# Use of Tooth Enamel Microstructure in the Study of Dinosaur Paleobiology: Perspectives and Potentials

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Abstract

*Dental encimei is the most highly mineralized tissue of organisms and undergoes little diagenetic alteration through time. Although considerable attention has been given to the microstructure of encimei of fossil mammals, very little attention has been paid to lhe analysis of encimei structure in dinosaurs. However, recent analysis of enamel microstructure in reptiles reveals that this tissue may be a valuable source of information in cladistic analysis, and also on the evaluation of speculations on the metabolism of dinosaurs and other extinct reptiles. In this article we review some relevant concepts of enamel microstructure and discuss the potential uses of this tissue in the study of dinosaur paleobiology.*

**Key-words:** *Tooth Enamel Microstructure, Dinosaur Teeth, Paleobiology.*

**Resumo**

O esmalte dental é o tecido mais mineralizado do organismo e, por isto, está sujeito a poucas alterações diagenéticas quando comparado a outros tecidos. A microestrutura do esmalte dental tem sido extensivamente estudada em fósseis de mamíferos, no entanto, pouca atenção tem sido dada a esta estrutura em dinossauros e outros repteis. Recentes análises da microestrutura do esmalte dental têm mostrado que este tecido pode fornecer importantes informações na análise taxonômica, permitindo também especulações sobre o metabolismo de dinossauros e outros répteis extintos. O presente artigo revisa alguns aspectos da microestrutura do esmalte dental e discute suas possíveis aplicações no estudo da paleobiologia dos dinossauros.

**Palavras-chave:** Microestrutura dentária, Dentes de Dinossauros, Paleobiologia.

## 1. Introduction

Understanding of dinosaur physiology, systematics and habits is an important matter in vertebrate paleontology. Since dinosaurs are extinct for at least 65 million years, the study of these creatures relies mainly on the observation of fossilized material. Much of what is known about the natural history of dinosaurs has been learnt by the study of tooth and bone anatomy. A number of other features such as footprints, chemical analysis, bone histology and even coprolites have been utilised (REID, 198l;CHlN *et al.*, 1998; CARVALHO, 2000).

Dental enamel is the most highly mineralized tissue of vertebrates. It consists mainly of submicroscopic crystals of hydroxyapatite. The analysis of fossil enamel has shown that it undergoes negligible diagenetic alteration through time. even in fossils more than 200 million years old (SAHNI, 1987). In the past few decades, considerable attention has been given to the microstructure of enamel in fossil mammals, and these studies have revealed important aspects of mammalian evolution (SAHNÍ, 1979; KOENIGSWALD *et al.*, 1987). The few studies regarding fossilized teeth of dinosaurs, are limited to descriptive analysis of the enamel structure (DAUPHIN, 1988; TORII, 1998). However, a recent and more comprehensive analysis of enamel microstructure in living reptiles and a Canadian carnosaur revealed that enamel microstructure is a valuable source of information in the study of dinosaurs and other extinct ectotherm (LINE, 2000). In this article T review some relevant concepts of enamel microstructure and discuss the potential uses of this tissue in paleobiology.

## 2. Enamel growth lines

The deposition of dental enamel is marked by the formation of growth lines, which reflect incremental growth. Incremental lines of enamel have been extensively used to investigate the temporal and spatial patterns of tooth development in living and fossil mammals (DEAN, 1987; DUMONT. 1995; SHELLIS, 1998; RISNES, 1998). Prism cross-striations are an internai record of time, which represent a diurnal rhythm in enamel formation. Measurements of the repeat interval can provide precise information on the rate of enamel deposition.

Although periodic markings have been observed in the enamel of non-mammalian vertebrates (DAUPHIN, 1988), the first analysis of the repeat interval in the enamel of ectotherms was published only recently (LINE. 2000). Small incremental repeats, ranging from 0.4 to 2 mm. were observed in the three living species analysed *(Rana castebeiana, Caiman crocodilus, Tropidurus torquatus).* However, the repeat interval found in the enamel of a Canadian carnosaur (3.9-6 mm, The tooth fragment was found in the Judith River Formation of southern Alberta, and is from the late Cretaceous. about 75 Ma old) was significantly larger than that of the other animais analysed, having approximately the same dimensions reported for human enamel periodicity (DUMONT, 1995). Furthermore, these incremental markings were more conspicuous than mammalian prism cross striation (figure 1). These simple morphological observations may have important implications, as they can provide new insights into dinosaur biology.