Whales, worms
and the story of life

What's the point of studying dead whales and the worms that eat them? Recondite research can be more relevant than you'd think, as Nick Higgs explains.

Adrian Glover/ Nick Higgs

An individual Osedax mucofloris.

'Why is NERC even funding this research?' asked a perplexed volcanology professor in my department. I had just given a nervous five-minute talk introducing my future PhD work to a bemused audience of Earth scientists. It was a question that I hadn't given a lot of thought to, but one I have subsequently spent a lot of time considering. Since then I have been asked the dreaded question by broadcasters and teenagers alike, sometimes with a soul-crushing tone of perplexity or distain: why does your work matter?

You see, I've spent the last three years studying whales… sort of. That's what I say to get people interested. The truth is that I only study dead whales and, if I'm honest, I'm more interested in the worms that live on dead whales. But these aren't just any old worms. They live only on animal skeletons at the bottom of the ocean – which they use as food. Their Latin name, *Osedax*, means 'bone devourers'. Amazingly, they don't even have a mouth or gut to digest the bones. Instead they have root-like tissues that grow into the bone and dissolve it, like fungi growing into a log.

My research looks at how *Osedax* affect the whale's fossilisation. Do these worms completely destroy the whale skeleton before it can become a fossil? What effect has this had on whale fossilisation in the past? In short, I am trying to find out how whales become fossils.

Understanding how fossils form is vital to interpreting the fossil record, and that of whales is especially important. The evolution of whales is one of the best examples of macro-evolution, where one kind of animal evolves into a very different one. The fossil record provides us with an exquisite sequence of skeletons, showing how land mammals adapted to aquatic and then fully marine environments, becoming the ocean giants we admire today.

Equally important is understanding the evolution of the worms themselves. Originally it was thought that they evolved at the same time as whales, but new findings show they can thrive on other types of bones – fish bones, for example – suggesting that they may have been able to live on the skeletons of big fish and large marine reptiles. These leviathans were around long before mammals entered the oceans and later died out with the dinosaurs, so who knows how long *Osedax* has been devouring skeletons. That's the problem; they usually destroy any evidence of their existence.

The fossil record of worms is patchy, since they don't have many hard parts, but uniquely *Osedax* leaves distinctive traces on bones. I've been using the Natural History Museum's micro-CT scanner to study the borings of *Osedax* in modern whale bones. Recently, we discovered their traces in a three-million-year-old fossil whale bone from Tuscany in Italy. Palaeontological detective work let us show that *Osedax* had colonised much of the world's oceans by this point. Another group of scientists found similar traces in a 30-million-year-old whale bone from the north-east Pacific, showing that *Osedax* has been around since the emergence of the whales.

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These two finds are just the tip of the iceberg and we need much more work to get a handle on how *Osedax* has affected the fossil record of whales, and other marine vertebrates for that matter. The problem is that museum collections are

Osedax *worms living on a whale bone found off Japan.*

inherently biased. No one wants to display a half-decayed, broken-up skeleton; they covet the most complete specimens to study anatomy. Unfortunately it is the pock-ridden, eroded bones that are the smoking guns of *Osedax* activity.

For example, the fossil bone in which we discovered *Osedax* traces had been sitting in a dusty box for over a century and wasn't even on the museum's official catalogue, probably because it wasn't much use as a whale fossil. The other problem is that small holes in bones can easily be confused with sponge borings, so palaeontologists may not even realise what they have. We need collectors and curators to keep their eyes peeled and spread the word. By piecing together the evolutionary history of *Osedax*, we may be able to explain some gaps in the fossil record of whales.

Whether of whales or worms, the fossil record is part of the wider evolutionary story. As the naturalist John Muir wrote: 'When we try to pick out anything by itself, we find it hitched to everything else in the Universe.' Since evolution is what hitches us to the rest of the living world, getting it right matters. On a broad scale, research like mine helps shape how we think about ourselves and our relationship to the living world.

This is not to say that there are no immediate practical applications. History shows that fundamental research often spawns previously unimagined benefits. For instance, I am now looking at how my work on the decay of porpoise carcasses can help forensic investigators when bodies end up in the sea. Along with pioneering work by a Canadian team using pig carcasses, these studies help us understand common processes of decomposition in the sea.

I have specialist knowledge of how bones decay and can identify different animal traces on them. Both give clues to how long a body has been in the water. I could never have imagined that my research would lead me down this path three years ago, but with hindsight it makes sense. I should have guessed after *Osedax* featured in an episode of the crime drama *Bones*!

My research is aimed at understanding basic questions about how the natural world works, which may even have useful outcomes for modern problems. These are both great reasons why this type of science should be done. Similar arguments are routinely put forward in favour of fundamental research, but I think that these arguments lack force because they are missing a human element.

I do this research because I am filled with wonder at the natural world. When I give talks on my work it is this shared sense of wonder that connects me with my audience. It is the same awe that enthrals us with natural-history programmes on TV and enriches our lives through books and art. In the dozens of talks I have given since I first fumbled my response to the volcanology professor, the 'why' question has never come up first. Curiosity beats out cynicism every time. For a few moments the audience becomes part of the discoveries, they become scientists, and then they demand more information… more than I can give them.

There is still a lot more to learn about the natural world and in tough economic times funding for such research is at a premium. It is therefore all the more important to acknowledge the role of curiosity-driven research in capturing our imaginations and fulfilling our primal desire to explore the limits of our knowledge.

MORE INFORMATION

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