Craven Pothole Club

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Robyn Williams:
The oxygen just disappeared somehow.

Ian Metcalfe:
Or we had a lot of noxious gases introduced into the atmosphere which basically poisoned the atmosphere. We favour, our group favours, because we have dated huge volcanic eruptions in Siberia at exactly the same age as the mass extinction that we've dated in China, we believe that the main causative mechanism was this massive volcanism in Siberia. Now just to put this in context and compare it with your Yellowstone eruption: Yellowstone, if it did go up as a supervolcano, would put out about 2000 cubic kilometres of material into the atmosphere and into the environment. The eruptions in Siberia I'm talking about spewed out - and get this figure - 5 million cubic kilometres of material over about 1 million years.

Robyn Williams:
Kilometres!

Ian Metcalfe:
Yes, cubic, 5 million cubic kilometres of material. So we're talking a different scale here.

Robyn Williams:
The sky would have disappeared.

Ian Metcalfe:
Exactly, you could well have global winter for centuries, if not thousands of years, followed because of all the aerosol gases, the carbon dioxide, the hydrogen sulphide, the sulphur dioxide and so on, then you would have had after the global winter, global warming on an immense scale. And if this was cyclical, if these things were going off periodically over that million years then it would be a heat after heat on the global biosphere.

Robyn Williams:
Over a million years as well.

Ian Metcalfe:
Yeah, about a million years we estimate.

Robyn Williams:
It's astonishing that any life really survived at all?

Ian Metcalfe:
It is, it absolutely is and it almost didn't. Huge groups of organisms were wiped out and we see a major adjustment in the types of organisms that existed on Earth. New organisms evolved into all the new ecological niches that were provided.

Robyn Williams:
Even in the ocean, presumably?

Ian Metcalfe:
Yes, even in the ocean, major changes. All the corals for instance we see on the Great Barrier Reef now, they exist now because one or two species managed to survive this huge mass extinction and they're fundamentally different to the ones that existed previously in the Palaeozoic era.

Robyn Williams:
Have you been to Siberia to look at where it was?

Ian Metcalfe:
Yes, and our group has actually dated some of those volcanic rocks and the age comes out, as I say exactly the same as the mass extinction level where we see all this life disappear.

Robyn Williams:
And what are the circumstances like now, presumably the volcanoes would be extinct, they're quiescent?

Ian Metcalfe:
Yes, those particular volcanoes will be extinct and we think that those volcanoes were linked to a big upwelling of material deep in the Earth's mantle. The volcanoes that we see active at the moment around the globe are more related to plate tectonics and the shifting of the Earth's plates, grinding one against the other like the plate the ground and caused the tsunami, the earthquake in south east Asia recently. They also produce those volcanoes in Indonesia.

Robyn Williams:
Why would there have been an upwelling 252.6 million years ago?

Ian Metcalfe:
Well, the main eruption was at that age. The upwelling we think is an unusual upwelling that occasionally does happen, we call them superplumes that come up in the Earth's mantle and when they reach a certain level the hot magma that's coming from the Earth's mantle pierces through the Earth's crust and we get this huge amount of volcanism. There are other examples but the one in Siberia is the biggest one known to science.

Robyn Williams:
And you're about to tell me that it can happen again.

Ian Metcalfe:
It can but we now have techniques actually for looking deep in the Earth, we've got seismic tomography and so on. So we can actually look and see where some of these structures actually are forming and hopefully, certainly in another lifetime, we won't see that kind of eruption. But on a more individual volcanic eruption scale, certainly something could go off as was depicted for Yellowstone.

Robyn Williams:
Well something on that scale even with a warning I suppose the only recourse is to leave the planet?

Ian Metcalfe:
(Laughter) Well, it would be very difficult to avoid it. We've just done some work in Queensland actually, looking at some volcanic ash layers there that were formed about the same time as this big mass extinction. We've been studying one layer of ash in Queensland that covers most of Queensland and it's 1 metre thick. Now if you look at the scenario for Yellowstone, they were talking about a few centimetres of ash and dust blown out, so even here in Australia in the past we've had these kinds of eruptions.

Robyn Williams:
I only wish you at home could see Ian's face, the grin of relish as he describes these appalling characteristics.

Ian Metcalfe:
Well, it's amazing. I mean, we really are looking at something that's of a scale that many people just cannot appreciate. It's a little bit like talking to people about geological time or astronomical time and distance. It's a very difficult concept to try and think in terms of these really big events.

Robyn Williams:
Which were the creatures that disappeared for all time after that? Was it the ediacara or were they further back?

Ian Metcalfe:
Oh, they're further back. The kinds of things that disappeared at about 252 million years ago were - in the sea, trilobites, large groups of cephalopods, major groups of seashells, brachiopods. On the land we had quite a lot of insects were made extinct at that time, just before them we had some of the biggest dragon flies that ever existed by the way - 1 metre wing span - made extinct.

Robyn Williams:
Wow.

Ian Metcalfe:
Major groups of plants, of course at that time there were no flowers on Earth, no flowering plants, they only evolved after this huge mass extinction happened. We have very distinctive plants here in Australia and the southern continent of Gondwana, Glossopteris, many of your listeners may have heard of Glossopteris plants, they were all wiped out by this major event. There were land animals, small reptiles, pig-like reptiles, called Dicynodonts, all wiped out. So we had really major change in the fauna and geologists for hundreds of years have talked about the ancient Palaeozoic flora and then new Mesozoic flora and fauna that evolved following this huge event.

Robyn Williams:
How startling, how amazing. A final question: you said that it could have been this and it could have been that, with something on such a scale of a million years worth of eruption of this huge volcano, are any of your colleagues disagreeing with you and saying it's an asteroid or something else?

Ian Metcalfe:
Yes, there are groups who put forward an extraterrestrial asteroid impact, they even put forward a suggestion that there was an impact crater off north west Australia recently that may have been where this extraterrestrial body hit the Earth. We've looked at the evidence for this and we do not in fact find that it holds much water. For example there's no iridium spike, this is a rare metal that appears when you have an impact.

Robyn Williams:
Which rains down and yes, forms a layer.

Ian Metcalfe:
Yes, that's right and we've no other evidence like shocked quartz or global wild fires, no tektites, pieces of molten rock that are formed by the impact that splash up out of the Earth's atmosphere and fall back to Earth. We do have those at the Cretaceous/Tertiary boundary when extraterrestrial impact killed off the dinosaurs, we do have that but not at this Permian/Triassic one, the big one. So really there's not much evidence to support an extraterrestrial impact. There is a little more evidence for global anoxia and sulphur being put into the atmosphere but I think a lot of that is linked with the massive volcanism.