Science in the News – The Morrison Foundation

The Morrison Formation is a distinctive sequence of Late Jurassic sedimentary rock that is found in the western United States, which has been the most fertile source of dinosaur fossils in North America. It is composed of mudstone, sandstone, siltstone and limestone and is light grey, greenish gray, or red. Most of the fossils occur in the green siltstone beds and lower sandstones, relics of the rivers and floodplains of the Jurassic period.

It is centered in Wyoming and Colorado, with outcrops in Montana, North Dakota, South Dakota, Nebraska, Kansas, the panhandles of Oklahoma and Texas, New Mexico, Arizona, Utah, and Idaho. Equivalent rocks under different names are found in Canada. It covers an area of 1.5 million square km (600,000 square miles), although only a tiny fraction is exposed and accessible to geologists and paleontologists. Over 75% is still buried under the prairie to the east and much of the rest was destroyed by erosion as the Rocky Mountains rose to the west.

It was named after Morrison, Colorado, where the first fossils were discovered by Arthur Lakes in 1877. That same year, it became the center of the Bone Wars, a fossil-collecting rivalry between early paleontologists Othniel Charles Marsh and Edward Drinker Cope. According to radiometric dating, the Morrison Formation dates from 156.3 ± 2 million years old (Ma) at its base, to 146.8 ± 1 million years old at the top.

At the time, the supercontinent of Laurasia had recently split into the continents of North America and Eurasia, although they were still connected by land bridges. North America moved north and was passing through the subtropical regions.

The Morrison Basin, which stretched from New Mexico in the south to Saskatchewan in the north, was formed when the precursors to the Front Range of the Rocky Mountains started pushing up to the west. The deposits from their east-facing drainage basins, carried by streams and rivers from the Elko Highlands (along the borders of present-day Nevada and Utah) and deposited in swampy lowlands, lakes, river channels and floodplains, became the Morrison Formation.

In the north, the Sundance Sea, an extension of the Arctic Ocean, stretched through Canada down to the United States. Coal is found in the Morrison Formation of Montana, which means that the northern part of the formation, along the shores of the sea, was wet and swampy, with more vegetation. Eolian, or wind-deposited sandstones are found in the southwestern part, which indicates it was much more arid — a desert, with sand dunes.

In the Colorado Plateau region, the Morrison Formation is further broken into four sub-divisions, or *members*. From the oldest to the most recent, they are: **Windy Hill Member, Tidwell Member, Salt Wash Member, Brushy Basin Member.** Though many of the Morrison Formation fossils are fragmentary, they are sufficient to provide a good picture of the flora and fauna in the Morrison Basin during the Kimmeridgian. Overall, the climate was dry, similar to a savanna but, since there were no angiosperms (grasses, flowers, and some trees), the flora was quite different. Conifers, the dominant plants of the time, were to be found with ginkgos, cycads, tree ferns, and horsetail rushes. Much of the fossilized vegetation was riparian, living along the river flood plains. Insects were very similar to modern species,

with termites building 30 m (100 ft.) tall nests. Along the rivers, there were fish, frogs, salamanders, lizards, crocodiles, turtles, pterosaurs, crayfish, clams, and monotremes (prototherianmammals, the largest of which was about the size of a rat).

The dinosaurs were most likely riparian as well (dwelled by rivers). Hundreds of dinosaur fossils have been discovered, such as *Allosaurus*, *Camptosaurus*, *Ornitholestes*, and *Stegosaurus*. Since at least some of species are known to have nested in the area (*Camptosaurus* embryoes have been discovered), there are indications that it was a good environment for dinosaurs and not just home to migratory, seasonal populations.

DCN Questions

1. Which states does the Morrison Foundation include?
2. How big is the Morrison Foundation?
3. How much of the Morrison Foundation is buried underground?
4. How old is the Morrison Foundation?
5. Which supercontinent was North America and Eurasia a part of?
6. How were species able to travel from Eurasia to North America once they were split up?
7. What is the oldest region of the Morrison Foundation?
8. What is the youngest region of the Morrison Foundation?
9. What was the climate like of the Morrison Foundation?
10. How tall were the termite nests that were built in the Morrison Foundation?
11. List the dinosaurs that have been found in the Morrison Foundation.