RioTinto

Transcript

Things You Can't Live Without

Episode 5 – Cerys Matthews' Climbing Equipment

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Mark Davies [00:05]
Welcome to Things You Can't Live Without, the science podcast where we turn the spotlight on those items from our daily lives that we rely on the most. Each episode, I, material scientist Dr Anna Ploszajski, talk to well known figures to find out what single item they can't live without. Together, we'll interrogate a host of experts on the science behind what's really required to make these items and what needs to be done to make sure we can continue to sustainably fill the future with e-bikes, dictionaries, prosthetic legs, and all the other things we're going to hear in this series. And the legend that is sitting with me today is Welsh Singer/Songwriter, Author, MBE, and Broadcaster, Cerys Matthews. Welcome Cerys.

Cerys Matthews [00:46]
Hey, good to be here.

Dr Anna Ploszajski [00:48]
Thank you for being with us. So tell us what is the one item that you can't live without?

Cerys Matthews [00:54]
Climbing equipment.

Dr Anna Ploszajski [00:57]
Climbing equipment, okay, so what does that involve? Give us the brief rundown of your climbing equipment.

Cerys Matthews [01:03]
Well, I guess the first thing would be rope and carabiner and harness, some rubber shoes. But it's like hiking equipment as well. You know, like stretchy hiking trousers, and a good bag.

Dr Anna Ploszajski [01:16]
There must be a room in your house somewhere that is just full of carabiner clips, ropes and everything in between. I love it. Today, we're going to be focusing on that carabiner clip as our particular item that you can't live without, and to take us through the past, present and future of aluminium and the carabiner clip, we're joined by climber, librarian and climbing curator Nigel Buckley and Rio Tinto's Chief Technical Officer Mark Davies. Welcome to you both.

Nigel Buckley [01:42]
Hello. Thank you.

Mark Davies [01:43]
Hi, thanks for having me.

Dr Anna Ploszajski [01:44]
Lovely to have you with us. But before that, Cerys, tell us a little bit more about your climbing equipment. Where did your love of climbing first begin?

Cerys Matthews [01:53]
I guess, you know, I'm largely desk bound, I build radio shows these days, pulling music, sourcing it, referencing it, putting it into an order. It's great, you can escape into your head and into these compositions across the world, you know, brilliant sounds, but you don't move. It's all in your head. And I got into climbing by a complete accident, really. I wanted to do some hiking. So for my 50th I went to do the Everest trek, the base camp one. And I thought, I'm a bit scared of heights.

Dr Anna Ploszajski [02:31]
Okay.

Cerys Matthews [02:33]
And I said, you know, I'm gonna just start, I literally live next door to an indoor rock climbing centre. And I thought I'll just go there, get my head round, ropes and, I mean, tying knots is the only exam I've ever failed in my life. I got sent to do like a sailing course when I was a kid and it was awful. So, I thought, let's, let's, just face the fears and start climbing. And I went and I just simply got hooked.

Dr Anna Ploszajski [03:02]
So you went to base camp on Everest?

Cerys Matthews [03:05]
Yeah.

Dr Anna Ploszajski [03:05]
Wow. What was that like?

Cerys Matthews [03:07]
It's the best thing I've ever done in my life, easily.

Dr Anna Ploszajski [03:10]
And how long did the full track take you?

Cerys Matthews [03:12]
We took it slow because of the boys. So, I think, we were out out for about 11 days, total, including stays in Kathmandu, which is absolutely brilliant as well. The slower you go, the better you just zigzag up and down. I was the only one that got altitude sickness.

Dr Anna Ploszajski [03:28]
Oh wow.

Cerys Matthews [03:28]
I was, I was the one most keen to do it. And I was the only one that got altitude sickness. So it's quite funny.

Dr Anna Ploszajski [03:34]
I'm sold. I'm going to finish the episode and then I'm sold then I'm going to Everest. [music interlude]

Dr Anna Ploszajski [03:43]
I'm sure these sorts of treks don't come without risk. You know, a part of your climbing must be at

least getting over the fear of it, you know, good faith in the equipment that you have. And our question on this podcast is, what can't you live without? This might be a piece of equipment that saves your life on these treacherous tracks. But, of course, climbers haven't always had such high-tech equipment. So it's time for us now to turn to our history of climbing guru Nigel Buckley. Nigel, welcome.

Nigel Buckley [04:11]
Hi, thanks for having me. I certainly can't live without my climbing equipment.

Cerys Matthews [04:16]
Yay.

Dr Anna Ploszajski [04:17]
How long have we been climbing for?

Nigel Buckley [04:20]
So, the idea, the appreciation for altitude on the summit took a long time to take hold. From the 14th century, I have records of people going up mountains for religious reasons, meteorological, scientific, survival for food, but climbing as a pursuit, as a sport, in its own right, really sort of first attempt on a mountain for summit was 1492 on Mont Aiguille in France. That was led by Antoine de Ville and then in the 18th century a scientist in Geneva sort of went around the Mont Blanc area. I don't know what he was doing, maybe, it was word of mouth, but in my imagination, he was pinning up posters offering a reward for the first person to summit Mont Blanc, which was done in 1786. And Saussure himself later did it. I think it was the following year, he had 18 guides, food, wine...

Cerys Matthews [04:24]
What was a green curtain for?

Cerys Matthews [04:47]
Foie gras.

Nigel Buckley [04:47]
He had, mattresses. He took a green curtain them. You know, they toasted on the top.

Nigel Buckley [05:28]
I think, you know, to go around his bed, I imagine, so you know, getting changed and stuff. Then Alpinism really takes hold in the mid 19th century. The Alpine Club was the first mountaineering club in the world. That was founded in 1857.

Cerys Matthews [05:42]
Can I ask a question at this point, Nigel?

Nigel Buckley [05:44]
Yeah, yeah, go ahead.

Cerys Matthews [05:44]
So very much western based, the Alpine Club. Was it British, right? English?

Nigel Buckley [05:50]
Yes, yes. It started in London.

Cerys Matthews [05:51]
Any sort of evidence in history of mountaineers in perhaps Asia or other countries doing it for fun?

Nigel Buckley [05:59]
You know, people go up valleys. There was a an expedition a few years ago to find the Yeti and it's

in Bhutan. People were doing environmental DNA testing down huge valleys in the Gangka Ponsam area, which is the highest unclimbed mountain in the world. And they found evidence of human DNA. But, of course, a lot of things match human DNA quite, quite a lot, like bananas are like a 50% match...

Cerys Matthews [06:23]
Really?

Nigel Buckley [06:23]
...for human DNA. Yeah. But you know, the idea that you've gone down a valley that no one's ever been down, probably, it's not true.

Cerys Matthews [06:31]
I'm also thinking about people sort of fleeing persecution as well being pushed to the extremities.

Nigel Buckley [06:37]
Usually, mountains are political or geographic borders. So the summit is often in the way. What people were interested in, altitude wise, is passes the coals.

Nigel Buckley [06:48]
How'd you get from one place to the other. But climbing is a sport. That's really, it's mid 19th century, the railways, the Napoleonic wars are over, the railways are there.

Cerys Matthews [06:48]
Yeah.

Cerys Matthews [06:58]
People with a lot of money.

Nigel Buckley [07:00]
Well, so people have a lot of money. And on like national expeditions, we're looking for the poles. So we're looking for the Northwest Passage, you're well to do, upper middle class person could get out to the Alps, relatively easily. You could be a Mont Blanc in 24 hours. So that's when it really takes off. And then gear started coming along, because in the early days, they were going out with a long walking axe, some nail boots. Whymper in 1865 on the Matterhorn, he used the grappling hooks, a free pinned hook on a rope, he'd throw up and pull himself up things that you couldn't climb, but when the piton came along, it was really, really adopted by German climbers more than it was by British climbers or French climbers. And pitons you can hammer into rock to climb things that you couldn't previously climb safely.

Dr Anna Ploszajski [07:48]
What's a piton for those of us who are not climbers?

Nigel Buckley [07:51]
A piton came in different shapes. But basically, it was a sub arrow of metal. And they would be really thin sort of, sort of, knife blade. And he'd also have like two inch wedges of different sizes in between,. You'd hammer and hammer them into cracks, which is a sort of precursor to the bolt, which came along later.

Dr Anna Ploszajski [08:11]
And these are all different pieces of equipment that you hammer into the rock face to prevent you from falling very far. Is that right?

Nigel Buckley [08:17]
Yeah, you would fall down to the last one you put it in if it holds.

Dr Anna Ploszajski [08:21]
Okay, well, I mean, that doesn't give me much faith in the equipment, but I'm sure it worked in reality.

Nigel Buckley [08:26]
Pitons, at first, were iron and they were soft. When the steel piton came along, you could hammer it in. And, you know, they were rigid. At first people with the pitons, they'd have a ring. And then, and then, eventually the carabiner starts to be used. And, I think, the carabiner really started maybe more than 100 years ago for soldiers carrying rifles and things like that.

Cerys Matthews [08:46]
Describe the carabiner.

Nigel Buckley [08:47]
Describe the old type of carabiner, or the new? Shall I start with the old?

Dr Anna Ploszajski [08:51]
Start with the old. Take us through it.

Cerys Matthews [08:51]
Yeah.

Nigel Buckley [08:53]
Oval and quite weak. And then they started using a D shaped carabiner. And with different clips, so the first type was a sort of, snap gate and then screw gate started coming in and there were twist gates, and these are all steel, and then aluminium came along it made it much lighter. So imagine carrying, you know, 40 pitons made of steel and all the carabiners to go with them to clip in. It's just a lot of weight.

Dr Anna Ploszajski [09:00]
So it sounds to me like the story of climbing equipment. We've had advances in, in, safety and in the different ways that these pieces of equipment work, as we've had sort of advances in new materials and the popularity of it rising and, I guess, more money flooding into the scene, as well. I really want us to dig down now into the materials specifically. You know, we heard about Ötzi the Iceman. All of his materials were wood mostly, you know, all of his climbing equipment was, was, wood and natural materials and then we've gone on from there to hemp ropes and then, you know, in recent centuries, polymers and plastics, nylon, being a particularly good one for climbing, very lightweight, very strong. We're focusing in this podcast on aluminium. And you mentioned aluminium as being a real step forward in climbing equipment, mostly thanks to the fact that it's very lightweight compared to the iron or steel alternatives. Cerys, any idea where aluminium comes from today?

Cerys Matthews [10:18]
No.

Dr Anna Ploszajski [10:19]
Any guesses? Any guesses?

Cerys Matthews [10:21]
Africa, somewhere in Africa, a country.

Dr Anna Ploszajski [10:24]
Somewhere in Africa? Well, we will put this question to our expert and joining me in the studio today, Mark Davies, Chief Technical Officer of Rio Tinto. Can you answer this question for us? Where does aluminium in our climbing equipment come from?

Mark Davies [10:38]
So, Cerys, did a pretty good job. Actually, Africa is one of the places that the raw ore for making aluminium comes from. Aluminium ore is called bauxite, and it's little round marbles, little orange marbles. And it's formed by weathering in tropical regions. So rain washes away the other minerals and you're left with these little balls that contain about 25% aluminium.

Mark Davies [11:01]
And so most of the world's aluminium is bauxite, is mined in either West Africa, northern Australia or Brazil.

Dr Anna Ploszajski [11:01]
Okay, nice.

Dr Anna Ploszajski [11:08]
Okay, so well done, Cerys. Smashed it. And how does aluminium compare to some of the other metals that we've been talking about on this podcast, particularly steel and iron?

Mark Davies [11:18]
So the real advantage of aluminium is that it is very light for how strong it is. And it's also very corrosion resistant. And probably the biggest example is actually, aviation and space. You know, since World War II, every plane that you would have been in, every rocket ship, would have been made of aluminium because of this combination of strength, but lightweight.

Dr Anna Ploszajski [11:40]
Right, aluminium itself, in the story of metals, we're talking here about climbing equipment, it's relatively young, isn't it? We haven't known about it for that long.

Mark Davies [11:48]
It's very young as an actual metal actually, probably similar timing to the climbing story. So the aluminium salts were used back in history. The Romans used aluminium salts to preserve wood, but actually making it into a metal is really like an 1880s type invention.

Dr Anna Ploszajski [12:03]
1880s. Okay, so we started making, what were their first?

Mark Davies [12:06]
Yeah, look, the first recorded examples of aluminium were probably in Napoleonic times. It was utensils, really, it was very initially, utensils. When aluminium really took off, it was probably in around World War II. And in the aftermath, the sort of Cold War, a lot of new aluminium processing facilities were built.

Dr Anna Ploszajski [12:26]
Got you. So that was really the point when it started taking off. And then it was aeroplanes and later spacecraft. And what else do we use it for today?

Mark Davies [12:33]
So today, your laptop, your, your cans, but actually, it's growing a lot in cars. So because it's a lot lighter weight than the alternative metals, and, if, if you replace 1 kilo of a heavier metal with aluminium, over the life of the car, you probably save 20 kilos of CO_2. And so over the last 10 years, they've gone from like 170 kilos of aluminium to about 230 kilos of aluminium. So there's a quite a big step up in use in, in, the automotive sector. Still used in aeroplanes and buildings. So most of your window frames and doors, there'll be aluminium, once again, light and strong.

Dr Anna Ploszajski [13:13]
Yeah, I've got a bit of materials hypothesis that I want to run by you all and this has to do with temperature, and particularly how cold we can use these different metals. So, Cerys, firstly, I want

to ask you, when you were up Everest, or maybe some of your other climbs, what was the coldest sort of temperatures that you were walking in?

Cerys Matthews [13:33]
Oh, gosh, not that cold. I often think about cold climbing, you know, there's some classic stories of the past, where you read about these climbers stuck on the bottom of the hemp rope in minus temperatures. And I just can't imagine handling frozen rope with frozen hands and the exposure in the wind and stuff. Because I've not been lower than probably, I don't know, freezing point or something. No, I've been a very fair weather climber. Overall, though, during winter time when it gets freezing. This is, this is, even inside the indoor gyms, those handles can get quite cold. And then I'm thinking what, what a poor, what a fair weather the person that I am complaining about indoor climbing handles.

Dr Anna Ploszajski [14:18]
Even freezing temperatures is very cold. So I don't really consider you a fair weather climber. But I take the point that you know, certainly not subzero temperatures, but this point around zero degrees Celsius. That kind of freezing point is a really interesting temperature for materials. Because in the early equipment that would have been made out of iron and steel, iron and steel is actually not very good at temperatures around freezing and below. It becomes extremely brittle. There's a concept in materials called the brittle to ductile transition temperature, which is when you cool steel down around zero degrees or so. Below that point it becomes very, very brittle and actually this was one of the key problems as to why the Titanic disaster was so disastrous, was that the hull of the Titanic was submerged in water that we as we know, it was very, very cold. There were icebergs frozen seawater around. And when it hit the iceberg, it was below its brittle to ductile transition temperature. So it basically caused it to shatter a bit like glass. Rather than denting if it was any warmer, it would have sort of dented and potentially not been quite so disastrous.

Cerys Matthews [15:26]
And zero degrees is not that cold, is it?

Dr Anna Ploszajski [15:28]
It's not that cold. And I'm sure some of the early climbers with their iron and steel components would have been below that temperature. So that's another added element of danger.

Nigel Buckley [15:36]
There's quite a lot of stories of people being on the north face of the Eiger. So on Eiger, you could be with, two ice axes two technical short ice axes, and crampons with front points. And there are stories of people getting stuck because both of their axes are broken on the ice, and the crampons and then they're left just hanging around on a, on a, ledge waiting for rescue. Even, you know, in the in the 70s people waiting for helicopters to come and get them.

Dr Anna Ploszajski [16:06]
Oh my gosh, wow.

Nigel Buckley [16:07]
They can't progress because everything's broken.

Dr Anna Ploszajski [16:09]
That sounds terrifying. Well, I mean, the good news about aluminium is that it doesn't have this brittle to ductile transition. So that's one key reason as to why not only because it's more lightweight and easy to carry, but also that it doesn't have this weakness that when it gets cold, it becomes brittle and more likely to break.

Mark Davies [16:26]
Which is just as well when you're sitting on the aeroplane and it says minus 65 outside.

Dr Anna Ploszajski [16:29]
Right. Good point.

Cerys Matthews [16:32]
Good point.

Dr Anna Ploszajski [16:34]
So back to you, Mark, you told us about these little orange balls of aluminium that we find inside, inside, rocks in the, in the, ground, what's the process of taking those orange balls and turning it into an aeroplane?

Mark Davies [16:45]
Well, it's quite a long process, there's quite a number of steps. But it actually starts off by, we mine those those small balls. Now, it's typically, you know, quite shallow, you'd normally remove a small amount of topsoil, and you store that, so that you can reclaim the site afterwards. And then it's 2 or 3 metres of these small rocks that you scrape up with diggers and put it into trucks and then ships to move it to the next stage. And then the next stage of the process is actually where we dissolve those rocks in hot caustic soda at pressure. And so the idea there is that the bauxite is made up of a mixture of aluminium oxide, and a bunch of other stuff. And you want to separate the aluminium oxide out. So you dissolve it in this hot caustic soda. You filter off the mud, the red mud, and then you precipitate the aluminium oxide out. And then you bake the aluminium oxide to drive the moisture off and you're left with a powder that looks a little bit like flour or castor sugar...

Mark Davies [17:41]
...when that's aluminium oxide, and that's sort of one process that's called refining, alumina refining. And you take that alumina and then you move it to a smelter, and the smelter is typically somewhere where you have lots of cheap electricity because aluminium in many ways is frozen electricity. You know, the process to produce it requires very, very significant amounts of electricity. So you then dissolve that alumina in a cryolite, which is another mineral and pass an electric current through it. And then it sits within a big steel carbon lined cell. And the aluminium settles at the bottom and then you drain that and cast it into ingots. And then those ingots will go away, they'll be alloyed, they'll be rolled and rolled into sheet, which will then be folded lots of, lots of, lots of, little folds and turned into an aeroplane.

Dr Anna Ploszajski [17:41]
And turned into an aeroplane. Amazing. So there's sort of chemical process at the start to refine the aluminium oxide and then an electrochemical process that gets us the metal itself. And then you can process that afterwards.

Dr Anna Ploszajski [17:41]
Okay.

Mark Davies [18:42]
The biggest environmental footprint with aluminium is its carbon footprint, because you lose so much electricity. Unless you're losing green electricity or hydropower or renewables, you have a very large carbon footprint. So the average carbon footprint around the world is about 12 tonnes of CO_2 per tonne of aluminium. Now, if you're making it with coal fired power, that's about 18 tonnes of CO_2 per tonne of aluminium. If you're making it with pure renewables. So we have we have a massive hydropower system in Canada, where we make the most of our aluminium. So even with zero carbon electricity, because you use a carbon anode in the electrochemical process, you still get about 2 and a bit tonnes of CO_2 per tonne of aluminium.

Mark Davies [18:42]
Okay, so the chemistry of the process, it has, it gives off CO_2. Is it ever possible to make completely carbon neutral aluminium?

Mark Davies [19:32]
Yes, we're, we're working, well, we've, well, I hope so.

Dr Anna Ploszajski [19:35]
Amazing.

Mark Davies [19:36]
That's actually one of our key R&D efforts. This ELYSIS technology, in collaboration actually working with the Government of Quebec and Alcoa and the Government of Canada and Apple. And what happens in that is that we replaced that carbon anode with an inert anode. And so we put the electricity through you get aluminium and you get oxygen coming off instead of now...

Cerys Matthews [20:00]
Nice.

Mark Davies [20:01]
...this has been the holy grail for the aluminium industry.

Cerys Matthews [20:04]
It sounds like a secret thing. Are you allowed to tell us?

Mark Davies [20:06]
I, I, even I.... they, actually, even my team won't tell me what that inert anode made of. It is, it is, very secret. So like, even though the team that works for me, won't tell me what it's made of.

Cerys Matthews [20:16]
Diamonds.

Mark Davies [20:16]
Yeah.

Dr Anna Ploszajski [20:17]
We're gonna say some materials. And we're going to read your facial expressions and see if we can get.

Mark Davies [20:22]
I don't know if your MacBook has it. But we actually sold the aluminium from that first process to Apple. Yeah, because Apple actually put some money in to help develop this technology. So some MacBooks have this aluminium.

Cerys Matthews [20:34]
Is it safe for climbing on?

Mark Davies [20:36]
Yes, yeah, absolutely. So when we sell the raw aluminium, it's sort of like 99.99% pure. To make it into things like planes and carabiners, you alloy it. So you add a little bit of copper or zinc or manganese, then you heat treat it to get the sort of exact properties that you want. And so, actually, you know, one of the reasons that we need to make new aluminium is because when you recycle, some of these alloys build up and you get properties that you may not want.

Dr Anna Ploszajski [21:05]
So what's the negative then, why isn't an all aluminium zero carbon?

Mark Davies [21:10]
Because we're actually literally only in the middle of inventing this technology as we speak.

Dr Anna Ploszajski [21:14]
Okay, so it's a pilot project.

Mark Davies [21:15]
It's a pilot. The other thing that we have to do is that, you know, we have to really build out the world's renewable energy.

Dr Anna Ploszajski [21:21]
So it's a scaling issue, it's also a coordinating issue to make sure that the electricity it is being powered by is coming from sustainable sources as well.

Mark Davies [21:30]
The amazing thing is if we're going to really move to a zero carbon economy, that we need to transition to renewable energy and renewable energy uses a lot of metals, like I think it's over 6 billion tonnes of metals will be needed between now and, and, and, most of that is going to be aluminium, steel, copper.

Dr Anna Ploszajski [21:47]
Is there a cost aspect to this?

Mark Davies [21:49]
There will be, yes. Yeah, so primarily, because you do need to rebuild your smelter.

Dr Anna Ploszajski [21:54]
Yeah.

Mark Davies [21:54]
And a smelter today is several billion dollars. And so they have to have a price incentive that says, you know, we're prepared to pay more for versus regular aluminium.

Dr Anna Ploszajski [22:04]
Right, because I would always love to believe that people are wanting to decarbonise out of the goodness of their heart and, you know, trying to do the right thing. But there must have to be a financial incentive for it to...

Mark Davies [22:14]
There absolutely is. Now, obviously, the wonderful thing about aluminium is, it's sort of infinitely recyclable. And actually, I think the statistic is that 75% of the aluminium that's ever been made, is still in circulation, because we just keep recycling it.

Dr Anna Ploszajski [22:28]
Wow.

Mark Davies [22:28]
Now, as I said, you typically you can't use that recycled for everything. But we are actually doing research on how you can make alloys that are more tolerant of contaminant. [music interlude]

Dr Anna Ploszajski [22:41]
So, Cerys, I would like to transport you to an imagined future in which we can't find any more bauxite in which there is no more aluminium in which there are no more carabiner clips. What would life without your beloved climbing equipment look like?

Dr Anna Ploszajski [22:58]
I love that. Maybe without it, you'd have to learn how to do all those knots properly, because you'd end up tying things with rope instead of carabiners.

Cerys Matthews [22:58]
That, that's the point. Once you introduce the carabiner into your life, you don't just use it for climbing. You use it to carry your house keys. You use it to hang your car keys. You use it to hang your hat from your rucksack. I mean, you can't live without carabiners, once you've been introduced to this snap and loop bit of metal. What would I do? I'd probably cry. I know. The thing is the beauty with a carabiner is it's not, it's such a simple design. It's such a small item. But it's such an enabler. And it's also the promise of an adventure all in one little loop of metal. And so just to hold it, makes you feel happy.

Cerys Matthews [23:52]
And I wouldn't, I wouldn't think Nigel would be in a hurry to climb with me. Santa's bought me a book of knots. I am trying, from this. I know it's important, very. It's, it's, it's fatal not to learn. Literally. I've got, I've got, a question like so if you can't use aluminium, is there another metal that is light and usable for this kind of scenario?

Nigel Buckley [23:52]
Yeah, we'd carry steel, wouldn't we?

Cerys Matthews [24:16]
Just steel. Back to the heavy.

Nigel Buckley [24:21]
Yeah, we just get fitter.

Cerys Matthews [24:22]
You can carry them.

Dr Anna Ploszajski [24:23]
Maybe, titanium? Titanium is pretty lightweight. It's quite expensive.

Mark Davies [24:27]
It's, that's even harder to make.

Dr Anna Ploszajski [24:29]
It's even harder to make. Okay.

Nigel Buckley [24:31]
I think, you know, climbing is all about making things work with what you've got. I think it's in Czech Republic, where they just tie knots and use those as as protection in cracks, sort of tying knots in some nylon sling and slotting them in. Yeah, it's all about working with what we have.

Dr Anna Ploszajski [24:50]
So then that's not such a scary future after all, but I think we still don't want to live without aluminium.

Nigel Buckley [24:55]
No, I'll keep it.

Dr Anna Ploszajski [24:56]
Overall, I think we'd like to keep it. So Mark, what's the one thing that needs to happen. What for you would be the key breakthrough that you want to see?

Mark Davies [25:04]
I look, I'm going to cheat and have give you two things. Yeah. So I think we need to move to zero carbon electricity to start with, because without that, none of our processing is going to be decarbonised. And then, secondly, develop and scale up ELYSIS technology, which is this inert anode. Yeah, those are the two critical steps. There's a lot we need to do in the mining and the refining as well. But those are the ones that will really make a huge difference to the carbon footprint.

Dr Anna Ploszajski [25:29]
And how optimistic are you that we'll get there?

Mark Davies [25:31]
I'm certainly very optimistic on ELYSIS. And I'm optimistic on renewable energy. And in lots of parts of the world. I just think the challenge is can we go fast enough? And, I think, that requires a real partnership between governments and industry and society to roll out those low carbon renewable energies faster.

Dr Anna Ploszajski [25:50]
Nigel, you've seen the full story of climbing equipment from the start. Is there any where that you're excited to see it go next?

Dr Anna Ploszajski [25:58]
I'm always interested in lighter gear, I think all climbers are. But yeah, if I could buy recycled aluminium climbing equipment. Yeah, certainly. I'm really excited about lots of new people coming into climbing. I think the Olympics and, you know, there are more women climbing in climbing gyms and there are men, which I think it'd be great for, if we want to call it sport or sport or pursuit or whatever it is that we do.

Cerys Matthews [26:24]
Can I also add it's a great sport to start when you're over 50 as well, because you can continue climbing, especially when you're wearing a harness and a rope until you pop off this mortal coil. And if you like crosswords, it's a great sport.

Dr Anna Ploszajski [26:39]
You've inspired me. Cerys, what terrifying rock face awaits you next?

Cerys Matthews [26:45]
Well, I'm currently talking to you with a titanium arm. You mentioned titanium as I broke my arm recently. I'm not climbing. So walking into a library. Go figure.

Dr Anna Ploszajski [26:58]
Oh, well, there's everyone's warning, avoid libraries.

Cerys Matthews [27:02]
Yeah. So I'm learning in the pursuit of one armed climbing as we speak.

Nigel Buckley [27:07]
Nice.

Cerys Matthews [27:08]
Which is interesting. And when, when, it's better, I think I'd like to balance a lot of indoor climbing with, with, more outdoor climbing, you know, because I'm more enthusiastic than expert. I'm still very much at the beginning of my climbing kind of life, I hope. And so Majorca has got some nice routes. I've never climbed funnily enough in Wales, but have climbed in the Alps. And in England, so maybe, maybe Wales is calling too at some point.

Dr Anna Ploszajski [27:40]
Many adventures await you. So we've covered scraping orange balls in remote Australia and dangling in somewhat peril in the Alps. But personally, I'm really excited to hear about the prospect of zero carbon aluminium and personally quite nervously excited about some future mountain adventures for me and hopefully for us all as well. Thank you all so much for sharing your expertise and passions, Cerys Matthews, Nigel Buckley and Mark Davies.

Nigel Buckley [28:04
Thank you for having me.

Cerys Matthews [28:05
Thanks for having me.

Mark Davies [28:06
Thank you for having me.

Cerys Matthews [28:07
Lovely to meet you all. [music interlude]

Dr Anna Ploszajski [28:11
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–Ends–