

Why we need extensive, regional, bioavailable Sr isotope baselines for human mobility studies in archaeology: A case from the Peloponnese

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Sr isotopes have been applied as a provenance tracer in archaeology for over three decades providing unprecedented insights into past human mobility at an individual level. However, their successful application requires a comparison to the bioavailable Sr isotopic composition characteristic for the areas where finds were unearthed or are suspected to originate from (referred to as baseline). Due to financial reasons or other limitations many studies only take a few baseline samples within or in close proximity to the archaeological site for reference purposes. This can introduce large uncertainties to the interpretation of human ⁸⁷Sr/⁸⁶Sr data especially in geologically complex areas. Here, we present Sr concentrations and isotopic data of modern environmental proxies (plants, soils and water) sampled at 52 sites across the Peloponnese, Greece, and compare them to previously published ⁸⁷Sr/⁸⁶Sr data to evaluate the need for extensive regional baselines. The bioavailable Sr isotopic composition of the Peloponnese is characterised by a wide range in ⁸⁷Sr/⁸⁶Sr values (0.7077 – 0.7237). The distribution of the ⁸⁷Sr/⁸⁶Sr data corresponds well with the surface lithology, suggesting a dominance of Sr derived from the bedrocks. The ⁸⁷Sr/⁸⁶Sr baselines defined by the environmental samples taken from areas characterised by clastic and chemical surface sediments are calculated as comparatively unradiogenic, narrow ⁸⁷Sr/⁸⁶Sr ranges of 0.70832 ± 0.00053 ($\bar{x} \pm 2\sigma$) and 0.70835 ± 0.00089 ($\bar{x} \pm 2\sigma$), respectively. In contrast, the areas characterised by metamorphic outcrops are characterised by more radiogenic ⁸⁷Sr/⁸⁶Sr signals with wider ⁸⁷Sr/⁸⁶Sr baseline ranges of 0.70906 ± 0.00116 ($\bar{x} \pm 2\sigma$) and 0.71429 ± 0.01133 ($\bar{x} \pm 2\sigma$) for marbles and schists, respectively. These significantly extend the bioavailable ⁸⁷Sr/⁸⁶Sr baseline data of the Peloponnese compared to previously published data (0.70841 ± 0.00092 ; $\bar{x} \pm 2\sigma$). This emphasises the importance of regionally extensive sampling in geologically complex areas, such as the Peloponnese, to reduce uncertainties in the application of Sr isotopes as a tracer for past human mobility.