December 03, 2019

Evolution & Behavior

Ancient human DNA from a 10000 years old "chewing gum"

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This Break was edited by Max Caine, *Editor-in-chief* - TheScienceBreaker

ABSTRACT

We identified a new type of source of ancient human genetic data. Our group extracted DNA from Mesolithic masticated lumps, made from distilled birch bark pitch. The people in the Stone Age presumably chewed this material leaving behind ancient human DNA.

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In recent decades ancient DNA has been continuously used as a part of the tool-kit for studying human history and evolution. Ancient human DNA is found in both organic and inorganic material, for example, bones, teeth, mummified materials, coprolites, soil, etc.

Bones and teeth harbor the most significant amount of ancient human DNA. However, the preservation of such material is often a problem, and the amount of well-preserved human remains is scarce. Furthermore, most ancient human remains often cannot be connected to material culture, lacking any traces of "cultural hints" at the original location of the human remains. This issue becomes especially problematic for interdisciplinary studies as archaeological and demographic studies.

In our study, we extract human DNA nearly 10,000 years old from a new type of material. This source was masticated lumps from an early Mesolithic maritime site in western Sweden. This type of sticky glue product from birch bark was widely used as an adhesive agent by people all across Eurasia during the Stone Age. Remnants of this glue are found on different artifacts, from spear-heads to vessels and pottery and as chewed pieces as well. We can not confirm or deny the use of masticates as chewing gums in the Mesolithic age, but since these mastic pieces had "chewing gum" morphology and some carry teeth imprints, we called them chewing gums

within our project. The morphology of these mastic pieces gave the idea of looking for ancient DNA in this material. This study showcases DNA from three mastic gums and associated artifacts of stone tool production from the same site, fusing archaeology and population genetics.

The mastic and stone tools analyzed in this study derive from the “deep pit” deposit of Huseby Klev site, excavated in the early 1990s. The DNA from the three masticated lumps turned out to be fragmented, as ancient DNA should be and with a relatively low level of modern contamination. The sequences were plotted together with ancient European hunter-gatherers, which was another way to confirm that this DNA was indeed from Mesolithic individuals from the Huseby Klev site. The combination of genetic and local artifact analysis (also called lithic analysis) suggests that stone tool technology found at Huseby Klev and the genetic makeup of the people who used the technology can be traced to different areas of origin in Ice Age Eurasia. The artifact technology was brought to Scandinavia from the East European Plain, while the DNA from the mastics indicates early postglacial inhabitants of Western Europe. Such a clear connection between material culture and genetics is possible because "chewing gums" preserve DNA from people who were present at the site, and may have participated in everyday activities, tool production, and maintenance. We confirm that both sexes were present at the site and that this DNA is the earliest human genomic evidence from Scandinavia to date. The mastics material allows us to study both archaeological contexts and human genetics were we do not find any human remains.

In conclusion, we discovered a snapshot of DNA from living mesolithic people. Similar to a Jurassic Park scenario, where amber-capsuled insect preserved dino-blood, we find human saliva DNA in chewed masticated lumps from Stone Age. The DNA in the mastics connects the genetics and the cultural affiliation of the mesolithic dwellers of the Huseby Klev site. We used this human DNA to research the demography and culture of ancient dwellers of Western Scandinavia. We discuss the western origin of these pioneers, who used artifacts from the east. We have a lot of questions to answer in our further research, and we hope that other researchers will start using this material to update our ancient human DNA database.