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The Geopolitics of Antarctica

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Abstract

The paper analyzes the geopolitics of the Antarctic (South Pole) region which is dominated by strategies for the time after the end of the Antarctic Treaty in 2041. Antarctica with 13.2 million square kilometers and a landmass under the ice shield is protected as common heritage of mankind by the Antarctic Treaty from 1959 that came into force in 1961; the treaty is the legal framework and guarantees the free access and research rights for the international community. In 2023, the treaty had 56 parties; of these, 29 of them are Antarctic Treaty Consultative Parties (ATCP) which currently maintain approximately 80 research stations in Antarctica. While the Antarctic Treaty is valid until 2041, there are also territorial claims from the days of the South Pole expeditions by Australia, New Zealand, France, Norway, Argentina, Chile, and United Kingdom. All claims are 'frozen' by the Antarctic Treaty until 2041, but the geopolitics is already looking forward to the time after.

The Antarctic Treaty System ATS consists of the Antarctic Treaty and related agreements and conventions, the Agreed Measures for the Conservation for Flora and Fauna of 1964, the Convention for the Conservation of Antarctic Seals (CCAS) of 1972, the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) of 1980, the Convention on the Regulation of Antarctic Mineral Resource Activities (CRAMRA) of 1988, as well as of the Protocol on Environmental Protection to the Antarctic Treaty of 1991, also known as Madrid Protocol. As the end of the Antarctic Treaty in 2041 is coming closer, the actors start to bring themselves into an advantageous position on the Antarctic chessboard. The most important activity is the strategic positioning of research stations. While those countries with territorial claims focus on their territory, United States, Russia, and China place their stations across the claimed territories. Antarctic projects are typically national projects without international cooperation. The United States control the South pole with the centrally located Amundsen-Scott Station and have permanent stations in all sectors which are claimed by other states. Russia is also present with large stations that are used for space research and installations for the Navigation Satellite System GLONASS. Like for the Chinese satellite system BeiDou, the Western states are concerned about the dual use-potential of such installations. China has now five large stations and is expanding its capabilities and infrastructure also by an airstrip construction, modern icebreakers, and the systematic use of ports and gateways to Antarctica. Australia and Chile already made claims of continental shelves adjacent to Antarctica while Norway extended its territorial claims to the South Pole in 2015.

The debate about exploitation of resources such as minerals, oil, gas, metals, gold etc. is still more theoretical. Environmental aspects are the climate change with the melting ice shield, threats to biodiversity by invasive alien species, the increasing microplastic pollution and the biosecurity where giant viruses and virophages (viruses that infect other viruses) are important matters. It is unrealistic that the states with territorial claims would be able to squeeze out the large powers United States, China, and Russia out of their territories. For this reason, Antarctica is at risk to dissolve into a patchwork of territories with factual control by various nations, a phenomenon that is already known from the Spratly islands in the South Chinese Sea.

Content

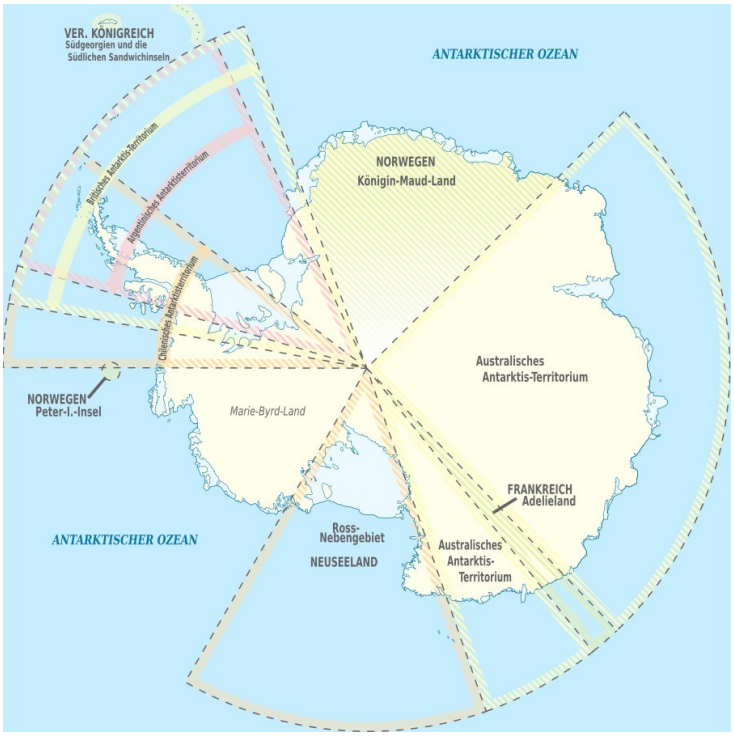
1 The Geopolitics of Antarctica

1.1 Introduction

The paper analyzes the geopolitics of the Antarctic (South Pole) region which is dominated by strategies for the time after the end of the Antarctic Treaty in 2041.

Antarctica with 13.2 million square kilometers and a landmass under the ice shield is protected as common heritage of mankind by the Antarctic Treaty from 1959 that came into force in 1961; the treaty is the legal framework for Antarctica and guarantees the free access and research rights for the international community. The original treaty was signed by the 12 countries which participated in the *International Geophysical Year* from 1957 to 1958. In 2023, the treaty had 56 parties; of these, 29 of them are *Antarctic Treaty Consultative Parties (ATCP)* which currently maintain approximately 80 research stations in Antarctica.

While the Antarctic Treaty is valid until 2041, there are also territorial claims from the days of the South Pole expeditions[1]. Claims are made by Australia, New Zealand, France, Norway, Argentina, Chile, and United Kingdom. While the claims of United Kingdom, Chile and Argentina are overlapping in the northwestern sector, the other claims are only made by one state, Norway in the North, New Zealand in the South, Australia in the East, and France with a small sector in the East. The southwestern part, the *Marie Byrd land*, is not claimed by any country. All claims are 'frozen' by the Antarctic Treaty, but the geopolitics is already looking forward to the time after 2041. But meanwhile, the USA and China have placed in all sectors stations at strategic relevant points and US has re-emphasized in 2020 that they keep the option for territorial claims open[2]. Almost the entire territory of Antarctica is covered with ice. Without ice, large parts of Western Antarctica and certain parts of East Antarctica would be covered by seas or even be under water.



Map of Antarctica Source/Author: File:Antarctica, administrative divisions - de - colored (explicit).svg Date 17 October 2012 **Author**: TUBS No changes made here.
Page URL: https://commons.wikimedia.org/wiki/File:Antarctica,_administrative_divisions_-_de_-_colored_%28explicit%29.svg **License**: Creative Commons Attribution-Share Alike 3.0 Unported via *Wikimedia Commons* **Link to license**: https://creativecommons.org/licenses/by-sa/3.0/deed.en

[1] CRS 2021
[2] CRS 2021

1.2 Brief History

Seal hunters from United Kingdom, Norway, Argentina, and Chile appeared in the 18th century in the Southern Ocean and the sub-Antarctic islands. In the 19th century, explorers, sealers, and whalers came to Antarctica and began to claim it for their respective countries. The first expeditions to the South Pole were those of Amundsen and Scott in 1911.

The argument of the states with territorial claims is that Antarctica is a "*terra nullis*", i.e., not owned or inhabited by anyone and that they were the first who came there. The United Kingdom issued a formal claim with a first *Letters Patent* in 1908 (reissued with modifications in 1917) and caused a domino effect of formal claims by New Zealand (1923), France (1924 with an amendment in 1938), Australia (1933), Norway (1939[3]), Argentina (1940 with declarations in 1943 and 1947), and Chile (1940 with formal documents in 1943)[4]. The British, Argentinian, and Chilean claims overlap while less than 20% of the territory, the southwestern *Marie Byrd Land*, remained unclaimed. Australia and New Zealand got their claims by a transfer from the British Empire[5]. North and West of Antarctica, the United Kingdom controls the *Falkland Islands (Malvinas)* which led to war with Argentina in 1982, the islands of *South Georgia* and *South Orkneys* and *Tristan da Cunha* which together form a barrier to South America and the Atlantic Ocean against other actors. Norway formally claimed to *Bouvet Island* and *Peter I Island* in 1931 and controls them[6].

In 1955, the United Kingdom tried to secure the claims at the *International Court of Justice ICJ* against the overlapping claims from Chile and Argentina. Together with the ongoing tensions in the Cold War, an attempt was made to solve this via **science diplomacy**[7], i.e., the use of scientific cooperation as a tool to mitigate political problems. After two international scientific cooperations in the North Pole Region, the *1st International Polar Year (IPY-1)* in 1882-83 and the *2nd International Polar Year* in 1932-33, a *Third International Polar Year 1957-58* was agreed and renamed to *International Geophysical Year – IGY* under the leadership of the neutral international organizations *World Meteorological Organization (WMO)* and the *International Council of Scientific Unions (ICSU)*. At the end of the IGY from 01 July 1957 to 31 December 1958 with 60 active research stations in Antarctica, the *Scientific Committee on Antarctic Research (SCAR)* and then the *Council of Managers of National Antarctic Programs (COMNAP)* were founded. The US-driven initiative for the *Antarctic Treaty* was taken which was signed in 1959 and which is valid until 2041.

As a result, all territorial claims were set aside and 'frozen'[8], but not revoked. The United States and Russia as successor of the Soviet Union reserve the rights for territorial claims based on their intense presence and exploration activities in the past[9]. Before joining the Antarctic Treaty, Ecuador reserved territorial claims in 1967 for the future[10].

[3] Norway originally claimed its territory only along the coastal line, but clarified in 2015 that the claims reach to the South pole, Headland 2022
[4] Cioppa 1995, Headland 2022, Mancilla 2018
[5] Headland 2022
[6] Cioppa 1995
[7] Rachold 2023
[8] Merschitz 2017
[9] Cioppa 1995, CRS 2021
[10] Headland 2022 Territorio Antarctico Ecuatoriano (83°30´W to 96°30´W, no northern limit) with a size of 323 ×103 km^2, it overlaps with Chiles claims and includes Peter Island of Norway [157 km^2]).

1.3 The Antarctic Treaty System ATS

The ATS consists of the Antarctic Treaty and related agreements and conventions[11].

- the *Agreed Measures for the Conservation for Flora and Fauna* of 1964 which was later replaced by the Protocol on Environmental Protection to the Antarctic Treaty of 1991,
- the *Convention for the Conservation of Antarctic Seals (CCAS)* of 1972,
- the *Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR)* of 1980,
- the Convention on the *Regulation of Antarctic Mineral Resource Activities (CRAMRA)* of 1988, as well as
- the *Protocol on Environmental Protection to the Antarctic Treaty* of 1991, also known as *Madrid Protocol*[12] with meanwhile five annexes.

Tourism is not covered by the ATS; but in 1991 the *International Association of Antarctica Tour Operators (IAATO)* founded to take care for responsible behavior of tourists during their stay in Antarctica.[13].

1.3.1 The Antarctic Treaty

The *Antarctic Treaty* for the region south of the 60º latitude (Article VI)[14], was signed in 1959 and entered into force in 1961; the treaty is the legal framework for Antarctica and guarantees free access and research rights for the international community. The original treaty was signed by the 12 countries which participated in the International Geophysical Year. In 2023, the treaty had 56 parties; of these, 29 of them are *Antarctic Treaty Consultative Parties (ATCP)*, which have the right to participate in decision-making by consensus while the remaining countries have observer status[15]. The consultative states participate in the regular *Antarctic Treaty Consultative Meetings (ATCM)*. New States can apply and join during a *Special Antarctic Treaty Consultative Meeting (SACTM)*, if they have a research station on Antarctica which is permanently used[16].

The territorial claims of Argentina, Australia, Chile, France, New Zealand, Norway, and the United Kingdom are now 'frozen'[17] which means that they are (together with the rights reservation of United States and Russia) a kind of geopolitical 'time bomb' in the Antarctic Treaty.

The Antarctic Treaty regulates that Antarctica can only be used in a peaceful manner for scientific purposes while military use (including nuclear use) is forbidden. Each member state has the right to do inspections at all other research stations and has the right for aerial observations which ensures compliance with these provisions[18]. Scientific activities should be done in a cooperative manner and with data sharing.

1.3.2 Other Agreements of the ATS

The related agreements and conventions of the ATS are[19].

- the *Agreed Measures for the Conservation for Flora and Fauna* of 1964 (also known as *Recommendation III–8*) was formally adopted at the *Third Consultative Meeting*

[11] Bazo 2020
[12] CRS 2021
[13] Merschitz 2017
[14] CRS 2021
[15] CRS 2021, von der Stein 2023
[16] Merschitz 2017
[17] Merschitz 2017
[18] CRS 2021
[19] Bazo 2020

held in Brussels[20] and was later superseded by the *Protocol on Environmental Protection to the Antarctic Treaty* of 1991,

- the *Convention for the Conservation of Antarctic Seals (CCAS)* of 1972 that came into force in 1978[21]. The CCAS is a separate treaty. The Antarctic Seal hunting was completely stopped.
- the *Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR)* of 1980 which entered into force in 1982 and regulates fishing in the Antarctic to protect the Antarctic krill (*Euphausia superba*, a small, shrimp– like crustacean) and other marine resources in the Southern Ocean[22] and toothfish, which was a main target of illegal, unreported, and unregulated (IUU) fishing[23]. A permanent *Commission for the Conservation of Antarctic Marine Living Resources* was established in Hobart, Australia. The convention covers approximately 10% of the world ocean and (in contrast to other agreements) reaches in some areas up to 50°southern latitude[24] at the *Antarctic Convergence*, a major circum-Antarctic biogeographic boundary[25]. The *Catch Documentation Scheme (CDS)* records and tracks toothfish catches through the supply chain[26]. An important element of this Convention is the establishment of *Marine Protected Areas (MPAs)*. Negotiations to expand existing and to create more *MPAs* around Antarctica failed, as China and Russia did not agree as they wanted to keep their options for fishing and mining[27]. Fishing is not completely forbidden, but allowed if done in a sustainable manner[28] and some krill is still fished primarily by Norway, China, and South Korea[29].
- the *Convention on the Regulation of Antarctic Mineral Resource Activities (CRAMRA)* which was signed in 1988 but not ratified by any country and thus did not ever enter into force. Its purpose was then covered by the *Environmental protection protocol from 1991* which forbids mining activities except for scientific purposes[30].
- the *Protocol on Environmental Protection to the Antarctic Treaty* of 1991, also known as *Madrid Protocol*[31] has meanwhile five procedural annexes for environmental impact assessment, conservation of Antarctic Fauna and Flora, waste disposal and management, the prevention of marine pollution, and area protection and management[32]. Furthermore, a permanent *Committee on Environmental Protection (CEP)* was established. The ATCM receives the advice of the CEP and makes legally binding measures and decisions[33]. The protocol is applicable for 50 years after entry into force (in 1998), i.e., until 2048 and remains applicable after 2048 until a new agreement is taking place[34]. Organizations for environmental protection are organized in the *Antarctic and Southern Ocean Coalition (ASOC)*[35].

[20] Cioppa 1995
[21] Cioppa 1995
[22] Cioppa 1995, CRS 2021
[23] Leuprecht 2022
[24] WOR 2019
[25] Cioppa 1995
[26] Leuprecht 2022
[27] Von der Stein 2023
[28] WOR 2019
[29] Leuprecht 2022
[30] Merschitz 2017
[31] CRS 2021
[32] Cioppa 1995. A sixth Annex *Liability Arising from Environmental Emergencies* was adopted in 2005 at the *Antarctic Treaty Consultative Meeting (ATCM)*, but needs to be ratified by all member states before entering into force.
[33] Leuprecht 2022
[34] Haftendorn 2014. Protected birds include the albatross and the petrel.
[35] WOR 2019

In summary, the above-mentioned agreements and instruments, the ATCM, CCAMLR, CEP, Scientific Committee, all agreed measures, and the Secretariats constitute the ATS[36]. The ATS is not part of the United Nations legal system. If not otherwise mentioned, the territory covered by the ATS is the area south of the 60° latitude.

Tourism is not covered by the ATS; but in 1991 the *International Association of Antarctica Tour Operators (IAATO)* founded which takes care for responsible behavior of tourists during their stay in Antarctica[37]. Tourism in Antarctica is rapidly growing, with most tourists from United States and China[38]. In 2019/2020, approximately 60,000 visitors were counted which is a growing ecologic burden[39]. Since late 2021, tourists can be transported with a large jet of type A340-300 from Cape Town to North Antarctica (*Wolf's Fang* blue ice airstrip) during the Antarctic summer[40].

1.4 Strategic Issues in the South Pole Region

As the end of the Antarctic Treaty in 2041 is coming closer, the actors start to bring themselves into an advantageous position on the Antarctic chessboard. The most important activity is the strategic positioning of research stations. While those countries with territorial claims focus on their territory, United States, Russia, and China place their stations across the claimed territories[41].

Also, when the countries establish *Antarctic Special Protected Areas (ASPAs)* with infrastructure, historical heritage (from the era of whalers, sealers, and explorers) with restricted access and *Antarctic Special Managed Areas (ASMAs)*, they preferably focus on their claimed territory. It is noteworthy that Antarctic projects are typically national projects without international cooperation[42]. Brazil discusses for this reason the need for more national capacity building by specialists with long-term presence to be well-positioned in polar geopolitics[43].

The United States control the South pole with the centrally located *Amundsen-Scott* Station, but also have with the *McMurdo* station the largest research station in Antarctica. They have permanent stations in all sectors which are claimed by other states[44]. In total, the US has more than 1,000 people in Antarctica. Russia and US are present near the South American entry points to Antarctica with the *Bellingshausen* and *Palmer* stations.

Russia is also present with large stations that are used for space research by the Russian state-owned corporation *Roscosmos*. This includes installations for the *Navigation Satellite System (GLONASS)* which is used as a GPS alternative. As for the Chinese systems, the Western states are concerned about the dual use-potential of such installations as they could theoretically also used for electronic and anti-satellite warfare.[45]

China joined the Antarctic Treaty in 1983 and has consultive status since 1985. China has now five large stations[46], the last one established in South Antarctica is the *Qinlong* Station close to the US *McMurdo Station*[47] and *Qinlong* can be used by 80 persons in the summer and 30 in the

[36] Leuprecht 2022
[37] Merschitz 2017
[38] Bazo 2020
[39] WOR 2019
[40] Spaeth 2024
[41] Hughes/Grant 2017
[42] Flamm 2019
[43] Gianattasio 2022
[44] Hughes/Grant 2017
[45] Runde/Ziemer 2023
[46] Great Wall on *King George Island* (1985); Zhongshan on *Larsmann Hill* (1989); Kunlun in the *Dome A area* near the center of East Antarctica (2009); Taishan on *Princess Elizabeth Land* (2014) and Qinlong in the *Ross dependency* in South Antarctica, CRS 2021 and Zoll 2024
[47] Burke/Matisek 2021

winter[48]. China has also near-Antarctic hubs, the port of *Daru Island* in Papua New Guinea[49] which is halfway between Shanghai and the South Antarctic *Qinlong Station*. Furthermore, China has the *Great Wall Station* in the near-Antarctic regions of Argentine and Chile. China wants to invest in the Ushuaia port, which is the Antarctic gateway of Argentina[50]. Australia created in 2016 the *Joint Committee on Antarctic and South Ocean Collaboration* with China to get influence on Chinese polar activities and Chile signed a *joint committee* with China in 2019, as China wants to use the Chilean Antarctic gateway, the Punta Arenas port, as well[51].

The three East Antarctic Stations of China are closely aligned which could theoretically enable China to secure a territory between them[52]. By additional constructions at the *Zhongshan Station*, China increases its remote sensing and data collection capabilities around the pole and Chinese space research bases now reach from Antarctica up through South America[53]. This corresponds to similar activities at the North Pole, where China has stations in Norway, Finland, Sweden, and Iceland to support its *BeiDou* satellite navigation system as alternative to the US-owned GPS satellite system[54]. *BeiDou* installations are present in all Chinese Antarctic Stations[55].

China is expanding its capabilities and infrastructure also by an airstrip construction near the *Zhongshan Station*, and the creation of an *Antarctic air squadron* in 2016[56]. China has also two modern icebreakers, *Xue Long* and *Xue Long 2*, also known as the "twin dragons" [57]. China wanted to reserve the *Dome A area* with the scientific station *Kunlun* as an *Antarctic Special Managed Area (ASMA)*, but this was rejected[58]. Negotiations to expand existing and to create more *Marine Protected Areas (MPAs)* around Antarctica failed, as China and Russia did not agree as they wanted to keep their options for fishing and mining[59].

Another strategic move are territorial claims based on the *United Nations Convention on the Law of the Sea (UNCLOS)* of 1982[60] that came into force 1994 and that specified the coastal sea and its contiguous zone, defined exclusive economic zones of the coastal states and an *International Seabed Regime (ISA)* for some Pacific areas. Extended territorial claims can be made based on so-called continental shelf (geologic extensions of the own land mass). The continental shelf is the natural (geologic) prolongation of the land territory up to 350 nautical miles from the coastal baseline; or 100 nautical miles beyond the 2500-meter isobaths (the line connecting the depth of 2,500 meters). The claiming nation must prove that the seabed is geologically a continuation of the own land mass.

The United States is not a party of UNCLOS III, but is following UNCLOS provisions relating to territorial waters, the EEZ, and navigational rights[61]. Any claims must be made to the *United Nations Commission on the Limit of the Continental Shelf (CLCS)* with sufficient geologic evidence. The CLCS can make recommendations, but cannot draw borders as this has to be done by agreement of the involved states. However, despite the CLCS explicitly states that their

[48] Zoll 2024
[49] Burke/Matisek 2021
[50] von der Stein 2023
[51] Bazo 2020
[52] von der Stein 2023
[53] Runde/Ziemer 2023
[54] Dams 2020, Fernández-Montesinos 2023
[55] CRS 2021
[56] Burke/Matisek 2021
[57] Runde/Ziemer 2023
[58] Bazo 2020, CRS 2021
[59] Von der Stein 2023
[60] More precisely, this is UNCLOS III, an extension of the previously existing UNCLOS I and II from 1958 and 1968.
[61] O'Rourke 2024

recommendations are no prejudice, it will be very difficult to dispute a claim that was accepted by the CLCS.

As a strategic move for the future, Australia and Chile already made claims of continental shelves adjacent to Antarctica[62]. A recognition of these zones in later decades would fortify the territorial claims of these countries. Also, Argentina would be able to make such claims[63]. While Norway has no continental shelf here, it extended its territorial claims to the South Pole in 2015[64].

A discussion is going on for future exploitation of resources such as minerals, oil, gas, metals, gold etc.[65]. However, most of these resources and their location is still hypothetical and lacks concrete evidence[66]; also, the harsh climate makes mining technically impossible so far. The resource debate is -in contrast to the territorial claims and the strategically located stations- still more theoretical.

It is unrealistic that the states with territorial claims would be able to squeeze out the large powers United States, China, and Russia out of their territories. For this reason, Antarctica is at risk to dissolve into a patchwork of territories with factual control by various nations, a phenomenon that is already known from the Spratly islands in the South Chinese Sea.

1.5 Environmental Aspects

1.5.1 Climate Change

Antarctica's ice shield is the largest fresh water reservoir on earth. The melting of this ice could significantly increase sea levels. The melting of shelf ice is also problematic for penguins who need this for the care of their breed[67].

An ice-free Antarctica could also facilitate exploration and use of resources which could undermine the protective function of the Antarctic Treaty System.

Finally, states who suffer from dry and hot climate could consider the fresh water that tis currently bound in the ice as potential resource as well[68].

1.5.2 Biodiversity

Typical Antarctic species are penguins such as the king or emperor penguins (5 of 18 penguin species only live Antarctica) and birds[69].

Also, insects like the midge *Belgica antarctica* are found. Furthermore, seals and whales are widespread in the Southern Ocean region, which is the reasons for the early presence of sealers and whalers in this region.

The Antarctic krill (*Euphausia superba*), a small, shrimp-like crustacean that lives in huge swarms, is the largest protein source in this region with an estimate total biomass of one billion tons and serve as food for hundreds of species, including whales, fish, invertebrates, and birds. The krill is also containing *omega-3-fatty acids* which are part of healthy nutrition concepts and therefore, the krill is a resource of interest[70].

Many alien species were imported (sometimes as 'blind passengers' on ships) to the Southern Ocean Islands, resulting in cat, mice, and rat predation on endemic insects and seabirds,

[62] Leuprecht 2022, United Nations 2022
[63] Haftendorn 2015
[64] Headland 2022
[65] WOR 2019, CRS 2021
[66] WOR 2019
[67] Merschitz 2017
[68] Gardiner et al. 2021
[69] Merschitz 2017
[70] Cioppa 1995

vegetation damage caused by rabbits and transformation of some plant communities by weeds[71].

In an amendment to the *Protocol on Environmental Protection to the Antarctic Treaty* in 1998, the introduction of domestic stock, sled dogs and non-sterile soil has been prohibited, and the introduction of living organisms became subject to strict permit conditions. Also, invasive species control and eradication programs were enhanced. The analysis of 3066 records for the terrestrial and freshwater Antarctic and Southern Ocean region showed a very limited invasion of mainland Antarctica, with 13% of records with locally invasive species[72]. Plants, insects, and arachnids were the most frequently reported species.

1.5.3 Biosecurity

Concerns exist that previously unknown microorganisms could be set free by ice-drilling research. Approximately 90% of the viruses under the *Ross Ice Shelf* in Southern Antarctica belonged to *Caudoviricetes* (*Duplodnaviria*; double-stranded dsDNA viruses which probably mostly belong to novel virus families), followed by single-stranded ssDNA viruses (*Monodnaviria*), RNA viruses (*Riboviria*), and *Varidnaviria* such as giant viruses and virophages[73].

Research in Antarctica showed the presence a new type of viruses, the **giant viruses** which form together with conventional large DNA viruses (such as *Poxviridae*) and new group (phylum) *Nucleocytoviricota*, formerly known as *nucleocytoplasmic large DNA viruses (NCLDV)*. Giant viruses were first discovered in amoeba in 2003[74]. The giant viruses can be larger than 1 µm and have almost the size of bacteria.

A giant virus that can cause pneumonia in humans[75] is a *Mimivirus* which was found in marine water from Antarctica[76] where giant viruses can be regarded as common.

New findings are viruses against viruses, so called **virophages**. The number of virophages is permanently growing, so several virophage genome sequences have been partially or fully assembled from metagenomic datasets, e.g., from two Antarctic lakes and the *Yellowstone Lake*[77]. From a biological perspective, nine virophages were identified until 2012, all of them directed against a special subclass of viruses, the giant double-stranded DNA viruses[78]. The *Sputnik* virophage is directed against a *Mimivirus*[79]; meanwhile, the related *Zamilon* virophage was discovered[80]. This may open the path to a new kind of unconventional antivirals.

1.5.4 Microplastic

Microplastics are synthetic organic polymers of various shapes and colors with the size of the largest dimension ranging from 1 µm to 5 mm[81]. The *International Atomic Energy Agency (IAEA)*, in cooperation with Argentina, launched in 2024 its first scientific research expedition to investigate the presence of microplastics as growing environmental problem, after the first evidence of microplastics were found in the East Antarctic coastal fast ice in 2009[82]. The IAEA uses its *NUTEC Plastics (NUclear TEChnology for Controlling Plastic Pollution)* for plastic

[71] Leihy et al. 2023
[72] Leihy et al. 2023
[73] Lopez-Simon et l. 2023
[74] Andrade et al. 2018 The *Mimiviridae, Marseilleviridae* and *Ascoviridae* family and the *pandoravirus, faustovirus, pithovirus, mollivirus, kaumoebavirus, cedratvirus* and *pacmanvirus* could be included.
[75] Zhanga et al. 2012
[76] Andrade et al. 2018
[77] Krupovic et al. 2016
[78] Zhou et al. 2012
[79] Zhanga et al. 2012
[80] Krupovic et al. 2016
[81] Tatsii et al. 2024
[82] IAEA 2024

pollution through recycling using radiation technology and marine monitoring using isotopic tracing techniques and its closely working with Argentina on this matter[83].

2 Conclusions

The paper analyzed the geopolitics of the Antarctic (South Pole) region which is dominated by strategies for the time after the end of the Antarctic Treaty in 2041. As 2041 is coming closer, the actors start to bring themselves into an advantageous position on the Antarctic chessboard. The most important activity is the strategic positioning of research stations. While those countries with territorial claims focus on their territory, United States, Russia, and China place their stations across the claimed territories. Antarctic projects are typically national projects without international cooperation. The United States control the South pole with the centrally located *Amundsen-Scott Station* and have permanent stations in all sectors which are claimed by other states. Russia is also present with large stations that are used for space research and installations for the Navigation Satellite System *GLONASS*. Like for the Chinese satellite system *BeiDou*, the Western states are concerned about the dual use-potential of such installations. China has now five large stations and is expanding its capabilities and infrastructure also by an airstrip construction, modern icebreakers, and the systematic use of ports and gateways to Antarctica. Australia and Chile already made claims of continental shelves adjacent to Antarctica while Norway extended its territorial claims to the South Pole in 2015.

The debate about exploitation of resources such as minerals, oil, gas, metals, gold etc. is still more theoretical. Environmental aspects are the climate change with the melting ice shield, threats to biodiversity by invasive alien species, the increasing microplastic pollution and the biosecurity where giant viruses and virophages (viruses that infect other viruses) are important matters. It is unrealistic that the states with territorial claims would be able to squeeze out the large powers United States, China, and Russia out of their territories. For this reason, Antarctica is at risk to dissolve into a patchwork of territories with factual control by various nations, a phenomenon that is already known from the Spratly islands in the South Chinese Sea.

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