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Mapping Bio-available Strontium Isotopic Compositions in Past Migrations: A Comparison of Modern and Archaeological Sampling Materials

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Strontium isotopes are a powerful tool for tracking modern and archaeological human and animal migrations. 87Sr/86Sr ratios in ecosystems depend primarily on their geological substratum and are not affected by biological processes. Strontium in human and animal tissues is mainly derived from diet and is almost exclusively stored in bones and teeth. Therefore, the comparison of the strontium isotope ratios of human/animal skeletons in combination with strontium isotope reference maps can provide insights into food sources and, by extension, habitat. But how do we build such maps? In particular, which samples provide the "right" comparative values when it comes to human/animal migration? And how can we ensure that such reference isotope data are relevant when applied to past populations?

To answer these questions, we present a preliminary study conducted in Eastern Germany (Sachsen-Anhalt) within the framework of the interdisciplinary Langobards Project supported by the German Ministry of Education and Research (BMBF). The overall aim of the project is to reconstruct the mobility and migration patterns of the Langobard population groups from the Lower Elbe to Italy during the early medieval epoch. Isotope mapping is crucial in helping to determine the provenance of the human remains. Therefore, various biological and geological samples (modern vegetation, rocks, river water, soil extracts, modern and archaeological animal teeth, snail and bivalve shells) were collected in the vicinity of two cemeteries (5/6th century A.D) in order to investigate the 87Sr/86Sr ratio isoscapes of the biosphere relevant to the migration questions. What to sample and how to map are major issues that are addressed in this study in order to draw inferences about past human mobility.
Our data show severe discrepancies among different materials from the same geological units. For example, although snail shells were collected in forests to minimize the contribution of fertilizers, they usually yield lower 87Sr/86Sr ratios than those of ground vegetation samples (average difference: 0.00019 ± 0.00038), which themselves are usually lower than those found in tree leave samples (average difference: 0.00027 ± 0.00017). In addition, the influence of modern fertilizers (with 87Sr/86Sr ratio of 0.70555 as determined by a ground vegetation sample collected on an agricultural field) is very likely seen in modern deer teeth 87Sr/86Sr, questioning the use of modern medium sized home range animals in mapping bio-available 87Sr/86Sr ratios. In contrast, although providing an average of the strontium isotope ratios of the geological units they pass over, river samples, when they are not affected by anthropogenic activity appear to provide a reliable guide as a first approximation of the modern regional variability.