

Text References

Joggins Site

- During the Carboniferous Period, more specifically the Late Pennsylvanian Epoch, which was around 320 million years ago, North America was laden with rainforests. However, changes in climate gave way to an event known as the Carboniferous Rainforest Collapse, which led to natural deforestation of the areas. The Joggins site is located in the northern region of Nova Scotia, Canada.
- The site drew interest from geologists such as Abraham Gesner, Richard Brown, etc in the early 1800s. The site was heavily documented by Sir William Dawson. Additionally, Gesner and William Logan, who surveyed the region for the Canadian government, observed the geological features of the site.
- Joggins is most famous for *Hylonomus lyelli*. Discovered by Dawson and Charles Lyell at the Joggins Formation site, *H. lyelli* is currently the oldest known fossil sauropsid, making it the most recent common ancestor of all living birds and reptiles. Based on its stratigraphic position upon its discovery, it would have lived around 312 million years ago. In terms of size, it measured to be around 20 cm in length.
- Other known discoveries include a variety of trees and flora, arthropods, etc.
- ¹⁰On a global scale, the site is used as a standard reference for the “Coal age”. It was vital in the development of “seminal geological and evolutionary principles”.

Synapsida and Sauripoda

- Amniotes descended from tetrapods. A prominent feature extinct and living amniotes share is the “amniotic egg,” which has a more streamlined and protective set of membranes around the embryo during its development. As reptiles, birds, and mammals are all derived from Amniota. As early amniotes laid eggs with hard shells, synapsids would eventually evolve into mammals, of which mostly give live births, with young surrounded in an amniotic sac.
- The Amniotes diverged into two clades called Sauropsida and Synapsida around 312 million years ago during the late Carboniferous Period.
 - **Sauropsida:** Sauropsids were the first group of reptiles. In the future, they would go on to evolve into dinosaurs and modern reptiles (lizards, crocodiles, snakes, and turtles) and birds. Additionally, Sauropsida is synonymous with the taxonomic class, Reptilia.
 - **Synapsida:** As well as *Hylonomus*, the Joggins Site is also home to the oldest known synapsid, *Protoclepsydraps*, which is theorized to be the earliest stem-mammal.¹³ Two more recent Late Carboniferous synapsid genera are *Archaeothyris* and *Clepsydraps*, which were found in Nova Scotia as well as more widely distributed areas in North America.^{13,14,15} Even though members of all three genera appear reptilian, they began to exhibit basal traits which would later be passed on to the future mammals. However, based on the fossil record, early synapsids might have been restricted to equatorial regions, as much of continental North America was located around the tropics in the Late Carboniferous.¹⁶

Basal Amphibians/Tetrapods

- Between the late Devonian and early Permian periods, there was expansion of amphibious tetrapods.
- ¹The most famous Joggins site species is *Dendrerpeton*. This small basal tetrapod is prominent in the Nova Scotian region. ²John Dawson also surmised there were many other “microsaur”-like tetrapods in the region.
- ⁴The region is also famous for housing the smallest amphibian footprints.
- ¹³The region has also recently been found to house plesiomorphic Aistopoda, amongst other typical Carboniferous fauna, more than previously thought.

Giant Arthropods

- The Carboniferous period is known for its wetter conditions and a more oxygen-rich atmosphere. These conditions allowed arthropods to grow, due to the fact that they had to exert less energy to breathe.
- The Joggins site housed a plethora of different marine arthropods. Subphylum of marine Arthropods found at the Joggins Site include Crustacea and Chelicerata, more specifically crayfish, and a host of marine spiders and scorpions. Some terrestrial arthropods found at the Joggins site include the subphylum Myriapoda, or millipedes, and flying insects, or the subphylum Insecta.
- Fossilized tracks of arthropleura were found at the Joggins site. The tracks of these extinct giant millipedes measured up to 50 cm wide!

Citations

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