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Overview

Breath taking stunning life under frozen wave of Antarctica

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ABSTRACT

The Antarctic is a polar region around the Earth's South Pole, opposite the Arctic region around the North Pole. The Antarctic comprises the continent of Antarctica and the island territories located on the Antarctic Plate. All of the land and ice shelves south of 60°S latitude are administered under the Antarctic Treaty System. Biogeographically, the Antarctic ecozone is one of eight ecozones of the Earth's land surface.

History: Millions of years ago, Antarctica was warmer and wetter, and supported the Antarctic flora. Antarctica was also part of the ancient supercontinent of Gondwanaland, which gradually broke up by continental drift starting 110 million years ago. The separation of South America from Antarctica 30-35 million years ago allowed the Antarctic Circumpolar Current to form, which isolated Antarctica climatically and caused it to become much colder. The Antarctic flora subsequently died out in Antarctica, but is still an important component of the flora of southern Neotropic (South America) and Australasia, which were also former parts of Gondwana.

Ecoregions: Four Antartica tundra ecoregions are recognized: Marielandia Antarctic tundra, Maudlandia Antarctic desert, Scotia Sea Islands tundra, Southern Indian Ocean Islands tundra

Time zones: Because Antarctica surrounds the South Pole, it is theoretically located in all time zones.

People: The first Antarctic land discovered was the island of South Georgia in 1675. The first confirmed sighting of the continent of Antarctica is commonly accepted to have occurred in 1820. The Antarctic region had no indigenous population when first discovered, and its present inhabitants comprise a few thousand transient scientific and other personnel working on tours of duty at the several dozen research stations maintained by various countries.

Wildlife: A variety of animals live in Antarctica for at least some of the year, including: Seals, Penguins, South Georgia pipits, Albatrosses, Antarctic petrels, Whales, Fish, such as Antarctic icefish, Antarctic toothfish, Squid, including the colossal squid, Antarctic krill. Scientists confirmed the existence of microorganisms living 800 metres below the ice of Antarctica. Cod icefish (Notothenioidei), as well as several other families, are part of the Notothenioidei suborder, collectively sometimes referred to as icefish. The suborder contains many species with antifreeze

proteins in their blood and tissue, allowing them to live in water that is around or slightly below 0 °C. Most of the Antarctic continent is permanently covered by ice and snow, leaving less than 1 percent of the land exposed. There are only two species of flowering plant, Antarctic hair grass (Deschampsia antarctica) and Antarctic pearlwort (Colobanthus quitensis), but a range of mosses, liverworts, lichensand macrofungi.

Blue Ice: Blue ice is exposed in areas of the Antarctic where there is no net addition or subtraction of snow. That is, any snow that falls in that area is counteracted by sublimation or other losses. These areas have been used as runways due to their hard surface, which is suitable for aircraft fitted with wheels rather than skis. Frozen blue towers were created when ice was compressed and the trapped air bubbles were squeezed out. During the summer the surface ice melts and new ice layers compress on top. The ice appears blue because when when light passes through thick ice, blue light is transmitted back out but red light is absorbed. If the bubbles were not compressed they would scatter the light, meaning it would all be reflected back out and it would appear white. Icebergs in the Antarctic area sometimes have stripes, formed by layers of snow that react to different conditions. Blue stripes are often created when a crevice in the ice sheet fills up with meltwater and freezes so quickly that no bubbles form. When an iceberg falls into the sea, a layer of salty seawater can freeze to the underside. If this is rich in algae, it can form a green stripe. Brown, black and yellow lines are caused by sediment, picked up when the ice sheet grinds downhill towards the sea.

This paper reviews study of the climate, weather, geology, and wildlife of Antartica which is a remarkable continent – remote, hostile and uninhabited. This frozen continent is key to understanding how our world works, and our impact upon it. Antarctica is important for science because of its profound effect on the Earth's climate and ocean systems..

Keywords : Antartic region, Penguins, Icefish, Toothfish, Antarctic hair grass (Deschampsia antarctica), Antarctic pearlwort (Colobanthus quitensis), Blue Ice.

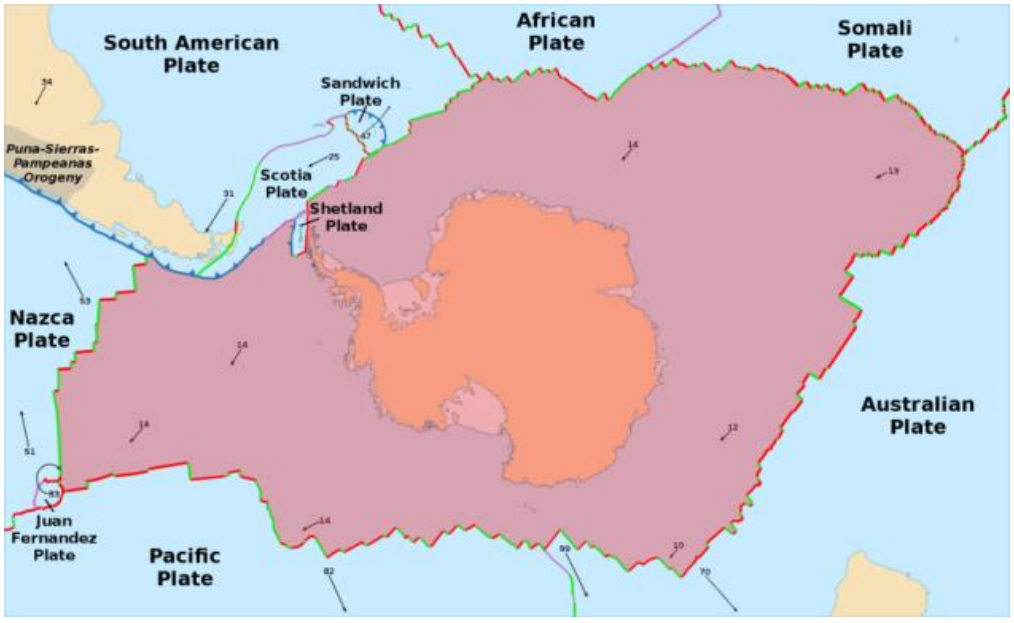
1. INTRODUCTION

The Antarctic is a polar region around the Earth's South Pole, opposite the Arctic region around the North Pole. The Antarctic comprises the continent of Antarctica and the island territories located on the Antarctic Plate. The Antarctic region include the ice shelves, waters, and island territories in the Southern Ocean situated south of the Antarctic Convergence, a zone approximately 32 to 48 km (20 to 30 miles) wide varying in latitude seasonally.[1] The region covers some 20 percent of the Southern Hemisphere, of which 5.5 percent (14 million km^2) is the surface area of the Antarctic continent itself. All of the land and ice shelves south of 60°S latitude are administered under the Antarctic Treaty System. Biogeographically, the Antarctic ecozone is one of eight ecozones of the Earth's land surface.

History

Millions of years ago, Antarctica was warmer and wetter, and supported the Antarctic flora, including forests of podocarps and southern beech. Antarctica was also part of the ancient supercontinent of Gondwana land, which gradually broke up by continental drift starting 110 million years ago. The separation of South America from Antarctica 30-35 million years ago allowed the Antarctic Circumpolar Current to form, which isolated Antarctica climatically and caused it to become much colder. The Antarctic flora subsequently died out in Antarctica, but is still an important component of the flora of southern Neotropic (South America) and Australasia, which were also former parts of Gondwana.

The Antarctic region with the Antarctic Convergence and the 60th parallel south [2]



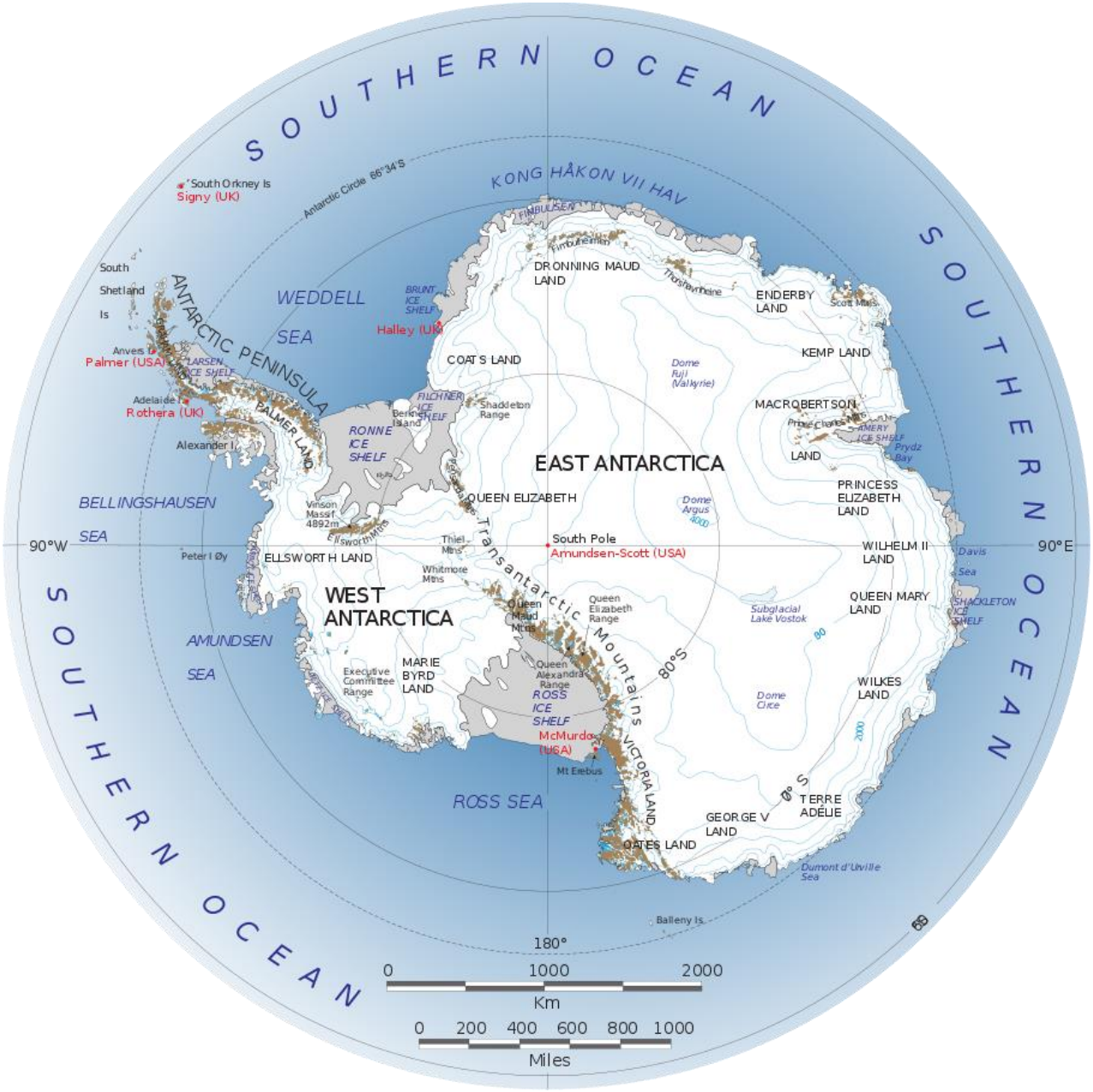
The Antarctic Plate [3]

Some botanists recognize an Antarctic Floristic Kingdom that includes Antarctica, New Zealand, and parts of Temperate South America where the Antarctic Flora is still a major component.

Ecoregions

Four Antartica tundra ecoregions are recognized:

Antarctica tundra	
Marielandia Antarctic tundra	Antarctic Peninsula
Maudlandia Antarctic desert	Eastern Antarctica
Scotia Sea Islands tundra	South Georgia and the South Sandwich Islands, South Orkney Islands, South Shetland Islands, Bouvet Island
Southern Indian Ocean Islands tundra	Crozet Islands, Prince Edward Islands, Heard Island, Kerguelen Islands, McDonald Islands



Transantarctic Mountains, West Antarctica, East Antarctica [4]

Time zones

Because Antarctica surrounds the South Pole, it is theoretically located in all time zones. For practical purposes, time zones are usually based on territorial claims or the time zone of a station's owner country or supply base.

People

The first Antarctic land discovered was the island of South Georgia, visited by the English merchant Anthony de la Roché in 1675. Although myths and speculation about a Terra Australis (Southern Land) date back to antiquity, the first confirmed sighting of the continent of Antarctica is commonly accepted to have occurred in 1820 by the Russian expedition of Fabian Gottlieb von Bellingshausen and Mikhail Lazarev on Vostok and Mirny. The first human born in the Antarctic was Solveig Gunbjørg Jacobsen born on 8 October 1913 in Grytviken, South Georgia.

The Antarctic region had no indigenous population when first discovered, and its present inhabitants comprise a few thousand transient scientific and other personnel working on tours of duty at the several dozen research stations maintained by various countries. However, the region is visited by more than 40,000 [5] tourists annually, the most popular destinations being the Antarctic Peninsula area (especially the South Shetland Islands) and South Georgia Island.

Wildlife

A variety of animals live in Antarctica for at least some of the year, including:[6, 7] Seals, Penguins, South Georgia pipits, Albatrosses, Antarctic petrels, Whales, Fish, such as Antarctic icefish, Antarctic toothfish, Squid, including the colossal squid, Antarctic krill.

On August 20, 2014, scientists confirmed the existence of microorganisms living 800 metres (2,600 feet) below the ice of Antarctica. [8, 9].

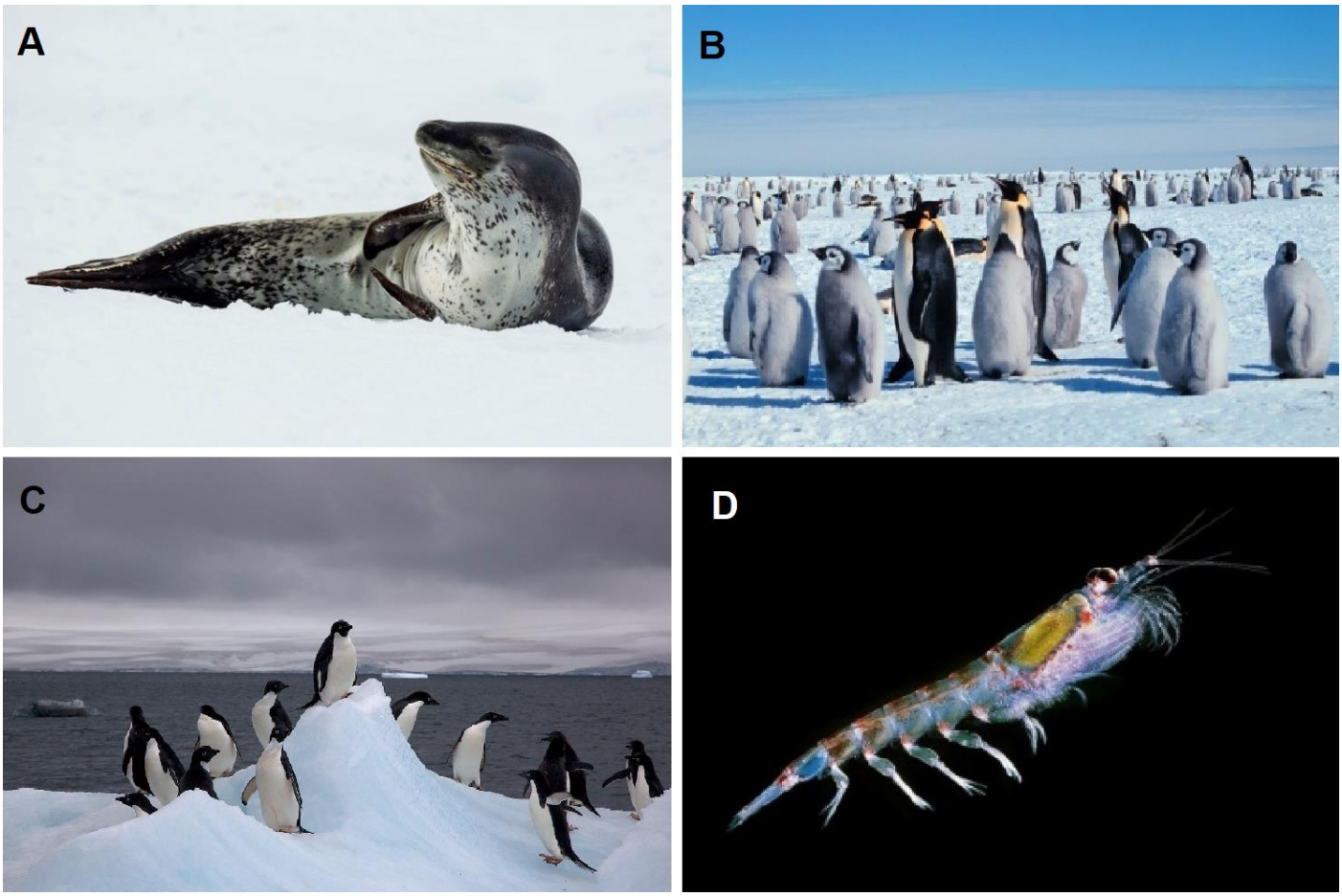


Fig. 1: A : Leopard seal (*Hydrurga leptonyx*), Antarctic Sound, near Brown Bluff, Tabarin Peninsula [10] **B**: Emperor penguins (Aptenodytes forsteri) are the only animals to breed on mainland Antarctica during the winter [11] **C:** Adelie penguins (Pygoscelis adeliae) in Antarctica [12] **D:** Antarctic krill (Euphausia superba) are a keystone species, forming an important part of the Antarctic food web [13].

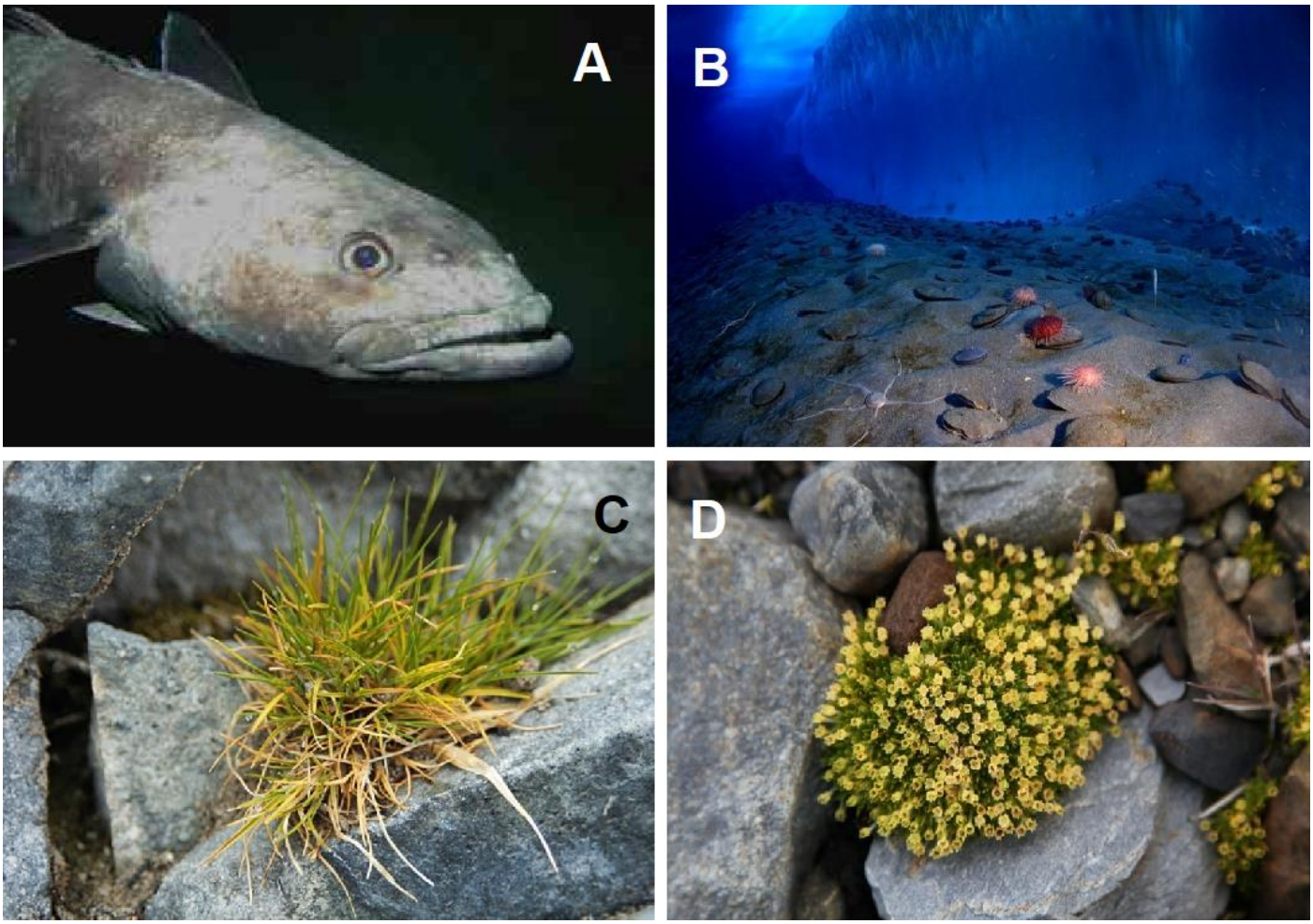


Fig. 2 A: A specimen of *Dissostichus mawsoni* the Antarctic toothfish (Notothenioidei, Nototheniidae) in McMurdo Sound, Antarctica [20] **B:** Underwater in McMurdo Sound, including the sea urchin Sterechinus neumayeri, brittle star Ophionotus victoriae, scallop Adamussium colbecki and other animals [22] **C:** Antarctic hair grass (Deschampsia Antarctica) at Petermann Island / Antarctica [28] **D:** The Antarctic Pearlwort(Colobanthus quitensis), At St. Andrews Bay, South Georgia [29]

Cod icefish (Nototheniidae), as well as several other families, are part of the Notothenioidei suborder, collectively sometimes referred to as icefish. The suborder contains many species with antifreeze proteins in their blood and tissue, allowing them to live in water that is around or slightly below 0 °C (32 °F). [14, 15].

Antifreeze proteins are also known from Southern Ocean snailfish and eelpouts. [17, 18]

There are two icefish species from the genus Dissostichus, the Antarctic toothfish (*D. mawsoni*) and the Patagonian toothfish (*D. eleginoides*), which by far are the largest fish in the Southern Ocean. These two species live on the seafloor from relatively shallow water to depths of 3,000 m (9,800 ft), and can grow to around 2 m (6.6 ft) long weighing up to 100 kg (220 lb), living up to 45 years. [14, 19].

The Antarctic toothfish lives close to the Antarctic mainland, whereas the Patagonian toothfish lives in the relatively warmer subantarctic waters. Toothfish are commercially fished, and illegal overfishing has reduced toothfish populations. Another abundant icefish group is the genus Notothenia, which like the Antarctic toothfish have antifreeze in their bodies. [14]

An unusual species of icefish is the Antarctic silverfish (*Pleuragramma antarcticum*), which is the only truly pelagic fish in the waters near Antarctica. [21].
The red Antarctic sea urchin (*Sterechinus neumayeri*) has been used in several studies and has become a model organism. [23] This is by far the best-known sea urchin

of the region, but not the only species. Among others, the Southern Ocean is also home to the genus Abatus that burrow through the sediment eating the nutrients they find in it. [24] Several species of brittle stars and sea stars live in Antarctic waters, including the ecologically important *Odontaster validus* and the long-armed *Labidiaster annulatus* that even may catch small swimming fish. [25, 26]

Most of the Antarctic continent is permanently covered by ice and snow, leaving less than 1 percent of the land exposed. There are only two species of flowering plant, Antarctic hair grass (*Deschampsia antarctica*) and Antarctic pearlwort (*Colobanthus quitensis*), but a range of mosses, liverworts, lichens and macrofungi.[27].

Blue Ice (Glacial)

Blue ice occurs when snow falls on a glacier, is compressed, and becomes part of the glacier. Air bubbles are squeezed out and ice crystals enlarge, making the ice appear blue.

Small amounts of regular ice appear to be white because of air bubbles inside them and also because small quantities of water appear to be colourless. In glaciers, the pressure causes the air bubbles to be squeezed out, increasing the density of the created ice. Large quantities of water appear to be blue, as it absorbs other colours more efficiently than blue. Therefore, a large piece of compressed ice, or a glacier, would appear blue.

The blue color is sometimes wrongly attributed to Rayleigh scattering, which is responsible for the color of the sky. Rather, water ice is blue for the same reason that large quantities of liquid water are blue: it is a result of an overtone of an oxygen–hydrogen (O−H) bond stretch in water, which absorbs light at the red end of the visible spectrum. [30] In the case of oceans or lakes, some of the light hitting the surface of water is reflected back directly, but most of it penetrates the surface, interacting with its molecules. The water molecule can vibrate in different modes when light hits it. The red, orange, yellow, and green wavelengths of light are absorbed so that the remaining light is composed of the shorter wavelengths of blue and violet. This is the main reason why the ocean is blue. So, water owes its intrinsic blueness to selective absorption in the red part of its visible spectrum. The absorbed photons promote transitions to high overtone and combination states of the nuclear motions of the molecule, i.e. to highly excited vibrations.

An example of blue ice was observed in Tasman Glacier, New Zealand in January 2011. [31]

Fig. 3 A: January Tasman Glacier in New Zealand - blue ice occurs when snow falls on a glacier, is compressed, and becomes part of a glacier [32].

Fig. 3 B: Iceberg on Jökulsárlón, Iceland [33]

Antarctic runways

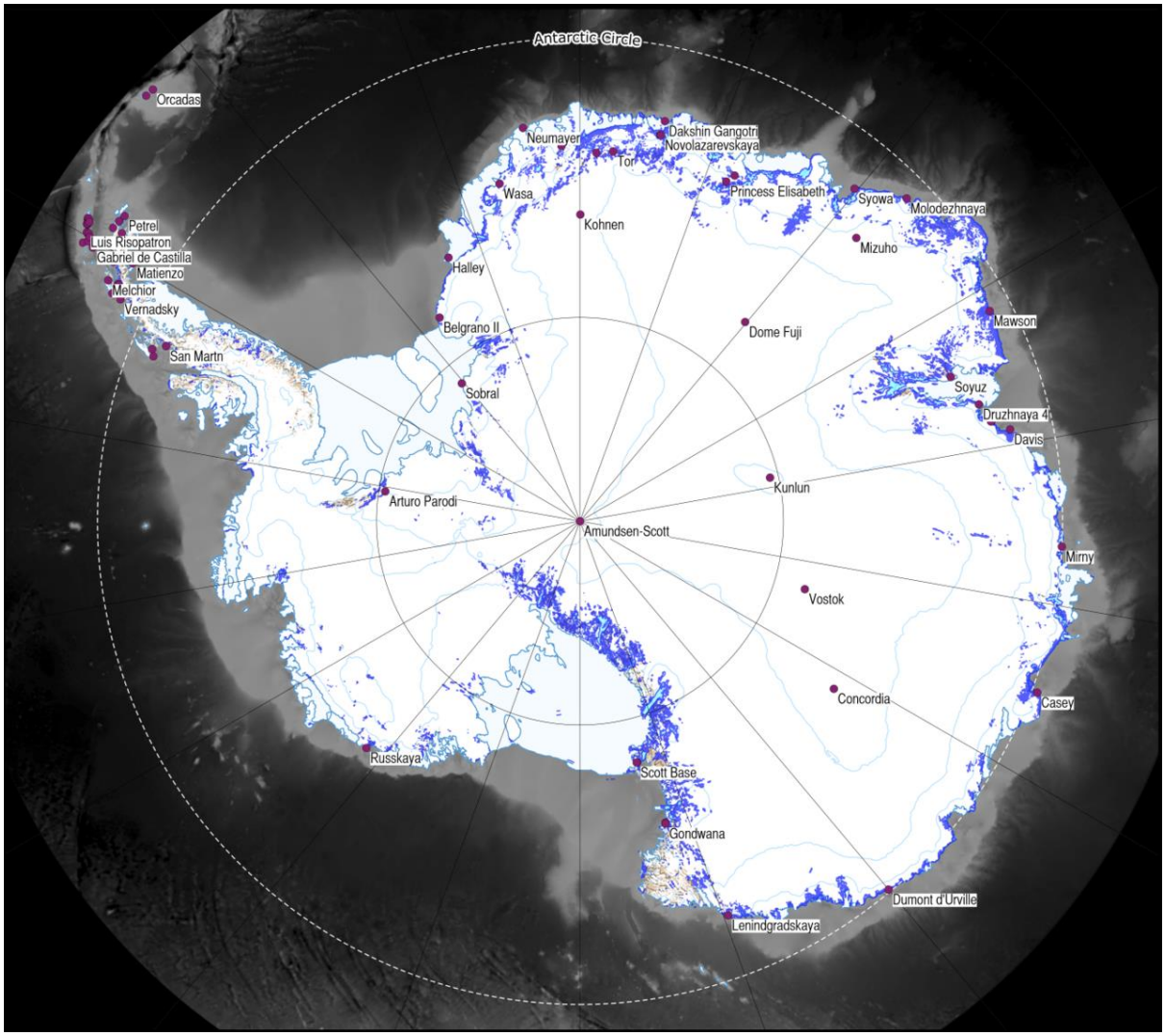


Fig. 4 C: Blue ice fields in Antarctica [34]

The 'frozen wave': Stunning 50ft blue ice monolith captured in the Antarctic [36]

Sturdy: Blue ice is easier for explorers to clamber over because it is safer and stronger than white ice [38]

Blue ice is exposed in areas of the Antarctic where there is no net addition or subtraction of snow. That is, any snow that falls in that area is counteracted by sublimation or other losses. [35] These areas have been used as runways (e.g. Wilkins Runway, Novolazarevskaya, Patriot Hills Base Camp) due to their hard surface, which is suitable for aircraft fitted with wheels rather than skis.

Frozen blue towers were created when ice was compressed and the trapped air bubbles were squeezed out. During the summer the surface ice melts and new ice layers compress on top. The ice appears blue because when when light passes through thick ice, blue light is transmitted back out but red light is absorbed. If the bubbles were not compressed they would scatter the light, meaning it would all be reflected back out and it would appear white. [37]

Striped icebergs [40, 41]

Larry Gedney wrote about blue snow and ice on the Alaska Science Forum. He explained: It takes an appreciable thickness of pure ice to absorb enough red light so that only the blue is transmitted. You can see the effect in snow at fairly shallow depths because the light is bounced around repeatedly between ice grains, losing a little red at each bounce.

We can even see a gradation of colour within a hole poked in clean, deep snow. Near the opening, the transmitted light will be yellowish. As the depth increases, the corer will pass through yellowish-green, greenish-blue and finally vivid blue. If the hole is deep enough, the colour and light disappear completely when all the light is absorbed.

Icebergs in the Antarctic area sometimes have stripes, formed by layers of snow that react to different conditions. Blue stripes are often created when a crevice in the ice sheet fills up with meltwater and freezes so quickly that no bubbles form. When an iceberg falls into the sea, a layer of salty seawater can freeze to the underside. If this is rich in algae, it can form a green stripe. Brown, black and yellow lines are caused by sediment, picked up when the ice sheet grinds downhill towards the sea. [39]

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