

The Devonian Dipnoan *Holodipterus*: Dental Form Variation and Remodelling Growth Mechanisms.

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ABSTRACT. The dentition of the Late Devonian *Holodipterus gogoensis* Miles (Osteichthyes: Dipnoi) is described from the original material and four new specimens. Variation between specimens is considerable because growth took place in cycles that involved extensive resorption of tissues of all types on the dental surface, followed by periods of reconstruction during which new distributions of hard tissues were established. The teeth have an enamel cover and a hard compact dentine core within which an unusual interstitial material is present. They were added alternately to the lateral margins of the pterygoids and the prearticulars. In this way new teeth were always added outside the occlusal surface. Enlarged marginal denticles around the edges of the bones provided a surface to protect against wear by opposing teeth during the growth of the new teeth on the opposing jaws. The surfaces of the pterygoids and the prearticulars were partly covered with superficial denticles that were shed individually, or episodically in large numbers during phases of total resorption at an advancing front. Isolated denticles were also shed and regrown independently of those around them. After the episodic resorption, newly formed denticles were gradually embedded in, and in some places overgrown by, a layer of simple superficial dentine. This was then invaded by hard pleromic dentine. The next resorption phase did not remove all this dentine, and callosities of hard, compact dentine remained to continue pleromic growth into the palate. The generic relationships inferred from this unique dental pattern are discussed. A consideration of the complex of features forming the feeding apparatus leads to the conclusion that *Holodipterus* shares more characters with members of the denticulate dipnoan lineage than the tooth-plated lineage. However, characters shared with the primitive tooth-plated genus *Speonesydrium* may be significant. Further information on the dental structure of some other genera, particularly *Fleurantia*, is required before more definite conclusions can be reached.

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This work is dedicated to the memory of E.S. Hills, formerly Professor of Geology at the University of Melbourne, who died in 1986. In the *Records of the Australian Museum*, Volume 21, 1941, he published a paper on the primitive Devonian lungfish *Dipnorhynchus sussmilchi* (Eth. fil) which initiated a new phase of palaeontological study of the Dipnoi in Australia and overseas.