Locating foods on the isotope map

The origin of any food product can now be traced thanks to the isotopic composition of the elements in it. This is turning out to be an innovative, valuable aid to detecting food fraud. TEXT ROB RAMAKER

Does that pack of orange juice really come from Greece? And is that batch of palm oil actually from a sustainable plantation? Increasingly, isotopes are able to reveal the answer to such questions. Many chemical elements have 'heavy' and 'light' versions, depending on the number of neutrons in the atoms' nuclei. For example, the element chlorine has two stable versions: roughly three-quarters of the atoms have 18 neutrons and the rest have 20 neutrons. These versions of an element, known as isotopes, are present in varying proportions in nature and that fact is now being used to determine where a product comes from, since the isotope ratios in food products often differ per location. At the same time, work is going on to determine the isotope ratios occurring in different parts of the world. This information is recorded in isotopic landscapes, or *isoscapes*.

These isoscapes are a hot topic; the police, food authorities and ecologists are all enthusing about the potential applications. For instance, food authorities will be able to compare the ratio of isotopes in a product with the information on the isoscape and thus determine whether that exorbitantly priced olive oil really was made in that photogenic village in Tuscany. In the past, tracking down food origin fraud involved ploughing through the accounts and other paperwork; now, isotopes and isoscapes are increasingly being used instead.

FINDING THE SOURCE

Compiling an isotope map is no easy task, explains Grishja van der Veer, researcher at RIKILT Wageningen UR. He was involved in the TRACE European project, which ended in 2010. It involved more than sixty European partners developing methods of tracing food products back to the source. They had to decide, for instance, which elements and isotopes were best suited to finding that source. Then an isoscape had to be available, or created, for that element. Determining the ratio for every element in every square metre would be an impossible task so scientists look instead at patterns in the incidence of different isotope ratios. 'You are looking for natural variations associated with the isotope ratios', explains Van der Veer. This approach was used to create one isotope map for hydrogen and one for oxygen for use in tracing the origin of mineral water (H_2O). The isoscapes make use of the fact that the ratios between lighter and heavier versions of hydrogen and oxygen are related to the average temperature. A lower average temperature also means lower proportions of heavy hydrogen and oxygen isotopes.

Van der Veer helped map the isotope ratios for European mineral water. This involved analysing and summarizing the isotope ratios for more than six hundred spring waters. The measurements for these six hundred plus locations could be used to make a rough isoscape for Europe, but there is not enough variation in the isotope ratios to enable detection of the exact source of an unknown mineral water. To do that, you would need to analyse the isotope ratios in the trace elements in addition to the hydrogen and oxygen. The accuracy of such source calculations is now being improved by combining different isoscapes, and that makes it possible to trace a product to that picturesque Tuscan village.

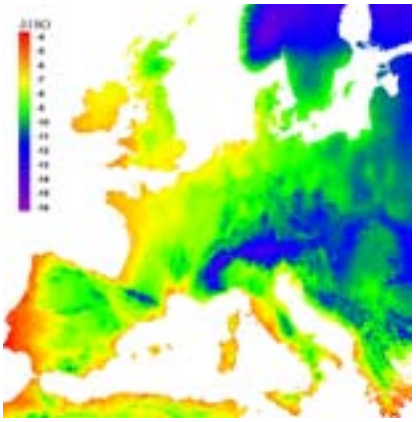

ILLUSTRATION TRACE

Isoscape of the isotope ratios for oxygen

PALM OIL

Isoscapes are currently very much in the ascendant. Van der Veer says TRACE has demonstrated how useful they are. Furthermore, the analytical techniques are getting faster and more user-friendly, can be used in a wider range of settings and require less material. And more geographical data on isotope ratios is being added to databases. In fact, isoscapes could not be compiled without such databases.

Food regulatory authorities in particular are interested in the potential for determining the geographical origin of food products. For example, Van der Veer developed isoscapes that can be used for palm oil. It is possible to detect whether the oil comes from Brazil, West Africa or Southeast Asia using a combination of several isotope ratios. That is good to know because Africa does not have any sustainable palm oil production. But RIKILT would really like to be able to locate the source much more precisely. Van der Veer says this would require isotope ratios for a number of elements and for more data to be available for different areas. They are now working on this in partnership with the private sector.

Van der Veer is also looking at the options for using nitrogen isotopes to distinguish between organic products – where the use of artificial fertilizer is not permitted – and conventional food products. The RIKILT researcher is also expecting more projects in the pipeline, including non-food applications. 'We are talking to the Wood Research Foundation about the possibility of using isoscapes to check the origin of sustainable tropical wood.' ■

The isotope ratios of more than 600 mineral waters were analysed