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THE GREENLAND GOLD RUSH

Promise and Pitfalls of Greenland's Energy and Mineral Resources

TIM BOERSMA AND KEVIN FOLEY

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Contact for the John L. Thornton China Center:

Ryan L. McElveen
Assistant Director
(202) 797-6281
rmcelveen@brookings.edu

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Contact for the Energy Security Initiative:

Jennifer Potvin
Project Assistant
(202) 797-4389
jpotvin@brookings.edu

About the Authors

Tim Boersma is a fellow in the Energy Security Initiative at the Brookings Institution. His research focuses on energy policy coordination, energy security, gas infrastructure and regulation, resource scarcity, and unconventional natural gas extraction. He holds a Ph.D. in international relations from the University of Groningen. In 2011–2012, he was a Transatlantic Academy fellow in Washington, D.C. Before starting his career in research, Tim spent five years in the private sector, working as a corporate counsel to the electricity production sector in the Netherlands. Tim is currently finishing a monograph with Philip Andrews-Speed, Raimund Bleischwitz, Corey Johnson, Geoffrey Kemp, and Stacy D. VanDeveer called *Want, Waste, or War? The Global Resource Nexus and the Struggle for Land, Energy, Food, Water, and Minerals,* to be published by Routledge in November 2014. In addition, he is working on his manuscript entitled "Energy Security and Natural Gas Markets in Europe: Lessons from the EU and the United States" which is scheduled to be published in the series *Routledge Studies in Energy Policy* in June 2015.

Kevin Foley is a doctoral student in the Department of Government at Cornell University, where his research focuses on comparative politics and international political economy. At the time this report was researched and written, he was associate director of the John L. Thornton China Center at the Brookings Institution. Prior to joining Brookings he was managing editor, Asia for research and intelligence firm OTR Global LLC, where he covered the energy and mining industries. Before that he worked in Beijing for Caijing Magazine and the Cheung Kong Graduate School of Business where he researched Chinese corporate strategy and industrial policy. Kevin is fluent in Mandarin Chinese and holds an M.A. from the Johns Hopkins University School of International Studies (SAIS).

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Acronyms and Abbreviations

BP	British Petroleum
DCE	Danish Center for Environment and Energy
DKK	Danish Krone
EC	European Commission
EEC	European Economic Community
EIA	Environmental impact assessment
EIPs	European Innovation Partnerships
EITI	Extractive Industries Transparency Initiative
EPC	Engineering, procurement, and construction
EU	European Union
GDP	Gross domestic product
GEUS	Geological Survey of Denmark and Greenland
GINR	Greenland Institute of Natural Resources
GME	Greenland Minerals and Energy
GNR	Global Response Network
GOSR	Greenland Oil Spill Response A/S
GSG	GeoSurvey Greenland
IA	Inuit Ataqatigiit
IAEA	International Atomic Energy Agency
IBA	Impact and Benefit Agreement
ILO	International Labor Organization
MOU	Memorandum of Understanding
MW	Megawatt
NATO	North Atlantic Treaty Organization
NDRC	Natural Development and Reform Commission (China)
NFC	China Nonferrous Metal Industry's Foreign Engineering and Construction Co., Ltd.
NGO	Non-governmental organization
OCTs	Overseas Countries and Territories (EU)
OECD	Organization for Economic Co-operation and Development
PDSD	Programming Document for the Sustainable Development of Greenland
REE	Rare earth element
RGTD	Royal Greenland Trade Department
TTIP	Transatlantic Trade and Investment Partnership
UNCTAD	United Nations Conference on Trade and Development
USGS	U.S. Geological Survey
VSAT	Very small aperture terminal
WNA	World Nuclear Association
WTO	World Trade Organization

Executive Summary

This report targets three audiences. For foreign policy officials in Washington, D.C., there is growing interest in matters related to the Arctic region as the United States prepares to assume the chairmanship of the Arctic Council in 2015. For those in the United States who are not familiar with recent developments in Greenland, this report aims to provide a broad overview of the background to Greenland's self-rule government and some details on the history of Greenland's connection to Denmark. The report is also intended to be a resource for those in Greenland and Denmark who are engaged in ongoing debates about the strategic implications of Greenland's efforts to mine (amongst others) uranium and rare earth elements and about what many see as an emerging relationship with China. Finally, the report discusses Greenland in the context of its current and potential relationship to Europe, particularly as an alternative supplier of critical raw materials.

SELF-RULE IN GREENLAND

Greenland's citizens voted for a new system of self-rule government that took effect in June 2009, and it must now find a way to pay for the costs of its government. Under the previous Home Rule system, a block grant was negotiated with Denmark each year that covered the cost of activities for which Greenland had authority and the grant increased as Greenland's social welfare obligations and other costs went up. The block grant is now frozen at real 2009 levels, and Greenland faces steadily increasing social welfare costs as the population ages over the next two decades. Both major parties in Greenland hope to address this anticipated shortfall with revenue from oil and minerals exploitation.

Mining projects have been an important part of Greenland's economy since the 19th century. Cryolite, a raw material once critical to the aluminum smelting process that was produced only in Greenland, was mined until the resource was depleted in 1987. The costs of exploration and extraction of other resources in Greenland are high due to the harsh environment and the lack of infrastructure, both of which are deterrents to investment. Like other areas on the frontiers of resource extraction, successful development of major projects in Greenland depends largely on international commodities prices.

The first years of Greenland's self-rule government (2009 to mid-2011) coincided with stratospheric prices for raw materials such as iron ore, copper, zinc, and rare earth elements. These prices were driven by global demand—in particular, by surging demand from China driven by heavy Chinese infrastructure spending from economic stimulus programs in the wake of the global financial crisis. Prices have now receded for most commodities, and although Greenland's economic development strategy still depends on the development of a mining industry, **it now seems less certain that the country will be able to get projects off the ground on the ambitious schedule that it announced in 2014 in its oil and minerals strategy**. Nevertheless, Greenland is taking significant steps to promote itself as a destination for the mining industry, and it is our impression that **large mining projects will eventually be developed.**

The story is similar with offshore oil, although the chances of commercial oil production in the next few years appear to be nonexistent. Exploration costs for offshore oil in this part of the world are very significant, amounting to roughly $100 million for a single exploration well under the most favorable conditions, and the harsh conditions pose a challenge with currently available technology. Although global warming is making Arctic waters more accessible, icebergs remain a potential hazard and exploration is still limited to a few months in the summer when daylight hours and temperatures are suitable. Based on our analysis and our conversations within the industry, we find **that it could be decades before commercial oil production in Greenland takes place.**

POLITICS, POLICY, AND REGULATION

Investment in mineral and energy resources depends on a stable policy environment. There have been some complaints from the mining industry regarding the pace of Greenland's licensing process and about the transparency with which policies are set. But we did not find this to be a problem from a policy perspective. Rather, we found that **Greenland's authorities have been appropriately cautious in their efforts to develop an effective regulatory and policy framework to manage extraction projects**. At the same time, we acknowledge that the government—like any of its counterparts around the world—is walking a fine line between establishing the safeguards necessary to protect the environment and creating an attractive investment climate. The reality is that the government of Greenland is small and faces serious administrative bottlenecks when dealing with large, complex projects. A recent (and controversial) proposal by the government to relax transparency standards reflects the challenge the government faces in managing large and technically complex projects while reporting in three languages to the public and the industry. At the same time, NGOs have expressed concerns about the lack of transparency on a number of other occasions.

GREENLAND'S RESOURCE ENDOWMENT

For the parts of the country that have been properly explored, Greenland does indeed have a rich resource base consisting of a variety of minerals as well as promising potential for offshore oil, both to the east and the the west of the country. Greenland has excellent potential for iron ore, copper, zinc, gold, uranium, and light and heavy rare earth elements. For areas that have not been explored, most estimates about resource potential are based on knowledge of shared geology with other areas, such as northern Canada and Norway, where resources have already been identified. As the larger part of the island has not been explored in any detail, it may well be that in the years ahead significant additional resource findings occur.

CHINA AND GREENLAND

Although some commentators and government officials have raised questions about China's strategic intentions in Greenland, a case-by-case review of Chinese interests in Greenland finds that the dominant narrative about China and Greenland is misleading. On the contrary, we find that Chinese companies have demonstrated little interest to date in projects in Greenland, despite substantial efforts to attract Chinese investment. This does not mean that these efforts have been misplaced—we conclude that seeking investment from Chinese firms is logical given the emergence over the last decade of Chinese mining and oil companies as major players in global resource investments. This is particularly true in the world of mining, where few major international mining companies are currently making investments in new projects. In this environment, Chinese firms stand out as at least slightly more likely than the rest of the industry to invest in new mines.

GREENLAND AND EUROPEAN CRITICAL RAW MATERIALS STRATEGY

Greenland features prominently in European plans to diversify its raw materials suppliers. Yet, it is too early to tell how successful these attempts have been or how much impact Greenland might have on European raw material supplies if or when mining projects become a reality. Historically, Europe has been closely associated with Greenland, as can be seen by the European Community's longstanding support for Greenland's fishing industry. In the spring of 2014, a new partnership agreement between Greenland and the EU aspires to build stronger ties in mineral and energy resources and climate change, and also includes funding commitments for education in Greenland. The details about Europe's role in Greenland's resource development are currently being debated, yet it is important to keep in mind that the EU mandate on this issue is limited, and private-sector and national-level policymakers play a more important role. Concerns about China locking in natural resources feature prominently in European

discussions about raw materials security, and here we find that European concerns (which are shared in the United States and Japan) are exaggerated. Commentators in China have argued since at least 2008 that China should tighten its limits on rare earth exports, and when China made steps in early 2009 to restructure its rare earth industry, it did so with an eye to slowing exports.[1] But contrary to what was widely reported at the time, we found no evidence that China halted exports of rare earths to Japan in response to a maritime dispute. China's ability to limit exports has been severely constrained by aggressive illegal mining of rare earths, which has kept supply of rare earth elements high in China. In fact, rare earth prices have steadily declined since 2011, and there are many new projects in the pipeline to mine rare earths outside of China. Chinese dominance in rare earth elements has little if anything to do with physical resources, but rather with processing capacity and knowledge. At this point, EU policies and actions do not give the impression that the supply chain for rare earth elements will be built up on the continent, and so even if Greenland were to extract these resources, processing would largely (if not entirely) take place outside Europe. In the United States, efforts are underway to revitalize its processing industry, though opinions differ as to whether the U.S. will be able to make this sector profitable without significant government support, as the Chinese have developed an impressive knowledge base and can operate very competitively. Thus, it is our impression that the Chinese will continue to play a prominent role in rare earth elements, yet that many of the concerns about Chinese interests in rare earth elements are overblown. U.S. and European resource policies should be evaluated accordingly.

[1] For an early (Chinese language) example of arguments to reduce rare earth exports on strategic grounds, see Jia Huaidong, "Duozhong Zhanlue Zonghe Zhili— Bahao Xitu Ziyuan Guomen," *Xitu Xinxi,* 2008.7, 22-23. The first major report claiming China was restricting rare earth exports to Japan in response maritime disputes was Keith Bradsher, "Amid Tension, China Blocks Vital Export to Japan," *The New York Times*, 22 September 2010. For a detailed overview of China's rare earth export and production quotas before 2010, see Jane Korinek and Jeonghoi Kim, "Export Restrictions on Strategic Raw Materials and their Impact on Trade and Global Supply," OECD Trade Policy Working Paper, no. 95, 29 March 2010. See also Amy King and Shiro Armstrong, "Did China really ban rare earth metals exports to Japan?" 18 August 2013, www.eastasiaforum.org/2013/08/18/did-china-really-ban-rare-earth-metals-exports-to-japan/.

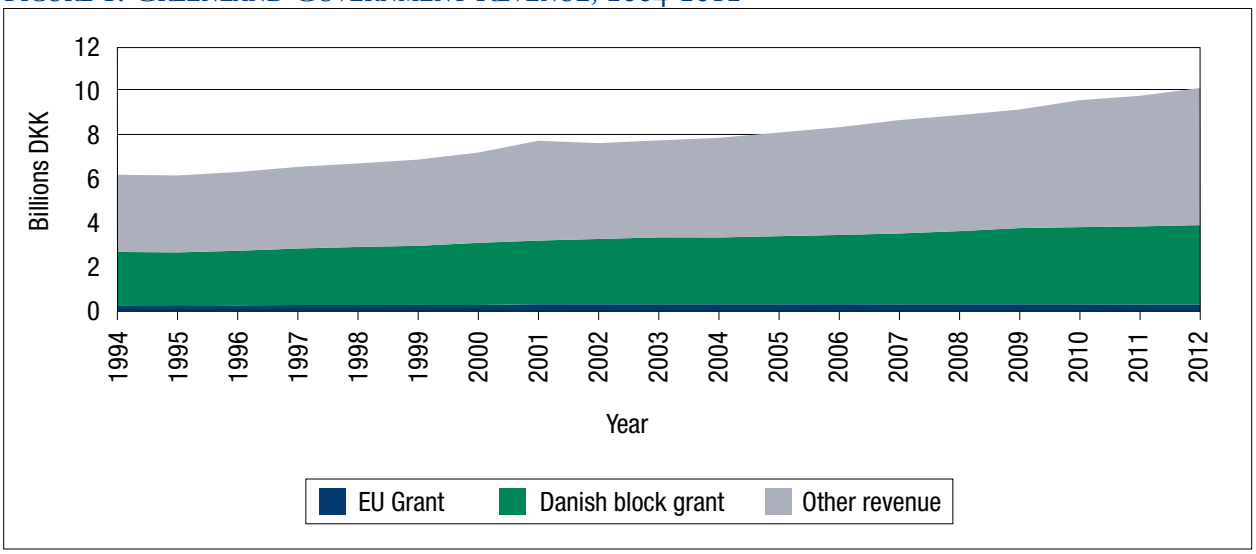
The town of Ilulissat (formally known as Jakobshavn) on the west coast of Greenland and overlooking Disko Bay.
Photo credit: © iStockphoto/oversnap (Dan Kite)

Introduction

In 2008, Greenland took an important step in its long movement towards political autonomy, a process that many people in Greenland hope will lead to eventual political independence from Denmark. On November 25, 2008, 75 percent of Greenlanders voted in support of a proposal submitted by the Greenlandic-Danish Self-Rule Commission for a more autonomous system of government for Greenland. The Self-Government Act came into force in June 2009, transferring legislative and executive authority to the Greenlandic parliament and government in most areas, while Denmark retains constitutional authority over foreign affairs, defense, and monetary policy. As part of the agreement, the annual block grant from Denmark providing over half of Greenland's government revenue was frozen at real 2009 levels. Greenland's costs are expected to continue to increase as its population ages and high unemployment drives many younger people to leave Greenland for Denmark.

The government of Greenland plans to cover this projected revenue shortfall, and ultimately even replace the Danish block grant, with revenue from mining and offshore oil. Mineral resources and oil are Greenland's best option to earn the revenue it needs to sustain its economy, but it is hard to know if mining projects will materialize soon enough. Greenland has seen small-scale mining in the past for cryolite, once a key raw material in the aluminum smelting process that was found only in Greenland and was mined until 1987.[2] Previous administrations

Figure 1: Greenland Government Revenue, 2004-2012



Source: Statistics Greenland

[2] Axel Kjær Sørensen, "Denmark-Greenland in the Twentieth Century," *Monographs on Greenland, Man and Society* vol. 34, (Copenhagen: Museum Tusculanum Press, 2007), www.mtp.hum.ku.dk/details.asp?eln=202835.

have also encouraged mining, but the resources that were identified were never developed due to technical and environmental challenges and, more fundamentally, falling mineral prices that rendered projects in Greenland too expensive. Greenland's economy today relies almost exclusively on seafood exports and the Danish block grant.

Only in recent years have exploration activities resumed as a result of global warming opening up parts of the Arctic, including areas in Greenland, along with dramatic increases in raw material demand and mineral prices in the mid-2000s. Many potential projects have been identified by entrepreneurial geologists, some of which are now ready for the next stage in the development of a mine. For minerals such as iron ore, this requires huge injections of capital, typically from an international mining conglomerate.

Greenland's new authority to manage its subsoil resources has been handled cautiously and has been the subject of occasionally strident public debates in Greenland's capital, Nuuk, over the potential risks that large-scale mining projects pose. The first self-rule government was led by the Inuit Ataqatigiit (IA) party, a historically leftist party favoring greater independence from Denmark. But despite its background as a leftist and pro-independence party, under Premier Kuupik Kleist the party pursued pragmatic policies. IA favored maintaining the Danish practice of abstaining from mining uranium because of general concerns linked to uranium and nuclear electricity and waste, and passed a law, known as the Large Scale Projects Act, to facilitate the immigration and management of large numbers of foreign workers needed to build and operate the mines.[3] The law, however, was opposed by Greenland's largest labor union because it wanted to safeguard jobs for the local population. Then, a new government under the Siumut Party, headed by Premier Aleqa Hammond, came to power after the 2013 elections. Siumut, a center-left social democratic party with closer historical ties to Denmark, was critical of the Kleist government during the campaign but ultimately pursued similar policies: passing minor revisions to the Large Scale Projects Act and continuing the policy of promoting a mining industry. More significantly, Siumut passed a law that paved the way for the mining of uranium. Despite the differences over labor and uranium, the two parties are in broad agreement in their support for self-rule and their desire to develop Greenland's mineral and energy resources.

Meanwhile, a parallel debate played out in Copenhagen, with the center-right and anti-immigration Venstre party opposing the Large Scale Projects Act and siding with the Socialist Red-Green Alliance in opposing Greenland's uranium mining. The Large Scale Projects Act required an amendment to Denmark's immigration laws that were passed in June 2011. The Danish legislation included commentary suggesting that Danish approval of large-scale projects should be handled on a case-by-case basis for projects involving rare earth elements, an addition to which the government of Greenland has objected. The Greenland government has also clashed with Denmark on the issue of uranium mining because the Danes have historically been heavily opposed to issues related to uranium, and the two sides are currently engaged in consultations in a uranium working group that was established in February 2013. A status report from the uranium working group is expected in late 2014, but it is not anticipated that a cooperation agreement between Denmark and Greenland that includes mechanisms for information sharing and shared administration on uranium extraction and potential trade will be concluded before 2015.[4]

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[3] Although references to a Danish ban on uranium mining are common in the Danish and Greenlandic debates over mining of uranium, it is in fact questionable whether a formal ban on uranium extraction ever actually existed. Gry Thomasen argues that the institutional status of the often debated zero-tolerance policy was at least unclear and perhaps nonexistent, leaving "a historical ambiguity to Greenland's vote conducted in October 2013," (see Gry Thomasen, "Zero Tolerance – A Policy That Never Really Was?" Danish Institute of International Studies, http://en.diis.dk.) We thank Cindy Vestergaard for this point.

[4] See Cindy Vestergaard, "Greenland's Uranium and the Kingdom of Denmark," in Hvidt, Nanna and Hans Mouritzen, eds., *Danish Foreign Policy Yearbook*, (Danish Institute for International Studies, 2014), 62, http://en.diis.dk/home/news/2014/yearbook+dansk.

Politics aside, Greenland clearly has set an ambitious agenda for the coming years and it will be a challenge in the short term to develop the legal framework and regulatory capacity to effectively manage the mining industry. Worldwide, hundreds of exploration licenses have been granted for mineral projects, of which only a handful may eventually make it to the market. As in previous mining booms, success depends on a number of factors, including global raw material demand, commodity prices, stock market and equity financing, available infrastructure, legislative and regulatory frameworks, and labor supply. As this analysis will show, it is safe to say that Greenland is "under construction." In this context, that means that most of the aforementioned prerequisites are being developed actively, but are not yet in place. In addition, Greenland's resource ambitions are part of global commodities markets and must compete for investment with other resource-rich areas from around the world and with countries that have comparable ambitions to those of the Greenlandic government.

Because it shares geological features with neighboring formations in Norway and northeastern Canada, Greenland is widely believed to have very good, and in some cases world-class, resource endowments, although detailed exploration has been limited to date. There are six projects under active development regarding the mining of iron ore, zinc, lead, nickel, heavy and light rare earth elements, rubies and sapphires, anorthosite, and uranium, as well as several offshore oil blocks that are licensed for exploration. There is also believed to be good geological potential for copper, gold, and olivine. Several mines were operating until recently but were shuttered, in the case of the Nalunaq goldmine because reserves were depleted. Greenland is considered a frontier area for oil, gas, and minerals, and like other such areas, exploration becomes more likely during periods when resource prices are high.

Comparatively little has been written about Greenland, and this report aims to make a contribution in that respect. This report does not intend to make policy recommendations to the governments of Greenland or Denmark about how Greenland's energy and minerals policy should be managed. Rather, we hope to provide clarity on controversial issues that are often mischaracterized by politicians and government officials with potentially far-reaching consequences. The report also aims to provide a balanced perspective on Greenland's efforts to develop mineral and energy resources for readers in the United States, where there is an increasing focus on Arctic issues as the United States prepares to assume the chairmanship of the Arctic Council in 2015.

With this audience in mind, this report begins with a historical outline of Greenland and its connection to Denmark, and a review of more recent developments related to Greenland's self-government and its efforts to develop mineral and energy resources. Then, we provide a broad overview of energy and mineral resources in the country, their potential for extraction, government policies to make the country an attractive place to invest, infrastructure challenges, and regulatory developments. Greenland's resource endowments are also placed in the global market context. Subsequently, we address the European Union's and China's interests in Greenland. From the European side, historically and culturally there have been strong ties with Greenland because of its relationship with Denmark. Spurred by increased political and market interest in certain mineral resources (particularly, but not exclusively, rare earth elements), European officials have in recent years actively engaged with Greenland to develop closer relationships. This report explores European policy initiatives, providing an assessment of the validity of its concerns, that Chinese firms will lock in resources and avoid them from being available in the global market space, and the effectiveness of existing and pending policy initiatives.

China is central to strategic concerns about raw material supply not only in Europe but also in other developed economies. China's unprecedented economic growth and build out of capital stock drives global demand for raw materials and has led its mining and energy industries to acquire assets around the world, presenting opportunities for mining countries like Greenland while at the same time contributing to

strategic anxieties in the U.S. and European Union. Because the specter of massive Chinese investment in Greenland's mining sector has factored heavily into political debates in Denmark and to a lesser extent in Greenland, this report explores the potential role that Chinese investment realistically might play in Greenland's mining industry. It also offers some explanations for the motivations of Chinese firms that make overseas mining investments. It is important to note, however, that actual Chinese involvement in Greenland to date remains quite minimal, and that concerns about China's role in global commodities markets seem therefore exaggerated.

Arctic ice of Rode Fjord, East Greenland.
Photo credit: © iStockphoto/dawnn (Dan Kite)

1. Historical Background

Greenland is currently dependent on the Kingdom of Denmark as the island lacks a major economic base of its own. While Greenland has the right to self-rule and has control over its resources, the people of Greenland still seek full independence. With Greenland's potentially vast resource base, it may have the ability to become a major player in global mineral and energy trade. In this section, we outline the basic history of Greenland and move into the current political debate on the push for independence. If Greenland finds a way to overcome the many challenges its economy faces, such as a lack of infrastructure and a small workforce, the possibility of breaking away from Denmark and moving Greenland towards economic independence may become a reality.

HISTORICAL BACKGROUND TO DANISH SOVEREIGNTY OVER GREENLAND

While physically located in North America, Greenland has historically been both culturally and politically closer to Europe; its connection with Scandinavia began in the 10th century with the arrival of settlers from Norway and Iceland. The Norse settlers in Greenland lost contact with Europe and apparently died out during the 15th century, a process that appears to have been precipitated by increasingly icy waters that impeded travel between Greenland and Iceland and dwindling food supplies, both of which occurred during a period of global climate change known as the Little Ice Age. Norway maintained its claim to Greenland despite the apparent disappearance of the original settlers. Norway later joined Denmark under a single monarchy deemed the Kalmar Union from 1397 to 1523, which joined the two countries with Sweden. After Sweden left the Kalmar Union, Demark and Norway remained and were unified as the Kingdom of Denmark-Norway from 1524 to 1814.

Denmark-Norway reasserted its claim on the island in 1721 with a new settlement organized by Hans Egede, a Norwegian missionary. From the 18th century, a Danish presence was re-established on the island and an administrative presence was established by Danish missionaries and the Royal Greenland Trade Department (RGTD), a state trading monopoly established in 1774. Following the Napoleonic Wars, Norway was ceded to Sweden in 1814, while Denmark retained sovereignty over Greenland. Norway pressed its historical claim to Greenland after gaining independence in 1905, resulting in a dispute between Denmark and Norway over the uninhabited parts of the island. The Danish missionaries and the RGTD remained active through the 20th century, with the church responsible for the education system in Greenland until after World War II. Until 1908, there was no dedicated civilian administration in Greenland; instead, the RGTD handled administrative affairs as part of the administration of its trading monopoly. The claim to Greenland by both Norway and Denmark was resolved with a ruling at The Hague in 1933 that recognized Danish sovereignty over the entire island.[5] The RGTD was reassigned to

[5] Mads Lidegaard, *Grønlands historie*, (København: J.H. Schultz, 1961).

the Greenland Home Rule Government in 1986 and still exists today as the country's largest state-owned company. A reform movement at the beginning of the 20th century led to the separation of the trade monopoly from political administration and the introduction of indirect elections.

THE LEGACY OF WORLD WAR II AND LINKS WITH THE UNITED STATES

Significant changes for Greenland were introduced during World War II, including an expanded relationship with the United States. Unlike Iceland and the Faroe Islands, Greenland was not occupied by Allied forces following the German invasion of Denmark in April 1940. Since 1911, Greenland was divided into Northern and Southern districts with separate, indirectly-elected provincial councils and governors. These councils played a consultative role, and governors were responsible for implementing policies set in Copenhagen. For most of WWII, administrative power was concentrated in Nuuk with Eske Brun, the governor of Northern Greenland, along with his counterpart Aksel Svane, the governor of Southern Greenland. These two provincial governors cut administrative ties to Denmark and instead established a relationship with the Danish representative in Washington, Henrik Kauffmann. A basing agreement was signed with the United States that opened up critical supply lines for deliveries of American aircraft to Britain via a short-hop route across the North Atlantic, thereby bypassing the German submarines patrolling the Atlantic. A United States Coast Guard presence was also established in Greenland during the war.[6,7] The basing agreement was approved retroactively in 1945 by the Danish parliament. The United States retained the agreement with Denmark after the end of the war. In 1951, a new agreement was signed to reflect Denmark's membership in NATO; it was updated in 2004 in an agreement between the United States and Denmark that was also signed by the Home Rule Government of Greenland.[8,9] Greenland was also an important supplier of the mineral cryolite, used in the aluminum smelting process, to the United States aircraft industry. WWII gave Greenland's governing elite its first experience with direct and centralized government.

Greenland's strategic importance to the United States and NATO continued to grow after World War II. This was matched by new anxieties in Denmark that Danish sovereignty over Greenland was threatened by the emerging geopolitical competition between the United States and the Soviet Union.[10] This shift in strategic perceptions of Greenland may have been a factor in the increasing financial support from Denmark for social services, education, and health care following WWII, and was likely also a factor in Denmark's re-evaluation of Greenland's position in the Danish realm.[11] Later in the Cold War, American air bases played an important role in U.S. global alert programs, and in 2004, the basing agreement was updated to allow for upgrades to the radar and missile defense systems at Thule air force base in northwestern Greenland.

POSTWAR DEVELOPMENTS, HOME RULE AND THE DECISION TO LEAVE THE EEC

After the war, a number of changes were introduced to increase investment in education and health care and to open up Greenland's economy to participation by

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[6] Mads Lidegaard, Grønlands historie, (København: J.H. Schultz, 1961).
[7] John A. Tilley, "The Coast Guard & The Greenland Patrol," (Washington, DC: United States Coast Guard, 1992), www.navcen.uscg.gov/pdf/iip/history/The_Coast_Guard_and_the_Greenland_Patrol.pdf.
[8] Sørensen, "Denmark-Greenland in the Twentieth Century."
[9] Agreement between the United States and of America and Denmark Amending and Supplementing the Agreement of April 27, 1951, U.S.-Den., 6 August 2004, *United States Treaties and Other International Acts Series* (T.I.A.S.) 04-806.
[10] Sørensen, "Denmark-Greenland in the Twentieth Century," and Bo Lidegaard, *A Short History of Denmark in the 20th Century*, (København: Gyldendal, 2009).
[11] Sørensen, "Denmark-Greenland in the Twentieth Century."

Danish firms, primarily Danish and Faroese fishing companies seeking to fish in Greenlandic waters. In 1950, Greenland's administration was centralized, with one directly-elected provincial council meeting in Nuuk and with a single governor. As under the previous system, the provincial council had only limited authority and until 1967, the council was chaired by the governor, who was appointed by Denmark. When a new Danish constitution was adopted in 1953, it effectively promoted the status of Greenland by expanding the scope of the constitution to include explicitly the entire Danish realm (including Greenland) while awarding Greenland two representatives in the Danish parliament.

The 1970s saw the establishment of Greenlandic political parties and the election of a new generation of politicians who increasingly pushed for a new institutional relationship with Denmark. The catalyst for what became the home rule movement was the vote in Denmark to join the European Economic Community (EEC), an action that most Greenlanders strongly opposed on the grounds that it would open Greenland's fishing waters to vessels from other countries, posing a serious challenge to the management of the state-owned economy. In a referendum held across Denmark in 1972, in which an overwhelming majority of Greenlanders voted against joining the EEC, Denmark voted to join and Greenland thus also joined the EEC as a part of the Kingdom of Denmark. A home rule movement was launched which eventually took effect in 1979. This new arrangement gave Greenland full control over the administration of the country in self-financed areas and some control over implementation of policies in spheres that were covered by subsidies from Denmark.[12]

Greenland voted to leave the EEC in a 1982 referendum and ultimately left in 1985, six years after the passage of the Home Rule Act. As a result of this departure, Greenland is not part of the European Union, though it does receive a grant from the European Commission as an Overseas Country and Territory (OCT) of Denmark.

THE BEGINNING OF SELF-RULE

After a period of debate and consultation that lasted nearly a decade, Greenland held a referendum in 2008 that demonstrated overwhelming support for the establishment of a self-rule government with full legislative authority in most administrative areas; this change in status was passed into law at the end of that year. The Act on Greenland Self-Government (a.k.a. the Self-Government Act) came into force in June 2009, transferring most powers to the government of Greenland, with the notable exception of foreign affairs, defense, and monetary policies. Although the Danish government retained control over these policy areas, Greenland's government was granted limited rights such as the ability to establish overseas representation and in some cases enter into international treaties.

The Self-Government Act also set an amount for the block grant, fixed in 2009 Danish Krone, but subject to annual adjustments based on price and wage inflation in Denmark. The government of Greenland became responsible for financing the cost of all areas for which it assumed administrative responsibility and assumed ownership of state-owned assets in these areas. This differed from the Home Rule arrangement, under which the annual block grant from Denmark was renegotiated on an annual basis to account for rising costs of administration.

Under the Self-Government Act, Greenland also gained full control over the management and exploitation of its subsoil resources, ending the system of joint administration and joint veto power that had been in place since 1979. Greenland's government was now entitled to keep all revenue from mining activities with the caveat that an amount equal to 50 percent of any government of Greenland revenue in excess of 75 million DKK (US $14.44 million in

[12] Sørensen, "Denmark-Greenland in the Twentieth Century."

2009) would be subtracted from the annual grant from Denmark.

ECONOMY AND RESOURCE BASE

Greenland's economy is small and highly dependent on subsidies from Denmark. Greenland's GDP in 2010 (the most recently available data) was 12.86 billion DKK (US $2.37 billion). The Economic Council of Greenland estimates that GDP grew by 3.2 percent in 2011 and then fell in 2012 and 2013 by 3.1 percent and 1.4 percent, respectively.[13,14] In 2013, public expenditures totaled 6.45 billion DKK (US $1.19 billion). The Danish block grant in 2013 totaled 3.624 billion DKK (US $668.8 million), or 56 percent of government spending and somewhere between 25 percent and 30 percent of GDP. The number of registered job seekers has not changed significantly since 2012 despite the shrinking economy, a phenomenon which the Economic Council of Greenland attributes to net emigration during these years. The relative ease with which young people can leave Greenland for Denmark exacerbates what is expected to be an increasing demographic burden on Greenland's public finances in the coming decades.

The government of Greenland has developed a strategy to address this shortfall in funding by developing its mineral resource and offshore oil industries. This strategy, which is discussed in more detail in the following chapter, aims to open three to five mines and have one or two exploratory offshore oil wells drilled by 2018.

Although the oil and minerals strategy is central to the Greenland government's plans for future economic development, mineral resources, oil and gas currently account for a negligible share of Greenland's economy, employing a monthly average of only 181 people while contributing an estimated 348 million DKK (US $61.7 million) to Greenland's economy in 2012.[15]

Fishing is a major industry in Greenland and is one of the only sources of export revenue. Greenland did not traditionally rely on fishing, which only began to replace seal hunting as a major source of income in the early 20th century.[16] Cod fishing was an important source of food and import revenue during and after WWII. As a result of warming ocean temperatures, cod populations have migrated and shrimp and Greenland halibut now represent the majority of the catch by value. The fishing sector is industrial, export-oriented and dominated by two large companies: Polar Seafood (a private company) and Royal Greenland (a government company). As of 2012 the industry accounted for 8 percent of Greenland's GDP and 91 percent of exports.[17]

It is also important to note that Greenland's economy is dominated by large public companies owned by the government of Greenland. These companies, which as noted trace their roots back to the Danish royal trade monopoly commencing in 1774, represent many of the largest employers in Greenland. These publicly-owned enterprises play an important role due to their outsized contributions in terms of employment, revenue, and provision of services to remote settlements. These companies account for about 15 percent of total employment and are justified because, although technically managed on arm's length principles, they fulfill an important public need by taking on investments in areas unattractive to private capital.[18] Setting aside the issue of publicly-owned companies, Greenland is also dominated by large employers. In 2006, for example, the 32

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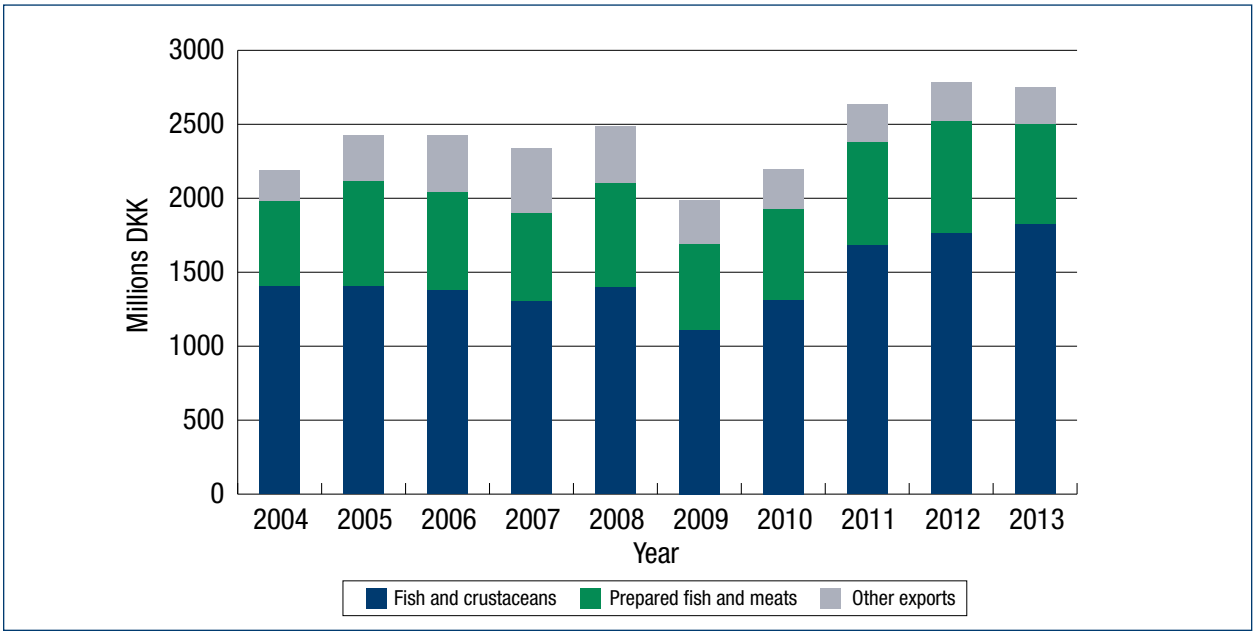
[13] Statistics Greenland, "Greenland in Figures 2014," www.stat.gl/publ/kl/GF/2014/pdf/Greenland%20in%20Figures%202014.pdf.
[14] Økonomisk Råd, "Grønlands *Økonomi* 2013," http://naalakkersuisut.gl/~/media/Nanoq/Files/Attached%20Files/Finans/DK/Oekonomisk%20raad/100913Oekonomisk_Raads_Rapport_2013_DK%20(1).pdf.
[15] Statistics Greenland, "Greenland in Figures 2014." Note that only monthly employment averages are made available.
[16] Sørensen, "Denmark-Greenland in the Twentieth Century."
[17] Exports of fish products include the category "Preparations of Meat, of Fish, or of Crustaceans, Molluscs, or Other Aquatic Invertebrates." See Statistics Greenland, "Statistical Yearbook," http://bank.stat.gl/dialog/statfile.asp?Lang=1.
[18] Torben M. Andersen et al., *Hvordan Sikres Vækst og velfærd i Grønland? Baggrundsrapport*, Skatte-og Velfærdskommission, 2010.

Figure 2: Greenland Seafood and Prepared Foods Exports, 2004-2013



Source: Statistics Greenland

largest companies in Greenland were responsible for 57.5 percent of all payroll.[19]

Geological exploration in Greenland has taken place since the early 18th century and there has been intermittent small-scale mining since at least 1856, when cryolite mining first began. Cryolite sold to the United States provided Greenland with an economic lifeline during WWII, and as noted, cryolite mining continued until 1987.[20] In more recent years, small-scale mining of gold and olivine has taken place, although operations ceased at these mines in 2013 and 2010, respectively. Including those mines that have been recently shuttered, exploitation licenses have been granted for projects to extract lead, zinc, gold, molybdenum, olivine, rubies, and iron ore. Of this group, the Aappaluttoq ruby mine and Isua iron ore projects are under active development by True North Gems and London Mining, respectively, with the ruby mine expected to start production in 2015. However, as of the writing of this report there are no mines in operation in Greenland, and the large projects with the most potential to impact the economy significantly are still searching for funding.

RIGHTS TO MINERALS REVENUE

The question of who owns Greenland's underground mineral resources has been an important part of Greenlandic politics since the late 1970s, when discussions over this issue were conducted separately from, but in parallel to, discussions over Greenlandic Home Rule.[21] This was a contentious debate and made the issue of mining and minerals politically fraught to the present day. Passed in 1978 and effected in 1979, the Home Rule Act and revised Mineral Resources Act gave both the Danish Government and the Home Rule Government veto powers over

[19] Torben M. Andersen et al., Hvordan Sikres Vækst og velfærd i Grønland? Baggrundsrapport, Skatte-og Velfærdskommission, 2010.
[20] Sørensen, "Denmark-Greenland in the Twentieth Century."
[21] Before the home rule period the Danish government encouraged international exploration of mineral resources in Greenland and had passed special legislation to this effect in 1961, leading to a period in the 1970s of relatively active exploration for mineral resources and offshore oil. Many of the mining projects in Greenland that are now seeking large scale foreign investment were originally discovered during this period.

mineral revenue and stipulated that mining revenues should be applied towards reducing the annual subsidy from Denmark.[22,23] At issue in the years leading up to passage of the Home Rule Act was the question of whether underground resources belonged to the Danish state or to the people of Greenland, and who constituted the people of Greenland. Ultimately the 1979 legislation recognized the right of people in Greenland to control its natural resources.[24]

While there was some exploration activity by international companies in the 1970s, activity slowed towards the end of the decade and did not pick up again until after the passage of the 1978 Mineral Resources Act. Several revisions were made to the Mineral Resources Act in the 1980s and 1990s, and in 1998 the joint administration of subsoil activities by Greenland and Denmark was moved to Greenland and managed by a newly established Bureau of Minerals and Petroleum (which in early 2014 became the Ministry of Industry and Mineral Resources).[25]

After the establishment of Greenlandic Self-Rule in 2009, a new Mineral Resources Act was passed, this time in the Greenlandic Parliament rather than in the Danish Parliament, canceling the previous legislation and, as of January 2010, vesting full authority over the administration of subsoil resources with the government of Greenland.[26] This new legislation, along with the 2012 Large Scale Projects Act, was designed to pave the way for the development of large-scale mining projects. Essentially, the Large Scale Projects Act allows foreign companies to contract foreign workers on collective agreements. This entails large projects for the exploitation of mineral resources or hydraulic power, and projects are considered large scale if it involves capital expenditure of more than 5 billion DKK ($670 million). Moreover, either there needs to be a demonstrated lack of local available workforce, or the requirements for the project must exceed the capabilities of Greenlandic companies.[27] The Mineral Resources Act marked a significant shift of administrative and revenue powers in Greenland's favor. The subsequent political debates in Denmark over mining issues in Greenland are best understood in light of this history.

GREENLANDIC DEBATES ON MINING AND POLITICAL OPPOSITION FROM DENMARK

Greenlandic politics since the advent of self-rule in 2009 have been characterized by a mood of urgency and caution. Both leading parties have pursued policies that attempt to strike a balance between the pressing need for faster economic development and recognition of the potentially calamitous social and environmental impact of major oil and mining projects. The major political disagreements in Greenland have revolved around questions of how to manage the foreign labor required to build and (to a lesser extent) operate mines and whether or not to move forward with projects that would extract radioactive materials. In Denmark, there has been a parallel political debate in which opposition parties have challenged the government's handling of Greenland's affairs, largely by appealing to specific issues in Greenlandic politics that can be linked to Danish foreign policy obligations.

The first years of independence also marked the first time that Inuit Ataqatigiit (IA), a left-wing party that has traditionally favored greater autonomy and ultimately independence for Greenland, won a majority

[22] Sørensen, "Denmark-Greenland in the Twentieth Century."
[23] Bent Ole Gram Mortensen, "The Quest for Resources – the Case of Greenland," *Journal of Military and Strategic Studies*, vol. 15, no. 2, 2013.
[24] Ibid.
[25] K.G. Hansen, "Greenlandic perspectives on offshore oil and gas activities – an illustration of changes in legitimacy related to democratic decision processes." *Journal of Rural and Community Development,* vol. 9, no. 1, 2014, 134-154.
[26] Ibid.
[27] For more background and a legal perspective, see Rasmus Høj Christensen and Tina Reissmann, "The Large-Scale Projects Act," Plesner, www.plesner.com/cms/site.aspx?p=2173&CardId=598.

Figure 3: Greenland Geology and Selected Mineral Occurances

Source: GEUS

of seats in the Greenlandic parliament. The IA government, headed by Premier Kuupik Kleist, moved quickly to establish a legal and regulatory framework that would pave the way for construction of large projects: in particular, an iron ore mine at Isua, a fjord about 100 miles from the capital city of Nuuk, that would require thousands of foreign workers in the construction phase. As noted, the controversial Large Scale Projects Act was passed to simplify foreign workers' immigration. At the same time, the IA government was cautious on mining radioactive minerals such as uranium, preferring to stick with the Danish practice of not mining uranium. However, even the relatively anti-uranium IA government recognized the need to extract uranium together with rare earth deposits in certain cases and allowed the Australian mining company GME in 2010 to undertake exploration activities at Kvanefjeld.[28]

In March 2013, elections brought to power a new government led by the center-left Siumut party. Siumut, headed by Premier Aleqa Hammond, won support from Greenland's labor unions by calling for revisions to the Large Scale Projects Act that would require foreign employees to receive wages in line with existing collective bargaining agreements. Siumut's campaign also included a promise to reverse the longstanding practice of not mining uranium. After the election Hammond's government indicated that the uranium question was Greenland's to decide.

These questions of uranium and foreign labor became highly politicized in the Folketing, Denmark's parliament. The ruling coalition, led by the center-left Social Democrats and Prime Minister Helle Thorning-Schmidt, had said they would not get in the way of Greenland's efforts to develop mining, including uranium.[29] However, the coalition was also clear that should uranium be exported from Greenland, that action would come with foreign and non-proliferation obligations that fall within Copenhagen's responsibility. At the same time, the socialist Red-Green Alliance and the center-right Venstre party found themselves uncharacteristically allied in their opposition to uranium mining, which they argued fell within the scope of foreign affairs and thus beyond the authority of the Greenlandic government.[30] Venstre, staunch opponents of immigration and cultural integration in Denmark, also sided with Danish labor unions in questioning whether the Large Scale Projects Act ran afoul of Denmark's foreign policy, and in particular whether it would cause Denmark to violate its international obligations under the International Labor Organization (ILO).[31]

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[28] "Greenland Eases Uranium-Mining Ban, Greenland Minerals & Energy to benefit," *Proactive Investors*, www.proactiveinvestors.com.au/companies/news/9924/greenland-eases-uranium-mining-ban-greenland-minerals-energy-to-benefit-9924.html.

[29] Jesper Vangkilde and Kristian Klarskov, "Danmark er klar til eksport af uran," *Politiken*, 26 January 2013, http://politiken.dk/indland/politik/ECE1880246/danmark-er-klar-til-eksport-af-uran.

[30] Jesper Vangkilde and Kristian Klarskov, "Uranflertal isolerer Enhedslisten og Venstre i sjælden alliance," *Politiken*, 27 January 2013, http://politiken.dk/indland/politik/ECE1880322/uranflertal-isolerer-enhedslisten-og-venstre-i-sjaelden-alliance.

[31] See for example Thomas Søgaard Rohde and Pia Glud Munksgaard, "Hjort anklager Thorning for arrogance i Grønlandsstrid," *Berlingske*, 2 February 2013, www.b.dk/politiko/hjort-anklager-thorning-for-arrogance-i-groenlandsstrid.

Boat sailing in front of an iceberg in Disko Bay, Greenland.
Photo credit: © iStockphoto/waggers33 (Richard Waghorn)

2. Assessing Greenland's Resource Potential

Resource extraction has become a key feature of Greenland's strategy for greater independence from Denmark. In the next five years, Greenland's administration plans to have several mineral resource projects on stream and anticipates at least one significant oil discovery. In this section, based on our interviews and other available publications, we elaborate on these government ambitions and Greenland's oil and mineral strategy for the period until 2018.[32] We then examine the country's resource base. Finally, we address the international context in an attempt to evaluate Greenland's strategy in light of the global geopolitical and commercial environment.

GREENLAND'S OIL AND MINERAL STRATEGY

The government of Greenland certainly does not lack ambition. In its official Oil and Mineral Strategy (released in early 2014) the government announced that by 2018, it anticipates that three to five major mines will be opened. In addition, Greenland expects that every other year, an oil exploration well will be drilled. From our conversations with the administration, it is apparent that the government hopes that one of these wells will be successful.

At the same time, this comprehensive strategy also reveals what can hardly be a surprise: given its geographic isolation, mineral and hydrocarbon extraction projects in Greenland need to be built almost entirely from scratch, owing to the lack of physical infrastructure to support mining or energy projects. Projects therefore rely heavily on the construction of associated infrastructure.

The climate in Greenland is harsh, and the country is remote relative to other mining destinations, and the short summers offer a very narrow window for exploration. On the other hand, the effects of climate change have to some extent relaxed these constraints, extending the summer season and exposing more areas of land to geologic research. In the case of offshore oil exploration, the effects of global warming may be more nuanced, as acceleration in ice melting may in fact lead to more icebergs, which can complicate exploration activities. So far, most data indicates that Greenland holds great promise for resource extraction, though it has not been extensively explored, and detailed information beyond a general sense of promise is only available in a few locations.

The government's strategy is built around a number of pillars, namely new measures related specifically to oil and mineral extraction, proposed taxation schemes, the creation of an independent geological survey; and finally sustainable development encompassing environmental protection, the establishment of regulatory frameworks, infrastructure requirements and investments, and issues related to the Greenlandic labor market.

[32] See "Greenland's oil and mineral strategy 2014 – 2018," Government of Greenland, FM 2014/133, February 2014, http://naalakkersuisut.gl/~/media/Nanoq/Files/Publications/Raastof/ENG/Greenland%20oil%20and%20mineral%20strategy%202014-2018_ENG.pdf.

ENERGY RESOURCES

The government of Greenland has high expectations of oil extraction. Though it seems aware of the commercial uncertainties, the government highlights in its strategy that based on current information it believes that two productive oil fields can be on stream in the near future; the first field of roughly 500 million barrels of reserves could be in operation by 2020, while the second of nearly 2 billion barrels of reserves could come on line by 2025. Together these fields could contribute more than 435 billion DKK ($78 billion) to the Natural Resource Wealth Fund in the period until 2060.[33] In order to facilitate exploration, in the period until 2018 five new areas will be licensed: Jameson Land (2014, onshore, East Greenland), South-West Greenland (2014, offshore), Disko-Nuussuaq (2016, offshore, West Greenland), Baffin Bay (2016/2017, Northwest Greenland), and Davis Straight (2018, West Greenland).

Exploration for oil has taken place since the 1970s, though activity has been limited with only 15 wells drilled to date. Price spikes in the 1970s raised the first commercial interest in Greenland, but when prices fell, private-sector interest faded.[34] Through most of the 1990s under the so-called Kanumas project, large parts of offshore Greenland were prospected by several major oil companies including ExxonMobil, Statoil, BP, Japan National Oil Company, Royal Dutch Shell, and Texaco, along with Greenland's state-owned company Nunaoil. USGS data from 2007 (we have been told that these data are currently being updated) showed great promise in the East Greenland Rift Basins Province, with an undiscovered estimate of 31.4 billion barrels of oil equivalent in oil, natural gas, and gas liquids.[35] While several parts of Greenland may have favorable geological conditions, it is thought that East Greenland may hold the most promising hydrocarbons acreage since this region used to be connected to the Norwegian plateau and therefore should have similar geological conditions.[36] However, the most recent wells that were drilled (by Cairn Energy in 2010 and 2011) were in West Greenland. The hydrocarbon potential of this region is believed to be significant as well; the most practical reason for drilling here being that this part of the country is currently ice-free for about six months of the year and generally has somewhat milder weather and sea conditions. Because of the multilayer ice and extremely harsh conditions, exploring in East Greenland is still technologically challenging, and therefore no exploration is expected to take place there in the near future. To further illustrate the challenges, we were told that several ice breakers and helicopters are required just to collect reliable data in this part of Greenland in order to clear the area of ice and provide an early warning of approaching icebergs. As a result of the harsh conditions, it is at this point uncertain what the costs per exploration well will be in this part of the country. In West Greenland, icebergs continue to pose significant challenges to industrial activities, and these are generally towed away, or in cases where they cannot be towed, the rig has to be moved. Ironically, the fact that global warming is making parts of the Arctic more accessible to vessels does not necessarily make operating in the Arctic either safer or easier. In Greenland, the estimated costs for drilling one exploration well are around $100 million in the most favorable circumstances, and based on current estimates, developing an entire oil field will cost around $6 billion to $7 billion.

Industry estimates provided to us suggest that commercial oil production in Greenland 20 years from now is realistic, and in an optimistic scenario this

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[33] Ibid., 23.

[34] Kevin Casey, "Greenland's New Frontier," The Arctic Institute, 20 January 2014, www.thearcticinstitute.org/2014/01/greenlands-new-frontier-oil-and-gas.html.

[35] D.L. Gautier, "Assessment of Undiscovered Oil and Gas Resources of the East Greenland Rift Basins Province: U.S. Geological Survey Fact Sheet 2007-3077," U.S. Geological Survey, http://pubs.usgs.gov/fs/2007/3077/.

[36] Bojesen-Koefoed et al. conclude that the petroleum potential in Northeast Greenland is 2 – 3 times higher than expected from initial data, though their study does not give a quantitative assessment of the estimated resource. See: Jørgen A. Bojesen-Koefoed, Peter Alsen and Flemming G. Christiansen, "Six years of petroleum geological activities in North-East Greenland (2008–2013): projects and a view of the future," Geological Survey of Denmark and Greenland Bulletin 31, 59-62, www.geus.dk/publications/bull/nr31/nr31_p59-62.pdf.

Figure 4: Areas of Hydrocarbon Development, as Licensed by Greenland

Source: nunagis.gl

may be closer to 10 years. Although it seems unlikely that commercial oil production will take off in the near future, virtually all of the international oil companies seem to have an interest (in the form of licenses) to see whether the long-held promise of Greenland will materialize. In December 2013, three consortiums of international oil companies (including Statoil, Shell, Chevron, ENI, ConocoPhillips, and BP) were granted a total of four exploration/exploitation licenses for Northeast Greenland.[37] In August 2014, Cairn Energy, which has drilled the last seven wells offshore of Greenland, announced that it will further decrease its interests in Greenland in an effort to minimize capital expenditure in "high risk frontier acreage positions."[38] In all of these consortiums, the Greenlandic state-owned company Nunaoil holds a 12.5 percent stake in the project, which it would probably have to sell at least partly in case of a significant oil find (because it is unlikely that it could finance its entire stake were a field developed). To our knowledge, no drilling activities have been planned at this point.

Given the occasional interest in exploration activities, Greenland's regulatory framework is reasonably detailed. According to the Mineral Resources Act, companies interested in exploration activities are selected based upon certain criteria such as previous exploration or exploitation of hydrocarbons in areas with similar conditions; a strong financial balance sheet; and proven systems and procedures aimed at safety, health, and the environment.

The Environment Agency for Mineral Resources Activities safeguards environmental protection related to oil extraction in collaboration with the Danish Center for Environment and Energy (DCE) at Aarhus University and the Greenland Institute of Natural Resources (GINR). These two institutes together carry out strategic environmental impact assessments (EIAs) that determine which on- and offshore areas should be opened for a licensing round. Normally an exploration license requires an EIA, though it is not entirely clear as sometimes less stringent criteria are applied. It is also not clear who decides if an EIA is required.

The government of Greenland expects that as global warming continues to melt Arctic ice, both on- and offshore oil exploration activities will become easier. However, it is important to note that exploration companies will continue to have to deal with sea ice and icebergs for the foreseeable future. All license holders are mandated to have emergency response plans in place. Part of the requirements is to contract with an oil spill response company that is a member of the Global Response Network (GRN). In addition, every license holder has to contract with the Greenland Oil Spill Response A/S (GOSR). Despite these requirements, Greenland is remote and vulnerable in case of spills, as confirmed by the estimated worst-case scenario response time of 52 hours, as documented in relation to the drilling activities of Cairn Energy in 2010 and 2011.[39]

Notwithstanding the substantial ambition of the Greenland government to facilitate hydrocarbon extraction, to date only 15 exploratory wells have been drilled. So far no commercial discoveries have been made, though in some of the respective areas working hydrocarbon systems have been proven. As such, the impact of oil activity on local communities has been limited. One reason for this is that Cairn Energy, the company that has drilled all recent wells in Greenland, did not have drillers stay in Greenland, but instead flew personnel from Edinburgh to Kangerlussuaq, Greenland's main international airport, and then on to Nuuk and Aasiaat. For the most recent exploration well, pilots of Air Greenland were trained for air support. Moreover six engineers that were trained at the Greenland School of Minerals and

[37] "Licensing Round 2012/13 news," Press release, Government of Greenland, www.govmin.gl/index.php/petroleum/exploration-a-exploitation/previous-licensing-rounds/licensing-round-2012-13.
[38] See "Half-Yearly Report Announcement," Cairn Energy PLC, 19 August 2014, www.cairnenergy.com/index.asp?pageid=27&newsid=457; for an explicit reference to Greenland, see 6.
[39] "Greenland's oil and mineral strategy," Government of Greenland, 29.

Petroleum in Sisimiut received additional training in Edinburgh and took part in the drilling activity.

Like most of the Arctic, Greenland is a frontier area, where conditions are harsh and the costs of exploration high. At the same time, the broad interest of international oil companies in Greenland, as reflected in the variety of different license holders, suggests that Greenland is at least on their radar. Unfortunately for the Greenland administration, that says little about the likelihood of exploitation activities taking place in the years ahead. From that perspective, international market developments may not be favorable to Greenland in the near term. As unconventional oil becomes more widely available in the United States, extraction technologies continue to evolve and the costs of extraction come down, it is likely that unconventional oil resources outside the United States will be produced as well, in places as diverse as Russia, China, Argentina, and Australia. In most parts of the Arctic where international and national oil companies are exploring for new resources, investments are being postponed due to these developments. There are some exceptions, such as the southern Barents Sea offshore Norway, but typically the exceptions are in places where the conditions are less harsh—and technological requisites less significant and exploration/exploitation costs therefore lower—than generally is the case in the Arctic. To date, the data do not suggest that Greenland is one of these exceptions, and so the expectations of the Greenland administration, as reflected in the oil and mineral strategy 2014–2018, may be overly optimistic.

MINERAL RESOURCES

The Frasier Institute's 2013 Survey of Mining Companies gives an overview of the concerns that mining companies have regarding investment in Greenland. These concerns center on possible future regulations, the taxation regime (which by some is seen as a strong financial deterrent), the lack of a skilled labor force, and future political stability. Of all of these concerns, the lack of infrastructure is the most significant: Issues such as access to electricity, functioning telecommunications, and poor physical infrastructure such as roads, harbors, and airstrips pose the greatest challenges.[40]

Industrial activity such as mining and oil extraction raises demand for energy. Historically, electricity generation is scattered throughout Greenland, similar to the locations of the towns and settlements. Constructing transmission lines on the island is unlikely, as the costs would be very high. The largest installed electricity generation capacity is currently 54 MW, located near Nuuk. Over 70 percent of energy consumption (both electricity and heating) is covered by hydropower, with the alternative fuel source being diesel. By law, not only is there 100 percent connectivity in the country, but because of the harsh conditions all settlements have fully redundant backup power production as well. The costs of electricity are comparatively low because of the large share of hydropower helping to offset the high costs that come with the policy to connect even the smallest settlement in the country.

In order to facilitate the expected increased usage of energy, the government of Greenland has, in agreement with the Danish authorities, installed a territorial exemption from Denmark's commitments to reduce carbon emissions under the Kyoto Protocol. In addition, Greenland has a standing policy of requiring companies, which are responsible for setting up and financing their own utility systems, to use hydropower where possible. Due to permafrost, the opportunities for this are currently limited to the southern and western coast of Greenland, up to Disko Bay.[41] Two of the mineral resource projects currently under discussion may use hydropower: Kvanefjeld and Kringlerne, both rare earth elements projects. In

[40] Miquel Cervantes, Kenneth P. Green and Alana Wilson, "Survey of Mining Companies: 2013," Fraser Institute, 3 March 2014, 48, www.fraserinstitute.org/publicationdisplay.aspx?id=20902&terms=greenland.
[41] "Greenland's oil and mineral strategy," Government of Greenland, 73.

addition, hydropower could be used to supply the iron ore project in Isua if it were financed and developed, but most of the water potential in that region has been locked in by Alcoa, which has been deliberating the construction of an aluminum smelter in Nuuk, Manitsoq, or Sisimiut since June 2006. According to the memorandum of understanding (MOU) between Alcoa and the government of Greenland, it is estimated that if the smelter were constructed, it would require 600 MW of electricity under long-term contract conditions. Interestingly, and not in accordance with the country's most recent Greenland Oil and Minerals Strategy, this memorandum suggests that the government, national or municipal, would "most likely" facilitate both power supply and investments in harbor facilities.[42] During the course of our research, it became clear that it is highly uncertain whether the aluminum smelter will be built. More research is required to establish whether the hydropower potential in the region could be used for other purposes in the event that the Alcoa plant is not constructed within a certain timeframe.

Air traffic infrastructure in Greenland is crucial, yet limited. Currently there are two civil airports (Narsarsuaq and Kangerlussuaq) with runways that can support jet planes to and from areas outside Greenland. There is some precedent for using this existing infrastructure, such as when Cairn Energy used the Kangerlussuaq airport to fly its personnel between Edinburgh and Greenland, while using smaller Dash 8 and 7 airplanes for domestic transport. Mining companies that are currently planning potential investments are looking at various contingencies. Projects that are less labor intensive, such as True North Gems' ruby project and the Tanbreez heavy rare earth mine, are considering constructing a helistop. Larger projects such as those of London Mining or Ironbark Zinc are considering building a runway to accommodate larger aircrafts. The government of Greenland is currently mapping the future requirements of extraction companies and is also considering using facilities at Thule Air Base for industrial purposes.

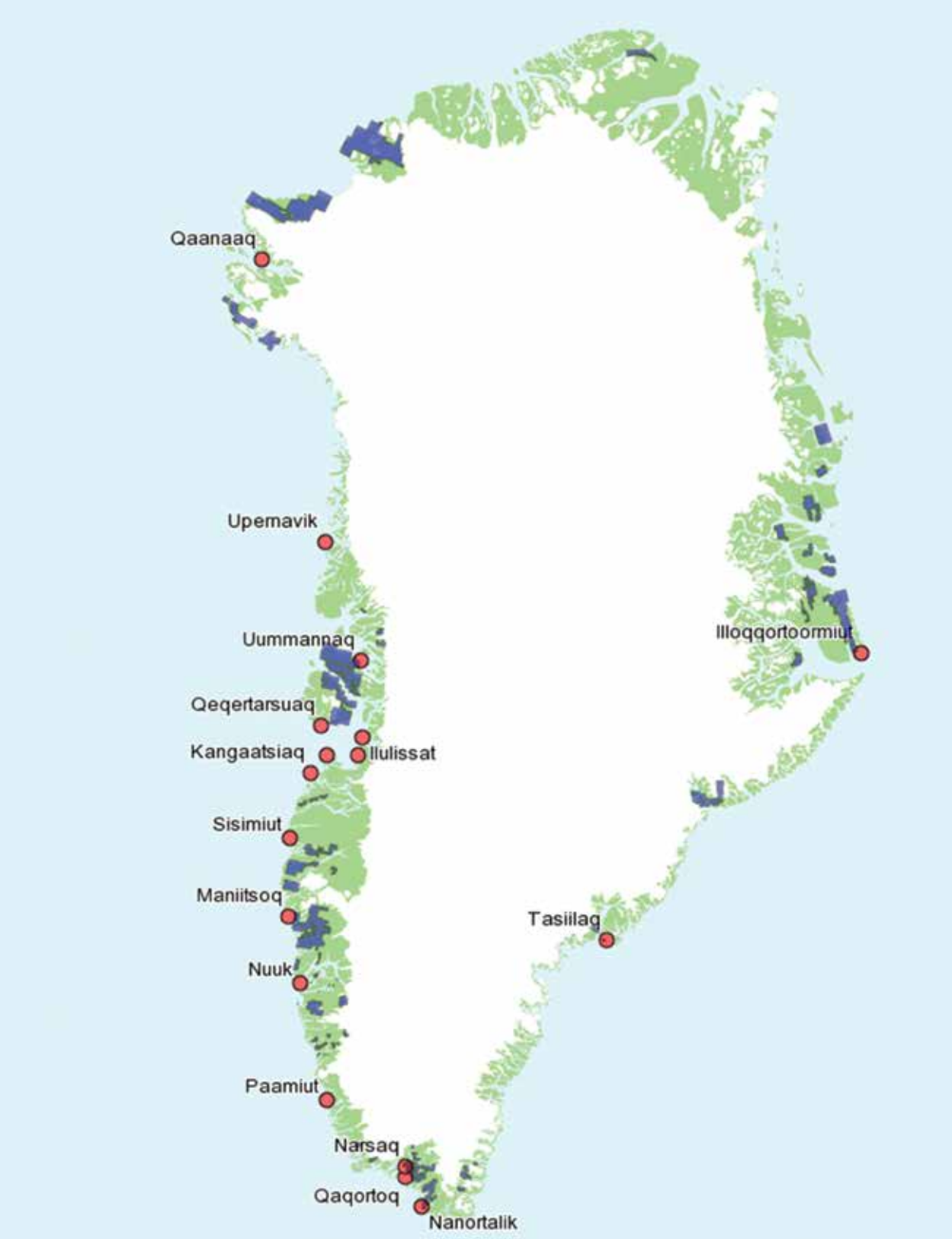
Similar to air traffic, harbor capacity and sufficient storage facilities are important to facilitate supply ships for both the oil and mining industry. To date, the experience here is limited as well, but from the case of Cairn Energy (where the harbors of Aasiaat and Nuuk were used) the government of Greenland has learned that in particular the room to store vital equipment is very limited. One of the challenges is that there is widespread demand for harbor facilities, specifically in Nuuk, for coasters, supply ships, cruise ships, and fishing boats.[43] Currently, the government of Greenland is studying the opportunities and desirability to upgrade some of the existing harbor facilities. At the same time, companies are expected to make their own determination as to what supporting infrastructure they require.

Telecommunication facilities in Greenland are fairly basic as well. Currently there is a submarine cable to Iceland and Canada, a radio link on the west coast of Greenland, and satellites covering East and North Greenland (areas which are not served by the aforementioned options). The concession holder—and effective monopolist—to operate telephone and data services is TELE Greenland. During its operations in 2010 and 2011, Cairn Energy used a foreign very small aperture terminal (VSAT) connection (basically a small satellite connection). TELE Greenland did facilitate a radio link for the gold mine in Nalunaq that operated until late 2013 as well as a satellite connection for the olivine mine at Fiskefjorden. The Greenland administration has indicated that it will examine whether deregulation of the telecommunication sector would better suit the interests of extractive companies.

[42] This is based on the Memorandum of Understanding between the Government of Greenland and Alcoa dated 25 May 2007. Conditions may have changed since then.

[43] "Greenland's oil and mineral strategy," Government of Greenland, 78.

Figure 5: Exploration Licenses, as Granted by Greenland



Source: nunagis.gl

MAJOR REGULATORY CHANGES

Regulation is a tool to achieve societal, economic, and environmental policy objectives.[44] These objectives may on occasion conflict, which is why regulatory authorities are ideally independent of institutions that may have other interests. To give an example, the government of Greenland may have an interest to spur investments in mineral resource extraction. Most forms of resource extraction come with environmental concerns: effects on water supply, air quality, soil pollution, and so on. In order to safeguard environmental policy objectives such as clean water and fresh air, it is prudent to have a separate entity enforce regulations to safeguard water quality and to monitor other major public interests.

Environment Agency for Mineral Resources Activities

While there is currently no separate entity to enforce environmental concerns in Greenland, change is in the air. By amending the Mineral Resources Act in 2012, effective in 2013, the Environment Agency for Mineral Resources Activities was established. This was a first and important step towards creating an independent regulatory authority in the area of mineral resources. The question of how to divide political and administrative responsibilities is unclear to date, but it seems obvious that the licensing authority and the environmental regulatory authority will become separate and independent entities. The environment agency, together with DCE and GINR is involved with the pending revision and expansion of EIA guidelines, which is planned for release in 2014. However, with regard to environmental safeguards, a number of important questions remain unanswered at this point, for example whether the Greenland authorities will be inclined to adopt the principles of the Extractive Industries Transparency Initiative (EITI) and/or those of the Natural Resources Charter.[45] In addition, several reports have come out that question the level of transparency in Greenland related to raw materials. In 2012, Transparency Greenland issued a report in which it amongst others called for better streamlining of public consultation procedures and complained about limited public access to relevant documents.[46] In July 2014, reports suggested a "rather contentious" legislative proposal by the Greenland government that may limit the public's access to documents related to raw materials.[47] More broadly speaking, transparency in extractive industries has a long road ahead, and the case of Greenland does not seem to be an exception.[48]

Creating an Independent Geological Survey

To date, collecting geotechnical knowledge of Greenland and providing the administration with geological advice are tasks performed by the Geological Survey of Demark and Greenland (GEUS). In the coming years, Greenland will establish its own national geological data center: GeoSurvey Greenland (GSG). Traditionally, GEUS worked with the Greenland administration under five-year agreements. In August 2014, the Greenland administration signed a new five-year agreement with GEUS to maintain the "good and constructive" relations, and together start building GSG as a natural extension of Greenland's assumption of independent responsibility for mineral resources (the new institution is to be established in 2016).[49]

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[44] See "OECD Best Practice Principles for the Governance of Regulators," OECD, 21 June 2013, www.oecd.org/gov/regulatory-policy/governance-regulators.htm.

[45] For the Extractive Industries Transparency Initiative (EITI), visit "The EITI Principles," EITI, accessed 29 August 2014, http://eiti.org/eiti/principles; for the Natural Resources Charter, visit http://naturalresourcecharter.org/ (accessed 29 August 2014).

[46] Marina Buch Kristensen and Louise Smed, "Integrity Study on the public sector in Greenland," Nordic Consulting Group A/S, prepared for Transparency International Greenland, January 2012, www.ncg.dk/index.asp?id=35538.

[47] Marc Jacobsen, "Proposed Law Amendment May Threaten Good Greenlandic Governance," The Arctic Institute, 28 July 2014, www.thearcticinstitute.org/2014/07/072814-proposed-law-amendment-good-governance-greenland.html.

[48] For a more detailed overview of possibilities to increase transparency in extractive industries, see e.g. Raymond Bleischwitz, "Transparency in the extractive industries: Time to ask for more," *Global Environmental Politics*, July 2014.

[49] "Ny samarbejdsaftale styrker råstofudviklingen," *Sermitsiaq AG*, http://sermitsiaq.ag/samarbejdsaftaleny-samarbejdsaftale-styrker-raastofudviklingen.

GSG will be a state company, based in Nuuk. Its aim is to concentrate all drill core functions in one place, in order not only to facilitate its advisory task to the Greenland authorities, but also to provide easy access to drill core archives. The organization will focus on geological mapping (expanding knowledge of areas that may potentially be interesting for exploration activities); collecting geophysical and geochemical data (as the vast majority of Greenland is unexplored territory; and preparing a plan for data collecting. GSG will construct laboratories and databases, and the three existing drill core depots in Kangerlussuaq (one for minerals and one for oil drill cores) and Narsarsuaq (to date, mainly used to facilitate the gold mine in Nalunaq) will all be moved to Nuuk.

Taxation and royalty regimes

According to its oil and minerals strategy, the government of Greenland has put significant effort into developing different taxation schemes for each of its natural resources. As an illustration, almost 25 percent of the entire strategy document concerns taxation. As a study by the Fraser Institute suggests, uncertainty about the taxation regime and a feeling that the taxation regime changes frequently are among the chief concerns voiced by mining companies about Greenland. Though there are several sign posts confirming that the government of Greenland may have focused too much on generating short-term revenue, it is beyond the scope of this study to draw definitive conclusions about this.

GLOBAL MINERAL SUPPLY AND DEMAND

Iron Ore

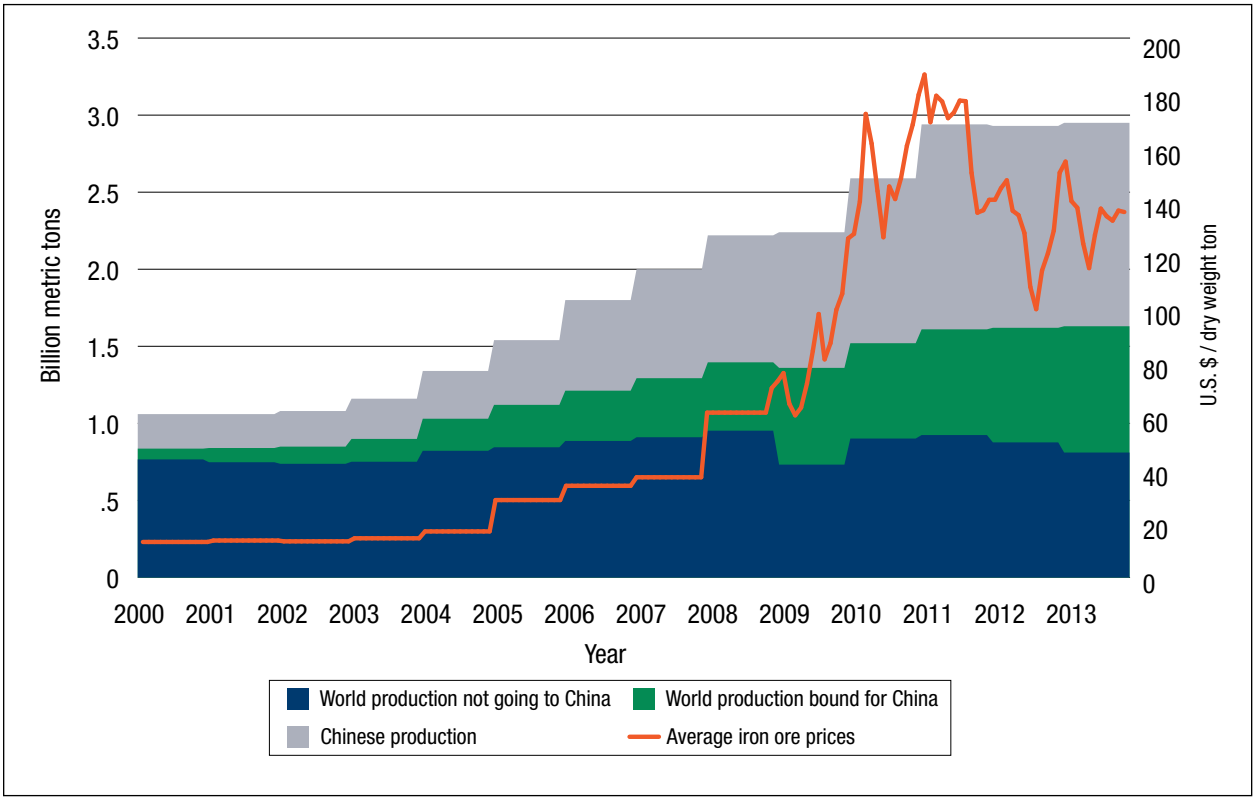
Iron ore is abundant globally, and because of its low cost and bulk its extraction costs depend heavily on economies of scale. The global iron ore industry is thus dominated by very large companies, with three large companies (BHP Billiton, Rio Tinto, and Vale) accounting for 60 percent of global seaborne trade in 2009.[50] This dependence on scale is increasing as low-cost hematite resources are becoming harder to find and the bulk of new iron ore projects rely on extraction of magnetite, an ore with lower iron content and higher processing costs.[51]

Greenland has excellent iron ore resources, with very large deposits at Isua, Itilliarsuk, and along the Lauge Koch Kyst supracrustal complex in far Northwestern Greenland.[52] The Isua deposit has been explored since the 1960s, and was purchased in 2005 by the London Mining Corporation which has been granted an exploitation license for the project and is now seeking around $2 billion in financing. The iron ore deposit has estimated resources of 1,107 million metric tons, including indicated resources of 380 million metric tons at 33 percent Fe and inferred resources of 727 million metric tons at 32 percent Fe. The resource is expected to produce high grade blast furnace pellet at 70.2 percent Fe. Other companies are engaged in iron ore exploration elsewhere in Greenland. Avannaa Resources has done some exploration around Itilliarsuk, where NunaMinerals A/S previously estimated a resource of 150-200 million metric tons at 20 percent Fe.[53] Resource estimates are not available in the Northwestern region, which was mapped by the Danish Geological Survey in the 1970s.

China is central to global iron ore markets. Global production is concentrated in China, Brazil, and Australia, which accounted respectively for an estimated 44 percent, 18 percent, and 13 percent of output in 2013. China is the world's largest producer of iron ore, but its enormous production capacity is insufficient to fuel demand created by the Chinese

[50] "Iron Ore Market 2011-2013," UNCTAD, June 2012, http://unctadxiii.org/en/SessionDocument/suc2012_Iron_Ore_en.pdf.
[51] Well-known but source here: Rodney Nelson, "Quarterly Commodity Insights Bulletin: Iron Ore," KPMG, March 2013, www.kpmg.com/Global/en/IssuesAndInsights/ArticlesPublications/commodity-insights-bulletin/Documents/iron-ore-q4-2012-march-2013.pdf.
[52] H. Stendal and K. Secher, "Iron Ore Potential in Greenland," *Geology and Ore*, no. 19, GEUS, March 2011, www.geus.dk/minex/go19.pdf.
[53] NunaMinerals was part of state-owned Nunaoil until 1999. In 2008 then independent NunaMinerals was privatized. It is one of the exploration companies that has been actively involved in Greenland.

Figure 6: Chinese Iron Demand Fuels Global Production, Drives Prices



Source: MOFCOM, *Xinhua* reports, USGS data, Index Mundi

steel industry. China therefore also drives global demand, accounting for 67 percent of global seaborne iron ore demand. China is heavily dependent on imports, with 73 percent of its demand coming from imports in 2013.

The importance of demand from China means that the industry as a whole is highly dependent on continued economic growth in China, yet it seems likely that demand will decelerate in the future. The extent of that deceleration is highly uncertain and subject to debate, but the country's efforts to rebalance its economy away from industrial investment towards a more consumer-driven model and evidence of a slowdown in real estate construction point towards a slowdown in steel demand.[54] Estimates by the World Steel Association predict demand growth of 3 percent and 2.7 percent in 2014 and 2015 (compared to 6 percent growth in 2013), but expect that deceleration in demand may be moderated by growth in developed economies.[55]

Stable iron ore prices are critical for China's economic stability, and the country's dependence on imports and on the international mining majors has been a point of acute strategic anxiety. This anxiety came to international prominence in 2008 and 2009 when the state-owned Aluminum Corporation of China (Chinalco) quietly acquired a 9 percent stake in Rio Tinto, then the world's third-largest mining company, in order to prevent a proposed merger between Rio Tinto and BHP Billiton. The following year,

[54] See also Elizabeth C. Economy and Michael Levi, *By All Means Necessary – How China's Resource Quest Is Changing the World,* (Oxford, U.K.: Oxford University Press, February 2014).

[55] Tanya Powley, "Global steel demand to slow as Chinese economy cools," *Financial Times*, 9 April 2014, www.ft.com/intl/cms/s/0/62377438-bfe7-11e3-9513-00144feabdc0.html#axzz3BnjJDIAg.

Chinalco proposed a $19.5 billion investment in Rio Tinto, a deal that was unanimously endorsed by Rio Tinto's board but later collapsed for commercial reasons amid mounting opposition among Rio Tinto shareholders and the Australian public.[56]

These were bold moves by China and demonstrate the strategic importance of iron to both producing and consuming countries and the great extent to which Chinese industry can be mobilized to resolve this problem. Both deals were motivated by Chinese concerns over the international benchmark system for iron prices, a system which concentrated enormous pricing power in the hands of the international mining majors. That pricing system, which had lasted for over 40 years, collapsed in 2010, and iron ore contracts are now negotiated quarterly on a spot basis, a system which results in greater price volatility.

Prices shot up drastically between 2010 and 2011 following the collapse of the benchmark system. By February 2011, the average monthly spot price for 62 percent Fe ore surpassed $187 per ton, more than double the 2009 price and over five times the price in 2007. Since 2011, prices have relaxed gradually and as of this writing have dipped close to $90, the lowest price in five years but still very high by historical standards.[57] Production is expected to continue to increase despite falling prices as international majors expand production. This move will in turn threaten many smaller new projects which operate at much higher costs.

In the current global environment of increasing supply, inefficient production at the margins, and softening demand from China, it appears unlikely that investment will materialize for major iron ore projects in the near future. However the potential exists for investments from state-owned mining companies, particularly those from China, where government and the steel industry remain deeply concerned about the stability of overseas supply. The prospects for Chinese investment will be explored in more detail in chapter 4.

Rare Earth Elements

Rare earth elements (REE) have likely been one of the most-discussed mineral resources during the last five years in policy circles. Moreover, these discussions have been marked by widespread misunderstanding and confusion. To start with, despite the expectation that global demand for most of these minerals will increase in the coming years, REE are not physically rare or scarce and there is no geological shortage. Recent estimates suggest that the static range of REE is in excess of 850 years and may be significantly larger.[58] The name "rare earth" refers to the difficulty that 19th century chemists had in separating the elements from each other and it indicates that REE are generally stable as oxides (earths) rather than metals.[59] REE form a group of 17 chemically-similar metallic elements, including 15 lanthanides, scandium, and yttrium. The 15 lanthanides are generally divided into lower atomic weight elements (light rare earth elements) and heavy rare earth elements (to which yttrium is generally added).

Greenland possesses significant REE resources that according to some may, if produced, meet global demand for a number of years, though numbers vary widely. By 2015, global demand may according to some estimates be anywhere between 160,000 tons and 210,000 tons per year.[60] Estimates of world

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[56] Erica S. Downs, "Whatever Became of China, Inc.?" *Gavekal Dragonomics*, 24 June 2014, http://www.brookings.edu/research/articles/2014/06/11-whatever-became-china-inc-downs.

[57] Price data from: "Iron Ore Monthly Price - US Dollars per Dry Metric Ton," Index Mundi, accessed 29 July 2014, www.indexmundi.com/commodities/?commodity=iron-ore. Note that average monthly prices do not reflect day to day volatility.

[58] Volker Zepf, *Rare Earth Elements: A New Approach to the Nexus of Supply, Demand and Use: Exemplified Along the Use of Neodymium in Permanent Magnets*, (Berlin: Springer, 2013), 127.

[59] Frances Wall, "Rare earth elements," in Gus Gunn, ed., *Critical Metals Handbook*, (UK: Wiley-Blackwell, 2014), 312.

[60] Marc Humphries, *Rare Earth Elements: The Global Supply Chain*, Congressional Research Service, 16 December 2013, http://fas.org/sgp/crs/natsec/R41347.pdf.

reserves of REE are about 114 million metric tons of rare earth ores, of which an estimated 48 percent is in China.[61]

The main environmental concerns related to REE are not in the elements themselves but in the chemicals used in the extraction and separation process and, in the case of the Kvanefjeld deposit in Greenland, in the presence of radioactive elements (thorium and uranium) in the ore deposit. It is worth noting that there will almost always be some level of thorium and uranium present in any final concentrate.[62]

China is now the world's leading producer of rare earth elements by a wide margin, having taken over the bulk of global production and processing from the United States in the 1980s. Prior to that time, the Mountain Pass mine in California was a major producer and was the world's leading supplier of rare earths during the 1960s and 1970s. Since the mid to late 2000s China has sought to regulate its domestic rare earth industry, in which small illegal mines relying on low-tech in-situ leaching techniques are major sources of rare earth oxides to downstream processing facilities. China introduced a tax on rare earth exports in 2006 and has had production quotas in place since the 1990s and export quotas since at least 2004, but stepped up its efforts to regulate the industry by increasing these quotas in mid-2009 and again in December 2009.[63,64] The mid-2009 adjustment came several months before a maritime collision and the arrest of a Chinese trawler captain by Japanese authorities led to tensions between China and Japan, but many at the time erroneously believed the reduction in rare earth quotas was a Chinese response to the trawler incident.[65]

Despite the fact that this incident appears to have little or no basis in fact, the story dovetailed with an emerging narrative of a newly assertive China willing to use its economic muscle for political gains, and thus made a lasting impression on policymakers in the United States, Europe, and Japan. It spawned a variety of policy programs aimed at reducing dependence on Chinese rare earth exports and sparked two separate WTO cases.[66] In the United States, a congressional caucus on rare earths was established with the aim of rebuilding the domestic rare earth industry, and the European Union stepped up its efforts on establishing a unified initiative to secure access to rare earths (this policy is described in more detail in the following chapter).

These events spurred exploration activities around the world, and also raised the profile of Greenland, which had long been known to host a promising yet largely unidentified resource base. While the investment cycles of larger mining companies are generally too long for political attention on certain minerals to generate investments, this is not the case for smaller exploration companies. In most cases, these junior miners depend on equity markets for their financing, and to some extent they rely on publicity to sustain interest among investors, many of whom are small shareholders.[67] The narrative of Chinese restrictions on rare earth exports would thus have been a boon to junior miners.

The story of the Chinese rare earth embargo coincided with an explosion of interest in rare earth projects. Around 300 rare earth deposits worldwide have been evaluated in recent years, of which only a small handful are likely to be built. As David Humphreys,

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[61] Wall, "Rare earth elements," 331.
[62] Ibid.
[63] Jane Korinek and Jeonghoi Kim, "Export Restrictions on Strategic Raw Materials and Their Impact on Trade." *OECD Trade Policy Papers,* no. 95, (OECD Publishing, 2010).
[64] Wayne M. Morrison and Rachel Tang, *China's Rare Earth Industry and Export Regime: Economic and Trade Implications for the United States*, Congressional Research Service, 30 April 2012, http://fas.org/sgp/crs/row/R42510.pdf.
[65] King and Armstrong, "Did China really ban rare earth metals exports to Japan?"
[66] In March 2014 WTO ruled in favor of the US, EU, and Japan: Tom Miles and Krista Hughes, "China loses trade dispute over rare earth exports," *Reuters*, 26 March 2014, www.reuters.com/article/2014/03/26/us-china-wto-rareearths-idUSBREA2P0ZK20140326.
[67] For a more elaborate explanation of these market dynamics, see David Humphreys, "The mining industry and the supply of critical minerals," in Gus Gunn, ed., *Critical Metals Handbook*, (UK: Wiley-Blackwell, 2014).

a London-based mining consultant and former chief economist at Rio Tinto, puts it: "This gold rush mentality is an age-old feature of the mining industry."[68]

There seems to be reasonable agreement that Greenland will produce REE at some point, though it is difficult to tell when investments will be made. In recent years, REE deposits have been well investigated in Kvanefjeld and Kringlerne; the former also containing uranium and zinc, while the latter additionally has deposits of zirconium, tantalum, and niobium.[69] Kvanefjeld has been investigated for decades, but lost its appeal for commercial reasons in the 1980s. It is important to note that REEs at that time were not well known or in high demand, as demand only increased recently with the rapid deployment of new technologies, such as smartphones and renewable energy technologies. As an illustration, the U.S. Department of Energy in 2011 published its Critical Materials Strategy, in which it concluded that supply challenges for five REE (dysprosium, terbium, europium, neodymium, and yttrium) may affect clean energy technology development in the years ahead.[70] In 2007, Greenland Minerals & Energy (GME) purchased the Kvanefjeld project, estimated to contain 10.3 million metric tons of rare earth oxides including 0.37 million metric tons of heavy rare earth oxides.[71] The Kringlerne deposit is owned by the Australian mining company Tanbreez, and is estimated to contain 28 million metric tons of rare earth ore, of which 30 percent are thought to be heavy REE. Contrary to many REE projects around the world, Kringlerne does not contain uranium or thorium, making the refining process easier.

As noted above and elaborated in more detail in chapter 4, China's industrial policies on rare earth elements have been at the heart of global policy discussions about these metals. China produces the vast majority of the world's rare earth elements and is, practically speaking, still the only country with a viable REE processing industry. China's dominance in global rare earth markets is a relatively new phenomenon, having taken hold only after the closure of the Mountain Pass facility in the 1980s. Why did this happen? First, it is important to consider that at the time REE were not high in demand and did not have any perceived strategic value, and it simply made commercial sense to transfer processing technology and know-how to China, which was able to process rare earth oxides at lower costs and at the time was less worried about environmental pollution. The United States in particular had a full supply chain of REE, but gave this up in a context of weak demand for REE, significantly lower costs in China, and increasingly stringent domestic environmental standards. Today the United States, the EU, and Japan find themselves in a situation where demand for rare earths has risen significantly, but rebuilding the entire supply chain will be very costly and time-consuming. On top of that, Chinese companies have become experts at processing rare earth oxides and are now so cost competitive that some market observers believe that without significant government support it is unrealistic to expect that the United States or the EU could compete with Chinese firms. Whether that is problematic or not is an entirely different debate (one we think is not necessary) but it is important to keep in mind given European ambitions to secure a foothold in Greenland. Assuming that at some point in time Greenland's rare earth deposits are developed, a significant part of the processing of the minerals will happen in China, unless sufficient processing capacities are installed elsewhere in the world. Some processing facilities have been reopened outside of China: most prominent is the Mountain Pass mine in California, but also the Silmet factory in Estonia, which is owned by Molycorp (the company that also operates Mountain Pass).[72]

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[68] Ibid., 24.
[69] Bo Møller Stensgaard, Lars Lund Sørensen, GEUS, "Mineral Potential in Greenland," *Geology and Ore,* no. 23, GEUS, October 2013, www.geus.dk/minex/go23.pdf.
[70] U.S. Department of Energy, *2011 Critical Materials Strategy*, December 2011, http://energy.gov/node/349057.
[71] World Nuclear Association (WNA), "Uranium from Rare Earths Deposits," July 2014, www.world-nuclear.org/info/Nuclear-Fuel-Cycle/Uranium-Resources/Uranium-From-Rare-Earths-Deposits/.
[72] Wall, "Rare earth elements," 333.

Uranium

Uranium resources are thought to be abundant and reasonably widespread throughout the world. Knowledge about uranium resource availability is fairly limited, according to the World Nuclear Association (WNA), and further geologic exploration and changes in costs and global prices can substantially change measured resource estimates.[73] Based on 2011 data, the largest recoverable resources are located in Australia, Kazakhstan, Russia, Canada, and Niger, which together possess almost 70 percent of global supplies. In 2012, International Atomic Energy Agency (IAEA) estimates suggested that total identified uranium resources would cover at least one century of consumption.[74] Despite the expected increase in demand for nuclear reactor capacity worldwide, more efficient technology and recycling—combined with anticipated further geological exploration—are expected to increase the expected lifetime of existing supplies significantly, possibly by more than 2,000 years.[75]

Though resource estimates have to be viewed skeptically, according to the Danish Institute of International Studies, Greenland is believed to have anywhere between the sixth and tenth largest uranium reserves in the world.[76] The WNA in 2014 estimated that the Kvanefjeld uranium resource base holds 101,000 metric tons uranium (tU) of indicated resources (somewhat well defined) and 120,000 tU of inferred resources (in essence, an educated guess). The WNA also notes that IAEA data suggest that in the vicinity of Kvanefjeld there is considerable additional mineral potential, perhaps up to 600.000 tU.[77] The Kvanefjeld deposit in Greenland was intensively investigated between the 1950s and the 1980s but interest waned when uranium prices fell in the late 1970s and early 1980s. Moreover, Denmark's declaration of support for a nuclear-free zone in 1984 precluded further development. In addition, there was wide popular support against uranium, as illustrated by the 1985 parliamentary resolution that effectively banned nuclear power plants from being built in the country.[78]

This situation changed with the passage of the 2009 Act on Greenland Self-Government, which gave Greenland full authority over its natural resources. As a result, in 2010 the Greenland administration relaxed its zero-tolerance policy on uranium and allowed mining companies to explore its resource potential. In October 2013, the government of Premier Hammond and her Siumut party pushed legislation through Greenland's parliament to overhaul a 25-year-old practice against the extraction of radioactive materials such as uranium and thorium, with a minimal victory of 15 against 14 votes and two abstentions.

As has been noted above, uranium mining has become a thorny political issue in both Greenland and Denmark, and Greenland's parliament is close to evenly split on the subject. The more left-wing Inuit Ataqatigiit (IA) party, led by former Premier Kleist until May 2014 and currently the main opposition party, has indicated that it may overhaul recent decisions in favor of uranium mining if it regains a majority in the next elections. The main argument of the Siumut party in favor of lifting the zero-tolerance policy has been that uranium and thorium mining in Greenland, based on current geological knowledge,

[73] World Nuclear Association, "Supply of Uranium," August 2012, www.world-nuclear.org/info/Nuclear-Fuel-Cycle/Uranium-Resources/Supply-of-Uranium/.
[74] International Atomic Energy Agency, "Global Uranium Supply Ensured for Long Term, New Report Shows," 26 July 2012, www.iaea.org/newscenter/pressreleases/2012/prn201219.html.
[75] Toni Johnson, "Global Uranium Supply and Demand," Council on Foreign Relations, 14 January 2010, www.cfr.org/world/global-uranium-supply-demand/p14705.
[76] Cindy Vestergaard and France Bourgouin, "Should Greenland Mine its Uranium?" Danish Institute for International Studies Policy Brief, May 2012, http://subweb.diis.dk/sw118858.asp.
[77] WNA, "Uranium from Rare Earths Deposits."
[78] "Denmark," Joint Research Centre, Institute for Energy and Transport (IET), accessed 29 July 2014, http://ehron.jrc.ec.europa.eu/denmark.

are not stand-alone uranium projects. Instead, in the Kvanefjeld project, uranium is a by-product of rare earth elements, as is the zinc potential found there. Now that it has full authority over its natural resources, the Greenland administration has argued that extraction of rare earth elements should be decided independently from the uranium debate. Lifting the uranium ban was therefore seen as a necessary precondition to rare earth mining at Kvanefjeld.[79] Greenland's decision to mine uranium has been a source of neuralgia for the Danish government, which is responsible for safeguarding international conventions on non-proliferation. In the spring of 2014, Greenlandic Premier Hammond met with Danish Prime Minister Helle Thorning-Schmidt and agreed to establish a consultation process on the foreign policy implications of uranium mining. As discussed earlier, these discussions are ongoing but are not expected to reach a definite conclusion until 2015.

Greenland is already covered as part of the Kingdom of Denmark by the Treaty on the Non-Proliferation of Nuclear Weapons. In addition, it has signed a voluntary IAEA protocol to include nuclear substances extracted by mining.[80] A part of the export controls and relevant regulations on uranium exploitation and exports likely have to go through Denmark. The Greenland administration currently expects that establishing the entire regulatory framework related to uranium extraction will be completed in early 2016. It has stated explicitly that until then no license to extract uranium or other radioactive elements will be granted.[81] It is also not clear whether this means that the Kvanefjeld rare earth elements project will not receive an extraction license before 2016, but it seems unlikely that exploration can start before all the laws and regulations are in place.

Copper and Other Nonferrous Metals

Copper ranks third among all metals in terms of global consumption behind iron and aluminum. As with iron ore, demand has been driven primarily by rapid economic growth, urbanization, and industrial investment in China and as with many other mineral commodities copper prices peaked in early 2011. China accounts for 35 percent to 40 percent of global consumption but has relatively limited domestic access, producing just 9 percent of mine output in 2013.[82] China also is expanding its capacity for copper smelting rapidly and its mix of imports are expected to move more towards copper concentrates and away from refined products. Chile is by far the world's largest copper producer, followed by China, Peru, and the United States.[83]

Greenland is thought to have excellent geological potential for sediment-hosted copper although to date there has been little exploration. China's largest copper producer, Jiangxi Copper, is involved in exploration in eastern Greenland in partnership with other investors from Jiangxi province and Nordic Mining, a British mining exploration company. Jiangxi Copper has aspirations to become one of the world's largest integrated mining companies and is currently involved in a series of mergers and acquisitions in China aimed at becoming a major player in China's rare earth industry. Jiangxi Copper appears eager to secure overseas assets to supply its smelting business with copper concentrates, and recently acquired a stake in mining operations in Albania. If the group from Jiangxi makes a significant discovery they would have the capacity, through Jiangxi Copper, to develop a mine relatively quickly.

The most likely areas for undiscovered copper deposits in Greenland are located in the country's northeast and

[79] See also Cindy Vestergaard, "Starting from Zero: Denmark and Greenland's Uranium," Center for Strategic and International Studies, 30 April 2013, http://csis.org/blog/starting-zero-denmark-and-greenlands-uranium.
[80] "Greenland's oil and mineral strategy," Government of Greenland, 40.
[81] Ibid., 41.
[82] Rhona O'Connell et al., "GFMS Copper Survey 2014," (London, U.K.: Thomson Reuters, April 2014).
[83] "Mineral Commodity Summaries 2014," USGS, 28 February 2014, http://minerals.usgs.gov/minerals/pubs/mcs/2014/mcs2014.pdf.

central east.[84] Unlike other minerals such as iron ore, uranium, and rare earths where significant deposits are already known from earlier periods of exploration, copper mining in Greenland will depend on further exploration. Given the weak investment climate and the short summer time window for exploration, we do not expect that Greenland will have copper mining activity in the near future. As is the case with iron ore, investment in new mines has slowed following a period of intense investment in response to rising prices. Prices again are falling; in addition many new global projects are expected to come online in the next two years. Production costs are also increasing at existing mines. Given this market situation industry analysts do not expect that there will be major investments in new mines in the near future.[85]

Greenland has a zinc mine, known as the "Black Angel" mine, that operated between 1973 and 1990 and is now under development by Angel Mining PLC.[86] There is also a major zinc project under development by Ironbark Zinc Limited in the northeastern part of the country at Citronen Fjord. A zinc mine was also operated near Blyklippen near Mesters Vig in East Greenland from 1956 to 1952, and has more recently been explored by Ironbark Zinc Limited.[87] Each of these three mines also contains lead. Greenland is thought by geologists to have multiple areas with geological potential for zinc deposits that have yet to be discovered.[88]

Rubies and Sapphires

The one mine in Greenland that is likely to open soon is a ruby mine being developed by the Canadian company True North Gems in Aappaluttoq, south of Nuuk. Though the project experienced some delays over regulatory uncertainties, in March 2014 the company and the Greenland government reached agreement on an exploitation license, making it the second company after London Mining to do so.

After completion of the environmental impact assessment and the social impact assessment, in late May 2014 the government of Greenland also approved the company's Exploitation and Closure Plan as well as its Impact Benefit Agreement (IBA).[89] The latter document is intended to safeguard the interests of local communities and the benefits of the project for Greenlandic society. It was presented to and approved by Sermersooq municipality on June 4, 2014, signaling a final go-ahead for the mine.[90]

It is expected that construction will take approximately six months, with full production commencing next year. Roughly 60 workers will operate the mine in shifts. According to True North Gems, most of the workforce will be locals, though these numbers are not specified in the IBA, most likely due to uncertainty as to whether the labor force has the skills required to construct and operate the mine. The IBA explicitly mentions the intention to employ as many local workers as possible, and commits True North Gems to allocate 250,000 DKK ($45,000) in 2014 and 2015, and 1,000,000 DKK ($180,000) each year from 2016 until the mine is decommissioned for educational programs to improve skilled and unskilled workers' job opportunities in the mining sector.[91]

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[84] Bo Møller Stensgaard, "Sediment-hosted copper in Greenland," *Geology and Ore,* no. 18, GEUS, January 2011, www.geus.dk/minex/go18.pdf.
[85] O'Connell et al., "GFMS Copper Survey 2014."
[86] "Black Angel Mine – Project Overview," Angel Mining PLC, accessed on 29 July 2014, http://angelmining.com/?page_id=278.
[87] Bjørn Thomassen, "The Blyklippen lead-zinc mine at Mesters Vig, East Greenland," *Geology and Ore*, no. 5, GEUS, December 2005, www.geus.dk/minex/go05.pdf.
[88] Lars Lund Sørensen, Per Kalvig and Kristine Thrane, "The zinc potential in Greenland," *Geology and Ore,* no. 21, GEUS, February 2012, www.geus.dk/minex/go21.pdf.
[89] "True North Gems obtains Greenland Government approval for Ruby Mine," Press release, True North Gems Inc., 30 May 2014, http://truenorthgems.mwnewsroom.com/press-releases/true-north-gems-obtains-greenland-government-appro-tsx-venture-tgx-201405300949305001.
[90] "Municipality of Semersooq approves impact benefit agreement for True North Gems' Ruby Mine," Press release, True North Gems Inc., 4 June 2014, http://truenorthgems.mwnewsroom.com/press-releases/municipality-of-sermersooq-approves-impact-benefit-tsx-venture-tgx-201406040950079001.
[91] See "Impact Benefit Agreement, under Mineral Exploitation License 2014 / 21," Kommuneqarfik Sermersooq, True North Gems Greenland and Government of Greenland, June 2014, article 10.3, 12, http://naalakkersuisut.gl/~/media/Nanoq/Files/Publications/Raastof/ENG/Signed%20IBA%20TNG%20ENG%2016%2006.pdf.

It is expected that this mine will operate for nine years, a period that may be extended if more mineral deposits are found. From the perspective of the government of Greenland, this project is hoped to provide a showcase that successful and sustainable mining can take place in Greenland.

Gold

In 2004, the Nalunaq gold mine was inaugurated as Greenland's first gold mine. It is located in Kirkespirdalen and its name means "the place that is hard to find."[92] Until 2009, there was regular mining and shipping of ore.

In 2009, Angel Mining purchased the mining assets including equipment, a fully operational mining camp, and harbor facilities. In order to make the mine operate profitably, Angel Mining reported that it decided to construct a gold separation unit inside the mine.[93] Between 2009 and 2011, an excavation chamber was built inside the mine together with the separation unit, which included cyanide use, to increase the recovery of gold from the ore. It is estimated that from 2011 until the closure of the mine in October 2013 an additional 670 kg of doré was produced in Nalunaq.[94] Reports suggested that in 2012 Angel Mining greatly benefited from high global gold prices, and the revenues from Nalunaq were said to be used by Angel Mining to fund its envisaged reopening of the Black Angel zinc and lead mine in East Greenland.[95]

In October 2013, production from the Nalunaq gold mine stopped. In its most recent environmental monitor (carried out annually since 2004) DCE reported that in 2013 the mine had been shut down briefly after a problem with the separation unit, after which high concentrations of cyanide were measured. Angel Mining closed down the unit and cleaned up, and DCE hereafter measured no levels of cyanide above the maximum acceptable concentrations.[96] The overall environmental impact was assessed as being "minor and decreasing." The clean-up of the site is expected to be finished in 2014.

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[92] K. Secher, H. Stendal & B.M. Stensgaard, "The Nalunaq Gold Mine," *Geology and Ore,* no. 11, GEUS, February 2008, www.geus.dk/DK/publications/newsletters/minex/Documents/go11.pdf.

[93] See "Nalunaq," Angel Mining PLC, accessed on 29 July 2014, http://angelmining.com/?page_id=282.

[94] Lis Bach, Maia Olsen and Gert Asmund, "Environmental Monitoring at the Nalunaq Gold Mine, South Greenland 2013," Scientific Report from the Danish Centre for Environment and Energy (DCE), no. 97, (Aarhus University, 2014), http://dce.au.dk/udgivelser/vr/nr-51-100/abstracts/no-97-environmental-monitoring-at-the-nalunaq-gold-mine-south-greenland-2013/.

[95] Andre Lamberti, "Angel Mining reports record gold pour from Nalunaq mine, Greenland," *Proactive Investors,* 29 May 2012, www.proactiveinvestors.co.uk/companies/news/43463/angel-mining-reports-record-gold-pour-from-nalunaq-mine-greenland-43463.html.

[96] Bach et al., "Environmental Monitoring at the Nalunaq Gold Mine," 29.

A small town in the south of Greenland.
Photo credit: © iStockphoto/posteriori

3. In Search of Alternative Raw Materials: Greenland and the European Union

The European Union is highly dependent on non-energy raw materials to sustain its economy. This dependence is likely to increase with an expansion of the quality of life throughout the continent, and the push for a greater share of clean technologies, electric vehicles, and renewable energy. To give an example of the latter, solar panels require metals such as silicon, tellurium, and indium, and most wind turbines use magnets made with rare earth elements. In general, the importance of metals and minerals has received much less attention than resources such as oil and, especially in the case of Europe, natural gas. However, Europe's dependence on raw materials is substantially higher: it is estimated that the EU's overall contribution to global materials supply hovers around 9 percent.[97] Many important materials, such as borates, indium, rare earth elements, and titanium, are not produced domestically in significant amounts.

The European Union has many uncharacterized deposits and could thus potentially increase its domestic mining activities in areas such as northern Scandinavia. According to the Lapland Chamber of Commerce, in the period from 2014 to 2020 over €15 billion will be invested in northern Finland and northern Sweden combined.[98] However, in other parts of Europe the current economic and regulatory climate hinders domestic mining, as does increased land use competition. In addition, for several metals, e.g. tantalum, gallium, and germanium, the opportunities for recycling and substitution are limited so reducing import dependence through this policy approach is limited as well.[99] For other materials however, including some of the REE, recycling is increasingly economic and it is likely that more recycling will take place.[100] Still, access to international markets and reasonable market functioning is essential for Europe. The production of much of global supply of materials though is concentrated in only a few countries (particularly China).

In response to these developments, the European Union developed a series of policies related to raw materials. Some of these, such as the Roadmap to a Resource Efficient Europe, take a broad view and outline the opportunities for recycling and waste management in addition to calling on the urgent need to increase data collection and transparency.[101] Greenland, with its assumed vast treasure trove of raw materials and close historical ties with the European Union, features prominently in some of these

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[97] "Report on Critical Raw Materials for the EU," Report of the Ad hoc Working Group on defining critical raw materials, (European Commission, May 2014), http://ec.europa.eu/enterprise/policies/raw-materials/files/docs/crm-report-on-critical-raw-materials_en.pdf.

[98] Sweden and Finland in 2013 attracted €150 million in exploration budgets according to SNL Metals & Mining, despite a worldwide trend of decreasing investments in junior operations that started in 2012. See "World Exploration Trends 2014," Special report for the PDAC International Convention, SNL Metals & Mining, 2014, http://go.snl.com/rs/snlfinanciallc/images/WETReport_0114.pdf.

[99] For an elaborate overview of the possibilities of recycling of critical metals, see Christian Hagelüken, "Recycling of (critical) metals," in Gunn, ed., *Critical Metals Handbook*.

[100] Wall, "Rare earth elements," 333.

[101] "Roadmap to a Resource Efficient Europe," European Commission, COM(2011) 571, http://ec.europa.eu/environment/resource_efficiency/pdf/com2011_571.pdf.

policies, and may someday become an important supplier of raw materials to Europe. This chapter briefly describes European raw materials policies and what former European Commissioner for Industry Antonio Tajani has labelled "raw materials diplomacy."[102] It also touches upon related efforts that have been undertaken in some of the individual member states, and how these and private sector actions relate to each other. It then explains how Greenland could contribute to diverse and stable supplies of raw materials in Europe, assuming that these are developed in the future. The chapter then gives a current assessment of the involvement of European stakeholders, both public and private, in Greenland. This chapter ends with a description of Greenland's relations with the European Union, its influence on ongoing debates between them about raw materials, and what relations between Greenland and the European Union could look like after Greenland's potential future independence.

EU RAW MATERIALS POLICIES AND RAW MATERIALS DIPLOMACY

Since 2008, raw materials have taken firm root in European policymaking. Following increased concerns over their importance for economic performance, high import dependence, high concentration of production in just a few countries, and the lack of substitutes, the European Commission published its Raw Materials Initiative, which notes the dangers of a lack of integrated European policy with regard to raw materials.[103] Just before this publication, the European Parliament also flagged the importance of raw materials in its resolution called, "On Trade in Raw Materials and Commodities."[104] The European Commission proposed European action on raw materials along three pillars: safeguard access to raw materials under market conditions, better facilitate the sustainable extraction of raw materials from European deposits, and reduce domestic consumption of raw materials by increasing efficiency while promoting recycling and substitution.

This European strategy resulted in follow-up studies and the formal adoption of a list of fourteen deemed critical materials in 2011.[105] In addition, developments in the different markets for raw materials were monitored continuously and the list of critical materials updated every three years. **Table 1** below shows the list of critical materials that was published in May 2014.[106] While the methodology for analysis did not change, the scope of the research did; in the most recent study 54 non-energy, non-food materials were analyzed, as opposed to 41 materials in the previous study. In addition, the study exhibited greater concern with regard to REE, which are now split up in sub groups. In comparison to the 2011 list, one critical material (tantalum) was taken off the list thanks to a lower supply risk, while six new materials were added. The methodology used by the EC for its list of critical raw materials has received some criticism for lacking a holistic approach to raw materials supply chains and potentially leading to "scaremongering."[107]

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[102] "EU to step up raw materials 'diplomacy,'" *EurActiv*, 18 June 2010, www.euractiv.com/sustainability/eu-step-up-raw-materials-diplomacy-news-495397.

[103] "The raw materials initiative — meeting our critical needs for growth and jobs in Europe," European Commission, COM(2008) 699, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0699:FIN:en:PDF.

[104] Daniel Fiott, "Europe and Rare Earths: Dependable Diplomacy or Strategic Scarcity?" *Madariaga Paper*, vol. 4, no. 9, July 2011, www.madariaga.org/publications/madariaga-papers/487-europe-and-rare-earths-dependable-diplomacy-or-strategic-scarcity.

[105] "Tackling the challenges in commodity markets and on raw materials," European Commission, COM(2011) 25, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0025:FIN:en:PDF.

[106] "Communication on the review of the list of critical raw materials for the EU and the implementation of the Raw Materials Initiative," European Commission, COM(2014) 297, http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014DC0297&from=EN.

[107] "Critical thinking about critical raw materials in the EU," Roskill Briefing Paper, June 2014, www.roskill.com/news/critical-thinking-about-critical-raw-materials-in-the-eu-1/?searchterm=critical thinking.

Table 1: EU List of 20 Critical Raw Materials[108]

Raw materials	Main producers (2010 – 2012)	Substitutability index	End-of-life recycling input rate	Used to produce
Antimony	China 86%, Bolivia 3%, Tajikistan 3%	0.62	11%	Batteries, plastics, glass
Beryllium	USA 90%, China 9%, Mozambique 1%	0.85	19%	Electronics, telecommunication products, medical devices
Borates	Turkey 41%, USA 33%	0.88	0%	Glass, agriculture, cleaning and detergents
Chromium	South Africa 43%, Kazakhstan 20%, India 13%	0.96	13%	Metallurgical industries, chemicals, desalination plants
Cobalt	DRC 56%, China, Russia and Zambia all 6%	0.71	16%	Batteries, biotechnology
Coking coal	China 53%, Australia 18%, USA 8%	0.68	0%	Steel production
Fluorspar	China 56%, Mexico 18%, Mongolia 7%	0.80	0%	Chemicals, steel, aluminum
Gallium	China 69%, Germany 10%, Kazakhstan 6%	0.60	0%	Integrated circuits, laser diodes, photovoltaic
Germanium	China 59%, Canada 17%, USA 15%	0.86	0%	Infrared optics, solar cells
Indium	China 58%, Japan, Korea and Canada all 10%	0.82	0%	Low-melting-point alloys, photovoltaic
Magnesite	China 69%, Russia and Slovakia 6%	0.72	0%	Refractory industries including steel and cement
Magnesium	China 86%, Russia 5%, Israel 4%	0.64	14%	Aluminum alloys, automobile industry
Natural Graphite	China 68%, India 14%, Brazil 7%	0.72	0%	Steel industry, fuel cells, batteries, nuclear reactors
Niobium	Brazil 92%, Canada 7%	0.69	11%	Alloys, magnets, superconductors
Phosphate rock	China 38%, USA 17%, Morocco 15%	0.98	0%	Chemicals, plant and animal nourishment in fertilizers, detergents
Platinum Group Metals	South Africa 61%, Russia 27%, Zimbabwe 5%	0.83	35%	Catalysts in chemical electrochemical and petrochemical, glass, medical industry
Heavy Rare Earth Elements	China 99%, Australia 1%	0.77	0%	Magnets, batteries, lasers, cell-phones, electric vehicles, wind turbines
Light Rare Earth Elements	China 87%, USA 7%, Australia, 3%	0.67	0%	Magnets, batteries, lasers, cell-phones, electric vehicles, wind turbines
Silicium	China 56%, Brazil 11%, USA and Norway 8%	0.81	0%	Aluminum, chemicals, solar cells, electronics
Tungsten	China 85%, Russia 4%, Bolivia 2%	0.70	37%	Cemented carbides, fabricated products, alloy steels

Source: Largely derived from COM (2014) 297 Final.

[108] Substitutability index values between 0 and 1, with 1 being least substitutable. Recycling input rate gives percentage of products that are produced out of end-of-life scrap. Both sets of data mark the limited options for substitutability and recycling, though subject to technological development.

Raw materials diplomacy falls under the first pillar of the European strategy and consists of a wide range of activities, such as promoting free trade, addressing export restrictions in negotiations, enforcing international trade rules, maintaining dialogue, and putting raw materials related issues on the agenda in international forums such as the G20, the Transatlantic Trade and Investment Partnership (TTIP) negotiations with the United States, and within the OECD.[109] Under the first pillar, the European Commission actively engages with Greenland on a variety of topics. Essentially, its aim is to ensure that raw materials are not locked in by major producers, but are instead produced and then reach the market where European companies can compete for them under global market conditions. There is some concern that companies from China may pursue investments in rare earth elements in Greenland in order to lock up supply for Chinese producers. As is noted in the section on China, there has been some interest in Greenland by Chinese companies that mine and process rare earths, but export and production quotas would not apply to Chinese companies producing overseas. In addition, it is important to note that Chinese dominance in this respect has little if anything to do with the possession of physical rare earth elements. Rather, in the 1980s processing capacity for rare earth elements has moved out of countries like the United States, and so it is in this arena that the Chinese have become dominant. Rebuilding this supply chain would take an estimated 15 years and require significant investments.[110] Thus, the reality seems to be that even if market participants decided to develop the rare earth element deposits in Greenland, it is almost certain that they would be processed in China, or at least outside the EU.

The first tangible result of raw materials diplomacy was the signing of a letter of intent on cooperation in the area of mineral resources in June 2012 between EC Commissioners Antonio Tajani and Andris Piebalgs, of Industry and Development respectively, and then Greenlandic Premier Kuupik Kleist.[111] The letter sets up a dialogue between the government of Greenland and the European Union, which is to be reinforced in the areas of geological knowledge, analysis of infrastructure and investment needs related to mineral resource exploitation, competence building, and environmental and social issues related to mining. While this sounded like a promising start for closer collaboration, most of our interviews in Greenland suggested that activities after the signing of the letter of intent were perceived as moving ahead very slowly, if at all.[112] We discuss Europe's involvement and investment in Greenland to date in greater detail later in this chapter and will give our view on this perceived inactivity.

In 2012 another program, the European Innovation Partnership (EIP) on Raw Materials, was launched. Its basic premise is that collective public and private innovations are required to address a wide range of raw materials related issues in the EU, such as improving the knowledge base within Europe, (re)developing mining skills within Europe, and improving waste management. It notes that every citizen in the EU generates 17 kg of electrical and electronic equipment waste per year, a number that is expected to further rise.[113] The EIP also observes that member states insufficiently collaborate on raw materials related issues, research institutions operate in a very fragmented manner, and Europe to date has underestimated the geopolitical role it must play in ensur-

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[109] For more details, see: "On the implementation of the Raw Materials Initiative," European Commission, SWD(2014) 171, http://register.consilium.europa.eu/doc/srv?l=EN&f=ST%2010457%202014%20ADD%201.

[110] See also Tim Boersma and Jaime De Bourbon Parme, "Competition for Resources and Consequences for the Environment," in Hans Binnendijk, ed., *A Transatlantic Pivot to Asia: Towards New Trilateral Partnerships,* (Center for Transatlantic Relations, Johns Hopkins University, 2014), 303, http://transatlantic.sais-jhu.edu/publications/books/A%20Transatlantic%20Pivot%20to%20Asia.

[111] "European Commission signs today agreement of cooperation with Greenland on raw materials," Press release, European Commission, 13 June 2012, http://europa.eu/rapid/press-release_IP-12-600_en.htm.

[112] As supported by several analysts, e.g. Marino G. Pieterse, "EU dithers on critical metals," *Arctic Journal*, 13 January 2014, http://arcticjournal.com/opinion/341/eu-dithers-critical-metals.

[113] "Making Raw Materials Available for Europe's Future Well-Being," European Commission, COM(2012) 82, 3, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2012:0082:FIN:en:PDF.

ing access for European companies to raw materials. Several steering groups and committees have been initiated to address these issues, though they fall outside the scope of this study. In April 2014, the first commitments under the EIP were announced, which again focus on recycling, substitution, increasing data availability, and innovation.[114] Further implementation of the EIP is ongoing, and its first monitoring and evaluation scheme was published in March.

Next to European institutions, several member states have designed national policies to address questions related to raw materials, such as the German Raw Materials Strategy (2010), the French Strategic Metals Plan (2010), and the U.K.'s Resource Security Action Plan (2012). It is important to note that despite the substantial amount of paperwork that has been produced the mandate of European institutions is still rather limited, and national policies are not necessarily aligned. Recently raw materials received significant attention because of WTO cases against Chinese protectionist behavior, but Europe had a say because this fell under trade policy, contrary to domestic extraction and industrial policy where European institutions have less clout. As these raw materials policies, both on the supranational and national level, are designed to deal with resource issues on a broader scale, we now turn to see what specific role Greenland could play in that larger framework.

GREENLAND'S POTENTIAL FROM AN EU PERSPECTIVE

Not all the resources that could potentially be extracted in Greenland are of equal importance to Europe. Some are more widely available in the market than others. For example, though the discovery of oil supplies offshore from Greenland would surely be welcomed by the Greenland administration for reasons of revenues and job creation, from a European point of view that would not be so important, as oil supplies are widely available.[115] So what resources would be of particular interest to the European Union?

Based on the list of critical raw materials established in 2014, Greenland has particularly strong potential in six of the 14 critical elements.[116] These are niobium, platinum group metals, rare earth elements, graphite, fluor, and chromium (note that tantalum was not included in the 2014 critical materials list, whereas it was on the 2010 list). Several other elements on the list of critical materials have potential for mining in Greenland. To put the size of these resource estimates in perspective, the EC in 2010 believed that it is "likely" that Greenland can become a mid-size supplier in the market for rare earth elements. Based on 2010 USGS data, Greenland holds 3.44 percent of the global rare earth elements potential. The vast majority of resources are located in Brazil (37.01 percent), China (25.33 percent), CIS countries (13.37 percent), and Vietnam (10.42 percent). The data for Greenland are currently updated by the Danish Geological Survey (GEUS), in collaboration with USGS. One would think that based on these numbers, and knowing that global demand for these rare earth elements is expected to increase dramatically due to the increased use of high tech products and the global push for renewable energy technologies, Greenland could not have a significant impact on the market. However, other, more recent reports have painted a much more colorful picture, concluding that while it cannot be a panacea to Greenland's financial challenges, Greenland's resource potential is "vast."[117] Thus, it is unclear what the exact potential of Greenland is, because

[114] "Stakeholders unite to boost access to raw materials in Europe," Press release, European Commission, 7 April 2014, http://ec.europa.eu/enterprise/newsroom/cf/itemdetail.cfm?item_id=7423&lang=en&tpa_id=1019&title=Stakeholders%2Dunite%2Dto%2Dboost%2Daccess%2Dto%2Draw%2Dmaterials%2Din%2DEurope.

[115] This notion was confirmed in several interviews with European policymakers.

[116] "Report on critical raw materials for Europe," European Commission, http://europa.eu/rapid/press-release_MEMO-12-428_en.htm and Report on Critical Raw Materials for the EU: "Defining 'critical' raw materials," European Commission, May 2014, http://ec.europa.eu/enterprise/policies/raw-materials/critical/index_en.htm

[117] See, for instance: The Committee for Greenlandic Mineral Resources to the Benefit of Society, "Mining no shortcut for Greenland," University of Copenhagen, 24 January 2014, http://news.ku.dk/all_news/2014/01/mining_no_shortcut_for_greenland/.

of the lack of geological research and data. As noted in chapter 1, currently only a number of larger projects have been properly explored, but the larger part of the country has not. The Kvanefjeld deposit in particular has been typified as "a world class mining opportunity."[118] Some have stated that Greenland may be able to meet at least 25 percent of the world's rare earth elements demand in the next 50 years, if not more.[119] In order to get a better sense of the raw materials potential in Greenland, DG Enterprise in December 2013 commissioned a study to give a detailed analysis thereof including the state of development, the results of which are expected to be published by the end of 2014. Yet it is reasonable to assume that after publication significant uncertainties will remain about the true potential of Greenland's subsoil, as exploration is at an early stage, and accessibility continues to be a challenge in significant parts of the country.

EUROPEAN INVOLVEMENT AND INVESTMENT IN GREENLAND

In light of the aforementioned European raw materials policies, this section gives an assessment of Europe's involvement in Greenland to date. What have the tangible results of these policies been until now? Here, we also touch upon investments made by private sector entities in Greenland's mining industry. At this point, it is important to note that the traditional division of labor in the private sector is that investments are made only in mining projects where conditions are considered favorable and cost efficient. The policy framework, though crucial in its own respect, sets the playing field and can be important in facilitating these investments.

In May 2014, the European Commission published its second annual review of the implementation of the Raw Materials Initiative, together with its review of the list of critical raw materials.[120] The review suggests that in the areas of the first and third pillars in particular (safeguarding access to raw materials and reducing their use by increasing recycling and substitution) the European strategy has made substantial progress, though firm indicators to monitor precise progress are still lacking. In the case of the second pillar (facilitating domestic mining), less progress has been made. The reported progress under the first pillar also consists of diplomatic efforts to improve or sustain relations with different suppliers of raw materials and sharing best practices with other import dependent countries, such as Japan. Most of these efforts fall outside the scope of this study, but are well documented.[121]

In February 2014, Greenland was included in the implementation of the Kimberley Process certification scheme (which the EU had implemented in 2002 and which intends to certify and establish import/export controls for rough diamonds).[122] Though Greenland is not part of European Union territory since it opted out in 1985, it is included in the list of overseas countries and territories, the purpose of which association is to promote economic and social development. We will discuss the status of Greenland and its relations with the EU further in the final section of this chapter. The inclusion of Greenland in this regulation, however, effectively means that for the purposes of the Kimberley Process and its certification, value chains of the EU and Greenland comply with one standard.

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[118] Marino G. Pieterse, "Setting the record straight on a world-class mining opportunity," *Arctic Journal*, 17 July 2014, http://arcticjournal.com/opinion/800/setting-record-straight-world-class-mining-opportunity.

[119] See Damien Degeorges, "The Role of Greenland in the Arctic," Institut de Recherche Stratégique de l'École Militaire, April 2012, 25, www.defense.gouv.fr/irsem/publications/laboratoire/laboratoire-de-l-irsem-2012/laboratoire-de-l-irsem-n-7-2012.

[120] See "Communication on the review of the list of critical raw materials for the EU and the implementation of the Raw Materials Initiative," European Commission, COM(2014) 297 and "On the implementation of the Raw Materials Initiative," European Commission, SWD(2014) 171.

[121] See for instance "On the implementation of the Raw Materials Initiative," European Commission, SWD (2014) 171.

[122] European Parliament and Council, "Regulation (EU) No 257/2014 of the European Parliament and of the Council," *Official Journal of the European Union,* 26 February 2014.

However, much more significant at this point than the inclusion in the Kimberley Process is the Council Decision on relations between the European Union on the one hand, and Greenland and the Kingdom of Denmark on the other, which renewed the existing decision from 2006.[123] The document describes—in light of the acknowledgement of Greenland's geostrategic position in the Arctic region—a basis for collaboration between the two on issues such as energy, climate change, and natural resources, including raw materials, maritime transport, and Arctic issues. The EU envisages being a partner in helping Greenland to diversify its economy in a sustainable fashion, by helping it expand the capacities of its labor force and its administration, particularly in areas of common interest such as energy, climate change, and raw materials. These areas of collaboration, and the framework for the partnership, are to be developed by the Greenland administration in a so-called Programming Document for the Sustainable Development of Greenland (PDSD).[124] Both the European Commission and the government of Denmark will give their views on this document, though off the record DG Development is said to have contributed to the draft PDSD, in collaboration with the Greenland Ministry of Education. Finally, the indicative amount of financial support that the European Commission has reserved for the implementation of this decision is about €218 million for the period until 2020. Though these finances have not been allocated at this point, undoubtedly in part because the PDSD has not been written by the Greenland administration, several sources have confirmed that this budget will be predominantly allocated for education. Given the high unemployment rate in Greenland, particularly in the age category between 15–35 years, it makes sense to invest not only in primary education, but also in more specialized training programs related to raw materials that have proven their value such as the Greenland School of Minerals and Petroleum in Sisimiut. It is expected that the study commissioned by DG Enterprise currently under way will shed more light on the level of investments required for sustainable raw materials extraction beyond the realm of education, such as infrastructure, technology, and regulations. The resolution of these issues will in turn feed into the debate about the role of both private and public stakeholders to promote resource extraction in Greenland, and what role the European Commission or (some of its) individual member states can play.

To date, European private-sector investment in Greenland is not large, with the European Commission in 2012 estimating that only 15 percent of the companies operating in Greenland are from the EU (namely Denmark, Germany, the Czech Republic, and the United Kingdom).[125] More importantly, only a few of the exploration licenses at the time were held by European companies. Though the letter of intent that was signed in 2012 according to the EC could have changed this dynamic, in the most recent Commission update on the implementation of the Raw Materials Initiative there is no mention of increased investment. It is worth reiterating, however, that this is part of a wider trend of a decrease of investments in raw materials in Greenland, which seems closely connected to supply and demand dynamics in the individual global markets for the different raw materials. Moreover, in light of Europe's primary policy goal to safeguard competitive global market access to raw materials in Greenland, it seems insignificant that investments by European mining companies in Greenland are not impressive. This is because about 60 percent of investments have so far been done by companies from Australia and Canada, who are generally not associated with protectionist behavior, and thus these investment patterns should in principle be

[123] European Council, "Council Decision 2014/137/EU - on relations between the European Union on the one hand, and Greenland and the Kingdom of Denmark on the other," *Official Journal of the European Union,* 14 March 2014), http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L:2014:076:FULL&from=EN.

[124] Ibid., section 2, article 4.

[125] "Greenland's Raw Materials Potential and the EU Strategic Needs," Press release MEMO 12/428, European Commission, 13 June 2012, http://europa.eu/rapid/press-release_MEMO-12-428_en.htm?locale=en.

positive from a global trade point of view. From a U.S. and EU point of view, monitoring investments in territories like Greenland however sounds like a prudent thing to do.

RELATIONS BETWEEN GREENLAND AND THE EUROPEAN UNION

Greenland and the EU have had special relations ever since the country opted out of the European Community in 1985, a historical event described in detail in chapter 1. Since that time, Greenland has been part of the EU's Overseas Countries and Territories (OCTs). In principle OCT nationals are EU citizens.[126] The EU *acquis*, European legislation and court decisions, does not apply to OCTs. Alternatively, EU rules and procedures for the OCTs are listed in the Overseas Association Decision, most recently renewed in November 2013.[127] Its core objectives are to establish close economic relations, promote shared values and standards, and facilitate OCTs' relations with third countries.

However, complementary to the Overseas Association Decision, Greenland has a comprehensive partnership with the European Union. The current agreement acknowledges Greenland's geostrategic position in the Arctic, and provides the basis for collaboration on a wide range of topics, including energy, raw materials, and climate change. Next to the comprehensive partnership agreement, under the Fisheries Partnership Agreement, Greenland and the EU have a special relationship designed to promote sustainable fishing, increase knowledge and support fisheries policy development. The EU contributes close to €18 million per year to Greenland under this agreement.[128]

In the Overseas Association Decision, there are two explicit situations where Greenland has a special position in comparison to other OCTs. First, Article 3 states that all OCTs, except Greenland, receive € 229.5 million/annum to achieve the goals of collaboration. Though no explicit reason is given for this exception, we assume that it is linked to the fact that Greenland has its own comprehensive partnership agreement, and receives financial support from the EU through a number of channels, e.g. the comprehensive partnership and the fisheries partnership. Second, and more importantly, the Overseas Association Decision refers to the importance of adequate waste management in the fragile island environments of the OCTs, including radioactive waste. For all OCTs, the Euratom Treaty applies, except for Greenland and British military bases in Cyprus.[129] Effectively, it seems that Greenland is not bound to provide the European Commission with general data on radioactive waste, nor with a disposal plan in case it ever established one. Undoubtedly this exemption is part of the ongoing debate between the government of Greenland and the government of Denmark about the status of uranium mining in Greenland, nuclear energy, and waste disposal.

DISCUSSION

Though we were repeatedly told in our interviews that little has happened after the letter of intent between the Greenland administration and the European Commission was signed in 2012, this is not supported by our analysis. In the previous sections of this report, we have shown that European policymakers increasingly have been active with regard to raw materials policies since the launch of the Raw Materials Initiative in 2008 (though it is important

[126] "EU relations with Overseas Countries and Territories," European Commission, accessed 29 July 2014, http://ec.europa.eu/europeaid/where/octs_and_greenland/index_en.htm

[127] "Council Decision 2013/755/EU on the association of the overseas countries and territories with the European Union," European Commission, 25 November 2013.

[128] "Fisheries: Bilateral agreements with countries outside the EU," European Commission, accessed 29 July 2014, http://ec.europa.eu/fisheries/cfp/international/agreements/index_en.htm.

[129] See Decision 2013/755/EU consideration 23, and Euratom Treaty 2010/C 84/01, article 198 for the exceptions and article 37 which stipulates member states to provide the European Commission with general data and a radioactive waste disposal plan.

to keep in mind that national policymakers have the primary mandate when it comes to industrial policy). Though Greenland features prominently in these policies, they were designed with broader considerations in mind. The comprehensive partnership agreement, renewed in March 2014, explicitly lays out that Europe envisages having close relations with Greenland on issues relating to raw materials, energy, and climate change, among others. To date most financial support goes to development (primarily education under the new partnership agreement) and the fisheries industries (under already existing agreements). In due time, however, more funds may become available to support industrial development such as raw materials extraction (e.g. infrastructure). Moreover, with regard to the further and more specific implementation of the comprehensive partnership agreement, more details will become available once the Programming Document for the Sustainable Development of Greenland is published. That ball is currently in the court of the government of Greenland. As we will discuss in detail in the next chapter, one cannot avoid the conclusion that Europe's ambition to prevent China from "locking-in" raw materials is ill-conceived and unnecessary. China's dominance in rare earth elements has little to do with physical resources, but mostly with expertise and technology to process in particular heavy rare earth elements. Though building up the entire supply chain is certainly possible (the U.S. government is currently in this process) this is a costly and time-consuming endeavor and it remains to be seen whether EU member states are interested to support such an effort.

Village of Kulusuk in Greenland, surrounded with icebergs.
Photo credit: © iStockphoto/robas (Rob Broek)

4. Chinese Interests and the Potential for Chinese Investment

Greenland's efforts to achieve economic independence from Denmark depend heavily on its ability to develop mining and energy projects. Achieving economic independence is a necessary precondition to future political independence, a goal which has been articulated in different versions by nearly all of Greenland's elected leaders since 1979. However, Greenland cannot develop major mining projects without large investments, and while it has done a very reasonable effort to establish a regulatory framework, its ability to attract investment is limited by global mineral prices and market forces beyond its control. In the mining industry, identification and proving of resources depends on small exploration companies which raise seed capital to identify valuable deposits and then market those projects to much larger international investors. From late 2009 to early 2012, exploration companies around the world had ready access to financing, and exploration in Greenland boomed during that time.[130]

Most projects that are now under development and seeking investment were in fact discovered in earlier exploration booms. These projects—Isua (iron ore), Kvanefjeld (rare earths and uranium), Citronen Fjord (nickel and zinc) and Kringlerne (rare earths)—are the closest to production and will require major investments, in the order of hundreds of millions or billions of dollars, to become operating mines. The mining world is currently at a low point for financing of international projects, and each of these projects faces an uphill battle in getting off the ground. But in an environment like this, many junior miners looking to sell their projects have turned to Chinese mining companies as obvious potential buyers in a down market. Because of this, and in particular because of the very public debate in Greenland in connection with London Mining PLC's application to develop a major iron ore mine at Isua in partnership with a consortium of Chinese firms, Chinese firms have featured prominently in discussions of Greenland's mining projects.

CHINA'S EMERGENCE AS A PLAYER IN INTERNATIONAL RESOURCE DEALS

Exploration companies rely heavily on private venture capital or public listings to finance their operations, and then rely on selling the project to large international mining majors once resources have been proven. Greenland's self-rule government began seriously promoting its mining industry in 2009 and 2010, a time when funding was widely available for junior miners: mineral prices were reaching unprecedented levels and investment in listed exploration companies was rapidly increasing. The major force behind this investment boom was strong raw materials demand from China, where a 4 trillion yuan ($586 million) stimulus package from 2008-2009, rapid urbanization, and ongoing state-led investment in infrastructure and industrial projects were fueling a construction boom that was driving global demand for iron, steel, copper, and aluminum.

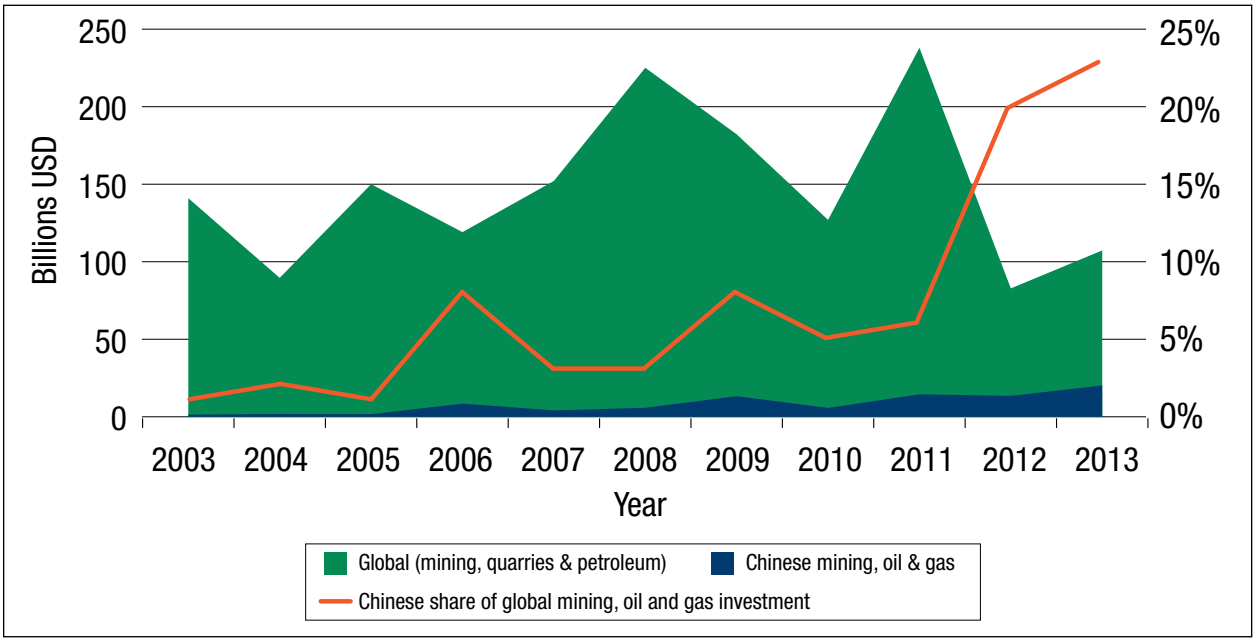
[130] Data on financing markets for junior miners comes from SNL Metals & Mining, "World Exploration Trends 2014."

Meanwhile, Chinese companies had recently emerged as major players in overseas resource investments. After decades of promoting foreign investment in its export and manufacturing sectors, in 2000 China announced a "go global" strategy to encourage its largest companies to invest overseas in key areas, and over the last 15 years Beijing has developed a policy framework to support this strategy. Beginning around 2004 and picking up speed during the global financial crisis, Chinese mining and energy companies began a series of high-profile overseas investments. Many international investments by Chinese mining companies were met with strong public opposition, with concerns focusing primarily on three sets of issues:

- Labor issues, particularly the use of Chinese labor instead of local workers and the use of Chinese labor standards and employment practices towards host country mine workers that were below host country standards;
- The threat, real or imagined, of China locking up long-term access to strategic raw materials through equity stakes in mining or energy companies;
- Concerns, primarily in the international development finance community, that Chinese resource investments and the state-backed loans that financed them were undermining international standards in development finance and promoting corrupt practices by offering unconditional loans in fragile states. From this perspective, it is not helpful that China does not participate in global transparency initiatives such as EITI.

Mining investments proved particularly nettlesome for Chinese companies. Workers in Chinese-owned mines in Zambia, Peru, and Papua New Guinea went on strike and staged protests that occasionally turned violent. In Australia, shareholder opposition combined with public worries about the prospect of increased Chinese control over a core sector of the economy to scuttle a U.S. $19.5 billion bid by Chinalco to invest in Rio Tinto. Despite these issues, Chinese mining companies were successful in completing many of their deals and rapidly increased their overseas presence. In 2009, the year that Greenland's self-rule powers took effect, Chinese mining, oil and gas companies made a string of acquisitions of cash-strapped international companies, spending

Figure 7: Chinese and Global Investments in Mining, Oil, and Gas, 2003-2013



Source: UNCTAD World Investment Report and MOFCOM data

an unprecedented $13.34 billion in overseas investments including $9.2 billion in overseas mining acquisitions.[131,132] In 2009, Chinese investors accounted for $17 billion, or 22 percent, of worldwide mining merger and acquisition activity.[133] Having more than doubled their international investments at a time when global mining investment was entering a steep decline, Chinese companies emerged as a potential alternative source of capital for mining projects in a down cycle.

EXCHANGES BETWEEN CHINA AND GREENLAND

With the passage of the 2010 Mineral Resources Act, which gave Greenland rights to revenue from subsurface resources, the government of Greenland looked to China to help develop its mining industry. Beginning in 2011, official delegations from Greenland have traveled each November to China's top mining conference and visited officials and mining companies in support of investment deals.[134] In 2012, Xu Shaoshi, China's Minister of Land and Resources (and now the head of China's National Development and Reform Commission) brought a Chinese delegation to Greenland to explore investment opportunities. As has been noted above, the government of Greenland during this period also passed special legislation, the Large Scale Projects Act, to make it easier for international construction and mining firms to bring in large groups of foreign workers. This legislation, which is explained in more detail in chapter 1, was also widely associated with China since it was conceived in part to pave the way for London Mining PLC, a British mining company, to attract investment from a consortium of Chinese mining and construction companies.

DANISH VIEWS ON CHINA IN GREENLAND

The prospect of Chinese-backed mining operations in Greenland has aroused deep concerns in the Danish and Greenlandic media, and has factored into the political debate in Denmark over the extent to which the Danish government can or should regulate Greenland's mining industry. Our conversations in Greenland and Denmark and a review of Danish press reports reveal four broad areas in which Chinese involvement in Greenland has been questioned:

- Raw materials security concerns relating to Chinese companies tying up long-term access to Greenland's rare earth resources;
- Concerns relating to the mining of uranium and security of nuclear materials;
- Concerns over the implications of imported Chinese labor, both for labor standards in Greenland and Denmark and for Denmark's obligations to the International Labor Organization (ILO);
- More general worries that Chinese investments in Greenland are part of a larger Chinese geopolitical strategy aimed at securing a strategic and political foothold in the Arctic region.

Because the subject of Chinese involvement in Greenland has come up so frequently in public discussions of Greenland's mineral resources, placing these Chinese investments in a global context will help inform the broader public discussions around foreign investment in Greenland's extractive industries. Beginning

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[131] Outbound oil and gas FDI data from MOFCOM reports.

[132] "Mining For Growth: A review of outbound mining M&A activity from China," Deloitte, August 2010, www.mergermarket.com/PDF/Deloitte_MINING_English.pdf.

[133] "Mining Deals: 2009 Annual Review," PricewaterhouseCoopers, 2009, www.pwc.com/cz/en/poradenstvi-pri-transakcich/assets/mining-deals-2009.pdf.

[134] These efforts have not been limited to China; Greenland participates each year in a major mining conference in Toronto and has sent official delegations to South Korea. In September 2012 South Korean president Lee Myung-Bak visited Greenland with a delegation that included the Korea Resources Corporation (KORES), a state-owned mining company, which signed an agreement for mineral exploration.

with brief case studies of the mining projects that have been associated with actual or potential Chinese investors, this chapter assesses the motivations behind these investments. This analysis leads to three conclusions with important implications for how public and policy makers in Denmark and Greenland might evaluate the role that Chinese mining companies have played, and may potentially play in Greenland's future.

The first conclusion is that Chinese interest in Greenland has to date been very limited, despite the enormous significance that Chinese investment in Greenland could have for Greenland's mining ambitions. To the best of our knowledge there is only one Chinese company currently involved in exploring for minerals in Greenland, and one other company that has entered into non-binding agreements with two Australian mining companies for engineering and downstream processing.[135] Moreover, Greenland is not a priority for mining companies in China that are becoming increasingly shrewd in evaluating global investment opportunities. Both of these observations are important because they run counter to what has been suggested in media coverage and political commentary that has hyped China's strategic ambitions in Greenland and the potential threat the country poses to Danish values and foreign policy interests.

Second, while the three Chinese mining companies that have been frequently discussed in connection with projects in Greenland all have state ties, only one of them belongs (and reports) to the central government. None appear to be motivated by strategic concerns at the national level. The distinction in China between central and provincial state-owned enterprises is important and is often overlooked in debates about the role of outbound investments by Chinese state enterprises. Indeed, there has been a noticeable trend in recent years towards greater outbound investment by companies not managed by the central government. We discuss later what this difference implies. Finally, while all outbound resource investment from China can be said to be the product of a set of coordinated policy incentives designed to achieve a strategic goal—namely to improve China's overall global competitiveness and secure reliable and diversified access to strategic raw materials—we found no evidence to support the notion that the actions of Chinese firms are masking ulterior geopolitical motives with respect to Greenland or the Arctic. Again, this finding contrasts with views that have been expressed by commentators in Denmark and elsewhere.

Third, in the handful of cases where Chinese companies have invested in projects in Greenland or considered such investments, it is important to note that these deals were initiated by entrepreneurial middlemen who turned to Chinese firms as an alternative source of financing for exploration projects in the face of a deteriorating global investment climate. Junior miners typically depend on finding a major mining company to provide financing, technical expertise and offtake agreements in order to sustain exploration and to ultimately turn small exploration projects into operational mines. The ability of Chinese firms to make large equity investments or to secure financing from state-owned banks at very competitive rates, becomes especially important in periods when the international mining majors or very large private equity funds focused on mining projects are cutting back on their investments. This was the case in the period immediately following the global financial crisis and it is the case once again, as mining majors cut back on investment and focus on streamlining costs at existing mines.

[135] Jiangxi Union Mining, which is involved in exploration in Western Greenland through a partnership with Nordic Mining, is in fact a consortium of companies from Jiangxi consisting of Jiangxi Zhongrun, a privately held investment company, Jiangxi Copper, China's largest copper mining company, and the investment holdings company of the State-owned Assets Supervision and Administration Commission of Jiangxi Province, the government agency charged with managing state-owned assets in Jiangxi Province.

Before looking more closely at cases of Chinese investment in Greenland, it is important to note that China is not the only Asian country that has sent delegations to Greenland. South Korean President Lee Myung-Bak visited Greenland with representatives from the Korean Resources Corporation. The visit resulted in Memoranda of Understanding on resource development and geological surveying, and a Greenlandic delegation followed up later that year with a trip to South Korea.[136] A delegation from Greenland is also reportedly scheduled to travel to Japan in late 2014.

LONDON MINING AND CHINESE IRON ORE INVESTMENT

London Mining, a British mining company listed on the London Stock Exchange, was established in 2005 to take advantage of the rapidly increasing global demand for steel driven primarily by urbanization and infrastructure development in China.[137] That same year the company acquired the rights to an iron ore deposit located in a fjord about 100 miles from Nuuk, Greenland's capital. The deposit was not new, having been first discovered in 1965 during an earlier period of resource exploration.

Since acquiring the rights to the Isua block in 2005, London Mining has been searching for strategic investors to fund the project's construction and operation and, presumably, to guarantee buyers once the mine goes into production. It appears that London Mining's strategy from the beginning was to secure investors from China who could fund the project and build the mine. The company occasionally has been referred to as a Chinese mining company, yet to date it has not been successful in attracting investment from China. In 2011, the company appeared close to reaching an agreement with a consortium of Chinese investors led by Sichuan Xinye Mining, China Communications Construction Company Group, Sinosteel and the China Development Bank, but no deal was reached and at least one of the investors, Sichuan Xinye, eventually abandoned the Isua block project.[138] London Mining has continued to move forward with permitting and hopes to find investors for the project.[139]

London Mining's project in Isua was the first large-scale mining project to be submitted to regulators in Greenland, and because of its requirements for imported foreign labor on a large scale the project has generated by far the most controversy of any of the proposed mines in Greenland. London Mining estimates that 1,500 to 3,000 workers would be required over two to three years to build the necessary infrastructure to support this mine and indicated in company materials that these workers would come from China, presumably following the model of other international Chinese-funded infrastructure projects which frequently rely on Chinese labor.[140]

The proposed project would also call for about 700-800 workers after the mine goes into production, the majority of which London Mining assumes will come from outside of Greenland, with the majority of construction workers presumably coming as contracted workers employed by a Chinese partner. China Communications Construction Corporation, one of the world's largest overseas engineering construction companies, was part of the 2011-2012 group that was in talks with London Mining about the Isua project but it has not signed an agreement with London Mining.

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[136] "South Korea, Greenland discuss ways to explore resources in Arctic region." *Yonhap News* (South Korea), 13 December 2012.
[137] LMC 2007 prospectus to the Oslo Børs, 39
[138] Pu Jun, "China's Arctic Mining Adventure Left Out in the Cold," *Caixin*, 26 November 2013, http://english.caixin.com/2013-11-26/100609861.html.
[139] "Annual Report 2013: Producing high quality iron ore for the global steel industry," London Mining Plc, published 2014, available at www.londonmining.com/investors/reports-and-presentations/.
[140] See, for example, the Isua project's social impact assessment from March 2013 at: "Social Impact Assessment for the ISUA Iron Ore Project for London Mining Greenland A/S," Prepared for BMP by Grontmij A/S on behalf of London Mining, March 2013, http://naalakkersuisut.gl/-/media/Nanoq/Files/Attached%20Files/Raastof/Hoeringer/ISUA%202012/SIA%20London%20Mining%20final%20march%202013.pdf.

International memoranda of understanding are typically a key output of official visits to China, and when a delegation from Greenland visited China in 2011 to attend the China Mining Congress in Tianjin, China's Ministry of Land and Resources highlighted an agreement with Chinese companies to invest in the Isua project as a key outcome of the conference. Following the Mining Congress, China's Ministry of Land and Resources announced non-binding MOUs for 42 overseas mining projects totaling 10.2 billion RMB ($1.6 billion USD) and that a deal had been reached between London Mining and Sichuan Xinye. Sichuan Xinye, however, was quick to point out to the press that no deal or MOU had been reached and that the company had some reservations about the feasibility of the project and would not be able to reach an agreement until several months after London Mining released a feasibility study. In interviews with Chinese journalists, a representative from Sichuan Xinye was impressed by the welcoming attitude of Greenlandic officials towards Chinese workers and the willingness of authorities in Greenland to enact a special policy to allow Chinese workers to come to Greenland.[141]

The study was released in early 2012, and after visiting the site in the summer of 2012 Sichuan Xinye withdrew from negotiations with London Mining. In interviews with Chinese media, a source from Sichuan Xinye cited essentially the same concerns over technical challenges and project costs that the company had voiced the previous fall. Funding an iron mine in Greenland did not make sense. Two other external developments may have also played a role in Xinye's decision to withdraw after expressing some initial interest in the project. First, by the summer of 2012 iron ore prices had dropped by about a third from their peak value in early 2011, significantly reducing the appeal of a potentially costly project with higher shipping costs. Second, by the spring of 2012 a number of other Chinese overseas iron ore investments had run into serious problems. Sino Iron, a Chinese iron mine in Western Australia backed by the Hong Kong-based investment firm CITIC Pacific was increasingly burdened by cost overruns and long delays to production timelines as initial assumptions about labor laws and environmental standards proved incorrect. The budget for the Sino Iron project, originally set at $2.5 billion, had increased to $7.1 billion by the spring of 2012. In the wake of this situation, a $2 billion iron mine in Greenland looked considerably less attractive to a Chinese investor.[142]

The Isua project was the first proposal for a large-scale mine in Greenland and it sparked a debate in both Greenland and Denmark over the potential impact that large numbers of foreign construction workers might have on Greenland's society and economy. The government of Greenland, headed at the time by Premier Kuupik Kleist and the Inuit Ataqatigiit (IA) party passed special legislation in December 2012, the *storskalalov* or Large Scale Projects Act, to allow foreign workers to come to Greenland on employment terms below the standard minimum wage in Greenland. This was met with opposition from Greenland's and Denmark's labor unions, and the law became an issue in the March 2013 election in Greenland. Following the victory of the Siumut party in that election, the new government passed changes to the Large Scale Projects Act which addressed concerns that had been raised by Greenland's labor unions. The debate continued in Denmark until this June, however, because the Danish government retains control over immigration matters and was required to pass special legislation to pave the way for Greenland to implement its Large Scale Projects Act. This amendment was passed in the Danish Parliament in June 2014.

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[141] Huaxi Dushibao, "Chuanqi Beiji Xunkuang," *WCC Daily,* 22 November 2011, www.wccdaily.com.cn/epaper/hxdsb/html/2011-11/22/content_400587.htm.

[142] Peter Cai, "China's WA love affair sours," *Sydney Morning Herald,* 8 March 2012, www.smh.com.au/business/chinas-wa-love-affair-sours-20120308-1ums3.html; also Pu Jun, "Can Sino Iron Dig Out of Its Investment Hole?" *Caixin,* 16 January 2014, english.caixin.com/2014-01-16/100629880.html; and "China turns cautious on Aussie iron ore projects," *Sydney Morning Herald,* 8 March 2012, www.smh.com.au/business/china-turns-cautious-on-aussie-iron-ore-projects-20120308-1um2z.html.

It seems likely that London Mining will soon obtain all necessary permits to begin mining. The company has continued to move forward on permitting and in October 2013 was awarded an exploitation license. That is no guarantee, however, that the company will be able to identify an investor to back the project. Iron ore prices have dropped to 50 percent of their peak value in February 2011 and the current investment environment will likely not support new projects.[143]

A major investment by a Chinese iron and steel company is therefore probably the most plausible scenario by which the Isua project could receive the over $2 billion in funding necessary for construction and operation. It is hard to say, however, if London Mining will be successful in attracting Chinese investors. The last three years have been very slow for Chinese outbound iron ore investments, with only a handful of major deals, all of which came from companies owned by provincial governments rather than from state enterprises managed by the central government.[144] Based on this recent history and the currently dim prospects for the global investment environment, one might expect that Chinese steel companies will be wary of making new investments.

The period of heavy overseas investment from 2008-2011, mostly in Western Australia, have created new pressures on the Chinese iron and steel industry quite different from those in earlier years. Those investments were made in response to rapidly rising iron ore prices that put enormous strain on China's steel producers. Now, having invested heavily in iron ore mines in China and overseas, many of which are producing at more than double the operating costs of the international mining giants, Chinese steel companies are worried that falling prices will threaten these investments. Indeed, many of these projects are reportedly now struggling to stay afloat.[145,146] Adding insult to injury, BHP Billiton, the world's largest mining company, announced in a July 2014 statement that it would continue to increase iron ore production, putting pressure on profit margins and squeezing out many of the high-cost producers that emerged when iron ore prices peaked from 2009-2010.[147]

The Chinese government and the iron and steel industry see BHP's decision to increase production despite falling prices as part of a coordinated strategy by international mining majors to undermine the power of Chinese mining companies in international markets. Maintaining a stable supply of iron ore is critical to China's economic security, and from Beijing's perspective securing iron ore resources remains a point of acute strategic anxiety. China's economic planning body, the National Development and Reform Commission (NDRC), called in January for Chinese mining companies to address these concerns by resuming their overseas investments in iron ore mines.

In May 2014, Baosteel Resources, a centrally-managed Chinese state-owned steel company, launched a dramatic, and ultimately successful, hostile takeover of Aquila Recourses, an Australian mining company in which it had earlier acquired a minority stake. The takeover of Aquila Resources by Baosteel was done in partnership with an Australian railway company. It directly addressed the perceived international challenge to China's overseas iron ore projects, nearly all of which are located in Western Australia and have experienced cost overruns and production delays. The Baosteel acquisition thus relieves pressure not only on Baosteel's own investment but also on those of several other Chinese miners.[148]

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[143] Cervantes et al., "Survey of Mining Companies: 2013."
[144] Xingguo Chang, "Zhongqi Touzi Jingwai Tiekuang Yinyou: Cunpin Kuang Duo Pinwei Di Deng Wenti," *China Economics Weekly*, vol. 528, 21 July 2014, www.ceweekly.cn/2014/0721/87626.shtml.
[145] Ibid.
[146] Xiaolong Yu, "Jiaosha' Tiekuangshi," Zhongguo Jingji yu Xinxi, 23 June 2014, www.chinaeinet.com/article/detail.aspx?id=8897.
[147] Rhiannon Hoyle, "BHP Aims to Boost Iron-Ore Output Even as Prices Fall," *Wall Street Journal,* 23 July 2014, http://online.wsj.com/articles/bhp-output-trumps-forecasts-for-fiscal-year-1406070992.
[148] Sonali Paul, "China's Baosteel in $1 billion bid to revive Australia iron ore project," *Reuters*, 5 May 2014. www.reuters.com/article/2014/05/05/us-aquila-rsc-baosteel-idUSBREA4400J20140505.

Does this mean that Chinese iron and steel companies will begin to step up their overseas investments despite falling iron ore prices? There is no way to predict this, of course, but it is safe to say that strategic concerns in Beijing are more likely to drive investment in Greenland than firm-level business interests. Nonetheless, although the central government is still encouraging steel miners to invest overseas, the record of largely failed investments from 2008-2011 will cause Chinese companies to think very carefully before investing in new projects.

JIANGXI'S FORAY INTO GREENLAND

It is ironic that London Mining, a British company with no major Chinese shareholders that has not yet signed agreements with any Chinese partners, has sparked such intense debate in Greenland and Denmark about Chinese interests in Greenland. London Mining is not a Chinese company. There is only one Chinese company with any operations in Greenland, and it has not been the focus of much attention. The company, Jiangxi Union Mining, has been prospecting for copper for several years in Carlsberg Fjord in eastern Greenland, near the remote town of Ittoqqortoormiit. The exploration team has reportedly identified promising deposits of lead, zinc and copper in that area.[149] Jiangxi Union is in fact a consortium of investors from Jiangxi province that includes Jiangxi Copper, China's largest copper miner and one of the world's largest mining companies by revenue.

Miners from Jiangxi were introduced to Nordic Mining, a British junior mining venture with a prospecting claim in eastern Greenland, at a conference in May 2009. The conference, hosted jointly by the province's bureau of commerce and state assets supervisory committee, the government body charged with supervising the activities of state enterprises owned by the provincial government, convened provincial officials, local state-owned mining companies, and a private investment company registered in Jiangxi province to discuss Chinese investment in Greenland.[150,151] The private investment company, called Jiangxi Zhongrun, appears to have played the role of middleman by establishing a joint venture and then attracting investment from state-owned partners.

Two weeks later, an official from Jiangxi Province's Department of Commerce, speaking with a journalist from a local state-owned newspaper, announced that a private company from Jiangxi Province had become the first Chinese company to enter the emerging mining market in Greenland through a 20 percent strategic investment in the Greenland operations of Nordic Mining Company.

Few details are publicly available about this investment from Jiangxi beyond the initial reports in the Chinese media. In statements to media, local officials billed the investment as an important step in securing raw materials for the province's copper smelting industry, a pillar of the province's industrial economy that was increasingly dependent on imported copper as domestic demand skyrocketed. Jiangxi Zhongrun, the Chinese investor, is a private company with unclear ownership that was not well known even in Jiangxi's mining circles.[152] Since the deal was announced, Jiangxi Zhongrun was joined by other Jiangxi companies to form what is now called the Jiangxi Union Mining Company.

Jiangxi Copper is a very large company, with over $28 billion in revenue in 2013, ranking it among the largest mining companies in the world. No other company on this scale has been involved in Greenland

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[149] Zhiyong Zhang, "Lizu Jiangxi, Fushe Quanguo, Zouxiang Haiwai: Youse Dizhi Kancha 'Qiangnei Qiangwai' Xiang," *Jiangxi Ribao*, 23 April 2014, http://epaper.jxnews.com.cn/jxrb/page/186/2014-04-23/A02/89841398184708130.pdf.

[150] Jincun Du, "Guangxi Minqi Jinjun Shijie Zui Da Kuangdao." *Jiangxi Ribao,* 9 June 2009, http://jiangxi.jxnews.com.cn/system/2009/06/09/011130468.shtml.

[151] Department of Commerce of Jiangxi Province, Press Release, 1 June 2009, http://www.jxdoftec.gov.cn/zwgk/swdt/200906/t20090601_144822.htm.

[152] Kang Huang, "Jiangxi Minqi Jinjun Gelinglandao Kaikuang Yinfa Zhengyi?" *Zhongguo Jingying Bao,* 8 July 2009 www.cb.com.cn/index.php?m=content&c=index&a=show&catid=577&id=23687.

in recent years.[153] With Jiangxi Copper's backing, the Jiangxi consortium exploring in Greenland would not need to find outside investors to build a mining operation. The company's presence in Greenland demonstrates more interest than other companies of that size have shown towards Greenland's mineral resources, but it would also be easy to overstate the significance of this exploration project, which is after all still a small operation.

But unlike other major global copper companies, Jiangxi Copper is actively pursuing overseas projects and has recently invested in major mines in Peru, Afghanistan, and Albania. The company has laid out a strategic goal of diversifying its operations into other metals and rare earths and eventually becoming one of the world's top five mining companies.[154] To do this, it needs to look overseas.

Also unlike many of China's largest companies, Jiangxi Copper is not managed by the central government. And unlike with iron ore, where outbound investments occasionally are expected to serve national strategic goals, overseas copper deals by Chinese companies have seemed to be driven simply by a need to secure the raw materials to feed the enormous downstream demand coming from China. The company's overseas investments are held by a Hong Kong-listed subsidiary, a structure which imposes some transparency on the company's operations.

Provincial leaders in Jiangxi are also happy to see the company acquiring overseas assets, both because these investments allow these leaders to claim credit for promoting outbound investment under the "go global" policy, and also because it feeds the province's economy with raw materials that it cannot source fast enough domestically to meet demand. The copper and nonferrous metals industries are central to Jiangxi Province's industrial economy with revenues in 2011 accounting for 22.5 percent of the province's GDP. Rapid economic growth in Jiangxi province and China's surging copper demand means that the province is no longer able to maintain its industrial growth without securing ore from overseas. Given the pressure on this core industry, it is easy to understand why provincial officials would offer every encouragement for its mining companies to invest in foreign mining operations.

NFC AND ZHUJIANG RARE EARTHS

China Nonferrous Metal Industry's Foreign Engineering and Construction Co., Ltd. (NFC) is a state-owned international engineering company focused on overseas engineering contracts and mining projects. The company, headquartered in Beijing, had revenues of 14.5 billion RMB (U.S. $2.4 billion) in 2012, the last year for which data is available. The company's traditional engineering and construction business brought in 397.4 million RMB (U.S. $66.2 million) while its mining operations earned 3.8 billion RMB in revenue. The company also earned substantial revenue from equipment manufacturing. In 2012, NFC produced 185,549 tons of zinc ingot and alloy and another 94,399 tons of zinc-lead concentrate. The company also mines rare earth oxides (REO), and produced 1,383 tons of REO in 2012. Its rare earth business is primarily domestic but the company is also exploring opportunities to develop overseas assets in zinc, copper, lead, bauxite and rare earth elements. The company is engaged in resource development in Myanmar and Russia and has investments in Zambia, Mongolia, Thailand, Kazakhstan, Iran and India. The company also has entered into MOUs for mine engineering projects in countries where its business is less established, including Australia, Indonesia, Ukraine, and Papua New Guinea. The company's MOUs typically follow the engineering, procurement and construction (EPC) model as fixed price turnkey projects with 70 percent of the project financed by a Chinese bank.[155]

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[153] However Rio Tinto explored in Greenland in the 1990s before selling on the iron ore claim that was eventually purchased by London Mining PLC at Isua.
[154] "2013 Annual Report," Jiangxi Copper, 49, www.jxcc.com/english/E-JCC-AR016-hkex.pdf.
[155] "2012 Annual Report," NFC, www.nfc.com.cn/upload/accessory/20139/2013911184029639648.pdf.

NFC has entered into MOUs on projects in Greenland. Its first MOU in Greenland was signed with Ironbark Zinc in 2011 to develop the Citronen Fjord Zinc mine in Northeastern Greenland.[156] The 2011 MOU was executed by NFC's Australian partner Arccon Limited, an engineering subcontractor. Arccon folded in mid-2013 and in April 2014 Ironbark signed a new non-binding MOU directly with NFC.

The Ironbark-NFC MOU follows the format of other agreements NFC has signed elsewhere, with a non-binding agreement to handle all aspects of the construction of a zinc mine and an agreement to secure 70 percent of project costs with loans from Chinese banks. The MOU also gives NFC the right to enter an offtake agreement for mined concentrates and an option to purchase 19.9 percent of the project.[157]

In March 2014, NFC signed an MOU with a second junior mining company in Greenland, this time to develop a rare earth and uranium mine at Kvanefjeld. This MOU is very different from others that NFC has signed in that it agrees to establish a cooperative relationship between the Greenland Minerals and Energy Ltd. (GME), the Australia-based exploration company that established the resource claim at Kvanefjeld, and Guangdong Zhujiang Rare Earths Company, a subsidiary of NFC. The non-binding agreement calls for GME and Zhujiang Rare Earth to develop an integrated global rare earth supply business. There is currently no agreement between GME and NFC to build a mine at Kvanefjeld, and GME is still seeking an investor to fund the project. NFC's subsidiary Zhujiang Rare Earth is part of a group of companies organized by NFC to become a leading processor of rare earth elements. The company has been relocated to Xinfeng County in Guangdong province as part of a joint effort with NFC's other subsidiaries and cooperative partners in the rare earth industry to develop a rare earth separation facility with a capacity of 7,000 tons per year. The Xinfeng facility is intended for heavy rare earths. NFC has also established a joint venture with a private company in Jiangsu province for a light rare earth separation facility with a capacity to separate 10,000 metric tons a year.

Although many Chinese mining companies have invested in overseas assets, outbound investment is not at all common in the Chinese rare earth industry. As noted above, China was essentially the only country in the world with significant capacity for rare earth mining and processing from the time of the closure of the Mountain Pass mine in the United States in the 1980s until around 2009-2010, when an international effort was launched to restart production of rare earths outside of China on fears that China's dominance in the market posed a threat to advanced economies' raw materials supply. As has been detailed elsewhere in this report, these concerns were prompted by China's efforts to reorganize its industry and promote mergers and consolidations of companies across provincial boundaries, a process that has not been entirely successful.

This process of industry consolidation in China has kept the major companies engaged in rare earth metals occupied domestically. So why would a company like NFC be looking for supply deals outside of China? One reason is that NFC needs to find rare earth oxides to sell to its massive new separation facilities in Guangdong and Jiangsu provinces. A crackdown on illegal production of rare earth oxides in China that began in 2009 has finally begun to show results, and rare earth companies in China are having trouble securing the rare earth oxides they need to supply their separation facilities due to mining quotas for rare earth elements.

Although NFC has not announced plans to invest in any rare earth exploitation in Greenland, it is reportedly prospecting for rare earth elements in Myanmar, and the company's new vice president Gao Dehua

[156] "Arccon (WA) Pty Limited (Arccon) Memorandum of Understanding with Ironbark Zinc Limited." Allmine Group Limited press release, 1 September 2011.
[157] Ironbark Zinc Limited press release

recently coordinated a report on outbound investment in rare earth projects that was delivered this year to the Ministry of Industry and Information Technology, the government agency responsible for industrial policies in the rare earth industry.[158,159]

CHINA'S OUTBOUND INVESTMENT AND INTERESTS IN GREENLAND

As the above examples make clear, attracting Chinese investment is probably the most likely option for Greenland to attract the kind of multibillion dollar financing needed to convert resource claims into large-scale mining operations in the present international environment. Greenland, however, cannot take this investment from China for granted, as Chinese mining companies are growing increasingly sophisticated, having many other places to invest their money that offer far fewer complications.

Although the prospect of Chinese involvement in Greenland, and the efforts that Greenland has taken to attract investment from China, has triggered concerns in Greenland and Denmark and led to political debates on a range of issues narrowly related to China, there is no evidence that Chinese interests in Greenland represent any kind of geopolitical strategy, as has occasionally been suggested by some commentators in both Greenland and Denmark. On the contrary, Chinese mining companies do not appear to be particularly interested in projects in Greenland despite the considerable efforts by officials and mining entrepreneurs to generate such interest.

There are two reasons to expect that Chinese mining companies might be ready to consider serious investments in projects in Greenland. The first is that powerful state-owned enterprises owned by provincial governments are having trouble expanding domestic production but want to continue to develop their provincial metallurgical industries. This is particularly apparent in the rare earth industry, where the central government's efforts to regulate the market and encourage certain companies to build national champions is being met with resistance by others in the industry who have aspirations to grow their rare earth business but have not been included in the list of "champions." It can also be seen in the case of copper, where Jiangxi province, the largest producer of copper, could not secure enough ore domestically to fuel its smelting business.

Another reason Chinese firms may be interested in investing in Greenland is to secure stable access to iron ore, a key strategic objective that resonates at the highest levels in China's central government. With around 1 billion tons of resources, the Isua project would reduce China's dependence on mines in Australia and Brazil, countries where China believes the international mining majors enjoy a home court advantage. This kind of investment, however, is not typical. Most recent Chinese investments in iron ore mines were made by provincial state enterprises to take advantage of rapidly rising iron ore prices, and while they may have been encouraged by a policy framework in China that made it easier for provincial firms to invest overseas, they seem to have been motivated by business considerations rather than national strategy. With that earlier round of investments facing serious losses, it is doubtful that these provincial investors will want to take on new projects in frontier areas like Greenland.

[158] NFC web site, available at www.nfc.com.cn/templates/T_new_list/index.aspx?nodeid=13&page=ContentPage&contentid=2923.
[159] Guo, Shen, "*Zhongse Gufen: Miandian Xigui You Ji Duo, Hezuo Duoying Ming Xinluo.*" China Securities Journal, May 11, 2011. Accessed September 2014 at http://www.cs.com.cn/gppd/05/201105/t20110511_2874689.html.

Kangia glacier near Ilulissat in Greenland.
Photo credit: © iStockphoto/anderspa (Anders Peter)

5. Conclusion

There is wide agreement that Greenland possesses a vast treasure trove of mineral and energy resources, but there is significantly less agreement about whether and when some of these projects will make it to the market. In the next five years, it seems that a small number of mining projects may reach production, but overall the aggressive pace of development that the Greenland administration has laid out since the most recent elections in the spring of 2013 seems too optimistic. More importantly, the larger part of Greenland remains unexplored to date, and thus more data would be useful.

Greenland's administration continues to do an impressive job of laying the foundation for future investments, including the development of a regulatory and legal framework as well as the construction of physical infrastructure such as harbors, airstrips, and electricity supply. When it comes to the kind of very large-scale mining projects that the government of Greenland envisions, it is worth nothing that it has started essentially from zero, and so a number of important concerns remain, for instance in terms of environmental safeguards and transparency. Despite several previous waves of resource exploration, global market conditions and the harsh and difficult local circumstances were never aligned to make exploration feasible and suitable infrastructure to support resource extraction was not built.

Greenland now finds itself with a more pressing imperative to develop its economy as its financial position is expected to deteriorate significantly over the coming 10 to 20 years. The immediate cause of this is the aging population and emigration of young people to Denmark, a phenomenon which effectively accelerates the aging of the population. Greenland must now move quickly to develop its economy.

The mining and energy sectors appear to be the best option for economic development but it may not happen soon enough, and ultimately the speed with which the industry develops depends more than anything else on the external investment environment. Continued economic growth in China has been driving global demand for raw materials and has fueled a round of intensive global investment in mining projects, but as demand from China begins to decelerate, many of those plants have yet to come online. This means that mining majors are generally not eager to invest in major projects at this point.

Each type of mineral has its own peculiar supply, demand, and pricing dynamics, and economies of scale also vary according to mineral type. Generally speaking, Greenland needs large projects, but the large projects in Greenland are the least likely to be developed given the state of global markets. Smaller projects appear more likely, but they are not large enough to help transform Greenland's economy.

In terms of energy resources, exploration activities in the Arctic more broadly are at a very early stage, and based on what we have seen and heard it seems unlikely that Greenland will become a producer of hydrocarbons in the foreseeable future.

It is fairly certain that extractive industries in due time can make an important contribution to the government's efforts to address unemployment in the

country. The employment situation in Greenland is worrisome, and this will not change overnight. There are, however, some important first initiatives underway, such as the Greenland School of Minerals and Petroleum in Sisimiut which, supported by institutes such as the Colorado School of Mines, has found its graduates employed by Cairn Energy, demonstrating that locals can be trained as engineers and employed in the field. Though this is only a small example, it is important that the Greenland administration builds on examples like this, and it seems keen to do so, also in collaboration with and with the support of the European Union.

Herein lies probably one of the most important lessons for the Greenland administration: although there is very much that it can do, its influence has limits and based on that notion, it is important to manage expectations. Greenland has not been the first, and will most likely not be the last example of a territory where resource endowments (and often only estimates) have on occasion been mistaken for guaranteed and quick revenue.

Inflated attention for some of Greenland's resources does not necessarily come from within. As several scholars have explained in detail, this gold-rush mentality in minerals markets is nothing new, and is a function of how the markets work as junior miners compete to attract capital to risky but potentially highly rewarding frontier exploration. This is further stimulated by an increase of political attention to certain resources, as is the case with rare earth elements.

There is something paradoxical about the European Union's ambitions to work closely with Greenland in order to prevent its critical minerals, such as rare earth elements, to be 'locked in' by China. China's dominance in rare earths markets has captured the attention of policymakers in the EU, the United States, and Japan. Its dominance however has little to do with the physical availability of these critical minerals. Rather, other countries have outsourced the rare earth elements supply chain and with it all knowledge about processing facilities, at a time when demand for these elements was modest and they had no perceived strategic value. With the rapid development of modern applications such as cellphones and laptops, and increasing demand for renewable energy technologies and batteries, that dynamic changed. Chinese companies have developed world-leading expertise in processing these minerals, and experts estimate that it will take at least 15 years and per chance significant government support to rebuild the entire supply chain in the United States or Europe. Currently the United States, where the Mountain Pass mine was recently reopened in response to the renewed focus on rare earths, seems willing to make these investments. Thus, while Europe is strengthening its ties with Greenland, even if non-Chinese companies were to extract the resources, their processing would still largely if not completely take place outside of the EU and in the short to mid-term in China. On the other hand, as mining in the Arctic is not exclusive to Greenland, as witnessed by increased investments in northern Sweden and Finland, not to mention Canada and Alaska, in due time it may be that processing facilities are built on European soil although they may struggle to compete with Chinese processing facilities on cost.

The potential of Chinese investment in Greenland has sparked controversy, in particular in Greenland itself and even more so in Denmark. Our view is that these concerns are understandable given headlines from around the world, but on balance they are unfounded. After a thorough but certainly not exhaustive review, we have found no reason to believe that the three Chinese companies that have considered making investments in Greenland have any ulterior motives in Greenland beyond a basic desire to secure raw materials to support downstream processing in China. They are encouraged in doing this by a set of policies that aim to stabilize raw material supplies by encouraging Chinese companies to make direct investments in overseas resource assets. As is often the case in such deals, we found that Chinese interactions with Greenland were in fact initiated by entrepreneurial middlemen and initiatives taken by the government of Greenland.

The more valid concerns regarding Chinese investments in Greenland could be said to be true of any

large-scale investments. Greenland is a small place in a sensitive natural environment. An influx of workers could in theory have a destabilizing effect. This is likely to be offset by the fact that most workers on major mining projects or offshore oil rigs would likely fly directly in and out of the work site. Moreover, the same issues caused by other Chinese workers would be caused by workers of any nationality.

As discussed, it is unthinkable that Chinese dominance in the processing of several minerals will decline in the short to middle term. The relevant question is whether that is problematic or not. Referring to recent WTO cases between China and the collaboration of U.S./EU/Japan and export restrictions of rare earth elements, one could say yes. These restrictions, however, need to be seen in context, in which the Chinese largely seem to have put them in place to crack down on illegal domestic mining, and to address environmental concerns. That does not make the restrictions less concerning though, and the attendant price spikes unpleasant for related industries.

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The Brookings Institution
1775 Massachusetts Ave., NW
Washington, D.C. 20036
brookings.edu