

## CHAPTER FOUR

# Biodiversity

## The History of Biodiversity

The history of life on Earth is recorded in its rocks. When living organisms die, they decay completely. However, under certain conditions, their remains can sometimes be preserved in Earth as fossils and unearthed millions of years later with varying degrees of detail. Such fossilized specimens usually consist of the hard structure of the living organism – bones, shells, claws, or teeth – that are left after the soft body tissues decay. However, if the conditions are right, fossils can even capture and preserve traces of skin, feathers, and soft body tissue in detail. Dead organisms decay more quickly when they are in contact with oxygen. When a plant or animal dies or is trapped in a watery environment and is immediately buried in mud or silt, the lack of access to oxygen slows or halts the decay process. The remains of the organism that do not decay remain preserved in the sediment. With time stretching over thousands or millions of years, the sediments build over and harden into a buried rock, preserving the left-over parts of the organism. With erosion or the opportune excavation of paleontologists, the rock may become exposed, revealing its hidden secrets – the fossilized remains of a distant ancient organism.

While the discovery of fossils offers a clear insight into a specific life form at a particular period in Earth's history, it has limitations. Fossil records are not

always abundantly or readily available. Nature – and not us – determines the fossilized organisms of a particular period. And of those rare organisms fossilized within Earth's crust, only a small fraction is eventually – and fortuitously – discovered by humans. As such, the fossil record is patchy and incomplete. Furthermore, fossils often contain only partial traces of the organism – and do not faithfully preserve its DNA. Dating the fossils can be tricky as well. Different techniques are used to estimate the age of a fossil, from radiometric dating to relative sedimentary layer dating. Such techniques provide dating estimates ranging from fairly accurate to reasonable and are subject to refinement as more data becomes available.

Given the above challenges and limitations in the availability and dating of fossil records, paleontology offers a different degree of exactness than other science disciplines, such as physics, chemistry, and mathematics. Nevertheless, paleontology still offers a robust and reliable framework for studying prehistoric life. The cumulative collection of all the discovered fossils – chronologically pieced together diligently and painstakingly from all parts of the world by the world's paleontologists – offers a reasonably sound and clear picture of the history of life. The picture may not be complete or crystal clear, but it has enough data to form the image with sufficient details and offer a reliable outline of life's history. At the same time, as more and more fossil records are discovered and analyzed every year, the picture becomes more refined – or may even adjust its shape – to adapt to the new data. With these caveats about fossil finds and their timelines in mind, we briefly outline the history of life on Earth.