

Business and Trade Sub-Committee on Economic Security, Arms and Export Controls

Oral evidence: Critical Minerals, HC 1795

Wednesday 22 April 2026

Ordered by the House of Commons to be published on 22 April 2026.

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Members present: Liam Byrne (Chair); Dan Aldridge; John Cooper; Sarah Edwards; Justin Madders; Charlie Maynard.

Questions 53 - 77

Witnesses

- James Kynge, Senior Research Fellow for China and the World, Chatham House;
- Tom Baxter, Project Manager, Dialogue Earth;
- Dr Kathryn Moore, Associate Professor in Critical and Green Technology Metals, University of Exeter.

Examination of witnesses

Witnesses: James Kynge, Tom Baxter and Dr Kathryn Moore.

Q53 Chair: Welcome to today's final panel in our opening witness session in the inquiry on critical minerals. Thank you very much indeed to our witnesses for joining us as we turn to the question about the role of China in critical minerals supplies to the UK. James Kynge, perhaps you could kick us off by telling us a bit about where China is especially strong in the critical mineral chains that are coming into the UK and what you worry about with those things.

James Kynge: It is an easy question really: China is strong across the board. If we look at China's dominance in rare earths, for instance—these are the 17 main minerals that are generally spoken about; there are a lot more than that, but there are 17 main ones—China dominates the world to the tune of making up 60% of global mining of rare earths, 91% of global refining and 94% of permanent magnet manufacturing. Those numbers are from 2024-25, so they are very much up to date.

We saw the potential peril of this last year, in particular on 9 October, when China weaponised the chokehold that it has over rare earths, and other critical minerals as well but particularly rare earths, when it subjected the world to a case-by-case licensing regime. It has now softened that, so that we are in a different type of licensing regime.

Although the current licensing regime from China is rather opaque—in fact, very opaque—it is still the case that China has a chokehold over the supply of these rare earths to companies all around the world that may need them for civilian uses. Rare earths, as you know, are used in basically all types of high-tech manufacturing and have military uses. This, to me, is China's most effective chokehold. It showed last October that it can weaponise that, and will weaponise it when it needs to. China has many other chokeholds, but this is the most effective.

Q54 Chair: If we think about the military equipment that we are going to need in the future, such as Storm Shadow missiles or anti-tank missiles such as those we supply to Ukraine, do they rely on Chinese components?

James Kynge: That is a very good question and I have been trying to research this. It is very hard to get a good answer on those topics. For instance, the question of where the Pentagon and US arms contractors get their rare earths to make weapons is almost entirely shrouded in secrecy. Given that China is such a huge producer in the world, you would have to assume that at least some Chinese rare earths are used in the manufacture of weapons all over the world.

Q55 Chair: Having done that research, what is your gut feel? Do you suspect that it would be pretty difficult for us to make Storm Shadow missiles without Chinese rare earths?



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James Kyngge: My gut feeling, if you are asking for that, is yes. At the moment, I would say yes. The weaponisation of the Chinese supply chain for rare earths caused a great deal of soul-searching across the west, in the US, Europe and everywhere else. There have been several reactions to that. In the future, in general, the west is hoping to get an insulated supply chain that is not so dependent on, or at least resilient to, China. Those are all words that need definition. We certainly need to get moving and actually do something in that regard. At the moment, we are extremely exposed to China's potential and actual weaponisation of the rare earth supply chain.

Q56 **Chair:** Let me make sure I have understood this. The implication of what you are saying is that we cannot expand rearmament, as things stand, without increasing our dependence on Chinese rare earths.

James Kyngge: That is not exactly what I am saying. What I think I am saying is, as things stand, it stands to reason that, given China's extreme dominance of the entire rare earth supply chain and value chain, we would be exposed. We would have to go to China in some form or another, maybe through an intermediary, to get the rare earths that we needed to make our weapons and to make many civilian technologies. When it comes to the future, I have a lot of information here on various plans that are currently being followed by allies in the west to try to build up resilience, or in other words to try to build up an insulated supply chain that is not dependent on China.

Q57 **Chair:** That sounds like a position that we do not want to stay in for long.

James Kyngge: Completely, yes.

Q58 **Chair:** Tom Baxter, is there anything that you would add to that picture about Chinese dominance today?

Tom Baxter: That is true. That is the picture, particularly in rare earths, as James Kyngge was saying. There is one thing that could be added to that. In some of the different critical minerals we often talk about—this is lithium, nickel and copper—China is a major player in processing, refining and the things that come downstream from that, such as the manufacture of batteries, EVs and various other pieces of electronic equipment.

When it comes to mining, it is a slightly different picture because not all of these reserves are in China. China is a big domestic miner, but it is also going overseas and exploring mines in different parts of the world, particularly in Africa, Latin America and south-east Asia. In this space, it is not the only player. It is a massive player, but the big international miners, such as Rio Tinto, Glencore and so on, are still operating in that space and in some cases are working together with it. There are some major mines that are joint ventures or other forms of co-operation between Chinese companies and some of these big international miners.

Q59 **Chair:** Kathryn, what would you add to the story?



Dr Moore: There are a couple of things that I would add. First, in terms of the actual commodities, we should have a particular mind to tungsten. Tungsten is a very important commodity for defence, for hardening steel and for a lot of armaments, but how much is produced is sometimes shrouded in mystery. China is the dominant producer.

I flag this one because we have sizable tungsten and tin deposits in the south-west of the UK that are coming online. We have a real potential here to have some resilience for some of the strategic defence commodities, but we do not have the processing capability. At the moment, the offtake agreements would be to send them to China. There are other places that they could go; that would need some strategic care.

The really important thing here is, if we produce tungsten domestically and we export it as tungsten concentrate, that is at low value. If we then import refined intermediate tungsten products at higher value, we have a net loss of mineral wealth from the UK. That is something we need to look at really carefully. Integration and where the processing happens is really important.

We heard the comment previously about broadness. The number of different commodities means that there are only a couple that we can do that with in the UK. Negotiations and diplomacy with other countries are really key for that.

Secondly, we have heard a lot about aggression from China, but that is not the only reason why supply concentration is a real issue here. The export licence controls that they put on are dominantly focused on the upstream end—the raw materials and refined materials. There are some cases of them reducing exports of semiconductors and other critical components, but it is really focused on the upstream end.

The fact that we have supply concentration means that there are other impacts on those mines that can have a real impact. In the last five years, there have been floods in several coal mines, a lead zinc mine and a copper mine, all in China. China is responding to this. It has just amended its mining law to include a clause for emergency response and how it sets up emergency mining rapidly. It has a mind to managing its own risks, but it also has the dual circulation strategy, which prioritises the internal circulation of materials over the external market, while maintaining that. In the event of some internal crisis, priority will go to domestic economic resilience in China before it releases other materials.

Q60 **Chair:** That means our supply chains are even more fragile, perhaps, than we think.

Dr Moore: Yes.

Q61 **Sarah Edwards:** I want to come back to what you were saying earlier. You said we are not doing the processing and, as a result, we end up with a net loss. Could you give us some insight into why we are not doing it?



What would it mean if we could do it? What are those barriers? Just briefly, it might be similar to what we have heard, but I would like to know.

Dr Moore: Throughput is really the key issue. Our mines are not yet operating, so where would we get tungsten from to put through any processing facility? Ultimately, we would have to be importing it. For us to be importing it from somewhere else to set up our processing facility in-nation, we would have to be the partner of choice. This is where the economic part is balanced with the diplomacy part. How does the UK become a partner of choice? How do we strategically decide which supply chains we want to intervene in for the processing?

We heard earlier about graphite. China holds the biggest resources of natural graphite, but we need to blend natural mineral graphite with synthetic fossil fuel-based graphite to design the functionality of batteries, so it is a bit of both. P66 is producing synthetic fossil fuel-based graphite and it is going to China, but the EU, particularly countries in Scandinavia, has been trying to integrate vertically and is really struggling with it. There are partners closer to home in the EU that are trying to do these things, so we should be having more conversations with them about how we help them succeed in their vertical integration. We should be thinking about how we find alternative places to put our output and have people bring their output to us for throughput.

This applies to recycling and secondary raw materials as well. Although the export controls are on primary materials from China, it controls two thirds of the world's battery recycling capacity as well. We have a really good knowledge economy that is emerging in the UK on the recycling of technology materials. It is really good, and that is being exported around the world as we have heard, but ultimately throughput is an issue there as well.

Chair: I am going to come on to recycling shortly.

Q62 **John Cooper:** Talking about the industrial landscape, the dragon in the room, if not the elephant, is that China does not really play fair, does it? You talk about tungsten. If we were to try to maximise our tungsten reserves, it is not beyond the realms of possibility that China would artificially affect the market by potentially putting out more tungsten and depressing the price, which would make investing in the south-west of England less attractive. We saw this in America with lithium. When the Americans were looking at lithium, amazingly, the lithium price suddenly collapsed. What are China's levers and how do they use them?

Tom, you have been out there. What do you think about that? The Chinese seem to be very good at knowing how we operate and turning these things against us. We outsourced mining to them and now they are expert miners. We seem to be fighting with smoke.



Tom Baxter: A lot of that expertise comes from the very clear policy directions and industrial policy that have happened in China over decades.

As to that point about not playing fair, as you phrased it, that is where the diplomacy part comes in. This whole supply chain—this is something that the world has woken up to—is not something that is going to be shaped solely by market dynamics. It is highly political. Yes, China utilises it in a political way, but other countries are waking up to this. The US has put through massive support for critical minerals. It is suggesting a price floor for critical minerals to steer on some of those areas.

I would have thought that, from a UK and European perspective, the best insulator against those risks was through diplomacy channels.

Q63 **John Cooper:** I will come to you, James. It strikes me sometimes that we are feeding the Chinese dragon in the hope that it will immolate us last. Is that really where we are? Do we have to go to China and try to be diplomatic and friends with them?

James Kyng: My personal view is that we should take a hybrid strategy. We should not try to cut China off—it is far too big a force in this area—but we also need to have our own viable strategy. The other two panellists have already mentioned elements of that.

One of the elements is about working with allies. There is this Pax Silica plan that the Americans are leading. It was inaugurated last December. A lot of other countries were involved, but there are other potential allies that are not in that, such as Norway. Norway has a very big plan to do rare earth mining. It has a considerable amount of money in the Norwegian sovereign wealth fund to fund that type of thing.

We have seen examples in America of how to make rare earths viable with Government support. Let us face it: you have to have Government support because China is the lowest-cost producer by far. If I may give you this quick example that illustrates a lot of the stresses that you are talking about, in California there is a company called the Mountain Pass rare earth mine. It was not viable in 2015. It racked up huge debts simply because it was producing rare earths at costs that were far too high compared with Chinese competition. The American Government have stepped in. They have invested \$400 million to get a 15% equity stake in the company. It has also given a price floor of \$110 for the two main rare earths that are being mined there. That price is double the price in China of the same two rare earths. That gives a sense of the differential we are talking about: China is half the price of the American mine.

The Americans are doing this because they want to have security. They want to have a more secure supply chain. That is leading to all kinds of other spillover effects. In other words, they are getting better at mining; they are going to get better at processing rare earths and manufacturing



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magnets. They are building a supply chain in the US. There are a couple of other US initiatives as well, both of which are being funded by the US CHIPS and Science Act, which, as you know, has about \$160 billion to invest.

Q64 John Cooper: Magnets were mentioned there. Rare earth magnets are critical to things like drones. We think of drones as being relatively simple, but they are not. Rare earth magnets for drones is another area that we are trying to dominate. We are hearing that America is doing this by trolleying money to it, and their pockets are deeper than ours. Is this a race that we can win?

Dr Moore: I was looking at the billions that the US and Australia are putting in. Canada is also putting in a couple of billion. We have £50 million. There is a large differential there. Ultimately, as we heard earlier, those countries are large. They have large land masses, large ore deposits and deep pockets. We cannot compete with that. Do we need to be doing more? Yes, we do. Do we need a slightly bigger budget? Yes, for sure. But we need to be pragmatic about what we can do. We have a lot of friends around the world, and that is really key for us.

To your question about not playing fair, that is one of the characteristics of Chinese mining. The reason they went from less than 40% of rare earth oxide production in 1992 to 90% of global production in 1998 was because of their domestic policies to dispossess artisanal and small-scale miners and to consolidate those resources into six big corporations, which were state-backed. There were crackdowns in 2011 and from 2016 to 2018 to reinforce that concentration of wealth and their control of mineral wealth.

When China started being slightly worried that they were not going to be able to continue that expansion, they started the going global and one belt one road strategy initiatives. Ultimately, the domestic policy of dispossessing miners and taking control is one that they have replicated in the international jurisdictions where they are working. It is not making them particularly popular. Nevertheless, those partners, particularly in west Africa, are looking towards China because gaining investment from China is relatively easy compared with gaining investment from us. Again, it is a hybrid strategy. We need to optimise our investment and be a partner of choice who will behave responsibly.

There is another key thing that is really important. If you look at the critical minerals strategies of the producer nations, they deal with blockages and supply chains. For example, one of the key things in South Africa's strategy is looking at rail and port blockages to supply chains so that they can get their concentrate out.

If we look at Namibia and Nigeria, Nigeria wants more than 30% of processing to be local so that it can retain its own mineral wealth, like we have the concern about tungsten here. They have a lot of minerals. Namibia has banned the export of unprocessed concentrate. They are



really thinking very carefully about how extractivist investment is taking out cheap product and failing to deliver on socio-environmental and economic gains for them. They will have a critical mass of throughput locally. It is really key to think about how we invest in processing in those countries and taking them further along the value chain to our mutual benefit. That is something that Russia has done quite well. It did that in Guinea very effectively.

Chair: Let us just stare into the abyss for a bit.

John Cooper: There is a lot of that here.

Q65 **Sarah Edwards:** I want to pick up on an element of that, but before I do, James, at the beginning of the session, you started talking about supply chain weaponisation. You covered some of what I would have asked, but what is the likelihood of that being used? Could it—there are different schools of thought here—be sustained? Would there be mutually assured destruction from, for example, China deciding to use that? They have interdependencies as well, but we do not often get into the detail of those when we are thinking about the huge amount that they do control. Perhaps you could shed some light on that. If the other members of the panel want to come in, that would be very welcome. You could talk more about friends.

James Kyngge: Chokeholds and mutually assured destruction are one of the topics that I have been looking at quite a lot. It is a very big topic. China has many potential chokeholds. Rare earths is probably their prime one because they are so dominant and because it has a strategic and military aspect to it. The idea that a country will not be able to get the rare earths to make its weapons really makes Governments think.

China has other chokeholds as well. About 60% of the world's generic drugs and about 70% of the world's active pharmaceutical ingredients are made in China. About 80% to 90% of solar panels and 70% of wind turbines are made in China. About 60% to 70% of legacy semiconductors are made in China. Those are semiconductors above 14 nanometres. You can really go down the list. China has a whole dashboard of potentially weaponisable chokeholds.

The west has chokeholds too. In Europe, there is the Dutch company AMSL. It is unique in the world. It makes tiny semiconductors. These days it can make semiconductors about 1.5 microns. That is a chokehold. The Americans have weaponised that against the Chinese. There are many more.

A lot of these, as you mentioned, are not well understood. The Japanese have a lot of these chokeholds, such as photoresist, which needs to go on to semiconductors to make them viable. Japan dominates that market to a huge degree. For high-end semiconductors, we know about NVIDIA and so on. It is a very big topic. My back-of-the-envelope characterisation is



that China's chokeholds are more numerous and more weaponisable than those of the west, but the west does have chokeholds.

Tom Baxter: If I can add directly to that, there is a point about understanding the chokeholds that the UK, Europe and its allies may have, but there is also a point about understanding the interdependencies. If we think particularly about the supply of batteries, solar panels and EVs, these sectors are absolutely fundamental to the Chinese economy at the moment. Last year, they accounted for a third of economic growth in what is now a sluggish economy that the Government are extremely worried about.

Those manufacturers are extremely dependent on export markets. The UK is a major export market and the EU is another major export market. There is a certain interdependency there. In the EU, some countries are leveraging this.

Q66 **Chair:** It is not even interdependency. It is almost indispensability, is it not? Unless Chinese firms can access UK and European markets, they are in trouble.

Tom Baxter: Exactly, yes. Particularly in the sectors that I am talking about—batteries, solar and EVs—their margins are so slim partly because of the over-production or overcapacity crisis that they have at home. There is a big price war going on. A lot of these companies are in an existential battle day to day.

We have seen how Europe has utilised this to bring manufacturing into Europe. That is often Chinese companies setting up in Europe under joint venture structures, where there is supposed to be a degree of knowledge sharing, tech transfer and so on. These are areas to think about as well.

Dr Moore: The only thing that I would add is about interdependency. The threats that China has issued to the UK have been about our association with the US, whether we will follow their lead and things like that. That is the interdependency that we really need to worry about. The 2010 Japan rare earth elements crisis was targeted on Japan, but the rest of the world suffered as well. Likewise, the spat with US export controls last year affected everybody. The way that we get caught up in those wider trade wars is a bit of an issue that we have limited capacity to deal with.

Q67 **Charlie Maynard:** Just on that point about interdependency and limited capacity, it seems to be largely a failure of diplomacy and organisation at an international state level. You have a unitary state, China, and a whole load of other states who are getting whacked—"By the way, don't whack me because that's scary." We are not co-ordinated enough; none of us sticks our head up because we know we are going to get whacked.

The obvious solution is to be co-ordinated because there are tons of chokeholds, as you have just set out, that we have on China. We can debate all day long as to which are the best ones, but there are lots of them. It is all very interdependent. Where we are failing is by not having



co-ordinated diplomatic responses or reactions to it. Is that a fair statement?

Dr Moore: I can talk a bit about this. The EU is our nearest neighbour. While China has its emergency mining response law, the EU has the Critical Raw Materials Act. They are trying to take the permitting time for a mine down from 10 to 15 years to 27 months. They want to have the ability to respond quite rapidly.

I was involved in a mining project that was about how you set up a mine really fast in response to a crisis. The first panel revealed that a lot of mines go out of production not because they are exhausted of ore but because they are undercut by somebody else's production or for legal reasons. There is a lot of capacity in the UK and Europe. We know where those things are; we know they are sub-economic. In the event of a crisis, there is knowledge capability now about what we could do about that, and our ability to tap into that knowledge is key. That is where some of the EU collaborations and the Canada and Australia collaborations are really powerful.

Q68 **Chair:** This is about having mines on hot standby, as it were.

Dr Moore: They are not quite on hot standby. The permitting is the real issue that takes a long time. That was one of the key findings from that project. You can technologically get it done in about 18 months, but the permitting is key.

China is getting a lot of ore deposits on standby and getting them permitted in advance, which is really smart. Though their environmental record has not been great in the past, they now have a lot of green mining policies in place, which is what is driving some of their miners abroad.

Q69 **Dan Aldridge:** Thank you very much for everything you are saying. I love these sessions because you get to raise your eyes and look at the bigger picture and the global picture. It is really helpful because sometimes we just perceive the global threats and we forget that we have some game. There are weaknesses across the piece as well as strengths.

I would like to build on some of the stuff that you talked about originally, James, about the potential impact on UK sectors. If these chokeholds were used, what might the impact be? Where are the vulnerabilities? Across which sectors are they? That would be helpful.

James Kynge: We are talking about future scenarios and therefore it is going to be rather vague, but there are several different impetuses that could mean China would decide to use some of its chokeholds. One might be geopolitical. Let us say there was a scenario where China was using grey-zone tactics to pressure Taiwan and there was a western response. If China wanted to shut up the western response, it could use a part or some of these chokeholds, if it wanted to.



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Other uses of chokeholds would be more similar to the rare earths ones that we just saw. Those were in response to American tariffs and American entity list pressure. That was China using economic coercion to combat economic coercion from the United States. That is purely economic combat, not military or strategic combat.

As a general comment, we have entered a world now in which economic coercion is going to become more and more common. We are seeing it more and more regularly now between the US and China because the rivalry between the US and China is an economic one. It is about who is going to be top dog in technology, who is going to be the world's leading economy and who is going to set the rules of the global order, which is mostly an economic order. To me, the biggest lag is Government policy failing to adapt to a new world of economic coercion.

Mr Maynard was asking, "Where do we fail?" In my view, we fail through lack of clarity. We are not clear about where our vulnerabilities are, where we need to shore them up with policy and where our red flags are. Because we are not clear about where the red flags are, we are also not clear about the green flags. We are not saying to China, "Come in. Build a wind turbine factory in Scotland. Give us the latest technology, which is going to transform our ability to generate electricity at a cheap price because you are way ahead of us and everybody else," because we are not clear. We are just not clear about what is allowed and what is not. We in the UK have that in common with many other countries in Europe and throughout the west.

Tom Baxter: I want to come in on two points. First, if I can just briefly return to international co-ordination, it is relevant to this as well. Something that we need to remember is that "critical minerals" means different things to different countries. Of course, we are talking about it primarily in a security context now, and that is one of the most urgent questions for the UK at the moment, but it is also a climate question. For a lot of partners and potential allies in global south countries, where a lot of these resources are, it is fundamentally a development question.

When we are thinking about international co-ordination and allies, we need to shape the way that we are speaking about these issues accordingly. To put it more succinctly, if we are talking with partners in Africa about critical minerals and only framing it as a security concern for Europe, it is not beneficial to British interests.

On the implications for the UK of China weaponising these various chokeholds—James has already touched on it briefly—a fundamental one is about our energy transition and our goal to reach net zero by 2050, which is legally mandated here. That has all sorts of implications in terms of the cost of energy; energy security, as we know; access to technology; and the UK's credibility in these multilateral spaces that are dealing with climate. To date, the UK has been quite a leader in the climate space, but we need to make true on the commitments that are in law.



Dr Moore: Following on from that and some of the comments earlier, there is collaboration that is happening already but is not necessarily being flagged. Our partnerships with the Canadians and the Australians are very important, but the knowledge economy that we have here also has linkages. We are helping to set up a university in geoscience education in the United Arab Emirates, for example, who are wanting to transition away from fossil fuels and develop their critical minerals potential. The knowledge economy here is really valuable.

We heard earlier about the innovation drain out of the UK. We have to plug that drain, but we are not losing that capability in the research centres. The linkages with China are quite strong as well. There is a bit in the press occasionally about how that is fraught with difficulties around intellectual property retention and things like that, but those synergies all exist. To be able to augment how we foster those synergies without losing out on innovation is one of the really key things that we can do.

I would absolutely echo that the race for African critical minerals is really running at pace right now. That is a space that we should really be taking a lead in because we really can.

Q70 **Chair:** We have about five minutes left. Let me just ask one final question. What is the one recommendation that you would make to Government in order to try to derisk this situation? Dr Moore, do you want to kick us off?

Dr Moore: It is diplomacy—it is absolutely diplomacy. We need to think about the balance of connected and vertically integrated supply chains and where the processing is located outside of China. It is about the location of processing, what we can do here, what we need to friend-shore and how we optimise investment for that friend-shoring.

Q71 **Chair:** That is not just diplomacy, then; that is also cash, by the sounds of it.

Dr Moore: Yes.

Tom Baxter: I would say something very similar. There is a gradual movement of processing to the sites where these resources are mined. A lot of those countries are pushing very hard in lots of different fora to try to establish frameworks to enable that to happen. That came up in the climate negotiations in Brazil last year. It will come up again in Turkey this year. It came up in South Africa's G20.

I would add one specific thing here. I wonder whether the UK can take on that critical minerals framework in the G20 next year, when the UK is president.

Q72 **Chair:** I was going to say that there is a real road to the G20 opening up here. We have a bit of time for the UK to get its act together ahead of that, by the sounds of it.



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Mr Kynge, we have heard a bit about friend-shoring processing in particular, and about diplomacy, cash and perhaps some mobilisation of institutions. In a way, you have also alluded to this indispensability point as well. What would your recommendation be?

James Kynge: I very much agree with what has been said. The Pax Silica plan is something that the UK is engaging with and should very much engage with full bore.

If I could make a separate recommendation, it would be for recycling. This is the art of the possible. The idea of having a rare earth mine in Yorkshire is going to be controversial. It is going to be difficult. It is going to be costly. With recycling, we can do it. We are good at that. We can swing behind that. We can move the needle. That will hopefully focus people's ideas and attitudes and get us on to the road to some—

Q73 **Chair:** The transatlantic partnership is not going to be without tension, though. Jacob Helberg is not everybody's cup of tea in this country or indeed in Europe. Is that a durable bet for the future, as opposed to, say, RESourceEU?

James Kynge: It is hard to say. My view on Pax Silica is that there are enough other members to counterbalance the US. I mentioned Norway before. In fact, Norway is not a member of Pax Silica yet; Sweden is. A country such as Norway has a rare earth company. They are going to be mining. They have a massive sovereign wealth fund. They have money to bankroll this. We should be combining with Norway. That is a concrete example. There are many other concrete examples, but we can do stuff.

Chair: We love the Norwegians. They are buying all our ships and all sorts of other great things.

Q74 **Sarah Edwards:** Just briefly, it is very interesting to hear that focus on recycling because we were having a discussion in our private session about really looking at the operational challenges and barriers to that. I was just going to come at this slightly sideways. We are often looking at the Government's resources and what tentacles and feelers they have to go out into the world and find out things that they can bring back. We have these trade envoys. We are quite interested in looking at what they do and what is on their radar. Do you have any thoughts around trade envoys in this space? We are looking at the trade of these minerals. It may not be an obvious thing to be on the agenda of a trade envoy. I just wondered whether you had any very brief thoughts on that.

James Kynge: My only thought is that this is absolutely critical. We will pay for this over decades if we do not get it right.

Q75 **Chair:** Let us wrap up with money. Dr Moore, you said £50 million was welcome but not enough. Help us think through the orders of magnitude in terms of the increase that we should be contemplating here.



Dr Moore: When we look at the exploration budgets alone of other countries, in Namibia we are talking about over £100 million for exploration alone. They already have a very large, country-wide regional database. Ours is 50 years out of date in parts. We are behind a lot of other countries in the world in providing pre-competitive data, for example. We do not have a budget to do that.

With £50 million we could do the whole country, in fact we could start really well with £10 million in Scotland, but that is only one small aspect of it. You also need the companies, which need £20 million here and £20 million there. To get a processing plant for tin or tungsten—we could combine the two—we are talking about some millions just to do the feasibility study. Then it would be multiple millions to build the thing. For any one of these interventions, £50 million would take us a long way, but it would only do one thing. We are trying to do everything with that £50 million.

We need to think very carefully about prioritisation. If we can go through a prioritisation exercise and understand the orders of magnitude and how many times we are falling short, we could design a funding programme that really hit the brief very pragmatically, recognising that we are not going to have the billions.

Q76 **Chair:** Some of the estimates we have seen is that you would need something like \$60 billion to begin building global alternatives to processing. That is not us alone. That would be us potentially participating in a kind of syndicate, which you could probably buy your way into for a billion or two. Is that the sort of number that we are talking about?

Dr Moore: I am not sure how that would work in practice because of the diversity of the supply chains. One programme that does all would be very difficult to establish. We have a bit of a piecemeal approach because of the nature of raw materials.

One of the things that I would flag is that China having this monopoly on processing means it is extracting materials at refineries that cannot be got at mine sites. These are the by-products that are produced during refining, such as gallium or germanium, which China has a chokehold on as well. By simply moving the processing site, we would open up a lot of additional capabilities. Those kinds of things could be aligned quite nicely.

Q77 **Chair:** Mr Kynge, you were nodding vigorously for a moment.

James Kynge: Yes, \$60 billion sounds a good ballpark. If you look at the US, they are putting \$12 billion into developing mining, refining and manufacturing at the moment. They have three live projects right now. As you know, the CHIPS and Science Act is funded to the tune of \$160 billion. They have the money to do that. The EU is talking about this. I have mentioned Norway a lot, but there are plenty of other countries. Australia is absolutely key. Maybe a billion is about the price that you pay



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to be part of that club. If we are talking about resilience among allies, it seems to me that the Pax Silica club is important.

Chair: We could even count it against the 5% NATO defence and resilience target. We are out of time. Thank you so much indeed. That has been a brilliant discussion. You have really helped us with our thinking. We are really grateful to you for spending some time with us this afternoon. That concludes this panel and this session.