

Jurassic Cycadales

The gymnosperms dominated the Jurassic period. Ginkgoes, conifers, the true cycads, Williamsonias and the Cycadeoids filled a warm, humid world from nearly pole to pole. High sea levels meant many warm inland seas flooding the continents. Mountain ranges were relatively low and an immense double landmass straddling the equator (Gondwana in the south and Laurasia in the north) created a paradise for cycads-like vegetation. The fossil record of leaves, stems and cones indicates that it proliferated.

Three fossil leaf types attributed to the Cycadales are *Nilssonia*, *Ctenis*, and *Pseudoctenis*. The nilssonians were an undecided lot, some had simple entire leaves, while others adopted the compound leaf first adopted by the majority of ferns back in the Carboniferous. In the end, a compound leaf design won out.

The compound nilssonian leaf pattern had short, blunt, and wide leaflets similar to *Pentoxylon*, shown lower right of page 12. (Some authorities feel that simple leaves are better grouped with *Taeniopteris*, a seed fern, and that compound leaves are actually *Pseudoctenis*.) The leaflets of *Nilssonia* attached to the upper surface of the rachis (as in the modern *Lepidozamia* and *Dioon*) and the veins are parallel, as in *Macrozamia* and *Encephalartos*. Fossilized stems suggest that the leaves of *Nilssonia* did not leave leaf bases behind when they dropped away, instead they abscised cleanly. Some researchers feel that *Nilssonia* is different enough from the Cycadale norm to deserve family rank of its own alongside the Cycadaceae, Stangeriaceae, and the Zamiaceae.

The leaves of *Ctenis* were also similar to modern cycads. The broad rachis had compound leaflets attached along it. Some fossils have been found of leaves measuring six feet in length. The parallel venation in *Ctenis* had occasional cross connections. *Ctenis* was distributed all across the Jurassic landmass and so far fossils have been assigned to approximately 50 species.



Pseudoctenis lanei-type Cycadale with a striking similarity to the modern *Encephalartos*, Middle Jurassic.

John Sibbick

Pseudoctenis also had a worldwide distribution during the Jurassic and differed from *Ctenis* in one detail . . . the parallel venation of its leaflets had far fewer cross connections. Harris (1964) has observed that if leaves of the more generalized modern genera of *Dioon*, *Macrozamia*, *Lepidozamia*, and *Encephalartos* were to be discovered as fossils, they would be classified within the *Pseudoctenis* model.

Yorkshire, England is a fertile area for cycad fossils from the Jurassic. In addition to foliage leaves, many fossils of vegetative structures have been found, enough to hint at the route to both



The ancient heritage of the cycadales means they have been witness to many exotic encounters. Here a flock of pterosaurs (*Rhamphorhynchus*) are startled into flight by a ceratosaur's attack on a lone *Brachiosaurus*. The *Encephalartos*-like cycads shown in the foreground probably did not survive the battle unscathed.

Reconstruction of a generalized *Encephalartos*-like Cycadale. Fossil material suggests that by the beginning of the Jurassic the structural evolution of the Cycadales had settled on the pattern seen today in *Cycas* and perhaps other modern genera of cycads.

The scene at left, by John Sibbick, is set in North America during the Jurassic period.



Pseudoctenis spatula
world-wide, Jurassic



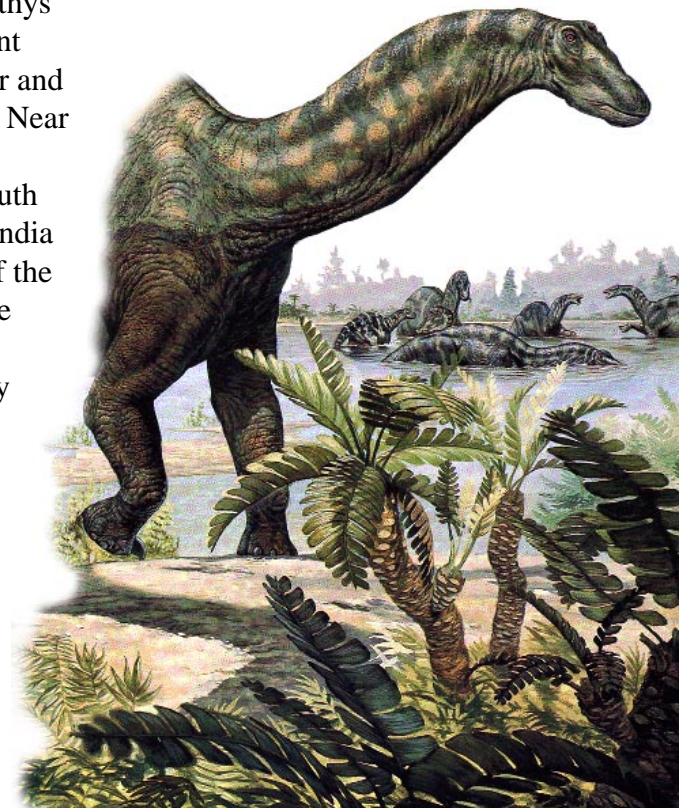
Ctenis biloba
A Cycadale, Jurassic



Closeup of leaflets showing the broad connection to the rachis. Note how the veins divide as they leave the rachis.

the loose megasporophyll design of *Cycas* and the tight closed cone design of the Zamiaceae. The cones of some of these cycads hung down from the leaf apex like pendulous fruit. While another of that same time (*Pseudoctenis lanei*) was quite similar in form to the modern *Encephalartos*, having a massive and compact male cone (named *Androstrobus manis*) and regularly pinnate leaves with parallel venation in the leaflets, enough that if further discoveries bear out these similarities the cycad may be classified within this genus. This would provide evidence for at least one of the early home ranges of *Encephalartos*, and indicate the antiquity of its origins. Another fossil cone, *Androstrobus zamioides*, from the Middle Jurassic sediments of North Yorkshire may be a *Stangeria* relative. Another *Stangeria*-like fossil from Argentina suggests that this monotypic and isolated Africa cycad originated in South America and was once global in range. The leaves of the newly discovered genus *Chigua* from Columbia are strikingly similar to the forked venation, serrated leaf edges, and strong midrib of *Stangeria*. Could this rare and relict genus be a surviving fragment of *Stangeria* in the New World?

As the Jurassic period came to a close, the continents continued shifting. The Tethys seaway opened a corridor from the present Caribbean through the Straits of Gibraltar and continuing south between Arabia and the Near East to the South Polar sea. Additionally, Africa had begun to break away from South America in the west and Antarctica and India in the east. The worldwide distribution of the Cycadales was now sundered. The unique characteristics of the major genera of the modern cycads would now appear as they began to specialize within much smaller ranges.



Pentoxylon
A *Nilsonnia*-type Cycadale, Jurassic