27.4C: Post-Cambrian Evolution and Mass Extinctions

The post-Cambrian era was characterized by animal evolution and diversity where mass extinctions were followed by adaptive radiations.

LEARNING OBJECTIVES

Differentiate among the causes of mass extinctions and their effects on animal life

KEY TAKEAWAYS

Key Points

- During the Ordovician period, plant life first appeared on land, which allowed aquatic animals to move on to land.
- Periods of mass extinction caused by cataclysmic events like volcanic eruptions and meteor strikes have erased many genetic lines and created room for new species.
- The largest mass extinction event in earth’s history, which occurred at the end of the Permian period, resulted in a loss of roughly 95 percent of the existing species at that time.
- The disappearance of some dominant species of Permian reptiles and the warm and stable climate that followed made it possible for the dinosaurs to emerge and diversify.
- Another mass extinction event caused by a meteor strike and volcanic ash eruption occurred at the end of the Cretaceous period, bringing the Mesozoic Era to an end and pushing dinosaurs into extinction.
- The disappearance of dinosaurs led to the dominance of plants, which created new niches for birds, insects, and mammals; animal diversity was also brought on by the creation of continents, islands, and mountains.
Key Terms

- **Cenozoic**: a geologic era about between 65 million years ago to the present when the continents moved to their current position and modern plants and animals evolved
- **mass extinction**: a sharp decrease in the total number of species in a relatively short period of time
- **Cretaceous**: the last geologic period within the Mesozoic era from about 146 to 65 million years ago; ended with a large mass extinction

Post-Cambrian Evolution and Mass Extinctions

The periods that followed the Cambrian during the Paleozoic Era were marked by further animal evolution and the emergence of many new orders, families, and species. As animal phyla continued to diversify, new species adapted to new ecological niches. During the Ordovician period, which followed the Cambrian period, plant life first appeared on land. This change allowed formerly-aquatic animal species to invade land, feeding directly on plants or decaying vegetation. Continual changes in temperature and moisture throughout the remainder of the Paleozoic Era due to continental plate movements encouraged the development of new adaptations to terrestrial existence in animals, such as limbs in amphibians and epidermal scales in reptiles.

Changes in the environment often create new niches (living spaces) that contribute to rapid speciation and increased diversity. On the other hand, cataclysmic events, such as volcanic eruptions and meteor strikes that obliterate life, can result in devastating losses of diversity. Such periods of mass extinction have occurred repeatedly in the evolutionary record of life, erasing some genetic lines while creating room for others to evolve into the empty niches left behind. The end of the Permian period (and the Paleozoic Era) was marked by the largest mass extinction event in Earth’s history, a loss of roughly 95 percent of the extant species at that time. Some of the dominant phyla in the world’s oceans, such as the trilobites, disappeared completely. On land, the disappearance of some dominant species of Permian reptiles made it possible for a new line of reptiles to emerge: the dinosaurs. The warm and stable climatic conditions of the ensuing Mesozoic Era promoted an explosive diversification of dinosaurs into every conceivable niche in land, air, and water. Plants, too, radiated into new landscapes and empty niches, creating complex communities of producers and consumers, some of which became extremely large on the abundant food available.
Another mass extinction event occurred at the end of the Cretaceous period, bringing the Mesozoic Era to an end. Skies darkened and temperatures fell as a large meteor impact expelled tons of volcanic ash, blocking incoming sunlight. Plants died, herbivores and carnivores starved, and the mostly cold-blooded dinosaurs ceded their dominance of the landscape to more warm-blooded mammals. In the following Cenozoic Era, mammals radiated into terrestrial and aquatic niches once occupied by dinosaurs. Birds, the warm-blooded offshoots of one line of the ruling reptiles, became aerial specialists. The appearance and dominance of flowering plants in the Cenozoic Era created new niches for insects, as well as for birds and mammals. Changes in animal species diversity during the late Cretaceous and early Cenozoic were also promoted by a dramatic shift in earth’s geography, as continental plates slid over the crust into their current positions, leaving some animal groups isolated on islands and continents or separated by mountain ranges or inland seas from other competitors. Early in the Cenozoic, new ecosystems appeared, with the evolution of grasses and coral reefs. Late in the Cenozoic, further extinctions followed by speciation occurred during ice ages that covered high latitudes with ice and then retreated, leaving new open spaces for colonization.