



Université  
de Strasbourg

# Proposal for JDS4

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Laboratoire Réactions et Génie des Procédés

LTSER Bassin de la Moselle

In partnership with D. Vignati (CNRS-UL-LIEC), M. del Nero & O. Courson  
(IPHC, Univ. Strasbourg)

France

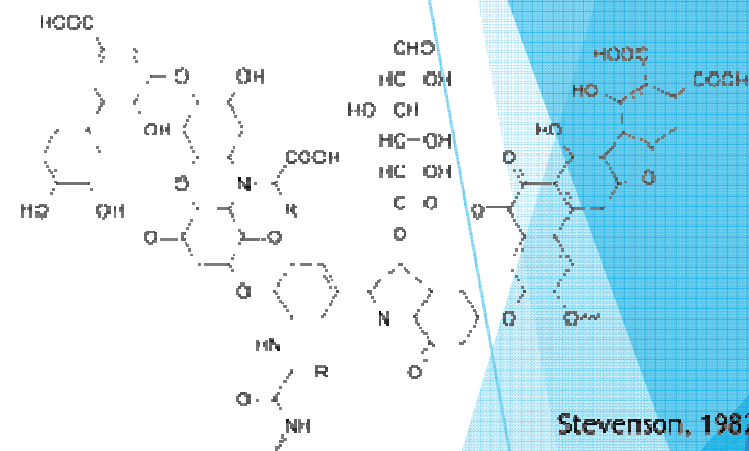


ZA Zones  
Atelier  
LTSER FRANCE BASSIN DE LA

# Our proposal in brief (in relation with our actual projects)

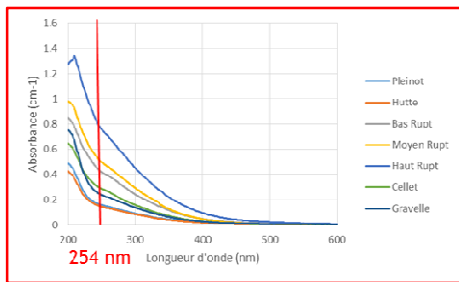
- ▶ Dissolved organic matter
  - ▶ drinking water production, transport of metals, global carbon cycle, etc ..
- ▶ Dissolved Organic Carbon
- ▶ Optical methods
  - ▶ UV-visible spectroscopy
  - ▶ Fluorescence spectroscopy
    - ▶ Emission ( $\lambda_{exc} = 254 \text{ nm}, 310 \text{ nm}$  and  $370 \text{ nm}$ )
    - ▶ Synchronous:  $\lambda_{em} - \lambda_{exc} = 50 \text{ nm}$
- ▶ High resolution mass spectrometry: NTS on DOM extracts
- ▶ Correlation between optical methods and HRMS
- ▶ Rare Earth Elements (incl. Gd, an anthropogenic marker)
  - ▶ Emerging contaminants ?, ecotoxicological effects ?
- ▶ Correlation with land use in the vicinity of the river (Corine Land Cover, population, ...)
  - ▶ Long Term Socio-Ecological Research

*1 possible representation*

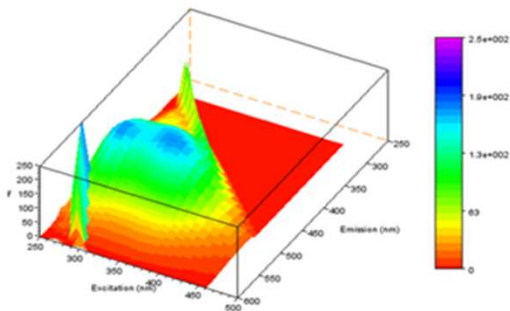


# Synchronous fluorescence

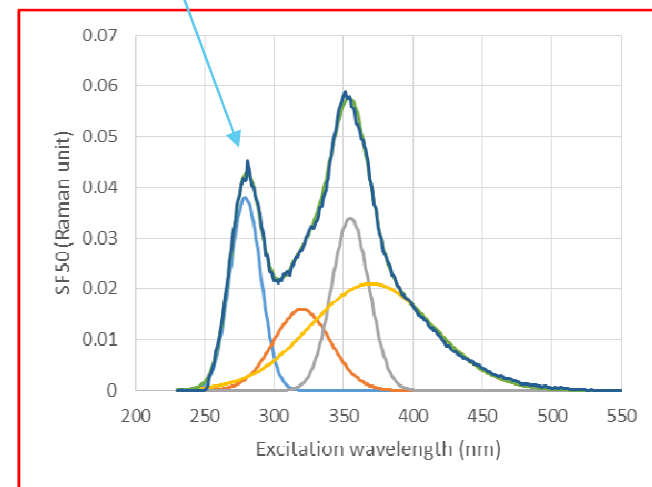
## ○ UV-vis spectroscopy



## ○ Fluorescence spectroscopy



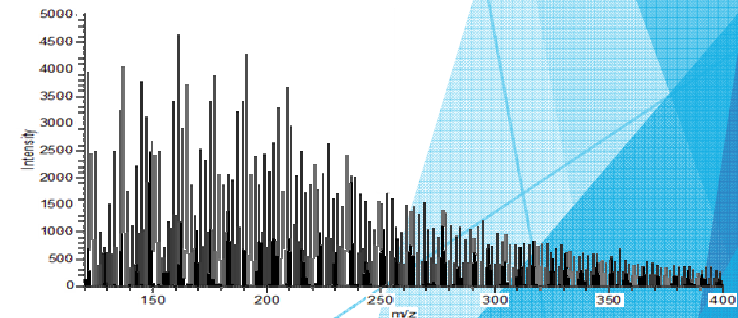
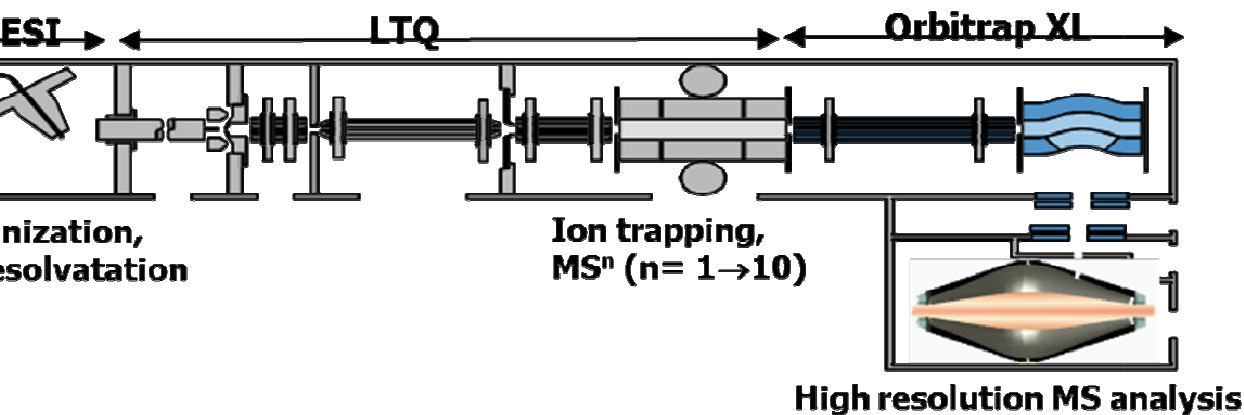
## Protein-like fluorescence



Deconvolution in basic « fluorophores »

# High-resolution mass spectrometry

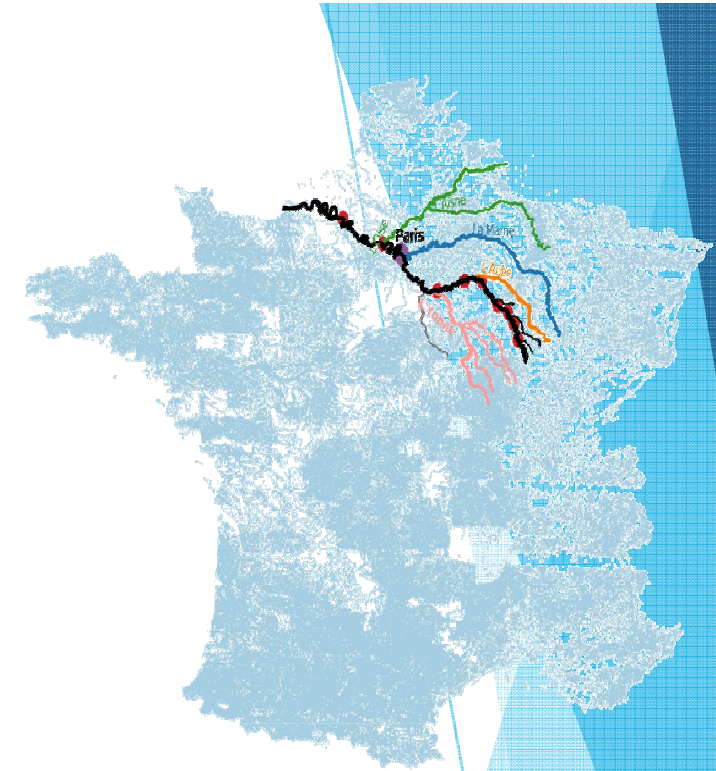
- ▶ Extraction of humic substances (+ other ...)
  - ▶ Several methods can be applied: XAD8 (IHSS), **OASIS-HLB**, C18, reverse osmosis + electro dialysis
- ▶ HRMS
- ▶ Direct injection of the extract



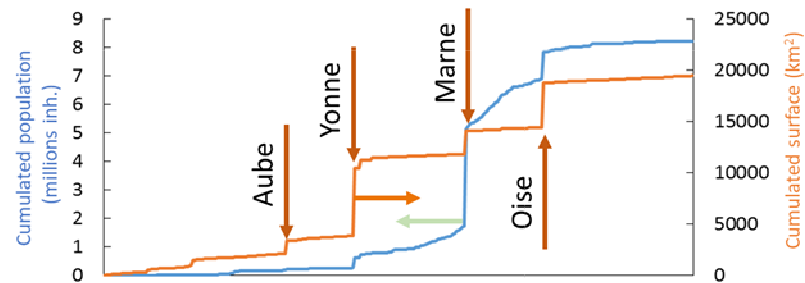
Determination of the most probable chemical formula ( $C_xH_yO_zN_t$  or  $C_xH_yO_zN_tP_uCl_v$ ) for each m/z in the spectrum (rules are applied)

# Example: the Seine River

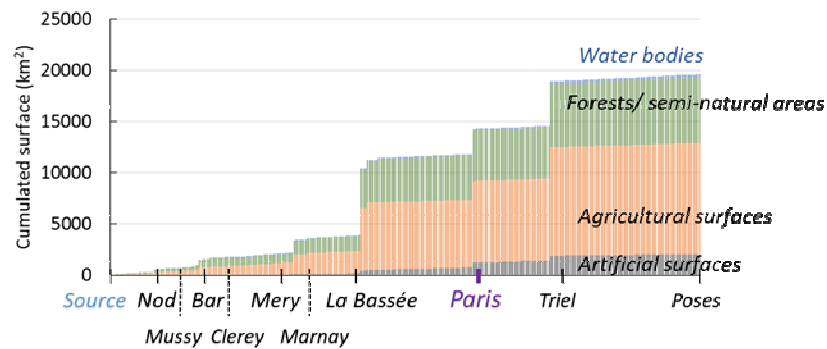
- 776.6 km long
- ~79 000 km<sup>2</sup> watershed surface
- 30 % of French population ~20 Millions inh
- Mean stream: 328 m<sup>3</sup>.s<sup>-1</sup> (Paris)



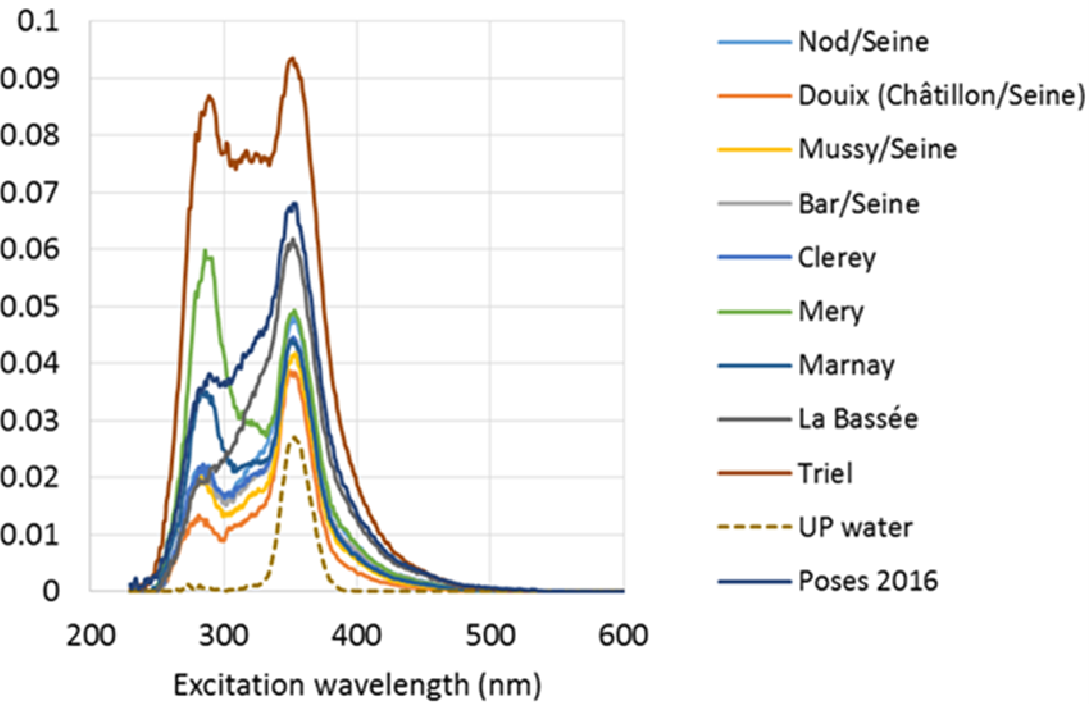
## Population



## Land use



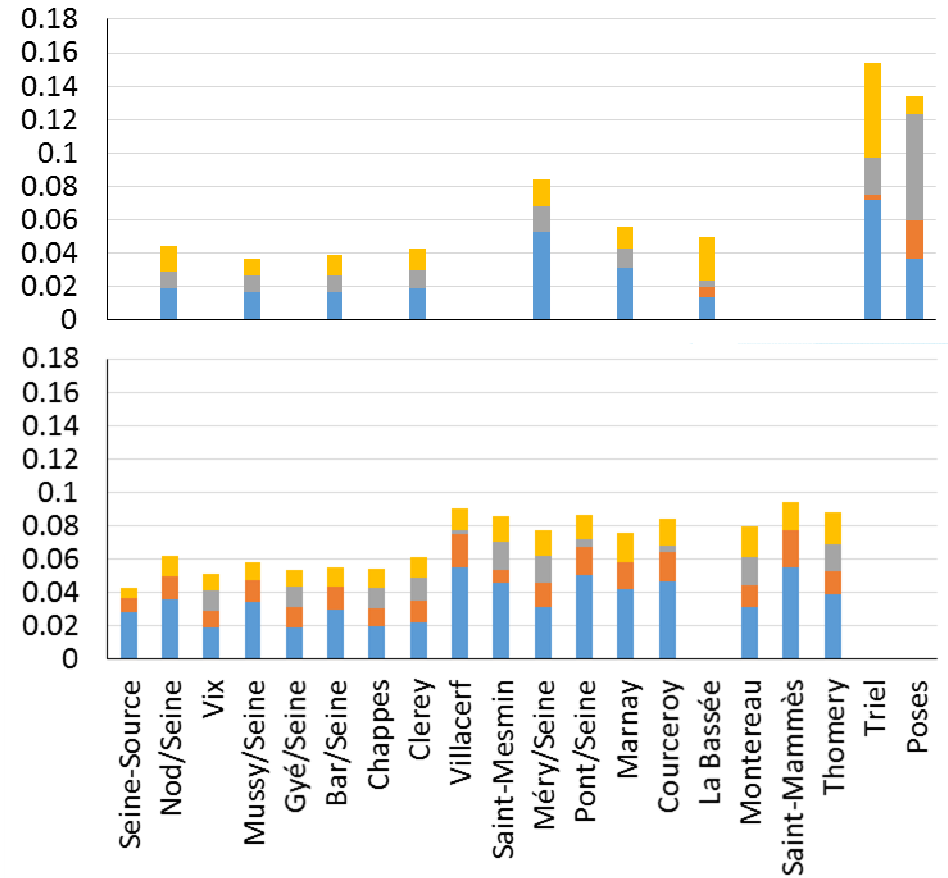
# Synchronous fluorescence



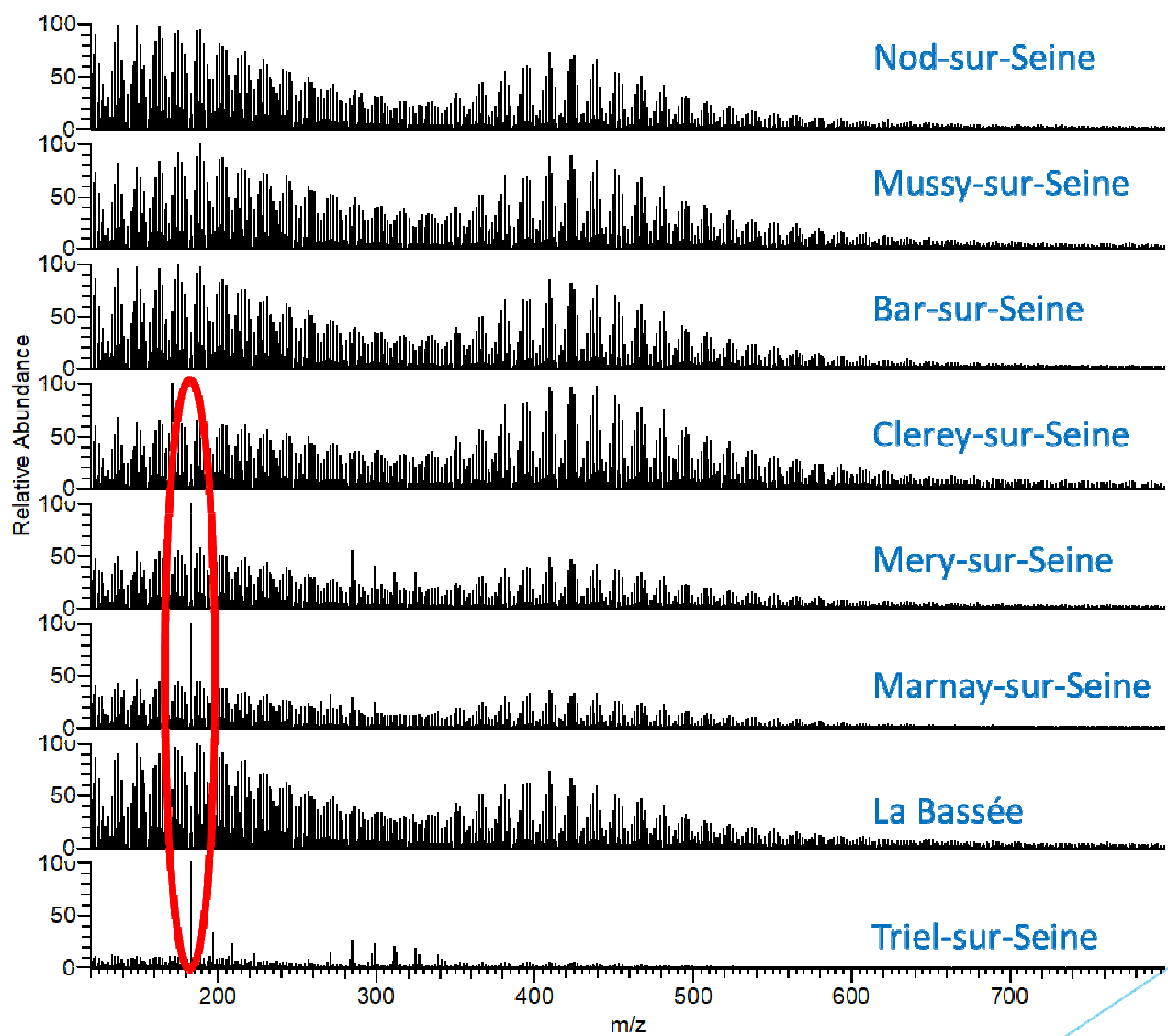
Snapshot surveys

## Protein-like fluorescence

F1 F2 F3 F4

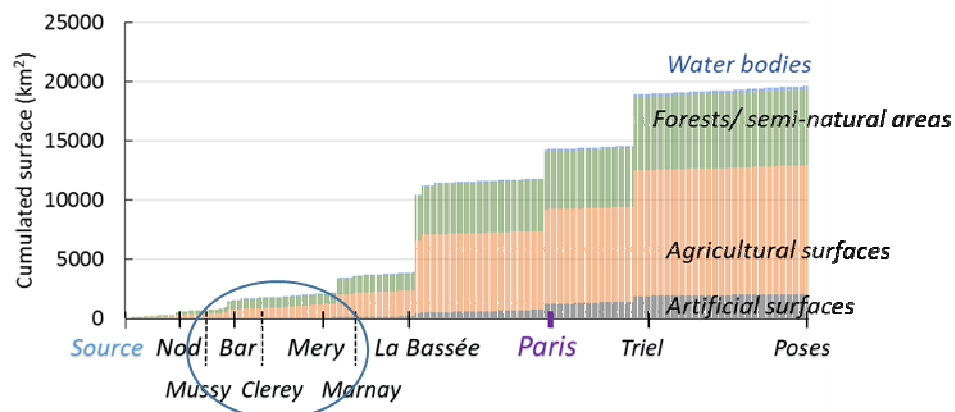


# HRMS

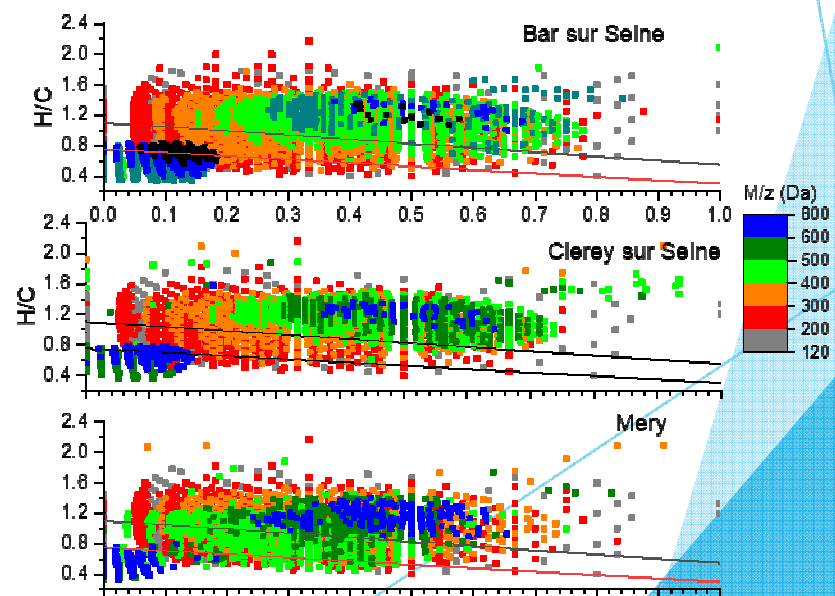


ref: Pons et al., 2017, 2018

# Example of a section with a large city (Troyes)



Van Krevelen diagram

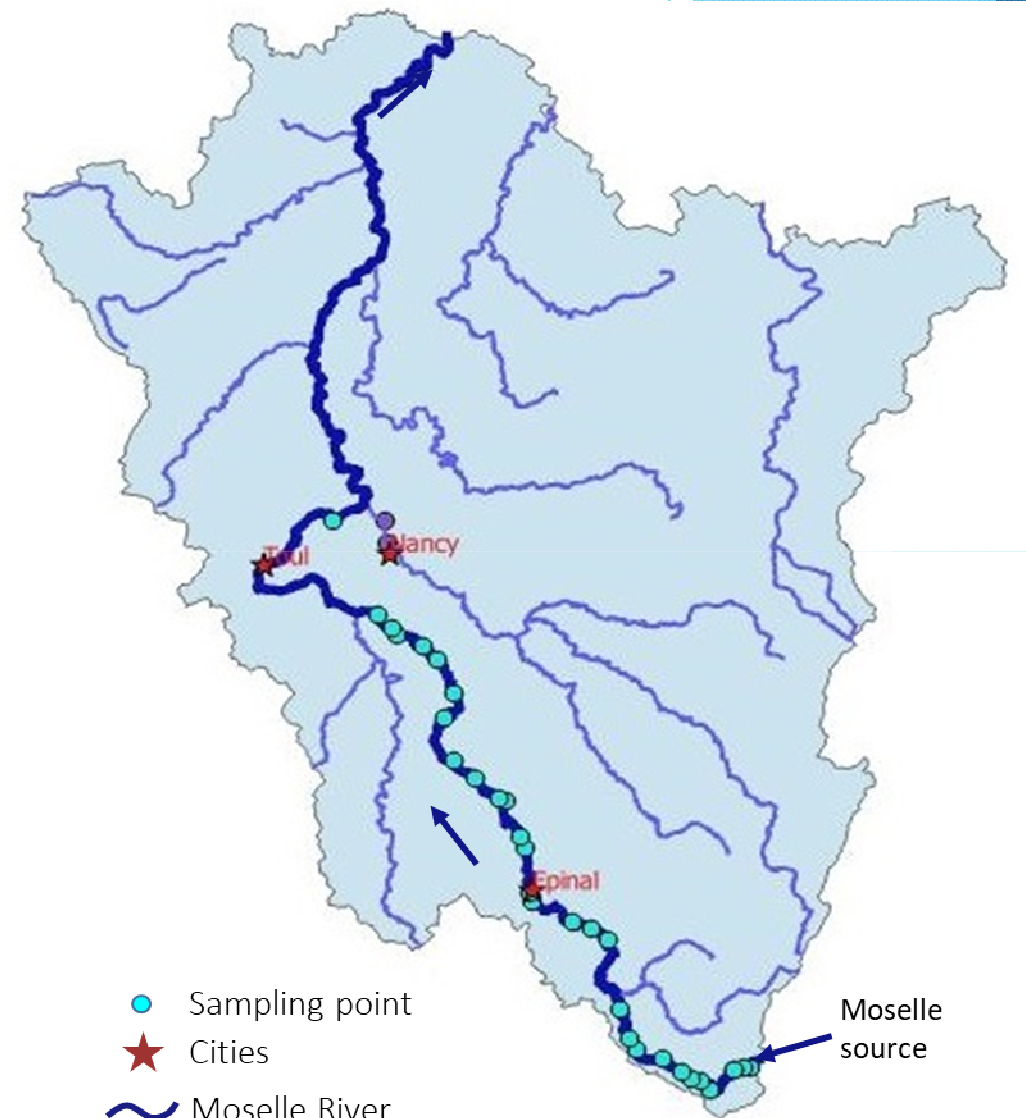




# Rare Earth Elements

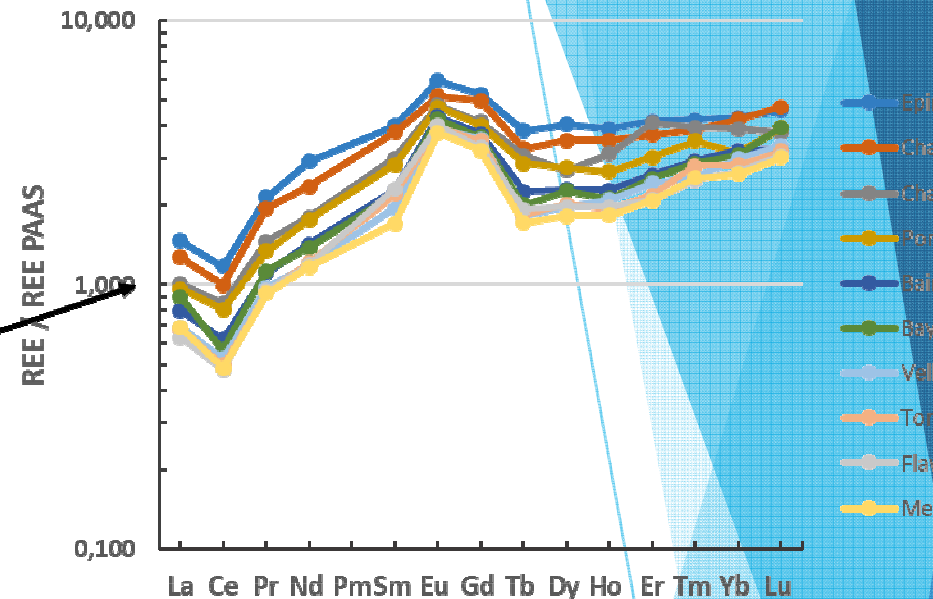
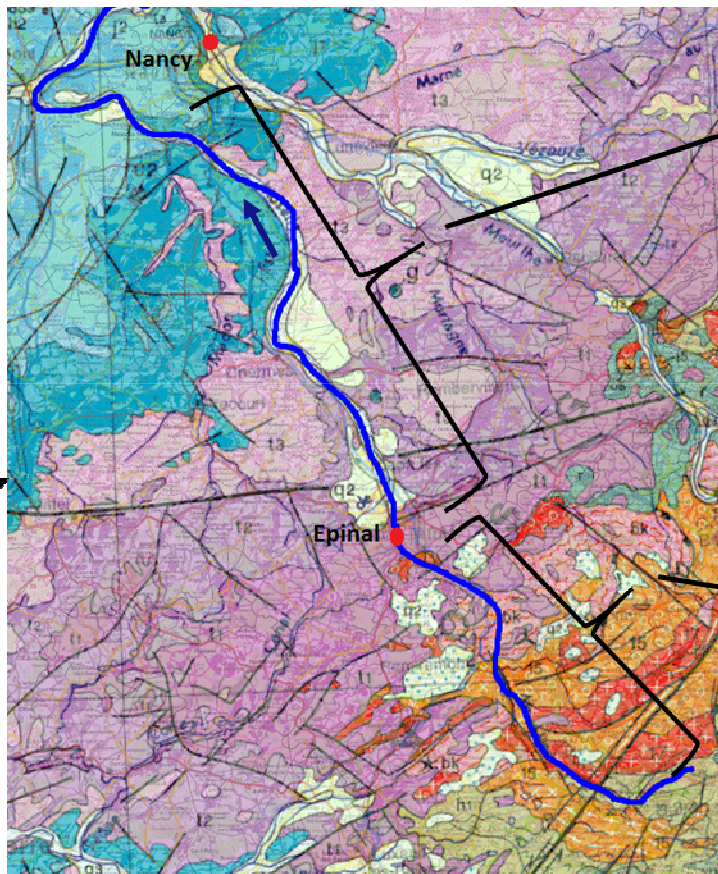
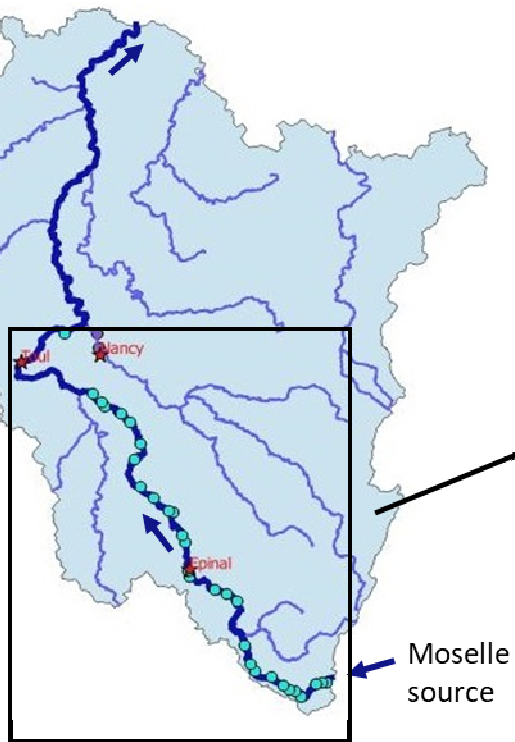
1																	2							
1	H																	He						
2	Li	Be																	B	C	N	O	F	Ne
3	Na	Mg																	Al	Si	P	S	Cl	Ar
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr						
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe						
6	Cs	Ba	La..	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn						
7	Fr	Ra	Ac..	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Uub	Nh	Fl	Mc	Lv	Ts	Og						
			La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu							
Z																								
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REE

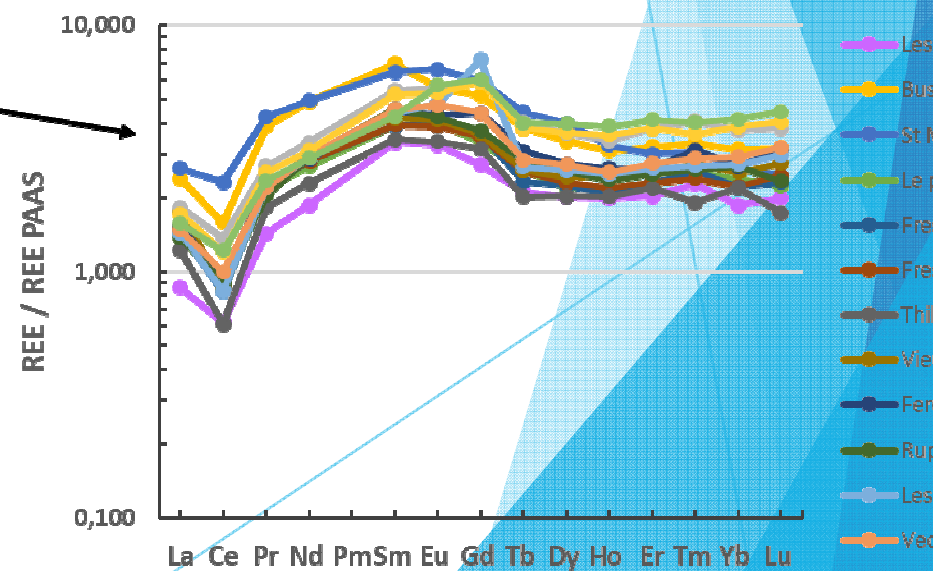


- Sampling point
- ★ Cities
- ~ Moselle River
- ~ Other rivers and tributaries

# Along the Moselle River



Figures: PAAS normalized REE patterns of Moselle samples



Snapshot survey

f: Louis et al., 2018

# Proposal

- ▶ DOC, optical methods, REE for all samples (51 (+1) + 10 groundwater samples)
  - ▶ DOM: 2 to 4 L, GF/F
  - ▶ REE: 125 mL, 0.45  $\mu\text{m}$
- ▶ HRMS on DOM extracts for a selected number (super-sites ?)
- ▶ Correlation between these methods
- ▶ Correlation with other chemical data
- ▶ Correlation with land-use (need help to get the data)