

## Competitive Exams: Evolution Time scale: Triassic

### Triassic Seas

A rival to the Ammonite appeared in the Triassic seas, a formidable forerunner of the cuttle-fish type of Cephalopod. The animal now boldly discards the protecting and confining shell, or spreads over the outside of it, and becomes a "shell-fish" with the shell inside. The octopus of our own time has advanced still further, and become the most powerful of the invertebrates. The Belemnite, as the Mesozoic cuttle-fish is called, attained so large a size that the internal bone, or pen (the part generally preserved), is sometimes two feet in length. The ink-bags of the Belemnite also are sometimes preserved, and we see how it could balk a pursuer by darkening the waters. It was a compensating advantage for the loss of the shell.

In all the other classes of aquatic animals we find corresponding advances. In the remaining Molluscs the higher or more effective types are displacing the older. It is interesting to note that the oyster is fully developed, and has a very large kindred, in the Mesozoic seas. Among the Brachiopods the higher sloping-shoulder type displaces the square-shoulder shells. In the Crustacea the Trilobites and Eurypterids have entirely disappeared; prawns and lobsters abound, and the earliest crab makes its appearance in the English Jurassic rocks. This sudden arrival of a short-tailed Crustacean surprises us less when we learn that the crab has a long tail in its embryonic form, but the actual line of its descent is not clear. Among the Echinoderms we find that the Cystids and Blastoids have gone, and the sea-lilies reach their climax in beauty and organisation, to dwindle and almost disappear in the last part of the Mesozoic. One Jurassic sea-lily was found to have 600, 000 distinct ossicles in its petrified frame. The free-moving Echinoderms are now in the ascendant, the sea-urchins being especially abundant. The Corals are, as we saw, extremely abundant, and a higher type (the Hexacoralla) is superseding the earlier and lower (Tetracoralla).

Finally, we find a continuous and conspicuous advance among the fishes. At the close of the Triassic and during the Jurassic they seem to undergo profound and comparatively rapid changes. The reason will, perhaps, be apparent in the next chapter, when we describe the gigantic reptiles which feed on them in the lakes and shore-waters. A greater terror than the shark had appeared in their environment. The Ganoids and Dipneusts dwindle, and give birth to their few modern representatives. The sharks with crushing teeth diminish in number, and the sharp-toothed modern shark attains the supremacy in its class, and evolves into forms far more terrible than any that we know to-day. Skates and rays of a more or less modern type, and ancestral gar-pikes and sturgeons, enter the arena. But the most interesting new departure is the first appearance, in the Jurassic, of bony-framed fishes (Teleosts). Their superiority in

organisation soon makes itself felt, and they enter upon the rapid evolution which will, by the next period, give them the first place in the fish world.

Over the whole Mesozoic world, therefore, we find advance and the promise of greater advance. The Permian stress has selected the fittest types to survive from the older order; the Jurassic luxuriance is permitting a fresh and varied expansion of life, in preparation for the next great annihilation of the less fit and selection of the more fit. Life pauses before another leap. The Mesozoic earth--to apply to it the phrase which a geologist has given to its opening phase--welcomes the coming and speeds the parting guest. In the depths of the ocean a new movement is preparing, but we have yet to study the highest forms of Mesozoic life before we come to the Cretaceous disturbances.

## **The Age of Reptiles**

From one point of view the advance of life on the earth seems to proceed not with the even flow of a river, but in the successive waves of an oncoming tide. It is true that we have detected a continuous advance behind all these rising and receding waves, yet their occurrence is a fact of some interest, and not a little speculation has been expended on it. When the great procession of life first emerges out of the darkness of Archaean times, it deploys into a spreading world of strange Crustaceans, and we have the Age of Trilobites. Later there is the Age of Fishes, then of Cryptogams and Amphibia, and then of Cycads and Reptiles, and there will afterwards be an Age of Birds and Mammals, and finally an Age of Man. But there is no ground for mystic speculation on this circumstance of a group of organisms fording the earth for a few million years, and then perishing or dwindling into insignificance. We shall see that a very plain and substantial process put an end to the Age of the Cycads, Ammonites, and Reptiles, and we have seen how the earlier dynasties ended.

The phrase, however, the Age of Reptiles, is a fitting and true description of the greater part of the Mesozoic Era, which lies, like a fertile valley, between the Permian and the Chalk upheavals. From the bleak heights of the Permian period, or--more probably--from its more sheltered regions, in which they have lingered with the ferns and cycads, the reptiles spread out over the earth, as the summer of the Triassic period advances. In the full warmth and luxuriance of the Jurassic they become the most singular and powerful army that ever trod the earth. They include small lizard-like creatures and monsters more than a hundred feet in length. They swim like whales in the shallow seas; they shrink into the shell of the giant turtle; they rear themselves on towering hind limbs, like colossal kangaroos; they even rise into the air, and fill it with the dragons of the fairy tale. They spread over the whole earth from Australia to the Arctic circle. Then the earth seems to grow impatient of their dominance, and they shrink towards the south, and struggle in a diminished territory. The colossal monsters and the formidable dragons go the way of all primitive life, and a ragged regiment of crocodiles, turtles, and serpents in the tropics, with a swarm of smaller creatures in the fringes of the warm zone, is all that remains, by the Tertiary Era, of the world-conquering army of the Mesozoic reptiles.

They had appeared, as we said, in the Permian period. Probably they had been developed during the later Carboniferous, since we find them already branched into three orders, with many sub-orders, in the Permian. The stimulating and selecting disturbances which culminated in the Permian revolution had begun in the Carboniferous. Their origin is not clear, as the intermediate forms between them and the amphibia are not found. This is not surprising, if we may suppose that some of the amphibia had, in the growing struggle, pushed inland, or that, as the land rose and the waters were drained in certain regions, they had gradually adopted a purely terrestrial life, as some of the frogs have since done. In the absence of water their frames would not be preserved and fossilised. We can, therefore, understand the gap in the record between the amphibia and the reptiles. From their structure we gather that they sprang from at least two different branches of the amphibia. Their remains fall into two great groups, which are known as the Diapsid and the Synapsid reptiles. The former seem to be more closely related to the Microsauria, or small salamander-like amphibia of the Coal-forest; the latter are nearer to the Labyrinthodonts. It is not suggested that these were their actual ancestors, but that they came from the same early amphibian root.

We find both these groups, in patriarchal forms, in Europe, North America, and South Africa during the Permian period. They are usually moderate in size, but in places they seem to have found good conditions and prospered. A few years ago a Permian bed in Russia yielded a most interesting series of remains of Synapsid reptiles. Some of them were large vegetarian animals, more than twelve feet in length; others were carnivores with very powerful heads and teeth as formidable as those of the tiger. Another branch of the same order lived on the southern continent, Gondwana Land, and has left numerous remains in South Africa. We shall see that they are connected by many authorities with the origin of the mammals. \* The other branch, the Diapsids, are represented to-day by the curiously primitive lizard of New Zealand, the tuatara (*Sphenodon*, or *Hatteria*), of which I have seen specimens, nearly two feet in length, that one did not care to approach too closely. The Diapsids are chiefly interesting, however, as the reputed ancestors of the colossal reptiles of the Jurassic age and the birds. These Synapsid reptiles are more commonly known as *Pareiasauria* or *Theromorpha*.

The purified air of the Permian world favoured the reptiles 'being lung-breathers, but the cold would check their expansion for a time. The reptile, it is important to remember' usually leaves its eggs to be hatched by the natural warmth of the ground. But as the cold of the Permian yielded to a genial climate and rich vegetation in the course of the Triassic, the reptiles entered upon their memorable development. The amphibia were now definitely ousted from their position of dominance. The increase of the waters had at first favoured them, and we find more than twenty genera, and some very large individuals, of the amphibia in the Triassic. One of them, the *Mastodonsaurus*, had a head three feet long and two feet wide. But the spread of the reptiles checked them, and they shrank rapidly into the poor and defenceless tribe which we find them in nature to-day.

To follow the prolific expansion of the reptiles in the semi-tropical conditions of the Jurassic age is a task that even the highest authorities approach with great diffidence. Science is not yet

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wholly agreed in the classification of the vast numbers of remains which the Mesozoic rocks have yielded, and the affinities of the various groups are very uncertain. We cannot be content, however, merely to throw on the screen, as it were, a few of the more quaint and monstrous types out of the teeming Mesozoic population, and describe their proportions and peculiarities. They fall into natural and intelligible groups or orders, and their features are closely related to the differing regions of the Jurassic world. While, therefore, we must abstain from drawing up settled genealogical trees, we may, as we review in succession the monsters of the land, the waters, and the air, glance at the most recent and substantial conjectures of scientific men as to their origin and connections.