CHAPTER ONE

Rise of the Sinocene?

China as a Geological Agent

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In 2018, China released its Arctic Policy, an English-language white paper asserting that the country is a "near-Arctic state" (*jin beiji guojia* 近北极国家) (State Council Information Office of the People's Republic of China 2018). Western political officials and media regard this self-declared status with skepticism. At the May 2019 ministerial meeting in Rovaniemi, Finland, of the Arctic Council (the region's preeminent intergovernmental organization), US Secretary of State Michael Pompeo declared, "There are only Arctic states and non-Arctic states. No third category exists, and claiming otherwise entitles China to exactly nothing" (Pompeo 2019). While any supposed "entitlements" that China—which is approximately nine hundred miles from the Arctic Circle—might have to the region are thus disputed, the sheer scale of the country's economic activities and its extending infrastructural networks are having significant impacts on the Arctic environment. The direct connection between China's economic activities and their global environmental footprint suggests that the country has become a geological agent, or an actor capable of substantially altering Earth's physical structure and substance.[1]

While climate change has spurred natural and social scientists to recognize humans' ability to indelibly alter the planet, more precise examinations of geological agency at scales more politically actionable than that of the entirety of humanity are lacking (Clark and Yusoff 2017; Yusoff 2013). The increasing evidence for all the ways in which humans are affecting the climate makes it easy to attribute responsibility to the species as a collective rather than "any individual person, policy, politician, community, or nation" (Rudiak-Gould 2015, 51). Yet specific phenomena can be connected to individual countries and their economic activities. Identifying these links is done not to point fingers, but rather to determine leverage points within complex systems where interventions can be made (Meadows 1999; Abson et al. 2017).

Since its policies of Reform and Opening Up began in 1978, China has driven much of the world's urbanization, industrialization, and development—all of which are carbon-intensive processes that impact the Arctic. The country's disproportionate role in driving Arctic climate change can be attributed to its massive scale. Between 1980 and 2010, China's level of urbanization increased nearly 30 percent, with its cities gaining an additional 478 million residents (Farrell and Westlund 2018). To support its urban, industrial, and infrastructural transformation, China has become the world's largest consumer of commodities—both quotidian, like oil and iron ore (Coates and Luu 2012), and obscure, such as molybdenum (Outteridge et al. 2019). The enormity of this resource consumption (especially of fossil fuels) led China to surpass the United States as the world's largest emitter of greenhouse gases in 2006 (Vidal and Adam 2007).

China's rapid industrialization combined with its greenhouse gas emissions have endowed the country with an "unprecedented ability to change the socioeconomic landscape, produced great wealth, and led to some catastrophic environmental change" (John Moore et al. 2016, 588), both within and outside its borders. Emissions from China alter Arctic atmospheric circulation patterns, which in turn affect East Asian weather patterns. China's status as the world's largest emitter of greenhouse gases thus makes it critical that we understand how activities originating within the country's borders are affecting climate change, both in and beyond the Arctic.

Examining China's geological agency is scientifically and politically timely for two reasons. First, since the early 2000s, scholars have increasingly recognized that the planet has entered the Anthropocene: the geological epoch in which humans have become the single largest geological force acting on the planet, making it warmer, wetter, stormier, and less biodiverse.[2] Natural and human forces have become so closely interlinked that "the fate of one determines the fate of the other" (Zalasiewicz et al. 2010, 2231). Even if the formal designation of a new geological epoch remains debated, there is a growing consensus on humankind's ability to drive not just environmental change but also geological change.

Second, the Anthropocene is not only a scientific concept: it is also a moral and political one (Ellis and Trachtenberg 2014). Acknowledging that a large proportion of global environmental change is anthropogenic represents an important ethical shift regarding humans' understanding of their place in the world (Chakrabarty 2009). However, to affect policy and change behavior, responsibility must be attributed at politically actionable scales. Social scientists have called for breaking down the "anthro" in the Anthropocene in order to identify the spatially uneven drivers and power relations of global environmental change.[3] From a similar standpoint, Kathryn Yusoff (2013, 782) suggests complicating the "unifying claims of global geologic agency" attributed to humankind—which this chapter, by examining China's geological agency, seeks to do. Within this framing, it becomes possible to conceive of the Sinocene, in which regional and even planetary environmental shifts can be attributed to activities occurring within China.

The fact that economic and environmental policies are still largely decided at the national level makes it logical to assign responsibility for environmental change to specific countries, whether historically or in the present day (Neumayer 2000). By highlighting the case of China, I aim to demonstrate how one country's economic activities can disrupt distant ecosystems. I wish to underscore that this research is done not to blame China for the Arctic's rapidly destabilizing environment, but rather to emphasize how the scale of China's economic activities affords it geological agency. While this capacity has negative environmental consequences, it also makes it possible for China to identify and implement unilateral, at-source solutions to climate change, alongside multilateral ones in which the government's involvement is key.

Interest in the Anthropocene has given rise to the subfield of political geology, which considers the relationship between politics and geological forces like eroding shorelines and erupting volcanoes (Bobbette and Donovan 2019). By entering the Anthropocene, society has arguably left the era of geopolitics and entered the era of geological politics (Clark 2013; Dalby 2015). If power relations in the previous era involved control over terrain, they now involve control over the entire planet, from its strata to the layers of the atmosphere. In the twentieth century, geopolitical power depended on the ability to project control over terrain, turning the planet's surface into a political technology known simply as "territory" (Elden 2010). States could accumulate territorial control by exercising military power over land, sea, or air or through "infrastructural power" and the ability to penetrate a distant polity's peripheries (Mann 1984, 185).

Yet in the era of geological politics, control over terrain has taken on a more vertical dimension, penetrating below and above Earth's surface (Elden 2013; Dalby 2013). Volumetric geology rather than flat territory is the new target of political manipulation and control, especially at "elemental interfaces" (Sammler 2019, 14). The expansion in the scale and extent of Anthropocene geopolitics is particularly apparent in the environmentally dynamic Arctic, whose rate of warming is now three times that of the global average (AMAP 2021)—a phenomenon called "Arctic amplification" (Dai et al. 2019). Melting ice sheets, thawing permafrost, and newly accessible fossil fuels are both causes and effects of a more volumetric regional geopolitics. National governments are sending submarines to the seafloor, icebreakers across the frozen surface, and satellites into space to accumulate more knowledge about the rapidly changing Arctic.

While significant attention has been paid to China's activities in the Arctic, fewer links have been drawn between the country's domestic activities and changes to the northern cryosphere. As China has urbanized, modernized, and industrialized, it has sought to perpetuate these economic activities and extend them beyond its borders. The country's participation in the development of climate-impacted regions such as the Arctic is facilitated materially, by global geophysical shifts set in motion within China, and discursively, by rhetoric that legitimizes the country's interventions while underplaying its responsibility for climate change. Countries that industrialized at a relatively early stage, like the United Kingdom, Germany, and the United States, are of course responsible for the bulk of historical greenhouse gas emissions, a fact that has spurred calls to hold them accountable (Neumayer 2000). For over 15 years, however, China has been the world's largest emitter of greenhouse gases. Moreover, due to Asia's rapid development over the past three decades, the continent's greenhouse gas emissions bear more responsibility for Arctic climate change than those from any other region (Sand et al. 2016). The environmental and political consequences of Chinese geological agency merit analysis, especially as the Chinese government becomes a bigger player in global development and governance (Y. Wang 2019).

This chapter is structured as follows: First, I conceptualize geological agency, noting the direct and indirect ways in which it sets in motion large-scale changes to Earth's ecological and biogeochemical systems. Second, to sketch out the materiality of geological agency, I relate China's greenhouse gas and black carbon emissions to environmental and geophysical transformations in the Arctic. Here, I draw on secondary sources—namely, peer-reviewed scientific literature examining the relationship between emissions from Chinese industries and the circumpolar north. Third, I reflect upon how Chinese state discourse presents the country as a geological subject or victim rather than as a geological agent, in a manner that suggests that China's actions in the Arctic are precautionary and defensive rather than offensive. I also address how the Chinese industrial sectors responsible for driving Arctic climate change (specifically, steel manufacturing) are taking advantage of new opportunities arising in Arctic shipping routes and oil and gas development, particularly in Russia. I conclude by reflecting on the ultimate ephemerality of geological agency.

By attending to "the deep temporalities and elemental forcefulness of the earth" (Clark 2013, 2831) as well as to the forcefulness of political actors such as China, the chapter analyzes not only the distinctly geological nature of politics in the Anthropocene, but also the scales at which these elemental changes are manifesting. Climate change remains a problem whose solution will require collective action. Yet developing an accounting of which actors and activities are responsible for environmental alterations—especially in remote and sparsely populated environments like the Arctic, where the consequences of activities outside the region are more extensive than of those from within—is a prerequisite for crafting precise, actionable policies. Regardless of whether states are non-Arctic or near-Arctic, their activities can still affect the circumpolar north. For that reason, geological agents, no matter how distant, must be considered in any reckoning of present and future conditions in the Arctic.

On Geological Agency

In the Anthropocene, geological agency can be traced to a narrower scale than the entirety of humanity, for certain actors bear more responsibility for environmental change than others. However, since contemporary critical social thought is arguably missing "a conceptual armature for dealing with the geologic agency of humankind" (Clark 2013, 2828), social scientists have yet to fully consider the geophysical implications of this uneven political culpability. The ongoing material and infrastructural turns within the social sciences suggest a renewed embrace of tactile topics rather than abstract representation, thought, and discourse (Anderson and Wylie 2009; Larkin 2013). Yet in fact, not only does much of this work ignore actual earthly matters and substances (Ingold 2007): it often fails to engage with research in earth sciences that can help explain the very changes to the planet's physical processes that undergird the Anthropocene. Examining these environmental dynamics through a political lens can more precisely identify the sources of geological agency, at a scale conducive to producing solutions to climate change.

So what exactly is geological agency? The term might first bring to mind geoengineering (the direct manipulation of Earth's ecosystem). The era of political geology inevitably presents new opportunities for the practice, which is the field "most directly and practically geared towards the prospect of transgressing thresholds in earth systems" (Clark 2013, 2829). For its part, China has become a geoengineering pioneer. Various technologies that the country's scientists are exploring include injecting aerosols into the stratosphere using a technique known as "stratospheric geoengineering" (Cao, Gao, and Zhao 2015), remediating air pollution and haze via "water spray geoengineering" (Yu 2014), and carbon sequestration. China's state-sponsored National Key Basic Research Program has established a coordinated team of scientists researching geoengineering, with their work notably focusing on China and the Arctic (Cao, Gao, and Zhao 2015).

Geoengineering, however, is not the only way in which geological agency can be exercised. Geological agency can also derive from indirect actions. Unintended geoengineering (the more or less accidental consequences of activities not meant to alter Earth's environment) is what is responsible for climate change. Humanity never intended to warm the planet by burning trillions of barrels of oil. On a smaller scale, China did not intend to contribute to Arctic climate change through its pursuit of urbanization, industrialization, and modernization—yet these processes are melting sea ice thousands of miles away. The links between environmental changes in China and those in the Arctic are well documented by research in the earth sciences, which the next section examines in order to provide insights into the material and geophysical dimensions of geological agency.

China also wields its geological agency in a discursive manner by putting forward narratives of a country that is threatened by climate change and that at the same time is contributing to the region's economic development. Radical changes to the Arctic's land-, sea-, and icescapes are generating new opportunities in shipping, tourism, fishing, and oil and gas exploration, all of which interest China (Moe and Stokke 2019; Hsiung 2016). In 2017, China incorporated the Arctic into its formal plans for the Belt and Road Initiative, and in recent years has been partnering with Russia to develop the Polar Silk Road (Tillman, Jian, and Nielsson 2018). These joint plans envision expanding shipping activities along Russia's northern coast in the hopes of better connecting markets in Europe and Asia—or at least, of facilitating the export of northern resources to these destinations. These environmental and economic shifts also offer political opportunities for the development and governance of a region perceived as being in a state of emergency, requiring collective and increasingly external action (Dittmer et al. 2011). Ironically, then, geological agency afforded by national economic activities can produce inroads into regional and global environmental governance.

On the one hand, China has demonstrated global leadership in climate change initiatives. The country signed the Paris climate agreements in 2016. It is also working toward replacing coal with natural gas, and is aiming to reach peak greenhouse gas emissions by 2030 (den Elzen et al. 2016) and carbon-neutrality by 2060. On the other hand, when legitimizing its involvement in the governance of distant environments—a role that could open the door to future participation in, for instance, the regulation of geoengineering (see, e.g., Dalby 2015)—China focuses on its role as geological victim rather than agent. Like climate change narratives from the Global North, these representations deterritorialize the origins of climate change while firmly territorializing its consequences (Doyle and Chaturvedi 2010). They also fit within the broader discourse that Beijing propagates, which depicts China as a victim of foreign adventurism and great power politics (Callahan 2009; Agnew 2012). Being a casualty rather than a culprit of climate change strategically aligns the country with the developing world in global climate change politics, even as the scale of China's contemporary geological agency, when measured in terms of greenhouse gas emissions, far surpasses that of the rest of the Global South combined (Fuhr 2019).

Where There's Smoke, There's Melting Ice

Greenhouse gases such as carbon dioxide (CO_2) and methane are found in Earth's atmosphere. Like a blanket, they absorb heat that rises up from the planet's surface. As the amount of greenhouse gases in the atmosphere increases, more heat is trapped, which melts Arctic sea ice and exposes open ocean water. The widening extent of dark water as opposed to reflective, white ice exacerbates these warming trends. China's CO_2 emissions have quadrupled since economic reforms began in 1978, largely due to a fourfold increase in the country's energy consumption (Guan et al. 2008). A majority of this energy still comes from coal, the most carbon-intensive of all fossil fuels, which also pumps black carbon (or soot) into the atmosphere with further warming effects. Between 1950, one year after the Chinese Communist Revolution, and the early 2000s, the country's greenhouse gas emissions from burning coal increased 2,600 percent (Bond et al. 2007). In 2021, China was responsible for 26.1 percent of global emissions (Ge, Fredrich, and Vigna 2021), exceeding the shares of the United States and Europe (the two next-largest emitters) combined. The sector of the Chinese economy that produced the most CO_2 emissions in 2015 consisted of electric power, steam, and hot water production and supply, while the smelting and pressing of ferrous metals (generally for steel manufacturing) came in second (Shan et al. 2018). Illuminating, powering, and heating China and producing steel therefore constitute large and identifiable contributors to Arctic climate change.

All told, China's steel manufacturing sector is responsible for some 4–5 percent of global greenhouse gas emissions (Jing et al. 2014). In 2010, China's iron and steel manufacturing industry emitted 1.82 billion tons of CO_2 (Tian, Zhu, and Geng 2013), a figure that likely rose over the following decade given the sector's continued growth. Even if we take this somewhat outdated statistic, convert it to metric tons (1.65 billion), and multiply it by the 2.7–3.3 square meters of September sea ice that are estimated to be lost per metric ton of CO_2 emitted (Notz and Stroeve 2018), China's iron and steel manufacturing industry is still responsible for the loss of 4,455–5,445 square kilometers of September sea ice every year—an area almost as large as Shanghai (figure 1.1).

The declining amount of Arctic sea ice directly impacts environmental quality and public health in China. Preventing the loss of the Arctic ice cap may help lessen the probability of more frequent extreme winter weather in China. Scientists

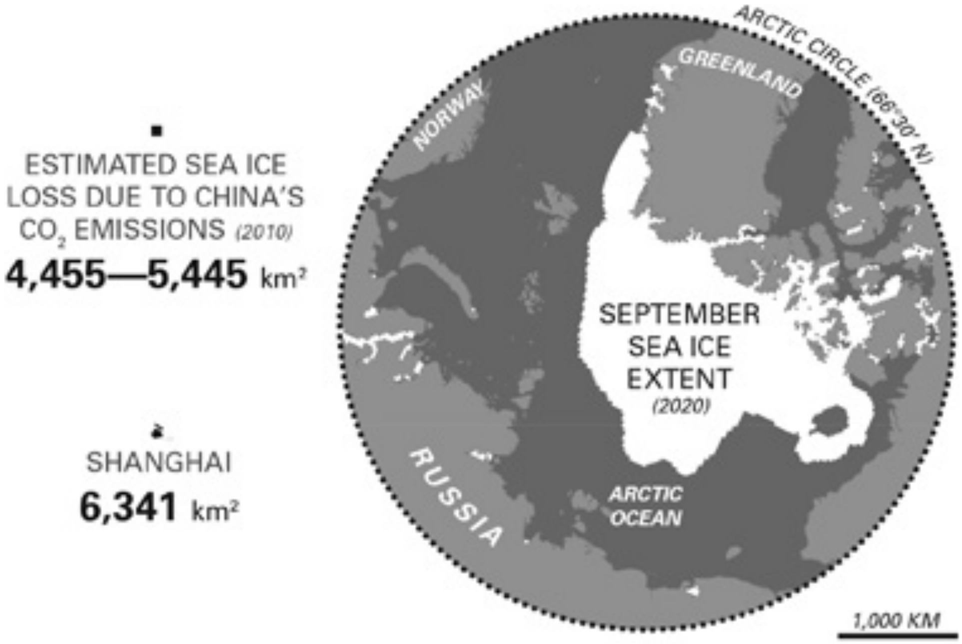

Figure 1.1. Arctic sea ice. (Map by Dorothy Tang. Made with Natural Earth and NSIDC Sea Ice Index data. See NSIDC 2021.)

have demonstrated that a loss of a million square kilometers of autumn Arctic sea ice is linked to increased snow cover and cooler temperatures in northern and central China (Liu et al. 2012). When sea ice thins and retreats, it affects the Arctic Oscillation, an atmospheric circulation pattern around the North Pole and high latitudes. In turn, an altered Arctic Oscillation can cause cold air masses from the Arctic to penetrate the Eurasian and North American continents (Cohen et al. 2014; Francis and Vavrus 2013). These sudden penetrations of cold air exacerbate winter conditions in Eurasia by lowering surface air temperatures and increasing the amount of snow, rain, monsoons, and dust storms (He et al. 2017).

Arctic sea ice reduction is also driving atmospheric shifts that are leading to unprecedented levels of winter haze in China, events colloquially called airpocalypses (Zou et al. 2017). While local precipitation and surface wind influence haze levels above cities in heavily industrialized northeastern China, perhaps surprisingly, Arctic sea ice exerts an even greater impact (H. Wang and Chen 2016). Changing atmospheric circulation patterns due to melting sea ice cause the atmosphere to stagnate over northeastern China and weaken cyclone activity. Winter haze can then hang in place, choking the many cities in the region. As sea ice continues to decline—a phenomenon that has led to increased snowfall in northern latitudes—winter haze and poor regionwide ventilation conditions are likely to persist (Zou et al. 2017).

Even if cities in China take measures to lower the amount of pollutants they are emitting into the air, continued sea ice decline—a process set in motion long ago and difficult to quickly reverse—will keep winter haze in place (H. Wang and Chen 2016). Demands from China's urban population for cleaner air are spurring government initiatives to clear the skies (J. Zhang et al. 2010), and the state is promoting cleaner steel production by closing heavily polluting facilities and encouraging the use of higher-grade iron ore.[4] However, greenhouse gases sent aloft years ago that are shrinking Arctic sea ice may undermine the impacts of these localized environmental policies.

While global climate change mitigation efforts target greenhouse gases, specifically CO_2, one type of emission whose effects may be easier to limit immediately is black carbon (Ding et al. 2016). This particulate matter occurs as a result of the incomplete combustion of fossil fuels, biofuels, and biomass. Black carbon is particularly harmful in the Arctic because when it falls atop snow or ice, it reduces reflectivity, and sunlight is absorbed instead of reflected (Wobus et al. 2016). This darkening effect may warm and melt snow more effectively than any other anthropogenic agent (Qian et al. 2014). Black carbon does not persist in the atmosphere as long as other greenhouse gases: soot remains for just four to eight days (Stohl 2006), whereas CO_2 emissions last for years. Efforts to reduce black carbon can therefore generate a more immediate effect than efforts to reduce CO_2.

As with emissions of greenhouse gases, emissions of black carbon from East Asia are higher than those from any other world region, surpassing those from Europe, North America, and Russia combined (Stohl 2006). They have also risen quickly: black carbon emissions from China have doubled since the 1970s. By contrast, emissions from the former Soviet countries in the late 1990s were less than a quarter of their 1980 peak levels (Koch and Hansen 2005), reflecting the disastrous consequences of the Soviet Union's collapse. Even as China continues to develop and modernize, most of the country's black carbon emissions still come from residential coal burning (R. Wang et al. 2012). Without wishing to absolve governments or corporations of culpability for climate change, it is worth noting that this fact underscores the collective role of individuals, whose responsibility for climate change often goes unaddressed in "Anthropocene blame narratives" (Rudiak-Gould 2015, 59). Black carbon has been shown to travel from western China all the way across the Pacific Ocean to Alaska (Sharma et al. 2013). At the same time, due to the nature of the atmospheric pathways that transport black carbon, emissions from China actually have a lower impact on climate change in the Arctic than those from Europe (Stohl 2006).

Nevertheless, the Chinese government's stated plans to develop Arctic shipping and natural resource extraction will likely lead to an increase in black carbon emissions from within the Arctic. Approximately two-thirds of the black carbon emitted by Arctic shipping comes from burning heavy fuel oil (International Council on Clean Transportation 2017). While the Polar Code introduced in 2017 by the International Maritime Organization bans the use of heavy fuel oil in the Antarctic, it has taken longer to implement a similar ban in the Arctic, where the economic burden associated with altering industry practices has historically outweighed environmental concerns. In 2020, the International Maritime Organization finally approved a ban on the use of the fuel in the Arctic that will take effect in 2024. However, numerous exemptions will last until 2029. Fortunately, since most Arctic shipping occurs in summer, the resulting black carbon emissions are less likely to be deposited on top of snow and ice (Corbett et al. 2010).

Black carbon emissions from oil and gas extraction may have a more significant impact on Arctic climate change than those from shipping. Drilling occurs year-round, meaning that there is a large window during which black carbon can fall onto snow and ice (Corbett et al. 2010). The practice of gas flaring (burning off excess gas that cannot be exported or sold) contributes 42 percent of annual mean black carbon surface concentrations in the Arctic (Stohl et al. 2013), a figure that is poised to rise due to the opening in recent years of new resource extraction sites. Norway's USD 5.6 billion Snøhvit liquefied natural gas (LNG) project began production in 2007; Russia's USD 27 billion Yamal LNG plant commenced exports a decade later. The Yamal Peninsula, an area primarily inhabited by Nenets reindeer herders before the discovery of extensive gas fields in the 1960s (Forbes 1999), lies below one of the main atmospheric pathways along which air masses travel north to the Arctic (Evangeliou et al. 2018) (figure 1.2). Black carbon emitted there may thus have an easy conduit north, where its warming effects will be amplified. The Yamal LNG project likely would not have been realized without the assistance of Chinese investors, who contributed over USD 15 billion to the project (Pan and Huntington 2016). As such, gas extraction and flaring at Yamal LNG, and the resultant year-round black carbon emissions darkening Arctic snow and ice, are arguably direct effects of Chinese foreign investment.

Yamal LNG, which produced 18.8 million tons of LNG in 2020, or approximately 5 percent of the LNG sold in the global market (Bajic 2021), provides a new source of the commodity for China as it seeks to import more natural gas and reduce its reliance on coal. So, too, may the opening of the Arctic LNG 2 project across the Ob Bay from Yamal, from which China's state-owned Shenergy Group has agreed to purchase three million tons annually. While slated to become operational by the end of 2022, the project may be delayed if Western sanctions levied in response to Russia's invasion of Ukraine prevent key technologies from arriving. Regardless, while China's shift to natural gas will help lower

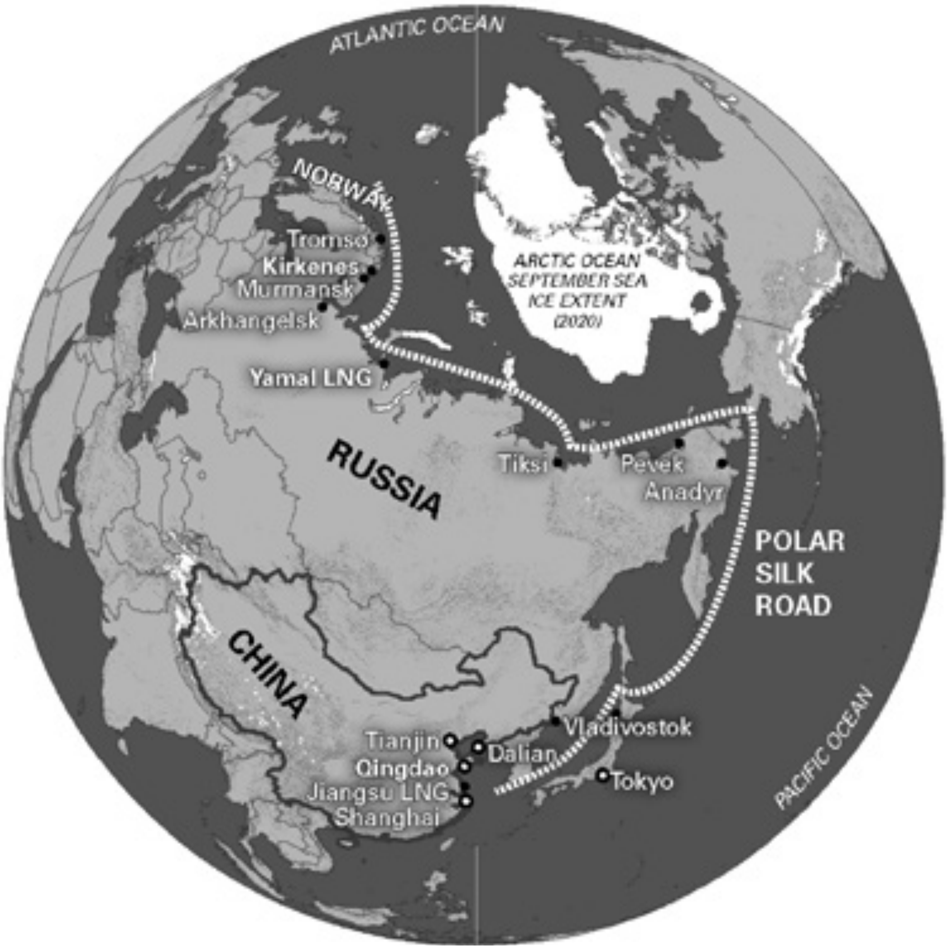

Figure 1.2. The Polar Silk Road. (Map by Dorothy Tang. Made with Natural Earth and NSIDC Sea Ice Index data. See NSIDC 2021.)

domestic black carbon emissions, this will likely increase black carbon emissions within the Arctic, exemplifying China's tendency to offshore domestic environmental hazards (Saha 2020). Ironically, however, any increase in black carbon emissions within the Arctic—particularly from year-round activities such as fossil fuel extraction—may weaken the East Asian winter monsoon and exacerbate winter haze over places like Beijing (Lou et al. 2018). In other words, air pollution may worsen over China's northeastern cities regardless of any drop in local coal combustion. At this point, the so-called Arctic paradox, in which the negative effects of polar climate change are simultaneously creating new opportunities (Finger 2016), may be extended one step further. While the climate-induced opening of new economic sectors may undermine the region's environment, it may also wreak havoc in the very countries promoting these activities, such as China.

China: Geological Agent or Victim?

China's efforts to legitimize its status as an Arctic stakeholder emphasize the feedback loops associated with the region's warming. For the Chinese state, two major implications of being a near-Arctic state are that, first, it could fall victim to Arctic climate change; and second, this risk provides both a reason and a responsibility to act—and perhaps to offer its own model for governance in a region it perceives as a "strategic new frontier" (Andersson 2021). The country's 2018 Arctic Policy states:

> The natural conditions of the Arctic and their changes have a direct impact on China's climate system and ecological environment, and, in turn, on its economic interests in agriculture, forestry, fishery, marine industry and other sectors.
>
> China is also closely involved in the trans-regional and global issues in the Arctic, especially in such areas as climate change, environment, scientific research, utilization of shipping routes, resource exploration and exploitation, security, and global governance. (State Information Office of the People's Republic of China 2018)

In just two sentences, the policy juxtaposes the impacts China faces from Arctic climate change with the country's ability to manage Arctic affairs. The phrasing also reproduces the tendency of climate change narratives to refrain from blaming any particular actor (Rudiak-Gould 2015). China's Arctic Policy draws attention to the hazards brought about by a changing physical environment instead of to the reasons they are occurring—one of which is the country's own geological actions.

At the same time, China readily draws attention to itself as a victim of climate change. China's Arctic Policy, like the state's wider discourse on climate change, focuses on the country's vulnerability rather than its culpability (Spangenberg 2014). This presumption of vulnerability is not unfounded: of the ten major coastal cities most at risk of economic losses caused by flooding due to a rise in sea levels, two, Guangzhou and Shenzhen, are in China (Hallegatte et al. 2013). Moreover, half of Shanghai could be flooded by 2100 due to a combination of sea level rise, land subsidence, and storm surges (J. Wang et al. 2012).

At various forums, including two major international conferences on Arctic development that I attended, Chinese officials have underscored the country's vulnerability to melting ice sheets and rising seas. At the annual Arctic Circle

Assembly in October 2017 in Iceland, China's Vice Foreign Minister Zhang Ming stated, "The changing natural environment and resources exploration of the Arctic have direct impacts on China's climate, environment, agriculture, shipping, trade, as well as social and economic development" (Zhang 2017). Then, at the Arctic Circle Forum in May 2019 in Shanghai, Wang Hong from the State Oceanic Administration of the Chinese Ministry of Natural Resources said, "Shanghai and a lot of other cities around the world are so closely related to the developments in the Arctic, so what is important is that we should use cooperation to override the distance" (field notes, May 10, 2019).

Both officials sidestepped the responsibility for climate change of actors within China, from individuals to private firms to state-owned iron and steel giants. Instead, they described climate risks as emanating from an unstable and unpredictable physical environment. The thawing, cracking, and fast-melting region is portrayed as out of control, even though many of these changes are directly attributable to national, and ultimately controllable, actions.

China is not unique in claiming to be a victim of climate change. Trinidad and Tobago, which has become one of the wealthiest countries in the Caribbean and Latin America thanks to a century of oil and gas production, is a smaller-scale example of a country that positions itself in the "victim slot" in climate change narratives, despite having one of the world's highest levels of CO_2 emissions per capita (Hughes 2013, 571). Both cases demonstrate how geological agency is generally cast at the planetary scale (if it is mentioned at all), while geological victimhood is scaled nationally.

Even as Chinese officials exculpate their country from responsibility for climate change, they readily promote China's willingness and capacity to influence development in regions affected by climate change and global governance of that change. Together, these narratives of victimization and intervention present the country as taking defensive rather than offensive action, making its wielding of geological agency potentially more palatable to the global community.

Such a discursive strategy may already be working in locales such as Iceland, which over the years has demonstrated a willingness to work with the Chinese government on issues ranging from energy development to scientific cooperation. The country's former president, Ólafur Ragnar Grímsson, has championed increased Asian engagement in the Arctic (Tonami 2014) as part of his efforts to broaden global participation in the region's development. In 2013, Grímsson helped initiate the aforementioned annual Arctic Circle Assembly. Spin-off events are held in various cities around the world, including Shanghai in 2019. In his speech opening the event, Grímsson stated:

> Often, as I speak in different parts of the world, I am asked, “Why is China so interested in the Arctic?” The answer is in fact very simple: the aggressive melting of the Arctic sea ice, which has been taking place with increasing pace in recent years, causes extreme weather patterns and fundamental destructions in China only a few months later. The melting of the Greenland Ice Sheet, which also has been happening faster than any scientific institution predicted in recent years, will raise sea level all over the world. And if only a quarter of the Greenland ice sheet melted, it would lead to two meters’ rise in sea level everywhere, making the great cities on the coast of China uninhabitable. And as I said to the distinguished vice mayor of Shanghai, who is with us here this morning, the security of Shanghai in the future will be determined in the Arctic. (Grímsson 2019)

Grímsson thus endows the Arctic with a level of geological agency that threatens China, while failing to mention China’s responsibility for contributing to sea level rise.

While the Chinese government is taking major steps to reduce its greenhouse gas emissions, its climate change policy is largely driven by economic rather than environmental motives (Z. Zhang 2003). Rather than devoting attention to the country’s climate change mitigation efforts, for instance, China’s Arctic Policy reflects upon the ways in which the state and Chinese enterprises might leverage new opportunities, such as developing oil and gas, shipping, fishing, and tourism.

China has become a world leader in constructing the necessary infrastructure for many of these industries as a result of technological advances achieved by its steel industry—the very sector responsible for 4–5 percent of global greenhouse gas emissions and for a nonnegligible percentage of Arctic sea ice melt, as described earlier. Ice-class vessels that can be exported to Arctic countries have thicker hulls and extra structural components that require steel welded at very high temperatures (Song and Zhang 2013). The United States, Japan, and Korea have traditionally dominated this advanced form of steel manufacturing. Yet in 2018, China’s HBIS Group, the world’s second-largest steelmaker, successfully developed the technology to manufacture polar-class steel (P. Zhang et al. 2018). This advance enables China to construct polar-class vessels, which has been a policy objective since China released its Thirteenth Five-Year Plan in 2016 (Eiterjord 2020; Compilation and Translation Bureau 2016).

For the time being, Chinese state-owned enterprises are building ice-class vessels for two main purposes: first, for domestic needs, as with the icebreaking research vessel *Xue Long 2* (China’s second icebreaker, constructed in a Shanghai shipyard and launched in 2018); and second, for export to foreign countries and companies seeking to break through melting Arctic ice for commercial purposes. In 2018, China entered the market for ice-class expedition vessels when the state-owned China Merchants Heavy Industry began building ships for cruises to the Arctic and Antarctica, with the first ship delivered to Miami-based Sunstone Ships in 2019. Also in 2018, using a design licensed by Finnish engineering company Aker Arctic, Guangzhou Shipyard International built China's first Arc7 ice-class condensate tanker, *Boris Sokolov*, to export condensate (a type of light oil) from Yamal. The vessel can travel in temperatures as low as -50°C and in ice up to 1.8 meters thick. As Chinese shipyards seek to produce more ice-class vessels for navigating the Arctic, whose black carbon emissions will undoubtedly exacerbate melting, future analyses should examine not only China as a geological agent, but also its steel and shipbuilding sectors.

China's ability to participate in Arctic development is made possible physically by the country's greenhouse gas emissions, and discursively by rhetoric that positions China as a victim of climate change. Together, these material and rhetorical actions enable China to intervene in the region and, in the words of its Arctic Policy, "create favorable conditions for mankind to better protect, develop, and govern the Arctic" (State Council Information Office of the People's Republic of China 2018). Such altruistic and universal language accords with China's repeated advocacy of a "community of common destiny" (D. Zhang 2018), both in the polar regions and worldwide. Yet this unifying lens neglects the fact that China's industries, which are well-positioned to develop the Arctic, bear particular if partial responsibility for undermining the region's ecological and geophysical processes and Indigenous Peoples' traditional ways of life, many of which are ice-dependent. The Chinese government appears ready to tackle climate change while leveraging new economic opportunities arising from it. In this sense, China is concurrently attempting to limit and exploit the effects of its geological agency. In terms of the norms and narratives it constructs and circulates, however, the Chinese state seems relatively unwilling to admit its responsibility for instigating the Anthropocene—or, more precisely, the Sinocene—in the first place.

Conclusion: The Ephemerality of Geological Agency

In tracing the specific processes responsible for the Anthropocene, social scientists have suggested terms like "Capitalocene" and "Plantationocene" (Haraway 2015; see also Carney 2021; Jason Moore 2017, 2018), drawing attention to the responsibility of capitalism, colonialism, and racism for climate change. Another more nuanced interpretation of the Anthropocene, in line with the rise of geological as opposed to strictly geopolitical politics, might be the Sinocene. Climatic and industrial shifts within China are directly and indirectly altering the Arctic's natural and built environments. Greenhouse gases originating from China's cities, steel mills, and power plants are melting sea ice, the shrunken remains of which are being smashed through by new, steel-based infrastructure built in Chinese shipyards. China is not just a geopolitical force: the rising power has become a geological agent, too. Greenhouse gas emissions from industrial sites like Chinese steel mills are melting Arctic sea ice, which in turn affects atmospheric circulation patterns that disrupt weather in Chinese cities.

At the same time, thawing sea ice helps produce new economic opportunities such as longer shipping seasons in the Arctic. While mariners have plied the Northern Sea Route for centuries, their journeys, especially in the ice-clogged eastern section leading toward Asia, have typically been confined to summer. In July 2018, the first delivery of liquefied natural gas from Yamal reached the Rudong LNG Terminal in Jiangsu Province, not far from the Shanghai shipyard where *Xue Long 2* was launched two months later. Then in January 2021, for the first time, three ice-class LNG carriers traversed the route from Yamal to East Asia without icebreaker escorts. These pioneering voyages demonstrated the increasing feasibility of year-round shipping from the gas-rich peninsula in northern Siberia to destinations to its east. The shipping route that Chinese officials refer to as the Polar Silk Road is not a discursive sleight of hand: it is a geophysical reality.

Grandiose Chinese government undertakings such as the Belt and Road Initiative and the Polar Silk Road are often criticized as "smoke and mirrors" (Russell 2018). Admittedly, Beijing's foreign policy strategies have not yet spurred the wholesale realignment of the world's infrastructural corridors. But China's domestic greenhouse gas emissions are already producing environmental changes in faraway regions, which serve as the literal groundwork on top of which China may be able to materialize its developmental visions. In the meantime, technological changes within China are enabling the country's industrial sectors to take advantage of geophysically transformed environments.

So far, despite increased commercial opportunities, the Chinese government has not managed to turn a warming polar climate entirely to its favor. Diminished Arctic sea ice is increasing the number of winter haze days in Chinese cities and affecting polar atmospheric circulation patterns, which may send more severe snowstorms and colder temperatures to the country's northern regions. The recurring observation that activities within the Arctic reconfigure the region's physical environment (Depledge 2015) is thus only half the story. Environmental and geophysical shifts in the circumpolar north affect conditions elsewhere on Earth, too.

If enough ice disappears, there could come a time, perhaps centuries from now, when China's homegrown polar-class technologies are less in demand. Rapid responses to combat or profit from climate change may accelerate shifts in the natural environment, making ambitions like the Polar Silk Road ultimately fleeting geophysical realities. As geology changes faster than ever, so too may geological politics. While humans "will remain a major geological force for many millennia, maybe millions of years, to come" (Crutzen 2006, 17), whether China remains a geological agent for very long remains to be seen.

Notes

1. An earlier, French-language version of this chapter was originally published as "De glace, de fumée et d'acier: La géo-ingénerie chinoise sur la route de la soie polaire" (Ice, smoke, and mirrors: Chinese geoengineering of the Polar Silk Road), in *Les nouvelles routes de la soie* (*The New Silk Roads*), edited by Frédéric Lasserre, E. Mottet, and B. Courmont (Québec City: Presses de l'Université de Québec, 2019) 119–140.
2. See Crutzen 2002; Steffen, Crutzen, and McNeill 2007.
3. See Davis and Todd 2017; Haraway 2015; Jason Moore 2017, 2018.
4. Chinese demand for higher-grade iron ore is driving up the price of the resource in the Arctic, which is home to many high-quality deposits. At the LKAB iron ore mine in Kiruna in northern Sweden, a manager I interviewed on August 19, 2019, remarked that the reason for the rise in prices was that "the Chinese authorities decided that Chinese people should be able to see blue sky."

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