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GREENLAND: SECURITY, TRADE, COMPETITION

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EXECUTIVE SUMMARY

In August 2019, when it surfaced that the incumbent President of the United States sought to purchase Greenland from Denmark, the world, not surprisingly, greeted the story with derision and incredulity. The idea that one country – no matter how large or powerful – could simply make an offer to purchase another country – no matter how unfamiliar or remote – seemed anachronistic at best, prompting the Danish Prime Minister Mette Frederiksen to dismiss the proposal as "absurd". Furthermore, the very notion that Greenland was a mere appendage of Denmark that the latter could put up for sale was highly problematic, leading Greenland's Premier Kim Kielsen to assert, "Greenland is not Danish. Greenland is Greenlandic." Yet, by causing the world to sit up and take notice of this large Arctic island, Donald Trump may have unwittingly lifted the veil on Greenland's – and indeed the Arctic's – geostrategic importance to the US and Europe more widely than ever before. The renewed emphasis on Greenland in US foreign, defence and security policy, as shall be seen, is much more explicable and reasonable when viewed against the backdrop of Greenland's vast resource potential and increasing US-China great power competition. What this policy brief will explore, by focusing on Greenland's mineral resources in particular, is why Greenland should matter just as much, if not more, to the UK. It shall demonstrate why a bilateral UK-Greenland trade agreement is vital not simply to Global Britain's trade policy, but also to a post-Brexit UK's defence and security, business growth and industrial strategy, climate and energy policy, and foreign relations, especially with the US and the EU.

Greenland's Vast Resource Potential: An Overview

Changing Arctic sea ice conditions have opened up the possibility of increased navigation along the Northern sea routes, dramatically reducing the time it takes to ship goods between Asia, Europe and North America, while presenting new opportunities for Greenland's waterways and port infrastructure. Likewise, the growing practicality and popularity of using polar air routes that result in substantial time and fuel savings on flights between North America, Europe and Asia have opened up new opportunities for Greenland's airways and airport infrastructure. What makes Greenland so strategic though is not just where it sits geographically, but also what it holds resource-wise. In 2008, the US Geological Survey estimated that the three major basins off the coast of Greenland could yield up to 52 billion barrels of oil equivalent. Furthermore, a 2015-study found that Greenland could produce enough hydropower to meet its own needs and export the surplus to Nunavut or Newfoundland and Labrador and perhaps even further through an undersea cable.[1] Greenland's fish-rich waters also make it one of the world's largest exporters of cold-water prawns, cod, haddock, halibut and snow crab. Mineral-rich Greenland, moreover, holds large reserves of copper, zinc, lead, iron ore, nickel, titanium, cobalt, gold, precious gemstones, platinum-group metals, rare-earth elements and other minerals.

1 B. Pehora, "Greenland to Nunavut electricity exports? It just might be possible", *Nunatsiaq News*, 14 January 2016. https://nunatsiaq.com/stories/article/65674greenland_to_nunavut_hydro_exports_it_just_might_be_possible/

Growing Chinese Interest in Greenland

Greenland's vast resource potential has not escaped China's attention. In 2018, China outlined its ambitions to build a Polar Silk Road (as an extension of its Belt and Road Initiative) by developing Arctic shipping routes; vessels belonging to China's COSCO Shipping have plied the Northern Sea Route since 2013. China, furthermore, has actively pursued investment opportunities in Greenland's airport, port and research infrastructure, as well as mining and energy sectors. Recently, a Chinese construction firm China Communications Construction Company (CCCC) bid for Greenland's airport projects, but withdrew after Denmark stepped in to finance the projects, reportedly in the face of mounting US concern over China's role with respect to Greenland's future air facilities.[2] When it comes to mining, Chinese firms, such as Shenghe Resources Holding Co Ltd, China Non-Ferrous Metal Industry's Foreign Engineering and Construction Co Ltd (NFC) and China National Nuclear Corporation (CNNC), have interests in Greenland, much to the consternation of the US. Greenland sits on some of the world's largest deposits of rare-earth elements that are critically important to the US, but for which the US is still heavily dependent on China, a dependence that China could weaponise in the US-China trade war. In the energy sector, two Chinese oil majors – China National Petroleum Corporation (CNPC) and China National Offshore Oil Corporation (CNOOC) – have expressed interest in bidding for Greenland's onshore oil and gas blocks in 2021. A 2017-study noted that Greenland attracted the highest levels of Chinese foreign direct investment as a percentage of GDP of all Arctic countries.[3] China also serves as one of the largest markets for Greenland's fish exports.

The Forgotten Giant: The UK's Economic Footprint in Greenland

While China undoubtedly has a growing footprint in Greenland, the preoccupation with China has resulted in the US overlooking the importance of other players, including its closest allies, in the region. Despite the media hullabaloo about China, it is the UK that, with the exception of Denmark, might still command the greatest economic footprint in Greenland. Today, there are at least 12 British companies holding 28 mineral exploration and prospecting licenses in Greenland (a clear majority), four UK entities holding licenses for oil and gas exploration in Greenland, at least one UK firm exploring water and ice export opportunities from Greenland and, albeit not trade, a substantial UK research community engaged with research projects in Greenland. Furthermore, the UK is one of the largest markets for Greenland's fish and fish products and accounts for more than 10% of Greenland's total exports. There is a substantial value chain that has developed around Greenlandic seafood in the UK, one that includes UK importers, processors, manufacturers, traders, distributors, wholesalers, retailers and foodservice channels (such as fish and chips shops, pubs and restaurants). It is as much in the interest of the US as it is of the UK, hence, to encourage a pivoting of UK foreign, defence, security and trade policy towards Greenland. If the tunnel vision approach of the US has not been challenged by the UK thus far, it is largely because of a general lack of awareness within the UK itself about its vast footprint in Greenland, beyond scientific cooperation.

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2 M. Shi, M. Lanteigne, "A Cold Arena? Greenland as a Focus of Arctic Competition", *The Diplomat*, 10 June 2019. https://thediplomat.com/2019/06/a-cold-arena-greenland-as-a-focus-of-arctic-competition/

3 M. Rosen, C. Thuringer, *Unconstrained Foreign Direct Investment: An Emerging Challenge to Arctic Security* (CNA Analysis & Solutions, 2017). https://www.cna.org/cna_files/pdf/COP-2017-U-015944-1Rev.pdf

Resource Exploration in Greenland: A Potted History of the UK's Involvement

The UK has a long and rich history of resource exploration and development in Greenland. Geologists, prospectors and explorationists from the UK have been instrumental in surveying and mapping the geology, as well as energy and mineral resources, of Greenland for the better part of two centuries. The UK remains relevant to Greenland today as a world-leading centre of energy and mining expertise, the leading centre of global energy and mining finance, and home to some of the world's biggest and most visible energy and mining companies. UK energy firms, such as BP, Royal Dutch Shell and Cairn Energy, have been a key feature of Greenland's oil and gas exploration landscape. While BP and Shell were part of a consortium of companies that was granted a prospecting licence under the KANUMAS (Kalaallit Nunaat Marine Seismic) Project as early as 1989, Cairn Energy had emerged as the biggest explorer in Greenland by 2011, though its USD 1.2 billion, 8-well drilling campaign proved unsuccessful. Likewise, the largest UK mining firms, Glencore, BHP, Rio Tinto and Anglo American, have been involved in Greenland at various points. For instance, Rio Tinto was already prospecting in Kangerluarsuk, Isua and Washington Land in the 1990s, and another UK-based firm London Mining acquired its Isua iron ore project from Rio Tinto in 2005. In 2013, London Mining was awarded a 30-year license to develop the Isua iron ore project, described then as "the largest commercial project to date in Greenland", though financial problems led to the transfer of its Greenlandic subsidiary to the Hong Kong-based General Nice Development.[4] Likewise, when BHP Billiton took over Canadian diamond producer Dia Met Minerals Ltd in 2001, it acquired a majority interest in a joint venture engaged in diamond exploration in western Greenland.[5]

The Mining Sector in Greenland Today

Although no mineral resources were mined in Greenland for a few years since the closure of its southern gold mine in 2013, the mining sector has grown steadily since then and now has two active mines.

- In 2017, LNS Greenland, the sister company of Greenland Ruby and both part of the Norwegian family-owned LNS Group, commenced the production of rubies – positioned as the world's only conflict-free rubies – at its Aappaluttoq mine.
- In 2019, the TSXV-listed Canadian firm Hudson Resources started production at its White Mountain Anorthosite mine, which it reports is the largest anorthosite occurrence, surpassed only by the moon.

There are also several firms that hold exploration and exploitation licenses in Greenland: the majority of these firms are based in the UK, Canada and Australia, with the rest based in Denmark, Czech Republic, South Africa and India. Of these, the two firms that appear to be of the greatest interest to the US and the EU are both Australian – Greenland Minerals and Tanbreez.

- The ASX-listed Australian firm Greenland Minerals, which holds a 100% interest in the Kvanefjeld multi-element Rare Earths Project, is developing the world's second-biggest rare earth operation and fifth-biggest uranium mine (uranium as a by-product).

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4 "Greenland awards London Mining huge iron ore project", *BBC News*, 24 October 2013. https://www.bbc.co.uk/news/world-europe-24658756

5 "Greenland drilling uncovers kimberlite dyke", *The Northern Miner*, 15 October 2001. https://www.northernminer.com/news/greenland-drilling-uncovers-kimberlite-dyke/1000109121/

- The privately-owned Australian firm Tanbreez holds licenses to the Kringlerne project not far from Kvanefjeld and is believed to sit on substantial reserves of rare earths as well, including the world's biggest deposit of dysprosium.

The UK's Involvement in Greenland's Mining Sector Today

In recent years, Greenland has rapidly re-emerged in the public imagination in the UK as a large, resource-rich island that forms a strategically important part of Britain's northern maritime neighbourhood, endowed with an exceptionally favourable geography and developed into a vibrant, stable and attractive jurisdiction for mining investment. The UK has, by far, the greatest footprint in Greenland's mining sector. As of October 2020, there are at least 12 British companies that hold 28 mineral exploration and prospecting licenses in Greenland, a clear majority, with Australia and Canada following suit. The UK is not just where many of the mining companies scoping out opportunities in Greenland originate, but often where they choose to fundraise or seek expertise. The following four examples reveal some of the ways in which UK companies and exchanges are involved in Greenland's mining sector.

- The AIM- and FSE-listed British firm Bluejay Mining is developing three projects in Greenland: the Dundas Ilmenite Project, which is the world's highest-grade mineral sand ilmenite (the key ore in titanium) project; the Disko-Nussuaq Project, a magmatic massive sulphide nickel-copper-platinum-cobalt project believed to host mineralisation similar to the world's largest nickel/copper sulphide mine in Siberia; and the Kangerluarsuk Zinc-Lead-Silver Project. In 2019, it also signed an agreement with Rio Tinto Iron and Titanium Canada, a member of the LSE- and ASX-listed Anglo-Australian mining giant Rio Tinto Group, for further analysis of the ilmenite from the Dundas project.

- The LSE- and JSE-listed British mining giant Anglo-American – the world's largest platinum producer – is one of the largest mining firms that holds licenses in Greenland, where it is undertaking polymetallic (copper-nickel-platinum group elements) exploration, as it is in Finland and Canada. Anglo-American had also taken over the London-headquartered global diamond giant De Beers Group in 2011, which has since obtained an exploration license for diamond exploration in Greenland.

- Another LSE- and JSE-listed British-Swiss mining giant Glencore is a significant shareholder at Ironbark Zinc and an offtaker for its Citronen project. The ASX-listed Australian firm Ironbark Zinc is developing the Citronen Zinc-Lead Project, which represents one of the world's largest undeveloped zinc-lead deposits with a resource of more than 13 billion lb in contained zinc and lead metal.

- In July 2020, the TSXV-listed Canadian firm AEX Gold, which has revived the Nalunaq Gold Project and which currently holds the largest gold license portfolio in Greenland, achieved a dual listing on the AIM, the sub-market of the LSE for small and medium size growth companies, after raising GBP 42.5 million through a placing and direct subscriptions.

Below is a list of British firms currently holding prospecting or exploration licenses in Greenland:

UK Licence Holders in the Mining Sector in Greenland		
License Code	**Owner Name**	**Type**
MEL 2019-115	Anglo American Exploration Overseas Holdings Limited	Mineral Exploration Licence (MEL)
MPL 2019-81	Anglo American Exploration Overseas Holdings Limited	Mineral Prospecting Licence (MPL)
MEL 2019-80	Anglo American Exploration Overseas Holdings Limited	Mineral Exploration Licence (MEL)
MEL 2019-79	Anglo American Exploration Overseas Holdings Limited	Mineral Exploration Licence (MEL)
MEL 2017-01	Bluejay Mining Plc	Mineral Exploration Licence (MEL)
MEL 2020-02	Bright Star Resources Limited	Mineral Exploration Licence (MEL)
MEL 2020-30	Bright Star Resources Limited	Mineral Exploration Licence (MEL)
MEL 2020-49	Bright Star Resources Limited	Mineral Exploration Licence (MEL)
MEL 2019-59	Challenge Holdings Ltd	Mineral Exploration Licence (MEL)
MEL 2020-21	Challenge Holdings Ltd	Mineral Exploration Licence (MEL)
MEL 2011-31	Disko Exploration Ltd.	Mineral Exploration Licence (MEL)
MEL 2012-29	Disko Exploration Ltd.	Mineral Exploration Licence (MEL)
MEL 2018-16	Disko Exploration Ltd.	Mineral Exploration Licence (MEL)
MPL 2019-15	Disko Exploration Ltd.	Mineral Prospecting Licence (MPL)
MEL 2019-116	Disko Exploration Ltd.	Mineral Exploration Licence (MEL)
MEL 2020-10	Disko Exploration Ltd.	Mineral Exploration Licence (MEL)
MEL 2020-06	Disko Exploration Ltd.	Mineral Exploration Licence (MEL)
MEL 2015-08	Dundas Titanium A/S	Mineral Exploration Licence (MEL)
MEL 2019-114	Dundas Titanium A/S	Mineral Exploration Licence (MEL)
MEL 2017-06	Longland Resources Limited	Mineral Exploration Licence (MEL)
MEL-S 2019-38	Longland Resources Limited	Special Exploration Licence (MEL-S)

MPL 2019-39	Longland Resources Limited	Mineral Prospecting Licence (MPL)
MEL 2013-06	Obsidian Mining Ltd	Mineral Exploration Licence (MEL)
MEL 2020-48	R500 Greenmin Ltd.	Mineral Exploration Licence (MEL)
MEL 2019-18	Stallion Resources Limited	Mineral Exploration Licence (MEL)
MEL 2017-29	White Eagle Resources Limited	Mineral Exploration Licence (MEL)
MEL 2018-25	White Eagle Resources Limited	Mineral Exploration Licence (MEL)
MEL 2017-41	White Fox Resources Limited	Mineral Exploration Licence (MEL)

What Resources are UK Licence Holders in Greenland Exploring?	
License Holder	**Minerals**
Anglo American Exploration Overseas Holdings Limited	Disko-Nuussuaq - Nickel, Copper, Platinum Group Metals
	Svartenuk Halvø – Nickel, Copper, Platinum Group Metals
Bluejay Mining Plc and through its subsidiaries **Dundas Titanium A/S Disko Exploration Ltd**	Disko-Nuussuaq Project – Nickel, Copper, Platinum Group Metals, Cobalt
	Kangerluarsuk Project – Zinc, Lead, Silver
	Thunderstone – Potential for Gold, Nickel, Copper, PGE, Lead, Zinc, Uranium
	Dundas Ilmenite Project – Ilmenite, Titanium
Longland Resources Ltd	Ryberg Project – Copper, Palladium, Gold, Nickel, Cobalt, Platinum
R500 Greenmin Ltd	Fiskenfjord – Olivine
Stallion Resources Ltd	Motzfeldt – Rare Earth Elements, Niobium, Tantalum
Alba Mineral Resources through its subsidiaries **Obsidian Mining Ltd White Eagle Resources Ltd White Fox Resources Ltd**	Amitsoq Graphite Project – Graphite
	Thule Black Sands Project – High-grade Ilmenite
	Melville Bay Iron Project – Iron Ore, Haematite, Magnetite
	Inglefield Land – Cobalt, Copper, Gold, Vanadium, Nickel, Zinc, Molybdenum

Source: Company websites and communication. Also, https://govmin.gl/exploration-prospecting/start-exploring/exploration-and-advanced-projects/

As reflected in the tables above, there is a substantial focus on base metals (copper, lead, zinc), light metals (such as ilmenite, titanium and magnesium), precious metals (such as gold, silver and the platinum group metals), iron and ferro-alloy metals (such as iron, nickel, cobalt, molybdenum, chromium and niobium), industrial minerals (such as graphite, olivine, feldspar and anorthosite) and specialty metals (such as rare-earth elements, zirconium, niobium, tantalum and uranium). Gemstones is another area where, as seen, one Norwegian-Greenlandic firm has commenced production and the export of rubies and pink sapphires; a UK-headquartered firm De Beers Group has secured a license for diamond exploration; and there is ample potential for growth in trade with the UK. These are all minerals that the UK uses and imports quite considerably and that are vital to the UK's resource security, climate and energy policy, business growth and industrial strategy. As the firms currently producing in Greenland expand and those prospecting or exploring eventually commence production, Greenland – owing to its resource potential and relative geographical proximity – is well-placed to become one of the UK's leading import sources for a number of these minerals. Furthermore, many of these firms will rely on UK expertise and mining finance, as is already the case, and also look to use or to develop processing operations in the UK. On all counts, it is as much in the interest of the UK as that of Greenland to ensure that these mineral resources can be imported into the UK on a tariff-free, quota-free basis, as has been the case under the EU-OCT arrangement.

Rare-Earth Elements: Critically Important to the UK, the US and the EU

With respect to few mineral commodities are the British, American and European needs as critical, and Greenland's strengths as obvious, as in rare earths, a group of 17 elements (yttrium, scandium and the 15 lanthanides) that are not necessarily rare in their occurrence, but so widely dispersed that they are rarely found in large concentrations. The *Scientific American* notes that rare earth elements make their way into consumer electronics (such as Apple AirPods and iPhones), green technologies (such as General Electric wind turbines and Tesla electric cars), medical tools (such as Philips Healthcare scanners) and military hardware (such as F-35 jet fighters).[6] Given China's dominance over the global production and supply of rare earths on the one hand, and Greenland's large rare earth reserves and the number of UK companies operating in Greenland on the other hand, Greenland presents a new and increasingly important avenue for UK-US and UK-EU cooperation. In the face of their growing demand for rare earths and desire to reduce their dependence on China for materials so critical to their economy and security, the US and the EU should work closely with the UK – government and industry – in developing a secure, stable and sustainable supply of rare earths from Greenland, thus enhancing resource security.

A report by the UK Parliament's Parliamentary Office of Science & Technology included rare earth elements, along with cobalt and helium, in its list of "critical materials" on the basis of "their economic or national security importance, or high risk of supply disruption". In spite of being "vital commodities for UK manufacturing, including for the aerospace, automotive, chemical and energy sectors", the report pointed out, these sectors "rely on materials

[6] J. Hsu, "Don't panic about rare earth elements", *Scientific American*, 31 May 2019. https://www.scientificamerican.com/article/dont-panic-about-rare-earth-elements/

typically extracted and processed abroad."[7] The European Commission has published a List of Critical Raw Materials every three years since 2011, using economic importance and supply risk as the key determinants of criticality: its 2020 list enlists separately both heavy and light rare earth elements, as well as cobalt, indium, magnesium, natural graphite, niobium, platinum group metals, scandium, tantalum, lithium and titanium – materials that are found in Greenland.[8] The EU has a 75-100% import reliance for most metals and 100% import reliance for rare-earth elements: it depends on China for 98% of its heavy rare-earth element supply and 99% of its light rare-earth element supply.[9] Likewise, in 2018, pursuant to Executive Order 13817, the US Secretary of the Interior, in coordination with the US Secretary of Defence, included the rare-earth-element group in its list of critical minerals it submitted to the Federal Register.[10] In 2019, of the 46 nonfuel mineral commodities for which imports constituted more than half of the annual consumption in the US, critical minerals accounted for 14 of the 17 mineral commodities with 100% net import reliance, the rare-earth-element group being one among them.[11] In May 2019, the US Department of Defence sent a report to the White House asking for federal funds to boost the domestic production of rare-earth elements to reduce US dependence on China.[12]

Rare earths have become increasingly important across key sectors in the UK, the US and the EU, especially defence, renewable energy and technology. Some of their uses in each sector have been outlined below:

Defence: Rare earths are critically important to the defence sector in the UK and the US, being used in:

- Guidance and control systems (such as smart bombs, Tomahawk cruise missiles, Joint Direct Attack Munitions, Joint Air-to-Ground fin actuators and Predator unmanned aircraft);
- Defence electronic warfare (such as jamming devices, electromagnetic railguns, Ni Metal Hydride batteries, Area Denial System and Long-Range Acoustic Device);
- Targeting and weapon systems (laser targeting, air-based lasers, Laser Avenger, SaberShot Photonic Dispenser, Future Combat Systems vehicles with laser weapon);
- Electric motors (such as CHPS Future Combat, integrated starter generators, hub mounted electric traction drive, Zumwalt DDG 1000 and Joint Strike Fighter electric aircraft);
- Communication (satellite communications, sonar transducers, radar technology, enhanced X Ray radiation detection and Multipurpose Integrated Chemical Agent Alarm); and

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7 Houses of Parliament Parliamentary Office of Science & Technology, Research Briefing: Access to Critical Minerals, *Postnote*, No. 609, September 2019, p.1. https://post.parliament.uk/research-briefings/post-pn-0609/

8 European Commission, *2020 List of Raw Materials* (2020). https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0474&from=EN

9 European Commission, *2020 List of Raw Materials* (2020).

10 US Geological Survey (USGS), *Mineral Commodity Summaries 2020* (Reston, Virginia: USGS, 2020), p.5. https://pubs.usgs.gov/periodicals/mcs2020/mcs2020.pdf.

11 USGS, *Mineral Commodity Summaries 2020* (Reston, Virginia: USGS, 2020), p.6. https://pubs.usgs.gov/periodicals/mcs2020/mcs2020.pdf.

12 P. Stewart, A. Shalal, "Pentagon seeks funds to reduce U.S. reliance on China's rare earth metals", *Reuters*, 29 May 2019. https://www.reuters.com/article/us-china-usa-rareearth-pentagon-idUSKCN1SZ2C6

- Optical equipment and speakers (such as night-vision goggles).[13]

When it comes to the amount of rare earths needed, according to a 2013 US Congressional Research Service report, a single F-35 Lightning II Joint Strike Fighter jet needs about 920 lb (418 kg); a DDG-51 Aegis destroyer needs around 5,200 lb (2,359 kg); while a single SSN-774 Virginia-class submarine requires 9,200 lb (4,180 kg).[14] Significant restrictions to the supply of rare earths, thus, can severely affect British and American defence and aerospace firms, such as BAE Systems, Rolls-Royce Holdings Lockheed Martin, Northrup Grumman, Raytheon and Boeing.

Renewable Energy: In June 2019, the UK Government became the first major global economy to set a net zero greenhouse gas emissions target for 2050, a 100% reduction compared with the previous target of an 80% cut in emissions from 1990 levels. It aims to achieve these targets by continuing to push for a shift to renewable wind, wave, tidal and solar energy, and also by decarbonising transport and other sectors. According to PwC's *Low Carbon Energy Index*, within the G20, the UK has the highest average decarbonisation rate in the twenty-first century.[15] This green, clean energy revolution, however, is predicated on the availability and use of rare earths, such as neodymium for wind turbines and tellurium for solar panels, and other critical minerals. Lithium, likewise, is a vital resource for lithium-ion batteries used by car manufacturers such as Tesla, Ford, BMW, Nissan and Renault. According to the World Bank, achieving the ambition of a low carbon future would translate as a rapid increase in the demand of certain metals and minerals, with the shift to electric storage batteries alone, under a 2°C rather than business as usual scenario, translating as demand for certain metals and minerals rising by more than 1000% by 2050.[16]

- The wind turbine market is projected to result in roughly 30% of the global growth in the use of rare earth magnets, with wind turbines believed to use roughly 600 kg of rare-earth metals each.[17]
- Rare earth magnets also find their way into the motors of more than 90% of hybrid and electric vehicles, as well as into their braking systems, power folding side mirrors, power seats, drivetrains, compressors and pumps. Hybrid electric cars use 10-15 kg of lanthanum in their batteries.
- A 2020-study commissioned by the European Commission noted that the demand for rare earths used in permanent magnets could increase 10 times by 2050, while the EU would require up to 18 times more lithium and five times more cobalt in 2030, and around 60 times more lithium and 15 times more cobalt in 2050, for electric vehicle batteries and energy storage.[18]

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[13] V.B. Grasso, *Rare Earth Elements in National Defense: Background, Oversight Issues, and Options for Congress*, Congressional Research Service, 23 December 2013, pp.10-13. https://fas.org/sgp/crs/natsec/R41744.pdf

[14] https://fas.org/sgp/crs/natsec/R41744.pdf

[15] PwC, *The Low Carbon Economy Index 2019*. https://www.pwc.co.uk/services/sustainability-climate-change/insights/low-carbon-economy-index.html.

[16] World Bank, *The Growing Role of Minerals and Metals for a Low Carbon Future* (2017). https://elibrary.worldbank.org/doi/abs/10.1596/28312

[17] S. Ritter, "A whole new world for rare earths", *C&EN: Chemical & Engineering News*, 28 August 2017. https://cen.acs.org/articles/95/i34/whole-new-world-rare-earths.html

[18] European Commission, *2020 List of Raw Materials* (2020). https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0474&from=EN

- According to a report commissioned by the Dutch Ministry of Infrastructure, meeting the greenhouse gas emission reduction targets under the Paris Agreement through renewable energy production requires that global production of several rare earth minerals used in solar panels and wind turbines has to grow at least twelvefold by 2050.[19]

Tech Industry: Rare earths are used in loudspeakers, computer hard drives, camera and telescope lenses, studio lighting and cinema projection, catalytic converters in cars, aircraft engines, aerospace components, vibration motors, lasers, microwave filters, LED screens, glass polishing, nuclear-reactor control rods, nuclear batteries, superconductors, visors, electrical components, fibre optics, and X-ray and MRI scanning systems. Lanthanum constitutes up to 50% of digital camera lenses.[20]

China's Dominance in Global Rare Earths Supply

It is in the context of China's dominance when it comes to rare earths that the real power it wields and the potential threat it poses may be best understood. The global production of rare earths grew from 190,000 MT in 2018 to 210,000 MT in 2019, representing a significant rise of 10.5%. In 2019, China was the leading producer of rare earths by far, accounting for 132,000 MT or 62.9% of global production, followed by the US (26,000 MT or 12.4%), Myanmar (22,000 MT or 10.5%) and Australia (21,000 MT or 10%) – and, thereafter, India, Russia, Madagascar, Thailand, Vietnam and Burundi (collectively accounting for less than 5%).[21] Likewise, with respect to rare earth reserves, at least as identified by the US Geological Survey (and not accounting for Greenland's estimates of its rare earth reserves), China is firmly in the lead. Of the estimated 120 million MT of rare earth deposits in the world, China holds 44 million MT (36.7%), with Brazil (22 million MT or 18.3%), Vietnam (22 million MT or 18.3%), Russia (12 million MT or 10%), India (6.9 million MT or 5.8%) and Australia (3.3 million MT or 2.8%) trailing in the distance. The US holds 1.4 million MT or 1.2% of the world's rare earth deposits.[22] As around 95% of the world's processing of raw ore also takes place in China, China is simultaneously the world's biggest reserve, producer, consumer, processor, importer and exporter of rare earths. The EU depends on China for 98% of its total supply of rare-earth elements. This dominance is even more dramatic in related industries, with China reigning supreme as the world's largest producer and exporter of rare earth permanent magnets, accounting for 90.5% of the global total output in 2018.[23]

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19 P. van Exeter, S. Bosch, B. Schipper, B. Sprecher, R. Kleijn, *Metal Demand for Renewable Electricity Generation in The Netherlands: Navigating a complex supply chain* (2018). https://www.metabolic.nl/publication/metal-demand-for-renewable-electricity-generation-in-the-netherlands/

20 "What are 'rare earths' used for?", *BBC News*, 13 March 2012. https://www.bbc.co.uk/news/world-17357863

21 USGS, *Mineral Commodity Summaries 2020* (Reston, Virginia: USGS, 2020), p.133. https://pubs.usgs.gov/periodicals/mcs2020/mcs2020.pdf.

22 USGS, *Mineral Commodity Summaries 2020* (Reston, Virginia: USGS, 2020), p.133. https://pubs.usgs.gov/periodicals/mcs2020/mcs2020.pdf.

23 Global and China Rare Earth Permanent Magnet Industry Report, 2018-2023 (March 2019): https://www.reportlinker.com/p05389598/Global-and-China-Rare-Earth-Permanent-Magnet-Industry-Report.html?utm_source=PRN

Concerns about Rare Earths Supply: The Security Implications for the UK

In the face of increasing demand for rare earths and China's peerless leadership in the space, the UK Department of Food, Environment and Agricultural Affairs (Defra) noted in 2010 that "it is likely that the UK will face long term supply availability issues, with significant implications for the development of aspects of a low carbon economy including key applications such as electric vehicles and wind turbines where REE materials are used for high efficiency, permanent magnets."[24] In its 2012 *Resource Security Action Plan*, Defra identified metals, electric equipment and domestic appliances, electronics and ICT, chemicals, rubber plastics and glass, construction material and other final consumer goods as sectors in which rare earths were used.[25] In 2019, the UK Parliamentary Office of Science & Technology (POST) pointed out that while the UK Government does not have a specific critical materials strategy to address supply chain security or a single government department with a clear mandate for policy in this regard, Defra had outlined, in 2018, its plans to revitalise its 2012 Resource Security Action Plan, including by improving government oversight of raw materials critical to the UK economy.[26] The European Academies' Science Advisory Council (EASAC) made clear that recycling solely could not satiate increasing demand for a material: among the potential solutions it explored were opening new mines (including in the UK), expanding mines already in operation, and investing in innovations in mining in hitherto inaccessible areas.

However, while EASAC put forward deep sea mining as an option, it left out mining for rare earths in Greenland, the country nearest to the UK with the largest deposits of rare earths.[27] Whether as a world-leading centre of expertise in mining, or as the leading centre of global mining finance, or even as a potential hub for processing of raw materials from Greenland, the UK would be well-suited to support rare earth production in, and export from, Greenland, while creating a more secure strategic minerals supply chain for itself, as well as for the US and the EU, that was not dependent on China. The UK is already home to the highest number of mining firms holding licenses in Greenland, including some focusing on rare earths. It is crucial that the UK Government identifies a government department with a clear mandate for policy concerning critical minerals, develops a critical materials strategy to address supply chain security, recognises the general disconnect between government and industry in the UK, compiles a list of UK industry actors present or interested in Greenland, facilitates dialogues about public-private cooperation to address the supply of critical minerals, explores support measures to incentivise investment (outward/inward, as relevant) in production and processing of critical minerals, seeks closer cooperation with the Government of Greenland relating to mineral resource exploration and development, and negotiates a bilateral trade agreement with Greenland to ensure continued tariff-free, quota-free preferential access for mineral resources from Greenland upon their importation into the UK after the end of the transition period on 31 December 2020.

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[24] AEA Technology plc for Department for Environment, Food and Rural Affairs (Defra), *Review of the Future Resource Risks faced by UK Business and an Assessment of Future Viability: Executive Summary* (London: DEFRA, 2010), p.6.

[25] Department for Business, Innovation and Skills (BIS) and Department for Environment, Food and Rural Affairs (Defra), *Resource Security Action Plan: Making the most of valuable materials* (London: Defra, 2012), p.19. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69511/pb13719-resource-security-action-plan.pdf

[26] Houses of Parliament Parliamentary Office of Science & Technology, Research Briefing: Access to Critical Minerals, *Postnote*, No. 609, September 2019, p.3. https://post.parliament.uk/research-briefings/post-pn-0609/

[27] European Academies Science Advisory Council, *Priorities for critical materials for a circular economy* (2016).

Concerns about Rare Earths Supply: The Security Implications for the US

With the US out shadowing the UK when it comes to imports of rare earths, it provides a clearer case study to observe the challenges posed by China's near-monopoly of rare earths for the US, the UK and their allies. In 2019, the US imported 170 million MT of rare-earth compounds and metals, a 6.25% rise from the 160 million MT it imported in 2018.[28] This reflects the growing dependence on rare earths across various sectors in the US: judging by end use, the US Geological Survey estimated that 75% of rare earths made its way to catalysts; 5%, metallurgical applications and alloys; 5%, ceramics and glass; 5%, polishing; and 10%, other uses.[29] Despite the extent to which the US depends on rare earths for its economic and national security, it relies on China for 80% of its imports of rare-earth compounds and metals. Its next largest import sources – Estonia (6%), Japan (3%) and Malaysia (3%) – also derive their rare-earth compounds and metals from mineral concentrates and chemical intermediaries produced mostly in China and Australia.[30] While rare earths are mined domestically in the US, most notably at the Mountain Pass mine in California, this mine – for decades, the world's leading source of rare earths – has had a chequered recent history, being moved into care and maintenance in 2015 before being revived in 2018. Although MP Materials, which purchased the mine in 2017, affirms a mission to "restore the full rare earth supply chain to the United States of America", plans to list on the NYSE later this year to boost production and has received backing from the Pentagon, it has not succeeded in challenging China's dominance yet. This US-led consortium, paradoxically, includes China's Shenghe Resources Holding Co Ltd that holds a non-voting 9.9% minority interest, while the firm sends more than 50,000 tonnes of its rare-earth concentrates to China for final processing and also depends entirely on Chinese customers for its annual revenue.[31]

China has repeatedly demonstrated its willingness to deploy economic levers for geopolitical gain. In September 2010, China halted the export of critical rare earth minerals to Japan in retaliation to its detention of a Chinese fishing trawler captain near some disputed East China Sea islands, causing the prices of rare-earth minerals to soar.[32] In July 2020, China threatened to impose new sanctions on US defence contractor Lockheed Martin, which would cut off its supply of rare-earth elements, in retaliation for a US approval of an arms deal for Taiwan relating to air defence missiles made by the company.[33] Then, there are also the risks of China restricting the use of domestic rare earth production for domestic manufacturing industries, which would disrupt global production in all of the sectors that depend on rare earths,[34] and,

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28 USGS, *Mineral Commodity Summaries 2020* (Reston, Virginia: USGS, 2020), p.132. https://pubs.usgs.gov/periodicals/mcs2020/mcs2020.pdf.

29 USGS, *Mineral Commodity Summaries 2020* (Reston, Virginia: USGS, 2020), p.132.

30 USGS, *Mineral Commodity Summaries 2020* (Reston, Virginia: USGS, 2020), p.132.

31 E. Scheyder, "U.S. rare earths miner MP Materials to go public in $1.47 billion deal", *Reuters*, 15 July 2020. https://uk.reuters.com/article/us-mp-materials-ipo/u-s-rare-earths-miner-mp-materials-to-go-public-in-1-47-billion-deal-idUKKCN24G1WT

32 K. Bradsher, "Amid Tensions, China blocks vital resource to Japan", *New York Times*, 22 September 2010. https://www.nytimes.com/2010/09/23/business/global/23rare.html

33 "China threatens to starve US of key defence materials", *The Times*, 16 July 2020. https://www.thetimes.co.uk/article/china-threatens-to-starve-us-of-key-defence-materials-j38rms7rn

34 J. Smyth, "Industry needs a rare earths supply chain outside China", *Financial Times*, 28 July 2020. https://www.ft.com/content/fc368da6-1c86-454b-91ed-cb2727507661

conversely, of China defending its monopoly by flooding the global market with rare earths to lower their prices considerably when necessary, thus drowning out new entrants.[35] Rare-earth elements have also emerged as China's weapons on standby in the US-China trade war: "Will rare earths become a counter weapon for China to hit back against the pressure the United States has put on for no reason at all?", asked China's *People's Daily*. "The answer is no mystery.", it replied unabashedly, adding later, "We advise the U.S. side not to underestimate the Chinese side's ability to safeguard its development rights and interests. Don't say we didn't warn you!"[36] By reducing the export of rare earths, China could seriously disadvantage American and British firms.

Greenland: Strategic Importance to the UK, the US and the EU

It is precisely as the UK, the US and the EU look to reduce their dependence on China for rare earths that Greenland grows so strategic. Greenland is reported to hold 38.5 million tons of rare earth oxides, and is believed to have enough rare earths to meet at least a quarter of global demand in the future.

- The ASX-listed Australian firm Greenland Minerals, which holds a 100% interest in the Kvanefjeld multi-element rare earths project, sits on a rare earths resource of 1 billion tonnes in three zones in the Ilimaussaq complex – Kvanefjeld, Sørensen and Zone 3. It is developing the world's second-biggest rare earth operation and fifth-biggest uranium mine: 11.1 million MT of rare earth oxide and 593 million pounds of uranium.
- The privately-owned Australian firm Tanbreez holds licenses to the Kringlerne project not far from Kvanefjeld and is believed to sit on substantial reserves of rare earths as well, including the world's biggest deposit of dysprosium: Tanbreez's JORC reserves stand at 29 million tonnes of contained REE in some 4.7 billion tonnes. It has had fewer obstacles to overcome, with respect to opposition from local communities and environmental groups, than Greenland Minerals as it does not contain radioactive elements such as uranium and thorium.
- The TSXV-listed Canadian firm Hudson Resources also owns the Sarfartoq carbonatite exploration project, believed to be rich in neodymium and a high-grade niobium/tantalum.

Greenland's vast rare earth reserves and the sheer number of UK companies operating in Greenland make Greenland a new frontier for UK-US and UK-EU cooperation. In the face of their growing demand for rare earths and their desire to reduce their dependence on China for such critically important materials, the US and the EU should explore closer collaboration with the UK – both government and industry – in developing a stable supply of rare earths from Greenland and a secure critical minerals global supply chain, thus enhancing resource security.

The Relevance of the UK-Greenland Trade Agreement

The UK must take all of the above considerations into account when negotiating its trade agreement with Greenland. Greenland is of critical importance to the UK's current and future

[35] J. Smyth, US-China: Washington revives plans for its rare earths industry", *Financial Times*, 14 September 2020. https://www.ft.com/content/5104d84d-a78f-4648-b695-bd7e14c135d6

[36] Wu Yuehe, "United States, don't underestimate China's ability to strike back", *People's Daily*, 31 May 2019.

defence and security needs, industrial strategy, business growth, climate policy, food security, mineral resource security, energy security, international trade, and foreign relations with the US and the EU. When it comes to Greenland's mineral resources and ensuring the security and stability of the UK's critical minerals supply availability and supply chain in the future, it is vital that the UK retains access to Greenland's resources under conditions no less favourable than the access offered to EU member states, supports the development of a favourable investment climate for UK businesses in Greenland and for Greenlandic businesses in the UK, facilitates the use of processing facilities in the UK by mining companies operating in Greenland, and allows for mineral resources to be exported from Greenland to the UK on a tariff-free, quota-free preferential basis, as would have been the case under the existing arrangement between the EU and the Overseas Countries and Territories (OCTs) constitutionally linked to the UK, Denmark, France and The Netherlands. To appreciate more fully the critical need for a bilateral trade agreement between the UK and Greenland that could help achieve the above, it would be useful to understand how UK-Greenland trade thus far fit into the wider framework of the EU-OCT arrangement.

Over the past 50 years, Greenland's formal relationship with the UK has been determined, to a large extent, by its relationship with Denmark and the EU. In 1982, three years after implementing Home Rule from Denmark, Greenland held a referendum on its membership of the European Economic Community (EEC), with 53% of the voters voting against continued membership. Another three years later, in 1985, the Greenland Treaty formalised Greenland's withdrawal from the EEC, making it the first country to leave the EU by referendum. Nevertheless, while no longer a member of the EEC, Greenland was still an autonomous constituent realm within the Kingdom of Denmark, enabling it to become an Overseas Country and Territory (OCT) to the EEC in 1985. Consequently, along with other OCTs including the 14 British Overseas Territories, Greenland retained some integration with the EU's Single Market via various association agreements and benefits from tariff-free, quota-free preferential access to the EU, including the UK. On 23 June 2016, the UK held a referendum on its membership of the EU, with a majority of 51.9% voting in favour of the UK leaving the EU. On 31 January 2020, the UK formally left the EU, though it has entered a transition period until 31 December 2020 during which it remains within the EU's Single Market and Customs Union. The UK's withdrawal from the EU has serious implications for Greenland-UK trade: in the absence of a favourable UK-EU agreement with respect to the OCTs and a UK-Greenland agreement that replicates the principles and provisions in the EU-OCT arrangement that underpinned UK-Greenland trade thus far, there is a real risk of significant trade disruption.

It would translate as the automatic application of UK Global Tariffs to products being imported from Greenland into the UK, whether finished products, semi-finished products or raw materials. The imposition of new tariffs on products originating in Greenland will adversely impact not just Greenlandic producers and exporters, but also British importers, processors and consumers, and – in the case of critical materials – have profound implications on national security. The following table illustrates how certain mineral resources from Greenland will be affected by the new tariffs on third countries upon their importation into the UK.

Import of Mineral Resources from Greenland in the UK: Impact of New Tariffs			
HS Code	**Product Category**	**Current Tariffs (OCTs)**	**UK Global Tariffs**
2523210000	Portland cement: white cement, whether or not artificially coloured	0.00%	1.70%
2817000000	Zinc oxide; zinc peroxide	0.00%	5.50%
28053010	Rare-earth metals, scandium or yttrium, intermixtures or interalloys	0.00%	5.50%
28053020	Rare-earth metals, cerium, lanthanum, praseodymium, neodymium, samarium, of a purity by weight of 95% or more	0.00%	2.70%
28053030	Rare-earth metals, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, lutetium, yttrium, of a purity by weight of 95% or more	0.00%	2.70%
2805304000	Scandium, of a purity by weight of 95% or more	0.00%	2.70%
2846	Compounds, inorganic or organic, of rare-earth metals, of yttrium or of scandium or of mixtures of these metals	0.00%	3.20%
2823	Titanium oxides	0.00%	5.50%
7801100000	Unwrought lead: Refined lead	0.00%	2.50%
7901	Unwrought zinc	0.00%	2.50%
7901110000	Zinc, not alloyed, containing by weight 99.99% or more of zinc	0.00%	2.50%
790112	Zinc, not alloyed, containing by weight less than 99.99% of zinc	0.00%	2.50%
7901200000	Zinc alloys	0.00%	2.50%
810820	Unwrought titanium; powders	0.00%	5.00%

In the case of fish and fish products, the imposition of new tariffs would result in adverse effects on the UK's food security, as well as the entire seafood value chain, from importers, processors, distributors, wholesalers, traders, retailers, foodservice channels (such as fish and chips shops, pubs and restaurants) and consumers. Although Greenland's exports to the UK currently consist almost entirely of fish and fish products, the sheer number of UK mining firms holding exploration and prospecting licenses in Greenland and the growing demand within the UK for mineral resources available in abundance in Greenland indicate that mining is simply too big and too important an emerging sector for bilateral trade and cooperation to be left out of any UK-Greenland trade agreement. As the firms currently producing in Greenland expand and those prospecting or exploring eventually commence production, Greenland – owing both to its resource potential and relative geographical proximity – is well-placed to become one of the UK's leading import sources for a number of critical minerals, including rare-earth elements. Furthermore, many of these firms will rely on UK expertise and mining finance, as is already the case, and also look to use or to develop processing operations in the UK. On all counts, it is as much in the interest of the UK as that of Greenland to ensure that these mineral resources can be imported into the UK on a tariff-free, quota-free basis, as has been the case under the EU-OCT arrangement. The bilateral trade agreement between these two island countries, both located at the edge of Europe and both incidentally the first to leave the EU, is the easiest deal the UK Government could ever make and yet a deal that would be crucial to the UK's current and future defence and security, as well as food, energy, trade, industrial, climate and foreign policy.