Sr isotope incorporation in soft tissues and enamel of rodents – controlled feeding experiments

MICHAEL WEBER[1], JENNIFER LEICHLITER[1], FEDERICO LUGLI[2], KLAUS PETER JOCHUM[3], MARCUS CLAUSS[4], THOMAS TÜTKEN[1]

[1]Institute of Geosciences, Johannes Gutenberg Universtity, Mainz, Germany (correspondence: mweber02@students.uni-mainz.de)
[2]Department of Cultural Heritage, University of Bologna, Ravenna, Italy
[3]Max-Planck-Institute for Chemistry, Mainz, Germany
[4]Vetsuisse, University of Zürich, Switzerland

Strontium isotopes in tooth enamel are widely applied to determine provenance and track migratory patterns of humans and animals. The Sr isotope composition of enamel reflects the $^{87}Sr/^{86}Sr$ of the ingested food and water. In addition, ingestion of mineral dust may contribute to the Sr intake of vertebrates. To quantify the contribution of Sr from diet (including mineral dust) versus water to $^{87}Sr/^{86}Sr$ in soft and hard tissues (bone, enamel), controlled feeding studies are necessary.

Here we present preliminary results from controlled feeding experiments with two rodent species (rats and guinea pigs) that were fed with different pelleted diets. Insect-, animal-, bone-, and plant-meal containing pellets were fed for up to 59 days in groups of six individuals each. Some guinea pigs were additionally fed lucerne-based pellets with different types of mineral dust, such as kaolin, loess and volcanic ash at a 4% level. All groups received Zürich tap water, except one group which recieved Ca- and Sr-rich mineral water.

The $^{87}Sr/^{86}Sr$ and Sr content of the bulk fodders and their main constituents, including mineral dust, as well as the drinking water, were analyzed to characterize the bioavailable Sr input. Due to the permanent and fast incremental growth of rat and guinea pig incisors (~1-2 mm/week), enamel is expected to record dietary changes. A staggered killing approach was used to monitor how fast the $^{87}Sr/^{86}Sr$ changes in body tissues with different turn-over rates, such as blood, muscle, hair, liver, kidney, bone and enamel, occurred. Serial intra-tooth $^{87}Sr/^{86}Sr$ and trace element analysis of incisors was performed by LA-(MC)-ICP-MS to determine: 1) the timing a diet switch becomes detectable in enamel and 2) if Sr from mineral dust is bioavailable and can compromise dietary $^{87}Sr/^{86}Sr$ values. Implications for diet and provenance reconstructions of vertebrates will be discussed.