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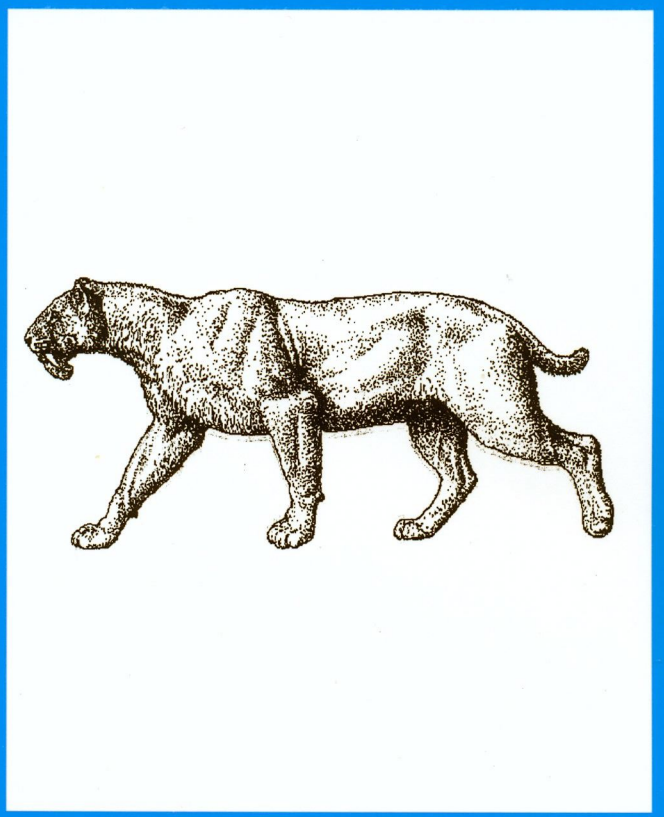

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Amelogenesis Imperfecta on a Deciduous Molar of *Coelodonta antiquitatis* (Blumenbach, 1799) (Mammalia, Rhinocerotidae) from Late Pleistocene Levels of Grotta di Fumane (Verona, Northern Italy): A Rare Case Report

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ABSTRACT

A particular rare case of dental structural anomaly of genetic origin is described. Such anomaly was ascertained on a deciduous molar of rhinoceros attributed by the authors to *Coelodonta antiquitatis* (Blumenbach, 1799) discovered in the Late Pleistocene levels of a cave described as Grotta-Riparo di Fumane (Verona, Northern Italy). The finding is particularly interesting because in the literature several anomalies about dentitions of mammals have been reported, but they are referred to present species; also, some anomalies concerning dentitions of rhinoceroses are described, but they only refer to malpositionings, irregular eruptions, *hyperodontiae,* asymmetries, rotations. Quantitative histological analyses are performed and the diagnosis of amelogenesis imperfecta of hypoplastic type autosomic-dominant was predicated.

Key Words: amelogenesis imperfecta (hypoplastic type, autosomic-dominant), Aurignacian, ectoloph, Levallois technology, Middle and Late Palaeolithic.

INTRODUCTION

In a cave, described as Grotta-Riparo di Fumane (about 350 m asl) (Valle di Manune, Monti Lessini, Verona, Northern Italy), in the Aurignacian levels, in addition to the skeletal remains of several mammalian and bird species, a tooth, belonging to a Rhinocerotidae, was discovered. It is the first and only discovery of a Rhinocerotidae remain in this site. The deposit, rich in levels, shows evidences of intense human occupation. The oldest level is referable to the Middle Palaeolithic and presents a lithic assemblage characterized by Levallois technology. The most recent levels are referred to the aurignacian occupation and are characterized by the presence of living structures (pit-hearths, post holes, organized arrangements of stones) (Broglio and Cremaschi, 1989-90, Bartolomei *et al.,* 1994). A lot of bones of several mammalian species *(Capra ibex, Cervus elaphus, Capreolus capreolus, Rupicapra rupicapra, Bison priscus, Megaloceros* cfr. *M. giganteus, Canis lupus, Vulpes vulpes, Ursus arctos, Crocuta crocuta, Panthera leo, Panthera pardus, Lynx lynx, Felis silvestris, Gulo gulo, Mustela putorius, Mustela erminea, Mustela nivalis, Martes* sp., *Lepus* cfr. *L. timidus, Marmota marmota, Castor fiber, Hystrix cristata*) and 47 different bird species (the most frequent ones are *Lyrurus tetrix, Crex crex, Pyrrhocorax graculus*) were discovered in the cave; these remains are mainly the result of human activity (Cassoli and Tagliacozzo, 1994). They are present mainly in the Aurignacian levels. A series of ^{14}C dates place the Aurignacian occupation between 37,000-35,000 and 32,000 years B.P. (Bartolomei *et al.,* 1994). According to

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the authors, the introduction of the tooth into the cave could probably be due to an occasional human action.

Compared to the permanent teeth, the discovery of rhinoceros deciduous teeth in archaeo-palaeontological sites is very rare; moreover, very often they are recovered as single specimens.

DENTAL STRUCTURAL ANOMALIES IN MAMMALS

As is known, odontogenesis is well genetically determined for each single species. If pathological factors occur, as a consequence there will be an anomalous development of the different dental tissues (enamel, dentine, cementum). Summarizing, dental structural anomalies can be classified as follows: anomalies due to local causes; anomalies induced by general pathologies; anomalies due to fluorosis aendemica; idiopathic anomalies; anomalies due to drug assumption; genetic anomalies. This last group includes, besides dentinogenesis imperfecta and dentinal displasia, also amelogenesis imperfecta. Amelogenesis imperfecta, anomaly localized exclusively on the enamel, is a consequence of pseudohyperparathyroidism, pathology of the proximal tubules of the kidney that produces a reduced absorption of phosphates. It has hereditary character and affect both arcades for deciduous and permanent teeth. It may be present in four forms: hypoplastic (quantitative defect), hypomineralized or hypocalcified (qualitative defect), hypomature and hypomature-hypoplastic with taurodontism. These four forms have been subdivided in fourteen subforms (Witkop, 1988). The hypoplastic form —the case that specifically interests us here— presents a normal structure of the enamel, but the quantity of tissue is reduced. In this reduced matrix, minerals are deposited in normal quantity, therefore abrasion reduces the thickness of the crown in a very short time; the crown is smooth and bright. The teeth are not in contact each with other.

AMELOGENESIS IMPERFECTA IN MAMMALS DENTAL ANOMALIES ABOUT RHINOCEROSES

In the literature some cases of amelogenesis imperfecta in animals, described as enamel hypoplasias of genetic origin, have been reported: *Colobus guereza caudatus* by C. S. Tomes (1898); another *Colobus* by Remane (1926); *Canis familiaris* by Mellanby (1929); by Jones and Cave (1960) about chimpanzee; *Pan troglodytes* by Schultze (1970); *Equus caballus,* characterized by total absence of enamel, by Miles and Grigson (1990). All these reports are referred to recent species. No cases of amelogenesis imperfecta about rhinoceroses are reported. Also, other genetic and developmental anomalies about themselves have been described, but they only refer to malpositionings, irregular eruptions, *hyperodontiae,* asymmetries, rotations. Capellini (1894) reported, in a fossil rhinoceros, a malpositioning of a premolar associated with the retention of the corresponding deciduous and Vialli (1955) identified a case of rotation, malpositioning and morphological anomaly in a fourth upper premolar of a modern african rhinoceros *Rhinoceros simus cottoni* Lyd. (=*Ceratotherium simum cottoni* Lyd.) preserved at National History Museum in Milan. Chow (1961) reports a mandible of *C. antiquitatis* from the site of Siki (China) presenting pathological features and Groiss *et al.* (1981) describe the malpositioning of second, third and fourth upper premolars always in *C. antiquitatis;* still in *C. antiquitatis,* Garutt (1990) has described supernumerary fourth upper premolar and third lower molar (*hyperodontia*) as possible atavism, while the same author (1992, 1994) shows a case of malpositioning, again in *C. antiquitatis,* of a fourth upper premolar due to its delayed eruption; such anomaly, according to the author, might be related to a juvenile fracture. Another malpositioning and malformation of a fourth upper premolar was reported for *Diceros bicornis* (Garutt 1994). Hillman-Smith *et al.* (1986) describe a supernumerary third lower molar in *C. simum,* in *C. antiquitatis* of Tatarstan and in *Rhinoceros mercki* (=*Stephanorhinus kirchbergensis*) preserved at the Halle Museum (Germany).

MATERIAL AND METHODS

Macroscopic analyses

The tooth from Fumane is a very worn upper deciduous molar —probably a second (D^2) (Fig. 1); it was very likely lost during the life of the animal because of the eruption of the second upper premolar. Although damaged in the bucco-distal and linguo-distal portion, the dimensions of the specimen are drastically reduced in comparison with homologous specimens (the length, along the buccal axis, is 27.5 mm). The tooth is made mainly of dentine, the whole surface is smooth and bright with reduced traces of thin and transparent enamel along the edges, inside the *medifossetta,* inside the distal *fossetta* and inside the interior valley; the color is very close to that of amber. On most of its surface there is a good quantity of MnO_2. The interior valley is connected to the *medifossetta* which is not completely closed. From the *norma pulparis,* the scarce development of the *bulbus pulparis* and the extremely reduced thickness of the enamel of the crown are evident. The morphological features of the specimen, including not completely closed *medifossetta,* allow its attribution to *Coelodonta antiquitatis* (Blumenbach, 1799)[1]. The hypothesis of a structural anomaly of the enamel produced by genetic factors referable to amelogenesis imperfecta of hypoplastic type is predicated on the macroscopic analysis of the specimen.

1. In the rest of the Italian peninsula, *C. antiquitatis* is recorded at Fadalto nel Polesine [Rovigo, Northern Italy] [Leonardi, 1947a, 1947b], at Opicina [Trieste, Northern Italy] [Leonardi, 1947a, 1947b; Bartolomei, Peretto and Sala, 1977], at Monte Circeo [Lazio, Central Italy] [Palmarelli and Palombo, 1981], in Terra d'Otranto [Apulia, Southern Italy] [Botti, 1890; Vaufrey, 1927], in the Grotta dei Pipistrelli [Matera, Southern Italy] [Flores, 1895; Guérin, 1980], at Ingarano [Gargano, Southern Italy] [Billia *et al.*, 1995; 1996].

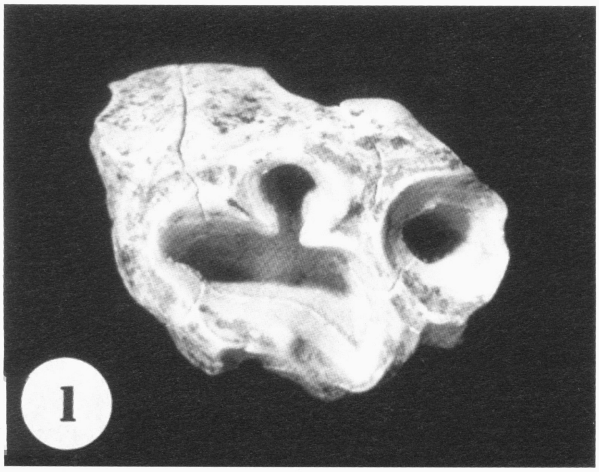

FIG. 1. *Coelodonta antiquitatis* (Blumenbach, 1799); Late Pleistocene; Fremane (Verona, Northern Italy) second (?) upper deciduous molar; *norma occluso-labialis* (max length 27.5 mm).

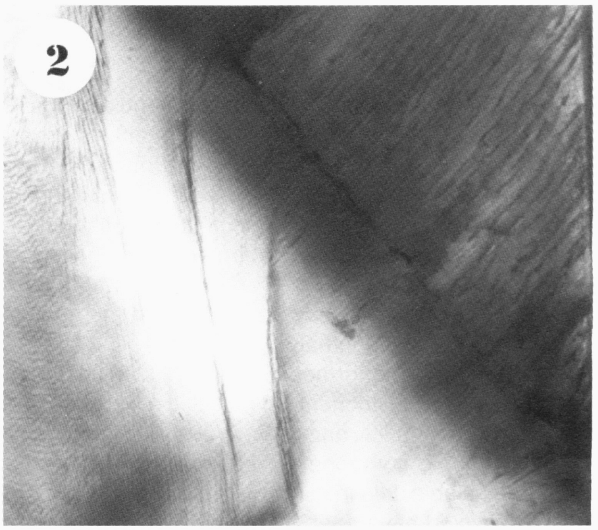

FIG. 2. Occlusal-distal section, EDJ (20x).

Microscopic analyses

In order to confirm the macroscopic diagnosis a histological examination of the specimen from Fumane was undertaken. It has been observed under binocular microscope and photographed from different views. Using fine diamond disks —in order not to damage the remain— two portions of dental tissues, one from the occluso-distal part (distal *fossetta)* in longitudinal section, and the other one from the disto-cervical part, were removed. From these thin sections were made by embedding them in a solid block of epoxy-resin Epo-thin (Buehler) and then sectioning them with a microtome until the desired thickness (110μ-80μ) was obtained. During the operations, about 15% of sections was lost because of fragility and porosity of the materials themselves. For the same reason, in only 40% of the cases was it possible to obtain samples where enamel and dentine were observable in the same plane. The resulting thin sections were then examined at the microscope under transmitted polarized light (Laser-Scan ZEISS, Oberkochen-Germany) at the Faculty of Dentistry of Calvary Hospital in Rome. By using a high resolution videocamera connected to a computer, color digital images were obtained. These images allowed the formulation of the diagnosis.

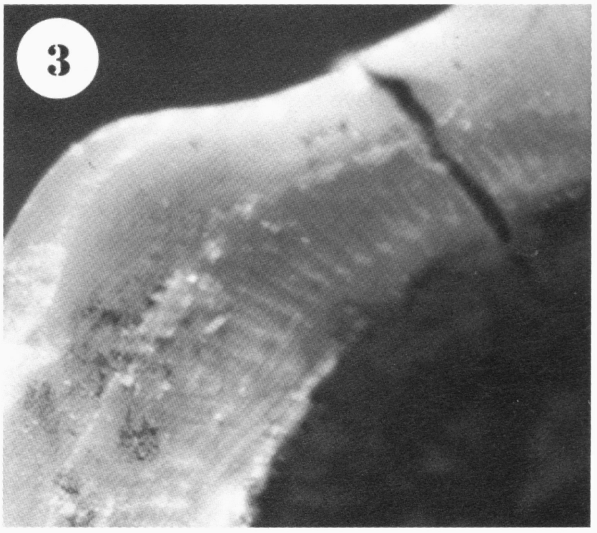

FIG. 3. Thickness of the enamel in the distal *fossetta.*

RESULTS

On the occluso-distal section of the specimen the presence of enamel and dentine can be observed; dentinal tubules are regular, branched, developing anastomosis and finishing with dead ends in the interglobular spaces and in the enamel-dentine junction (EDJ) (Fig. 2). The enamel presents a normal qualitative aspect, but quantitatively it is thinner than in normal cases (Fig. 3). Also, crack on dentine with MnO_2 sediments is observed. On the surface of the distal-cervical sample, which is irregular, dentine and MnO_2 sediments are present, but enamel is absent (Fig. 4). It is evident that on the surface of the crown the enamel was worn because of an anomalous development.

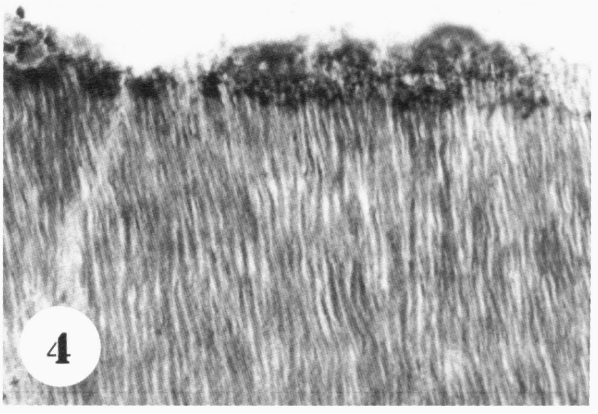

FIG. 4. Distal-cervical section, dentine (40x).

DISCUSSION

The fact that the enamel-dentine junction is undulating and the trend of the dentinal tubules is regular (Figs. 2 and 4) excludes the possibility of dentinogenesis imperfecta: if this were the case the enamel-dentine junction would be straight and the trend of the dentinal tubules would be irregular. The condition observed on the tooth from Fumane has confirmed the diagnosis of amelogenesis imperfecta of the hypoplastic type autosomic-dominant. It may be considered the earliest case of this genetic anomaly.

The analyses performed were only quantitative. At the present time, histochemical (specific coloration) and immuno-histochemical analyses, to evaluate the organic vs. non-organic components, are not appropriate for providing reliable data in the case of fossil remains. DNA analyses would have not been possible, in this specific case, because of the reduced dimensions of the remain and because, in various times, they have been manipulated possibly contaminated by several DNA; furthermore, in these cases, would have been very difficult to find a whole molecule of DNA. However, in this specific case, it would have been necessary to pulverize the tooth in order to take away from it a non-contamined portion, a process that would have required the distruction of this rare specimen.

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