Geopolitics, Environmental Change and Antarctic Governance: A Region in Need of a Transformative Approach to Science Diplomacy

Dhanasree Jayaram

Abstract Antarctica, a continent that has been dedicated to scientific cooperation for decades, is increasingly coming under the pressure of several environmental, climatic, geopolitical (including the rise of Asian powers such as China) and geoeconomic changes (including fishing and bioprospecting). Although the Antarctic Treaty (AT) is considered a successful example of science diplomacy, as countries have set aside their territorial claims and the continent is a nuclear-free zone by shifting focus to scientific cooperation, its future remains uncertain with these developments. Science diplomacy always goes hand in hand with geopolitics. The AT that reflects Cold War geopolitics needs to be modified to represent present-day geopolitical realities for it to be enduring. It is also critical for the Antarctic Treaty System to continue maintaining the continent as a peace zone, environmental conservation and protection, and scientific collaboration. In this context, this chapter analyses the recent geopolitical trends associated with the Antarctic (against the backdrop of climatic and environmental change) and argues that the Antarctic Treaty System (and specific agreements under it) need to be reviewed. A transformative approach to Antarctic governance (including the Southern Ocean), especially in terms of its resources, needs to be adopted.

Keywords Antarctic treaty system · Science diplomacy · Environmental change · Antarctic governance · Transformative approach · Polar geopolitics

1 Introduction

Antarctica is one of the world's most significant regions regarding climate change and geopolitics are concerned. Being one of the global commons on the one hand and subjected to global climate change with grave repercussions for the entire world on the other, Antarctica could potentially emerge as a hotspot in terms of governance

D. Jayaram (✉)
Department of Geopolitics and International Relations, Old TAPMI Building, Manipal Academy of Higher Education, Manipal 576104, Karnataka, India
e-mail: dhanasree.j@manipal.edu

N. Khare (ed.), *Assessing the Antarctic Environment from a Climate Change Perspective*, Earth and Environmental Sciences Library,
https://doi.org/10.1007/978-3-030-87078-2_1

and security. While the focus of the larger international community seems to be on the Arctic, Antarctica's geopolitical dimensions have principally been directed by the evolution of the Antarctic Treaty System (ATS).[1] Very often, due to the region's scientific importance, remoteness (territorial) or even the absence of the native human population, Antarctica has not been at the centre of geopolitical discussions. However, with climate change, more recently discovered geoeconomic and geostrategic potential, growing scientific opportunities as well as longstanding territorial ambitions, the need for a transformative approach beyond the ATS has assumed significance more than ever before. This is critical to preserving the region's environmental and scientific integrity and maintaining peace and stability. This becomes even more relevant in the criticality of this region's ecological stability for the rest of the world.

Antarctic governance has, therefore, been complicated by various factors, with the future being uncertain in many ways. Even though the likelihood of an open conflict in or over the region may be negligible, confrontations and disagreements may arise that could even dilute the AT and related agreements. Already there are instances in which fissures have appeared between the original 12 signatories that were active during the International Geophysical Year of 1957–58 and the late entrants such as China. In this context, it becomes pertinent to analyse the various ways geopolitics affect Antarctic governance and how, in particular, recent geopolitical developments affect the future of the AT and related agreements. Many agreements about the Antarctic concern governance of environmental and resource issues. Governance essentially connotes the act of making "collective decisions", choosing "collective goals", and taking "action to achieve those goals." As an extension, environmental governance "addresses issues of access, use, protection, and management of common-pool natural resources" (Chaffin et al. 2016). Hence, this chapter deals with the interplay between Antarctic geopolitics and governance with the primary focus on environmental and climate change. Since science diplomacy has been used as a vital tool to bring together various countries to cooperate and collaborate in the Antarctic, the chapter looks into this concept and its multiple dimensions. It has been argued that science diplomacy is not devoid of geopolitical underpinnings and considers today's geopolitical realities. The Antarctic requires a transformative approach to science diplomacy that could help reinvigorate Antarctic governance, achieve sustainability and maintain peace in the region.

2 Science Diplomacy in the Antarctic

Science diplomacy has been in play since time immemorial. The ATS and many other subsequent decisions and agreements reached by the international community in Antarctica and the Southern Ocean are attributed to science diplomacy. The use

[1] The Antarctic Treaty and related agreements can be found at: https://www.ats.aq/e/antarctictreaty.html.

of science as a tool for diplomacy is not the only element of science diplomacy. Beyond this, the science-policy interface, which manifests in science to design institutions and implement policies, or for international collaboration, or management of natural resources and environmental concerns, is critical to the concept and practice of science diplomacy. Therefore, it is imperative to reflect on the various aspects of science diplomacy and their relevance to Antarctic governance. At the same time, can science diplomacy be disassociated from geopolitics? As many examples, including from the Antarctic, would suggest, they are interrelated, and science diplomacy is often practised by the existing geopolitical scenario. Hence, in this section, the interrelationship between science diplomacy and geopolitics would be explained to provide a context to the future of governance in the Antarctic.

The United Nations Educational, Scientific and Cultural Organization (UNESCO) describes science diplomacy[2] as:

> Science, due to its international and universal nature, has the power to cross borders and connect different peoples, communities, and societies…a tool to achieve foreign policy objectives where, not only the research outcomes but also science itself as a process and way of communicating, may serve to promote peace and sustainable development.

This definition tends to delink science from politics, which is debatable in an age where the politics or the politicisation of science is often used as a tool to influence decision-making (Gibbons 1995). By treating science as 'international' and 'universal', it is also rendered 'rational', 'objective', and so on (Sabbagh 2017). This is where geopolitics also assumes significance as countries engage in scientific exploration, research and related diplomatic initiatives only in tune with the prevailing geopolitics and not separate from it. However, this definition brings out certain critical elements of science diplomacy—facilitation of communication and connection, the achievement of and alignment with foreign policy objectives, and promotion of peace and sustainable development. These are essentially the need of the hour, more so when the credibility of science (such as climate science) is being discarded by several sections of the political class.

Science diplomacy can be understood in many ways. First, "science in diplomacy", wherein the focus is on how science could inform foreign policy. Science has become integral to several foreign policy options and goals adopted by nation-states, whether related to transboundary resource management, trade, security-related issues or other sectors. Second, "diplomacy for science", wherein formal diplomacy becomes the means for achieving scientific goals. The Montreal Protocol on Substances that Deplete the Ozone Layer is a classic example of a treaty that was reached through successful diplomatic efforts to address the issue of 'ozone hole' or depletion of the ozone layer in the stratosphere. All the countries have committed to phasing out or have already phased out ozone-depleting substances (ODS) such as chlorofluorocarbons (CFCs), based on a scientific agenda. Third, "science for diplomacy", wherein science becomes a tool for collaboration, cooperation, engagement

[2] More on UNESCO's interpretation of science diplomacy and its practice can be found at: http://www.unesco.org/new/en/natural-sciences/science-technology/science-policy-and-society/science-diplomacy/.

and peacebuilding (Walport 2014). Initiatives such as "Science for Peace" in Cyprus have primarily been engendered by scientific communities to promote engagement and peace between North and South Cyprus that continue to be politically divided.[3] With science diplomacy, scientists' role in foreign policy development and international relations has also been reinforced more directly. The contribution of the Intergovernmental Panel on Climate Change (IPCC) to the global climate change negotiations can be cited as a case in point. On foreign policy developments in sectors such as nuclear and space, too, the scientific community has at times had a direct role to play.

If one takes Antarctica's case, one could argue that all three versions are applicable and have come into use at various points in time. Even at the peak of the Cold War, this region witnessed international collaboration and efforts to bring peace between countries. Perhaps this is the only global commons with so-called 'claimant states'—Argentina, Australia, Chile, France, New Zealand, Norway and the United Kingdom (UK). Besides, the United States (US) and Russia (erstwhile Soviet Union) have consistently opposed these claims. Concerns about nuclear tests and dumping had also gathered momentum. India was among the countries that first demanded that Antarctica be used only for peaceful purposes. It was under these circumstances that the ATS was signed with the active involvement of both the US and the Soviet Union, who were in agreement that Antarctica should not become the centre of East–West conflict. Territorial sovereignty was set aside by most nation-states. The movement for establishing peace gained momentum during the 1950s, which led to the promotion of scientific research and cooperation in Antarctica that later were integrated into the ATS. Science diplomacy has become a cornerstone of several other measures taken in the region, such as the ones aimed at biodiversity protection. One such initiative is the science-based Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) that is considered to be the ocean arm of the ATS. Science diplomacy in the Antarctic context has been used to attain scientific goals, achieve sustainable development, establish peace, promote international collaboration, and inform foreign policy objectives, among others.

3 The Antarctic Treaty System and Its Future

The Antarctic Treaty (AT) is considered a success story, primarily because it was arrived during the peak of the Cold War and survived many decades of rivalries and conflicts. The reason why the AT could be reached is at times attributed to the deliberate attempt by the chief negotiators to keep many provisions largely ambiguous, with mechanisms for compliance, enforcement and governance relatively weak. One could argue that science trumped geopolitics in this case, albeit as discussed, the two

[3] More on Science for Peace Initiative Cyprus can be found at: https://medium.com/naturewords/the-science-of-building-peace-with-nature- 838b36cd5bfb

go hand in hand. The AT needs to be seen through the prism of science diplomacy—how science played an important role in reaching intergovernmental agreements, including on marine living and mineral resources. With support from groups such as the Scientific Committee on Antarctic Research (SCAR), much before the CCAMLR came into force in 1982, a few more agreements were reached by the international community. These include Agreed Measures for the Conservation of Antarctic Fauna and Flora (1964) and Conservation for Antarctic Seals (1972). Science contributed to the adoption of precautionary and ecosystem approaches within these agreements, whether it is to "maintain populations that are the target of harvesting at healthy levels" or to "prevent irreversible damage in the Antarctic marine ecosystem" (Scully 2011, p. 3). The most recent step undertaken under the ATS is that of entry into force of the Ross Sea Marine Protected Area in 2017. This is the world's largest marine protected area (MPA) and will be in power for 35 years (Dodds and Brooks 2018).

The AT also needs to be seen against the backdrop of "scientific internationalism" that has dominated much of the debates on Antarctic governance, especially in the twentieth century. Scientific internationalism is based on three principles. First, the epistemological principle pertains to knowledge and asserts that scientific knowledge is borderless and universal (belongs to all). Second, the organisational focus concerns cooperation in scientific research, standardisation of research methods, discussion and interpretation (such as peer review), and information exchange, among others that could reduce costs and duplication of efforts. Third, the welfare principle "involves solidarity and the application of the fruits of science for the benefit of all humankind, including the distribution of its goods." As argued by Elzinga (2011, p. 59), the AT has been successful only on the epistemological principle, while on the other two, there are still gaps. Calls for declaring Antarctica as a "heritage of humankind" (to be put under the United Nations) or as a "World Natural Park" (by several environmental organisations) have not been endorsed even at the conceptual level, thereby highlighting the continuing role of territoriality and exclusivity attached to this continent. Nevertheless, these principles have reflected to some extent in the International Polar Year and International Geophysical Year.

The First International Polar Year (1882–83) was steered by the quest for knowledge, scientific exploration and cooperation. The second International Polar Year (1932–33) or IPY2 came more than a decade after the First World War, during which scientific internationalism suffered a setback. IPY2 also happened amid territorial claims by several nations—starting from the UK (along with Australia and New Zealand) during the early 1900s to France and Norway in the 1920s and 1930s. After IPY2, Argentina and Chile also entered the fray in the 1940s and their territorial claims overlapped with that of the UK. The International Geophysical Year (1957–58) or IGY laid the AT's foundation as the US, under former President Dwight D. Eisenhower, spearheaded preparatory talks and negotiations. The IGY saw 67 nation-states collaborating for scientific endeavours, out of which 12 were mainly involved in the Antarctic (Joyner 2011).

To contend that the IGY and the subsequently inked treaty were exceptions to the bitter Cold War rivalry and devoid of geopolitical motives would be naïve. The IGY had security, strategic and foreign policy objectives. The US saw "international

scientific cooperation and data exchange" as a potentially "powerful, yet neglected, vehicle for promoting American interests and values as well as for the collection of intelligence of use to the American state" (Naylor et al. 2008). By merely suspending all the territorial claims and allowing all countries to enter the continent freely and fully (as a global commons), the US and the erstwhile Soviet Union could establish their research bases/stations all over the mainland. Simultaneously, the claimant states (traditionally) restricted construction and scientific activities to their claimed territories only. Thus, the US built one of its research stations—Amundsen-Scott South Pole Station—at the much-coveted geographic South Pole.[4] In any case, the future of the Antarctic region as a nuclear-free zone for 'scientific' purposes was concretised.

Despite these success stories, questions are still raised over the future of governance in the region due to its relevance for the fishing industry (particularly krill and toothfish), the whaling industry, access to fresh water (since the area is home to 70 per cent of the world's freshwater), bioprospecting, mineral exploration (and potential exploitation), tourism and other human activities (Joyner 2011). Science may be the binding factor fostering international collaboration; it is also visibly being used as a geopolitical tool to expand research on climate change through physical presence on the continent that may even metamorphose into an opportunity to fulfil military or security or strategic objectives. The Antarctic is abundantly rich in resources (including marine life), with many species and resources still undiscovered. Both human activities and environmental change are, however, putting pressure on the region's ecosystems.

Whether or not the ATS has been able to check such activities and whether or not it will be able to do so in the future are questions that require further analysis. The Protocol on Environmental Protection to the Antarctic Treaty or the Madrid Protocol (concluded in 1991 and entered into force in 1998) has banned any activity related to mineral resources other than scientific research. However, there are no comprehensive frameworks and policy regimes to regulate other activities such as bioprospecting[5] in the region (except two resolutions adopted by the Antarctic Treaty Consultative Parties or ATCPs). There has already been the collection of microorganisms in Antarctica for various purposes (such as pharmaceutical and healthcare), and the interest in bioprospecting activities is growing further (SCAR 2009). In such a scenario, there could be conflicts on issues related to patenting, information exchange and benefit-sharing (Australian Antarctic Division 2004). Even the progress assessments made against the Strategic Plan for Biodiversity (includes a goal on "Benefits from biodiversity and ecosystem services"), adopted under the purview of the Convention on Biological Diversity (for until 2020), do not include Antarctica and the Southern Ocean (Chown et al. 2017).

[4] More information regarding the US' research station at the South Pole can be found at: https://www.nsf.gov/geo/opp/support/southp.jsp.

[5] Bioprospecting refers to "exploration of naturally occurring microorganisms, plants and animals for commercially valuable genetic and biochemical resources." The definition and other details can be found at: https://documents.ats.aq/ATCM25/wp/ATCM25_wp043_e.pdf.

The CCAMLR, which currently has 26 Members and 10 Acceding States (as of 2019),[6] successfully established the Ross Sea MPA. Being one of the most pristine and most productive (in terms of healthy marine ecosystems) stretches of the Southern Ocean, the demand for an MPA remained fervent from several parties, particularly New Zealand and the US (that also put forth a joint proposal). Scientifically too, it is one of the best-studied Antarctic continental shelf systems. The need for Ross Sea MPA was mainly driven by the rapidly intensifying fishing activities in the region. Setting a limit on fishing through the MPA became a priority for several CCAMLR parties. However, the journey was not smooth. In the initial years when the US and New Zealand came up with independent proposals, there were many technical differences and competing values between them and other member states. While the US hosts the most extensive scientific base in the Ross Sea, New Zealand has a historical claim over the area. The US is not involved in the toothfish industry and, therefore, recommended an MPA that would take away a more prominent place off the limits of toothfish fishery. New Zealand, on the other hand, sought to develop the Ross Sea fishery in the past and even claimed exclusive access to it, which was eventually denied as other CCAMLR members objected to it (Dodds and Brooks 2018).

Even in the discussions that led up to the establishment of Ross Sea MPA, there were a few parties that held out until the last minute. For example, during the discussions, China opposed no-fishing zones without enough scientific evidence of threat (based on the precautionary approach). Russia endorsed this view, too (Brooks et al. 2018). To accommodate the fishing interests of many parties, the area that was initially proposed for the MPA had to be trimmed by almost 40 per cent in 2013. This was the only way the initiative could have gained more support, and since the CCAMLR works on consensus, it was essential to have the affirmative vote of all parties. How geopolitics influences these discussions can be best exemplified by how the Ukraine crisis and tensions between the US and Russia influenced the discussions. In the end, the efforts of former Secretary of State John Kerry played a crucial role in bringing on board China and Russia. As remarked by Brooks, "It was not only an environmental win for Antarctica and the whole world but also a diplomatic win. It felt like a peace agreement, especially in heightened geopolitical tensions between the US and Russia. It made me realise that we still do have exceptional governance despite tensions and contested resource frontiers" (Jayaram 2019).

The Antarctic krill are increasingly coming under pressure from overfishing (illegal fishing too) and climate change. They are mainly used in aquaculture, omega-fatty-acid supplements and livestock foods. Although they are present in humungous numbers in the Southern Ocean, unregulated fishing could disrupt the overall ecosystems as other mammals (such as whales), and birds feed on the krill directly or indirectly (as a part of the food chain). The pressure on Antarctic species is immense, with several of them being almost driven to extinction, and only a few can recover. These include elephant seals, blue whales, marbled rock cod and king penguins. If one takes just the case of krill, around 300,000 tonnes are caught annually (Brooks

[6] More information regarding the CCAMLR can be found at: https://www.ccamlr.org/en/organisation/who-involved-ccamlr.

et al. 2018). While fishing has been regulated in the Ross Sea, other areas such as the Weddell Sea continue to be threatened by overfishing. A 2018 decision by the krill fishing companies that account for 85 per cent of krill fishing decided to stop fishing in areas of the Antarctic Peninsula just ahead of the CCAMLR meeting is a welcome step. However, as scientists observe, that may not resolve the problem, as other industries such as toothfish and icefish ones are still highly active in many areas. This is why the support for an EU proposal on Weddell Sea MPA is growing among the scientific and environmental conservation communities (Marshall 2018).

4 Climate Change and Changing Geopolitics in the Antarctic

Much before climate change became the centre-point of global discussions, Antarctica grabbed the spotlight when the stratospheric ozone hole was unexpectedly discovered over it (first reported in 1985). This revolutionised both science and environmental policymaking as it laid the foundation for the Montreal Protocol (Solomon 2019). Recent reports in 2019 suggest that the ozone hole is the smallest on record since it was discovered and that it could recover entirely by 2040 if the Montreal Protocol is adhered to by all the parties (Convey and Peck 2019). Despite being geographically remote and still inaccessible to many, Antarctica's scientific research opened up possibilities for further collaboration and corrective measures in the political domain. Today the region is no longer considered inaccessible as thousands of tourists flock to this continent. From around 5,000 every year in the early 1990s to about 45,000 in 2016–17, the number of tourists visiting Antarctica has risen and continues to increase. To a large extent, these numbers are partly explained by the phenomenon of "last-chance tourism", which implies that people are increasingly keen on visiting places/attractions that are threatened by natural or human factors such as climate change or over-tourism and may not be accessible or available for visits in the future (Abedi 2018).

The extensive impacts of climate change on the earth's cryosphere have been highlighted by several scientific groups, including the IPCC. These impacts are, however, not uniform in the Antarctic region due to which certain parts of the area are warming up more severely than others (such as the Antarctic Peninsula). At the same time, in some other places, the sea ice extent is increasing. According to the 2019 IPCC Special Report on the Ocean and Cryosphere in a Changing Climate, "Antarctic ice loss is dominated by acceleration, retreat and rapid thinning of major West Antarctic Ice Sheet (WAIS) outlet glaciers (very high confidence), driven by melting of ice shelves by warm ocean waters (high confidence)" (Meredith et al. 2019). Not only is the Antarctic adversely affected by climate change—in the form of increased temperature, ocean acidification and thinning of the ice shelf (also contributing to retreating ice sheet)—it also poses the potential risk of rising global sea levels as the grounded ice enters the oceans (Gudmundsson et al. 2019). Another

recent study reveals that the Antarctic Ice Sheet "lost 2,720 ± 1,390 billion tonnes of ice between 1992 and 2017, which corresponds to an increase in mean sea level of 7.6 ± 3.9 mm" (Shepherd 2018, p. 219). The west coast of the Antarctic Peninsula is reportedly one of the most rapidly warming regions of the world, with an increase of 3 °C recorded in air temperature. These warming trends have adverse impacts on the region's ecosystems, including the penguin and Antarctic krill. The prevailing measures, including under the CCAMLR, do not take into consideration long-term climate change scenarios. Because climate change has adverse impacts on these species, specific decisions such as fishing quotas or catches shares should account for it.

Climate change research in the Antarctic is critical to predicting the future of the earth's climate system. The Southern Ocean is crucial for the global climate and ecological systems as it serves as the link between the Atlantic, Pacific and Indian Oceans (Sallée 2018). Owing to the centrality of this region to the global climate system and ongoing scientific research activities, the Antarctic's scientific profile has grown over the years, leading to the arrival of many more scientific expeditions and the establishment of more scientific stations in the continent. The number of research stations and camps in Antarctica on the rise (Kotecki 2018). Yet unlike the Arctic that has been geopolitically volatile more than ever before in the event of increasing climate change effects, Antarctica has not been previously considered a geopolitical hotspot, mainly due to the existence and continuance of the ATS. However, recent developments show that with varying attitudes of different countries towards the region and its resources, contestations are expected to grow. The rise of Asian countries and their increasing involvement in the area, in particular, are being seen as trigger-points for the emergence of new rivalries—just as in the Arctic.

China's ambition to be a "polar great power" (Brady 2017) has been sufficiently explicated in its white paper on "Antarctic activities," in which it vows to abide by the principles of the ATS, including non-militarisation research (on issues such as climate change) and environmental protection that would entail a commitment to the existing ban on commercial resource extraction in the region (Tiantian 2017). At the same time, in its 13th Five-Year Plan for fishing industry technology (released in 2017), its intent "to increase its krill fishing and processing capacity and improve its fishing technology and competitiveness to support the growth of a krill industrial chain" is emphasised (Chun and Damin 2018). China currently has three research stations and one camp in Antarctica—Changcheng, Zhongshan, Kunlun and Taishan—with a fifth one built on the Ross Sea Ice Shelf (2022). Kunlun and Taishan lie within Australia's Antarctic claim. China is a signatory to the ATS and ratified the 1991 Madrid Protocol (in 1998) that prohibits any activity concerning exploitation of mineral resources in Antarctica. However, this will be open for review in 2048, and as pointed out by some analysts, the consensus reached by many countries on imposing a ban on mining may not hold water later in the current century (Liu 2019). In any case, commercial mining in the region is not viable at this stage (or shortly). Therefore, it might be too early to be speculating about the mining interests of countries such as China in the region. This does not mean that strategic competition over resources (including fossil fuels

and rare earths) in the area is impossible in the future as they become scarce in other parts of the world.

Nevertheless, China has been more overt in showing its interest in fisheries, bioprospecting, scientific research, tourism and shipping. For instance, China National Fisheries Corporation (CNFC) is one of the leading krill fishing companies in the region. Krill fishing was once dominated by the Soviet Union, and after its collapse, Japan took over. Currently, Norway, South Korea and China are ahead of the rest, with Russia also making a comeback gradually (Stark et al. 2019, pp. 37–38). China's krill fishing has increased over some time, touching 65,000 tonnes in 2016. The depleted fisheries in its backyard due to overfishing and marine pollution is pushing China to explore resources outside its territorial waters and exclusive economic zone (EEZ). According to the China Fisheries Bureau, under CCAMLR's umbrella, there is scope for further exploration and exploitation of krill resources in the Antarctic. Hence, China should invest more in such explorations, enhancing fishing activities, developing polar fishing technology and building krill fishing vessels for commercialisation (Liu and Brooks 2018). According to CCAMLR data, "China has more krill fishing vessels and fishes over a wider area than any other nation." Since the 2016/17 CCAMLR fishing season, China has also started to venture into East Antarctica to fish for krill. It is among the countries opposed to establishing the East Antarctic Marine Protected Area, proposed by Australia and the European Union (EU) (Liu and Brooks 2018).

It is rather apparent that besides the commercial and scientific relevance of the region, the Antarctic represents geopolitical and strategic space too in international politics. Countries would be interested in vying for influence in the region through increasing presence (bases, research stations, cultural edifices and so on). Russia, for instance, has built the continent's first Orthodox Church. Since the collapse of the Soviet Union, Russia has found it difficult to bounce back into the pinnacle of international politics. However, it is re-emerging as a world power with military, strategic, scientific and resource interests in Antarctica and the Southern Ocean using its "smart power strategy" (use of both hard and soft power) (Carter, Brady and Pavlov 2016). Even while actively participating in the multilateral arrangements concerning the Antarctic, it has gone ahead and deployed measuring stations for the GLONASS global satellite navigation system (akin to the US-led Global Positioning System or GPS) and plans to build additional ones (Kezina 2015). It plans to reopen its Russkaya station in 2021 as Roscosmos (state space corporation) has proposed to "install equipment for GLONASS" at the station (Xinhua 2019a).

Although the ATS forbids Antarctica's use for military purposes, it does not prevent military personnel or equipment in the region for scientific and peaceful purposes. However, it must be noted here that the ATS was negotiated and signed in the Cold War era in which one of its most important objectives was to keep Antarctica out of the conflict between the two superpowers (and their allies) as well as to suspend all territorial claims over the continent. The focus now was on preventing nation-states from using this continent for "military manoeuvres" or building "military bases and fortifications" and, most notably, nuclear weapons testing and radioactive waste disposal. The present-age technologies in the space and cyber domains, without

doubt, dual-use, are allowed under the ATS as long as they are used to meet scientific objectives. However, the global navigation satellite systems such as US-led GPS, Russia's GLONASS, China's BeiDou and Norway's Troll Satellite Station are further developed in Antarctica. These could be used during wartime for "missile targeting and timing, as well as access to fleet-based broadband for unclassified and classified systems, and environmental, situational awareness" (Brady 2018).

In response to these recent developments, Australia is rethinking its positions to regain its influence in the Antarctic—primarily by deploying its military equipment and defence technology (Gothe-Snape 2019a). There were also disagreements between Australia and China over the latter's proposal for a "code of conduct" at "Dome A" (considered to be the "best location for space observation on Earth due to its high elevation and outstanding visibility") that again falls within the former's Antarctic claim (Gothe-Snape 2019b). Although these disagreements may not be based on Australia's territorial claims, there are concerns regarding the use of such codes to be used in the future by nation-states to claim territory (especially since even under the ATS, the US and Russia do reserve the right to make territorial claims in the future). Since the ATS has frozen all territorial claims, Australia's claim over 42 per cent of the territory is not recognised. Yet, Australia has time and again stood by the need for preserving the integrity of the ATS to maintain its sovereignty over a part of Antarctica's territory (strategic interests) and at the same time achieve environmental/scientific goals (Bray 2016).

Similarly, in its 2018 Strategic Defense Policy Statement, New Zealand has expressed its apprehension over the "difficulty in distinguishing between allowed and prohibited activities" under the ATS, which could effectively be exploited by some parties to use the continent for "military or security-related activities." It has reinvigorated its commitment towards Antarctica and the Southern Ocean, especially to fight climate change, under the pretext of heightened presence and other countries' activities, including China, South Korea and Italy in the region. Even on mining, it acknowledges the fact that although mining activities are currently banned under the ATS, in the future, the treaty may not be able to prevent them (Ministry of Defence 2018). While resource exploitation might be on the cards in the long term, it could be deemed a long shot at this stage as the region's rough topography, the scarcity of adequate infrastructure, economic non-viability, and other factors are likely to derail any such efforts. However, this does not imply that advances in technology cannot overcome these bottlenecks in the future.

5 The Road Ahead: Science Diplomacy and a Transformative Approach

The current geopolitical realities call for a reinvigorated approach towards Antarctic governance. While geopolitics may not blatantly threaten the future of the Antarctic and its longstanding stature as a zone of peace and scientific collaboration, in light of

the above-discussed developments, there would likely be disagreements over a host of new activities (such as tourism, bioprospecting, fisheries and potential research exploration) that are now central to Antarctica. Impacts of climate change are further complicating these developments. On the one hand, climate change could be seen as a uniting factor that could bring countries together for further research that could more precisely predict the changing patterns. On the other hand, it could also become a dividing factor that pits nations against each other in resource and benefit-sharing. One must also not forget that nation-states could use climate change to gain more and more access to the continent. As more human population enters the Antarctic, its environmental integrity and sustainability could come under more pressure. The use of scientific facilities for military purposes is another concern, despite inspections under Article VII of the treaty.

Nation-states are vying for influence in the region through more scientific bases and personnel on the ground. However, it is not just the quantity that matters here; quality is equally important, as there is a push for all-year bases rather than just summer-only ones. The location, type and purpose of the grounds are also integral to the strategy adopted by countries. Overlapping territorial claims, competing prerogatives and values over resource and benefit-sharing, and bases for global navigation satellite systems, among others, dictate the nature and extent of influence that a nation-state could exert in the region. These efforts are being strengthened by increased spending on Antarctic-related activities in many countries –operational costs and research funding, and capacity building (including icebreakers). For example, in terms of the budget's size in Antarctica, China leads the world (Brady 2014). China's first indigenously built polar icebreaker—Xuelong 2—completed its maiden voyage for its 36th Antarctic expedition in 2019 (Xinhua 2019b). While many strategic analysts see China's rise and increasing influence as a threat or menace, the reality is that its ambitions and interests are not very different from that of the US and Russia, if not the claimant nations. China's quest for superpower status invariably entails a greater emphasis on Polar Regions. Therefore, although the possibility of conflict or confrontation cannot be ruled out entirely, there is ample scope for collaboration, cooperation and partnership that has, in any case, prevailed in the Antarctic for decades.

As far as India is concerned, Antarctica's presence is relatively marginal (compared to the US, Russia, China, Australia and others). It has so far set up three stations—Dakshin Gangotri (that has now become a supply base and transit camp), Maitri and Bharati (established in 2013) (Press Information Bureau 2013a). With the establishment of Bharati, India has joined the elite club of countries that have multiple research stations in Antarctica. However, in the long term, India has interests in the region for both scientific purposes as well as meeting diplomatic objectives (mainly to establish its place at the international level as a scientific power, as it has been able to achieve in other domains such as space, as this is indispensable to India's recognition as a world power). This is reflected in some of the recent decisions and steps were taken by the Government of India, including a Memorandum of Understanding (MoU) with Argentina on Antarctic cooperation—in earth sciences and environmental/marine conservation and protection (Press Information

Bureau 2013b). Being a party to the AT and a 15th Consultative Member of the Antarctic Treaty, India is increasingly becoming aware of climate change's geopolitical and security implications in the region. Thereby, there is a need for reviewing the effectiveness of the ATS and possible alternative governance solutions, which Chaturvedi (2016) labels the "climate security dilemma". At the same time, India's longstanding engagement with the Antarctic has not yet translated into a coherent Antarctic policy, partly attributed to its lack of "strategic culture" and "institutionalisation of the country's foreign policymaking" (Chaturvedi 2012). This would have to change significantly if India sees itself engaging in the region in a more strategic manner—an endeavour in which its growing emphasis on science diplomacy could play a critical role.

One needs to ask how to address climate change, resource, and environmental imperatives in the region by accommodating various countries' differing geopolitical interests. Science diplomacy could provide answers to this question. However, as we live in a world where science is continuously challenged and/or is politicised, the dangers of science diplomacy backfiring are also valid. The AT and related agreements could be reviewed. Climate change presents a window of opportunity to open up new research avenues into its impacts on the region and the entire world. Science diplomacy could also pave the way for comprehensive regulations on tourism and bioprospecting that are gathering momentum. There are various ways of bolstering science diplomacy efforts—from promoting science education and research through increased funding domestically to encouraging collaborative and joint use of scientific infrastructure (Antarctica). One of the purposes of science diplomacy is to overcome political and other differences. Hence, if there are mutual benefits to be gained, science diplomacy could foster scientific collaboration. Science diplomacy should ideally involve all communities, including indigenous peoples, that have been left out of the governance and decision-making mechanisms for a long time, even in the case of polar governance (in the Arctic). This is why the most recent International Polar Year (2007–09)[7] is distinct in many ways as it involved the indigenous peoples. Still, their integration with the governance regimes in a more meaningful way is yet to happen. In all these matters, the need of the hour is to strengthen the science-policy interface through co-creation and co-production. This would be possible by a more significant engagement level between different actors—both state and non-state—and from varying backgrounds (disciplinary, professional and bureaucratic). Even though this has been facilitated mainly under the ATS, non-governmental scientific and environmental organisations' participation needs to be boosted further as their outreach to the public and other stakeholders are immensely required to address various concerns about climate change, tourism and bioprospecting.

Science diplomacy could become more effective if a transformative approach to environmental governance is adopted in the Antarctic. By 'transformative approach', the goal would be to revise and redesign the existing structures, models and processes

[7] More information regarding the IPY 2007–08 can be found at: http://library.arcticportal.org/1211/1/IPY_Summary.pdf.

that characterise a particular governance regime, architecture or system. Environmental governance in this context becomes the binding factor as the Antarctic has emerged as a centre of geopolitical contestation on account of its rich resources. A transformative approach to environmental governance in the Antarctic, based on the changing climate and geopolitical realities in the region, needs to align scientific, resource and geostrategic objectives. In this endeavour, the transformation could be achieved through informal and non-governmental initiatives' more prominent involvement. As has been seen in the case so far, science has played a vital role in Antarctic governance and to maintain the collaborative nature of engagement between nation-states in the region. New governance models must be invented in place of the new geopolitical scenario marked by the emergence of new powers such as China. Transformative approaches to environmental governance in the Antarctic need to be precautionary as well. Different actors, including scientists, need to come together and collaborate on co-producing knowledge using various methods such as modelling, scenario building (involving geopolitical variables), experimentation and so on, and using it to frame a governance regime that is sustainable and cooperative (irrespective of the overall competing values and interests).

Instead of circumventing geopolitical realities, a transformative approach to science diplomacy in Antarctica needs to transform the concerned stakeholders' values, interests, and beliefs. This would entail systemic shifts in how diplomacy is practised; science is communicated, and internalised collaborative governance attitudes. Both framings of issues and agenda-setting within the governance architecture are crucial to adopting a transformative approach. Therefore, it is high time that the Cold War-based values embedded in the ATS are discarded, including the consensus-based system that has could stand in the way of adopting strong measures to check illegal and suspicious activities in the region. One such instance is unlawful fishing carried out by a South Korean fishing vessel in 2011, after which it could not be blacklisted (as per the Report of the Thirtieth Meeting of CCAMLR) (Commission for the Conservation of Antarctic Marine Living Resources 2011). South Korea has recently (in 2019) been warned by the US for illegal fishing once again (Yeon-soo 2019).

A multi-level governance regime with a nested leadership that does not promote hegemony or reinforce geopolitical rivalries may be better placed to maintain the 'global commons' status of the Antarctic. The new geopolitical realities reflect multipolar characteristics—multiple power centres with actors at different strategic capabilities, influencing capacity and geopolitical reach. Even if the US continues to be the preeminent power after the end of the Cold War, other power centres (such as China and Russia) are becoming geoeconomically and geopolitically more vital day by day. Claimant states such as Australia and New Zealand are becoming exceedingly wary of various geopolitical developments and the enhanced presence of a host of Antarctica countries, driving them to reassert their positions and claims. These developments are also adding to the environmental pressures of the continent. On climate change specifically, there is a need for concerted efforts to align scientific research in Antarctica and climate policy related to the region into intergovernmental mechanisms such as the United Nations Framework Convention on Climate Change (UNFCCC), which is yet to materialise in a meaningful manner. The ATS cannot be

the sole architecture that governs this remote, harsh and fragile region. Science diplomacy is premised on the idea that global problems such as climate change require global solutions. The Antarctic, central to several critical international science diplomacy initiatives, needs a transformative agenda that promotes scientific cooperation, sustainability and peace.

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