Trihalomethane studies in soil and sediments of Grand Canal d'Alsace

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M2 internship
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Juxta Rhenum project

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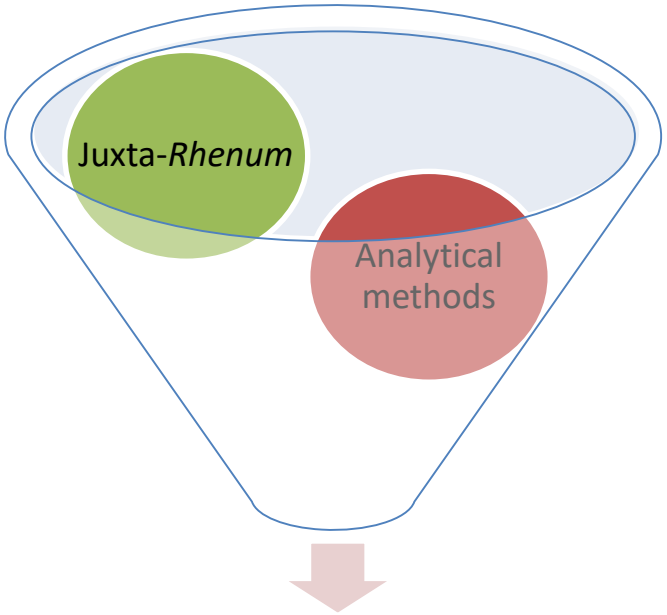
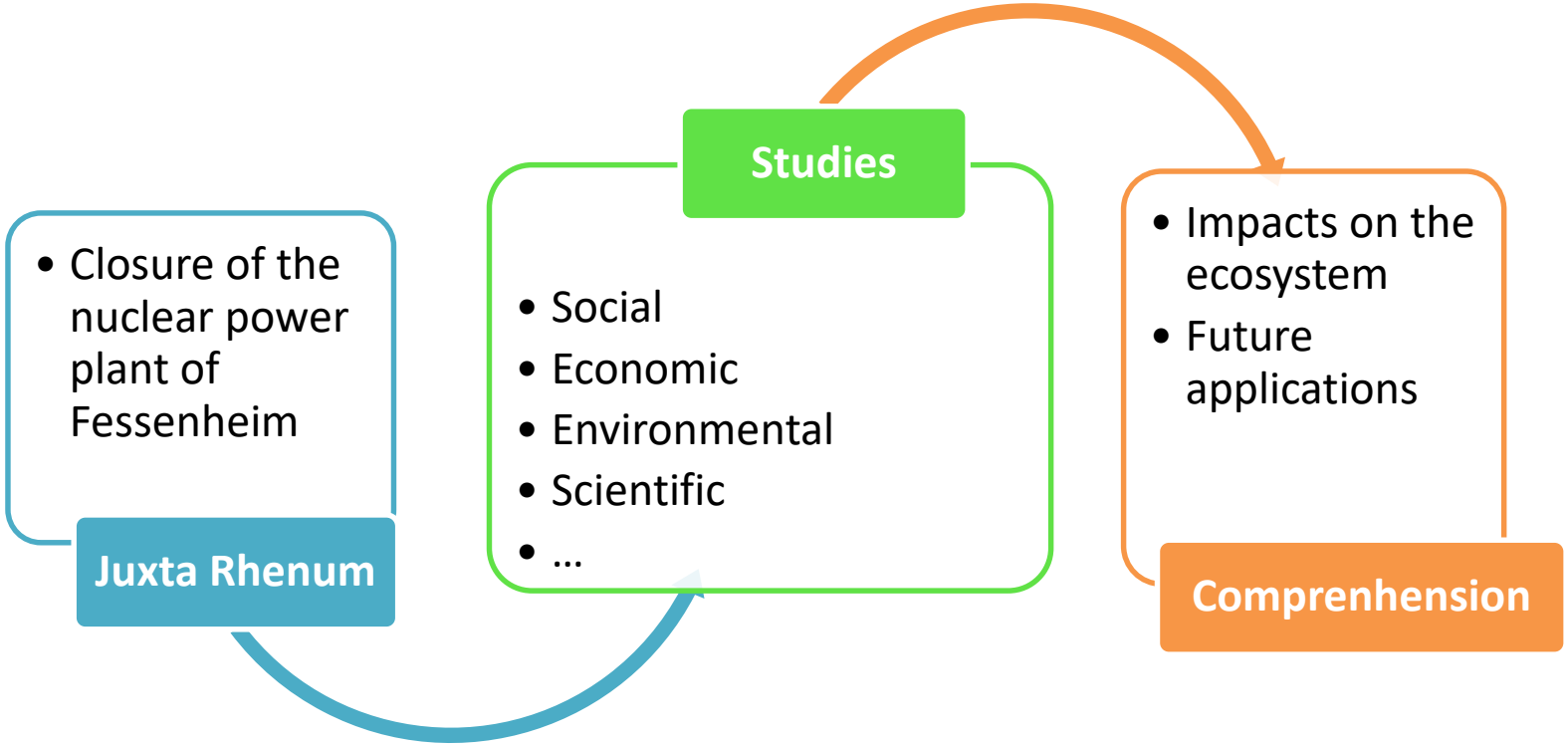
Introduction



Picture 1 : sediment matrices

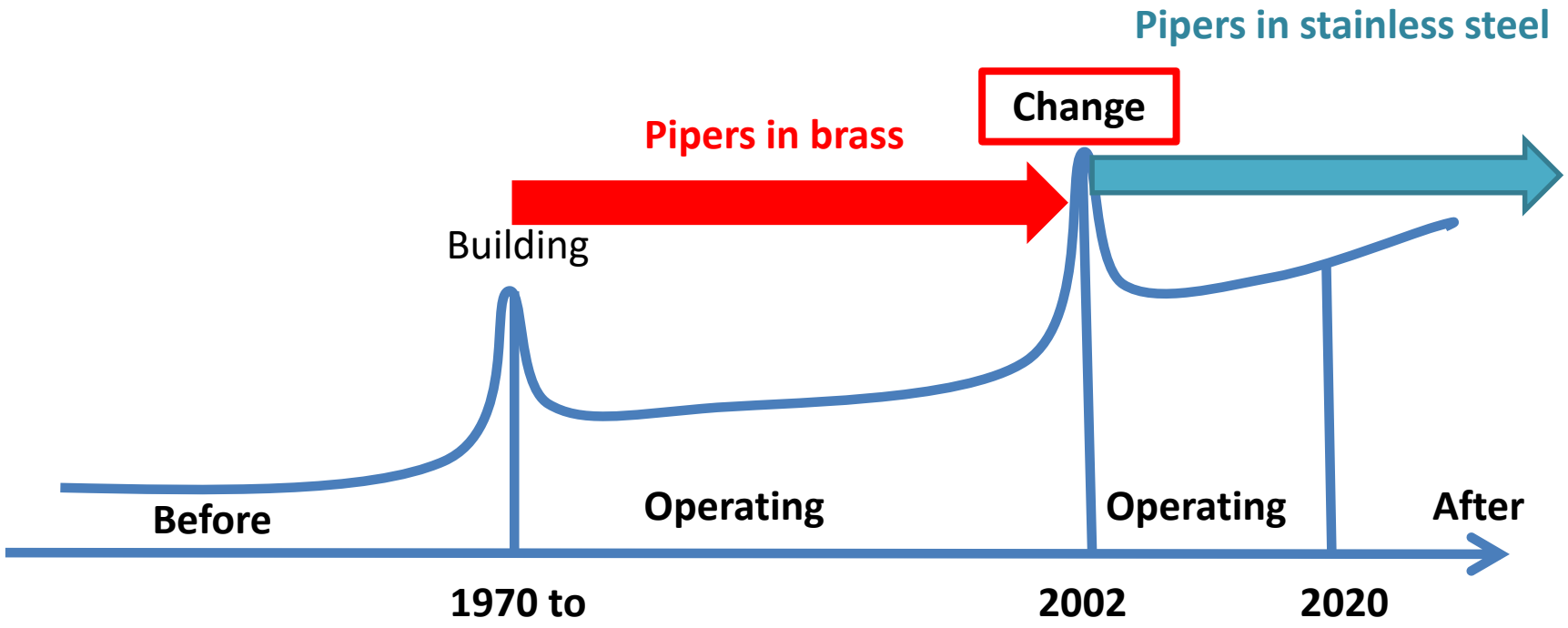
Picture 2 : aqueous matrices

Juxta-*Rhenum* project



- Multi-disciplinary approach
- Comprehension of the Fessenheim's ecosystem

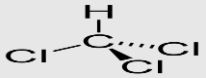
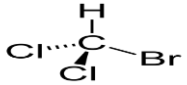
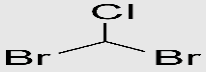
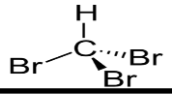
Fessenheim



	Before 2002	After 2002
Piper	Brass (Cu/Zn)	Stainless steel
Biocide treatments	No	Yes
Metal rejection	Yes	No
Cost/kg (€)	2,50	0,60

Stainless steel → No biocide effects → Use of $NaClO_2$

Trihalomethanes

Name of the molecule	Molecular mass (g/mol)	Boiling point (°C) at 100kPa	Structure of the molecule
Chloroform	119,38	61	
Bromodichloromethane	163,80	90	
Dibromochloromethane	208,28	119	
Bromoform	252,73	149	

- Disinfection by-products
- Toxicity mechanisms approved
- Volatile contaminants

Picture 3 : Water contaminated by THM

Analytical strategy

Sampling

- Shovel
- 2 mm sieve

Treatment

- Mechanical agitation for 10 min
- Magnetic agitation (5000 rpm) for 15 min
- Sonicator (37 kHz) for 5 min

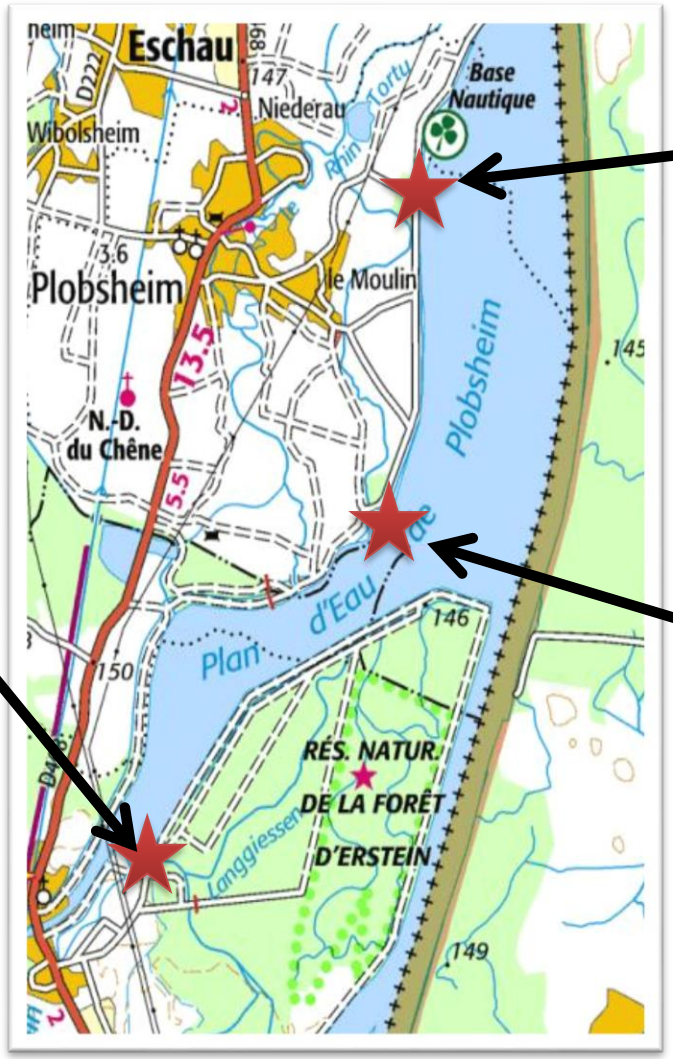
Analysis

- SPME in headspace mode
- GC-FID detection

- Tests on water and sediment samples
- Additional analysis (pH, dried matter)

Picture 4 : The GC-FID system (Agilent®)

Plobsheim



A

C

B

Results Plobsheim

Water	[X] (ppm)				
	$CHCl_3$	$CHCl_2Br$	$CHClBr_2$	$CHBr_3$	pH
A	2.0 3.2	nd	6.4 9.6	4.8 4.8	7,62
B	8.4 6.4	4.4 6.4	5.6 7.2	3.9 2.9	7,78
C	4.4 6.0	4.6 8.7	5.7 9.6	5.8 6.8	7,77

Table 1 : Concentration of THMs in the water samples of Plobsheim
Nd = Not detected

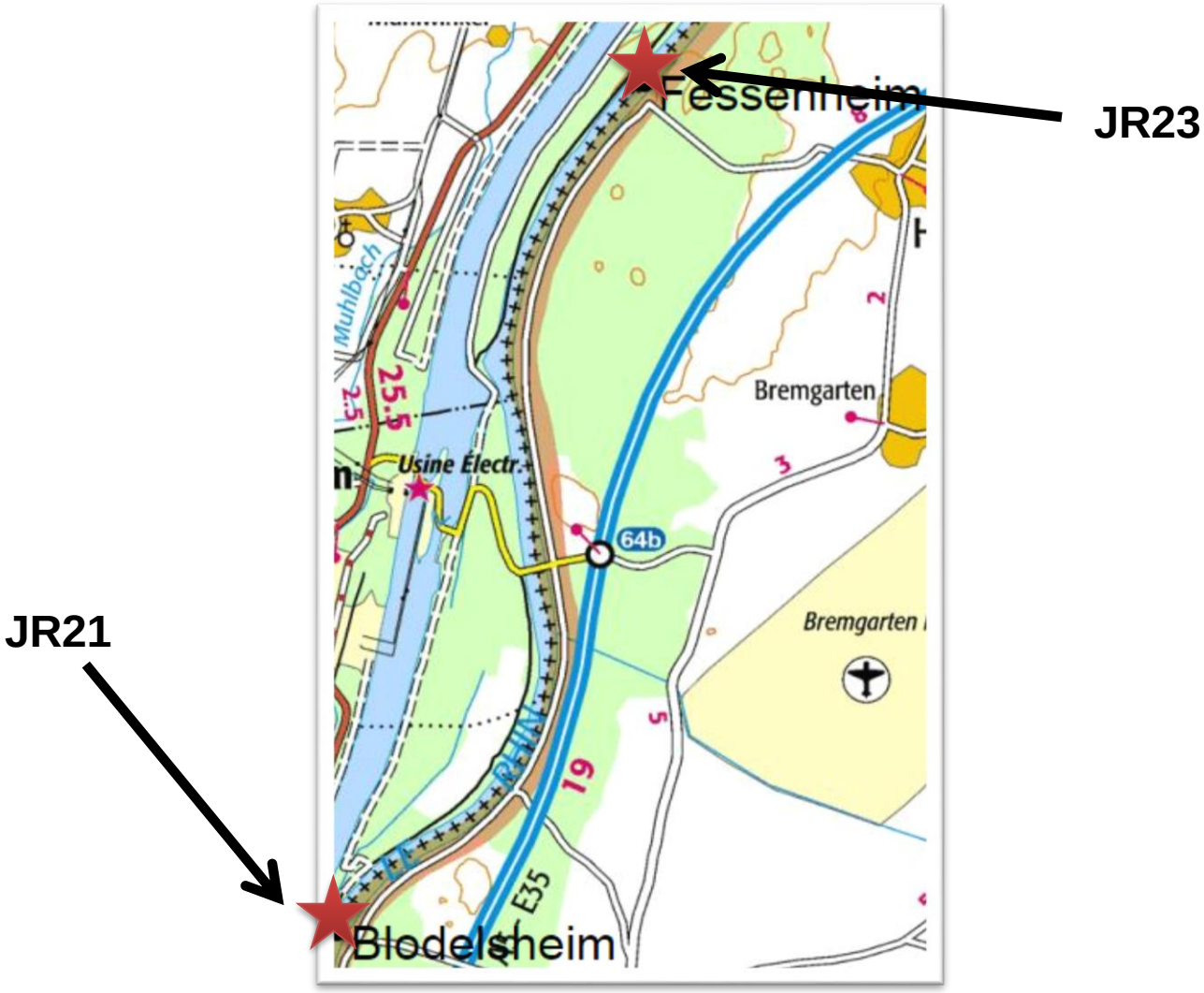
- Same proportions
- ∑4THMs < 100 ppm

Sediments	[X] $(mg/kg)_{brut}$				
	$CHCl_3$	$CHCl_2Br$	$CHClBr_2$	$CHBr_3$	w_{dm} (%)
B	0.01[a] 0.01[a] /	0.003[b] 0.002[b] /	0.48 0.26 0.37	0.04 0.03 0.02	72
C	0.02 ~ 0	/ /	0.52 0.31	0.03 0.02	71

Table 2 : Concentration of THMs for the sediments of Plobsheim
a. LD<[X]<LQ b. [X]<LD

- Brominated THMs
- ∑4THMs > 0,25 mg/kg MS

Fessenheim


JR23
JR21
Fessenheim
Muhlbach
Bremgarten
Usine Électr.
64b
Bremgarten
RHIN
E35
Blodelsheim

Results Fessenheim

Water	[X] (ppm)				
	$CHCl_3$	$CHCl_2Br$	$CHClBr_2$	$CHBr_3$	pH
JR21	2.4 2.1	/ /	2.5 2.5	1.9 2.9	6,72
JR23	0.8	/	4.5	7.8	6,75

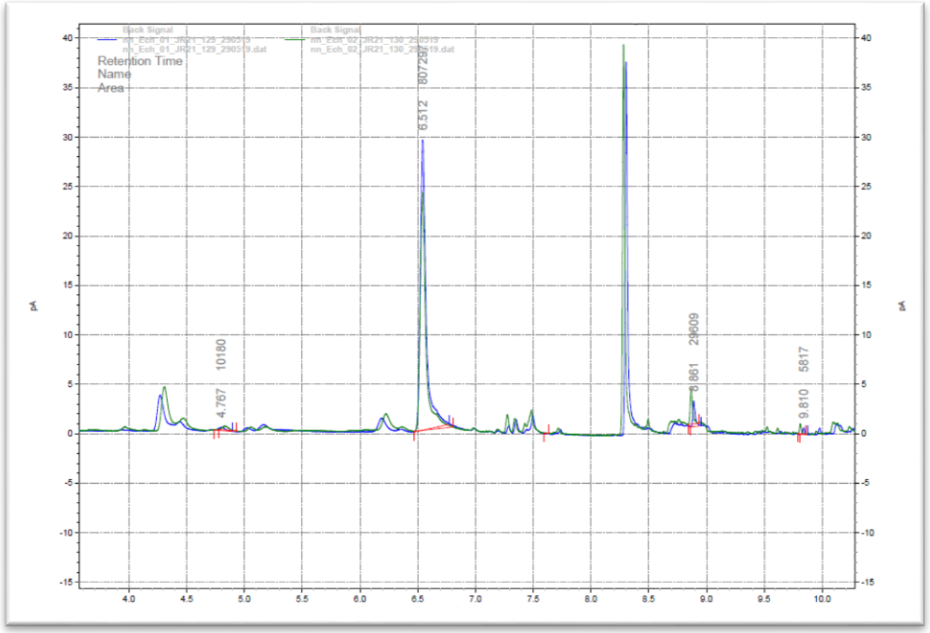
Table 3 : Concentration of THMs in the water samples of Fessenheim

- JR21 : same proportions
- JR23 : Bromine source ?
- ∑4THM < 100 ppm in both case

Sediments	[X] $(mg/kg)_{brut}$				
	$CHCl_3$	$CHCl_2Br$	$CHClBr_2$	$CHBr_3$	w_{dm} (%)
JR21	0.04 0.03 0.04	0.003 0.002 ~ 0	0.17 0.17 0.19	0.06 0.05 0.05	
JR23	0.06 0.05 0.10	/ / /	0.24 0.24 0.55	0.03 0.04 0.09	68

Table 4 : Concentration of THMs for the sediments of Fessenheim

- $CHCl_3$ and $CHBr_3$ in same proportions
- $CHClBr_2$ in excess
- $CHCl_2Br$ in small quantities
- ∑4THMs > 0,25 mg/kg MS



Picture 5 : Two chromatograms of JR21 sample

Discussions

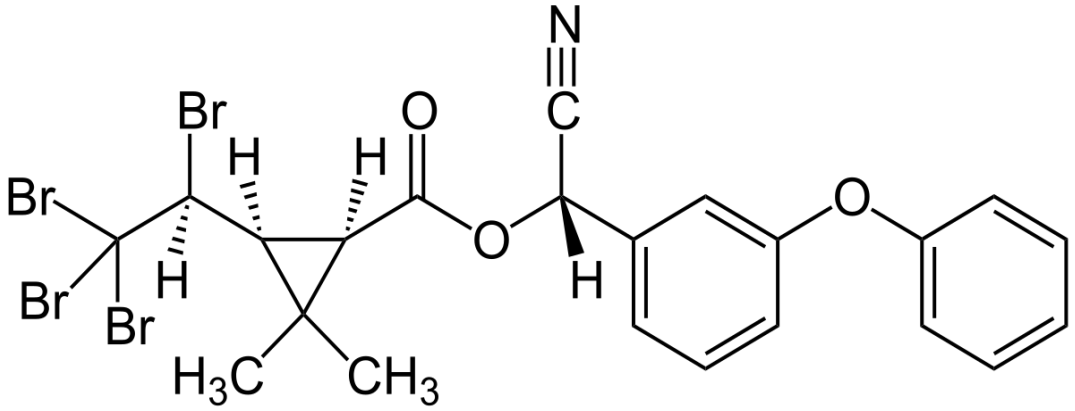
Picture 6 : Characea in Plobsheim

Picture 7 : Rhodia-operations industry

Cl_2,HOCl,ClO^-
Sodium hypochlorite
0.4T/an

OM
Seaweed

Pesticides
Plasticizers
Brominated compounds



Picture 8 : Tralomethrin pesticide

Conclusion

Done in this internship :

✓ Creation, optimization and validation of an analytical method

✓ Quality control

✓Sediments and water samples analysis

✓ Interpretations of results

Improvement:

✓ Test another homogenization methods

✓ Solid phase extraction

✓Analysis of more deeply sediments

Thank you for your attention !!!