Controlled feeding experiments of rodents to determine intra-population $^{87}Sr/^{86}Sr$, $\delta^{88}Sr$ and $\delta^{44}Ca$ variability of hard and soft tissues

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Radiogenic Sr isotopes in biogenic apatite, especially enamel, are widely employed to determine provenance and track human and animal migration. Body tissues record the $^{87}Sr/^{86}Sr$ composition of ingested food and water, allowing the reconstruction of provenance and mobility of individuals across a landscape. In contrast, stable Sr and Ca isotopes are proxies for the trophic level of an individual, allowing the reconstruction of past and present food webs. To quantify the contribution of diet and water, as well as the fractionation of Sr and Ca isotopes in different mammalian hard and soft tissues, controlled feeding studies are necessary.

Here we present results from controlled feeding experiments with two rodent species (rats and guinea pigs) that were fed up to 59 days with different pelleted and natural diets, representing different trophic levels (plant, insect and meat). All groups received Zürich tap water, except one, which received Ca- and Sr-rich mineral water instead to assess the influence of water versus food on Ca and Sr uptake. By comparing the inter-individual range within each dietary group, it is possible to assess the variability of Sr and Ca isotopes in different body tissues with distinct turnover rates under controlled conditions and for different diets.

Due to the continuous and fast incremental growth of rat and guinea pig incisors (~1-2 mm/week), this enamel is expected to record dietary changes continuously. A staggered killing approach was used to monitor isotopic changes in body tissues with different turn-over rates, including blood, muscle, hair, liver, kidney, bone and enamel. Serial intra-tooth $^{87}Sr/^{86}Sr$ analysis of incisors was performed by LA-MC-ICP-MS, to determine the timing of a diet switch.

This study will enable us to quantify the influence of Sr and Ca ingested from different sources on tissue $^{87}Sr/^{86}Sr$, $\delta^{88}Sr$ and $\delta^{44}Ca$ values and to determine the within-population variability of mammals feeding on different diets.