The Open University

Fossil Detectives
Microfossils and the Ichtyosaur

Hermione Cockburn
I want to change scale a little bit. Undoubtedly, large fossils, like dinosaur fossils, like the West Runton mammoth, are a lot fun, but it's sometimes tiny fossils, microfossils, that offer us insights into the past that are way beyond what their tiny size might suggest. So, in the final clip that I want to show you now, we're going to go back to central England, which is the first programme of the series, which is going out on Friday night. And we're heading back – these creatures were alive back during a time when there were volcanoes erupting around the landscape of what is now Hertfordshire, and that's what this clips starts with. And then we will see just how wonderful tiny fossils can be to compare to the larger fossils that we've been focusing on, so far.

Hermione Cockburn
When ash settles, it can create the perfect environment for preservation. Some of the most exquisitely preserved fossils in the world have been mineralised in clay that was once volcanic ash. Remarkably, these fossils can be found in Britain today, but they are mostly microscopic in size. So, to see just how amazing they are, some hi-tech detective work is called for.
Here, in Oxford, a research team has been applying cutting edge techniques to analyse these microfossils.

Based at the Oxford University Museum, Derek Siveter is a key member of the team.

Hermione Cockburn
What have we actually got here?

Derek Siveter
Well, we've got some of the most amazing fossils that have been discovered anywhere on the globe in the last 20 years.

Hermione Cockburn
Really? In this funny looking potato thing.

Derek Siveter
Well, yes, really.

Hermione Cockburn
I can't quite believe that this has got anything to do with what we're seeing on the screen.

Derek Siveter
Well, the fossils which you see in the nodules are transformed by the process of computer rendering, to give the type of fossil here which you see, on screen. And what you've got here is a sea spider. We can make it turn around so we can see the different parts of the morphology. And this sea spider is very similar to the sea spiders which you find present day.

Hermione Cockburn
And how big is that creature, that sea spider?

Derek Siveter
From here to here, it's about four millimetres.

Hermione Cockburn
And all that detail in four millimetres, is preserved inside one of these nodules.

Derek Siveter
Yes, and much more, because when you increase the magnification, you can see here, on this purple-coloured, nose-like feature, the mouth. So, that's the mouth of the sea spider. They're as rare as hen's teeth. You find them in about two or three localities anywhere in the world, and this, I think it's fair to say, is the best preserved of any of them.

Hermione Cockburn
They are preserved in calcite, a form of calcium carbonate.

Hermione Cockburn
How significant is this find?

Derek Siveter
It's very significant, because what these animals are providing us with are unique insights into evolution. They're throwing up particularly a combination of features which have been lost during the evolutionary process. And by analysing these features, we can get a much better understanding of ancient pathways, ancient lines of descent.

Derek Siveter
Our work has hit the popular press and, indeed, the broadsheets, but the thing we're most proud of is page 41 in *The Sun*.

Hermione Cockburn
'Old Todger,' great headline there. But what was the story, though?

Derek Siveter
Well, this is a small microfossil, it belongs to that very important invertebrate group called the arthropods. It's related to crabs, to shrimps, to lobsters, scorpions, that sort of thing. But the reason *The Sun* got it was because it preserves the oldest male organ anywhere on the planet.

Hermione Cockburn
Fantastic. In perfect 3-D preservation.

Derek Siveter
In perfect 3-D preservation. In fact, it's probably fit for action.

Hermione Cockburn
And it's not just this creature that was particularly tiny, all of these fossils were pretty small. They vary in size from less than a millimetre to about five centimetres.

The images you see on the screen are models constructed from virtual dissections, a pioneering way of analysing microfossils.

Mark Sutton
We take the fossil, we cut it into a very small block, and we grind it away, a very thin slice at a time, and we take a photo, and we do it again and again and again. Until at the end, of course, the fossil's gone, but the data is captured on computer, we get a data set like this.

Hermione Cockburn
Mark Sutton grinds down the fossils in successive stages. Although the fossils are destroyed through this method, he creates a kind of dissection with a rewind button. You can see incredible levels of detail.

Mark Sutton
We've come up with a process that's actually producing a very powerful way of working with fossils. It's something that's, in a lot of ways, better than having the real fossil in front of you. We can do things with this material that we couldn't do in any other way, and it's providing just a very important new way of working for palaeontologists.

Hermione Cockburn
Some of the really most fascinating fossils that I encountered while working on the series, and I think what that story illustrates nicely is that there are aspects of palaeontology today that are really cutting-edge, 21st century science, that are making use of up-to-the-minute technology to study something that, you know, you wouldn't be able to study. I mean, if Buckland or Mantell had found those funny potato nodules, they wouldn't really have been able to study them and get the insights into ancient life that Derek Siveter and his team is doing today. Now, I know, the time is getting on a bit, so the final clip that I've chosen to show to you tonight, illustrates the type of thing that if you were to go to one of the great fossil locations, hunting locations of Britain, that we have. I mean, really, you can find fossils all over the country, but you're probably familiar with the North Yorkshire coast and the Dorset coast, the Jurassic coastline, as places that many people go on holiday to look for fossils. You don't have to go to those destinations but, if you do, keep your eyes peeled, as this clip will show you, because every now and then a new and very exciting discovery is made, again, just by people who might be walking along the beach, an amateur or a holidaymaker even, just would see something in the rock and then report it.

Clip from Fossil Detectives

Hermione Cockburn
A little further along the coastline here in Yorkshire, I've heard there's an intriguing new fossil just exposed on the beach.

A fossil is any evidence of ancient life, naturally preserved. Phil Manning is a professional dinosaur hunter, and one of our regular fossil detectives.

Hermione Cockburn
Hi, Phil.

Phil Manning
Hi, there.

Hermione Cockburn
What are you looking at?

Phil Manning
You've got to come and look at this. This is a gorgeous fossil. You really rarely get to see one still stuck in a beach bed like this.

Hermione Cockburn
Wow! So, what is this? Is this a spine?

Phil Manning
Absolutely right. You're looking down the backbone of a sea dragon, a marine reptile that was stalking the oceans 190 million years ago.

Hermione Cockburn
And from these bones, do you know what creature it was, what reptile?

Phil Manning
Absolutely. You can look at the actual shape of the bones, it tells us straight away we're dealing with an animal called an Ichthyosaur.

Hermione Cockburn
An Ichthyosaur, right.

Phil Manning
Literally meaning 'fish-lizard.'

Hermione Cockburn

These pieces here, are they individual vertebrae, like we have in our spines?

Phil Manning
They are, indeed. And you can see even see the discs that it would have had in-between each vertebrae. Obviously, these have turned to stone over the 190 million years, but they show the spacing of the vertebrates, beautiful.

Hermione Cockburn
To actually have the discs, that's incredible preservation.

Phil Manning
Well, they've turned to stone. This is still – it's a fossil, the original material is long gone.

Hermione Cockburn
And is this quite a recent exposure?

Phil Manning
Yeah, a local group have found this fossil quite recently, and you can see how it's already been weathered quite badly by the seas on this wave-cut platform.

Hermione Cockburn
But at low tide we get to see it for a few hours.

Phil Manning
Yes, indeed.

Hermione Cockburn
And so how big was this Ichthyosaur?

Phil Manning
Well, you're looking at an animal about three to four metres in length. And this is a marine reptile. I know it's called a 'fish-lizard,' Ichthyosaur, but it is a reptile, an air-breathing reptile. If you can imagine it's got this long snout, lots of teeth, going into a really streamlined body. It's got small paddles at the front and paddles at the back, and almost a shark-like tail, with a beautiful dorsal fin just like you'd see on a shark. But this is a reptile. These animals were perfectly adapted, streamlined, to living in a marine environment.

Hermione Cockburn
These bones embedded in the rock are the fossilised remains of the animal itself.

Hermione Cockburn
So, what's going to happen to this fossil?

Phil Manning
Well, it's been weathered quite badly, but there's a huge amount of information we can get from the backbone. The most important information, though, would have been from the skull. Now, unfortunately for us, some folks got to the specimen before we could. Now, sometimes people dig things out of the ground, and they don't have the right tools, knowledge or expertise, and this can happen. And this is where the skull was. Now, it's sort of a cautionary tale, in fact, we've only got the tail, the caution is, don't remove the skull. And it had all the information on what the animal was like probably even down to a species level, and that's gone, that information has been lost.

Hermione Cockburn
So, here, I think that's even a chisel mark, you can see where somebody's tried to lever out the skull, that is a shame.

Phil Manning
It's so frustrating. If you find something like this, the best thing to do is go to your local museum, there are groups around the country who specialise in knowing exactly what to do

when you find a fossil. And the most frustrating thing for me, I can actually see where some of the skull bones once lay. That's' where part of the skull, the rostrum, was once sat. And it's just gone.

Hermione Cockburn
Shall we take some records of it, even though it's partially gone?

Phil Manning
There's still a lot of information we can record, so it's definitely worth doing, yes.

End of clip

Hermione Cockburn
So, there we are, a rather exciting find, but with that sad story that some unscrupulous people had got to it before it had been brought to the attention of people that would really know what to do with a fossil like that, a lesson perhaps for us all in there. And we've nearly run out of time, so, there we are, that was a flavour of what Fossil Detectives has to offer, back from the discovery of the dinosaurs to 21st century virtual dissections. And I hope you all hope enjoy the series. And I know that now Peter has very kindly agreed to answer some questions, that Mike will facilitate. And actually, I've got a question for Peter, how big do Iguanodons get? Because I think I said they were bigger than they really were.

Peter
Did you say six or seven metres?

Hermione Cockburn
Yeah, I did, but they don't get that big, do they?

Peter
That's alright, I think.

Hermione Cockburn
Do you? As soon as I said it, I thought, 'oh no, are they really that big?' But they are. Anyway, thank you very much.