

"Use of a specification approach for determining geographical origin"

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(and many others)



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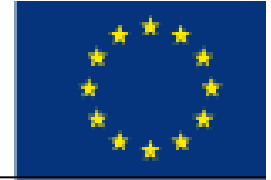
Combating food fraud seminar, FSA, 11 February 2008



To be discussed

- Overview of TRACE
- Food Origin mapping
- Specification Prediction Models
- Application of specification approach to mineral water sector

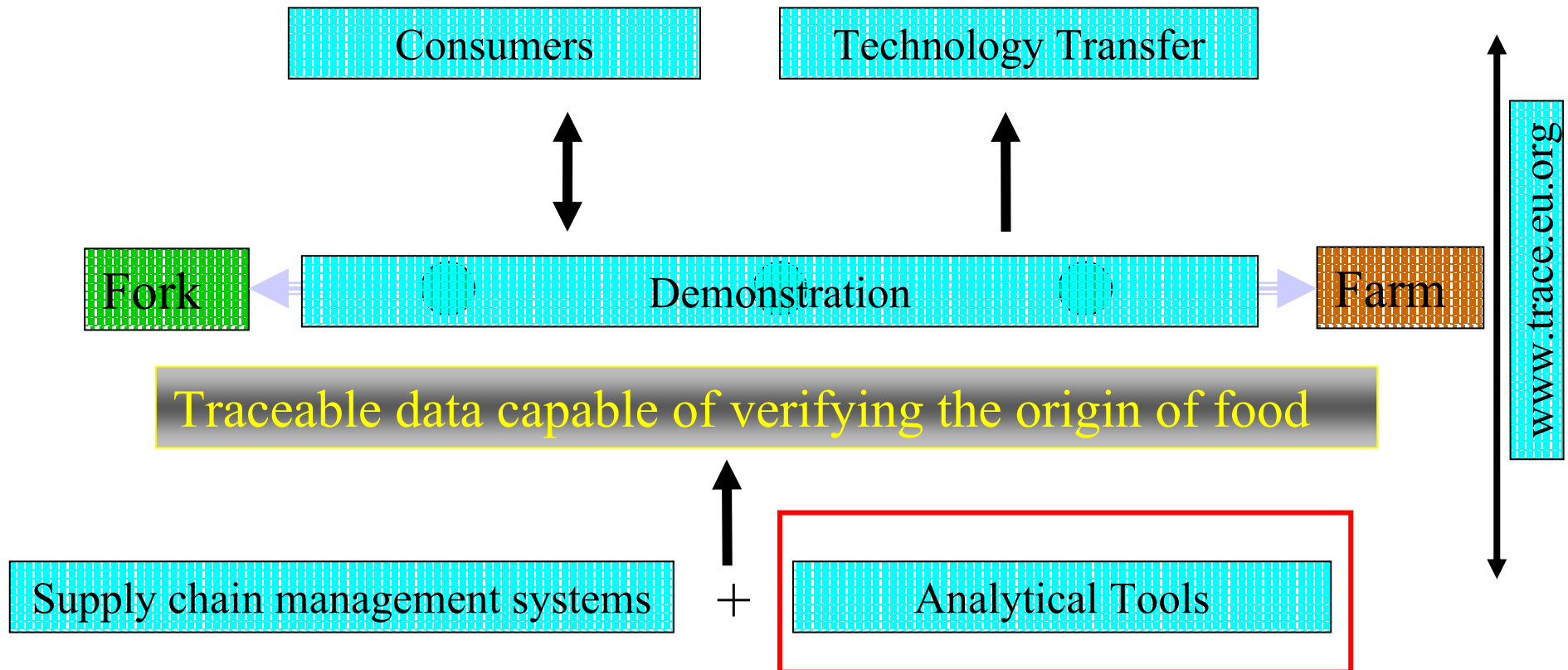




- 18.6 M€
- 60 months
- 50 participants (13 SME's)



➤ “To develop traceability methods and systems that will provide consumers with added confidence in the authenticity of European food.”



Analytical tools

- Developing cost effective tools:
 - to verify geographical origin (Food Origin Mapping)
 - to characterise foods (profiling)
 - to verify species/variety aspects of food



Tracers of geographical origin

- Trace element composition and stable isotope signature is affected by:
 - Geology e.g. $\delta^{87}\text{Sr}$, trace elements
 - Agronomy e.g. $\delta^{15}\text{N}$, trace elements
 - Physiological processes e.g. $\delta^{13}\text{C}$, trace elements
 - Environment e.g. Pb, trace elements
 - Climate e.g. $\delta^2\text{H}$, $\delta^{18}\text{O}$

Food Origin Mapping: rationale

- Can components in a food and its environment be linked?
- If so can we predict the levels of certain components in a food of declared provenance ?
- Can the predicted levels (specifications) be used as an objective means of verifying geographical origin ?



Experimental Design

- 21 Model sampling sites
 - Climate
 - Geography
 - Geology
- ~12,000 groundwater, soil and food samples analysed
 - $\delta^2\text{H}$, $\delta^{18}\text{O}$, $\delta^{13}\text{C}$, $\delta^{15}\text{N}$, $\delta^{34}\text{S}$, $\delta^{87}\text{Sr}$ and trace elements
 - > ~600,000 analytical data points to be produced
- Geochemical modelling to produce Specification Prediction Models



SPMs for mineral water

- SPMs modelled on climate produced for ^2H -excess and $\delta^{18}\text{O}$
- SPMs for $\delta^{87}\text{Sr}$ based on link to geology
- CART model for minerals and trace element based on link to geology?

Production of SPMs

Specification maps for different (independent) variables:

- What determines the variation of a parameter in some commodity
- How can we use this information to make specification maps

Example for mineral water:

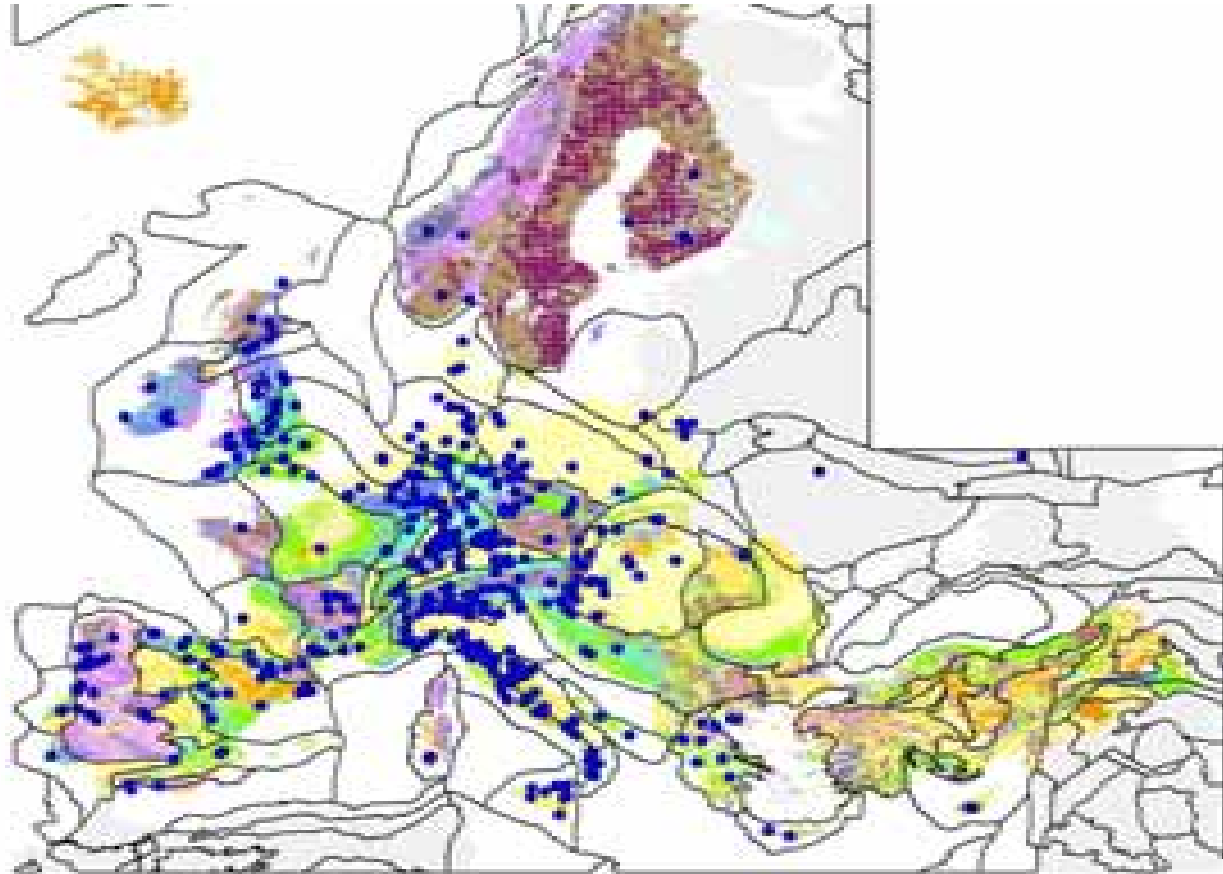
$\delta^2\text{H}$ (or $\delta^{18}\text{O}$ because related) -> (min.) surface temperatures

$\delta^{87}\text{Sr}$ -> lithology and age of rocks

Trace elements -> linked to lithology???



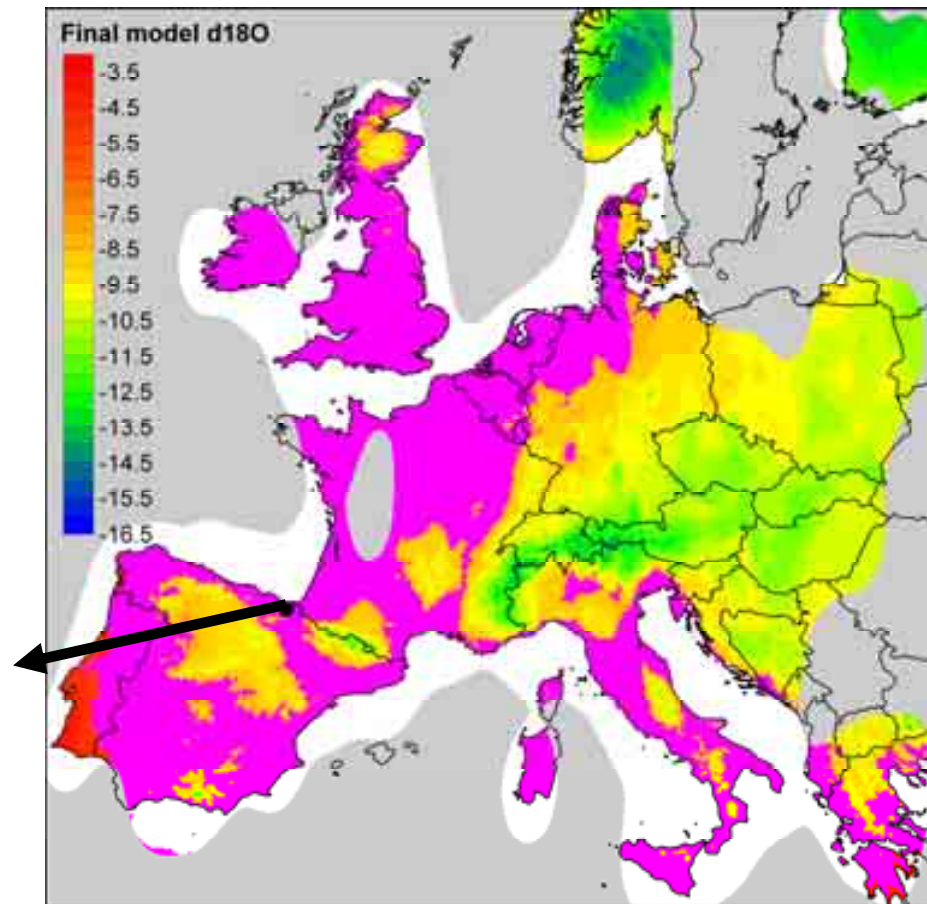
Geological map with sample locations



Specification map for mineral water: $\delta^{18}\text{O}$

Pink=specification area

Estimate for Insalus:
 $\delta^{18}\text{O} = -6.9 \pm 1.6 \text{ ‰}$

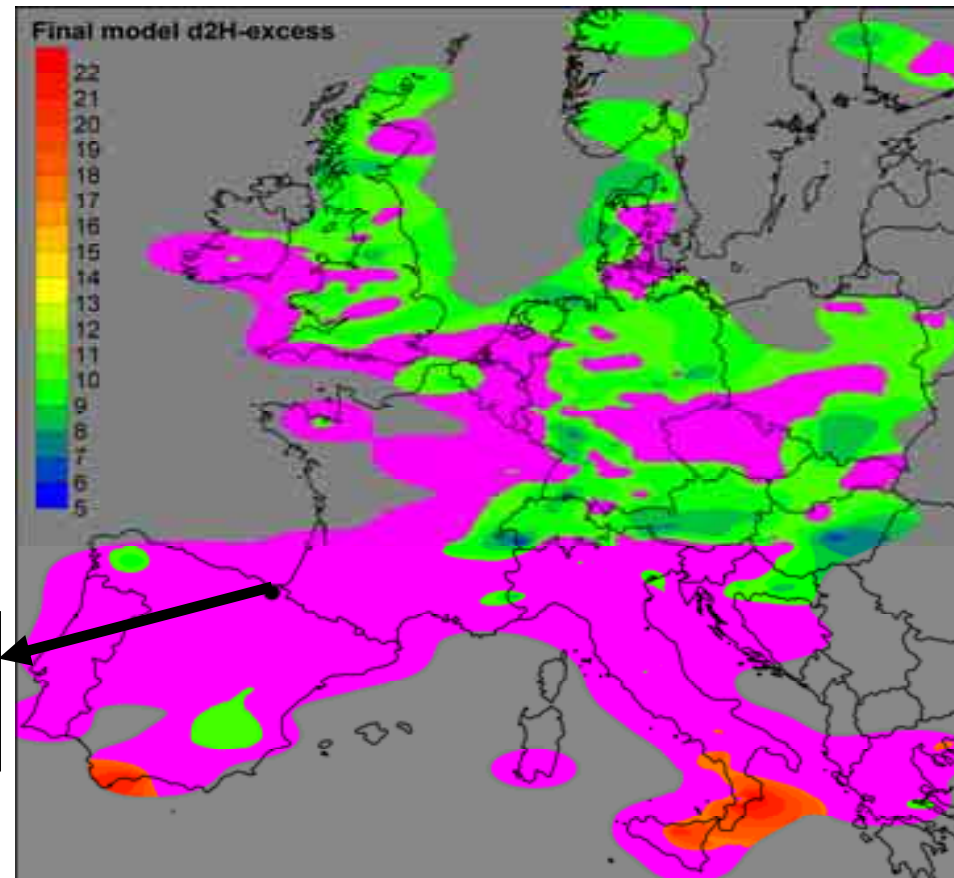


Specifications for mineral water: ^2H -excess

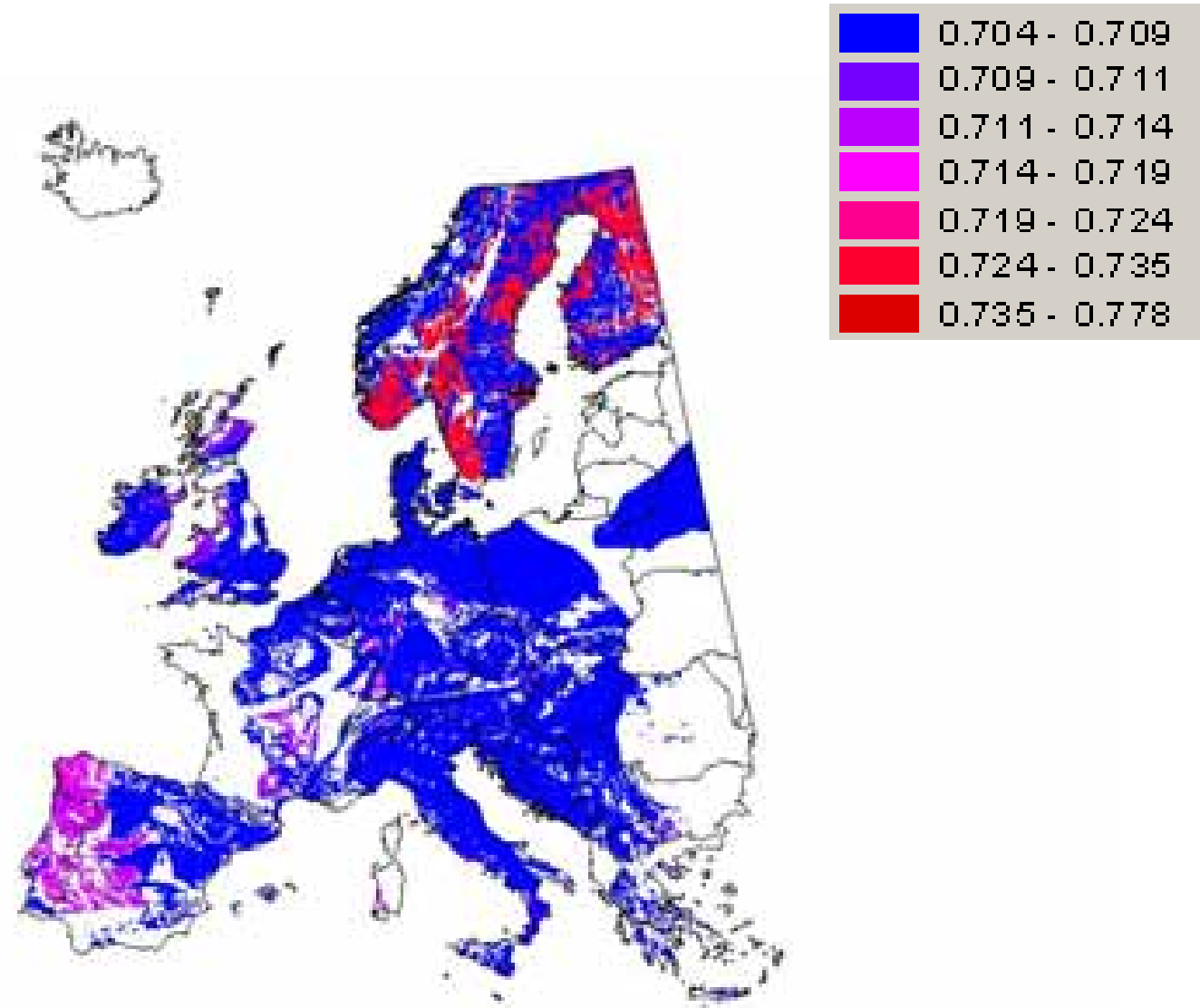
$$^2\text{H excess} = \delta^2\text{H}-8 * \delta^{18}\text{O}$$

In pink: specification
Area for Insalus water

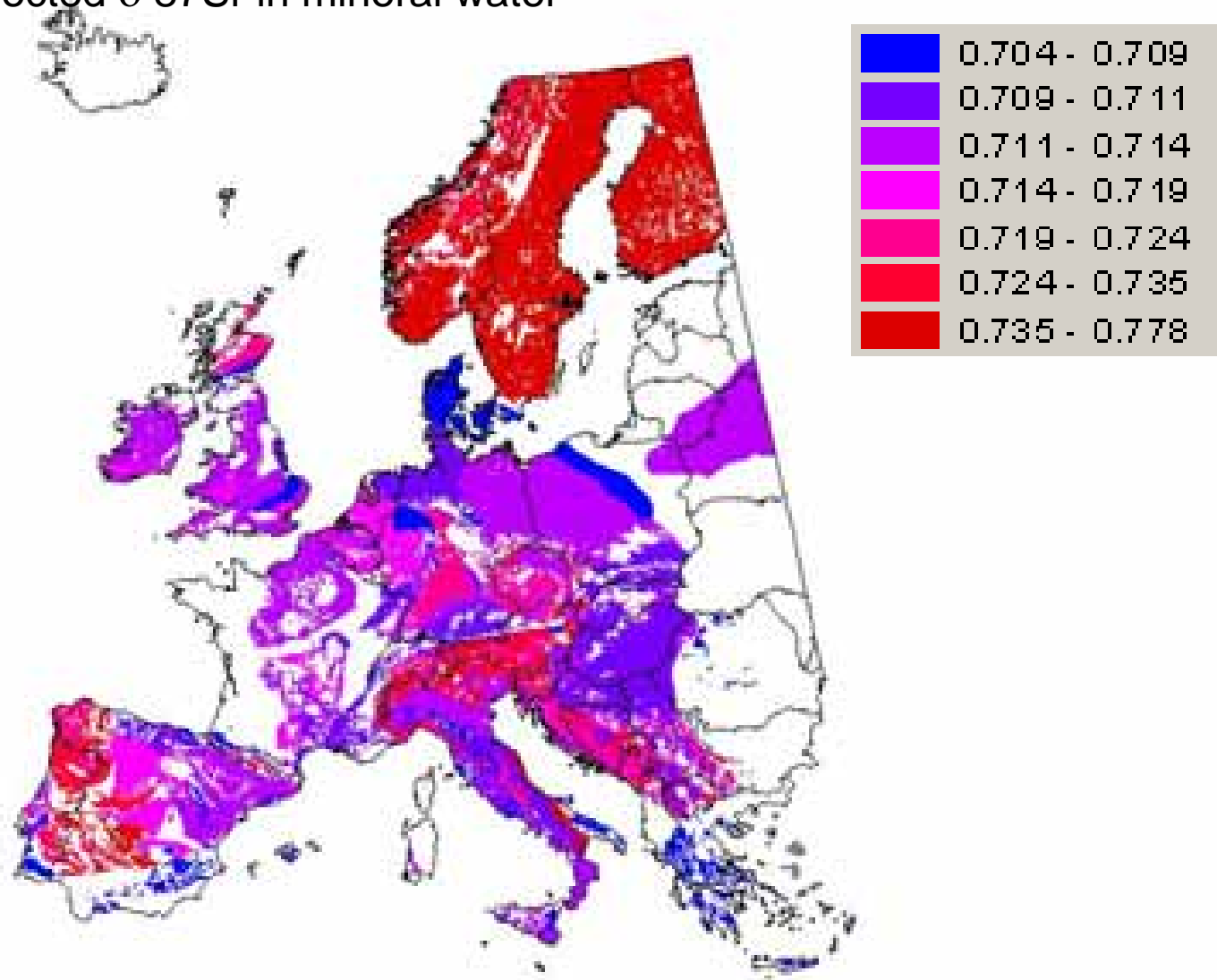
Estimate for Insalus:
 $^2\text{H-ex} = 14.2 \pm 3.5$



Minimum expected δ 87Sr in mineral water



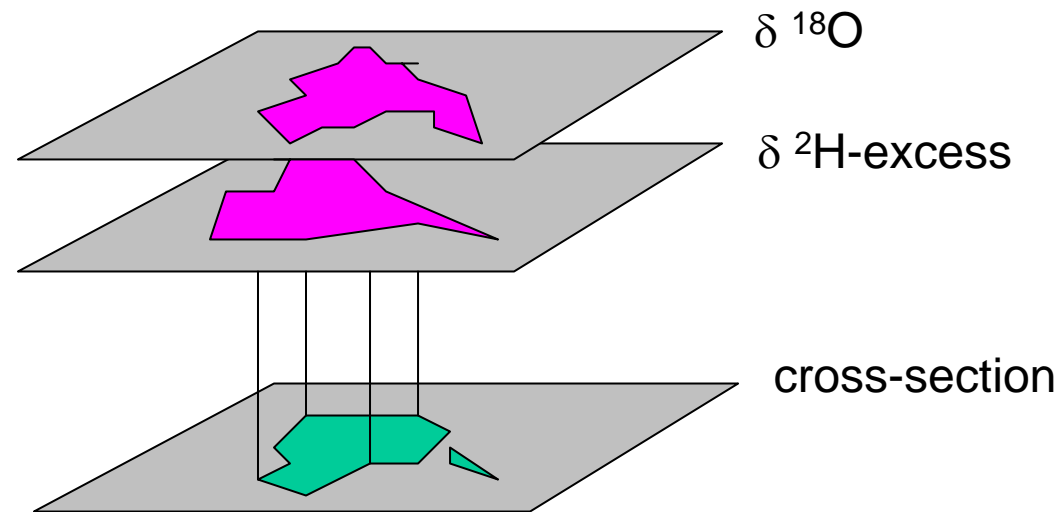
Maximum expected δ 87Sr in mineral water



Specifications for mineral water: $\delta^{18}\text{O}$ & $\delta^2\text{H}$ -excess:

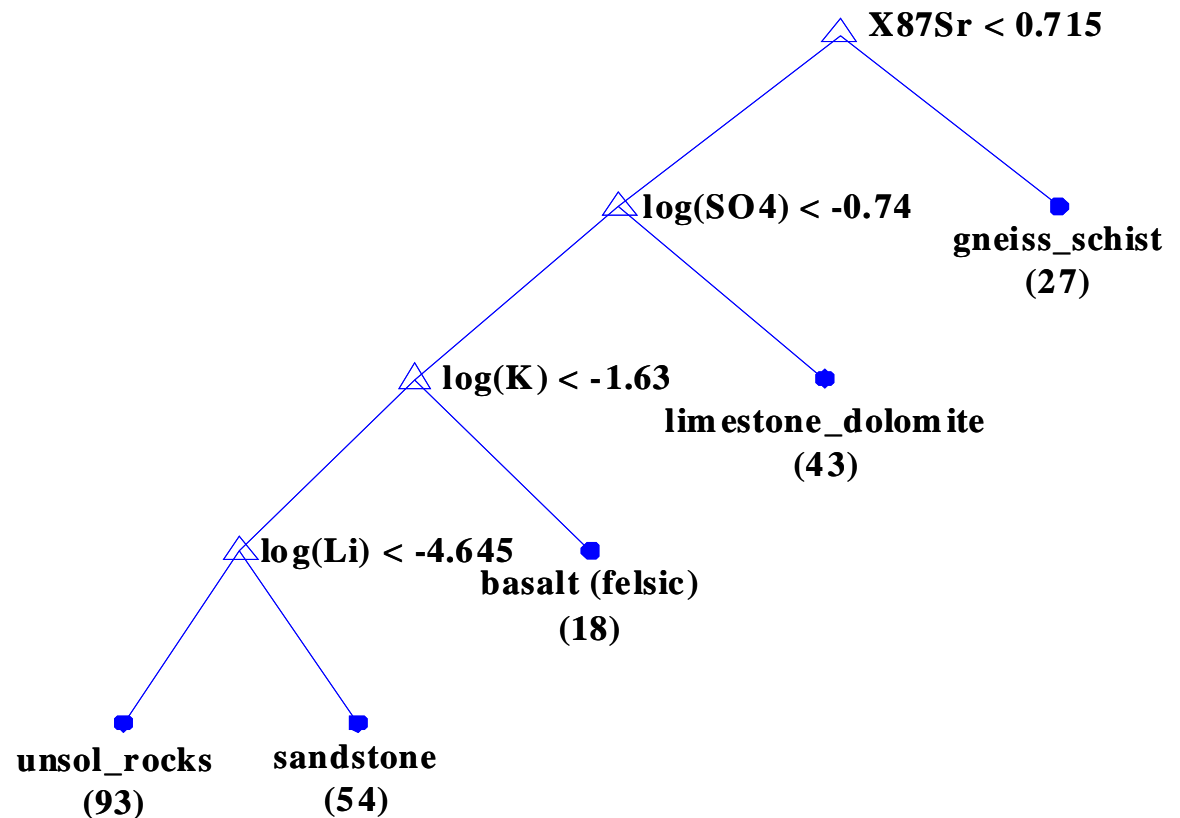
$$S_{\text{min wat}}(\text{Insalus}) = -8.5 < \delta^{18}\text{O} < -5.3 \ \& \ -17.7 < \delta^2\text{H} - \text{excess} < -10.8$$

Combination of ranges applies to an area, which is the cross-section of BOTH specification areas:



CART specification relating TE to geology

CART produced from
a study of mineral
water mineral and TE
profile vs lithology
(unvalidated)



Mineral water challenge

Can we discriminate Aqua Insalus mineral water from 18 other water samples using the predictive approach ?



Mineral Water Challenge

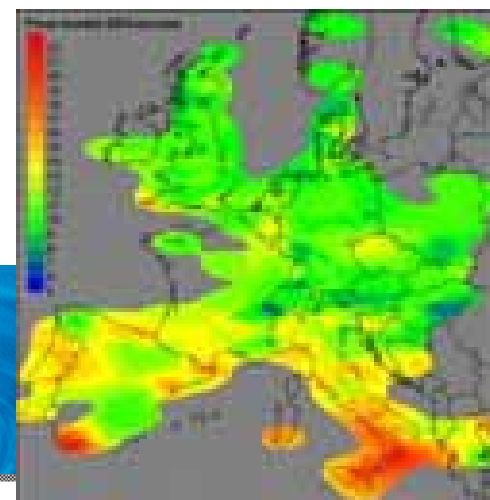
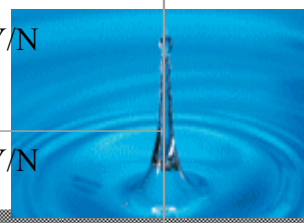
- Specifications for Insalus water produced from SPM's
- 20 "mineral" water samples sent to participants as blind samples-overseen by FSA
- Analysis by ICP-MS and IRMS
- Data analysis to see which samples comply (with spec).



Specification for Insalus water

Produced by Grishja van de Veer (Geochem) & Susanne Voerkilius (Hydroisotop)

Parameter	Specification	Result	Compliance
CART	multivariate	?	Y/N
^{87}Sr	0.704-0.714	?	Y/N
$^{18}\text{O} \text{ ‰}$	-5.3--8.5	?	Y/N
^2H excess	10.7-17.5	?	Y/N



Blind test revealed

Brand	Country	Climate		Geology	Result
		$\delta^{18}\text{O}$	$\delta^2\text{H-excess}$	Multivariate Analysis	
Korpi	Greece				non-compliant
AQUA BONA –SANT.	Spain				non-compliant
AQUAFINA	Spain				non-compliant
Himalayan	India				non-compliant
AQUA INSALUS	Spain				compliant
AQUA INSALUS	Spain				compliant
Spanish tap water	Spain				non-compliant
San Benedetto	Italy				non-compliant
Sainbury's Caledon.	Scotland				non-compliant
Spreequell	Germany				non-compliant
Apollinaris	Germany				non-compliant
M&S Glenpatrick	Ireland				non-compliant
English tap water	York, UK				non-compliant
evian	France				non-compliant
Vittel	France				non-compliant
Vittel	France				non-compliant
Apollinaris	Germany				non-compliant
Korpi	Greece				non-compliant
evian	France				non-compliant
San Benedetto	Italy				non-compliant



Integration into traceability system



Specifications produced without analysis or need of database

Eventually could be generated independently from website

Specification can be checked by any stakeholders in the chain

Parameter	Specification	Result	Ref to method
$\delta^{87}\text{Sr}$	[<-x->]	✓	TRACE
$\delta^{18}\text{O}$	[<-Y->]	✓	TRACE
$\delta^2\text{H}$ excess	[<-z->]	✓	TRACE



Conclusions

- First proof of principle of Specification Prediction Models for determining geographical origin
- The specifications provide an objective means for assessing provenance claims
- They can easily be incorporated into a traceability system to provide confidence in provenance claims
- Principle now being applied to honey



- Food authenticity
- Food traceability
- Consumer issues
- Library
- References search
- Links
- e_Newsletter
- TRACE brochures
- TRACE video

[Committees call for additional legislation](#)



TRACE 4th Annual Meeting
Lost without TRACE
21-25 April 2008
Tenerife - Spain
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26 January 2008
FOURTH TRACE
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The 4th Food
authenticity and
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NEWSLETTER
is available now in the spotlight
the announcement of the 4th TRACE annual conference
planned on 23 to 25 April 2008 in Spain.
Information supplied by Philippe Vermeulen, TRACE
web-correspondent (ORA-18)
Source: TRACE
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24 January 2008
PERSPECTIVE FOR FOOD
2030
On 17-18 April 2007 the
Directorate-General for
Research of the European
Commission organised a major Conference on
the future research and competitiveness aspects of the
European food industry. The overall purpose of the
Conference was to anticipate research needs by 2030
and defining coherent actions in view of the diverse and
increasingly important changes that the European food
industry will have to face.
Information supplied by Philippe Vermeulen, TRACE
web-correspondent (ORA-18)
Source: European Commission
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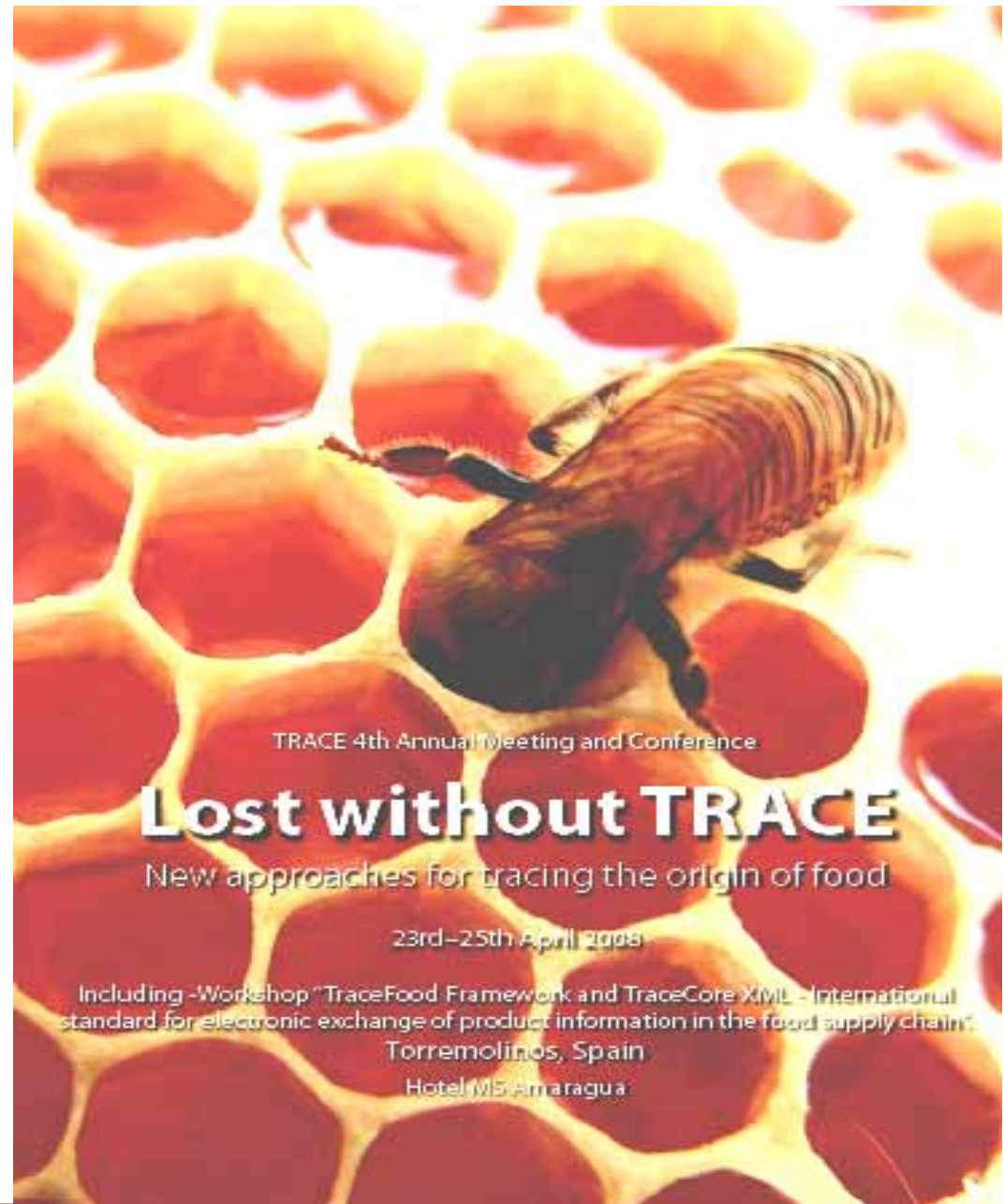
4th TRACE conference
“Lost without TRACE”

New approaches
for tracing the origin of
food

23-25 April 2008

Torremolinos, Spain

Register at:
www.trace.eu.org



Combating food fraud seminar, FSA, 11 February 2008



And acknowledgements to the consortium.....:



Combating food fraud seminar, FSA, 11 February 2008

