

episode 5_geology.mp3

Speaker 1 [00:00:03] This podcast is brought to you by the University of Aberdeen.

Speaker 2 [00:00:14] Hello and welcome to the Talking Geosciences Podcast, brought to you by the School of Geosciences at the University of Aberdeen. Over the course of this series, we will hear staff and students discuss how their teaching and research is helping us understand and address contemporary global challenges, including sustainability and climate change. In this episode, Dr. Rachel Brackenridge from the Department of Geology and Geophysics tells us about her research in hydrogen storage and the role geologists are playing in the transition to sustainable energy. You're welcome, Rachel. Can you begin by telling us what is geology and what kind of things geologists do?

Speaker 3 [00:00:52] Yeah, sure. So most simply, geology is the science of the study of the earth. So it's how it was formed, what it's composed of, and what processes act on it. So volcanoes, earthquakes and rivers, these sorts of things. And we study it by looking at the rocks that make up the earth. So either surface where they're exposed, which involves lots of lovely field trips or looking at the ground beneath our feet. And we do that by drilling wells or through geophysical methods that look into the earth. I guess what did you just do with that information? Why do we need to do it? And I think first and foremost, it's really important to understand how the earth evolved in the past, and we can use that to better predict what it might look like in the future. And that's really important for things like climate change. So in geological history there, there was times when the world was very warm so we can get an idea of what it might look like in the future. With continued global warming and on a more local scale, we can use that to understand geo hazards such as earthquakes, tsunamis and volcano risks. The other thing that is really important that geologists do is for resources. So we rely on the Earth for many resources that support a modern lifestyle. So from, you know, the minerals and metals that we have in our smartphones and that we have in our cars and homes, those all come from the ground. And we rely heavily still on coal, oil and gas for transport, heating, electricity. And these all come from underneath the ground. I guess the final important aspect to geology, what geologists do is to understand how to safely build in the land so we can go out and survey the ground before a building house or a road and ensure that the structures are going to be safe and that they're going to avoid hazards such as subsidence, flooding or more extreme hazards such as earthquakes. So lots of very things that geologists do.

Speaker 2 [00:02:57] And then in terms of yourself, can you tell me a little bit about your research? What's your kind of area that you focus on or any projects that you're currently working on?

Speaker 3 [00:03:06] Yeah, So my most recent research I'll talk about that examines the ground beneath the North Sea, just offshore Aberdeen. We're really trying to assess its suitability for energy storage. So one challenge that we're facing at the moment, moving away from oil and gas and towards renewable energy sources such as wind and solar, is that we can only produce electricity when the conditions are right. So for wind, when the wind is blowing for solar, when the sun is shining, and that doesn't always balance up with when we need electricity. So if you come in at the end of a hard day at work and you turn your lights on it, put the kettle on, is not necessarily going to be a windy day or the sun might not be shining. So we need to find ways to store that energy on the windy days so that we can use it on days that we cannot generate run electricity. So batteries would be one solution, but they don't scale up large enough to provide a whole nation's worth of electricity. So an alternative is to convert the electricity into hydrogen, store that hydrogen

temporarily, and then convert it back into electricity when we need it. And that's where my research is coming in. So I look at how we can store hydrogen safely underground. And one place that we can do that is in underground salt deposits and salts, a really good store for gases because it's a very good seal. It's very difficult once you put gas into a salt deposit for it to escape back to the surface. But for that to happen, we need just the right conditions. There's a bit of a Goldilocks zone where we need the right depth and pressure for the salt, the right thickness of the salt, and it needs to be very pure so that we can ensure that that hydrogen doesn't escape. So I recently examined the area of northeast coast of Scotland, and that's really directly supporting the government's current hydrogen strategy in the northeast of Scotland. It really helps towards a net zero emissions targets because we've got huge wind farm development currently ongoing offshore Aberdeen.

Speaker 2 [00:05:16] That's really interesting. And is the North Sea somewhere that you are particularly expecting to find these conditions for this type of storage or are there other parts of around the UK or even other parts of the globe that would be, you know, particularly where you might expect to find these conditions?

Speaker 3 [00:05:35] Yeah, it's a great question. And so really in Scotland we have very limited deposits onshore, but we do have some really good examples in the north of England. So it's a proven technology there. But we have sought basins around the world. So the learnings from this study can really easily be sort of brought forward to other salt basins around the world, in the U.S., in the Mediterranean, for example.

Speaker 2 [00:06:00] So for anyone listening who might be interested in maybe following your lead here and, you know, working in an area or researching or learning more about things like energy transition and hydrogen and just generally around sustainability, what programs here at Aberdeen in geology do we offer that, you know, could really be a good start for someone at that stage of their of their career?

Speaker 3 [00:06:29] Yes, there are undergraduate degrees and they all give us a really good grounding in our understanding of the earth, the fundamentals, but also expose students to the application of that knowledge. So how we can use geosciences to construct, contribute to a sustainable world. And this starts in the first year. There's an optional course on the UN's Sustainable Development Goals and concludes the fourth year with a more applied course of geoscience for the UN Sustainable Development Goals. Many of our students then go on to further study and we have a wide range of more specific postgraduate related degrees there, energy related, such as integrated petroleum geoscience, sustainable energy geoscience and geophysics. There's all these courses and seeing the rocks is really key to learning. So there's ample opportunity to visit the core store. We have a fantastic science teaching hub full of microscopes to look at these rocks to the microscope, and there's many field trips both in the undergraduate and postgraduate courses. And field trips are great that we have plenty here in Scotland. Scotland really the home of geology. So some world class examples of field areas to go explore. And then for the postgraduate courses, there's also some international destinations. So the MSE Geophysics School over to Ireland and the Petroleum Geoscience and Sustainable Energy Geoscience cover to Utah in the United States, which is really a fantastic place to see these rocks, that large scale. I guess these field trips don't only allow students to learn directly from the rocks, which is very important, but they're also designed to provide an opportunity to develop some employability skills. So we purposely building and team work and opportunity to develop your communication presentation skills as well.

Speaker 2 [00:08:30] Right. So speaking of employability, what kind of careers do geology students typically go into these days? And do you see the kind of role of a geologist or geology careers changing in the future?

Speaker 3 [00:08:46] Yeah, I would say there's probably the four main career paths for a geology graduate. Firstly, resources. So mining and quarrying, both for minerals and metals but also for building materials. Secondly, a big employers energy industry, so the safe extraction of hydrocarbons. And then as we move forward, sustainable energy solutions such as geothermal. Thirdly, a lot of our graduates go into engineering geologists, site investigation for construction, both onshore for housing and offshore. So there's a massively expanding wind offshore wind energy industry at the moment. So this is a really rapidly expanding sector. And I guess the final is sort of environmental geology and associated disciplines. So that's things like hydro geology and assessing the land for environmental stressors that contaminant contamination and also geo hazards. That's your earthquakes and volcanoes. So those are the main careers that graduates might go into. I guess thinking about how things are changing in the future, it's certainly a discipline that's in transition, particularly within those energy and resource sectors as we move away from oil and gas. And we need to scale up our energy transition technologies. And there's massive expansion in areas such as geothermal energy and offshore wind. And we're still learning a lot about how to implement those technologies. But fundamentally, we're still going to use the same skill. So we're still going to take our understanding of the ground beneath our feet and repurpose those skills to make a contribution to future mining and energy transition. I guess the other change that we're seeing is really rapid development in interdisciplinary studies to address geological problems. So there's been a massive expansion in digital geoscience and things like A.I. and machine learning in recent years, and I think that's going to just continue.

Speaker 2 [00:10:57] So would you say having an interest or, you know, strengths in things like numeracy and computing skills and data skills would be very important for a geologist? Or are there other particular skills like that would be important? You know, for someone thinking, is geology really for me? What do you think would be the most important, you know, interests or skills that you know, someone could bring to this discipline?

Speaker 3 [00:11:27] Yeah, absolutely. It's one of my favourite aspects of geology is being able to take diverse datasets, different types of data, and try and integrate them into to making a story and a numeracy and understanding how to interrogate large datasets is going to be pretty key now and going forward. The other key skill that I think geologists really need is a bit of creativity, and we are a science, but we sort of straddle that science, art, discipline boundary and you need a bit of creativity to fill in the gaps where we don't have data.

Speaker 2 [00:12:06] So you mentioned energy transition and the role of geology and geologists in the transition to sustainable energy. Obviously, Aberdeen, where we are known historically as the, you know, the oil and gas capital of Europe and a big hub for the oil and gas industry. What evidence do you see around Aberdeen right now in terms of the energy transition that's taking place? And can you give me any examples, you know, of things happening here around the northeast of Scotland? You know, that that are, you know, where this energy transition is actually happening?

Speaker 3 [00:12:49] Yeah, it really is a city in transition at the moment. So he says the oil and gas capital of Europe, we've got over 50 years of oil and gas expertise, but now

everyone seems to be really embracing the energy transition and using the skills developed in the industry for making net zero emissions a reality. And yes, multiple initiatives and lots of investment going on. We have the Northeast hydrogen hub, where we have a fleet of buses running on clean burning hydrogen at the moment. And this is part of a much larger investment into the city of Aberdeen, which includes things like the development of an energy transition zone, the Net zero technology centre. There's huge developments in offshore wind at the moment at I think our largest wind farm in the UK is now just opened up off the northeast of Scotland and we've also got carbon capture and storage projects going on as well as mineral exploration in its early stages. So there's a lot going on, a lot of investment into the city. I guess more specifically at the university, we have really good ties into this industry through our Centre for Energy Transition and that centres focusing on training and research in more interdisciplinary solutions to the energy transition. So we are we were known historically as the oil and gas capital of Europe, but I think we're now sort of becoming the net zero energy capital.

Speaker 2 [00:14:26] Yeah, you mentioned interdisciplinarity there a couple of times and I guess working as a as a geologist in the industry or in academia, do you get to work with? Do you get to interact a lot with people from different backgrounds, academic backgrounds or different disciplines?

Speaker 3 [00:14:46] Yeah, absolutely. So there's really close links to engineering, little cross-disciplinary work that goes on with the engineers in both the university, but also in implementing these big energy projects offshore. And in my own research, I work quite closely with data scientists, so we already mentioned the importance of data and integrating that data, but looking at new ways in which we can approach old oil and gas data and repurpose it for the energy transition. And we're using machine learning to sort of see what we've missed and see what value we can add to that data.

Speaker 2 [00:15:27] So as a geologist, what are the things that you are most excited about in your field right now and what are you looking forward to seeing happening over the next 10 to 15 years?

Speaker 3 [00:15:39] Yeah, it's a really exciting time for me to be teaching and researching in geology and specifically in applied geology and with the energy transition in progress, I'm pretty much updating significantly updating my lecture slides every single year because the discipline is evolving so quickly. But even in this really evolving landscape, I still get to do what I love, which is gather data from the ground beneath our feet, integrate that data and try and fill the gaps in our knowledge to understand what the world looked like millions of years ago. So I really love the detective work that's involved in that and then the creativity to sort of make that into a story. And I used that in the petroleum industry in my research for many years, but it's exactly the same workflows that I'm using to understand subsurface storage and carbon capture and storage. I guess looking forward to the next ten years or so. And I think the way that we use and produce the Earth's resources and its energy is going to change very significantly. But this change isn't going to happen overnight. I think on a global scale, many people are going to rely on hydrocarbons for a long time to come. And in order to make the energy transition happen on this. Global scale. We need to do it in a just and sustainable way that balances out in people's energy security. So this is a really major challenge ahead. I think balancing these three aspects of energy sustainability, equal access and security, we're going to need some pretty exceptional brains to to make that a reality. And I think geologists have a really crucial role to play in making that happen. So I'm pretty excited to see how the

young people who are choosing a career in applied geology today, how they're going to go on and shape the world of tomorrow.

Speaker 2 [00:17:48] You've been listening to the Talking Geosciences Podcast from the School of Geosciences at the University of Aberdeen. For more information about our teaching and research, visit our website. www.abdn.ac.uk/geosciences or follow us on Twitter and Facebook.

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