This phenomenon is caused by deposits of [black carbon](#) found in soot particles emitted during incomplete combustion, such as in diesel engines, electric plants or fires, sometimes hundreds of miles away from the glaciers.





Dust deposit and crevasse filled with water on a glacier on the Antisana volcano in Ecuador. Credit: Olivier Dangles/IRD, [CC BY-NC-ND](#)

Due to its lessened reflective powers compared to bare ice and its increased absorption of solar energy, the darkening of the ice accelerates the melting of glaciers. In certain places, especially in flat areas, these particles accumulate and form holes, called cryconites, in which biofilms form with communities of microorganisms whose metabolism generates heat and accelerates the melting of the ice.

The role of these cryconites in the process of ice extinction remains little known; but unlike the image of the magical "draconite" stones set in dragons' heads and much coveted by men ([probably the cause of their](#)

[disappearance](#)), they could turn out to be a weak spot for glaciers.

## Hic sunt dracones

What are the consequences of the extinction of glaciers for biodiversity?

Glaciers play [a major role in the formation and sustainability of a remarkable biodiversity](#) of animal, plant, aquatic and [terrestrial species](#), including some species that are endemic to periglacial zones, such as several species of aquatic flies. They provide water and minerals which are essential for life and generate heterogeneous and unstable environmental conditions that are [conducive to the coexistence of species](#).



Cryconites on the surface of glacier 12 of the Antisana volcano (4900 m), Ecuador. Credit: Olivier Dangles/IRD, [CC BY-NC-ND](#)

In the last few years, scientists have also discovered that there is a lot of life on the surface of glaciers: viruses, yeast, bacteria, algae, tardigrades, springtails, small crustaceans and insects, and even a [dragon](#). On the glaciers of the far south of the Andes, the "[dragon of Patagonia](#)" (*Andiperla willinki*), a 2cm long stonefly, lives its whole biological cycle in and around the ice: the larva lives in the water and the adult on the ice surface or in little crevasses.

This cryobiodiversity has developed an incredible array of physiological innovations in order to adapt to life on the ice, just like some of the magical powers of dragons: resistance to extreme temperatures (-272 °C), to considerable UV radiation and even to a vacuum.

Although this biodiversity is increasingly being studied in temperate areas, this is still not the case in tropical glacier settings which mostly remain terra incognita where only dragons live, or "Hic sunt dracones" as medieval maps put it. It is very likely that this type of cryobiodiversity will disappear before having revealed all its secrets.

## **A spiritual world**

Glaciologists and ecologists have been writing about the likely death of glaciers for several decades, but less has been written in the human sciences. In the image of the dragons feared by the inhabitants of the Alps, myths and beliefs surrounding glaciers can be found across the world.





The ‘dragon of Patagonia’ (*Andiperla willinki*), shown here at nymph stage, is an insect species belonging to the stoneflies family (Gripopterygidae) that can be found in the glaciers of the far south of the Andes (between parallels 46° and 56° South). Credit: [Wikipedia commons](#), [CC BY-NC-SA](#)





The summit of Cotopaxi volcano (5900 m) covered in snow in Ecuador. Credit: Olivier Dangles/IRD, [CC BY-NC-ND](#)

In Peru, for example, each year hundreds of pilgrims visit the sacred glaciers in the region of Cuzco during the religious celebration of [Quyllurit'i](#).

Glaciers have become powerful cultural symbols linked to the philosophical and moral dimensions of climate change. Looking beyond the effects it will have on water supply and on food supplies for animals and humans, the extinction of the glaciers will have considerable social consequences for mountain communities, including in terms of cultural identity, spirituality, esthetics and recreation. [Some anthropological studies](#) have suggested that the loss of glaciers could affect the identities

of communities and individuals, or subjective perceptions of the relationship between man and nature, or even lead to a generalized feeling of insecurity or eco-anxiety.

Men have been fascinated by [dragons](#) and [glaciers](#) for centuries. Although dragons still occupy a key place in our cultures despite their disappearance, what will the physical, ecological and spiritual consequences of a life without ice be?

As part of the "Life Without Ice" project, we are trying to answer this question through the integrated and interdisciplinary study of the extinction of glaciers, and by focusing on a sustainability science approach. Such an approach erases the boundaries between disciplines, promotes mutual exchanges between different models of thinking and reasoning, and combines values and facts in order to build knowledge systems which are better suited to the challenges of climate change.

And if glaciers should disappear for ever in a few centuries' time, at least we will be able to comfort ourselves with the predictions made by a number of well-known scientists, suggesting that [global warming will lead to the rebirth of real dragons](#)...

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