The tooth enamel of the Atapuerca hominids grew faster than in modern humans

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Individual XVIII teeth from la Sima de los Huesos. Credit: (Atapuerca)/M. Modesto-Mata/CENIEH

The CENIEH has conducted the first study which tackles counting the two types of enamel growth lines, in Lower Pleistocene and Middle Pleistocene populations in Europe. The data obtained in this research, together with those from other studies under way, could constitute the first solid evidence showing that the hominids from the Sierra de Atapuerca reached maturity earlier than modern humans

The Dental Anthropology Group of the Centro Nacional de Investigación sobre la Evolución Humana (CENIEH) has just published a paper in the journal *Scientific Reports*, led by the paleoanthropologist Mario Modesto-Mata, which counts for the first time the two types of growth lines observed in the tooth enamel of Lower and Middle Pleistocene hominids in Europe. This investigation has focused in particular on the species recognized at the sites in the Sierra de Atapuerca. The results indicate that the growth rate of the enamel in these hominids could have been up to 25% faster than in Homo sapiens.

This study closely examined the formation of enamel in the Atapuerca hominids, both at the sites of Sima del Elefante (1.2 million years), Gran Dolina-TD6 (Homo antecessor: 850,000 years) and Sima de los Huesos (430,000 years), in addition to in a fairly extensive collection of Homo sapiens teeth.

Modesto-Mata says, "teeth grow like onions, tree trunks, stalactites and hair…, that is, in layers and with regular intervals of formation, and it is precisely this way of growing which enables us to identify the different growth lines in tooth enamel."

There exist two types of growth line in the enamel, which remain unchanged throughout the individual's life: the short striations and the long striations.

The short ones, technically known as cross-striations, are formed each day (circadian growth) through the deposition of specific proteins by the ameloblasts, which are the cells responsible for forming enamel. When the proteins crystallize it is possible to observe a distance of a few microns between successive cross-striations. Approximately every 7-8 days, the work of the ameloblasts stops for a short period.

This brief stoppage gives place to the formation of the long striations,

visible under low-magnification microscopy, and which were described by Anders Retzius back in the nineteenth century. Between every two so-called striae of Retzius, some seven or eight cross-striations can be counted, making it possible to time the tooth enamel formation process very precisely. This number, called the periodicity, is constant in all the teeth of a single individual, and appears to be different in each species of hominid.

The lines at Atapuerca

The data found in this investigation suggest that the periodicity was lower in ancestral species, like those which lived in the Sierra de Atapuerca. In other words, the human tooth enamel recovered from the Sima del Elefante, Gran Dolina and Sima de los Huesos sites formed more rapidly than in modern human populations. "The estimations made in this work indicate that the crowns of the teeth of species such as Homo antecessor formed up to 25% more quickly than in recent humans," he adds.

One of the main problems the authors have had to grapple with is that of working with teeth worn by the effects of mastication. One part of the growth lines disappears as the enamel is worn down by use. "To overcome this problem, we developed a statistical technique based on polynomial regressions which lets us estimate the proportion of the enamel that has been lost, and thus compensate for the growth lines that have vanished," explains Modesto-Mata.

The data obtained in this research, taken with other studies still under way on relative tooth development and root growth, could constitute the first solid evidence of earlier skeletal maturity for the species obtained from the sites of the Sierra de Atapuerca. "If that is right, these humans reached adulthood several years earlier than we do," he concludes.

More information: Mario Modesto-Mata et al. Short and long period growth markers of enamel formation distinguish European Pleistocene hominins, *Scientific Reports* (2020). DOI: 10.1038/s41598-020-61659-y

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