
Up-Scaling with novel instrumental resources : New analytical challenges for Environment, Food and Health

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Why TunTwin and focus

SCIENCE: Metals and metalloids play a key role in most fields of our modern industrial societies. Not only as basic material such as steel in many industrial products, but also as trace elements under inorganic minerals, inorganic forms, organometallic moieties, large metallo-complexes that all play key roles in environmental, life sciences and in industrial processes. The new challenge is now not only to characterize the **metals** and their **reactive species** but also offer the unique possibility to localize their occurrence and **location in 2D or 3D** and hence their role in matrices and processes studied. Analytical sciences and characterization resources have been identified to be one of the main promoters of innovation and will open the way to new progress in industrial challenges. The developments within the TunTwin project will be directed toward **Food, Environment** and **Health**.

EUROPEAN STRUCTURE: Use advanced combined resources to promote novel sciences but also facilitate the integration of Tunisia in the European momentum.

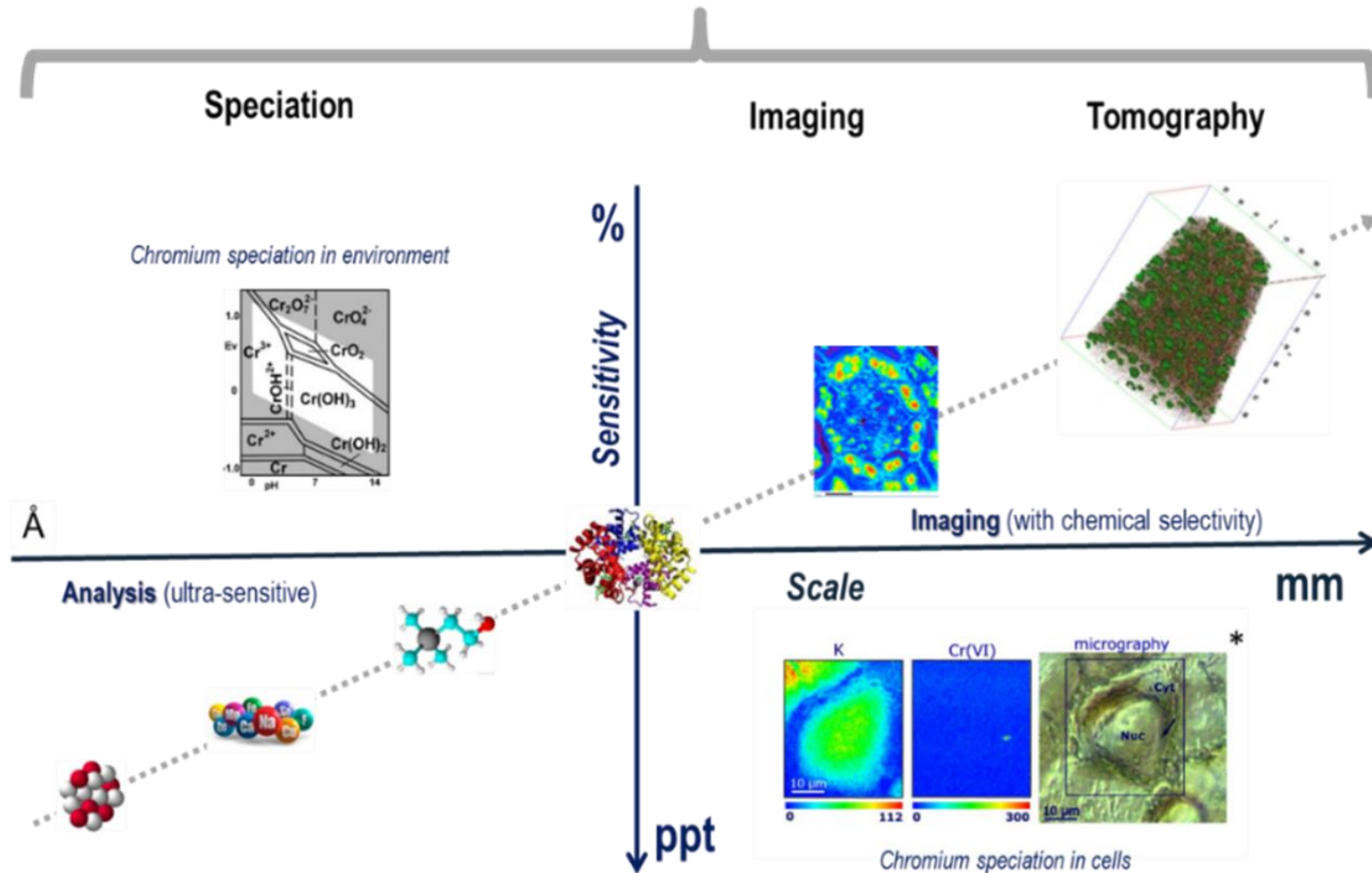


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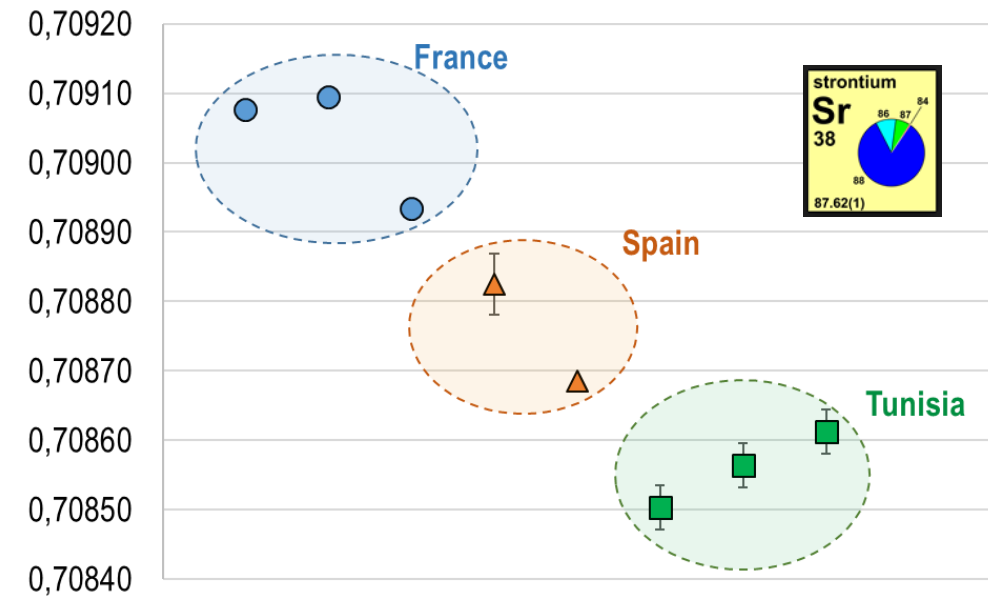
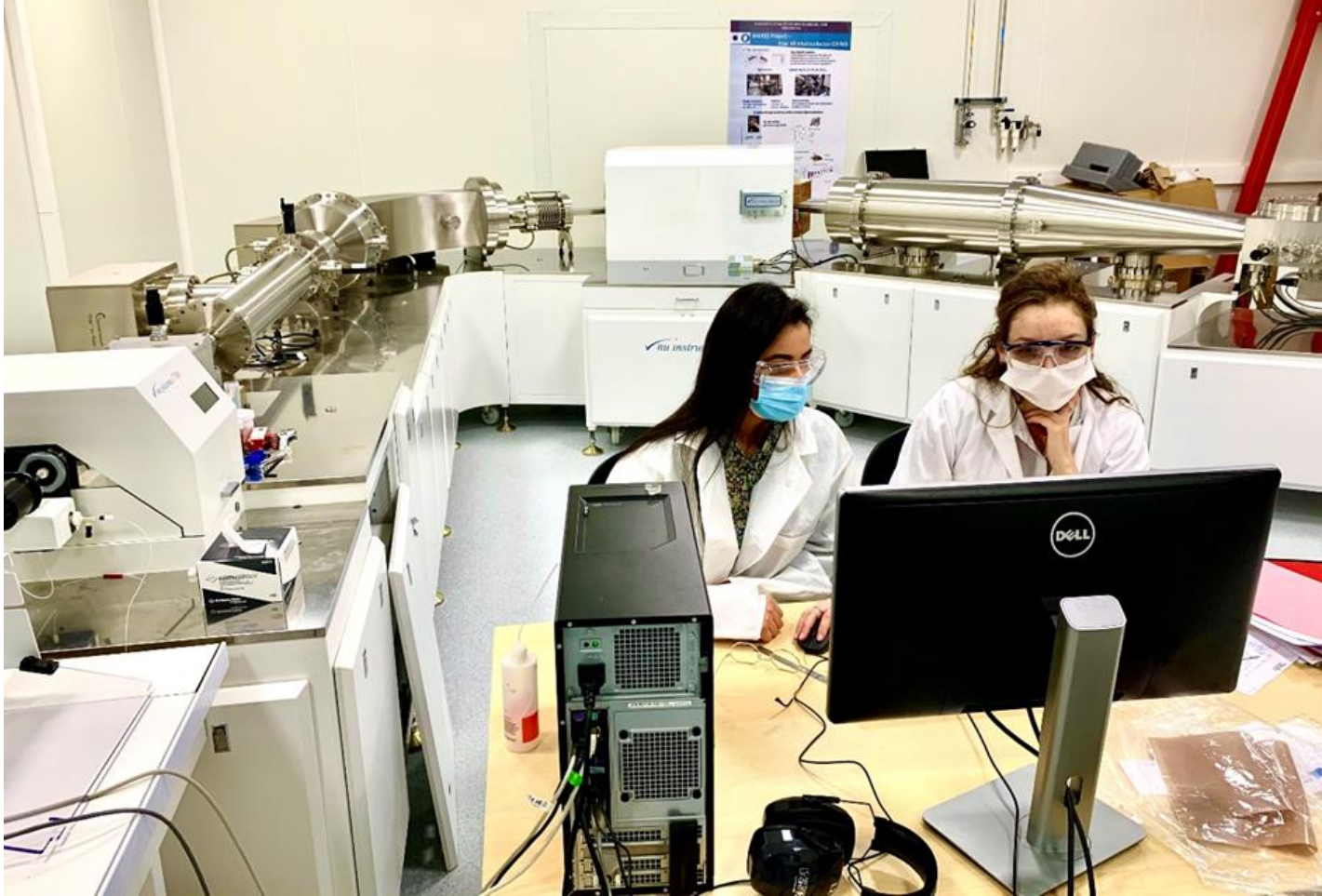


Bridging the gap

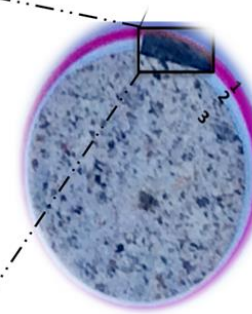
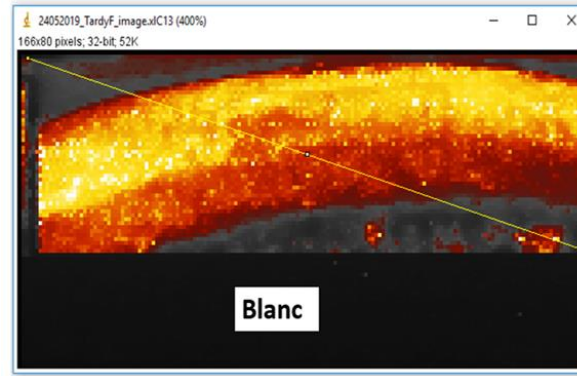
Bridging the gap



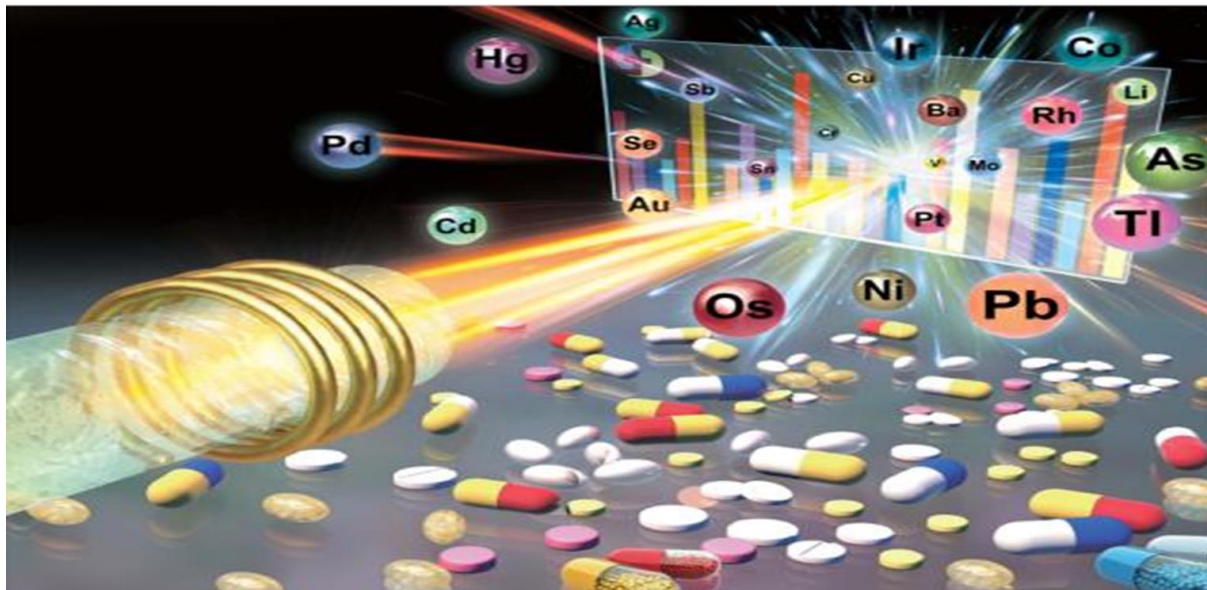
Food : Advanced traceabilities



Health: Advanced inorganic determination ICHQ3D



Laser Ablation/ICP-MS



Mass Spectrometry | Isotope Dilution Mass Spectrometry

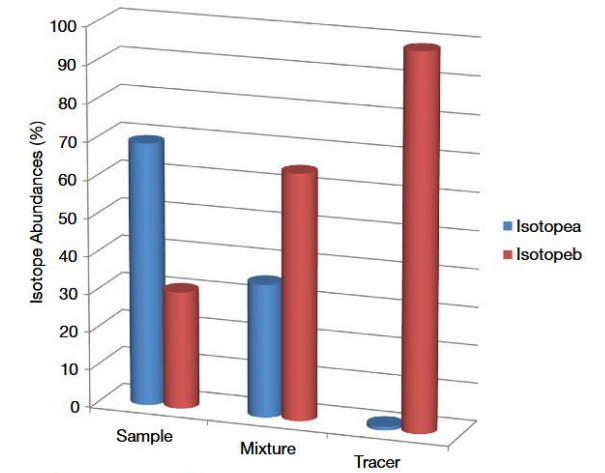
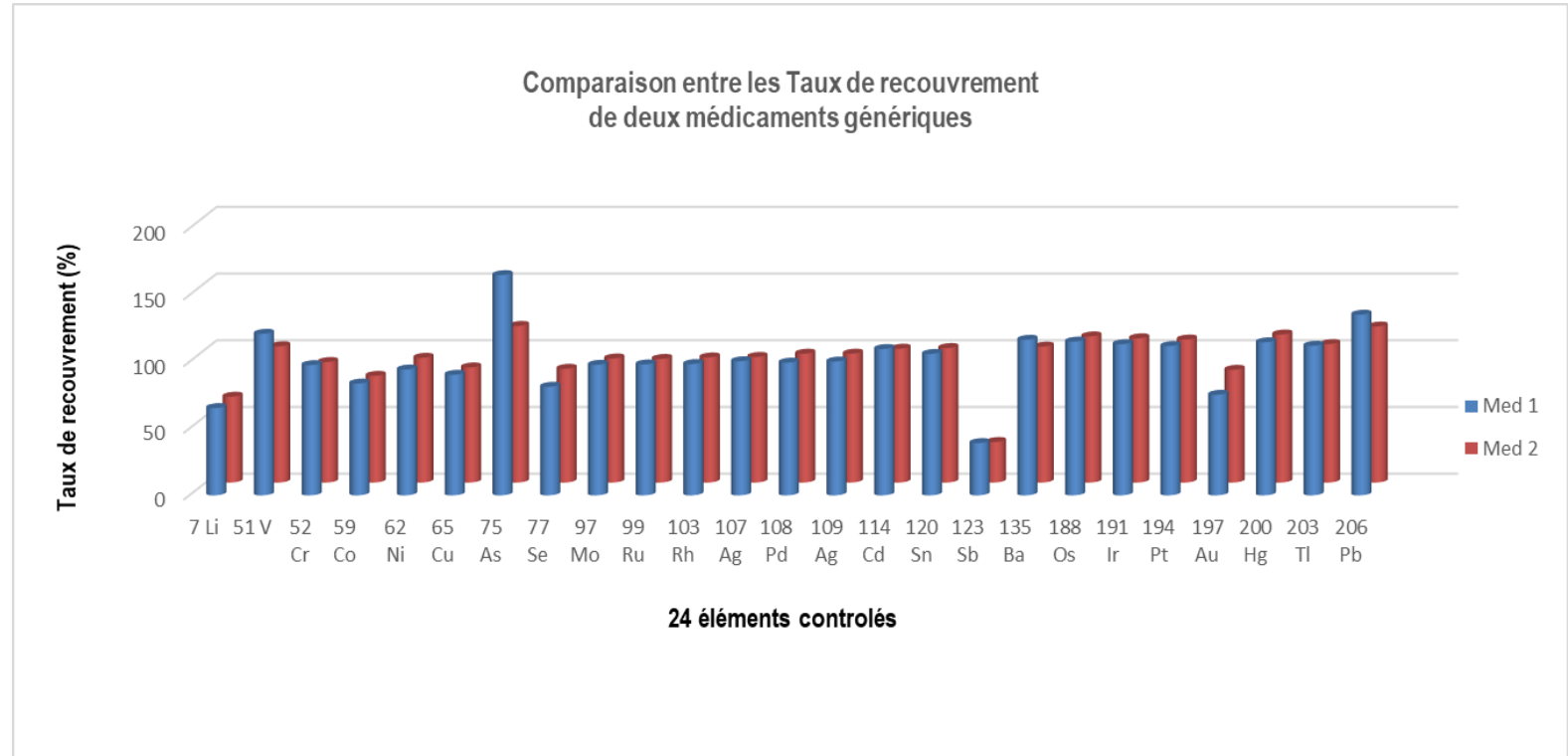


Illustration of the isotope dilution principle for a bi-isotopic element.

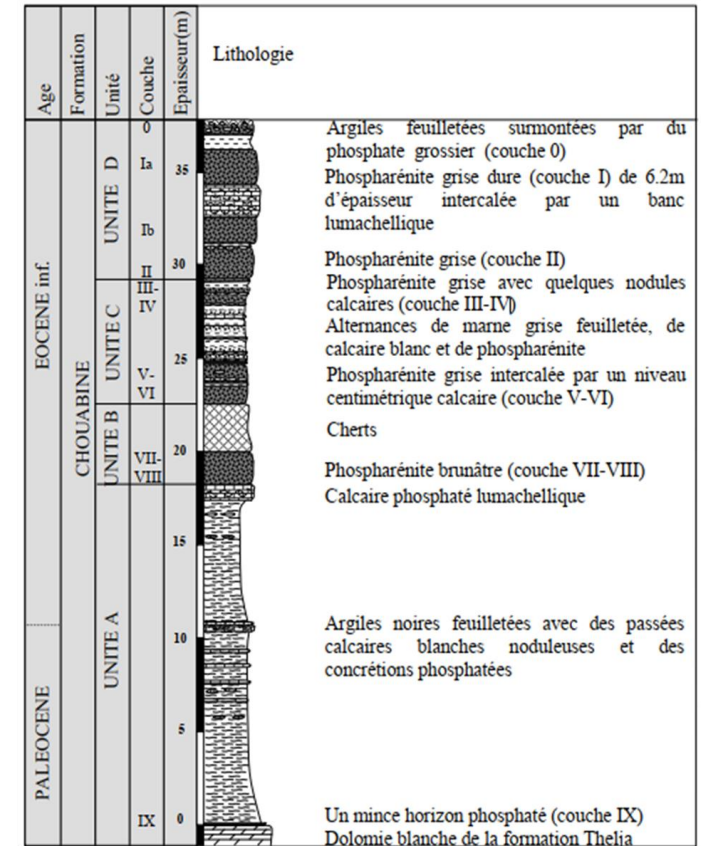
Isotopic dilution

Health: ICHQ3D

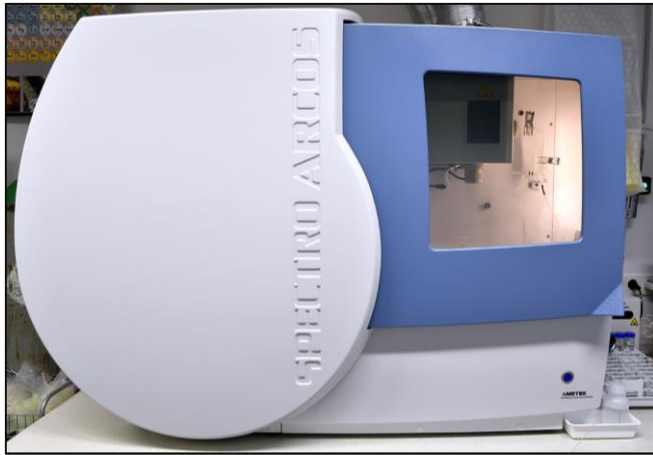


Critère de validation des taux de recouvrement T selon L'USP :
 $70\% < T < 150\%$

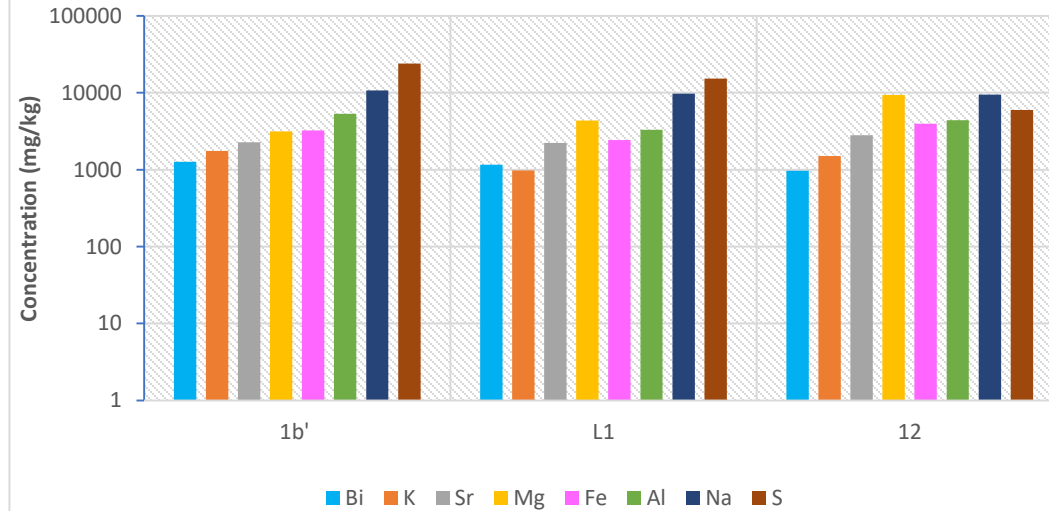
Environment: From Phosphate to Phosphogypsum



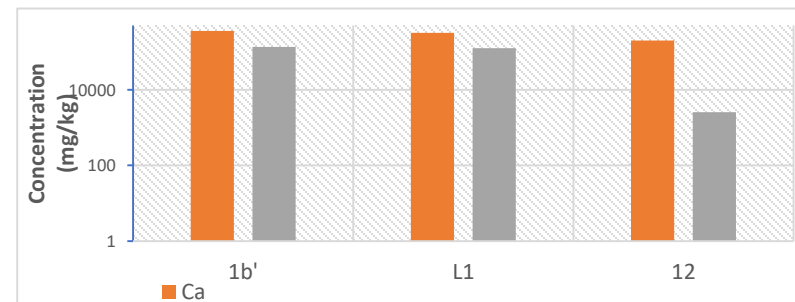
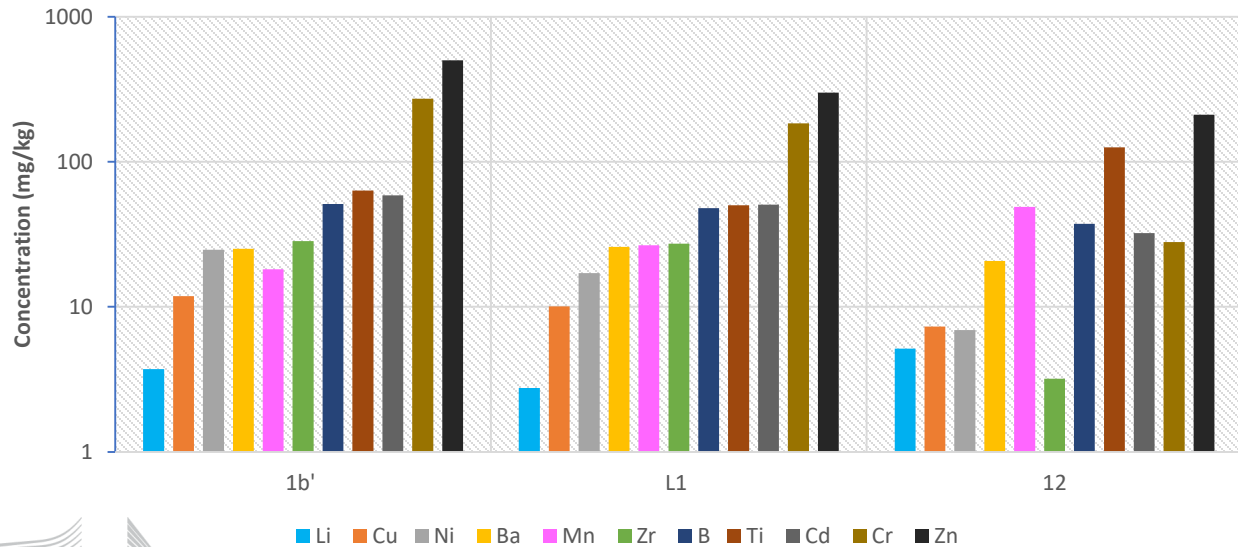
Environment: From Phosphate to Phosphogypsum



ICP-AES ARCOS



Metals	Samples		
	1b' (Raw Phosphate)	L1 (Laundry)	12 (Gabes Gulf Sediment)
Li	3,72	2,76	5,16
Cu	11,86	10,08	7,32
Ni	24,80	17,07	6,90
Ba	25,09	25,93	20,76
Mn	18,19	26,62	48,85
Zr	28,37	27,31	3,19
B	51,20	47,92	37,38
Ti	63,43	50,17	125,70
Cd	58,72	50,68	32,29
Cr	272,79	184,56	27,99
Zn	501,19	299,75	211,41
Bi	1268,63	1161,37	973,21
K	1760,14	982,91	1508,02
Sr	2272,98	2232,84	2799,47
Mg	3162,22	4377,93	9400,93
Fe	3251,45	2437,60	3955,96
Al	5357,37	3313,82	4397,92
Na	10770,64	9789,39	9502,05
S	24133,34	15308,02	5986,79
Ca	358082,73	322110,64	202650,54
P	137062,60	126050,02	2550,44



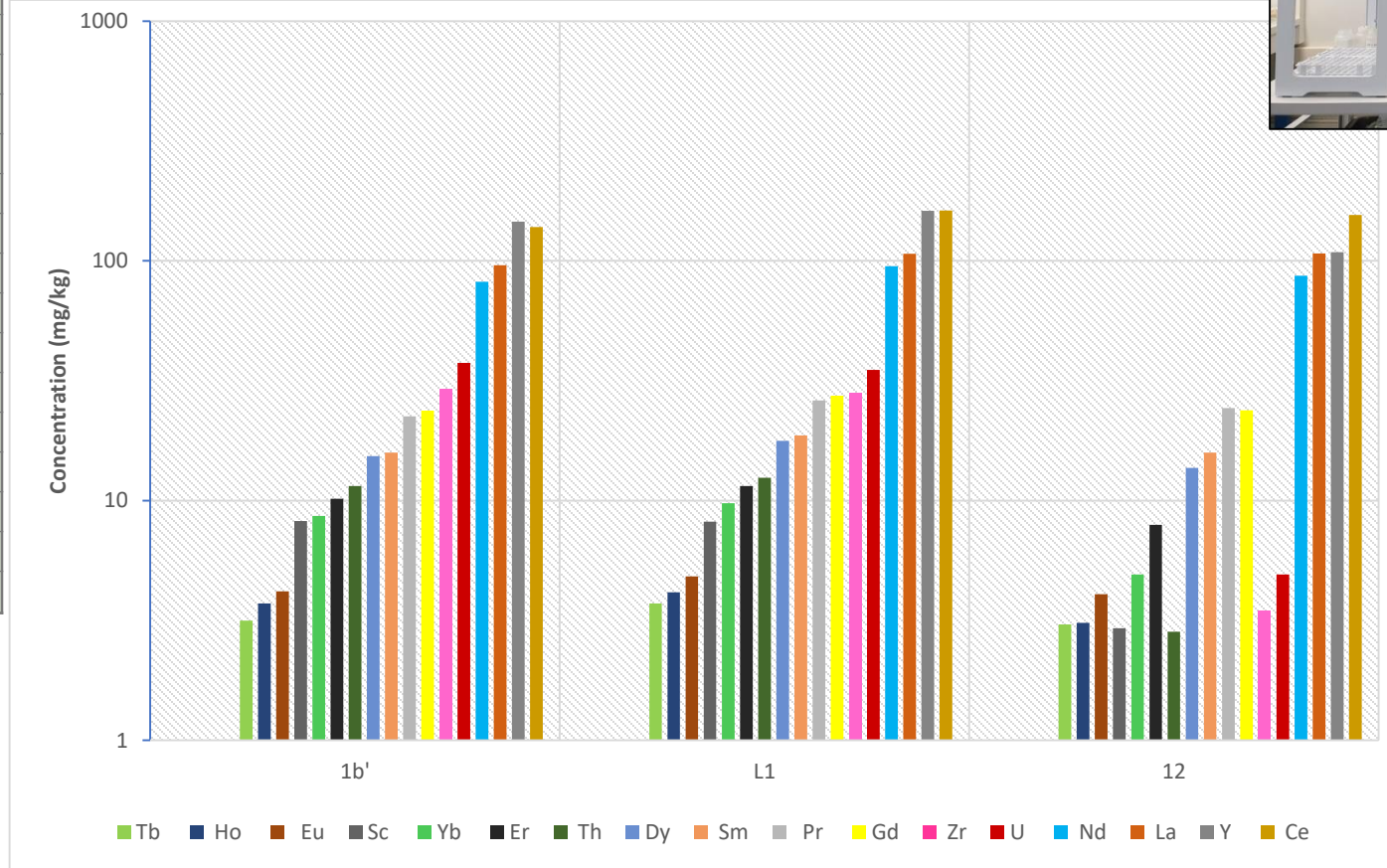
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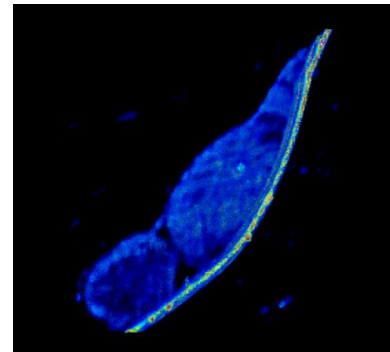
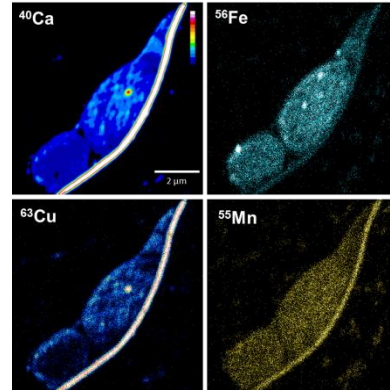
Environment: From Phosphate to Phosphogypsum

Elements	Samples		
	1b' (Raw Phosphate)	L1 (Laundry)	12 (Gages Gulf Sediment)
Tb	3,16	3,72	3,04
Ho	3,72	4,14	3,09
Eu	4,18	4,82	4,07
Sc	8,21	8,17	2,93
Yb	8,63	9,75	4,91
Er	10,19	11,50	7,92
Th	11,51	12,47	2,84
Dy	15,30	17,73	13,68
Sm	15,86	18,68	15,87
Pr	22,47	26,18	24,31
Gd	23,72	27,39	23,78
Zr	29,20	28,25	3,48
U	37,51	35,06	4,92
Nd	81,84	95,01	86,76
La	95,86	107,03	107,39
Y	145,95	161,79	108,57
Ce	138,17	162,04	155,38

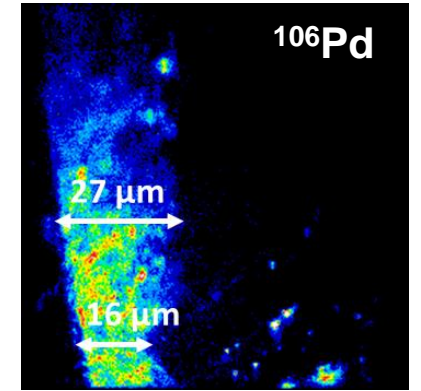
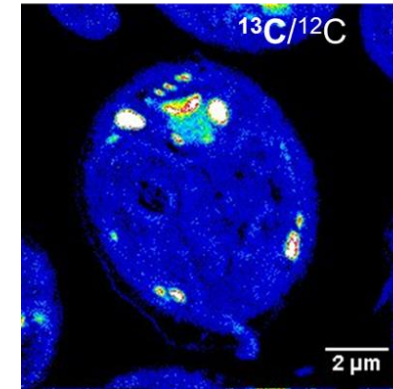
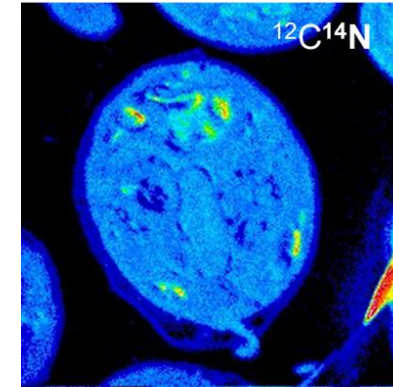
ICP-MS
For Rare Earth Elements' analysis



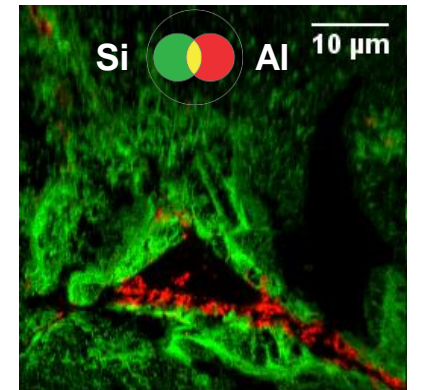
NanoSIMS: Imaging at nanometer level: nm



In plant chloroplasts:
2D and 3D subcellular
localization of trace
elements essential for
photosynthesis



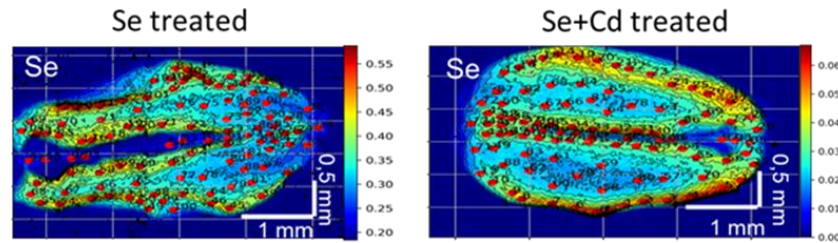
Characterization of
extreme **surfaces** of
catalysts



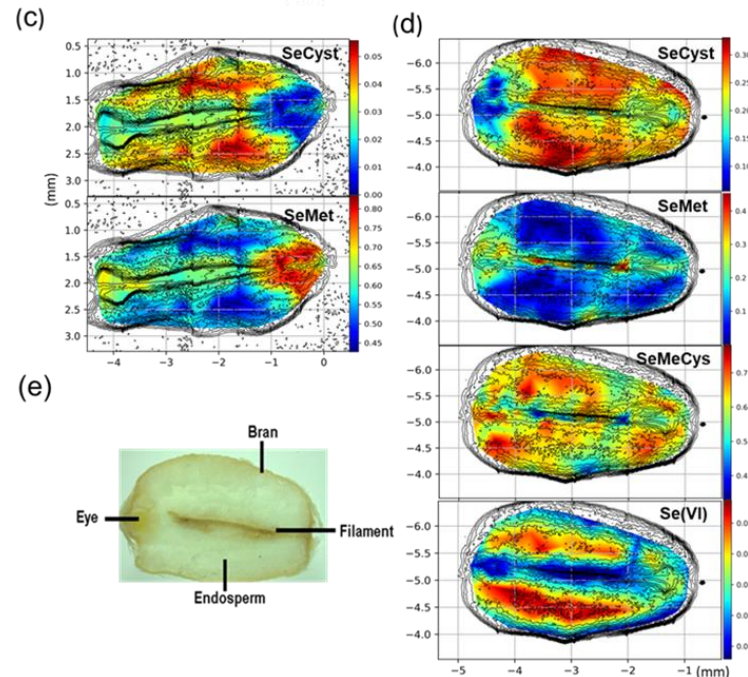
Characterization of
rocks for petrol
exploitation

Example of solid state speciation: μm

Elemental mapping and speciation of Se: μXRF and μXANES



Spatial resolution 50 μm



Production of Se-enriched wheat grains to overcome deficient levels of Se in diets that may incur on health issues.

Specific problem: Understanding the effect that Cd pollution exerts on the selenium species produced.

Decoupling the Se species accumulated on the grain.

SeMet: Filament and eye region

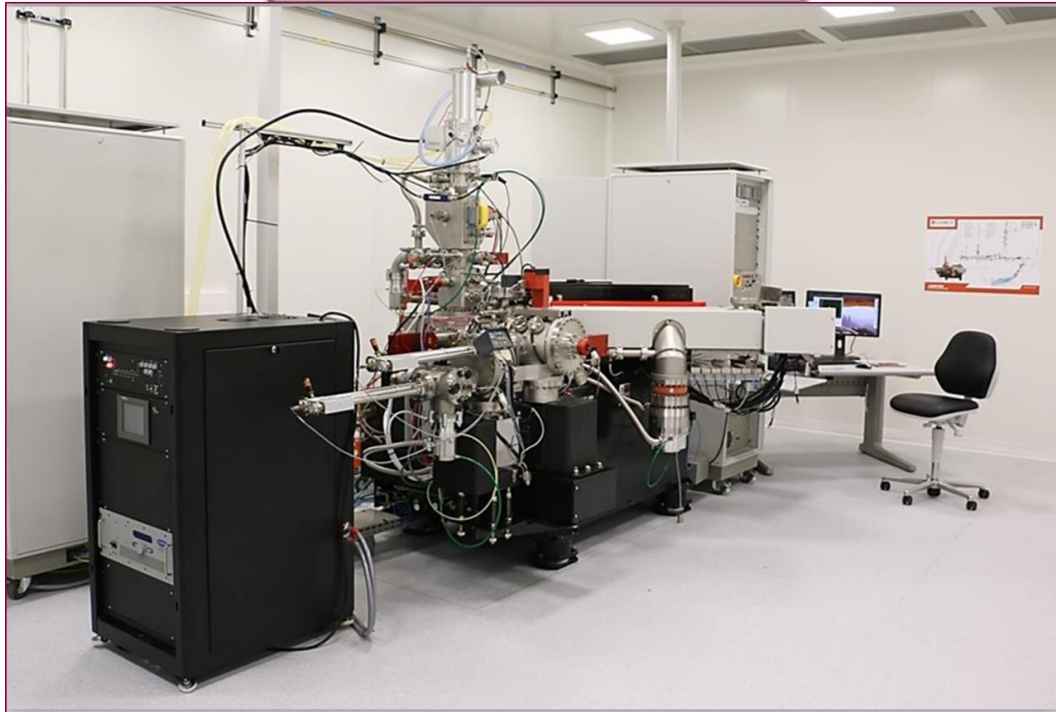
SeMeCys and SeCyst: Endosperm region

SeMet reduces in favour of SeMeCys in the presence of Cd

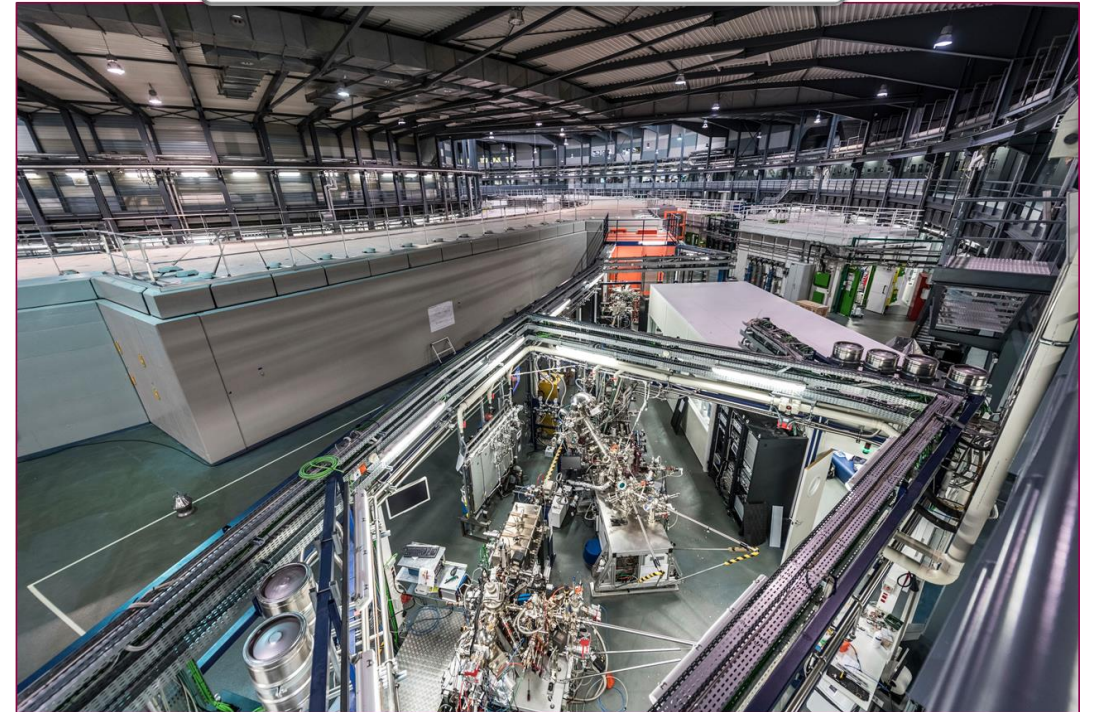
Environment: From Phosphate to Phosphogypsum

✓ Spatial and temporal distribution of Inorganic elements in Phosphate (NanoSIMS IPREM, Synchrotron ALBA)

NanoSIMS: Nano-meter Imaging



Synchrotron Alba: Micro-meter Imaging



WorkShops : Training



Organisation of international meetings

- **2016 : Ariana (Tunisie) : 27 – 29 Octobre :**
Workshop franco-tunisien de langue française
(80 participants)

RECHERCHE DEVELOPPEMENT & INNOVATIONS ANALYTIQUES

Chairmen : O.F.X. Donard et M. Hammami

- **2017: Hammamet (Tunisie) 27-30 Nov.** Conf. Int. de langue Française (250 participants)

CONGRES AFRICAIN & FRANCOPHONE SUR LES SCIENCES ANALYTIQUES & APLICATIONS

Chairmen: O.F.X. Donard, M. Hammami, N. Schildknecht, M. Aoui (<http://cafsaa.tn/>)



Integration in the EU Research network & programs

- **Contributing to the creation, development of new programs, EU networks**



- **Managements, writing and promotion of new projects**
- **Financial management**

Integration in the EU Research network & programs

- Contributing to the creation, development of new programs, EU networks

Projets européens

Nb de contrats	12
Coordinateur prin.	5
Membre du réseau	7



Contrat Européen ACRONYME	Periode								Montant	Typologie
	2009	2010	2011	2012	2013	2014	2015	2016		
TECNA									117 000	INTERREG IV B/SUDOE
BIOFILM									200 000	INTERREG/CTP
BIOCHROME									500 000	Europe/FONCYCIT
SYNABCO									209 092	IF
ORQUE SUDOE									1 685 550	INTERREG IIIB
SOLARREVOLUTION									167 000	IF
METMIC									150 000	INTERREG/CTP
POLION									311 000	IRSES
EUROLIS									2 800 000	FP7
BIOSOURCE-COMP									1 545 572	EFA179/11
ELENA									1 042 574	EFA220/11
ESTABLIS									3 870 293	ITN

12 598 081 € on 8 years >> 1 500 000 € / an



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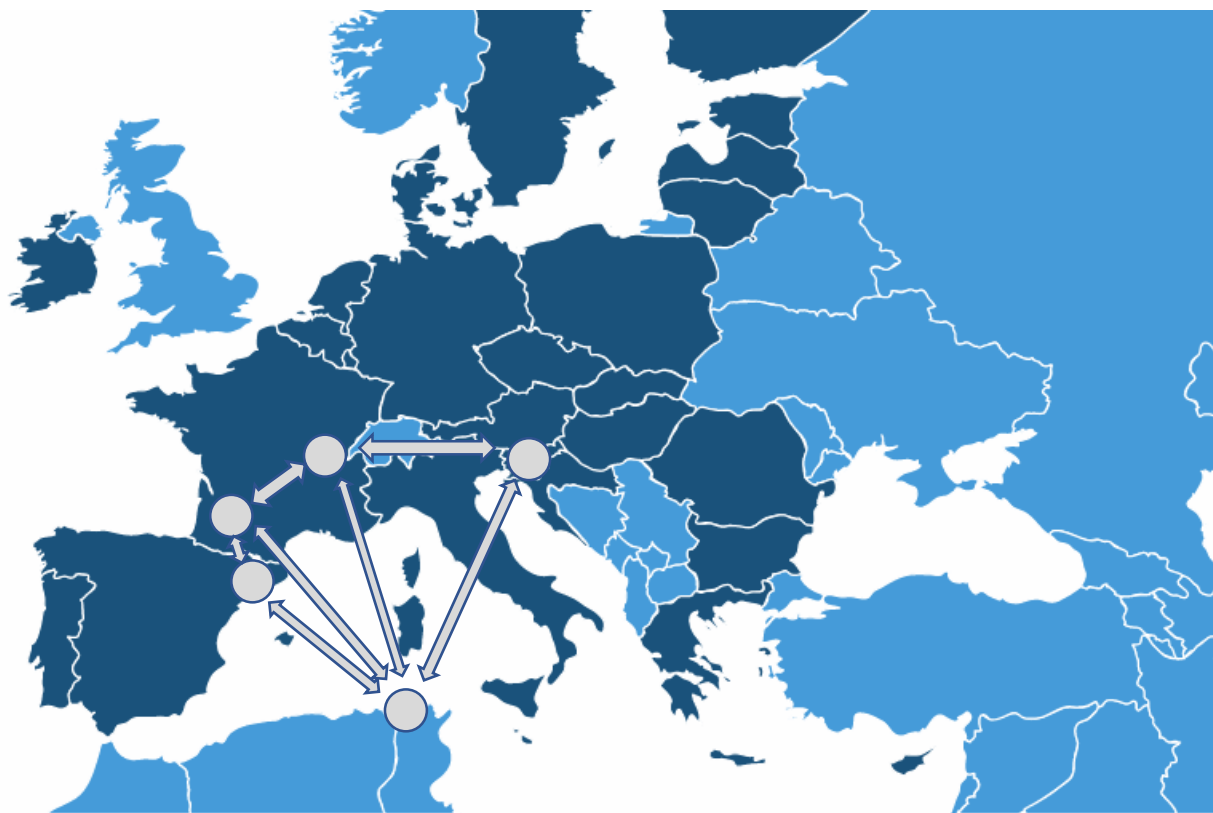
European dimension



■ Etat membre ■ Hors UE



- ESR
- Exchanges
- Workshops
- Moocs



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