

TOF-SIMS ANALYSIS OF HAIR FROM ARCHAEOLOGICAL REMAINS

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ToF-SIMS has been used to analyse elemental and molecular species in single hairs from approximately 1000 to 1500 year old mummified remains excavated from Pacatnamu, Peru. A technique has been developed for the longitudinal sectioning of hair samples to compare the internal and external concentrations in an effort to identify biogenic and diagenetic composition.

The nutritional source of growing hair is the blood supply, which contains traces of anything consumed by the individual. These xenobiotics and their metabolites become incorporated into the growing hair matrix. Hair analysis has been utilised in the study of nutrition, dietary habits, exposure to toxins, and drug abuse. However controversy exists, particularly in trace element research, regarding the role of exogenous contaminants. A full understanding of the stability of the hair matrix over time and hence its value in the study of ancient cultures is yet to be realised.

The method implemented here is not a bulk method, as is typically used and hence, has an ability to distinguish contamination from endogenous contributions. This method is valuable for the study of rare, valuable and/or minute samples, such as those from mummies where it is beneficial to use as little material as possible. Research performed by the authors has aimed at increasing the level of knowledge regarding the processes affecting constituents of hair samples from ancient civilisations.

Results from the analyses indicate that the burial environment plays an important role in the postmortem variation in elemental content of the hair samples. Various elements demonstrate an ability to permeate through the hair matrix over time. In addition, NaCl salt and what are believed to be aluminosilicates have been observed to accumulate on the surface of the hair. Various molecular fragments such as cysteic acid have been used to identify the extent and localisation of oxidation of the keratin proteins. Potential has also been found in the use of ToF-SIMS for the measurement of isotopic values indicative of dietary habits.
