

# TRACE: novel approaches to food authenticity and traceability

Paul Brereton

Central Science Laboratory York, UK



[trace.enquiries@trace.eu.org](mailto:trace.enquiries@trace.eu.org)

[www.trace.eu.org](http://www.trace.eu.org)

[www.csl.gov.uk](http://www.csl.gov.uk)



**AMBIENT INTELLIGENCE FOR FOOD QUALITY AND SAFETY,**  
November 15-16, 2005, Aula Magna Università di Firenze



# Introduction

- Background
  - Consumer distrust
  - traceability
  - need for tracing origin
  
- ***TRACE***
  - Overview
  - Novel approaches

# Traceability

- “The ability to trace the history, application or location of an entity by means of recorded information (ISO 8402:1994)”.
- “The ability to trace and follow a food, feed, food-producing animal or substance through all stages of production and distribution (draft EU Regulation – Food Law: 8/5/01)”.
- According to the General Food Law\*, traceability systems have to be operational in the food industry by January 1<sup>st</sup>, 2005 - one-up and one-down stage traceability.

\*Regulation of the European Parliament and of the Council laying down the general principles and requirements of food law (178/2002/EC).



**AMBIENT INTELLIGENCE FOR FOOD QUALITY AND SAFETY,**  
November 15-16, 2005, Aula Magna Università di Firenze



# Why European initiatives to support food traceability ?

- Consumer socio-economic concerns and preferences relating to the origin of food-
  - BSE,
  - dioxins,
  - Sudan red,
  - regional foods,
  - type of production
- EU FPVI Food 2003 2A T 4.1 “Development of reliable traceability methods and systems to establish the origin/mode of production of food products”

# Increasing consumer confidence

- Improved (cost effective) traceability for all
  - Faster
  - More efficient
  - Capable of carrying additional data
  - Improved risk management
  - Verifiable specifications relating to origin
- European food perceived as higher quality as quality (and safety) specifications can easily be traced and verified.
- Promotes value added foods and sustainable agriculture e.g. regional foods, organic, country of origin.
- Benefits the food industry as well as consumers

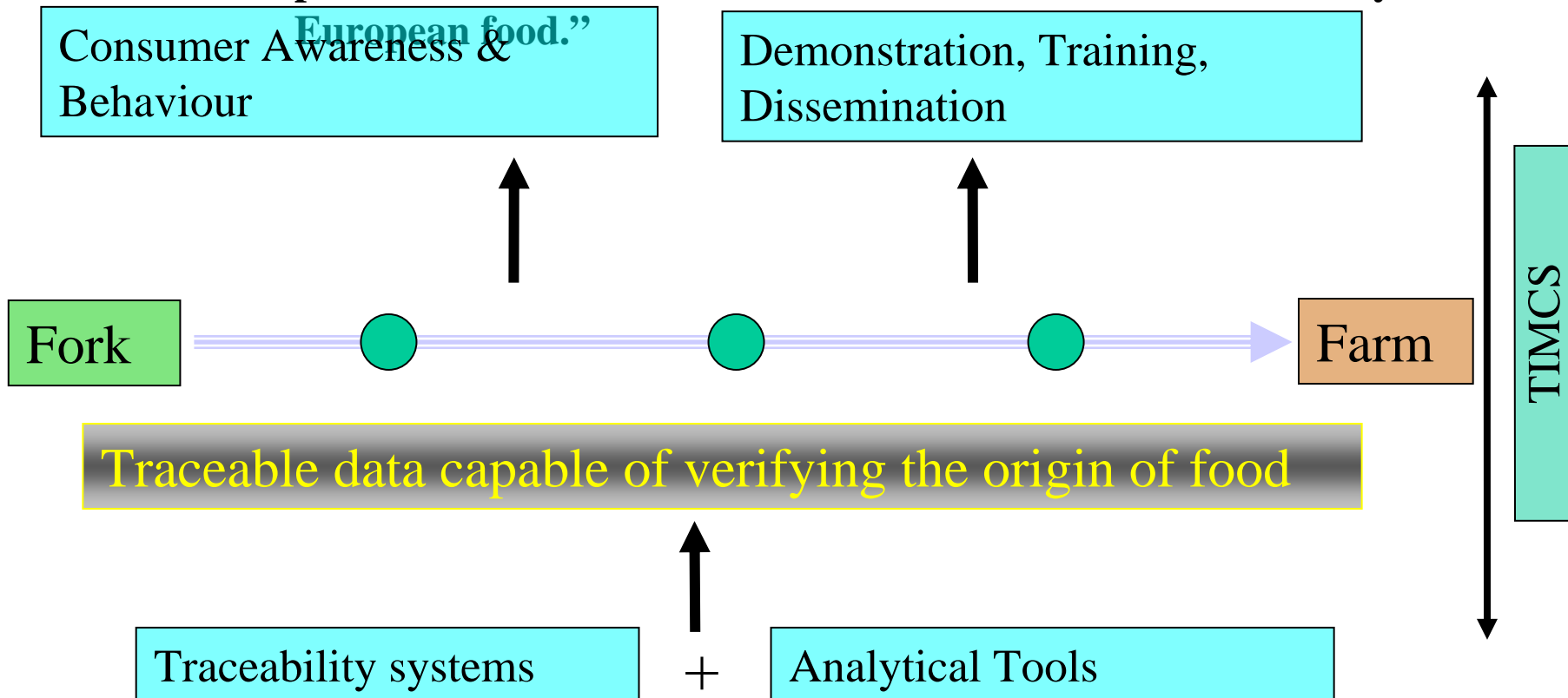


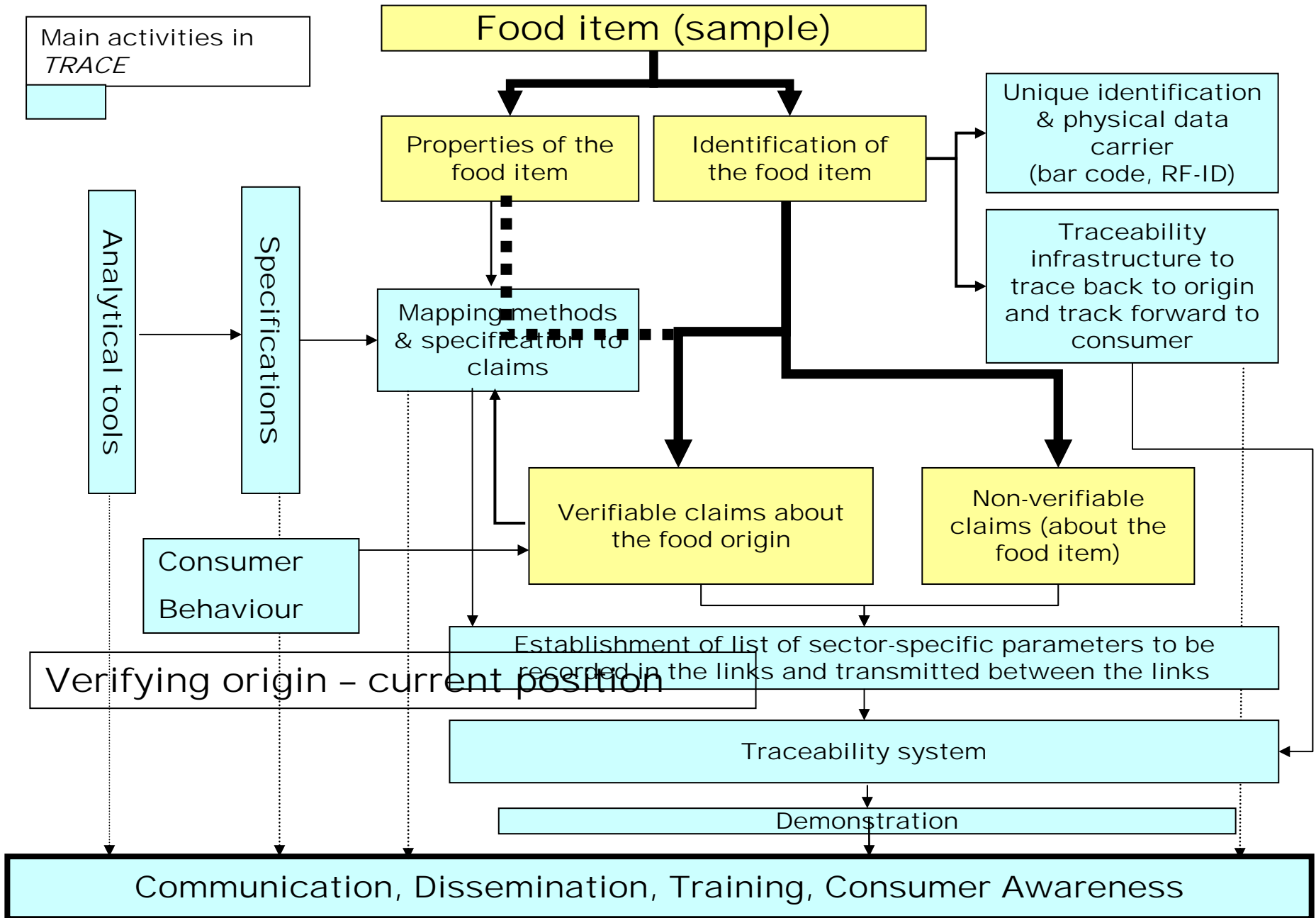
- 18.6 M€
- 60 months
- 50 participants (13 SME's)

# *TRACE (IP)*

## - tracing the origin of food

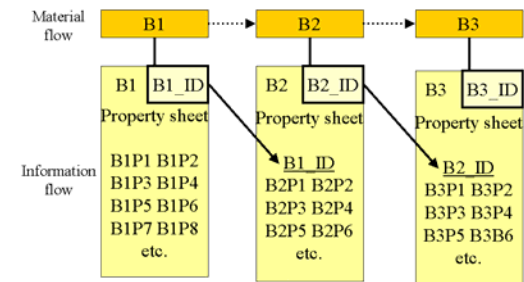
➤ “To develop traceability methods and systems that will provide consumers with added confidence in the authenticity of *European food.*”



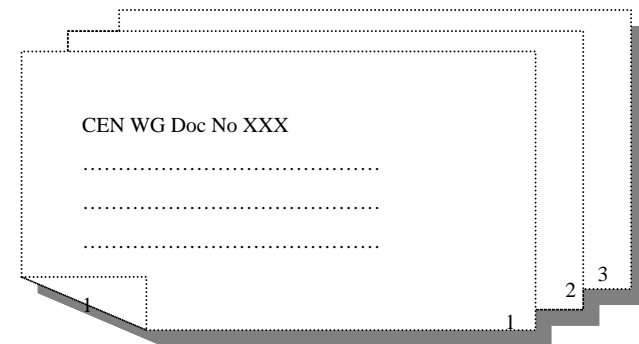


# TRACE -objectives

- To develop and test a generic information infrastructure to ensure complete traceability along entire **fork to farm** food chains
- To develop 'Good Traceability Practice' guides for the food industry
- To draft and demonstrate XML "request-response" schemes

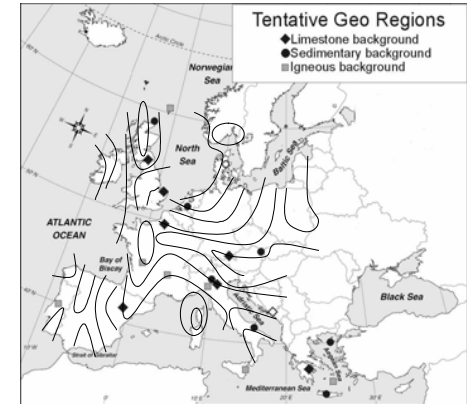


Property sheets (manual or electronic) are keyed to globally unique batch (trade unit) ID which in turn reference previous property sheets through their unique ID. The reference link can be passive (only used in exceptional circumstances, i.e. recall) or it can be active and involve a request-response scheme where B2 can ask B1 for more information about a certain B1\_ID, and get a (standardized, electronic) reply.



# TRACE -objectives

- To correlate geochemical morphology and bioclimatic factors with that of locally grown food



# TRACE objectives (continued)

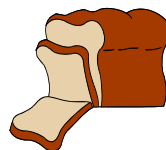
- To develop rapid, robust, accurate and cost-effective methods for determining species/variatal origin of food,



**Meat**

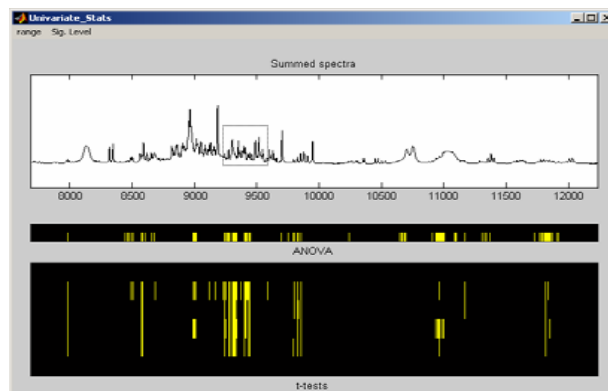


**Honey**



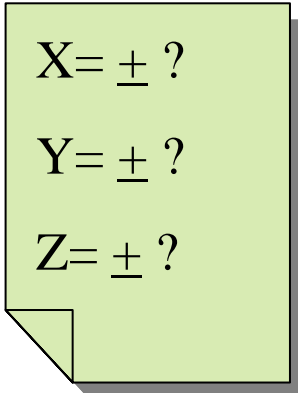
**Cereals**

- To develop rapid, cost-effective “fingerprint” methods that can characterise food products,



## TRACE objectives (continued)

- To develop novel specifications from multivariate analytical data, which can be used to characterise food products


$$X = \pm ?$$
$$Y = \pm ?$$
$$Z = \pm ?$$

- To map verifiable data to analytical methods specifications and thresholds

# TRACE objectives (continued)

- To assess European consumer perceptions, attitudes, and expectations regarding:
  - the ability to trace food products and food production systems,
  - attitudes to Designated origin products,
  - food authenticity
  - and food fraud

# TRACE objectives (continued)

- To develop and exploit TIMCS such that it will be the focus of European information on food authenticity and traceability



[www.trace.eu.org](http://www.trace.eu.org)

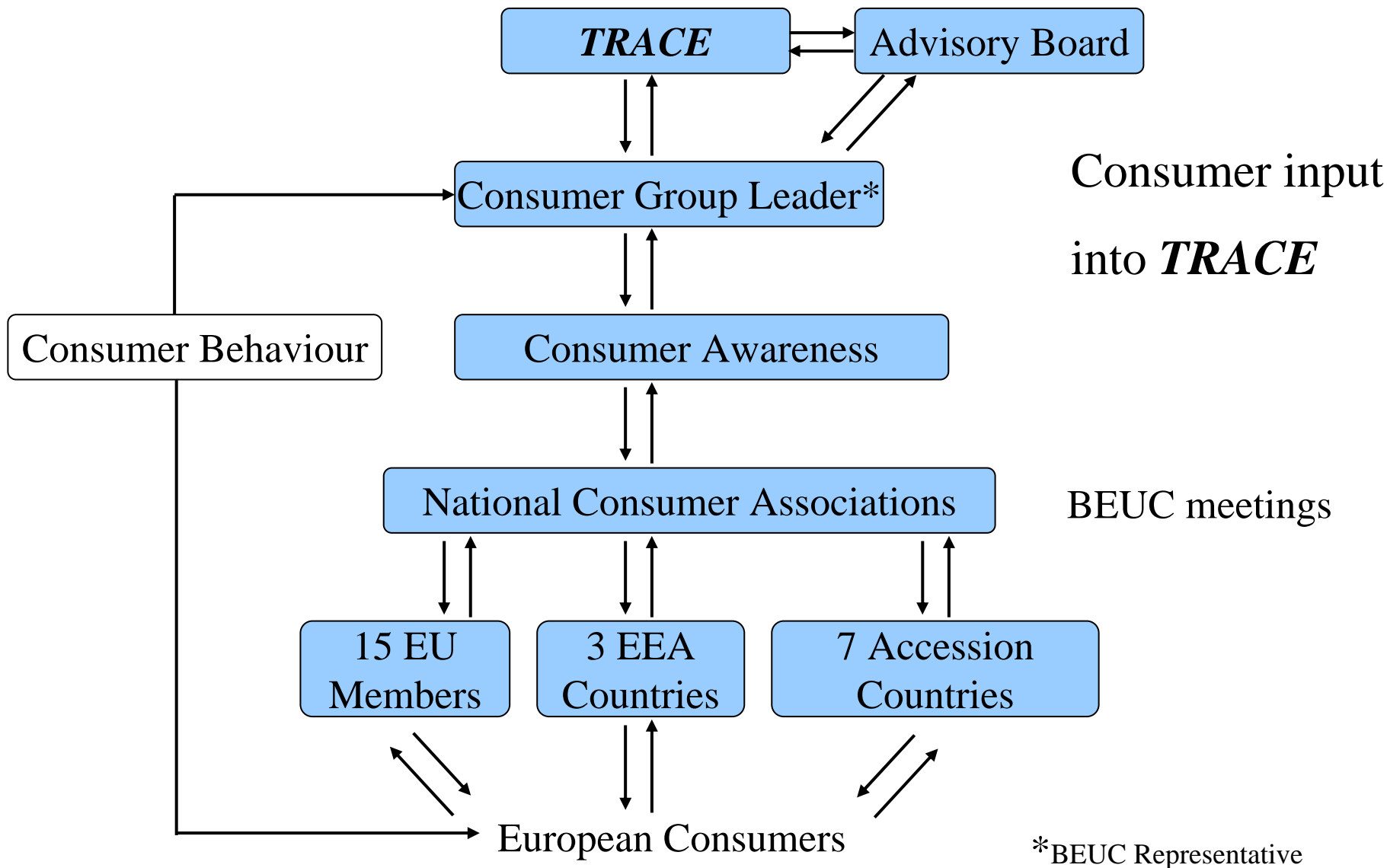
WPL Vincent Baeten

(CRA-W)

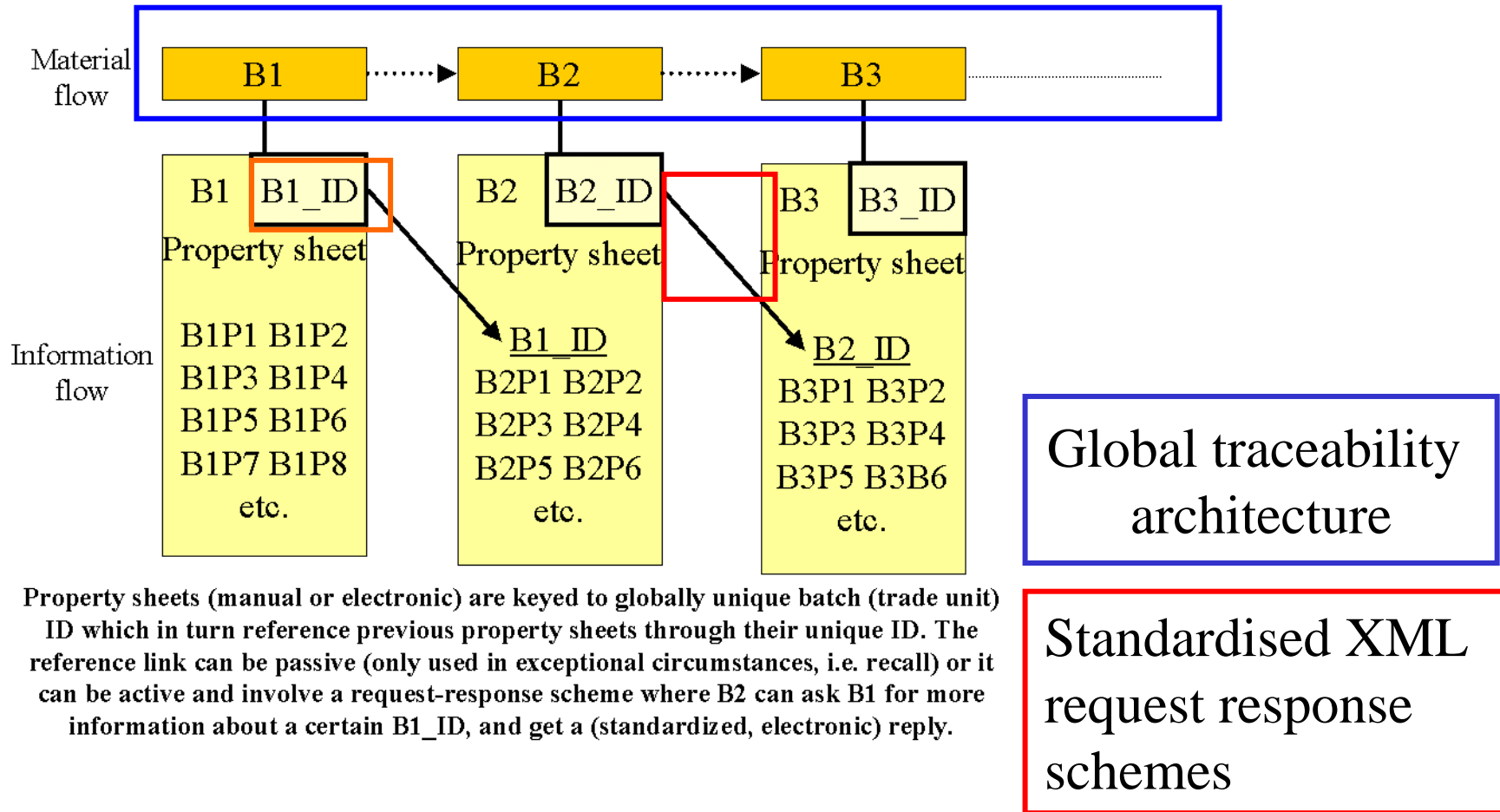
Webmaster: P. Vermeulen

[Webmaster@trace.eu.org](mailto:Webmaster@trace.eu.org)

TRACE web correspondents  
to provide news and  
information



# TRACE and Traceability



Data element		Description	Examples	Categorisation		
				Shall	Should	May
<b>PROCESSOR</b>						
CPR01	Food business ID	Name and address or GLN of food business that operates processing establishment	The Seafood Co, 22 Prince Street, London, SE5 7TK, England or n3+n13	x		
CPR02	Processing establishment ID	Name, address and registration number or GLN of processing establishment	Grimsby Seafood, Fish Dock Road, Grimsby, GY1 9SE, England. GY789 UK or n3+n13	x		
CPR03	GMP certification	Names of fish quality or food safety GMP schemes by which processor is certified	Efsis			x
<b>FOR EACH UNIT RECEIVED</b>						
<b>Identities</b>						
CPR04	Unit ID	SSCC if received as a logistic unit or GTIN+ if received as a separate trade unit	n2+n18 or n2+n14+A1's	x		
CPR05	Trade unit IDs in logistic unit	List of GTIN+s of the trade units that make up the logistic unit (if received as a logistic unit)	List of n2+n14+A1s	x		
<b>Source</b>						
CPR06	Previous food business ID	Name and address or GLN of food business from whom the unit was received (vessel, auction or transporter, etc.)	The Trucking Co, Goods Yard, Leeds, LS8 9FH, England or n3+n13	x		
CPR07	Date and time of reception	Date and time of transfer from previous food business	2002-06-28T08:30	x		
<b>Control checks (related to the logistic or separate trade units, as appropriate)</b>						
CPR08	Temperature of unit when received	Temperature of unit °C	+2.0 °C		x	
CPR09	Unit temperature record	Temperature/time log (if there is a recording device affixed to the unit)	Series of temperature (°C) / date and time points		x	
CPR10	Further quality control checks	Records of further quality control checks (organoleptic, physical, chemical or microbiological), each in the form of description of measurement and value, are available in electronic form, on paper or not available	Paper			x
<b>Production history (for each trade unit)</b>						

# Analytical tools

- Development of cost effective analytical strategies for the determination of:
  - Geographical origin
  - Production origin
  - Species origin
- Analytical techniques:
  - Stable isotopes and trace elements
  - Fingerprinting
  - Molecular biology

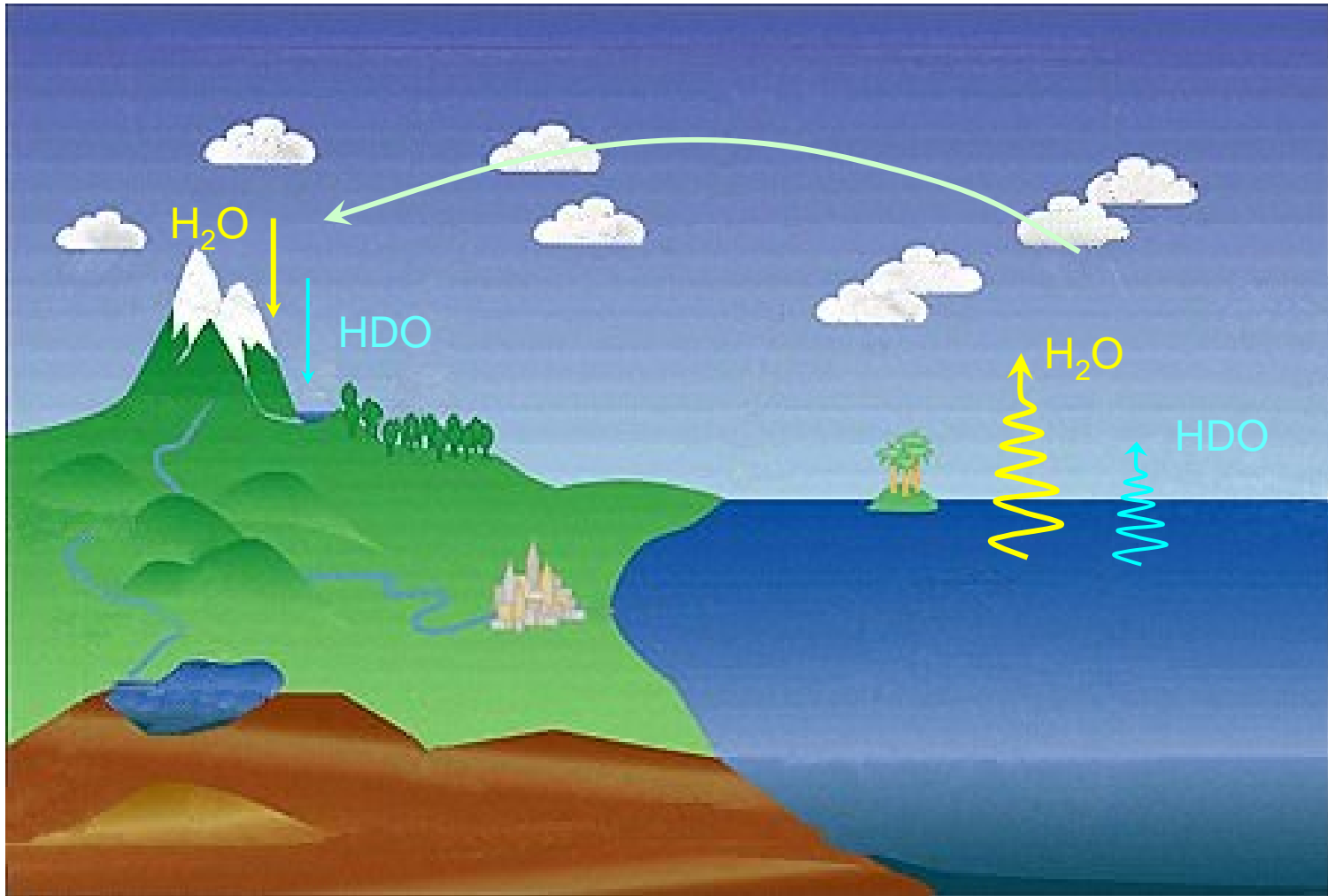
# Novel approaches-Food Origin Mapping

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

# Fractionation of stable isotopes of hydrogen

- Ratio of deuterium (nat abundance 0.015%) to hydrogen  $^2\text{H}/^1\text{H}$  is affected by fractionation due to several factors such as:
  - Environment
    - global
    - local
    - micro
  - Physiological processes

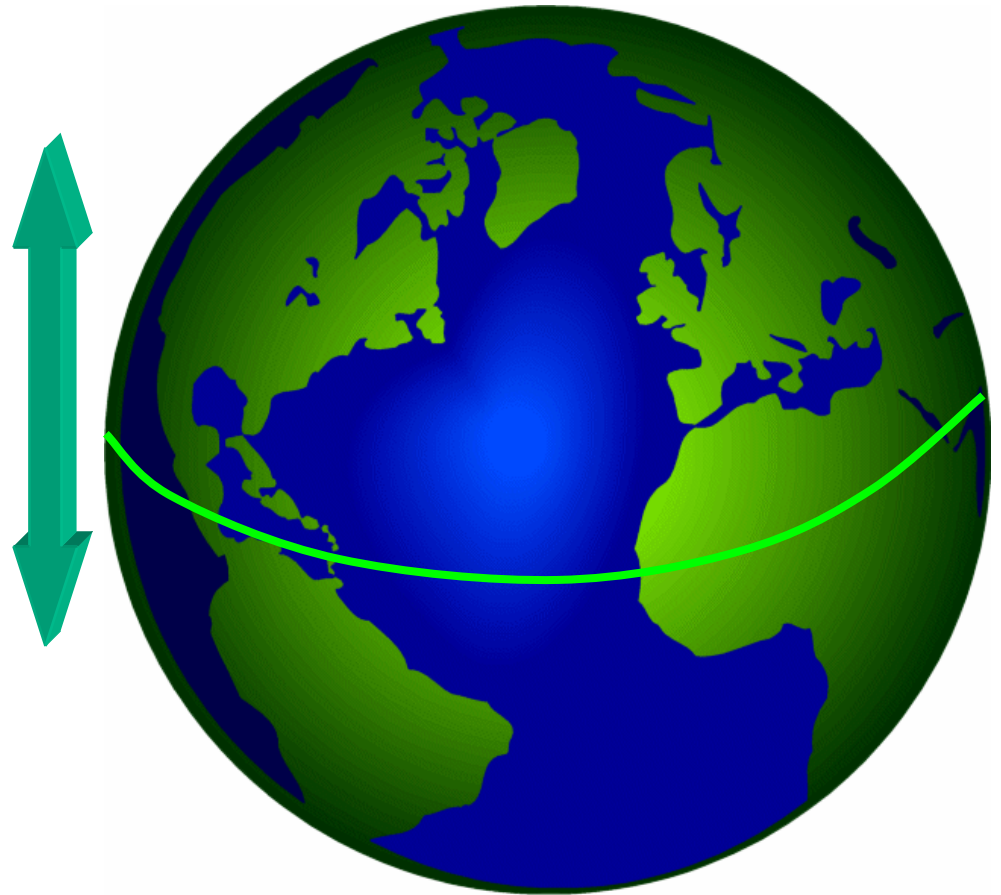
# Climatic Factors affecting D/H ratio - Evaporation & Reprecipitation



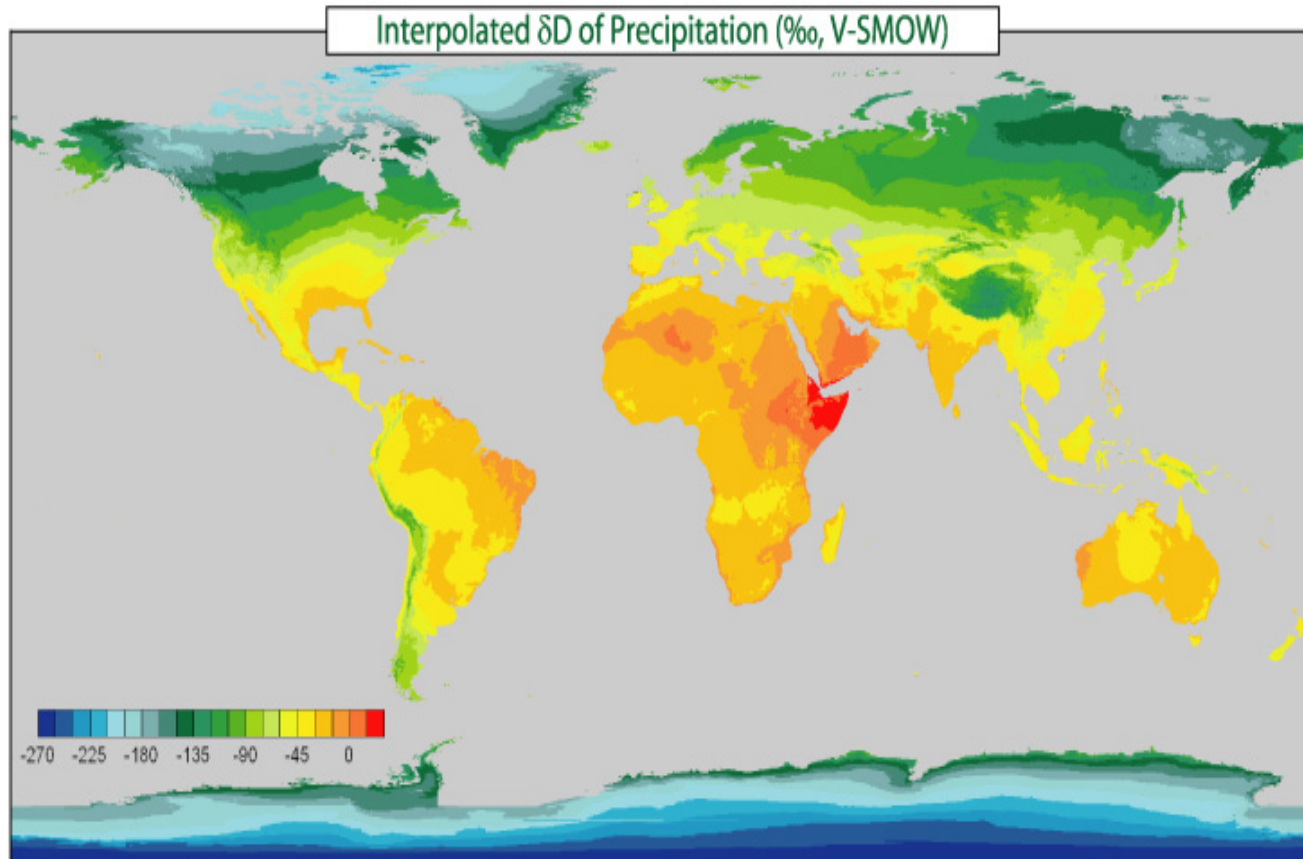
# Factors affecting D/H and ratio - Geographic Latitude

Increasing latitude from equator

Depleted deuterium content in surface and groundwater

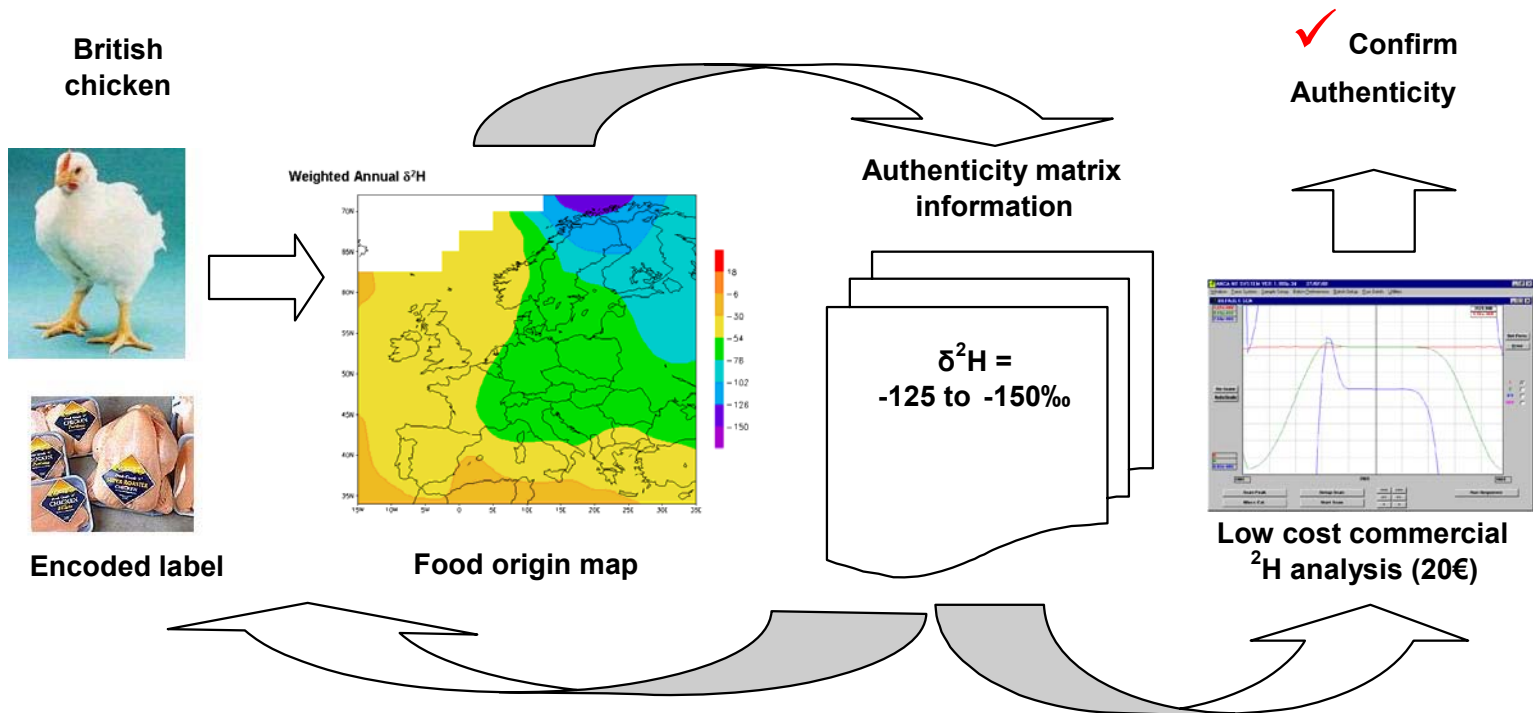


# Interpolated $\delta^2\text{H}$ of precipitation



Produced by James Elhringer University of Utah

# TRACE-Food Origin Mapping

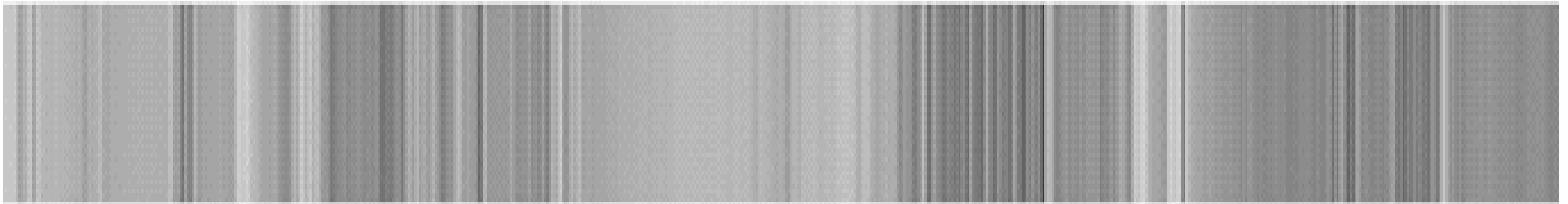


# Fingerprint/profiling methods

- New technology arising from metabolomics sector
- Fingerprinting- empirical approach for characterising food products
- Identification of marker compounds
- Methods: NMR, FT-IR, electrophoresis, LC-MS, GC-MS, NIR
- Food Verification Methods

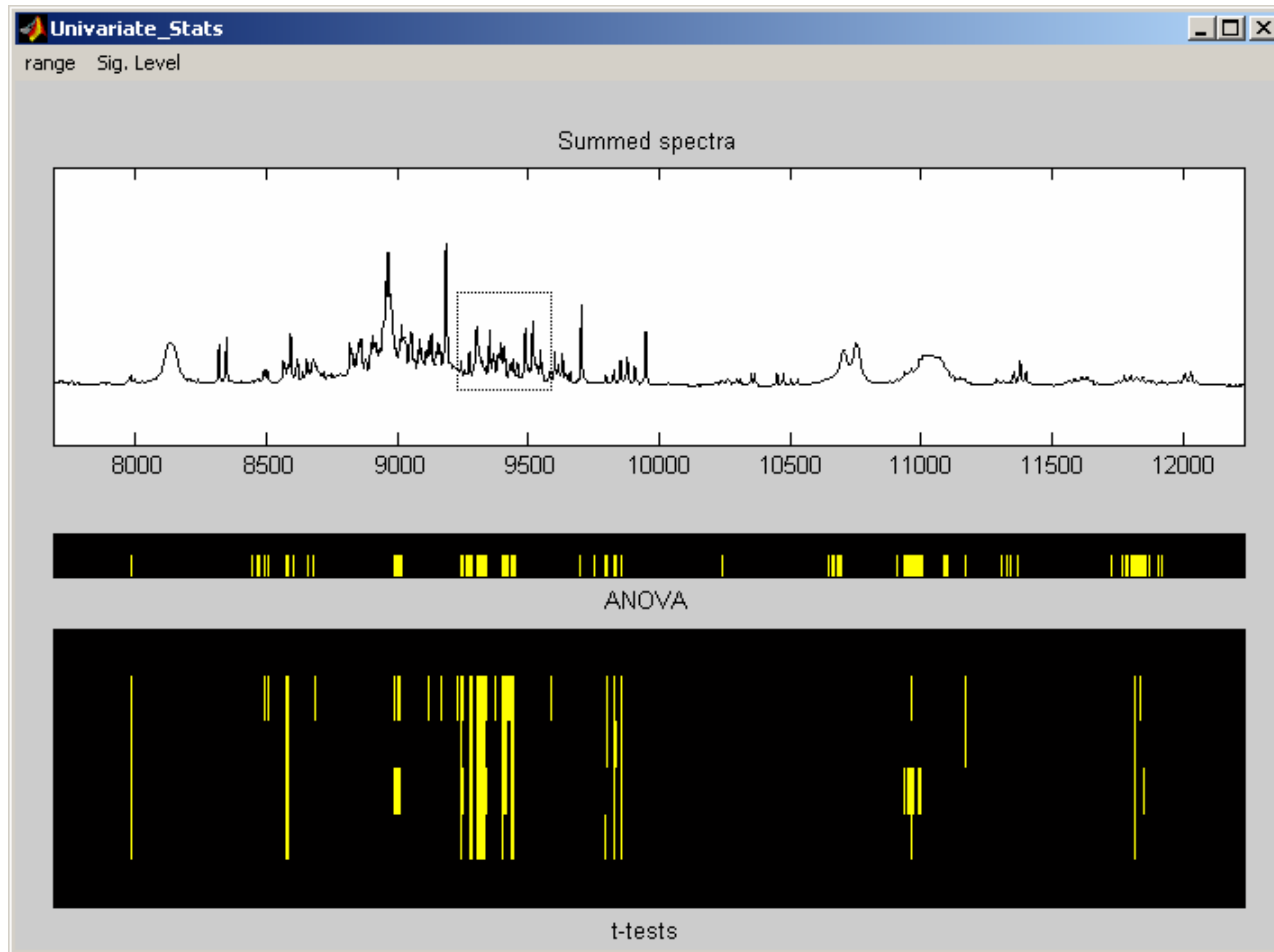
# Fingerprinting/Profiling

- Methods to verify food

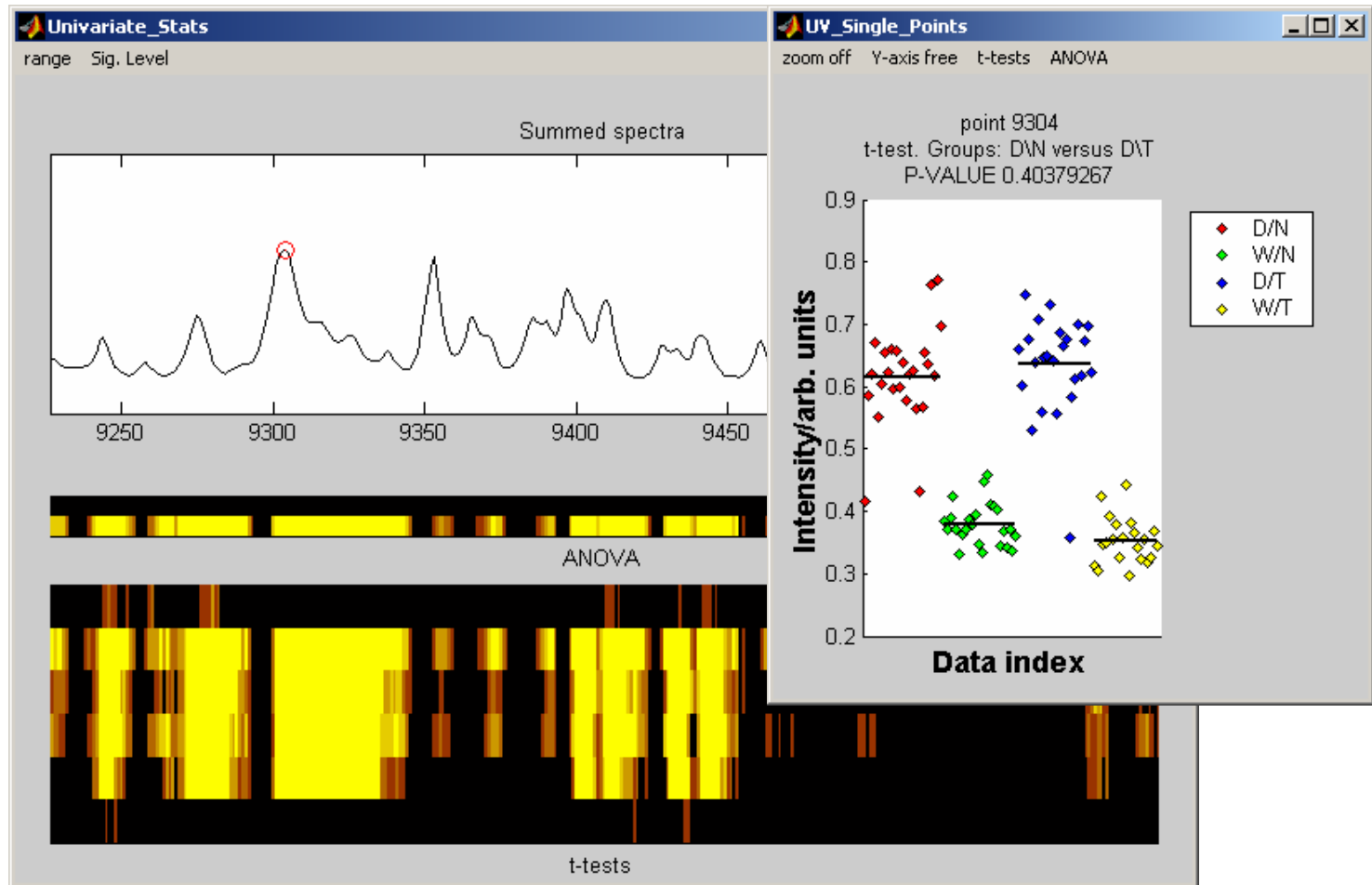


Contains spectral information characterising  
sample(s)/batches

# Data processing and interpretation tools e.g. Metabolab



# Data processing and interpretation tools e.g. Metabolab



# Technology Transfer

- 5 Demonstration activities
  - 3 month demonstration within the industry of the developed traceability systems and methods
  - Implementation of the new traceability systems and analytical mechanisms in the factory
  - Evaluation of the cost/benefit analysis
  - Workshop to discuss results
  - Demonstration activities start at month 19 and end at month 54
- Training Network
  - Comprehensive training of scientists within *TRACE*

# Demonstration Activities

It is vital that the outputs generated within TRACE are:

**exploitable**  
**applicable**  
**implementable**

There will be 5 Demonstration Activities:

- mineral water
- honey
- cereal
- meat (chicken and ham )



# TRACE Participants

- Consumer organisations
- Private companies including (SME's)
- Food Industry
  - Producers, distributors, Industry Association
- Research Institutes
- Universities
- Regulators,
- Country involvement: 17 (+ 8)
  - UK, FR, IT, DE, AT, GR, BE, NL, CZ, SI, IE, NO, PL, IS, ES, CN, CH, (US, CAN, T, RO, HU, SK, YU, BR)

## Summary- *TRACE*

- Traceability systems and methods will be developed to verify:
  - Geographical origin
  - Production origin
  - Species origin
- Work started January 2005
- Enquiries/ further information at [www.trace.eu.org](http://www.trace.eu.org)

# Acknowledgements: to the consortium.....



ISTITUTO AGRARIO  
DI SAN MICHELE ALL'ADIGE



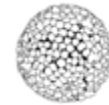
Universiteit Utrecht



UNIVERSITY OF SILESIA  
IN KATOWICE



Radboud University Nijmegen



GEOCHEM  
RESEARCH



WpA Beratende Ingenieure



HELLENIC RESEARCH HOUSE



INSALUS



AMBIENT INTELLIGENCE FOR FOOD QUALITY AND SAFETY,  
November 15-16, 2005, Aula Magna Università di Firenze

