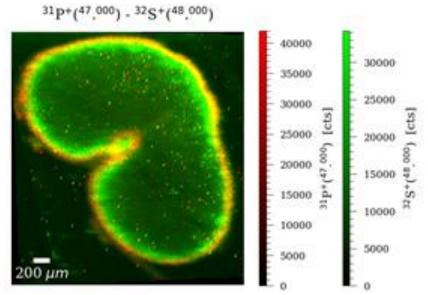


Laser Ablation Inductively Coupled Plasma Mass Spectrometry

High Resolution Imaging and Bulk Analysis



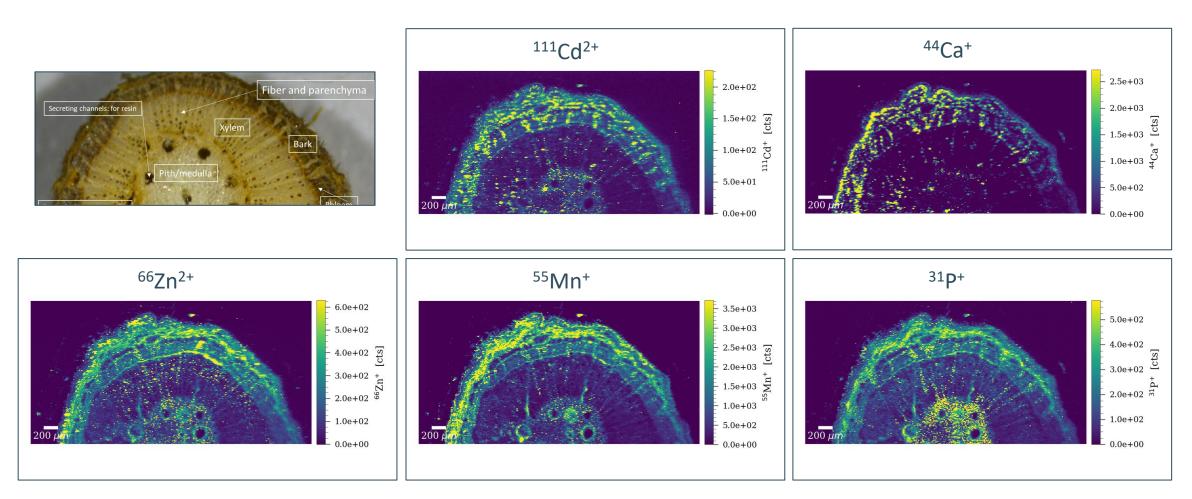
Wheat grain, picture Claudia Moens

Complete set-up LA-ICP-MS

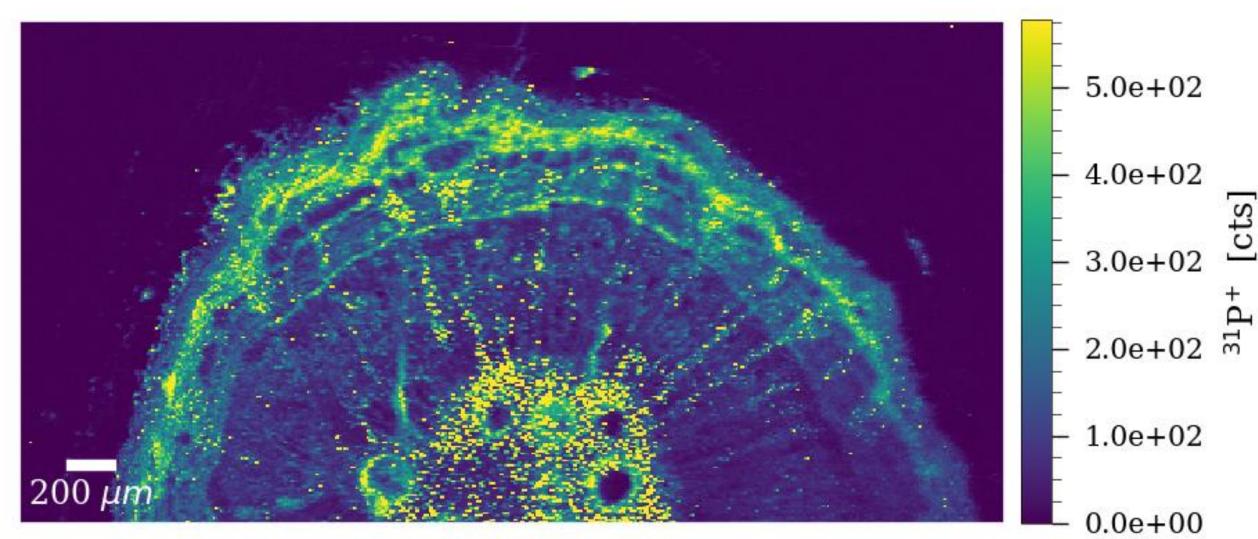


Source: Teledyne Cetac technologies

Example 1: wood core



Pictures: Hester Blommaert and Jesse Dekeyerel

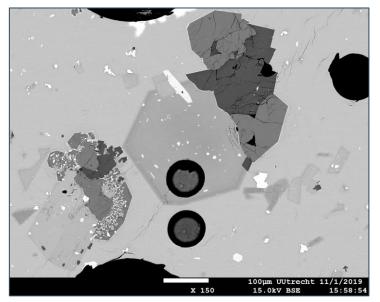


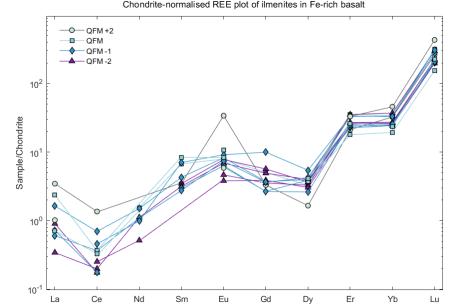
Pictures: Hester Blommaert and Jesse Dekeyerel

³¹P+

Example 2. analysis of REE in polished section

Spatially resolved elemental analysis





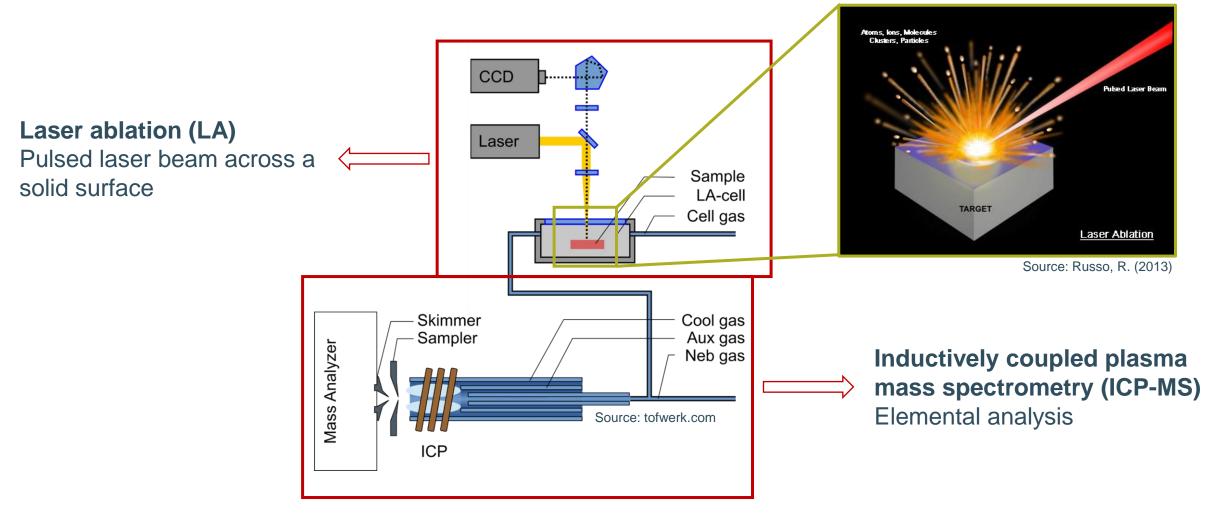
Spot analysis on polished section: crystal and melt Pictures: Alicia Van Ham-Meert

REE patterns of ilmenites: partitoning

Overview

- General concepts
 - Schematic overview
 - Laser ablation (LA)
 - Inductively coupled plasma mass spectrometry (ICP-MS)
 - Laser control software (Chromium)
- Applications
 - Imaging
 - Bulk analysis
- Examples

Schematic overview



0

HelEx arm end fitting ARIS adapter ICP-MS torch PEEK tubing **** Source: Teledyne Cetac technologies

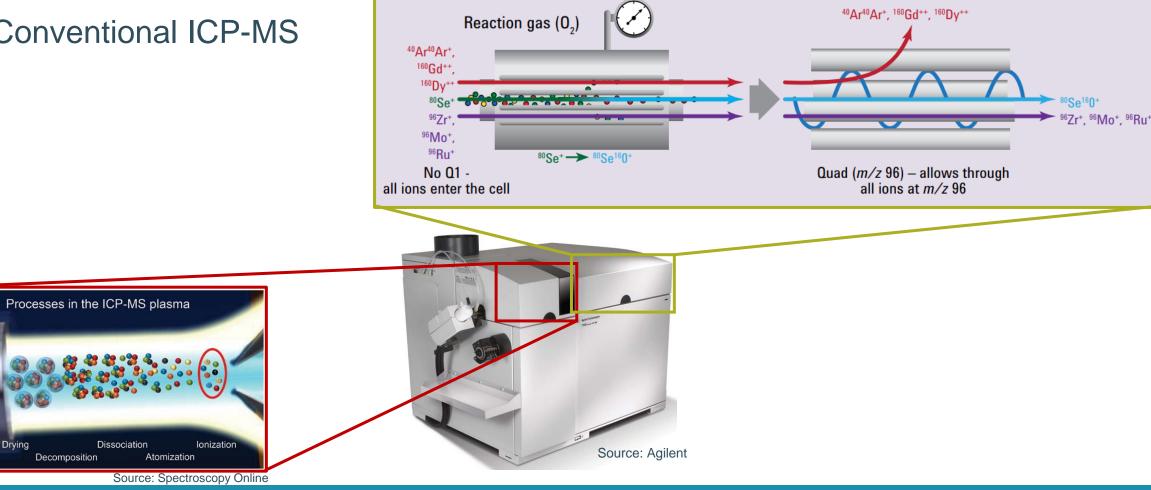
Laser ablation

- Analyte Excite+ laser ablation system
 - Deep-UV ArF laser (193 nm)
 - HelEx II Sample Cell
 - Sample introduction
 - e.g. ARIS for imaging

Division of Soil and Water Management **KUL**

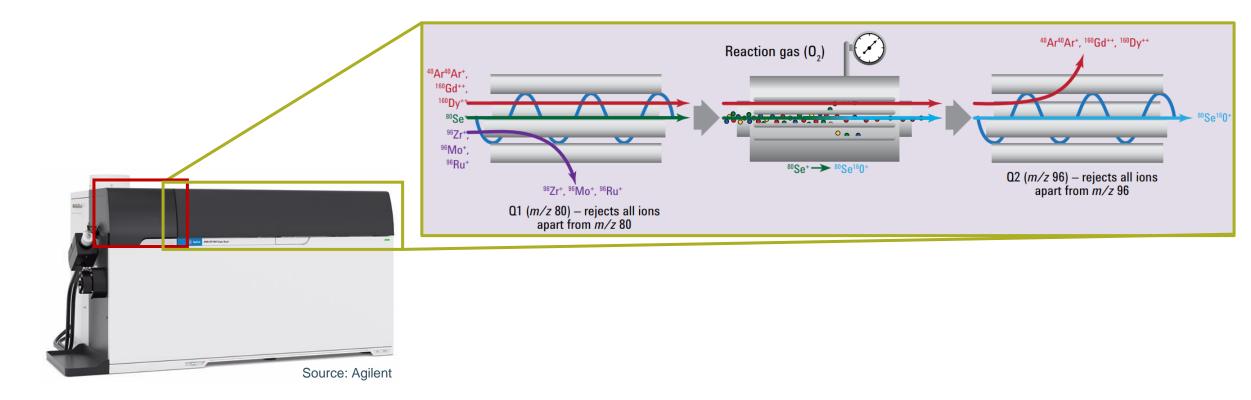
Inductively coupled plasma mass spectrometry (ICP-MS)

Conventional ICP-MS



Inductively coupled plasma mass spectrometry (ICP-MS)

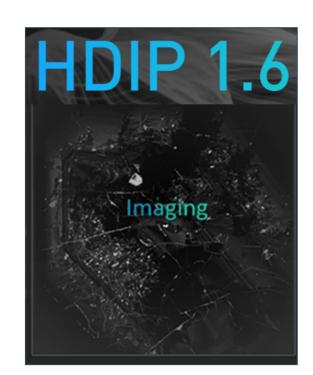
• 8900 Triple Quadrupole ICP-MS



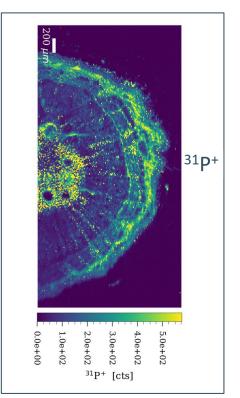
Raw results

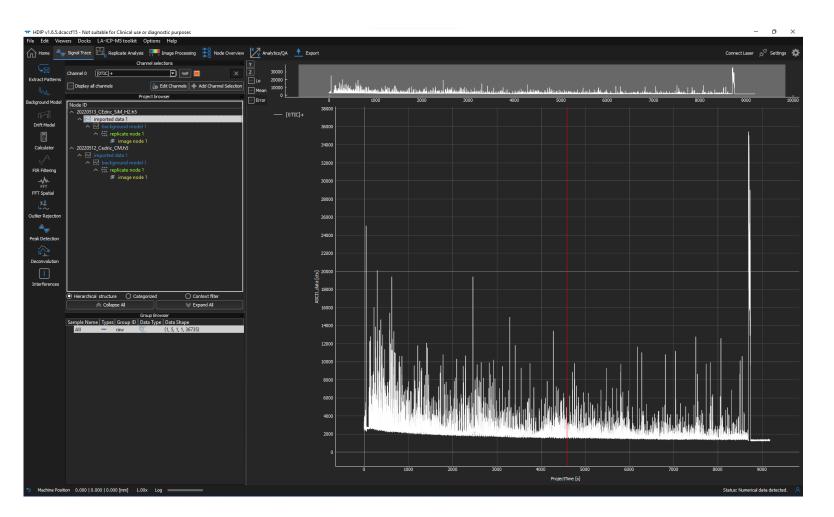
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2	Intensity V	Counts										
3	3 Acquired : 2021-07-14 11:12:06 using Batch 20210714_Hester_CLT15_wood_HEHe_1.b											
4	Time [Sec]	C13	P31	Ca44	Mn55	Ni60	Cu63	Zn66	Cd111			
5	0.2286	28	0	1	0	0	0	1	1			
6	0.4286	19	4	0	1	1	1	0	1			
7	0.6286	25	1	0	1	2	1	0	5			
8	0.8286	16	1	1	1	2	2	0	3			
9	1.0286	16	1	1	0	0	0	0	2			
10	1.2286	19	0	0	1	0	0	0	3			
11	1.4287	19	1	1	0	1	0	0	3			
12	1.6286	18	1	0	1	1	0	2	3			
13	1.8287	17	2	0	2	1	0	0	3			
14	2.0287	20	1	0	0	0	0	0	3			
15	2.2287	13	0	0	0	0	0	0	6			
16 17	2.4287	26 23	1	0	4	1	0	0	3			
17	2.6287	23	0	0	2	1	0	0	3			
10	3.0287	18	1	0	2	0	0	0	4			
20	3.2287	16	1	0	2	3	0	0	2			
21	3.4287	10	2	0	1	0	0	0	0			
22	3.6287	16	0	0	1	0	0	0	2			
23	3.8287	20	1	0	0	0	0	0	3			
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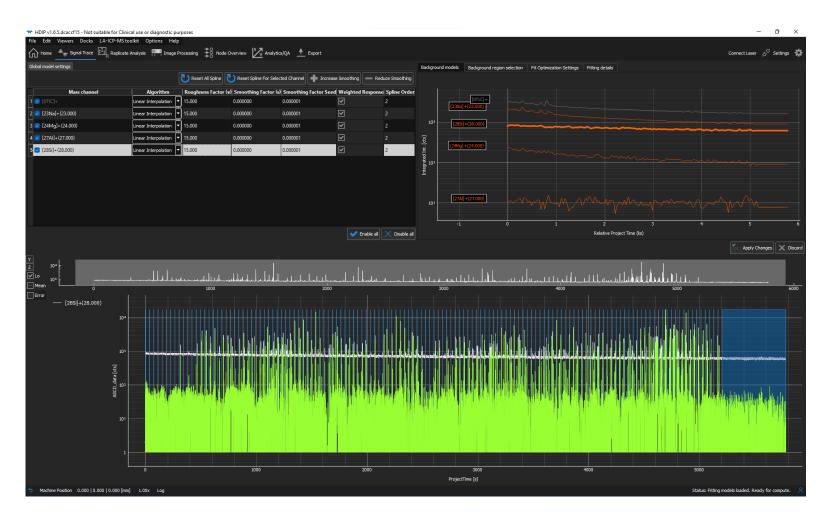
HDIP software



Image

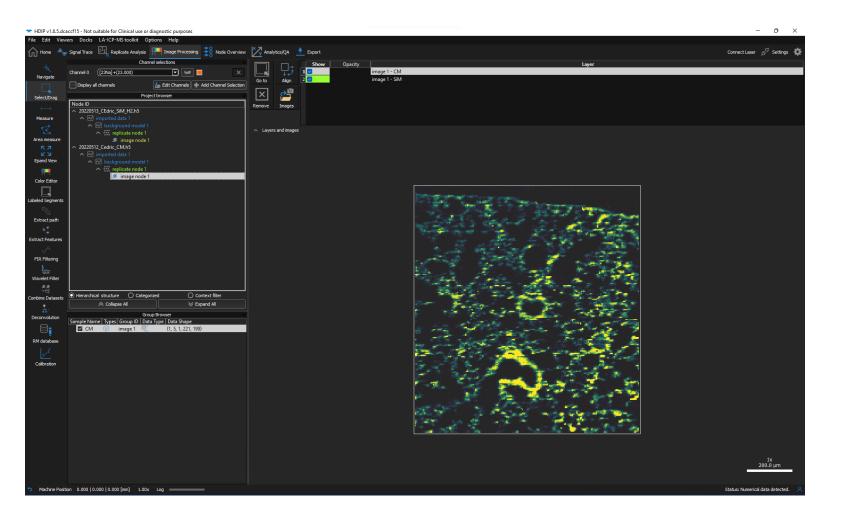






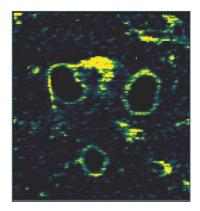
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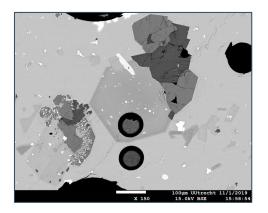
Division of Soil and Water Management **KU LEUVEN**



Imaging vs bulk

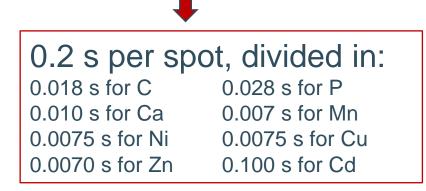
Imaging	Bulk					
Mostly qualitative	Quantitative					
Mapping	Spatially resolved, localized					
HDIP – background correction + imaging	HDIP – quantification (ref materials, EPMA data)					
Applications: imaging of various materials	Applications: thin sections, polished sections, archaeological glass, metal,					

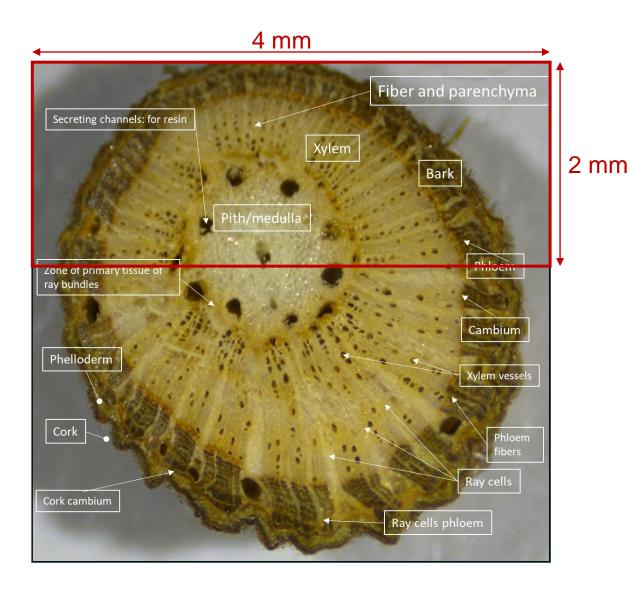




Example: wood core

- Fluence: 3.5 J cm⁻²
- Laser frequency: 50 Hz
- Spot size: 10 µm square
- Scan speed: 50 µm s⁻¹



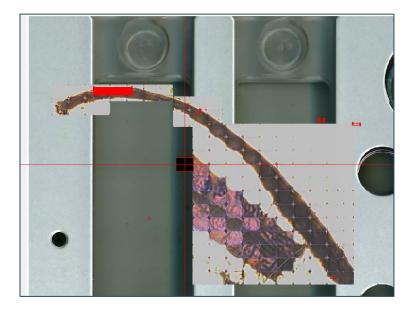


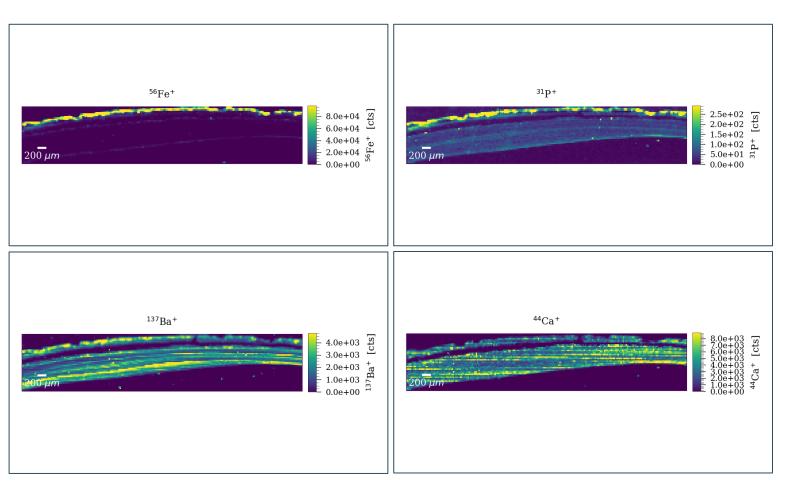
Example: freshwater bivalve (Swan mussel, Anodonta cygnea)



Pictures: Amber Veelaert and Florian Laurysssen

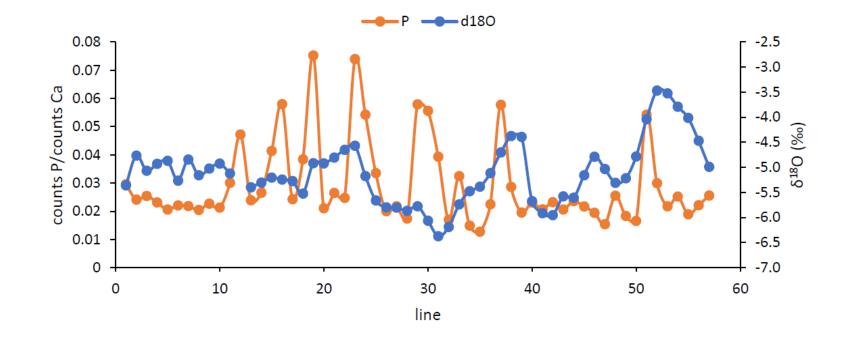
Example: freshwater bivalve (Swan mussel, Anodonta cygnea)





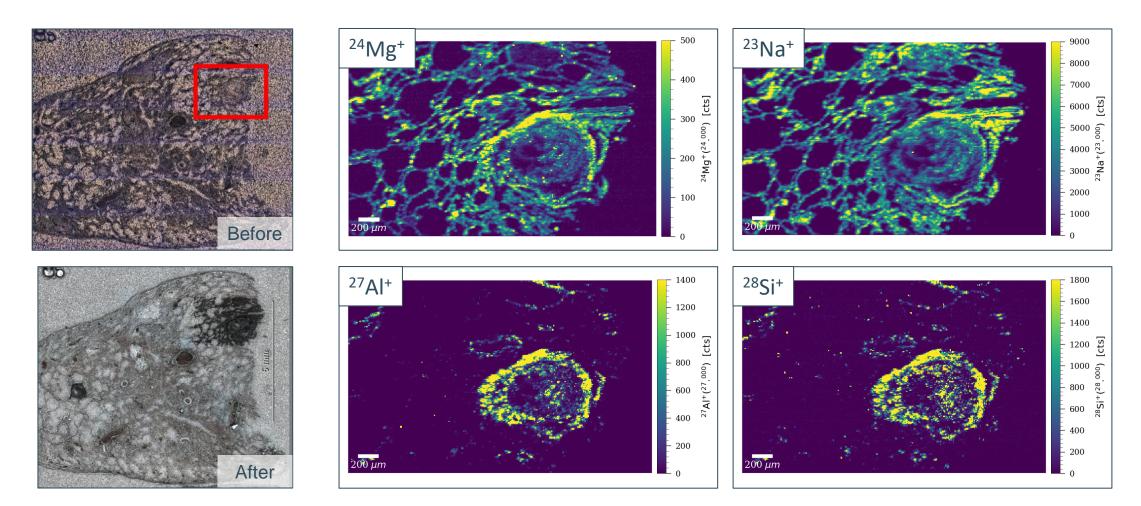
Pictures: Amber Veelaert and Florian Laurysssen

Example: freshwater bivalve (Swan mussel, Anodonta cygnea)



Pictures: Amber Veelaert and Florian Laurysssen

Example: silicosis lung tissue

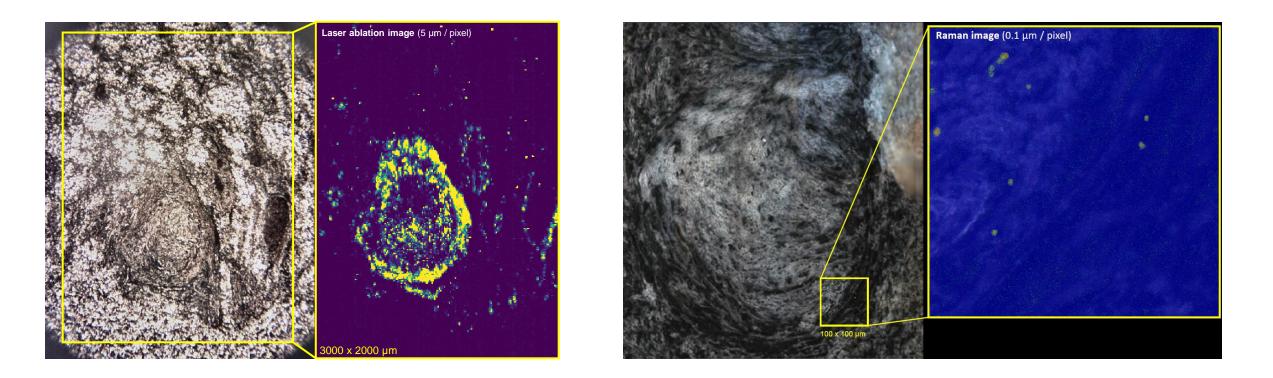


Pictures: Cedric Eelen and Steven Ronsmans

Example: silicosis lung tissue

Laser ablation VS

Raman



Pictures: Cedric Eelen and Steven Ronsmans

LA-ICP-MS

+: Good detection limits Detects isotopes (tracing experiments!) Quantititative "Fast"

Spatial resolution bad (5 µm) Trained personell needed Expensive: 675 €/day (research collaboration) or 2000 €/day (service)

Thank you for your attention! Questions?

jesse.dekeyrel@kuleuven.be charlotte.vermeiren@kuleuven.be alicia.vanhammeert@kuleuven.be