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Year 7 - 8

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Discovering *Spriggina*: South Australia's Window into Life's Beginnings

By Harris Cheong
Year 7

(Source: Author's photograph, South Australian Museum)

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Solving "Darwin's Dilemma"

When Charles Darwin, a renowned geologist and naturalist, published *On the Origin of Species*, there were no known fossils predating the Cambrian period. This gap in the fossil record raised doubts about Charles Darwin's theory that all species evolved from common ancestors. This dilemma, later known as "Darwin's dilemma" was not resolved until the discovery of *Spriggina* and other Ediacaran fossils, which became a major scientific turning point and provided evidence of complex animal life existing before the Cambrian period (Ediacara Foundation, n.d.; Flinders Ranges Ediacara Foundation, n.d.).

It was only 80 years ago that scientists began to uncover clear evidence of life dating back as far as 3.5 billion years ago. To understand the significance of this, and the timeline of this scientific turning point, it helps to step back through time. Today, we live in a world shaped by advanced technology, but just a few hundred years ago, Leonardo da Vinci was sketching inventions and painting the *Mona Lisa*. Thousands of years ago, ancient Egyptians built the pyramids while early civilisations learned to form cities. Travel further back 6 million years, and the earliest human ancestors begin to appear. At 66 million years ago, the dinosaurs became extinct after roaming Earth, while they first appeared around 240 million years ago (Natural History Museum, London, 2020). Around 335 million years ago, all the continents were joined together known as Pangaea. Then, 541 million years ago, the Cambrian Explosion marked the complex forms of life.

Finally, at around 550 million years ago, during the Ediacaran Period, a small soft-bodied organism called *Spriggina* lived on the ancient seabed. The discovery of Ediacaran fossils from this time filled the missing gap in the fossil record, helping to resolve "Darwin's Dilemma". This evidence suggests that complex life began much earlier than once thought (M. Droser, personal communication, 21 June 2026).

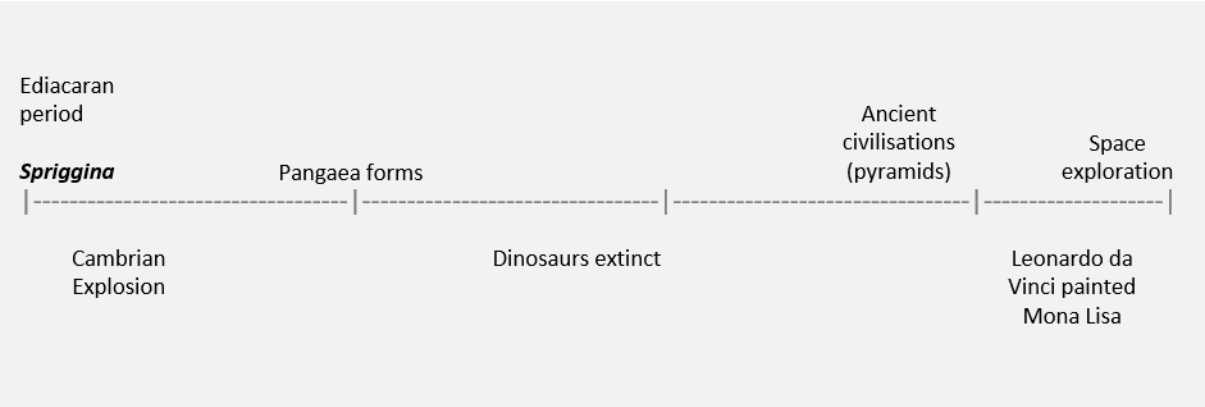

Figure 1: Timeline of Life on Earth

A Discovery That Opened a Window into Life's Beginnings

Imagine standing in the dry, rocky hills of the Flinders Ranges in South Australia in the year 1946, the land appears ancient and quiet, eroded after millions of years. Suddenly, some unusual patterns are

noticed in the rocks that seem like imprinted footprints. This discovery of Ediacara fossils represents one of the world's greatest records of evolution of early animal life on Earth. This was geologist Reginald Claude Sprigg's story (Government House Adelaide, n.d.; Sprigg, 1988). This discovery of the Ediacara fossils revealed the Ediacara biota, making it not just merely important for South Australia, but it also changed the way that scientists understood the history and evolution of life. This tiny fossil opened a window into life's beginnings, reshaping scientists' perspective about evolution (Flinders Ranges Ediacara Foundation, n.d.). Back in 1946, Reg Sprigg was a young geologist working with the Geological Survey of South Australia and it was in the Flinders Ranges where he discovered disc-like impressions on the lower surfaces of sandstone slabs. These impressions were described as various forms of jellyfish and they are now suggested to be fossils of anemones and anchoring discs of soft corals (South Australian Museum 2026).

Spriggina floundersi, the full scientific name of *Spriggina*, derived its name in honour of two important individuals who contributed towards its discovery. The genus name, *Spriggina,* came from Reginald Claude Sprigg (commonly known as Reg Sprigg), who was the geologist who recognised and published the first Ediacara fossils. The species name, *floundersi*, came from Ben Flounders, who found the first actual *Spriggina* fossil in 1957 (South Australian Museum 2026).

Spriggina was a small, segmented organism that typically grew around 2-4cm long (South Australian Museum 2026). *Spriggina* was the oldest known fossil animal with an identifiable head and segmented body. It was suggested that the horse-shoe shaped head of *Spriggina* is the earliest evidence of a brain and concentration of sensory organs. With a tapered posterior and a slightly wider head region, that resembled a shell and due to its segmented body that was divided into repeated sections, *Spriggina* became a crucial part of the evolutionary timeline as segmentation is found in many major modern animal groups. Although *Spriggina* seems to have bilateral symmetry, some argue it has glide-reflection morphology (South Australian Museum 2026; Trevelyan, 2026). All this knowledge makes *Spriggina* even more significant, as it is one of the clearest examples of bilateral symmetry and segmentation in the Ediacaran Period, highlighting that complex body organisation evolved before the Cambrian period.

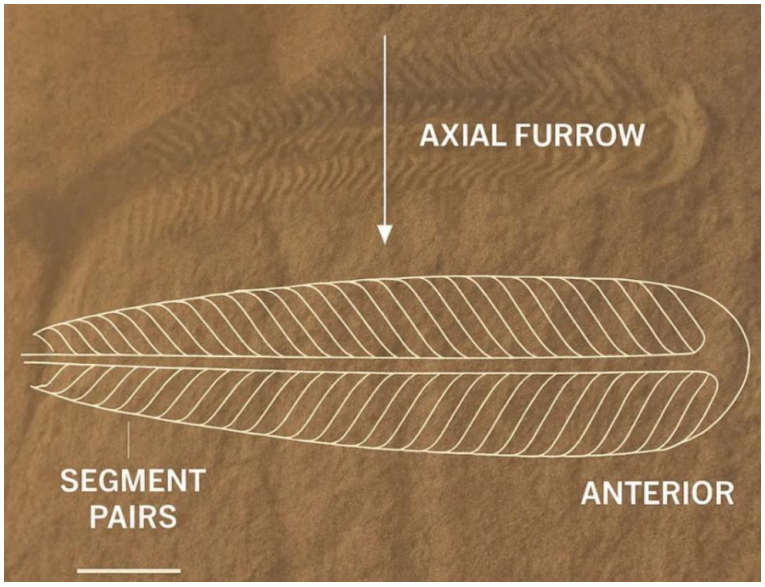

Figure 2: Anatomical features of *Spriggina* (not to scale). (Source: Trevelyan, 2026)

Studying *Spriggina* helped scientists understand how different animal groups are related. It provided clues about how early body plans developed and diversified (South Australian Museum 2026). This discovery also contributed to scientific debates as to what *Spriggina* really was. Some scientists believe that *Spriggina* is an early arthropod relative or an annelid due to its segmentation and external skeletons such as bugs and crustaceans. However, some think *Spriggina* is a completely unique extinct lineage that is a 'dead end' as it has no continuing lineage. It is also suggested that *Spriggina* could be a possible ancestor to arthropods, like shrimps, millipedes and centipedes (South Australian Museum 2026; Trevelyan, 2026). It is hypothesised that *Spriggina* was capable of movement, but no direct evidence has been published (Flinders University, n.d.).

Figure 3: Diagram of *Spriggina* showing segmentation and bilateral symmetry (not to scale). (Source: Government House Adelaide, n.d.)

From Seabed to Fossilisation

The fossilisation of *Spriggina* was due to a series of highly coincidental events, the alignment of which was extremely fortunate in helping to advance our understanding of evolution. Fossils are the preserved remains of ancient organisms. Since *Spriggina* had no hard parts, its fossilisation required special conditions. *Spriggina* lived on the soft seabed, which helped impressions to be marked in the sediment. When fine layers of mud quickly covered the organism, the shape was protected from decay. Over millions of years, these layers hardened into rock, keeping the impression with it. When fossils form in this way, it is called an impression fossil (Ediacara Foundation, n.d.; South Australian Museum 2026).

The preservation of *Spriggina* is particularly special because soft-bodied organisms like *Spriggina* normally decay quickly. The perfect conditions in the Ediacaran seas, such as the low oxygen levels and microbial mats helped to preserve these delicate forms. The mats helped to stabilise the sediment to help capture the detailed impressions of the organisms (Ediacara Foundation, n.d.; Gehling & Droser, 2012; Trevelyan, 2026).

The discovery of the fossils was also a serendipitous development. Geology, which is the study of Earth's rocks and processes, was critical to the discovery of *Spriggina*. The Flinders Ranges contain sedimentary rocks that were formed from the ancient seabeds of the Ediacaran Period (Department

of Environment and Water, 2023; ABC News, 2013). Geological processes such as tectonic uplift and erosion later allowed the exposure of the fossils, resulting in Reg Sprigg being able to discover them.

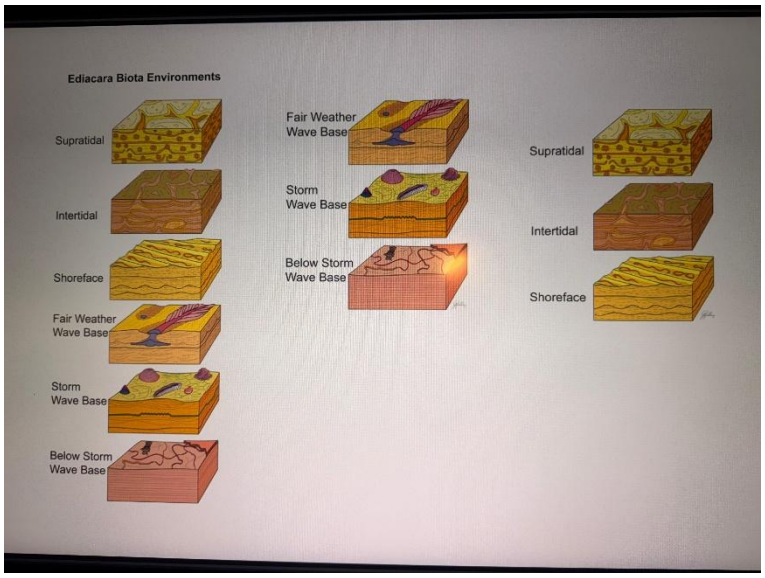

Figure 4: Ediacara Biota Environments. (Source: Author's photograph, South Australian Museum)

Understanding *Spriggina* is more challenging than studying most fossils. Unlike dinosaurs and shelled organisms, *Spriggina*, due to being a soft-bodied organism, had no bones or hard parts. Scientists had to rely on faint impressions on rocks, making it difficult to interpret. In many situations, scientists had to debate over whether features and impressions seen in the rock were real biological structures or purely the movement of *Spriggina*. Another interesting challenge is that living organisms today do not perfectly match *Spriggina*. Scientists cannot simply compare it to a modern animal. Instead, they must combine knowledge from geology, fossil patterns, and evolutionary theory to make careful interpretations about every single impression (Runnegar, 2022). Due to this, many scientists reach different conclusions about what *Spriggina* really was (Luskin, 2021).

According to Dr Mary Droser (personal communication, 21 June 2026), scientific understanding continues to evolve through new technologies like laser scanning and advanced statistical methods. The use of laser scanner allows scientists to further understand the details of *Spriggina* and explore different statistical ways of thinking about fossils.

Figure 5: Fieldwork at Nilpena and Flinders Ranges (Source: Droser Lab, n.d.)

From Fossils to Becoming a World Heritage Site

The region where *Spriggina* was discovered is being considered for one of the most prestigious levels of international recognition, the UNESCO World Heritage status. The Flinders Ranges were added to the Australia's World Heritage Tentative List in 2021, which was the first step toward being listed for UNESCO World Heritage status. Australia recently submitted a detailed application for UNESCO World Heritage status in February of 2026, and UNESCO are currently assessing the nomination. In 2027, the announcement on whether the Flinders Ranges will become a World Heritage Site is expected (Department of Environment and Water, 2026). Achieving this status will be a major turning point for the region as well as triggering benefits for the wider scientific community as only a small minority of the current UNESCO sites have earned their status through scientific importance, rather than being culturally important (United Nations Educational, Scientific and Cultural Organization, 2024). With the discovery of *Spriggina*, it has positioned South Australia as a globally significant location for understanding the very beginnings of life on Earth, making South Australia a unique destination for research, education, and tourism.

Figure 6: Nilpena Fossil Beds (Source: Ediacara Foundation, n.d.)

Small but Mighty

When I first started researching about *Spriggina*, I was wondering what it was and why I had never heard of it if it mattered so much. As I explored further, I realised that *Spriggina*, although a minute and obscure fossil, was the purest evidence that proved why *Spriggina* is one of the most significant fossils in the world. The discovery of *Spriggina* provided evidence to scientists to support the evolutionary theory, including that life comes from common ancestors and that complex life began before the Cambrian Explosion. This resolves the "Darwin's Dilemma" and builds our understanding of early life on Earth. This discovery has shown me that even the smallest fossils can hold answers to some of the biggest questions into life's beginnings.

Word Count: 1,493

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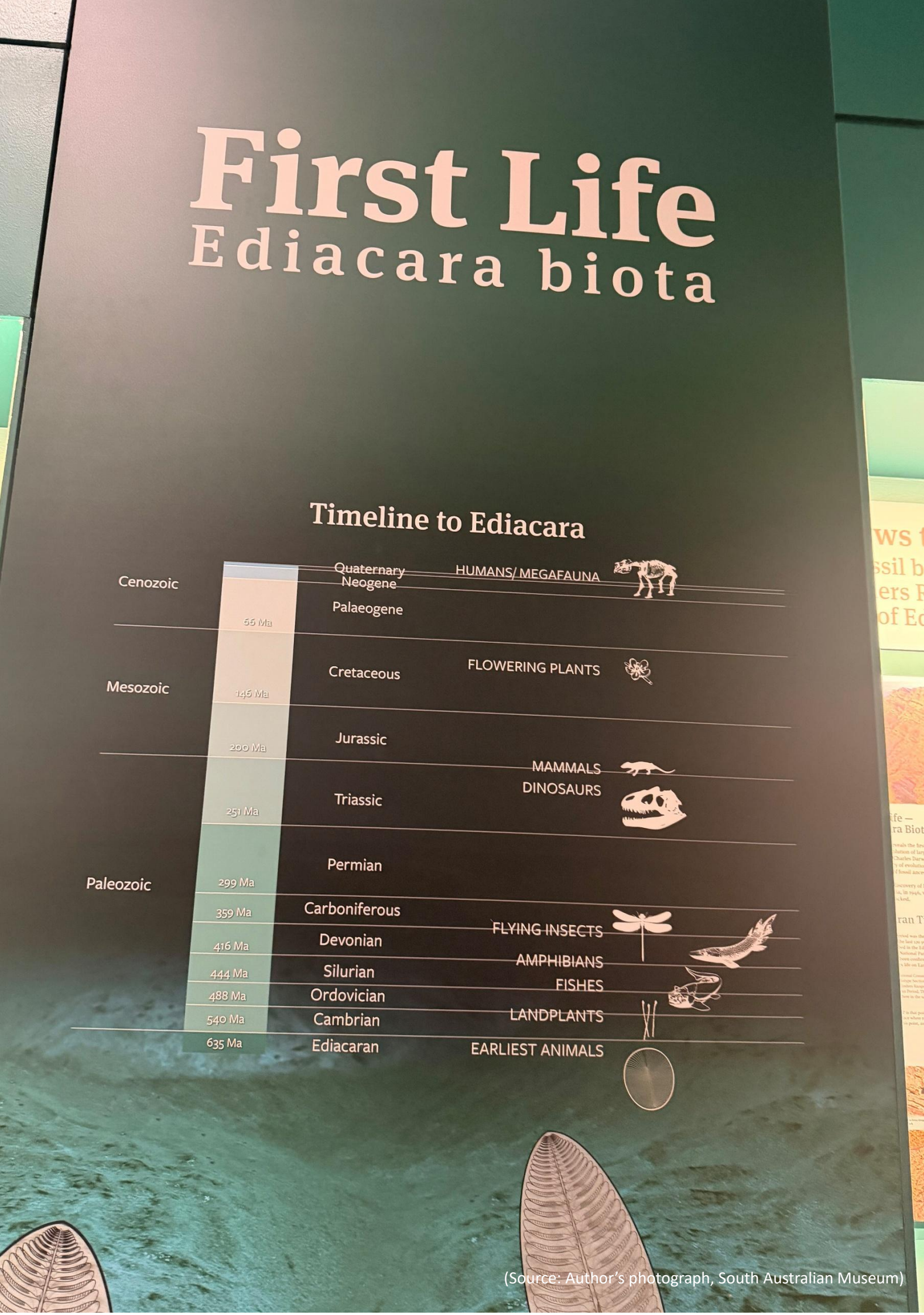

(Source: Author's photograph, South Australian Museum)