H101 Developing the "Isotope Fingerprint" in Human Skeletal Remains

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After attending this presentation, attendees will have an increased knowledge of the potential for isotope based analysis of human skeletal remains, which will assist in the identification of the post-mortem interval, and may further provide information which will suggest country, or region, of origin of the deceased, and even age estimations at death.

The authors consider that the analytic method will be of great benefit in investigations, providing information that will assist in identifying an individual, and provide additional information that, until now, had not been available to those examining skeletal remains.

With increased global transportation and movement of individuals, notably those gaining entry illegally into countries, any such method that can aid in identifying a deceased based upon isotope concentrations would be of great importance.

Forensic pathologists are often requested to examine remains that have been unearthed during excavations and building developments, particularly in light of the publicity surrounding recent criminal cases. Once it has been established that the remains are indeed human the question of period of internment arises. Despite the extensive literature published upon this subject it remains notoriously difficult to quantify with the majority of cases relying heavily upon the "experience" of the investigating pathologist.Whether such experience yields correct answers is questionable; corroborating evidence is often absent and therefore the pathologist is unable to recognise any errors in judgement.

It is generally accepted that remains should be no more than 75 years old to warrant police interest. Therefore any reliable dating method should distinguish bones from within this interval accurately from those lying outside of it. Previous work has focused upon the physiochemical properties of bone or its organic constituents, though the results have failed to produce a workable calibration system. Several papers have also suggested the measurement of specific radionuclides which, unlike methods that depended upon chemical changes, are affected less by alterations within the physiochemical environment to which bones have lain exposed.

Radiocarbon (14C) has proved a valuable tool for dating archaeological samples for over 50 years now. However, with a half-life of 5730 years, the accuracy of this technique within a narrower time frame has yet to be verified.

Previously the concentrations of 210Pb and 210Po have been determined in human bone mainly to evaluate the contribution to internal radiation doses. Little work has been undertaken into the potential for using these isotopes as detection tools for dating human skeletal remains, despite appropriate radioactive half lives (notably 22.3 years and 138.4 days for 210Pb and 210Po, respectively). The research is therefore examining the potential for using such isotopes as predictable biological clocks; ones that are activated at death and through analysis of which can provide the investigators with an accurate and reliable indicator of the post-mortem interval.

Though used in archaeology the use of radionuclide mapping has yet to be developed in forensic science. The theory is based upon the knowledge that in life an individual incorporates its environment into its body over time. The food we eat, the water we drink, the air we breathe all contain small quantities of isotopes and trace elements that, once ingested, enter our skeletal system to a varying degree. These quantities alter between geographical regions and countries, depending upon the underlying geology of the areas. It should therefore be possible, through the analysis of material, to confirm the region that the individual lived within when they died.

The forensic applications of both such systems would be of great benefit to both police forces and international organizations by narrowing search parameters down greatly. In cases where no documentation has been found to suggest where they lived, such a test would be invaluable to investigating officers who possess relatively limited resources.

Our initial results would appear to confirm these hypotheses and have proved useful in on-going investigations.

Isotope, Fingerprint, Postmortem Interval

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