The Geological Society — Written Evidence (ARC0031)

1. The Geological Society is the UK’s learned and professional body for geoscience, with more than 11,500 Fellows (members) worldwide. The Fellowship encompasses those working in industry, academia and government with a broad range of perspectives on policy-relevant science, and the Society is a leading communicator of this science to government bodies, those in education, and other non-technical audiences.

2. We have not attempted to answer all of the questions set out in the call for evidence. Our submission draws principally on the geoscience relating to potential development and protection of the Arctic, as well as the UK’s role in this process.

The Geology of the Arctic

3. A significant body of work has been developed on the geology of the Arctic, through investigation of what lies beneath the ice. With regard to oil and gas prospectivity, continental shelves are the principal area of interest, and the Arctic Ocean has the most extensive continental shelf area of any ocean basin. Approximately half of the area is made up of continental shelves and much of the seafloor in this area is less than 50m deep. These broad shelf areas are predominantly located off the coast of Russia.

4. A major Geological Society publication on Arctic Petroleum Geology (Memoir 35 – Spencer et al, 2011) brings together 50 papers authored by scientists from across the circum-Arctic nations, working in industry, academia and national geological surveys. It constituted a state-of-the-art assessment of Arctic geology; known hydrocarbon resources; prospectivity and potential for development of as yet unknown resources; and techniques for surveying, exploration and resource assessment in high latitudes. The publication builds on symposia held at the International Geological Congress (IGC33), Oslo, 2008, which focused particularly on Arctic geoscience – not just in relation to oil and gas, but also, for instance, to data from the Integrated Ocean Drilling Programme which provided new insights into the past role of the Arctic Ocean in the Earth’s climate system. If the committee wishes to consult this publication, we would be pleased to provide access.

Scientific Research in the Arctic

5. Melting of the sea ice and development of the Arctic, however undesirable, will provide new opportunities to investigate and study the sea bed, natural resources, shelf geology
and the ecosystems associated with it. The current geoscientific database for the Arctic is weak, particularly with regards to regional seismic and wells. There is also still limited understanding and knowledge of the natural environment in polar regions. Comprehensive baseline studies should be carried out in the region ahead of any planned increase in activity so that any resultant impacts can be effectively monitored.

6. The UK has a strong basis for Arctic research, with initiatives such as the UK Arctic Research Station and the NERC Arctic Research programme positioning UK scientists to carry out any research enabled by the development of the Arctic. In terms of a research presence in the polar regions, the RRS James Clark Ross research ship currently conducts research for the British Antarctic Survey and is deployed in the sub-arctic region during the Antarctic summer. Whilst this has greatly helped research in the Arctic region, the RRS James Clark Ross has no ice-breaking capability and can only handle seasonal ice <2-3m. It was announced this year that the Government has earmarked ~ £200 million for a new ship that will be ready for 2019. We understand that the new research ship is intended to replace two old ones, which will necessarily result in an overall reduction in the physical extent of research capacity. Much geoscience research is location-specific, and most data collection has to be carried out at site. This means that a reduction in the number of vessels will have a significant impact on research capacity as any vessel, regardless of how well equipped it is, can only be in one place at one time. If the polar regions are to share one vessel, this would constrain the amount of research that can be carried out. For more detailed information on this, we recommend that the committee contact NERC directly.

Natural Resources in the Arctic

7. Governance over the resources in the Arctic is shared by the five Arctic states (Russia, USA, Canada, Denmark (Greenland) and Norway). However, the majority of the oil and gas resources are likely to be in offshore Russia, as are most new shipping routes. Current development activity in the Arctic is being carried out by several companies by agreement with Russia, Norway and Greenland. Cairn Energy have a $600 million exploration program in West Greenland, and a number of companies bid successfully in licence rounds in East Greenland in 2012 and 2013. Norway and Russia reached a preliminary agreement to settle the median line dispute in the Barents Sea in April 2010 and Statoil has announced new discoveries in the Norwegian Barents. ExxonMobil has reached an agreement with Russia to explore the Russian Arctic with Rosneft and there are other activities off the coast of Canada and Alaska.
8. The Arctic is known to contain significant resources in the form of oil, gas and minerals. Estimates of the oil and gas resources in the Arctic vary enormously. The United States Geological Survey (USGS), for instance, estimates that up to a 1/5th of the world’s conventional undiscovered hydrocarbon resources lie under the Arctic. Note that this figure refers only to so-called ‘yet-to-find’ (YTF) values, excluding known oil and gas fields, and caution should be applied when using these. They are derived by applying standard methodologies to what is known about regional geology and known resources to estimate as yet undiscovered resources in the Arctic and worldwide, rather than reflecting the results of exploration. Such methodologies can be contested, and the results they produce are necessarily far from certain. While the USGS estimates 114 billion barrels of oil YTF in the Arctic, a UK-based WoodMac/Fugro Robertson study from 2006 estimated that undiscovered resources amount to only 43 billion barrels of oil. To date, most of the hydrocarbon resources found have been on the North Slope of Alaska, and much of the unexplored area under the ice cap may never become accessible for extraction. One factor in explaining such variation is disagreement in geological interpretation in the absence of exploration data. For instance, there is debate over whether any significant oil and gas prospectivity may have been destroyed by uplift and exhumation of the unexplored areas under the ice cap in the Eocene period (56-33.9 million years ago).

9. It is also important to draw a distinction between resources and reserves. Resource is the amount of oil or gas underground. Reserve is the amount of oil or gas that can be produced economically – that is, which we can realistically expect to extract from the ground given current technological, economic and social/regulatory constraints. In the Arctic, these additional considerations are considerable and so estimates and figures relating to resources may bear little relation to how much of it will be economically and technically extractable.

10. The Arctic region also has significant mineral resources, some of which have been mined for over a century. The main centres of mining north of the arctic circle have been in Russia, which is dominated by Nickel-Copper-Platinum Group Element (PGE) deposits as well as Iron Ore and Apatite. Finland also has significant Nickel-Copper-PGE and Gold deposits and Sweden, in addition to Copper, mines Iron Ore in the Arctic circle at one of the world’s largest underground mines which has been in operation over the last 100 years. Norway has iron ore deposits as well as coal mines in Svalbard. In the North American nations, Canada has Lead-Zinc deposits and there is also Zinc and Gold mining in Alaska. Greenland has no active mining industry at present but there is some interest
in the recent discovery of rare earth metals deposits in south-west Greenland which could result in mine development in this area.

Arctic Sea Ice

11. Arctic sea ice extent has been monitored by satellite for the past 30 years and, while there are fluctuations year-on-year with regards to maximum and minimum extent of the sea ice, overall it is shrinking. The reduction in the sea ice extent during the Arctic summer period has significant impacts on ecosystems, shipping routes and the livelihood of indigenous populations. In addition to the loss of sea ice coverage, sea ice is also thinning, making it more susceptible to break-up by storms and other extreme weather systems. According to the National Snow and Ice Data Center (NSIDC), 17 September marked the likely minimum extent of the Arctic sea ice for 2014, which was the sixth lowest extent in the satellite record. This reinforces the long-term downward trend in Arctic sea ice extent. Up to date and archive data on Arctic sea ice coverage, including a useful dataset collected by U.S Navy submarines of ice thickness (http://nsidc.org/data/docs/noaa/g01360_upward_looking_sonar/index.html), can be found on the NSIDC website (http://nsidc.org/arcticseaicenews/).

Technological Challenges

12. Development of Arctic resources provides many technological challenges with regards to access, research and extraction activity. Access can be significantly hampered by sea ice coverage, particularly in the winter, as well as the extreme climate conditions in the Arctic. Rapid movement of the sea ice (rotating around the pole) is a serious impediment to any exploration or production activity in ice-covered areas. Furthermore, many vessels struggle to break multi-year ice and the UK currently has no ice-breaking capability.

13. Some comments we received with regard to this call for evidence suggest that the technology required to improve resource characterisation in the Arctic is not yet ready and that it will be important to develop and test required technologies before any planned growth of activity in the Arctic. Technologies currently under development at the laboratory stage to allow ‘down-hole’ processing of hydrocarbons – to produce clean power and industrial feedstocks safely in situ without needing to extract and transport oil – may one day allow these resources to be used with minimal environmental impact. At present, they remain many years from maturity, and are unlikely to play any role in mitigating the effects of a first wave of Arctic development.
Environmental Change

14. An overwhelming body of evidence, published by the Intergovernmental Panel on Climate Change (IPCC) and others, shows that the anthropogenic contribution to current climate change is very significant and that this can be linked to the overall reduction in Arctic sea ice coverage. Importantly, temperatures are rising approximately twice as fast in the Arctic as the global average, and the polar regions play a vital role in climate regulation.

15. The Geological Society published a statement on the geological evidence base for climate change in 2010 (www.geolsoc.org.uk/climatechange), to which we issued an addendum in 2013 setting out recent research findings. This statement focuses on the geological evidence base for past and present climate change, which is independent of other lines of evidence such as atmospheric measurements and climate modelling. The expert working group which reviewed this evidence reached the same broad conclusions with regards to the anthropogenic contribution to climate change as those arising from other evidence bases. Whenever large quantities of carbon have been released rapidly into the atmosphere in Earth’s past, global temperatures have risen, temperatures in the polar regions have risen more rapidly, and sea ice extent has reduced greatly. Oceans have become more acidic and less oxygenated, major extinction events have occurred, and it has taken the Earth system a period of the order of 100,000 years to recover.

Environmental Management

16. Activities such as fossil fuel exploration and extraction in the Arctic need to be balanced with effective protection of what remains a near-pristine environment. Increased activity in the Arctic from exploration and the opening up of shipping routes could result in pollution. Effective monitoring of the impact of development on the Arctic will require comprehensive baseline surveys of background concentrations and emissions of key pollutants; this will help to provide a robust approach to environmental management.

17. At present there is no consistent regulatory framework amongst the five Arctic states. This needs to be developed ahead of any surge in activity in the Arctic. Both the UK and geoscientists more generally have an important contribution to make in terms of safe management of this unique environment. Geoscience research and expertise in areas such as paleoclimatology and environmental monitoring can enhance understanding of Arctic environments and contribute to the evidence base to inform future regulatory
frameworks. The UK has an opportunity to contribute to this through its observer status at the Arctic Council.

The Effect on the UK and the UK’s Role in Governance

18. As the UK is not an Arctic State, its governance role is limited, and direct impacts on the UK as a result of Arctic activity are not likely to be great. However, involvement of UK companies in oil and gas development in the Arctic may be beneficial for energy security in the medium term, particularly as we seek to bridge the gap between our current reliance on fossil fuels and more sustainable long-term means of energy generation in line with our decarbonisation commitments. UK involvement in the development of resources may also have also positive impacts on the economy. These potential benefits should be weighed against known and potential environmental impacts.

19. The development of the Arctic is an opportunity for the UK to demonstrate international leadership in a number of areas. The UK has an excellent science base in research supporting oil, gas and mineral exploration and extraction, as well as a thriving and respected industry which has much to offer in terms of expertise and leadership to any burgeoning industry in the Arctic. It also presents an opportunity to use and share our experience and expertise in robust regulation to support effective environmental management, and to provide leadership on issues of environmental monitoring and protection.

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Reference:
