Analysis of ^{14}C and ^{13}C in teeth to assist in identification work

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ABSTRACT

The characterization of unidentified bodies or suspected human remains is a frequent and important task for forensic investigators. However, any identification method requires clues to the person's identity to allow for comparisons with missing persons. If such clues are lacking, information about the year of birth, sex and geographic origin of the victim, is particularly helpful to limit the search for possible matches. We here present results of stable isotope analysis of ^{13}C, giving a clue to geographical origin, and bomb-pulse ^{14}C analyses for birth dating. The ^{14}C analysis of enamel can provide information of the year of birth with an average absolute error of 1.1 ± 1.3 years (1).

A human skeleton covered by 40 cm of soil at a construction site in Sweden during excavation work early 2015. Forensic examination revealed that the person had been killed by blunt force to the head. The responsible pathologist estimated the deceased to have been dead for less than 1 year, but could only provide a vague estimate regarding the age of the subject and reported that the person could be 25-45 years, which allowed for numerous alternatives.

Two teeth were extracted and enamel and roots were subjected to both ^{14}C, and ^{13}C analysis.

The average concentration of ^{14}C in both teeth enamel suggested enamel laydown at 1973.0. Using reference information about ^{14}C incorporation times in tooth enamel (2), the birth of the individual was calculated to be 1968.7.

^{13}C values were generally low, fitting individuals grown up in Scandinavia. At first, the police checked the missing person register and found 11 possible alternatives, however none of these matched DNA of putative relatives. Based on the isotope results, the police redirected their search and found a possible match, which was confirmed by DNA profile. This individual was indeed a male, and born 1967.8.

During the fall of 2014 a dead body was found in the water close to the Swedish east coast. The body was severely decomposed, but the characteristics of the body suggested a female. Three teeth were prepared for separate analysis of crown and root. The average birth of date of the person was estimated to 1976.6. The ^{13}C analysis of both crowns and roots showed somewhat higher values than those typical of the Scandinavian population.

Based on this information, the police eventually found a possible match, that was confirmed by DNA analysis of samples from muscles and bones of the body and blood

samples from relatives. The person was identified as a woman born 1975,4 from continental Europe. These cases illustrate the usefulness of isotope analysis in forensic casework.

References:

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