DFG Research - Group FOR 1670

TRANSALPINE MOBILITY AND CULTURAL TRANSFER

Localized historic $^{87}Sr/^{86}Sr$ isotopic ratios defined by environmental data – a model – confirmed by regional data from Inn valley (Austria).

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1 Introduction

In our study, we rely on the analysis of $^{87}Sr/^{86}Sr$ isotope ratios in bio-archaeological materials such as animal skeletal remains and diet-related basics as water, soil and vegetation. We shall show that the definition of local versus non-local specimens ultimately depends on the type of biomaterial consumed and its respective strontium sources.

We try to establish this model calculation using complete data sets of various regions along the Inn valley.

The study shows how the analysis of a variety of materials will corroborate the definition of appropriate cut-off values, and how the contribution of dietary strontium limits the allocation to a consumer be it human or animal to a likely place of provenance.

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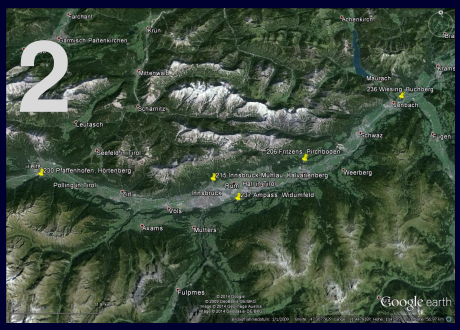


Aerial photograph of the Inn valley between Jenbach and Telfs. The sampled archaeological sites are marked with yellow taping pins. The Inn valley is one of the largest East-West extending valleys of the Alps filled with glacial sediments. It forms the boundary between the Northern Calcerous Alps and the Central Alps prevalently formed of crystalline rocks.

Sample description

206 Fritzens, Pirchboden
The Pirchboden is a hill site above Fritzens, type-locality of the Fritzens-Sanzeno culture (6th century B.C.) . The soil derives from the archaeologcal site, an argillaceous sand, light brown with crystalline boulder pavement of different size ($^{87}Sr/^{86}Sr$ of historic soil = 0.71490). Sampled vegetation are branches of hazelnut; the spring water derives from a nearby well.

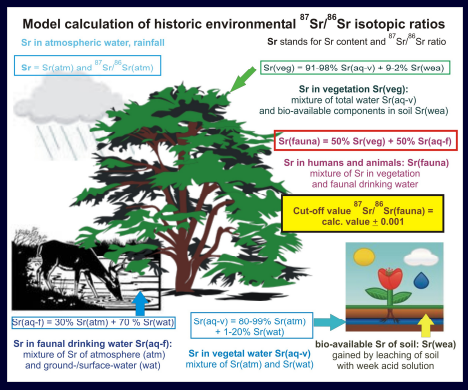
215 Innsbruck-Mühlau, Kalvarienberg
The soil derives from the side-cut of a road. It consists of brown rendzina soil with crystalline pebbles ($^{87}Sr/^{86}Sr$ = 0.70876). It is covered by landslide material with carbonate fragments. Vegetation (branches of hazelnut) and water (well) is sampled next to the church of the Kalvarienberg.

230 Pfaffenhofen/Inn, Hörtenberg
The Hörtenberg is an isolated hill near Pfaffenhofen. The Iorn Age archaeologic site is situated at the northern hill site near the Marienhof. The soil sample was taken from a road side cut 100 cm below surface. It consists of grey soft clay ($^{87}Sr/^{86}Sr$ = 0.72533). Vegetation is hazelnut; the spring water derives directly from well inside the Maierhof.

236 Wiesing, Buchberg
The Buchberg is an outstanding hill built of Triassic carbonate rocks overlain by glacial sediments loaded with crystalline components ($^{87}Sr/^{86}Sr$ of historic soil = 0.71671). It is a Bronze Age settlement site. Vegetation is hazelnut; the spring water originate from a well (fountain) in the nearby village Jenbach.

237 Ampass, Widumfeld
The Widumfeld lies east of Ampass and refers to findings from Iron Age to the Roman culture. The archaeological site is formed by sandy valley filling soil with pebbles of quartz-phyllite ($^{87}Sr/^{86}Sr$ ratio of historic soil = 0.71736). Vegetation are branches of hazelnut; the spring water originates from the nearby forest.

3 Schema of Strontium incorporation in animal and human consumer



Photographs of sample site 230 Pfaffenhofen, Hörtenberg

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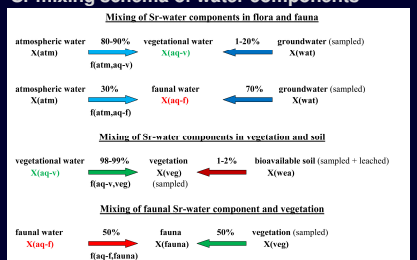
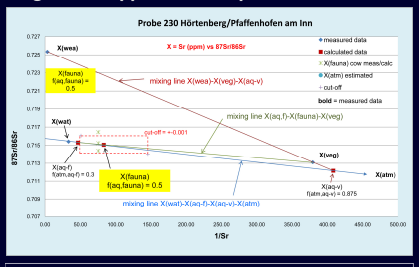
Soil samples were taken from archaeological sites, or from the undergroud level which represents place and time of ancient agri-culture. The soil was leached with 1N HCl .

5 Sr mixing schema of water components



The Sr isotopic composition of water which is assimilated by vegetation is totally distinct from that of faunal drinking water (see blue arrows).

Result of mixing Sr of water, soil and vegetation applied to sample 230



The straight lines in the diagram represent mixing of water components with soil and vegetation and result in the local $^{87}Sr/^{86}Sr$ ratio of the fauna (X(fauna)). Explanation of acronyms see diagram above.

7 Conclusion

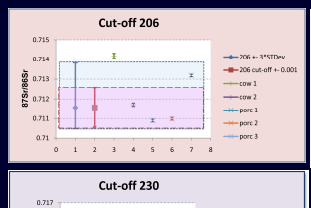
Our model calculation proves that local bio-available $^{87}Sr/^{86}Sr$ ratios can be verified by analyzing components of water, leached soil and vegetation from selected archaeological sites.

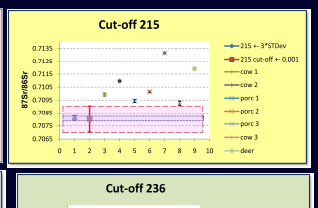
In a first step calculations of cut-off values for these ratios were applied to five localities along the river Inn.

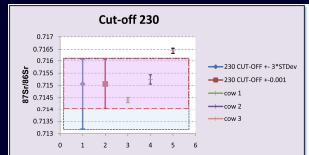
The results show that the cut-off value ($^{87}Sr/^{86}Sr$(fauna) ± 0.001) agree, within limits, with that of the excavated material of animals from the corresponding archaeological site (see location 237). Thus, the animal consumer can be clearly classified as local or non-local.

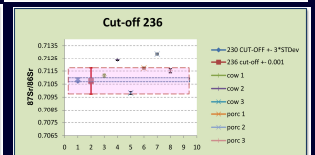
Data of locality 237 demonstrate that all analysed animals are local in contrast to that of 215, where animal bones show completely different $^{87}Sr/^{86}Sr$ ratios and are classified as non-local.

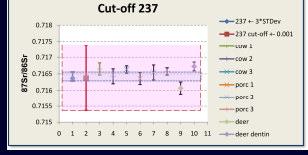
6 Diagram with cut-off values and corresponding isotopic ratios of local and non-local historic fauna











Diagrams show the local bio-available faunal $^{87}Sr/^{86}Sr$ ratios calculated from local compositions of water, soil and vegetation with errors ($^{87}Sr/^{86}Sr$ (fauna) ± 3*STDev, blue) and the adopted cut-off ($^{87}Sr/^{86}Sr$ (fauna) ± 0.001, red). Analyzed $^{87}Sr/^{86}Sr$ ratios of bio-archaeo-logical material of cows, porcs and deer can clearly be classified as local or non-local using the limits of the cut-off values.

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