



## **Examples of the application of stable isotopes of light elements for provenancing**

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The basic application of provenancing materials as food but also other materials is the global well-known pattern of water. The collection of the  $^{18}\text{O}/^{16}\text{O}$  and  $\text{D}/\text{H}$  data has been initiated by the IAEA and can serve as tool in many applications as palaeoclimate research and tracing back water-containing material. In former years our lab has succeeded in the detection of the illegal trade with butter across the formerly EU border and in another case of an Austrian trial, the so-called Causa Fuchs. In this case the geographic origin of a self-made bomb was constricted: The water bound in a gypsum foot of this explosive arrangement was extracted by azeotropic distillation. Later on the formation of a container made by concrete could be assigned to a certain region, at least a specific origin excluded.

From a historical point of view the origin of timber for the big medieval towns is of interest. The idea that timber is logged directly from the place of use has to be checked carefully and is often doubtful. Most of the wooded areas in the flat land and around human settlements has been cleared not only by agriculture but by grazing of cattle too. During the, timber has been harvested from increasing altitudes in the mountainous areas. To trace back the origin of timber not the water but the oxygen and hydrogen bound in the cellulose is used for the isotope ratio mass spectrometry.

For the interpretation often some additional information is necessary or even helpful. Some plantations are irrigated with water from other regions as vineyards in Southern Italy or potato fields in the desert region. Potatoes e.g. grown in the Sahara desert are irrigated from deep ancient aquifers which reflect an isotopic composition of postglacial conditions.

Beside the isotopes of oxygen and hydrogen of water or in organic bond other stable isotopes especially of the light elements can be used. Some remarkable isotopic patterns can be used easily as the fertilisation of green house cultivations with the carbon dioxide. This gas emitted from the heating with fossil fuels as gas or oil. This technique is used in countries of cold weather conditions and cheap energy supply as in the Netherlands. Sulphur isotopic composition is influenced close to the sea shore by the "seaspray", e.g. beef from Chile.

Regularly some contaminations of food or fodder are detected. To trace back the source of that material was successful comparing all the isotopic compositions of the light elements (bioelements) as an isotopic fingerprint. As an example, the source of wheat contaminated with the pesticide nitrofen in Germany was detected. And each spring the origin of asparagus is not always declared correctly. To solve that problem a mapping of the different locations of the cultivation of asparagus is used to identify regional origin.