Martin Sander
Bonn University

Ontogeny and Phylogeny of Sauropod Dinosaurs Reconstructed from Bone Histology

Bone histology has developed in to the major source of information on life history of dinosaurs, and sauropodomorphs are one of the best-sampled clades. The large long bones humerus and femur preserve the most complete growth record, which allows inferences about life history, thermometabolism, and other aspects of sauropod biology. Put into an evolutionary context, these inferences inform us about processes and mechanisms in sauropodomorph body size evolution from moderately sized basal sauropodomorphs to the largest terrestrial animals ever. By comparing plesiomorphic with derived life histories, body size change can be understood within the framework of heterochrony.

Basal sauropodomorphs such as Plateosaurus have fibrolamellar bone interrupted by regularly spaced growth marks, and termination of growth is recorded in an external fundamental system (EFS). Growth series of many taxa of sauropods also show exclusively fibrolamellar bone but differ in that growth marks appear only late in life or in most taxa only in the EFS. Growth rate and final size are taxon-specific and genetically predetermined. The lack of growth marks requires the use of histologic ontogenetic stages in comparing sauropod taxa.

As indicated by their highly vascularized fibrolamellar bone, but also by estimates from rare growth marks, growth rates of sauropods were comparable only to that of large herbivorous mammals and birds. Evolution of large body size of sauropods was brought about by an increase in growth rate and evolution of tachymetabolic endothermy, which must have been only incompletely developed in basal sauropodomorphs. The island dwarf Europasaurus evolved its diminutive body size by a decrease in growth rate and a shortening of the active phase of growth.