

Manchester Geological Association

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Vertebrates: Cambrian to Mesozoic

Speaker Abstracts

The Cambrian explosion and the first vertebrate skeletons

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Animals with hard skeletons, bristling with teeth, spines and shells, first evolved around half a billion years ago, changing the planet forever. Fortunately for us this big event left its mark in the form of some of the tiniest fossils. Once pieced back together, these microscopic bits and pieces, reveal the origin of animal skeletons, the ecological complexity of the Cambrian, and the first vertebrates to bare their 'teeth'.

Mesozoic Mammals of the Inner Hebrides and the Birth of the Modern Ecosystem

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The diverse array of vertebrates we see on Earth today—including mammals, amphibians, small reptiles and birds—populate environments from the Arctic to the Amazon. Many of these modern groups have their origins in the Mesozoic, a time that marks the birth of modern ecosystems. By studying Mesozoic life, we can therefore reveal how key vertebrate groups emerged and went on to play pivotal roles in the modern world.

The Kilmaluag Formation on the Isle of Skye is one of the most productive outcrops for Middle Jurassic small vertebrate fossils in the British Isles. Many animal groups underwent explosive diversifications at that time, but the cause has been hard to pinpoint, partly because Middle Jurassic fossils are so rare. In the last decade, fieldwork by researchers from National Museums Scotland and the University of Oxford has led to new and significant fossil discoveries. These include the bones of some of the earliest mammals, providing crucial information about their anatomy, ecology, and diversity.

In this lecture we will explore the latest discoveries being made on Skye, and what they tell us about the mammals and other small vertebrates that lived there. Through this, we add detail to our increasingly vivid picture of Middle Jurassic ecosystems, and the foundations of mammals' great success since the time of dinosaurs.

The early evolution of jawed vertebrates: new clues from Mongolia and the Canadian Arctic

Dr Martin D Brazeau

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More than 99% of modern backboned animals (vertebrates) are jawed vertebrates - a group that originated more than 420 million years ago. This event brought about not only the origins of jaws and teeth, but also paired appendages and new skeletal tissues. These structures would lay the foundations for a host of adaptations leading to novel ecologies and lifestyles, including the

eventual transition to land. Our scientific understanding of the origin of jawed vertebrates is hazy due to major gaps in the fossil record, leaving room for abundant speculation.

In this talk, I show how recent fossil discoveries have overturned some classic and widely held theories about the ancestors of modern vertebrates. Over the past decade, I have been undertaking fieldwork in western Mongolia and more recently the Canadian Arctic in an attempt to fill the gaps punctuating our current knowledge. I will present newly discovered fossil data with unexpected implications for the evolution of sharks and bony tissues and which can inform our interpretation of genomic data of modern jawed vertebrates. In particular, the new data suggests that bony internal skeletons may have evolved much earlier than previously thought and that the cartilaginous skeletons of sharks may be a secondary specialisation. Finally, I will discuss future directions regarding how fieldwork can address ecological questions about early transitions in vertebrate life in the sea.