Exploring Ice and Snow in the Cold War

Julia Herzberg, Christian Kehrt, and Franziska Torma

In 1962 the American missile and aircraft manufacturer Martin Marietta published an advertisement promoting Antarctica's first nuclear power plant. This small reactor was designed to supply power for approximately one thousand scientists at the US Antarctic Station McMurdo and support a comfortable modern lifestyle that expelled every last trace of the hostile Antarctic environment outside: "Last night in Antarctica, nuclear power lit the bulb, heated the room, fried the eggs, boiled the coffee, kept the scientific instruments running, burned the toast."[1] Small nuclear power plants for ships, submarines, or polar stations are typical components of Cold War–driven approaches to building military infrastructures in remote and often extreme environments around the globe.[2] The hubris of employing technology to overcome obstacles of ice and snow on a global scale, and becoming independent of seasonal weather and climate, is characteristic of the dominant attitude toward nature during this era. Robust military technologies, such as icebreakers, airplanes, and snowcats, as well as federal financial support for expensive expeditions enabled the massive assault on and conquest of the poles during the Cold War. The polar regions were Cold War laboratories in which it was possible to test new technologies and develop ways for scientists and soldiers to work under extreme climatic conditions.[3] Knowledge of ice and snow, and of how to technologically control these remote and hostile environments, was certainly of scientific value. However, more importantly, it was also of military and geostrategic significance.

This volume focuses on the multiple meanings, functions, and uses of cold environments and addresses the question of why ice and snow became an important topic during the Cold War. It explores questions of interest to historians of science and technology, cultural and environmental historians, and scholars in the field of Cold War studies. The time frame ranges from the prehistory of the Cold War in the 1930s to the last of the Cold War years, so as to better illustrate continuities and changes during this era. It considers cold regions as special environments that make political, cultural, scientific, and environmental processes visible in a condensed and place-bound way.

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Dramatic stories about ice and snow, melting glaciers, and vanishing and cracking ice sheets constantly feature in the news today, along with warnings about impending environmental disasters. These stories and warnings are directly related to pressing societal problems of climate change, rising sea level, and environmental destruction.[4] In his introductory essay on cryo-history, Sverker Sörlin asks what kinds of narratives and stories can be told by considering ice and snow not merely as natural but as social categories that are intrinsically linked to human society, history, and politics on a global as well as a local level. Cryo-history in this sense goes beyond the history of science and adopts a broader and culturally richer perspective by focusing on the histories of changing human-nature relations. Related stories do not only include science and scientists—for example, the development of glaciology as a modern discipline—but also cultural and anthropological narratives, local knowledge, and both regional and long-term perspectives.

Environmental histories of the Cold War are opening up a new field of research.[5] As this volume shows, many pressing questions of global importance have their roots in the Cold War.[6] But to tell new stories about global environmental issues goes beyond disciplinary and national boundaries and requires bringing together multiple, often unconnected fields and approaches, including the history of science and technology, international relations, and military and environmental history. During the Cold War the earth began to be considered from the perspective of the planet as a whole for the first time, as several recent landmark studies on global environmental history show.[7] John McNeill has pointed to the crucial role of the sciences in connecting the Cold War and the environment in complex and manifold ways.[8] Science became absolutely central to the perception of Cold War problems and offered expert solutions. At the same time, it was a placeholder in the realm of Cold War politics to secure knowledge about and provide access to environments and spaces of strategic value.

The history of the polar regions and of polar expeditions as well as the role of glaciers and cold climates is a blossoming and interdisciplinary field of research. The International Polar Years and their contribution to global knowledge production is a particular topic of interest.[9] Matthias Heymann has investigated the role of Greenland during the Cold War,[10] while the cultural geographer Mathew Farish focused on northern American Arctic landscapes in order to enable a better understanding of the people who lived there and the use made of these environments during the Cold War.[11] Yet one of the main shortcomings of current Cold War scholarship is the US-centric approach and a lack of contributions on the Soviet Union and other Eastern Bloc states, as well as on Eastern and Western Europe.[12] This situation is slowly beginning to change. We know more about ice and snow in the Soviet Union thanks to the work of scholars like Paul Josephson, John McCannon, Andy Bruno, and

Julia Lajus. However there is still much to be learned about Eastern European, Russian, and Soviet activities in the Arctic and Antarctica.[13] Knowledge of ice and snow not only emerged among the superpowers, in the United States and the Soviet Union, but also in Switzerland, Bouvet Island, and the Kazakhstan mountains. These multipolar sites of knowledge and associated transnational knowledge flows challenge geographies of the Iron Curtain.[14] Sverker Sörlin's focus on Hans Ahlmann as an actor who bridged the East-West divide is revealing.[15] Further work on the international expeditions, institutions, and networks that emerged after World War II is necessary, as well as studies on the activities of countries like India, China, Chile, Malaysia, and South Africa in the polar regions. But there is also a surprising lack of studies of European countries such as Switzerland, Austria, France, or East and West Germany, which have long histories of scientific interest in ice and snow, whether with regard to alpine or polar regions, especially in the period after World War II.

The Polar Regions as Sites of Knowledge

In 1950–51 the French geographer Jean Malaurie witnessed the construction of a large US air base at Thule in northwestern Greenland.[16] In the tradition of Knud Rasmussen's Thule Expeditions, Malaurie studied and collected geographic, social, and demographic data of the world's "most northerly inhabitants" at a time when these Arctic cultures and landscapes were drawn into the middle of Cold War conflicts.[17] Malaurie critically described the encounter of these archaic hunter cultures with the modern lifestyle and technology of the US military as a cultural shock that threw these "harpoon men into the atomic age."[18] The US military relocated the inhabitants of Thule further north and, in the course of Operation Blue Jay, transformed the site of the former settlement Pituffik into a hypermodern $800 million station, with cinema, radio telecommunication, radar, and a three-kilometer-long landing strip for the bombers and reconnaissance planes that flew from Thule straight into the heart of Soviet Russia. As the aviator and polar explorer Bernt Balchen wrote in a memorandum for the US Air Force, the topography of Thule was favorable from a military perspective.[19] It had a natural harbor and was accessible by icebreaker; there was an area mostly free of permafrost that was suited for the construction of a landing strip. Thule is close to the Greenland inland ice sheet and was the starting point for several expeditions and camps that used the location as a site for testing the construction of military infrastructures and acquiring new knowledge of ice and snow in order to live, fight, and build in these environments. Within a short time the US Army Corps of Engineers transformed Thule into one of the biggest strategically important air bases. As Nikolaj Petersen has pointed out, "the construction of the Thule base in

1951–1952 signaled the beginning of the polar strategy."[20] Thule became an important node in the global front lines of the Cold War; its central location between the United States and the Soviet Union made the Arctic highly appealing to US military experts, who hoped to control the vast spaces of the Arctic by integrating it into their air force network.[21] World War II had already demonstrated the strategic importance of the Arctic with its Northern Sea Route and weather data. Its military significance increased during the Cold War and necessitated the massive exploration of Arctic spaces.[22] US plans for the Arctic culminated in a futuristic Cold War fantasy of creating a gigantic secret missile base underneath the Greenland ice sheet that could target sites in the Soviet Union.[23]

While the United States treated Greenland as an empty space to be controlled by modern technology, especially radar stations and airfields, in fact it was neither empty nor uninhabited: there were local Inuit hunter cultures close by, members of which had regular contact with the US military. In her anthropological case study on Inuit responses to and experiences and memories of Arctic militarization in Greenland, Sophie Elixhauser shows that the US military presence had a long-term effect on the lifestyles, memories, and cultures of local Inuit in the Ammassalik region in eastern Greenland. Contact and the exchange of expert knowledge between local cultures and the military are highly complex and have only recently come to the fore in postcolonial, cultural, and anthropological studies.[24]

Knowledge of Ice and Snow

Glaciology as a modern scientific discipline and the systematic investigation of glaciers (for example, using photogrammetric methods) dates back to the late nineteenth and early twentieth centuries.[25] Glaciologists systematically investigated the structures and transformations of ice and snow and their layers, density, volume, and age in both Alpine environments and the polar regions, gaining new insights into earth history, weather patterns, ocean currents, and ice ages. The discipline was also applied to solving more practical problems of avalanche protection and the construction of houses, weather stations, roads, and airstrips in icy regions. As early as 1912–13, the German scientist Alfred Wegener was already pursuing glaciological questions during his second Greenland expedition with the Dane Johann Peter Koch, where they studied snow and firn accumulation in pits. Wegener's interest in Greenland's ice sheet culminated in his 1930–31 Greenland expedition, during which he hoped to gain insight into weather and climate conditions and the dynamics of the inland ice, as well as the laws of snow and firn formation.[26]

Systematic scientific knowledge about ice and snow was developed during the interwar period, with Switzerland at the forefront of efforts to better understand the nature and causes of snow avalanches. This is highlighted by Dania Achermann's chapter on the institutionalization of snow and avalanche research. The Swiss example is revealing because it can help to understand continuities and changes from the interwar period to the Cold War, as well as forms of knowledge transfer and circulation across national and regional borders. Swiss expertise in glaciology is rooted in avalanche research and precaution in the Swiss Alps. In the interwar period the first ice and snow laboratories were established, and new methods were developed to systematically collect scientific data regarding ice and snow behavior, density, layers, and formation. The Swiss scientist Henri Bader drew on his expertise in crystallography in the standard book *Der Schnee und seine Metamorphose,* published in 1939 (the English translation, *Snow and Its Metamorphism*, was commissioned by the US government in 1954).[27] The goal was to better understand the formation of snow avalanches in Alpine contexts. The new discipline combined laboratory methods with field science approaches in order to gain insight into the nature of ice and snow, a fragile subject of study that quickly lost its defining characteristics if transferred to a traditional laboratory. Thus special ice and snow laboratories with controlled conditions to directly observe ice and snow formation were necessary. It is also relevant in the Swiss case that international cooperation was limited by national concerns, especially during World War II.

In contrast to the Soviet Union and many European countries, the United States had little scientific experience of polar exploration and needed new knowledge in order to build military infrastructures, defense lines, air bases, and radar and weather stations in extremely hostile environments.[28] In World War II the US Air Force depended on the know-how of experienced European polar explorers for teaching pilots survival skills in Arctic environments. The science of glaciology only began to be fostered in the United States as a consequence of the new Cold War–driven interest in the polar regions. The earth sciences and geophysics blossomed all over the world in the Cold War, especially during the International Geophysical Year (IGY) 1957–58. In view of the flourishing of this research field, one scholar asks, "How was it that, for all the earth science disciplines, the postwar decades were probably the most productive periods in their histories?"[29] The answer to this question, at least from a Cold War perspective, is clear: geophysical data were necessary for atomic warfare involving intercontinental ballistic missiles, U-boats, and heavy bombers.[30]

As Janet Martin-Nielsen shows in her article on Henri Bader, the United States was driven by military concerns during the Cold War. The US Army, and its Snow, Ice and Permafrost Research Establishment (SIPRE) in partic-

ular, pushed ice and snow studies. SIPRE was founded in 1949 and directed by Bader himself. To obtain systematic, regular data beyond that collected during expeditions, a permanent station had to be erected and, if possible, integrated into an expanding network of weather stations around the globe. The Soviet drift station, for example, made it possible to study ice and the changing weather and water conditions over an extended period of time.

While the study of ice and snow gives basic insight into climate patterns and the role of polar ice sheets in climate history, Janet Martin-Nielsen shows that US endeavors were mainly driven by an engineering approach. Ice and snow had to be controlled in order to build airfields, military infrastructures, and radar and weather stations. Indeed, building military infrastructures around the globe in remote but strategically important extreme and hostile environments was a characteristic feature of the Cold War. This engineering approach is also emphasized in Ingo Heidbrink's study of ice and snow as construction materials in Greenland, which looks more closely at the Camp Century site erected by the US Army Corps of Engineers in 1959. Like in McMurdo, a small nuclear reactor was temporarily established at Camp Century and publicly promoted. A further shared characteristic was the lack of knowledge exchange with local people. For Heidbrink it is characteristic of the United States to treat these areas as if they were *terra nullius,* unclaimed land in which the military could do as they wished. The behavior of the natural environment was also largely ignored; technological control of the environment did not take into account the powerful ice sheet dynamics that ultimately destroyed Camp Century.

The Politics of Cooperation and Confrontation

Scientific cooperation and the exchange of data and ideas, as well as the transfer of methods, instruments, technological artefacts, and scientists across national borders, are characteristic of polar exploration, although the results are often interpreted as mere national achievements.[31] As John Krige has pointed out, the process of establishing US hegemony during the Cold War was largely dependent on transnational knowledge flows that secured hegemony via open knowledge and cooperation.[32] In this context the questions that remain to be answered are how different nations within the Eastern and Western Blocs profited or suffered from their cooperation with the Cold War superpowers and whether flows of knowledge across the Iron Curtain were possible. During the Cold War scientists organized international committees and unions such as SCAR, the Scientific Committee on Antarctic Research founded in 1958, in order to continue the international research conducted in Antarctica during the International Geophysical Year 1957–58.[33] Sixty-seven nations around the globe had pursued earth science investigations into the planet during the In-

ternational Geophysical Year. The IGY enhanced scientific cooperation across national and ideological boundaries and provided insight into global weather and climate patterns, ocean currents, and snow and ice covers. But such global geophysical data were also of immense strategic value.

From a political perspective, the exploration of Antarctica has a strong resemblance to the space race during this period. Both shed new light on the geostrategic dimension of these realms. Roger Launius shows that the Antarctic Treaty (1959), like the Outer Space Treaty (1967), has to be understood in the context of Cold War rivalries and emphasizes the political role of science in the appropriation of spaces that were outside national borders and territories. Both treaties are landmarks not only in the history of international relations and the governance of global commons but also in the history of the Cold War. Both treaties established a regime that is based on peaceful international scientific cooperation and nuclear-free zones during the height of the early Cold War. At the same time, these achievements came in the midst of a growing nuclear arms race; Antarctica was also appealing as a possible nuclear test site, and its oceans and ice caps were considered as sites for storing nuclear waste.

A study of a single site over an extended period of time can illustrate the variety of geopolitical interests struggling for control over the polar regions. Peder Roberts and Lize-Marié van der Watt trace the history of Bouvet Island in the Southern Ocean. During the interwar period it was a Norwegian whaling station, although the United Kingdom attempted to contest the Norwegian claim to the island. In the 1950s South Africa, which later took part in the IGY and was a founding member of the Antarctic Treaty System (ATS), became interested in Bouvet Island and tried to cooperate with Norway to construct a weather station in the context of what was to become the IGY network. While these actors were not at the center of Cold War conflict, the island was also of geostrategic relevance for the Soviet Union; at this early stage the Soviet interest in Antarctica was covert and not part of the early IGY plans and negotiations.

However, the significance of ice and snow during the Cold War was not limited to the polar regions. Just as in the Swiss Alps, problems resulting from avalanches and the needs of a growing tourist industry motivated the development of high-risk areas in both Western nations and in the Soviet Union and its satellite states. The example of the Kazakhstan mountains is typical of a self-confident approach to nature. Here, the Soviet state was not interested in military infrastructure, but rather the high modern development of a mountain region for tourism and the prestigious Winter Olympics. Glaciological knowledge and avalanche prevention were considered key to developing these regions in Central Asia under Soviet rule. As Marc Elie shows, nature was conquered and tamed by modern science and technology, exposing the expanding cities in cold regions to severe risks and environmental destruction.

Cultures and Narratives of Ice and Snow

The laboratory is a recurring trope in narratives of ice, snow, and cold regions.[34] On the one hand, scientific study of the polar regions was informed by modern laboratory methods for collecting data—for example, measuring oxygen isotopes or even radioactive fallout to date the age of ice cores and snow layers. On the other hand, the laboratory metaphor also has a broader political dimension, insofar as scientific expeditions have to be considered in the context of geostrategic conflicts and interests that were channeled and realized by and through the sciences and scientists.[35] Sebastian Vincent Grevsmühl shows that Antarctica with its peculiar physical features was perceived as "the largest laboratory in the world" and a unique site for researchers in many disciplines. Field sciences like geology, meteorology, and glaciology merged with the laboratory sciences and with cultural narratives: the polar regions were considered to be a "natural laboratory" with "pure" environmental conditions untouched by humans for thousands of years.[36] In addition, Antarctica was used as a laboratory for mimicking the conditions of space exploration. The medical and psychological effects on astronauts in outer space could be tested and compared with the experiences of scientists who overwintered in Antarctica.

Stories about ice and snow can also be told in a broader cultural and transnational framework, as Carolin F. Roeder and Gregory Afinogenov show in their contribution about the Soviet yeti craze. During its peak in the late 1950s, the craze had become an international cultural phenomenon at the intersection of public media and fringe, amateur and pseudoscience. While the yeti was a transnational phenomenon, the Soviet approach was distinctive because of the way it brought lay audiences and amateurs together with members of the Academy of the Sciences. The yeti fad can be compared to the space travel craze during the same period. Science became more popular and received increasing levels of state support and media coverage. After a while, the Soviet science establishment distanced itself from the phenomenon; the re-emergence of interest in the yeti in the late 1980s can be seen in the context of a growing public interest in occult phenomena.

Ekaterina Emeliantseva Koller focuses on the closed city of Molotovsk-Severodvinsk, an important production site for nuclear submarines in the Soviet Union. She shows how people in the Brezhnev era took the harsh climate in their stride as a source of symbolic capital and as a central component of community cohesion and self-identification. Narratives about the cold became a central element in the city's foundation myth, which took up Stalinist narratives about heroic Soviet citizens' conquest of nature in the Arctic. Authorities and inhabitants used the cold to legitimize and receive bonuses and higher

wages. They successfully established the image of Molotovsk-Severodvinsk as a unique "Far North" area, even though the climatic conditions were not exceptional when compared to settlements in the surrounding area.

As Pascal Schilling's contribution on the transpolar expedition of Reinhold Messner and Arved Fuchs demonstrates, perceptions of the polar region changed during the 1970s and 1980s. While Messner and Fuchs inscribed their polar expedition into the stories and heroic myths of polar exploration in the late nineteenth century, they explicitly rejected and denied the technologies and approaches of the Cold War. Instead, Messner and Fuchs understood their trans-Antarctic trip as an exploration of the self and a personal, even spiritual, experience of nature, self, and body. While profiting from satellite communication and lucrative as well as extensive media coverage of their voyage, they rejected the modern science, technology, and military approaches that were developed during the Cold War period. They did not want to enter the US south polar station and enjoy the comforts of modern life. Instead they underlined environmental concerns and a new awareness that is typical for the 1970s and 1980s, when new actors entered the polar regions and questioned the established scientific and political actors that had hitherto shaped Antarctic politics. The expedition coincided with the de facto end of the Cold War: the fall of the Berlin Wall. In this period further new actors and environmental interests, and a new perception of wilderness and global environmental concerns, came to the fore. These concerns were expressed not only by scientists but also by new interest groups such as Greenpeace, who campaigned for making Antarctica a nature reserve—a world park—and criticized not only military, touristic, and technological approaches, but also the erection of scientific research stations.

The thematic and methodological scope of this volume extends beyond the common narratives of Cold War histories that consider the era mainly in terms of political confrontation between power centers. The contributions can be read as a narrative of adaption to cold environments in everyday lives and practices. The technologies (e.g., avalanche research, climate and weather observation) that were tested and developed in the polar regions changed the meaning and the nature of ice and snow in a general sense. Transport technologies and new ways of coping with the cold transformed local and global geographies and polar environments. From the Western point of view, faraway places (e.g., Greenland, Antarctica, the Artic) became part of everyday lives as a result of the practices dealing with these conditions, but also as a result of narratives about coping with these extreme environments and the popular images of polar travel and the "conquest" of ice and snow. Common histories of the Cold War are often narrated from a state perspective or scrutinized through the lens of international politics. By focusing on questions of how the

exploration of ice and snow made icy peripheries centers of action, we focus on moments of exchange between local cultures, modern science, and Eastern and Western societies, as well as the people involved. The agents of our stories include the people who dealt and are dealing with extreme environments, be it the scientist from the Western or Eastern Bloc or the people who lived in these environments. From their perspectives, it is possible to appreciate how trajectories of knowledge gain momentum: examples of adaption show not only how science changed everyday lives in the context of local cultures, but also how (modern) scientists learned techniques of dealing with the cold from people who possessed genuine, and often tacit, local knowledge. A good example here is Alfred Wegener's Greenland experience. Wegner relied on indigenous knowledge of traveling and surviving in extreme environments and at the same time tried to introduce new means of transportation and communication that then shaped the Cold War period.

In this sense, modern approaches can be integrated into and compared with *longue durée* developments and older habits and ways of dealing with the cold. This sheds light on three major phases of human encounter with the cold; during the eighteenth and nineteenth centuries, the exploration of cold environments had empire- and nation-building functions. In tsarist Russia, for example, the scientific exploration of frost, ice, and snow became a means of integrating distant regions into the empire and carrying science, European morals, and the ideas of the Enlightenment to the peripheries of the realm. Its attempt to tame the cold through the sciences was also an attempt to present itself as a European state. In the Soviet Union of the 1930s, the exploration and appropriation of the Arctic delivered a message to its own people. The Soviet government used events like the rescue of the *Chelyuskin* crew in 1934 or the flight over the North Pole in 1937 as a tool to create an Arctic myth; this myth was supposed to unite a country that was terribly distressed by Stalinist terror and collectivization. The Arctic environments, which were closely connected to heroic tales of man versus cold nature, shaped identities within the communities that undertook these endeavors. The 1950s, however, threw light on a new emerging era, the third period at the heart of this volume. New technologies and the military turned the polar regions into sites of strategic concern and intense scientific research. They were Cold War environments in which new knowledge emerged and new forms of political cooperation and conflict were practiced and negotiated. The IGY and the modeling of the earth as a system led to the integration of polar environments into the globe as a whole, and the Antarctic Treaty System from 1959 defined Antarctica as a peaceful place without atomic weapons. The perception of the Arctic and of Antarctica as both being part of the global commons is central to this third phase and is based on the legacies, imaginaries, and knowledge that resulted from the Cold War years. Today these places are certainly still of military and geopolitical

significance, but they are also places where new histories of cold and extreme environments emerge.

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24. Julie Cruikshank, *Do Glaciers Listen? Local Knowledge, Colonial Encounters, and Social Imagination* (Vancouver: UBC Press, 2005); Mark Carey, *In the Shadow of Melting Glaciers: Climate Change and Andean Society* (New York: Oxford University Press, 2010).
25. See, for example, the photogrammetric work of Sebastian Finsterwalder (1862–1951) in the Bavarian and Austrian Alps. Finsterwalder was a professor of mathematics at the Technical University of Munich and crucial to the long-term measurement and monitoring, from 1889 to the present, of the Vernagtferner (Ötztal region) as a model glacier. See Kurt Brunner, "Die Karte 'Der Vernagt-Ferner im Jahre 1889' als erste exakte Kartierung eines Gesamtgletschers," *Zeitschrift für Gletscherkunde und Glazialgeologie* 29, no. 1 (1993).
26. Janet Martin-Nielsen, *Eismitte in the Scientific Imagination: Knowledge and Politics at the Center of Greenland* (New York: Palgrave Macmillan, 2013); Christian Kehrt, "The Wegener Diaries: Scientific Expeditions into the Eternal Ice," Environment & Society Portal digital exhibition (Munich: Rachel Carson Center for Environment and Society, 2013).

27. Henri Bader, *Der Schnee und seine Metamorphose: Erste Ergebnisse und Anwendungen; Systematische Untersuchung der alpinen Winterschneedecke* (Bern: Kümmerly & Frey, 1939).
28. See Ingo Heidbrink's contribution to this volume.
29. John Cloud, "Introduction: Special Guest-Edited Issue on the Earth Sciences in the Cold War," *Social Studies of Science* 33, no. 5 (October 2003): 629.
30. Ronald E. Doel, "Constituting the Postwar Earth Sciences: The Military's Influence on the Environmental Sciences in the USA after 1945," *Social Studies of Science* 33, no. 5 (October 2003).
31. See Pascal Schillings, "First at the South Pole: The Production of Geographical 'Matters of Fact' during the Norwegian Antarctic Expedition, 1910–12," *Historical Social Research* 40, no. 1 (2015); *Die letzten weißen Flecken: Europäische Antarktisreisen um 1900.* Göttingen: Wallstein Verlag, 2017.
32. John Krige, *American Hegemony and the Postwar Reconstruction of Science in Europe (Transformations)* (Cambridge, MA: MIT Press, 2008).
33. Sidney Chapman, ed., *The Histories of the International Polar Years and the Inception the Development of the International Geophysical Year,* Annals of the International Geophysical Year (New York: Pergamon Press, 1959); Launius, Fleming, and DeVorkin, *Globalizing Polar Science*; Barr and Lüdecke, eds., *The History of the International Polar Years (IPYs).*
34. For an understanding of the laboratory metaphor as a reconfiguration of social and natural order, see Karin Knorr-Cetina, *Wissenskulturen: Ein Vergleich naturwissenschaftlicher Wissensformen* (Frankfurt am Main: Suhrkamp, 1999), 45–73; Bruno Latour, *Science in Action: How to Follow Scientists and Engineers through Society* (Cambridge, MA: Harvard University Press, 1987). In the context of alpine expeditions and mountaineering, see Philipp Felsch, *Laborlandschaften: Physiologische Alpenreisen im 19. Jahrhundert* (Göttingen: Wallstein, 2007), 7; Charlotte Bigg, David Aubin, and Philipp Felsch, "Introduction: The Laboratory of Nature—Science in the Mountains," *Science in Context* 22, no. 3 (September 2009); see also Christian Kehrt, "Grönland im Kalten Krieg," *Technikgeschichte* 80, no. 3 (2013): 248.
35. Aant Elzinga, "Antarctica: The Construction of a Continent by and for Science," in *Denationalizing Science,* ed. E. Crawford (Dordrecht: Kluwer, 1993).
36. Kristian H. Nielsen, Michael Harbsmeier, and Christopher J. Ries, eds., *Scientists and Scholars in the Field: Studies in the History of Fieldwork and Expeditions* (Aarhus: Aarhus University Press, 2012).

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