

Abstract of the Dissertation

Incremental Development of Primate Dental Enamel

by

Tanya Michelle Smith

Doctor of Philosophy

in

Anthropology

Stony Brook University

2004

Tooth development is characterized by rhythmic secretions of enamel- and dentine-forming cells, permanently recorded in the mineralizing tissues, which are analogous to structural layers in marine organisms or tree trunks. Recent work has challenged the periodic nature of incremental features and the accuracy of histological analyses. In this study, experimentally labeled macaque (*Macaca nemestrina*) teeth were examined under regular and fluorescent light microscopy, and incremental features were related to injection intervals, demonstrating the existence of sub-daily, daily, and multiple-day rhythms. Using these features, the enamel crown formation time (CFT) and age at death were determined in several molars from individuals of known age at death. The accuracy of standard methodology for incremental development analysis was shown to be greater than 90%, and section obliquity is suggested to be the main source of error.

Previous analyses of non-human hominoid molar microstructure have been limited to seven individuals or fewer per genus. In this study, incremental features were examined in 267 histological sections of the mesial and distal cusps of 134 chimpanzee (*Pan troglodytes*) molars from 75 individuals. When possible, cuspal enamel secretion rate, Retzius line periodicity and Retzius line number were quantified, and CFT was determined for individual cusps. Daily secretion rate generally increases from inner to outer cuspal enamel, with an average rate of four microns per day. Retzius line periodicity generally ranges from 6 - 7 days, and appears to be consistent within teeth from the same dentition. Retzius line number varies within a cusp type, among cusps, and among molars, as does cuspal enamel thickness, resulting in CFT variation. Cusp-specific crown formation time generally ranges from two to three years, increasing from first to second molars, and often decreasing from second to third molars. These times are more similar to radiographic data than a previous histological study.

Given well-prepared material, counts and measurements of incremental features yield highly accurate estimates of the rate and duration of crown formation. Results from a large sample show that certain aspects of hominoid molar development vary considerably, which has implications for the taxonomic interpretation of small samples of living and fossil hominoids.