

Paleoecology of primitive ichthyopterygians suggested by bone histology

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Bone microstructure of derived ichthyosaurs is characterized by following two specialization: presence of rapid growing bone tissues (woven bone tissue and fibrolamellar complex) and osteoporotic-like state, which is a general feature for extant open-sea dwelling tetrapods that excel at maneuverable swimming and/or deep diving. In order to look into the evolutionary process of these interesting features, I conducted a detailed histological study of four individuals of Early Triassic basal ichthyopterygians from the Osawa Formation (Upper Spathian, northwestern Honshu of Japan) including two *Utatsusaurus hataii*, the most primitive ichthyopterygian.

At least one element of every individual examined have fibrolamellar complex or woven-fibered bone in the primary periosteal cortex, although slow-growing bone tissue (lamellar-zonal bone) may be dominant in some cases. Most bones have external fundamental system (EFS), which is a thin layer of the most peripheral region consist of avascular lamellar-zonal bone. This arrangement of bone tissue types suggest that these elements had grown rapidly in earlier stage and reduced growth rate dramatically in later stage. The cortex is generally composed of vascularized cancellous bone. Spongy inner cortex has thin trabeculae with secondary endosteal bone. On the other hand relatively compact outer cortex has resorption bays, but very little evidence of redeposition. The evidence of endosteal bone remodeling suggests dominancy of resorption through the remodeling process in cortex of basal ichthyopterygians. Although the 'lizard-like' appearance of basal ichthyopterygians, growth and remodeling strategies indicated by bone microstructure are similar to 'fish-like' more derived ichthyopterygians. These are significantly different from bone microstructure reported on non-marine Permian sauropsids such as captorhinids.