



BioEcoUVa



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STUDY, PRESERVATION
AND RECOVERY OF HERITAGE

Introducción al trabajo con mapas hiperpectrales

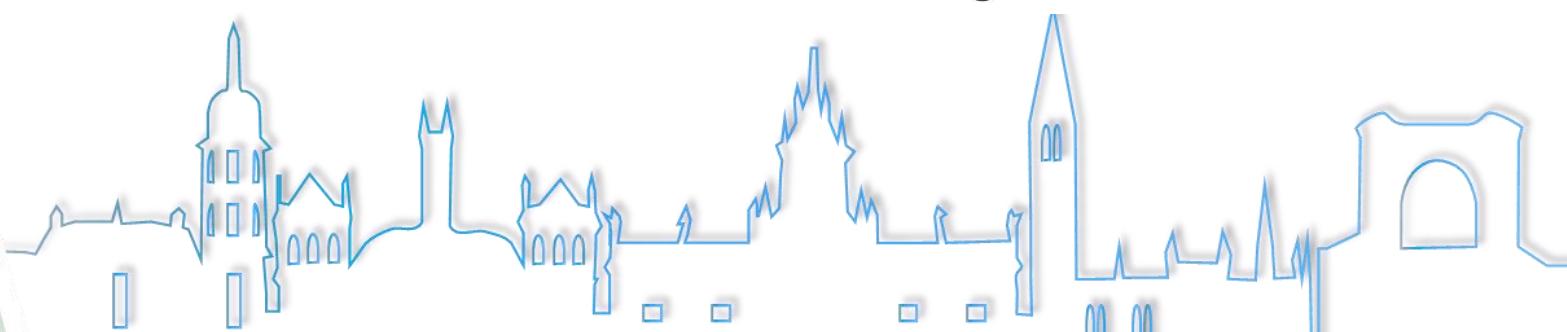
Alberto Plaza Ebrero (Centro de Conservación y Restauración de Bienes Culturales)

Suset Barroso Solares y Javier Pinto Sanz (AHMat-UVa)

NOS
IMPULSA



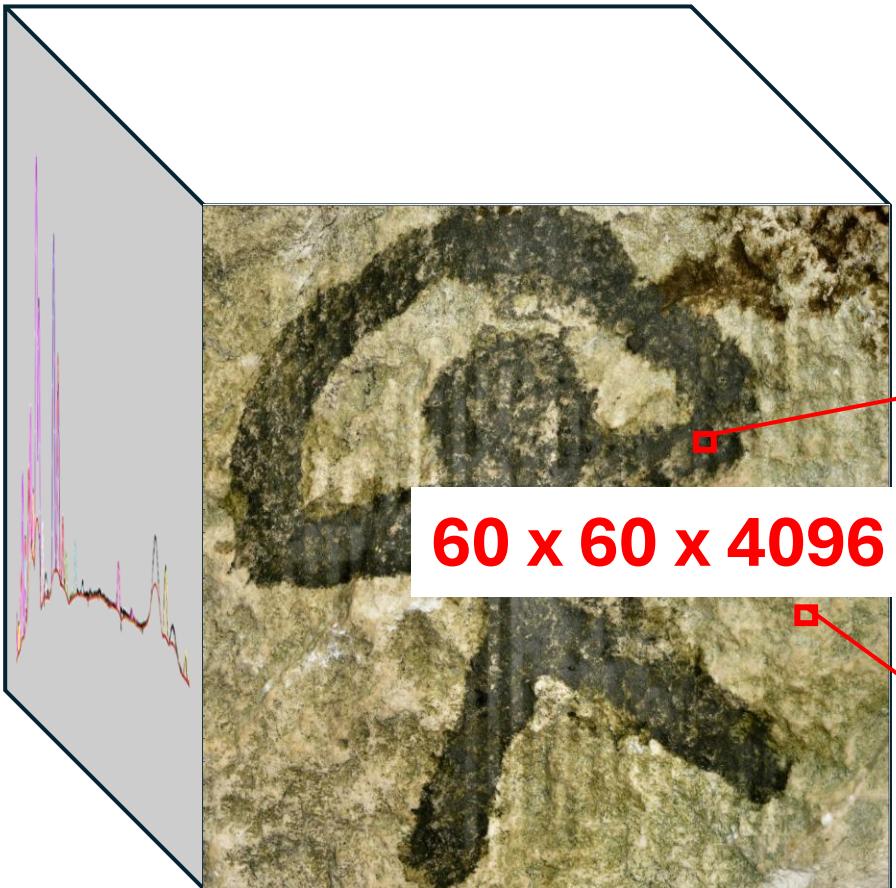
Junta de
Castilla y León



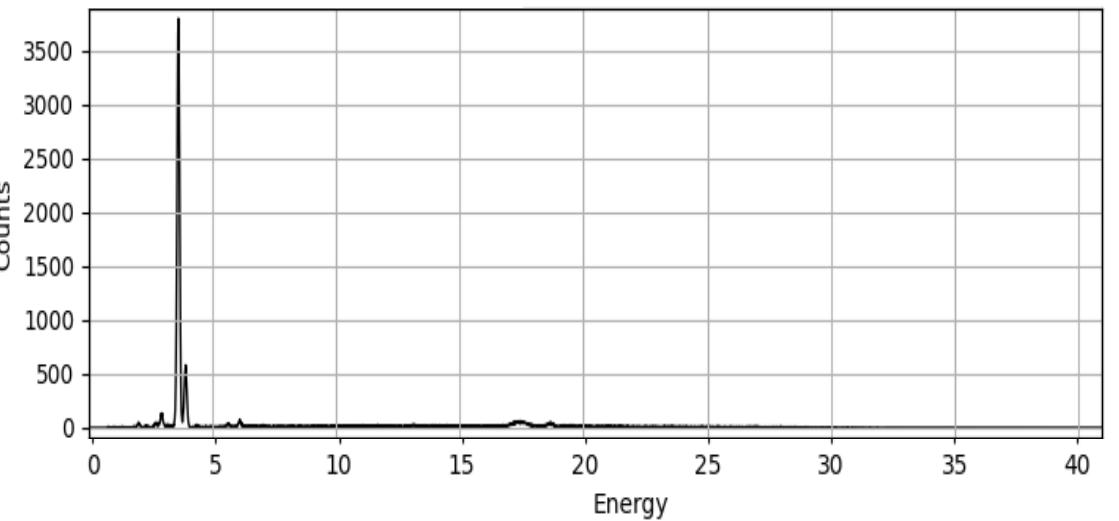
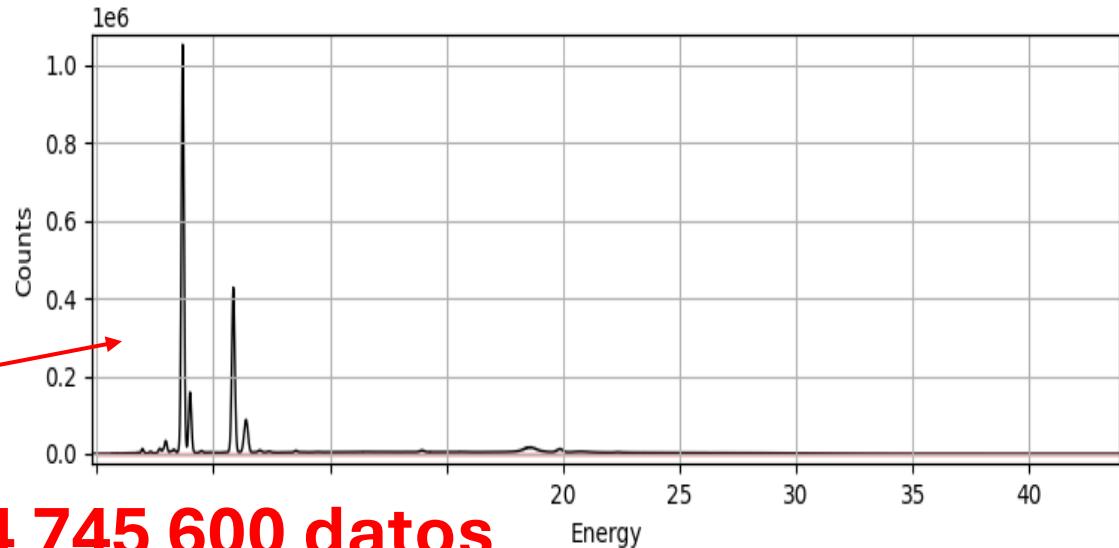


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$$60 \times 60 \times 4096 = 14\,745\,600 \text{ datos}$$





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¿Qué hace un fotógrafo en este lío de las imágenes hiperespectrales?





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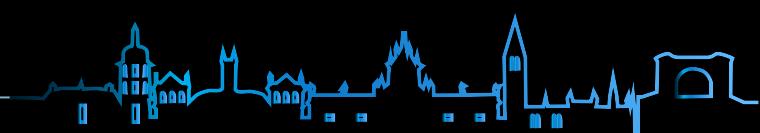
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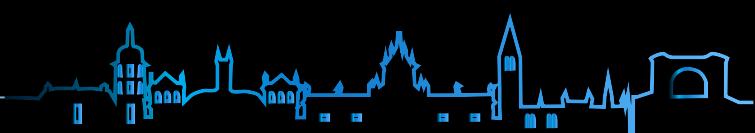
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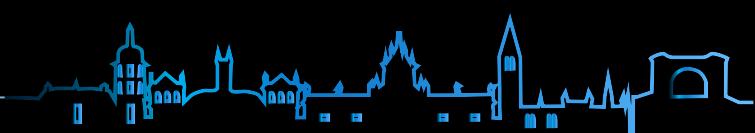
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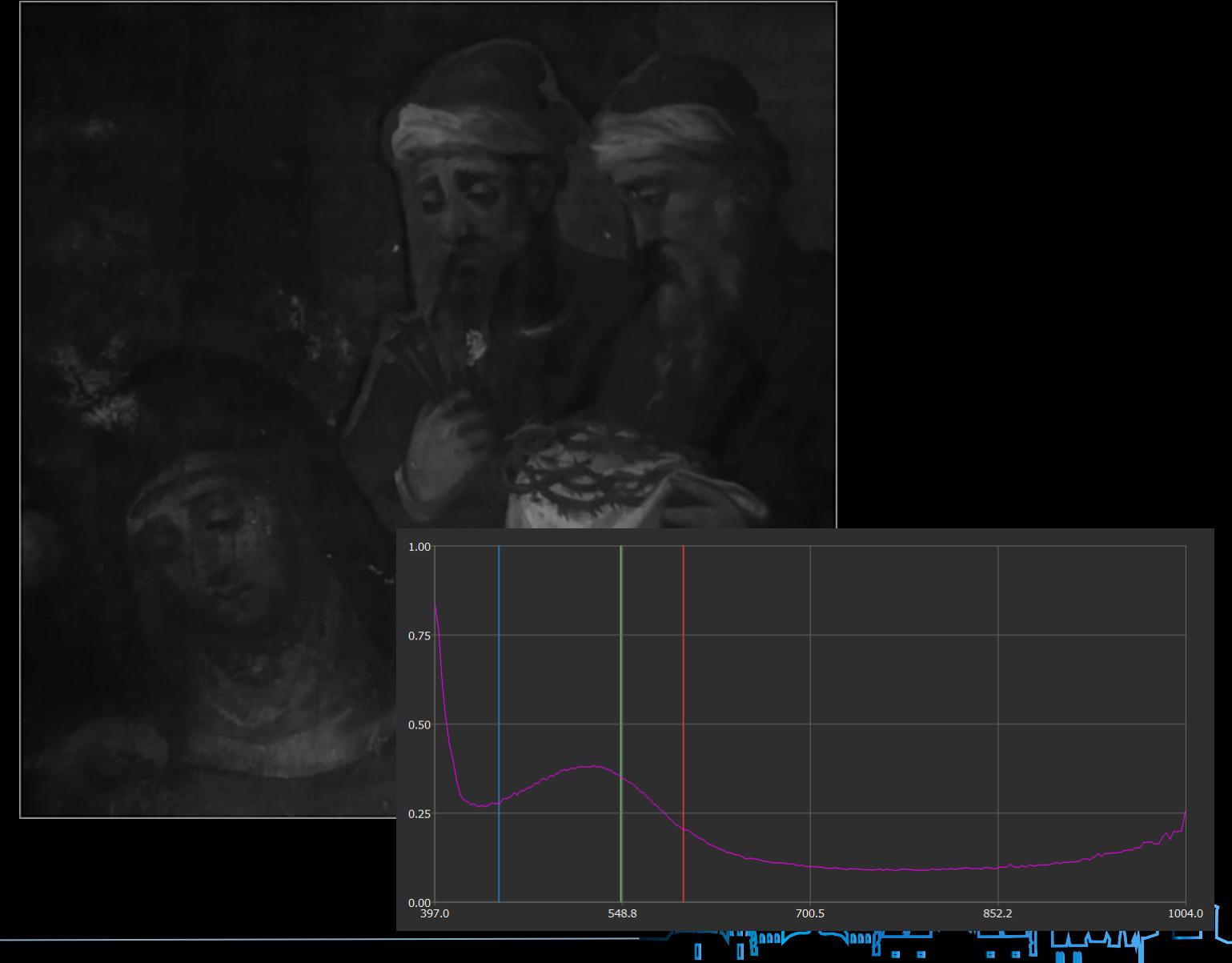


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Variación de la reflectancia en diversas bandas del espectro electromagnético.

La medida de la reflectancia en una coordenada concreta en la matriz de cada una de las bandas es la que nos proporciona una firma espectral correspondiente a un pigmento determinado.



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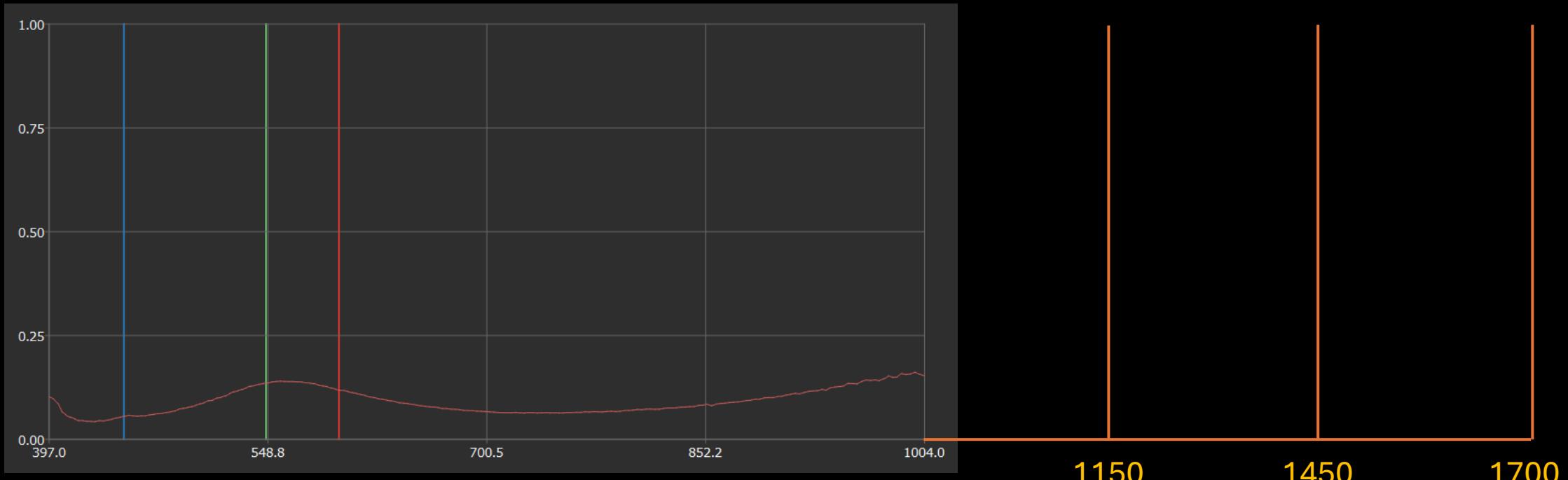


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Dificultades:

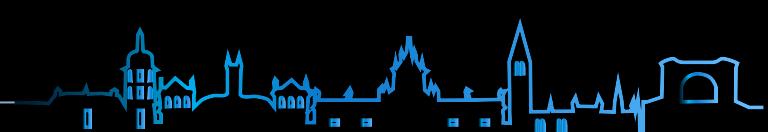
- Al trabajar en el rango visible y el infrarrojo cercano, de 400 a 1000 nm dejamos una parte del espectro sin evaluar.



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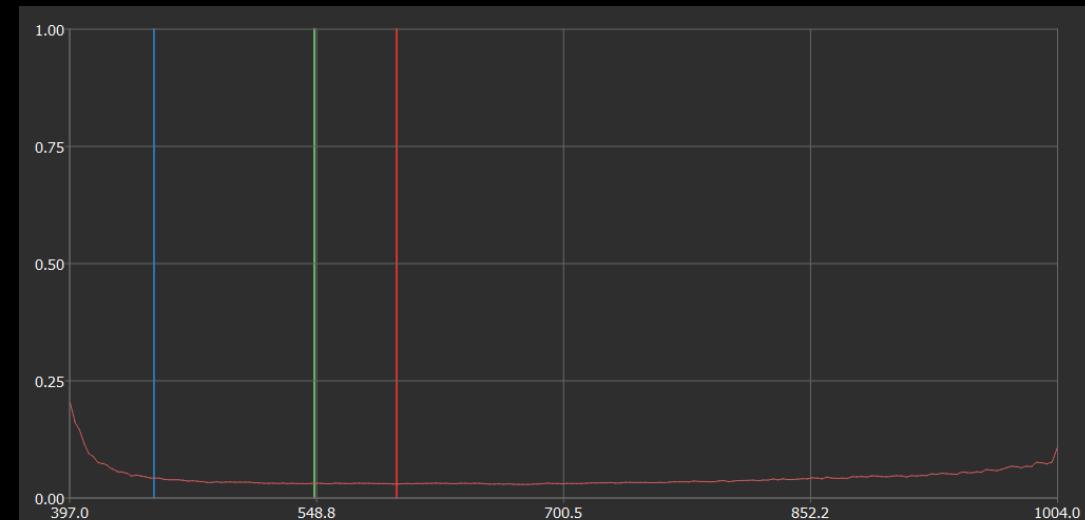
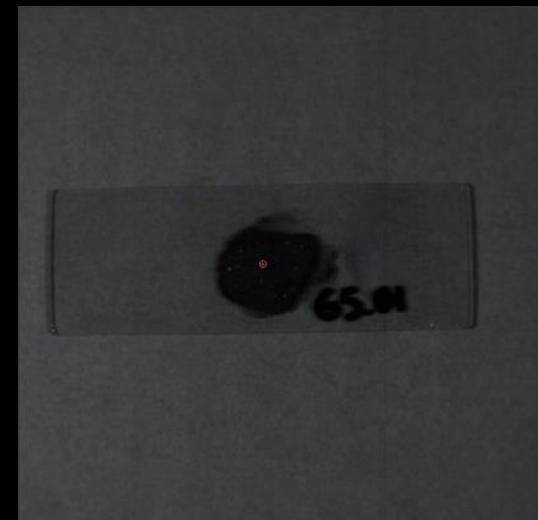
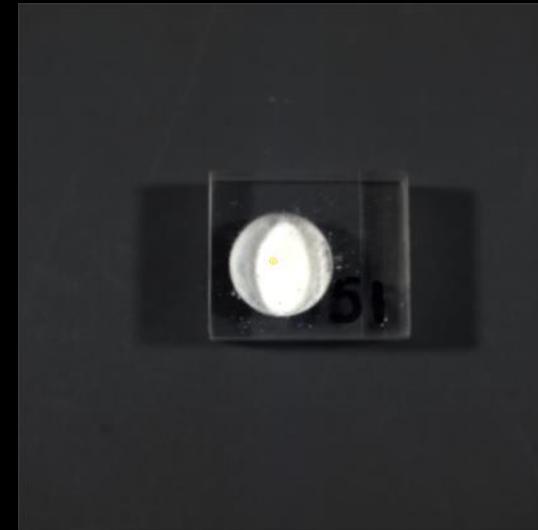


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Dificultades:

- En este rango los blancos están próximos a 1 y los negros a 0, en términos absolutos.



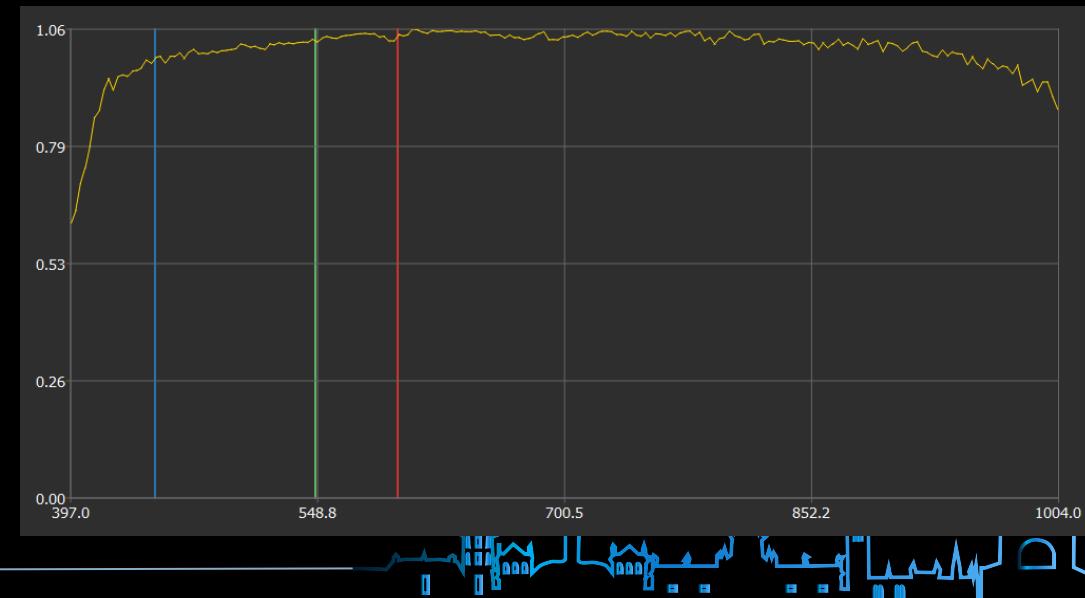
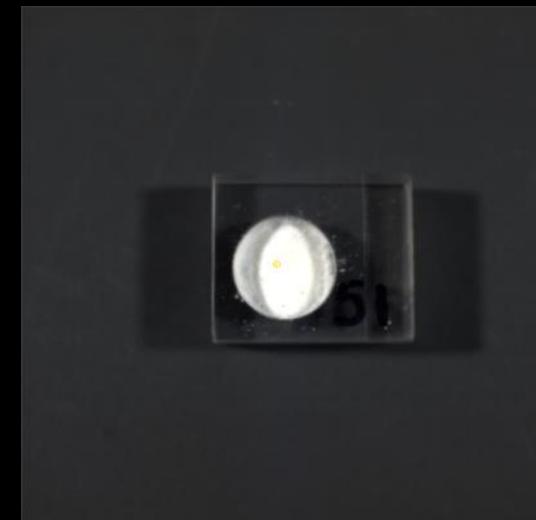
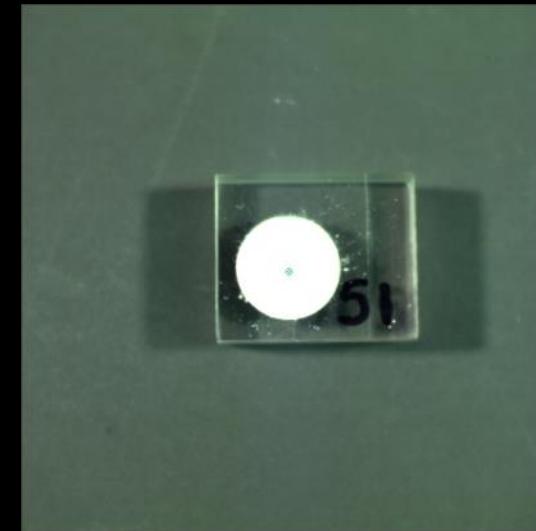


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Dificultades:

- La mezcla de luces es contraproducente.





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Dificultades:

- Baja resolución de solo 512 x 512 pixel. El tamaño del área de estudio es limitado.



126 x 64 cm



30 x 30cm



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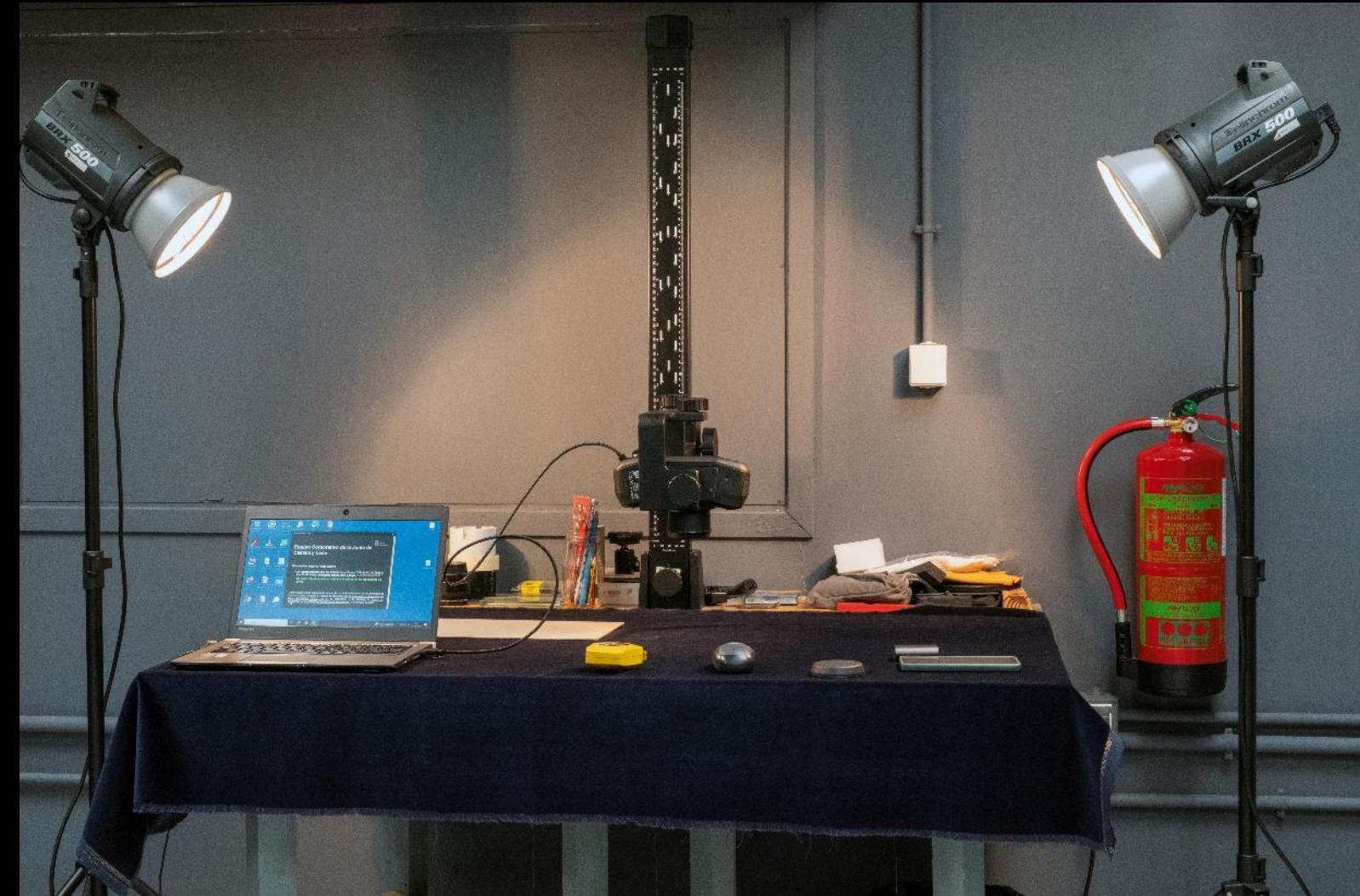
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Metodología:

- Usar siempre la misma iluminación, continua y sin sombras.



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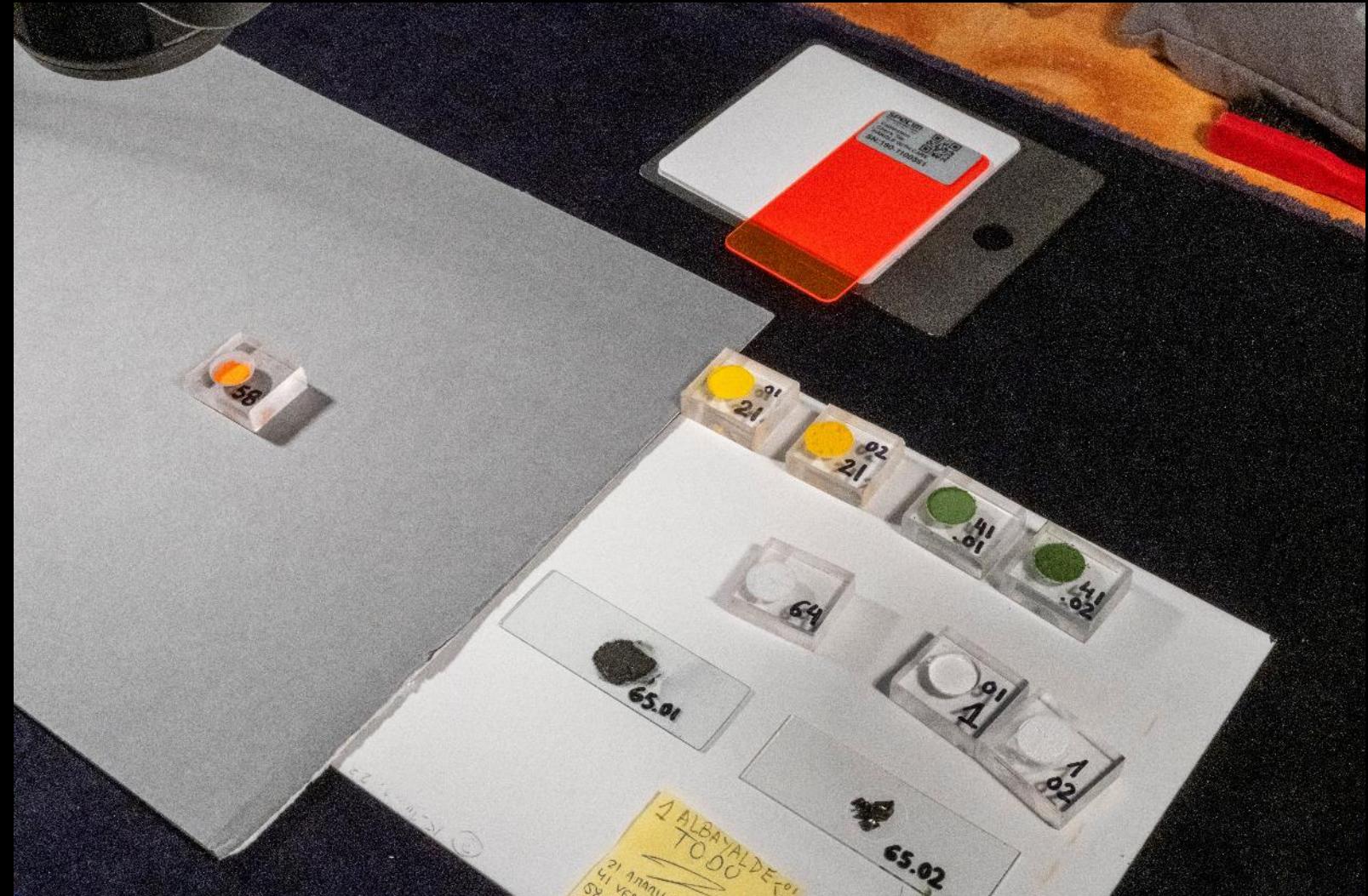


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Metodología:

- Calibración del equipo.

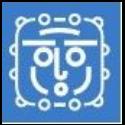


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Metodología:

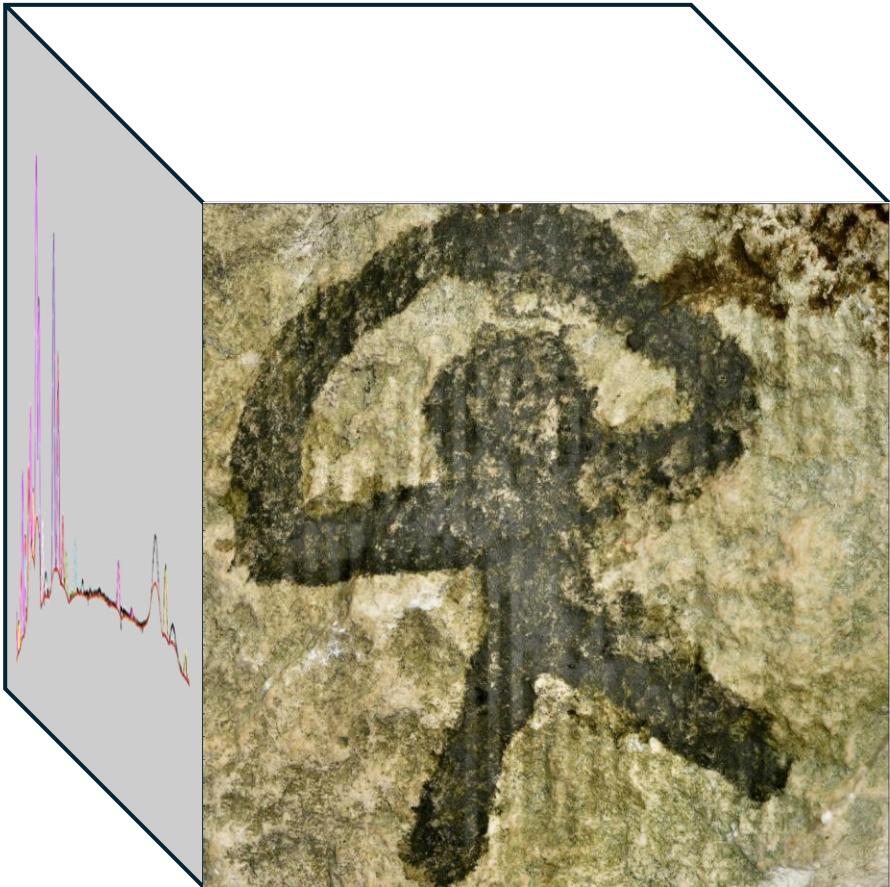
- Preparación de las muestras.





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¿Merece la pena?

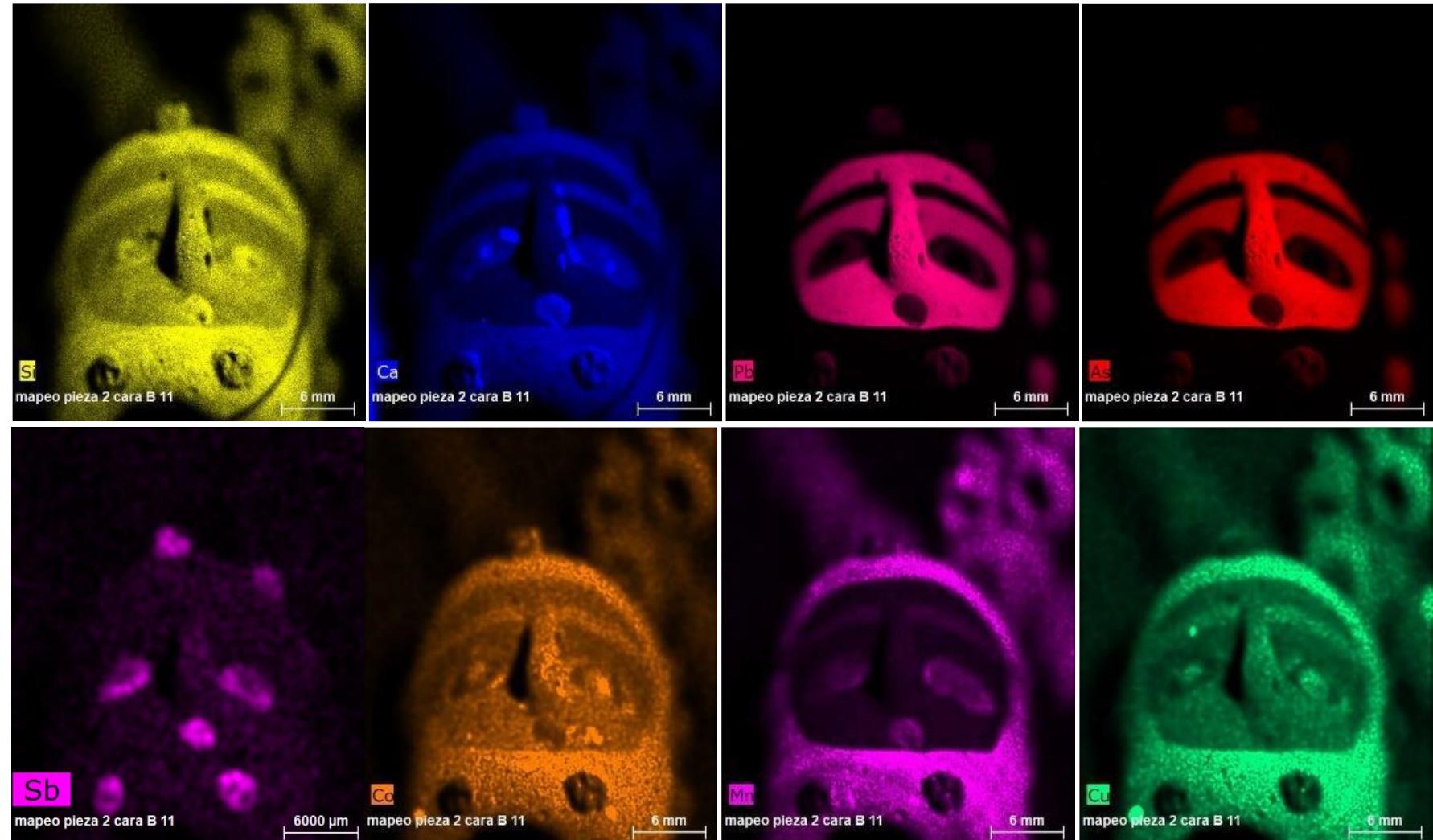




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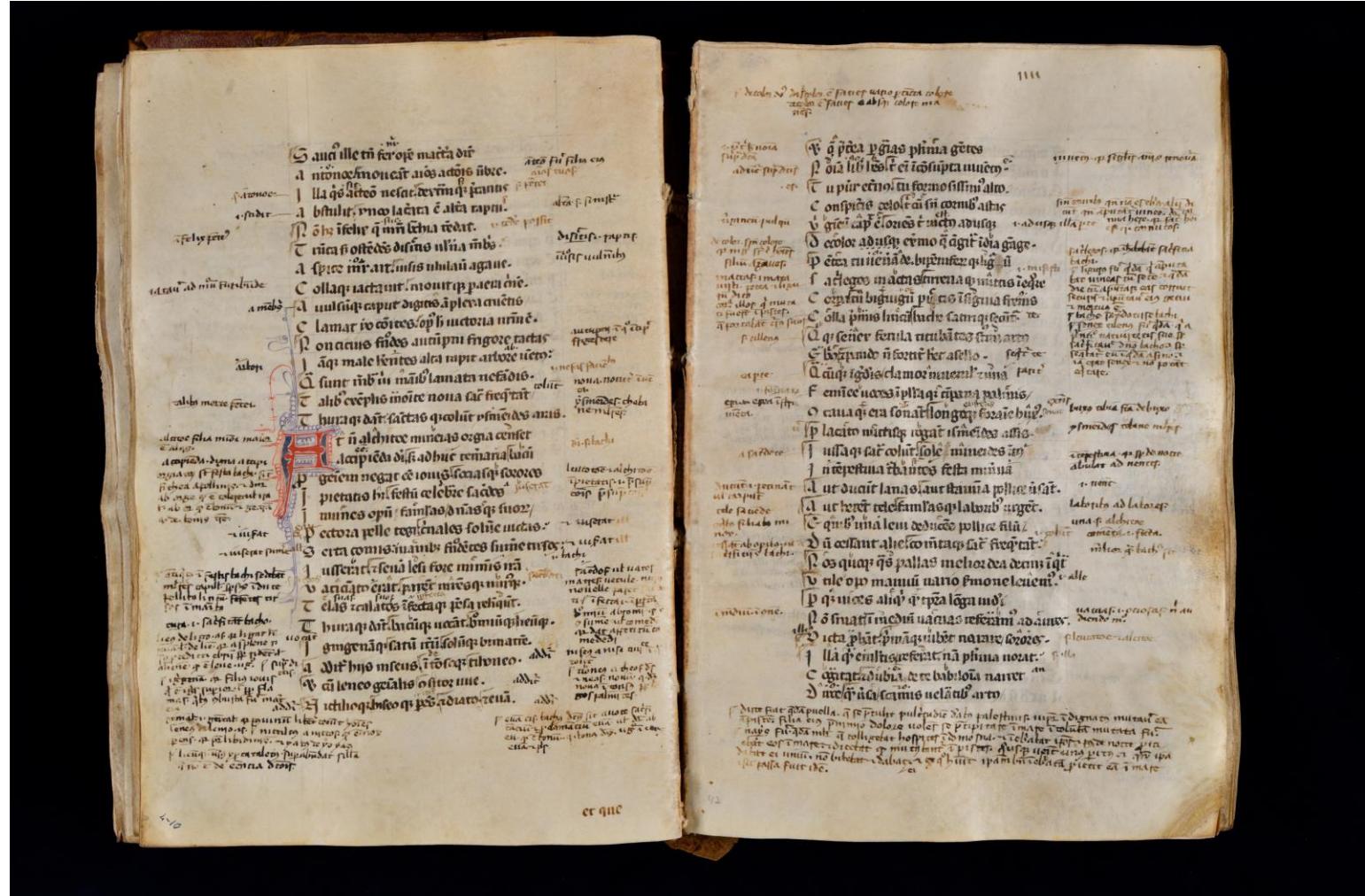
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Ovidio Nasón
Metamorphoseos
Fotografía: Alberto
Plaza Ebrero
(CCRBC)



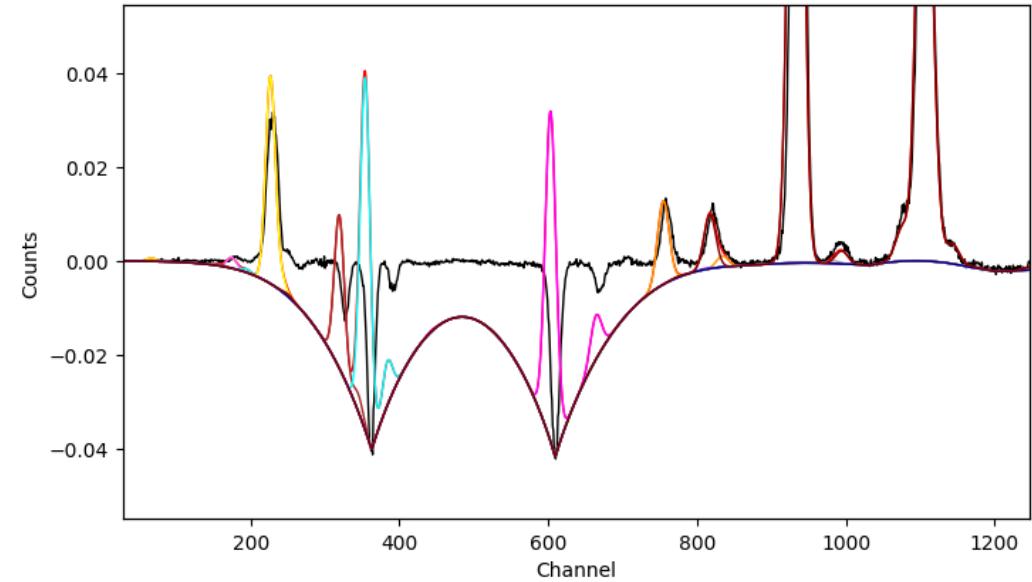
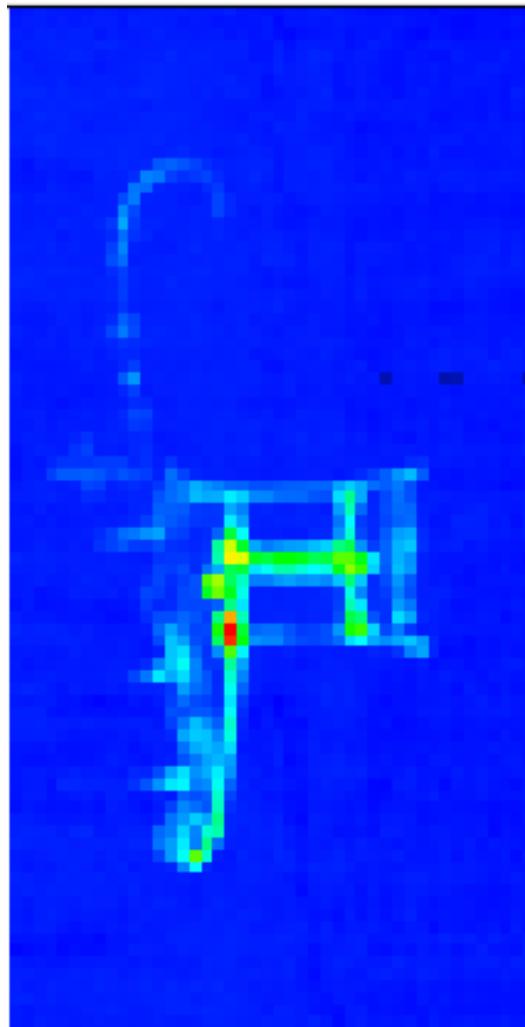


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Eigenimage 00



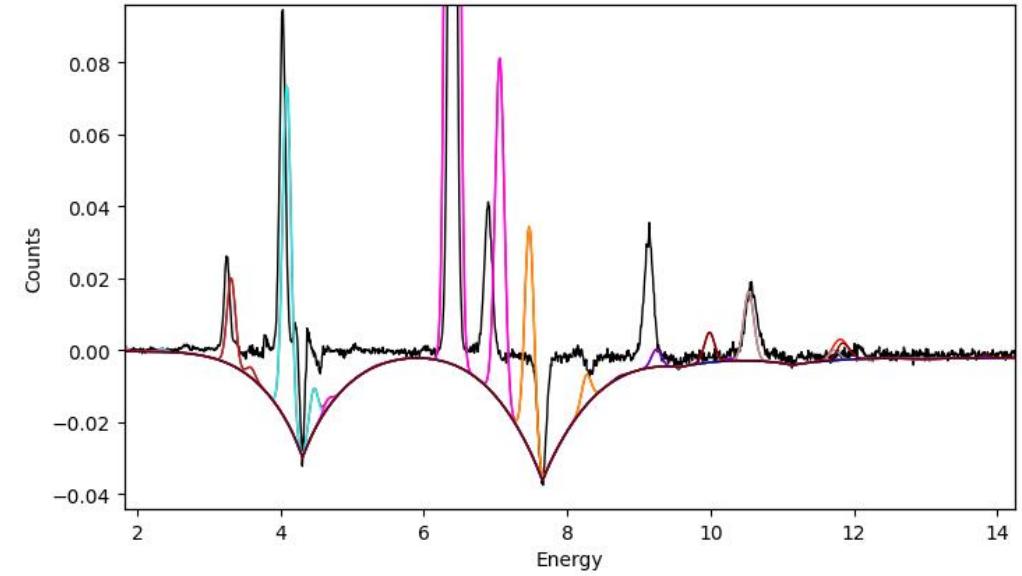
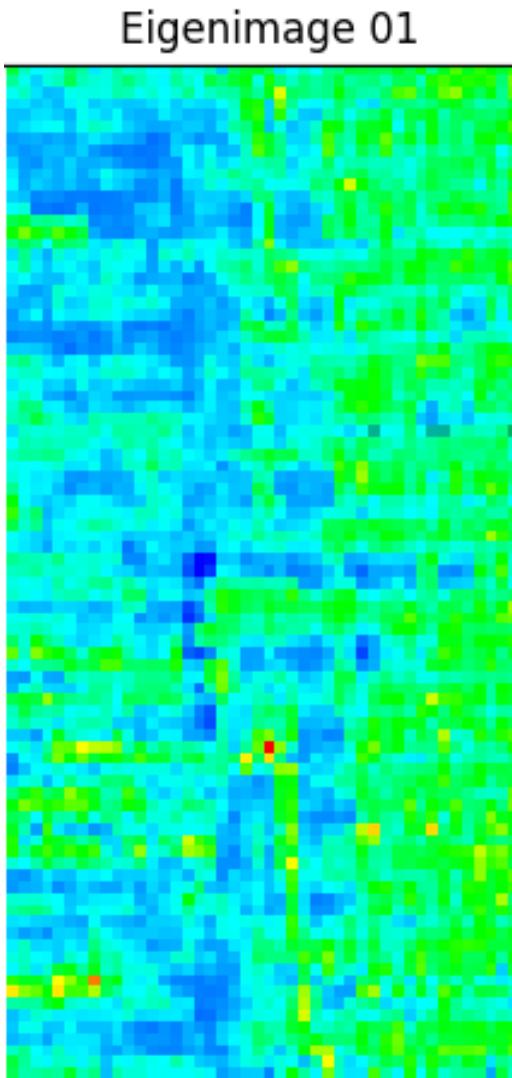
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Continuum	<input checked="" type="checkbox"/>
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SK	<input checked="" type="checkbox"/>
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Ca K	<input checked="" type="checkbox"/>
Fe K	<input checked="" type="checkbox"/>
Cu K	<input checked="" type="checkbox"/>
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Hg K	<input checked="" type="checkbox"/>
Hg L	<input checked="" type="checkbox"/>



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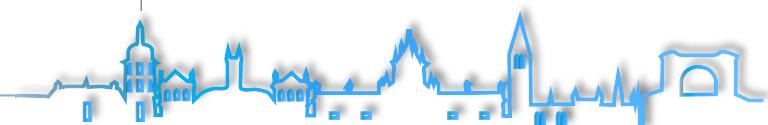


Introducción al trabajo con mapas hiperespectrales



Legend

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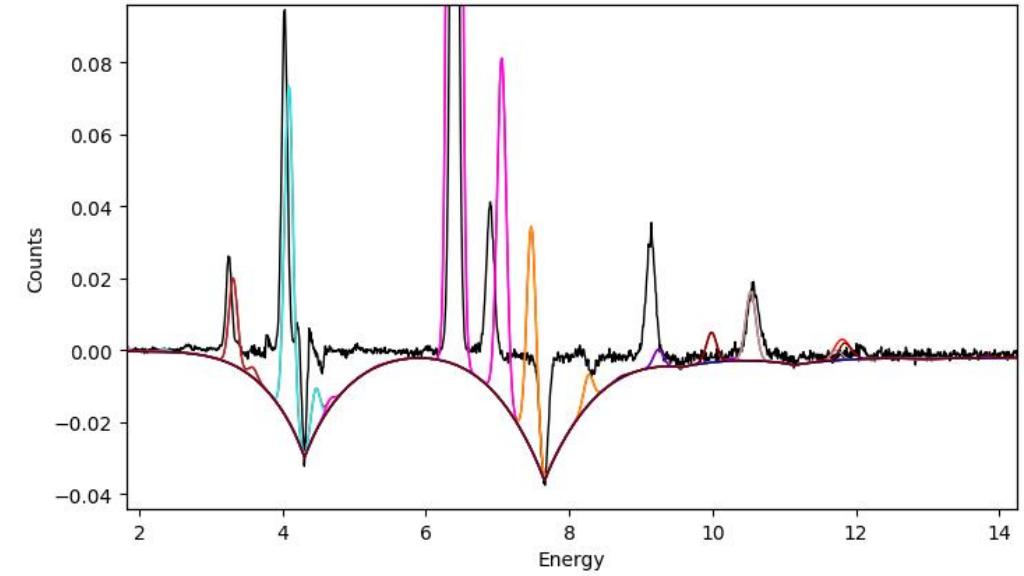
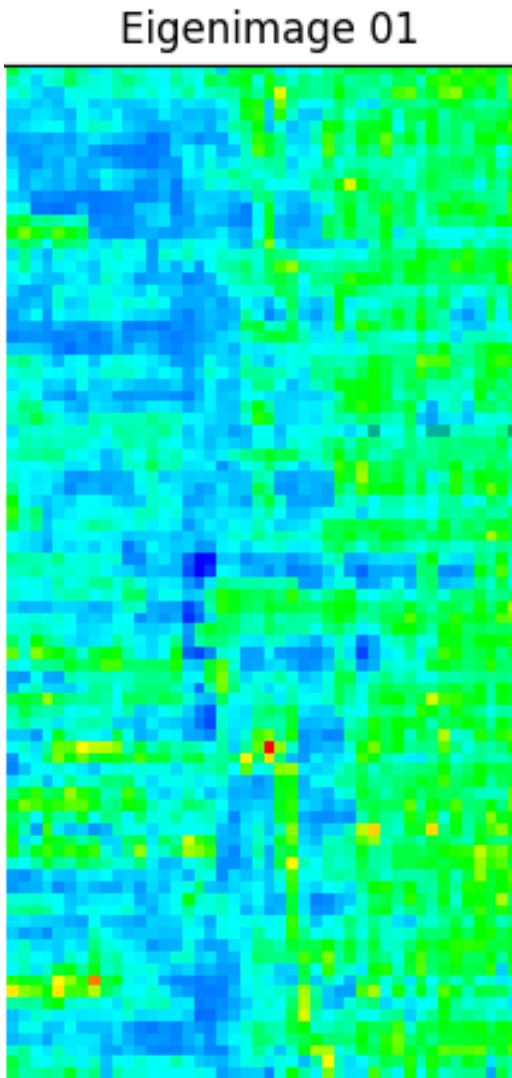




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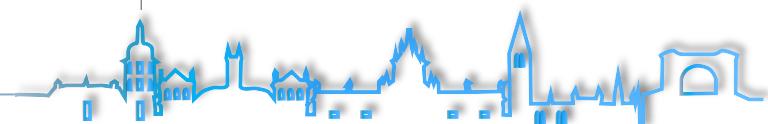


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Legend

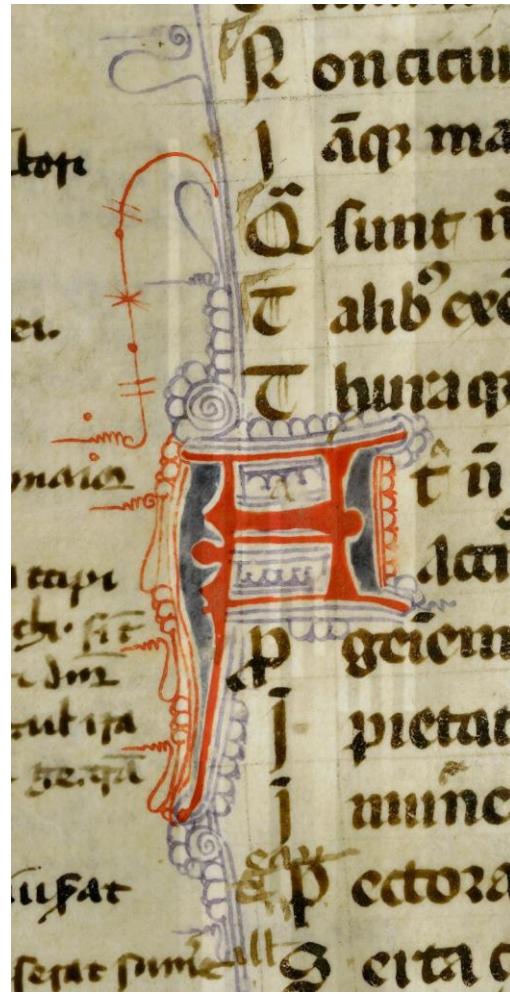
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Fe K	<input checked="" type="checkbox"/>
Cu K	<input checked="" type="checkbox"/>
Zn K	<input checked="" type="checkbox"/>
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Hg K	<input checked="" type="checkbox"/>
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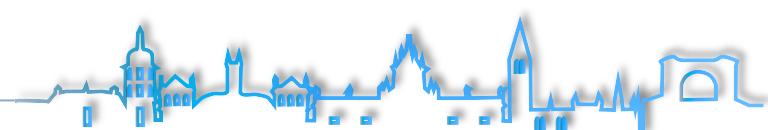
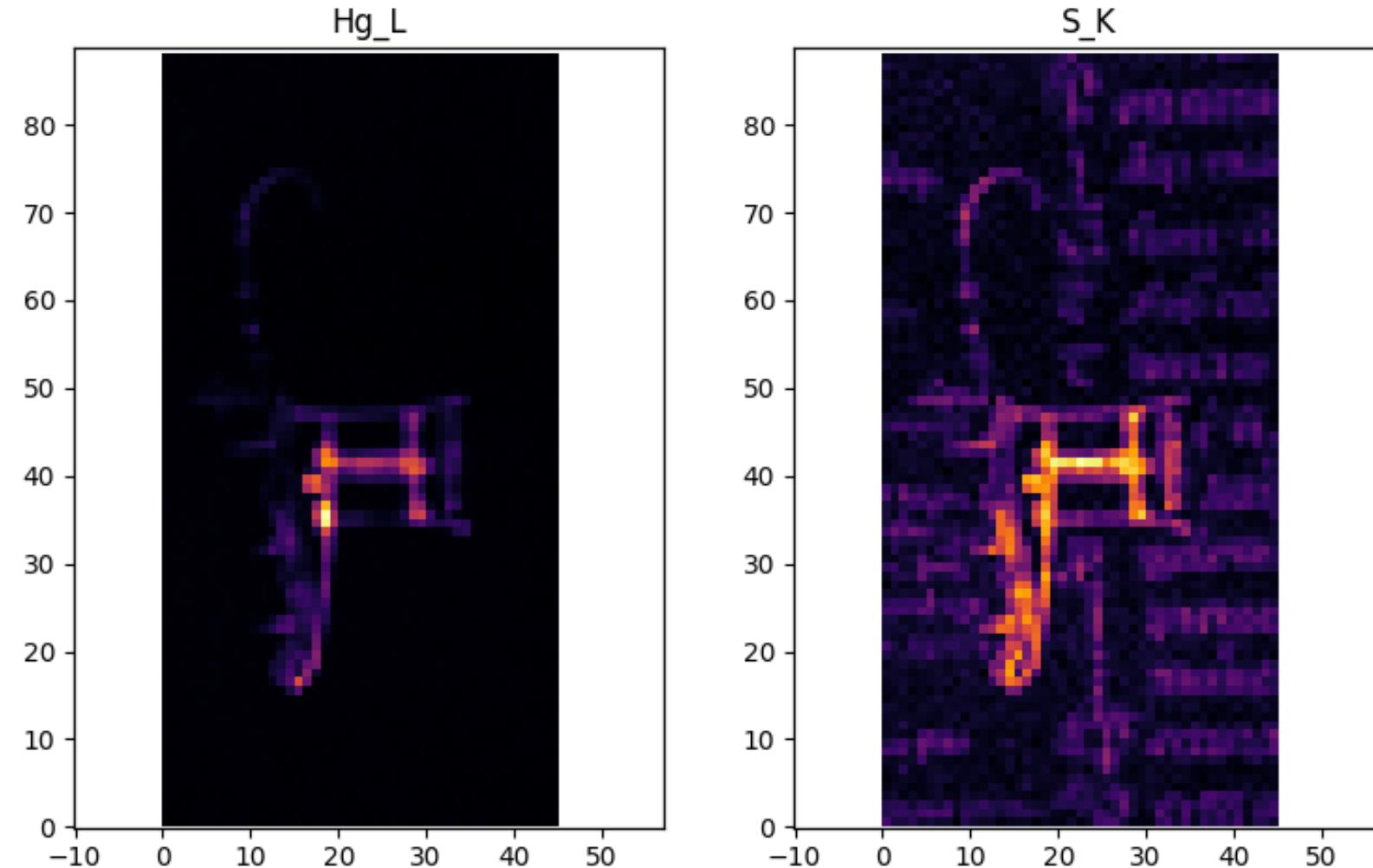
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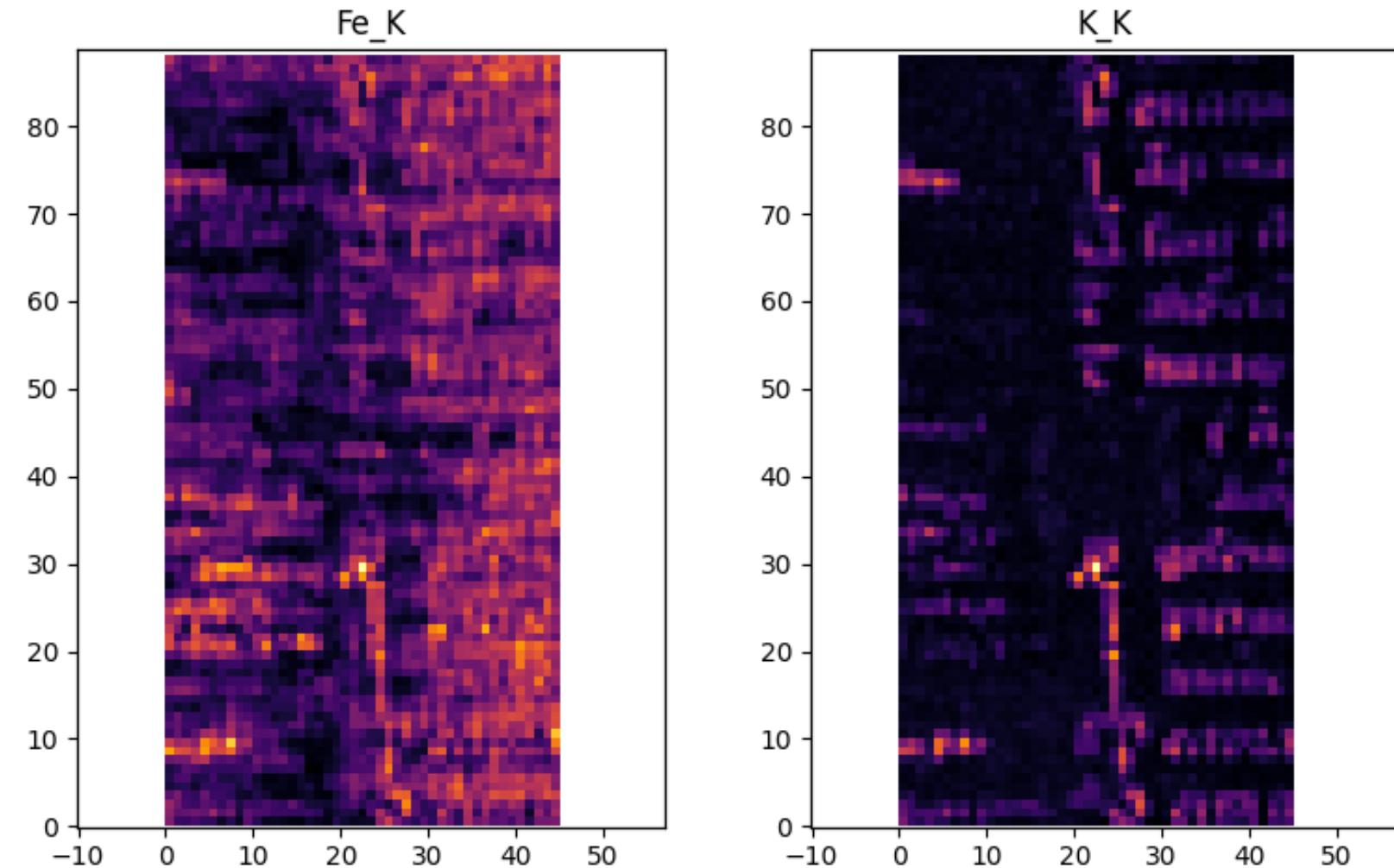
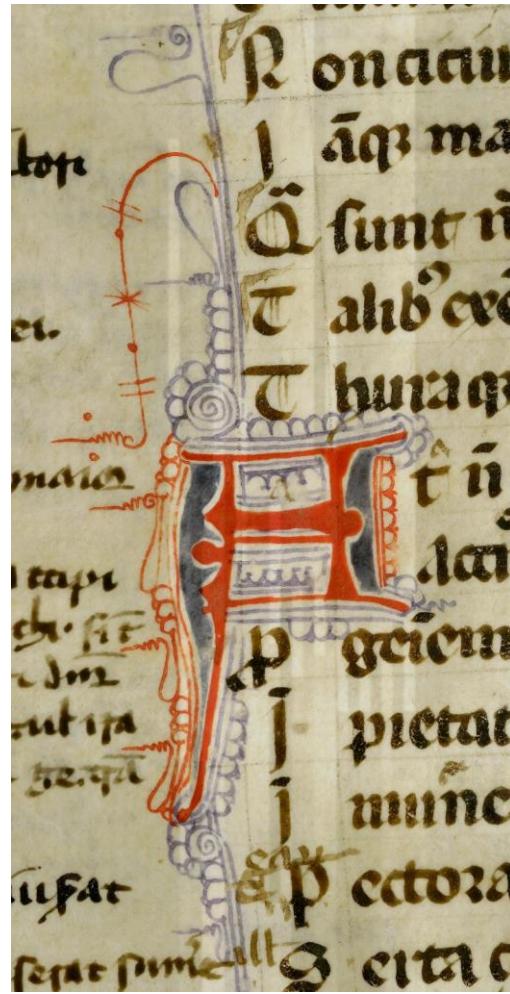
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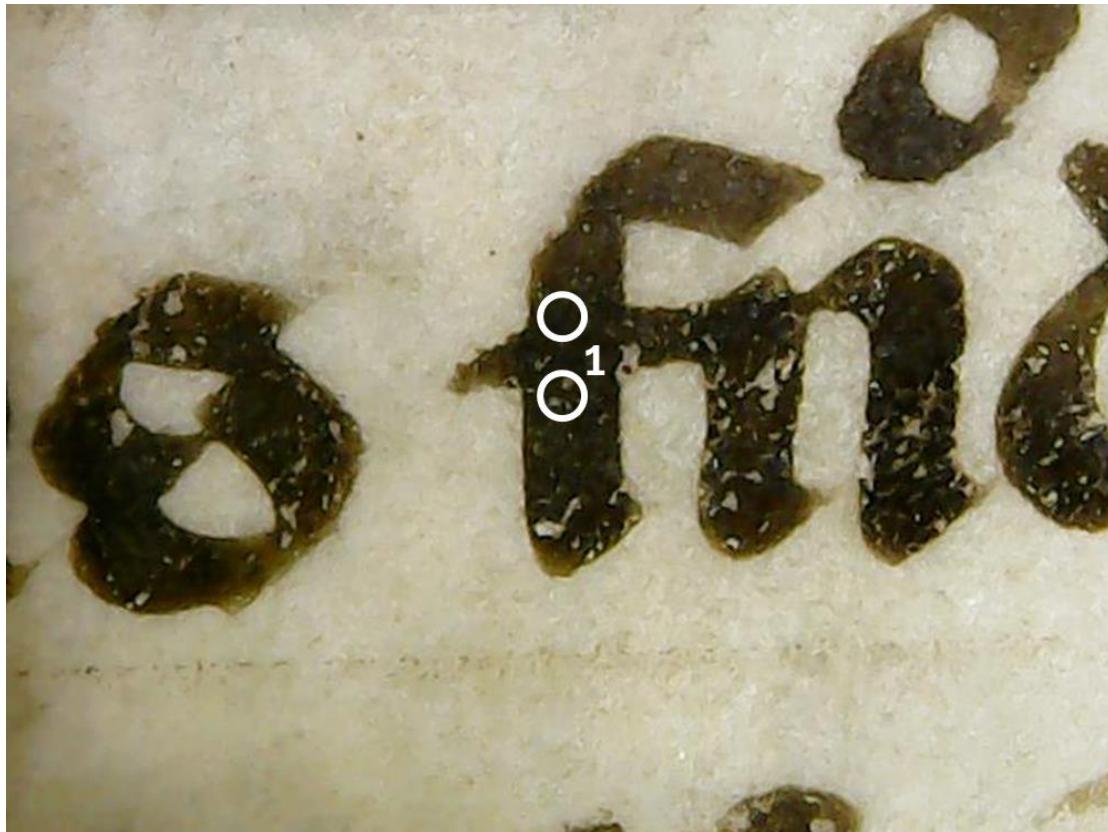
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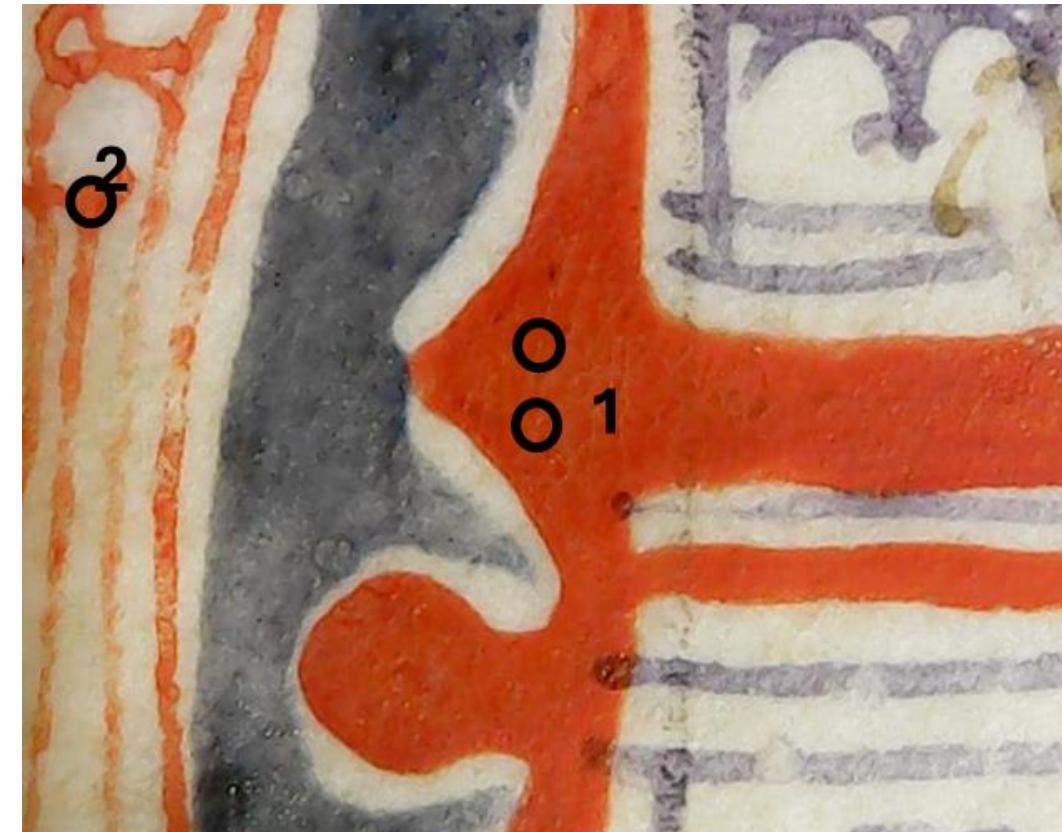


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Fe, K, S



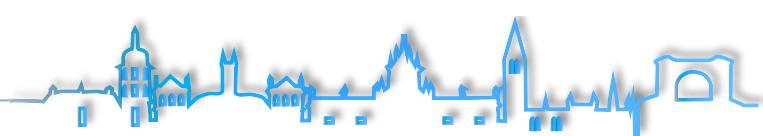
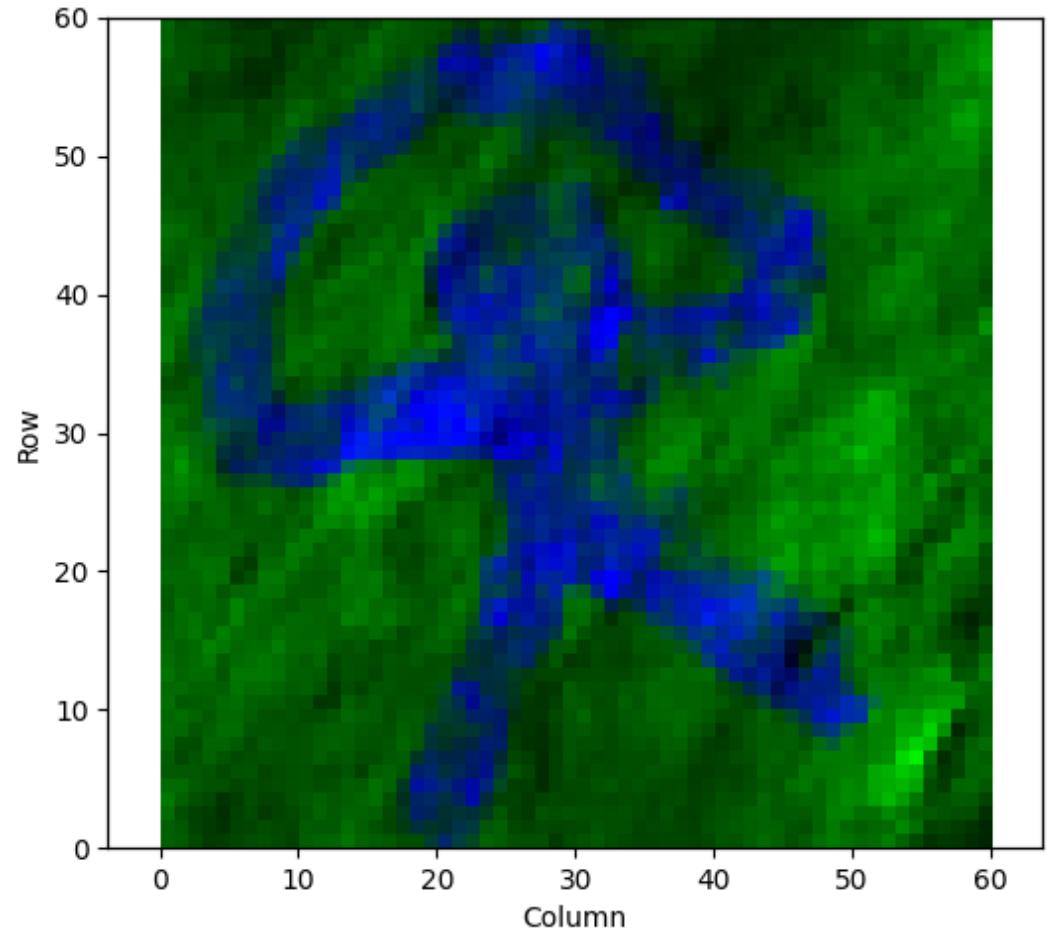
Hg, S





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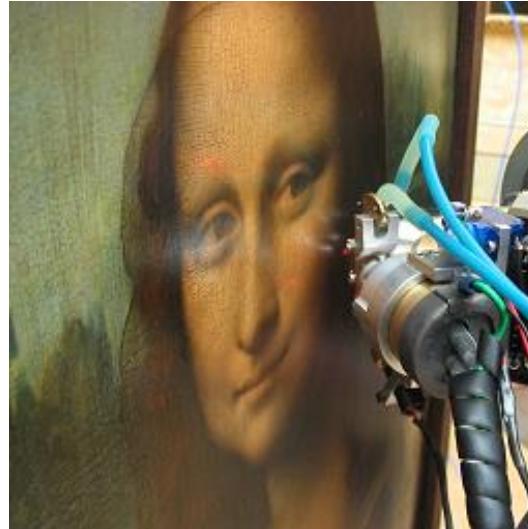
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quasar

<https://quasar.codes/>

PyMca

<https://www.silx.org/doc/PyMca/dev/index.html>





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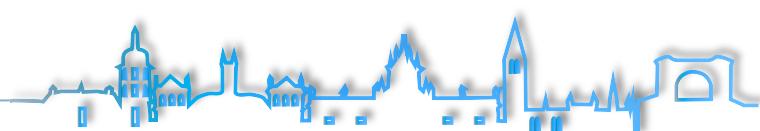


Quasar

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Fotografía: Alberto Plaza Ebrero (CCRBC)



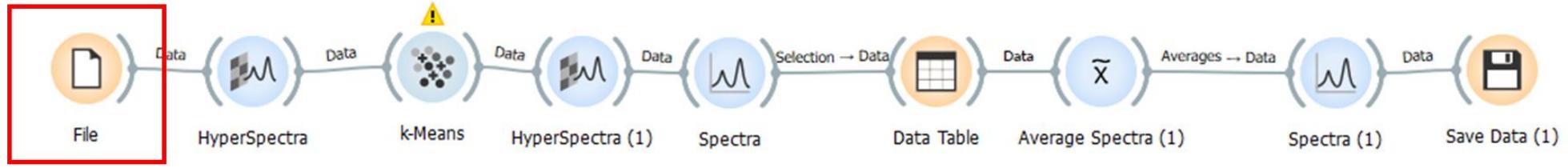


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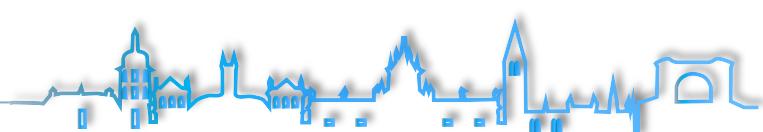
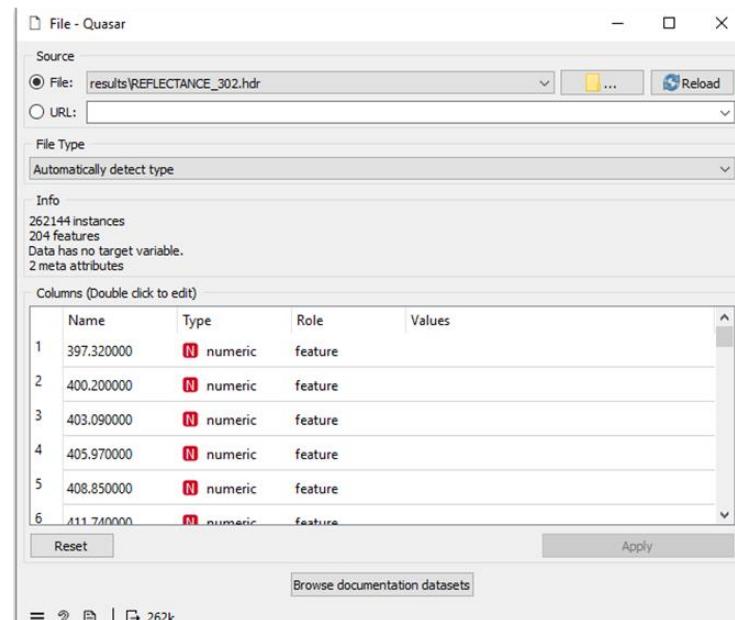


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1. Cargar el fichero *.hdr



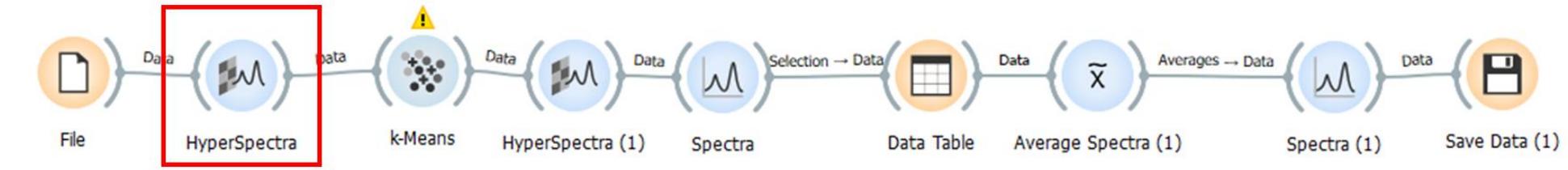


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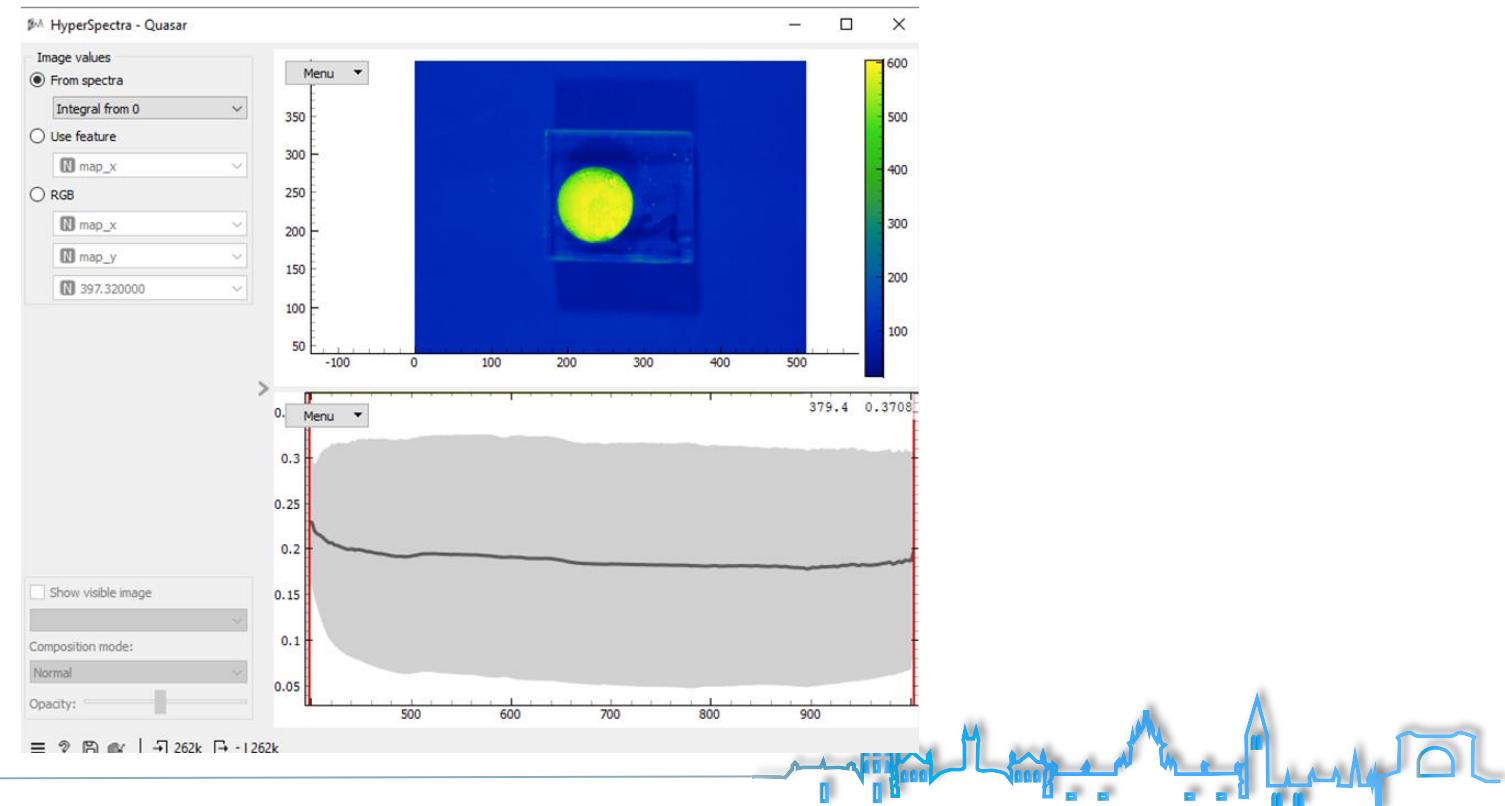


Quasar

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2. Comprobar que tenemos un mapa hiperespectral con una clara diferencia entre la muestra y el portamuestras/fondo



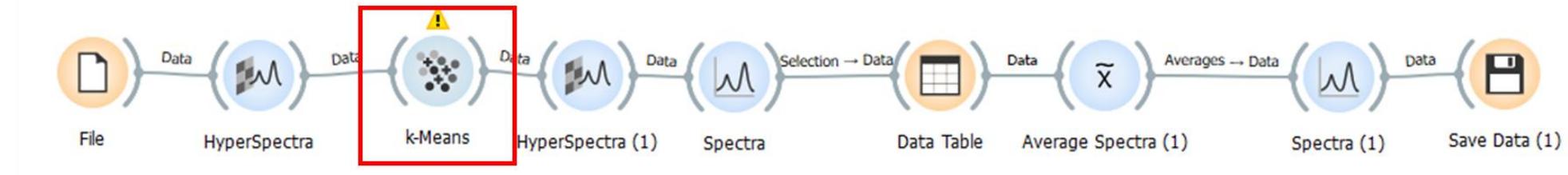


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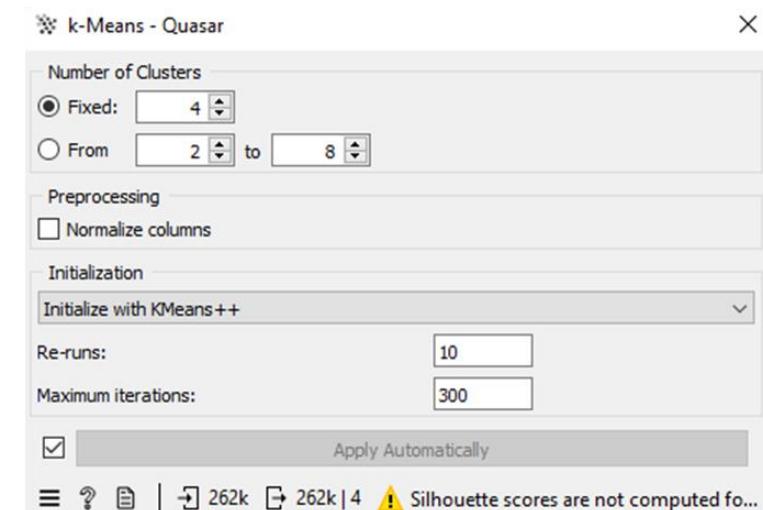


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3. Aplicar un “k-Means” para agrupar los datos en, al menos, 4 o 5 grupos



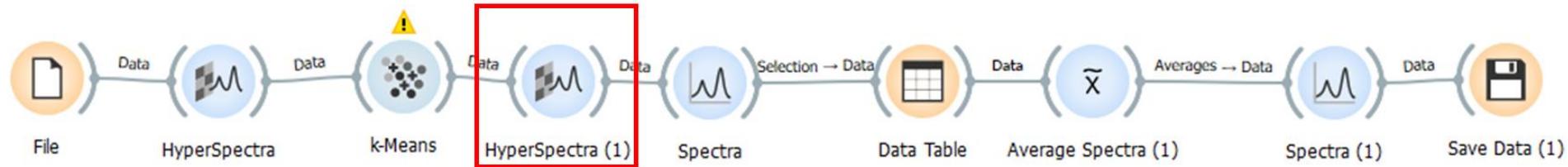


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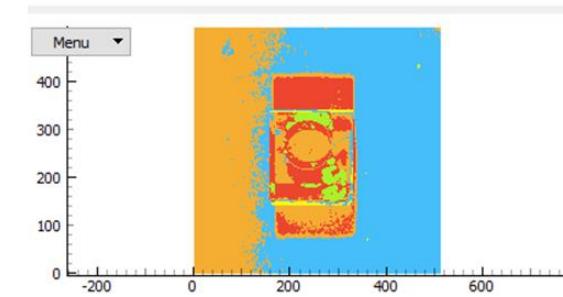
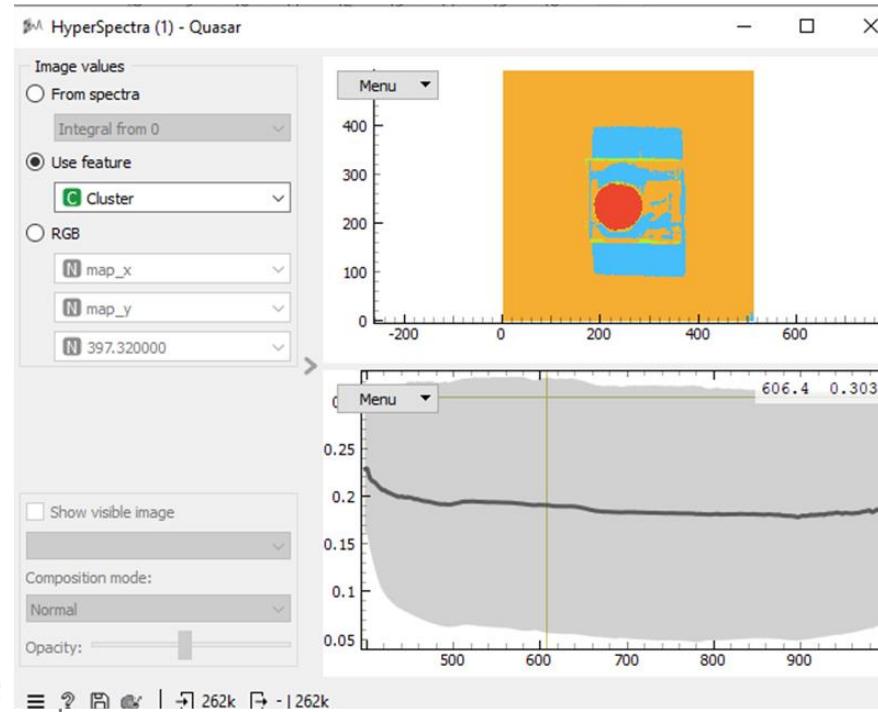


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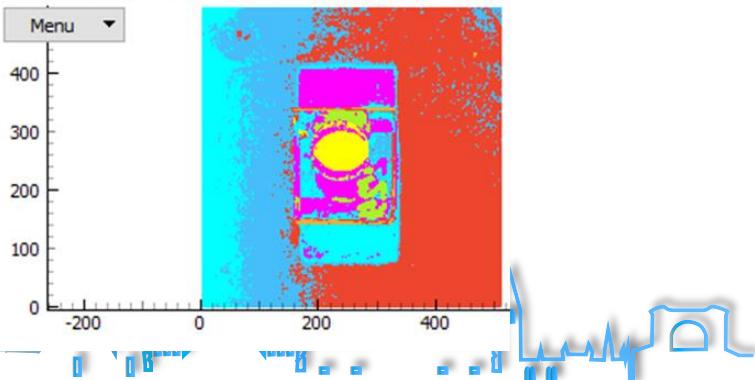
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4. Comprobar que se haya agrupado correctamente el mapa hiperespectral e identificar a que cluster se corresponde la región de interés (atendiendo al código de colores, en ocasiones puede no corresponder a toda la muestra sino sólo a su zona central, dependiendo de la capacidad de recubrimiento del pigmento o la presencia de sombras).



Sombra natural 5 vs 7 clusters



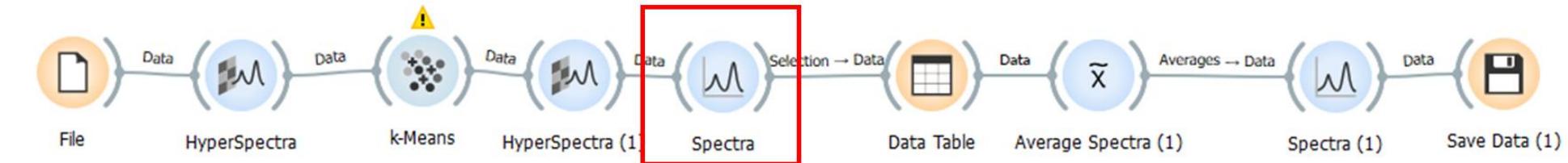


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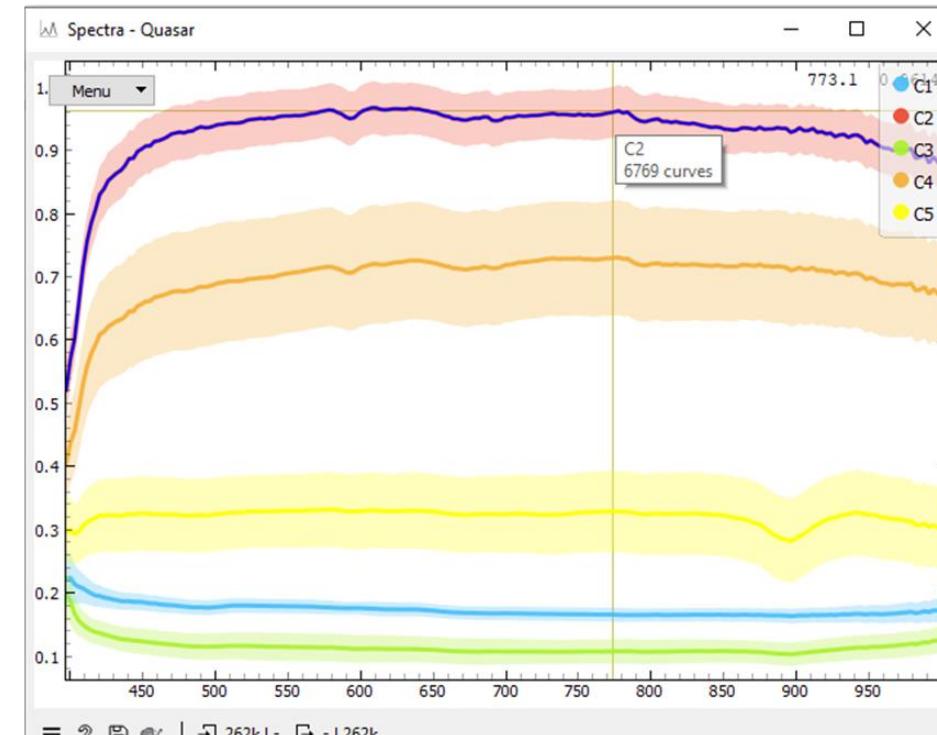


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5. Abrir la visualización de los espectros y seleccionar el cluster correspondiente.



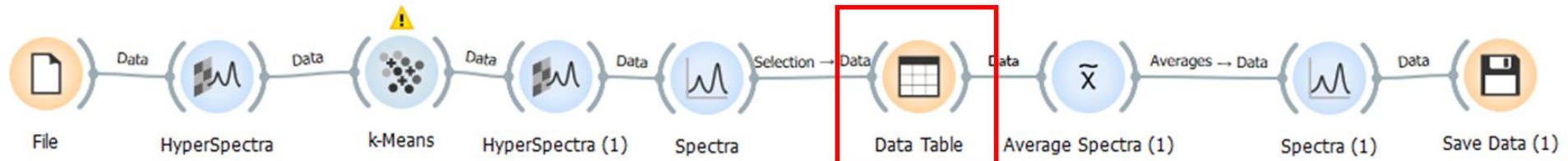


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6. En caso de duda es posible visualizar en el Data Table los espectros que han sido seleccionados (cluster C2 en este ejemplo).

The screenshot shows the 'Data Table - Quasar' interface. On the left, there's a sidebar with 'Info' (6769 instances, 204 features, Target with 2 values, 6 meta attributes), 'Variables' (checkboxes for Show variable labels, Visualize numeric values, and Color by instance classes), and 'Selection' (checkbox for Select full rows). The main area is a table with columns: map_x, map_y, Cluster, Silhouette, Selected (1), Group, and 397.32000. Rows 1 through 21 are highlighted in light green, indicating they belong to cluster C2. The 'Selected (1)' column shows '?' for most rows and 'No' for row 1. The 'Group' column shows 'G1' for all rows. The '397.32000' column shows values ranging from 0.39 to 0.42.

	map_x	map_y	Cluster	Silhouette	Selected (1)	Group	397.32000
1	227	187	C2	?	No	G1	0.39
2	228	187	C2	?	No	G1	0.35
3	229	187	C2	?	No	G1	0.35
4	230	187	C2	?	No	G1	0.35
5	231	187	C2	?	No	G1	0.35
6	232	187	C2	?	No	G1	0.35
7	233	187	C2	?	No	G1	0.35
8	234	187	C2	?	No	G1	0.35
9	224	188	C2	?	No	G1	0.39
10	225	188	C2	?	No	G1	0.39
11	226	188	C2	?	No	G1	0.39
12	227	188	C2	?	No	G1	0.39
13	228	188	C2	?	No	G1	0.42
14	229	188	C2	?	No	G1	0.35
15	230	188	C2	?	No	G1	0.39
16	231	188	C2	?	No	G1	0.35
17	232	188	C2	?	No	G1	0.35
18	233	188	C2	?	No	G1	0.39
19	234	188	C2	?	No	G1	0.39
20	235	188	C2	?	No	G1	0.39
21	236	188	C2	?	No	G1	0.39

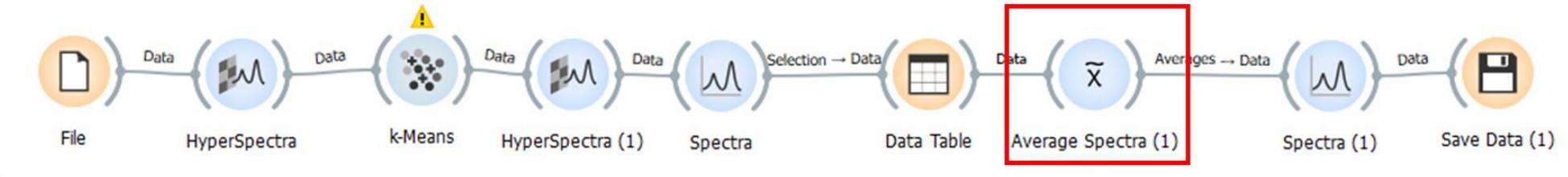


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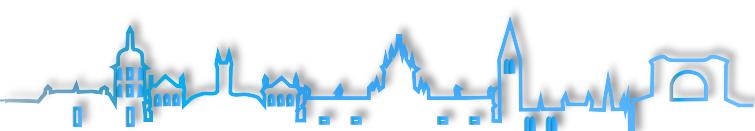


Quasar

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7. Posteriormente automáticamente se promedian todos estos espectros seleccionados.



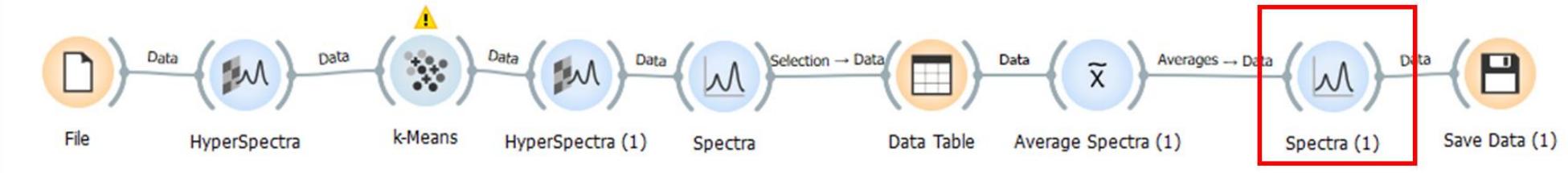


AHMat

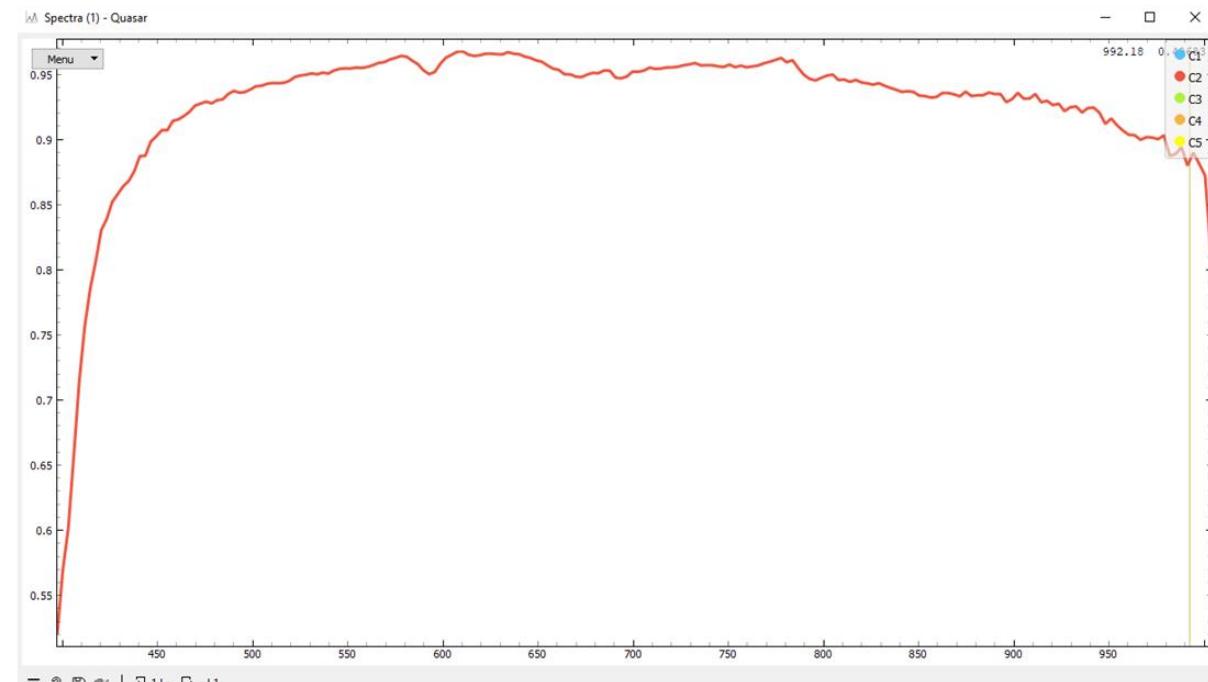


Quasar

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8. Es posible visualizar el espectro promedio resultante.



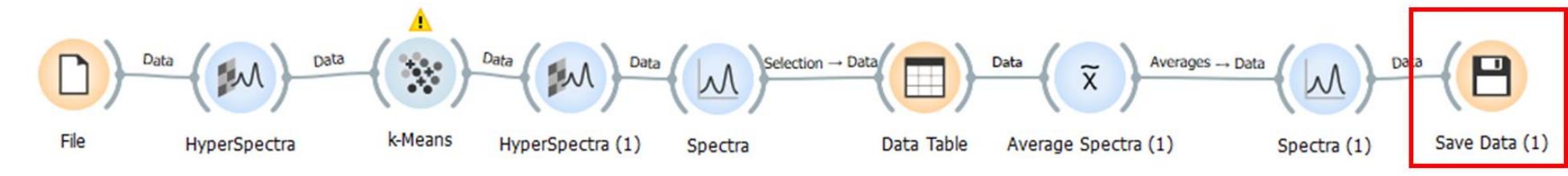


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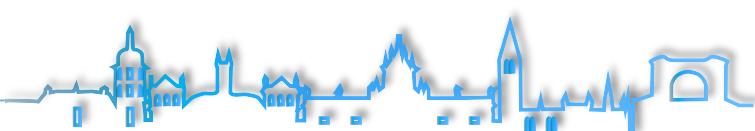
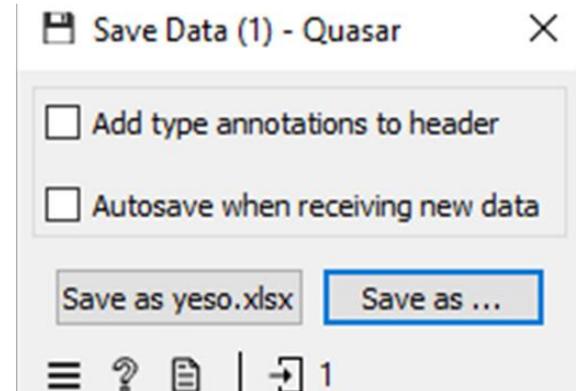


Quasar

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9. Finalmente se salva el espectro con el nombre y formato que se desee.





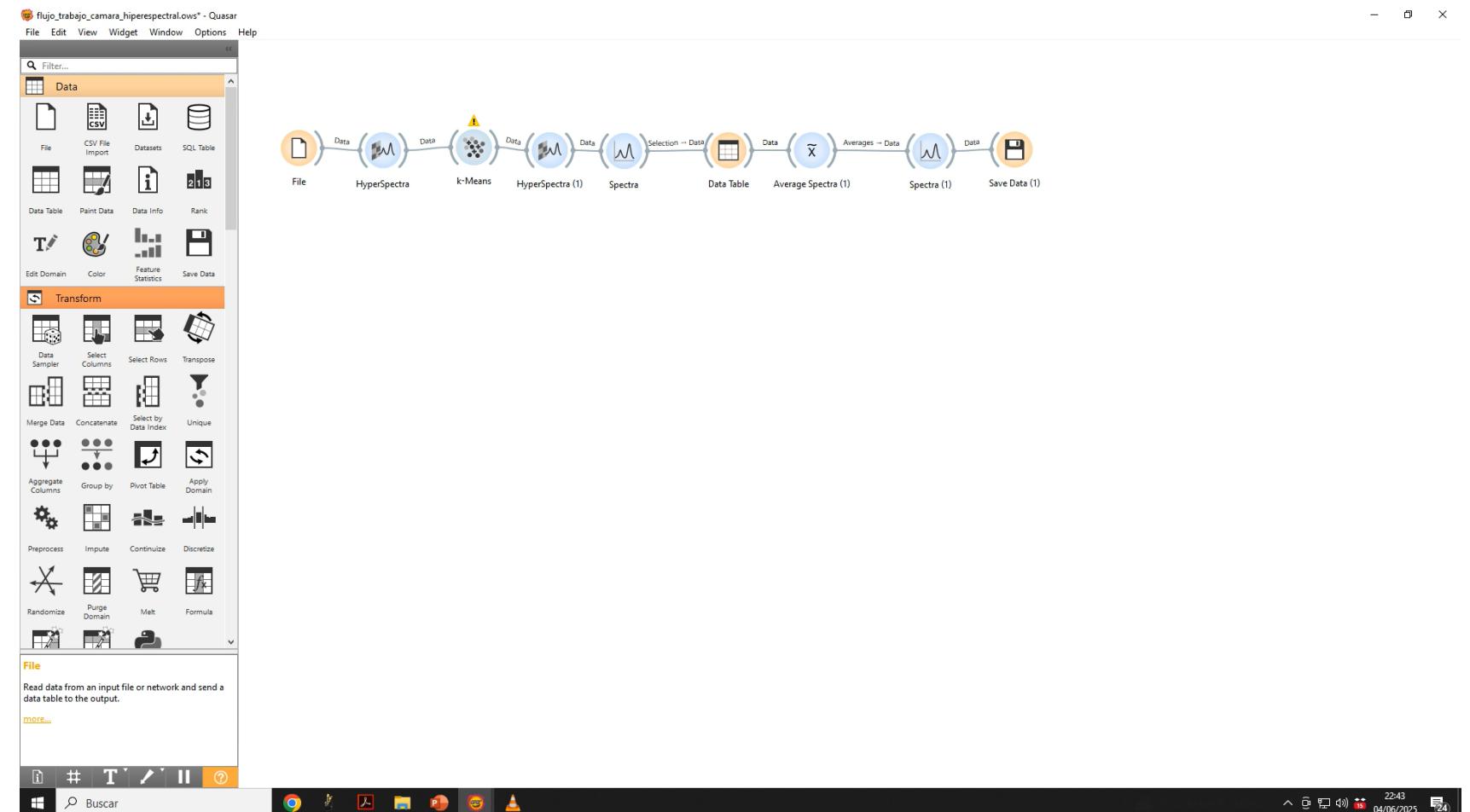
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Quasar



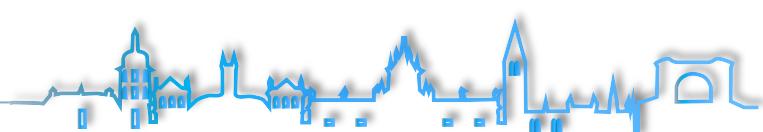
flujo_trabajo_
camara_hiper
espectral.ows



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AHMat



quasar

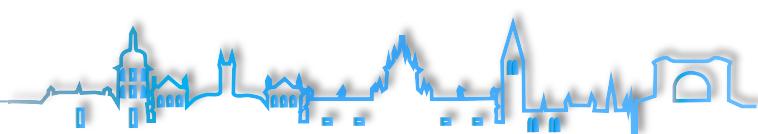


Fotografía: Alberto Plaza Ebrero (CCRBC)

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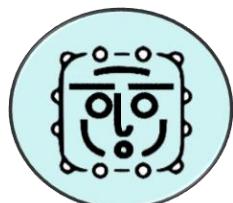
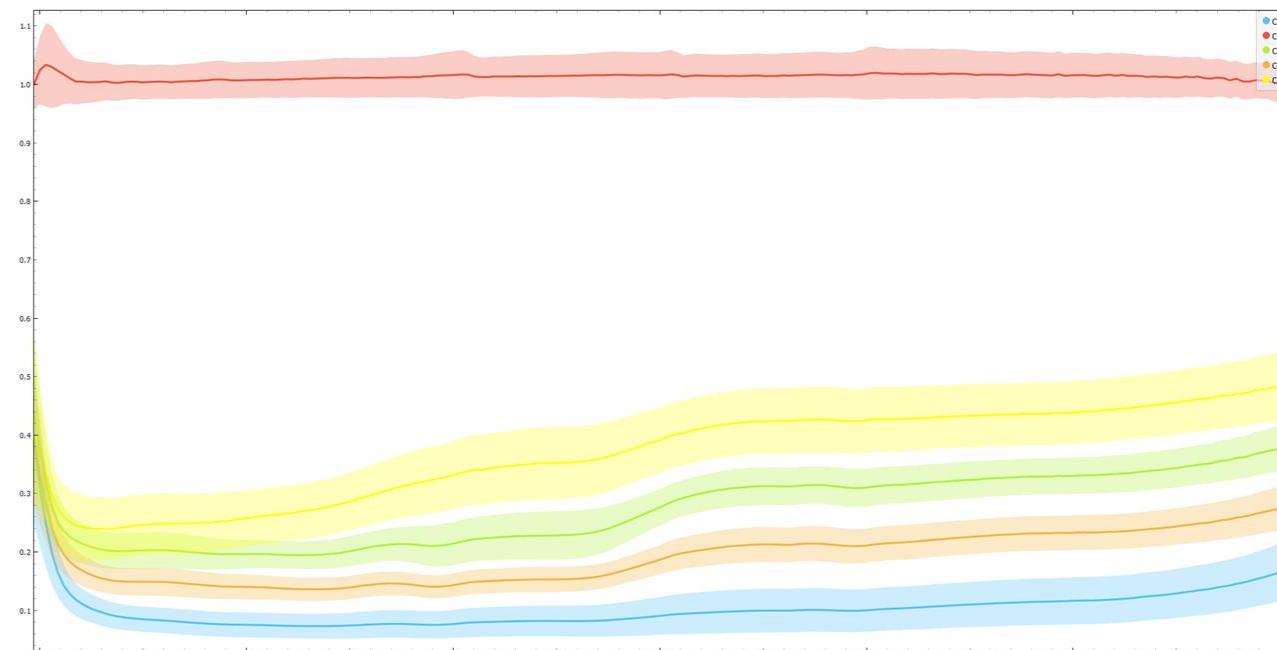
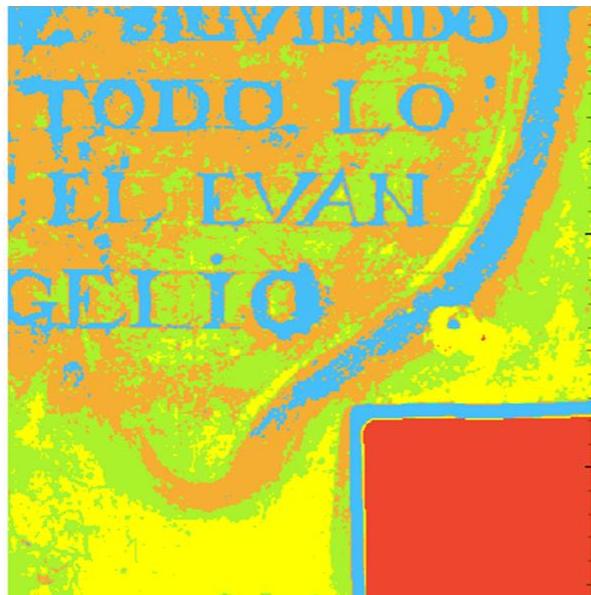




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Quasar



Identify

NOS
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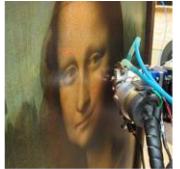


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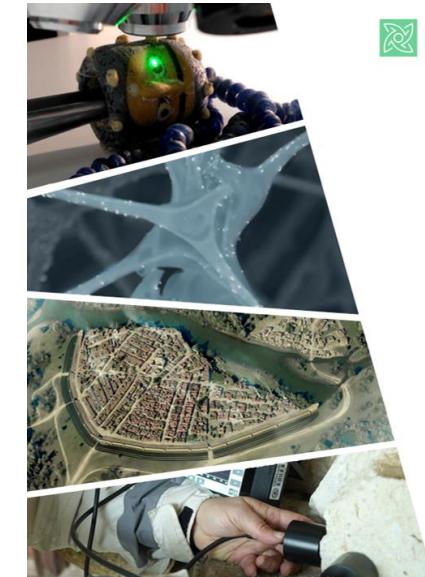




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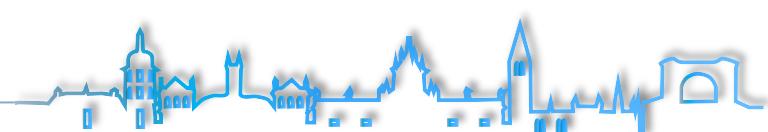
PyMCA training

V. Armando Solé (ESRF)

23/04/2024-24/04/2024

Proyecto: Desarrollo e implementación de una base de datos de pigmentos históricos como aplicación multiplataforma para el estudio y preservación del patrimonio de Castilla y León

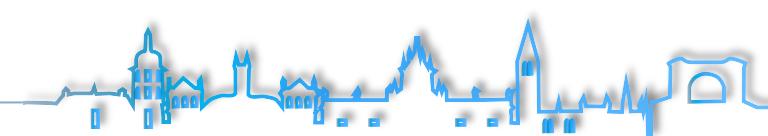
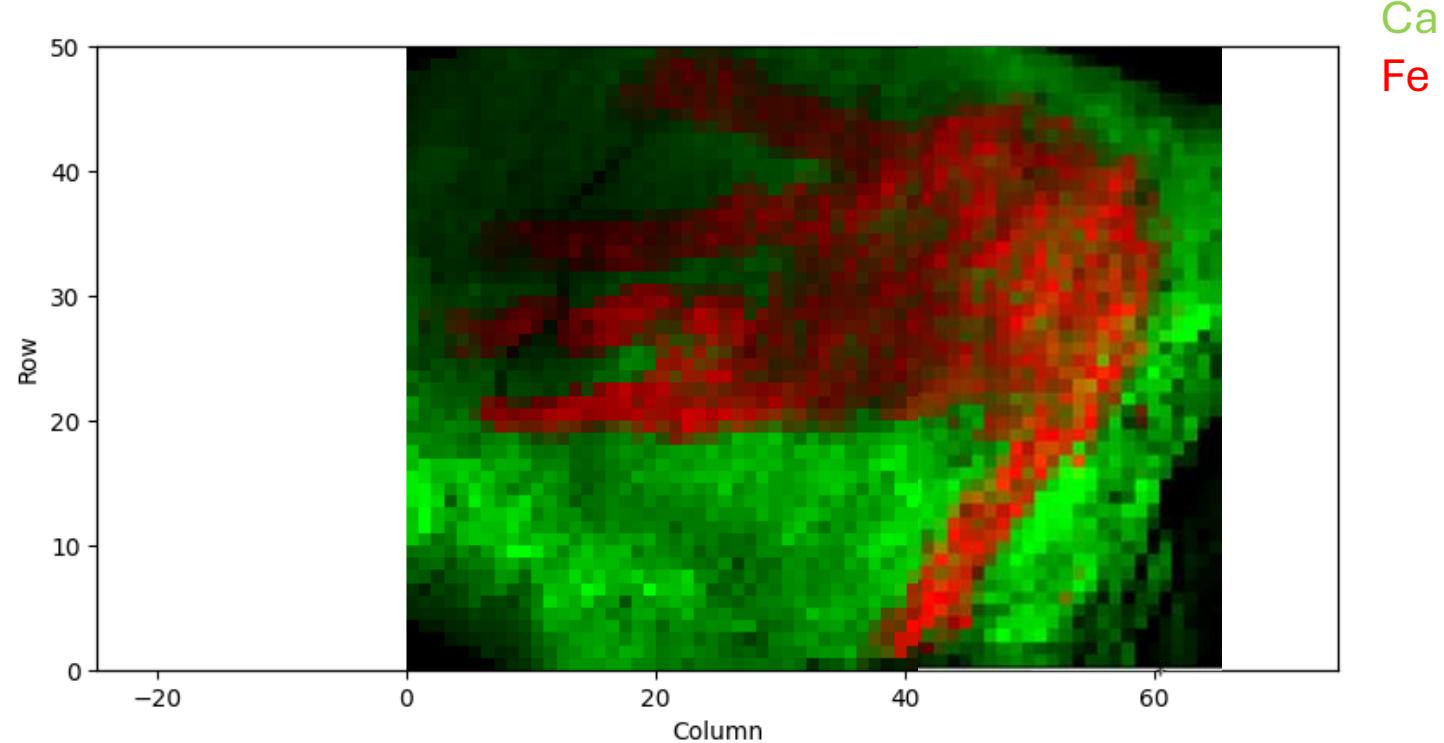
Financiado por:





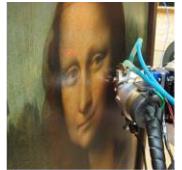
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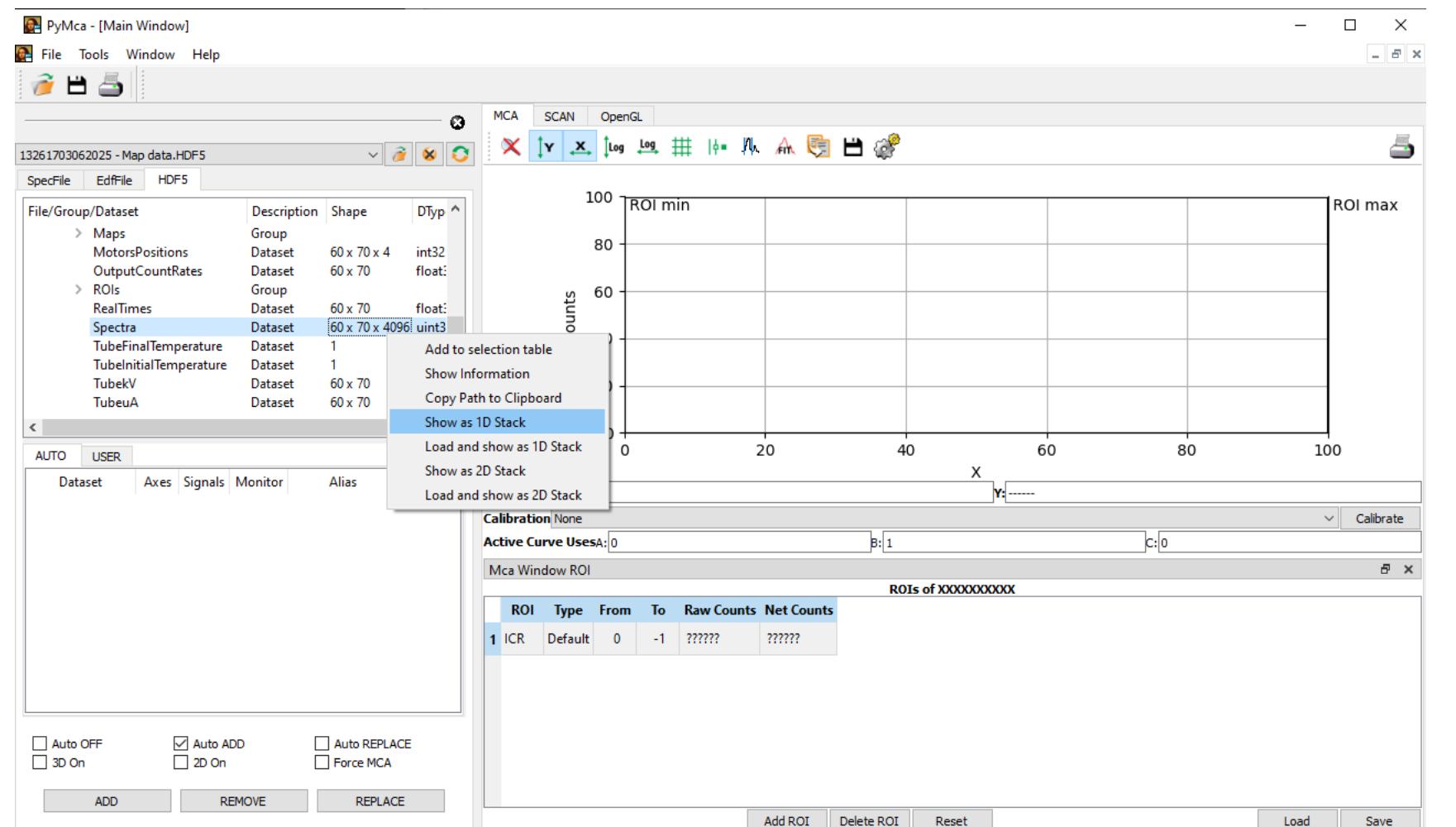
PyMca



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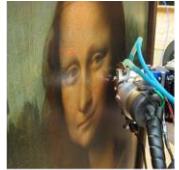
Junta de
Castilla y León



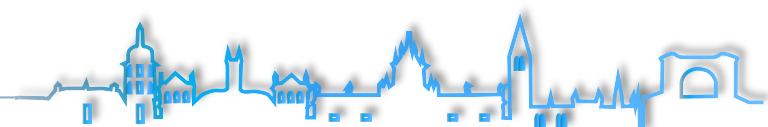
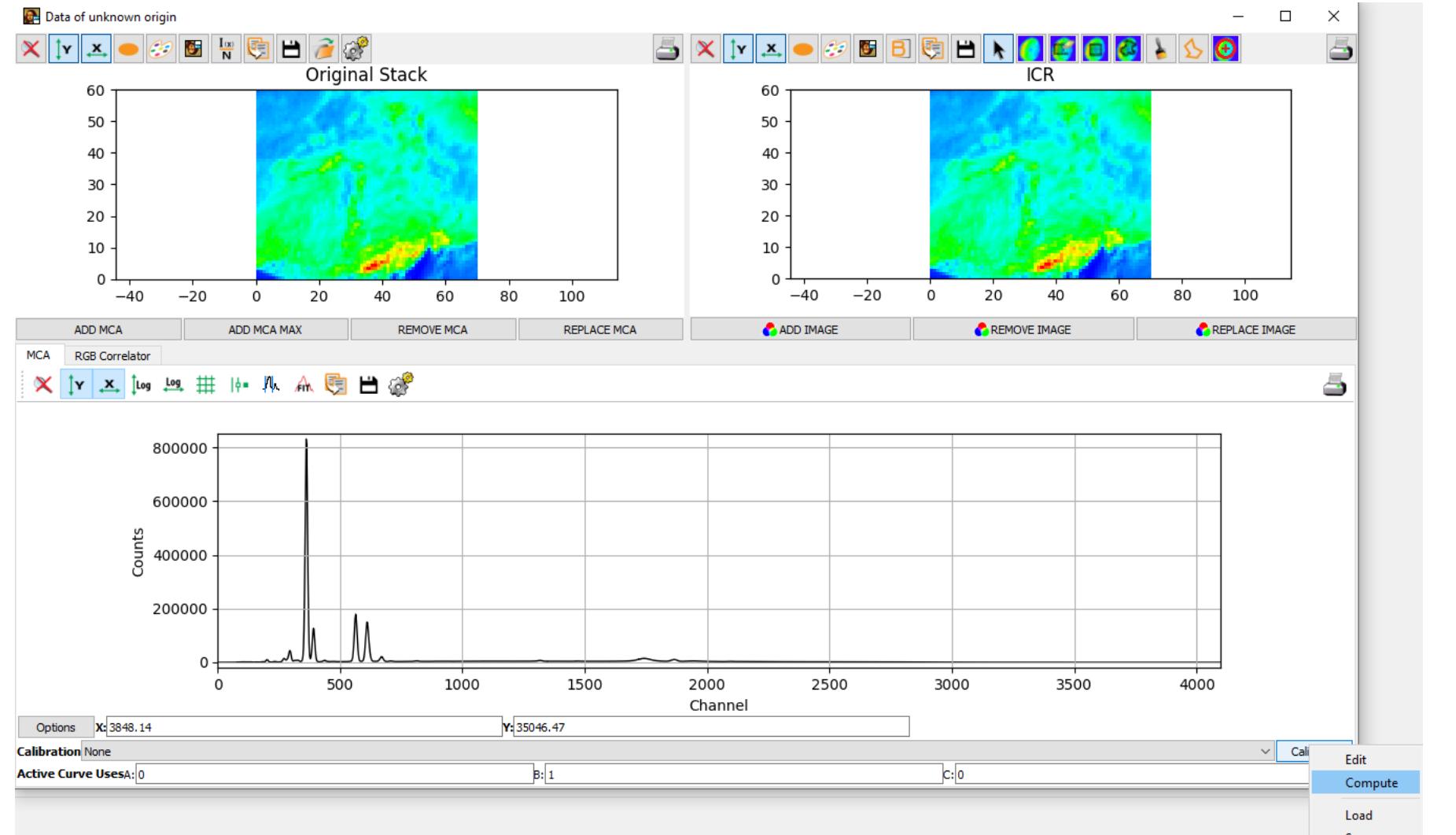
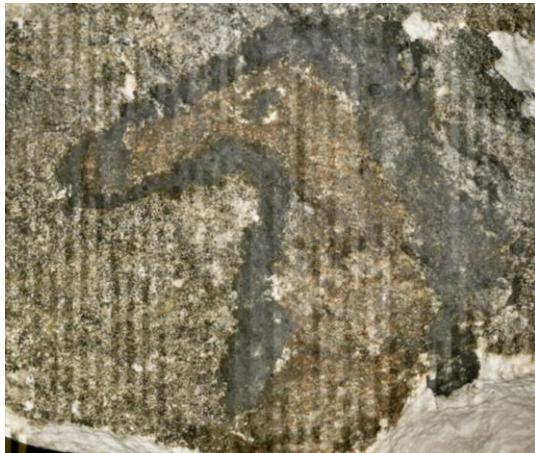


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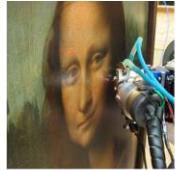


PyMca





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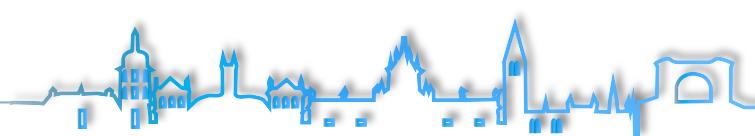
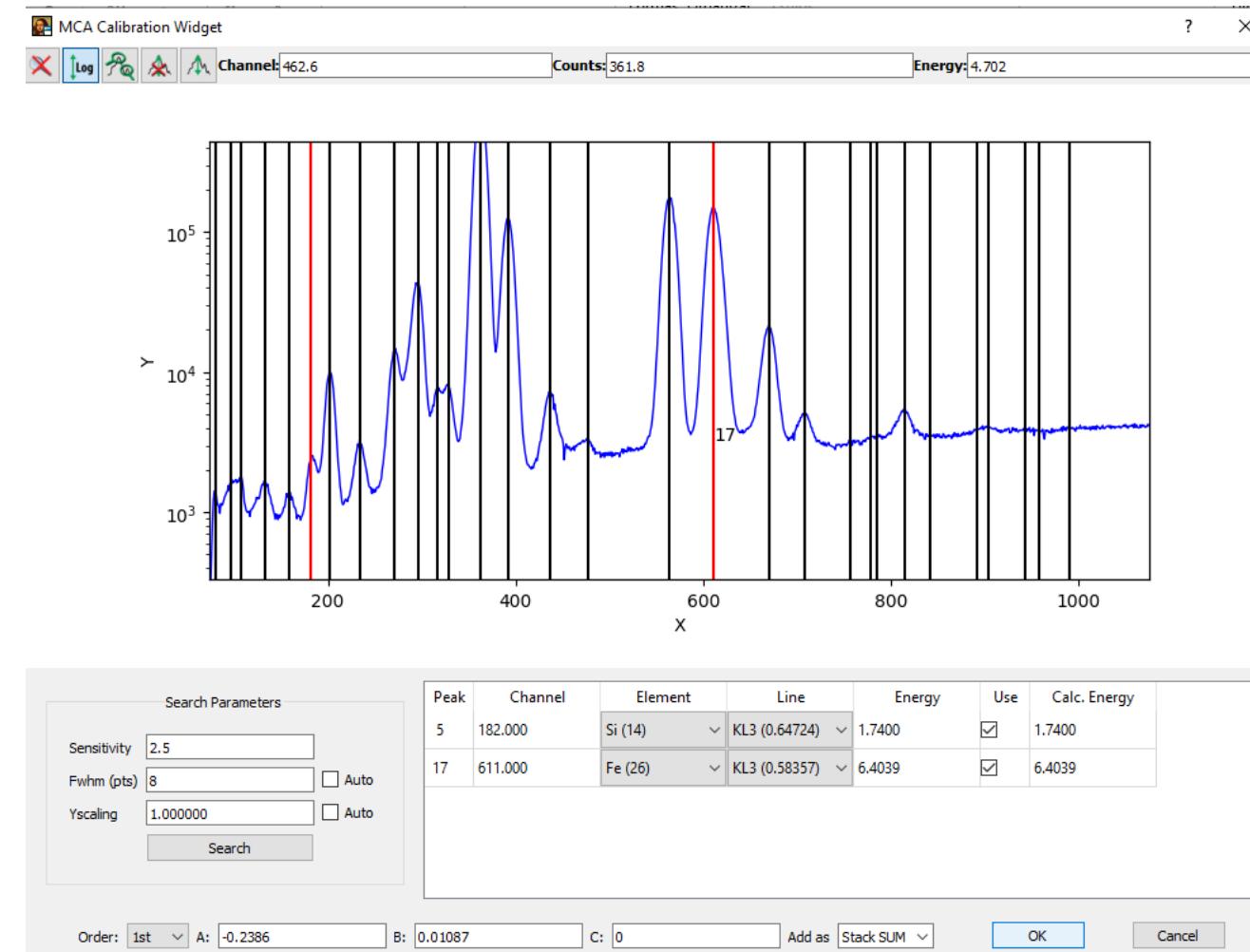


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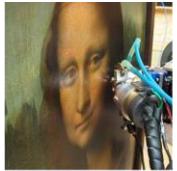
Introducción al trabajo con mapas hiperespectrales



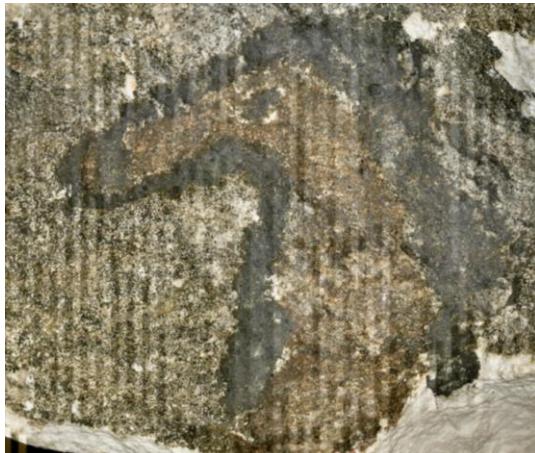


Introducción al trabajo con mapas hiperpectrales

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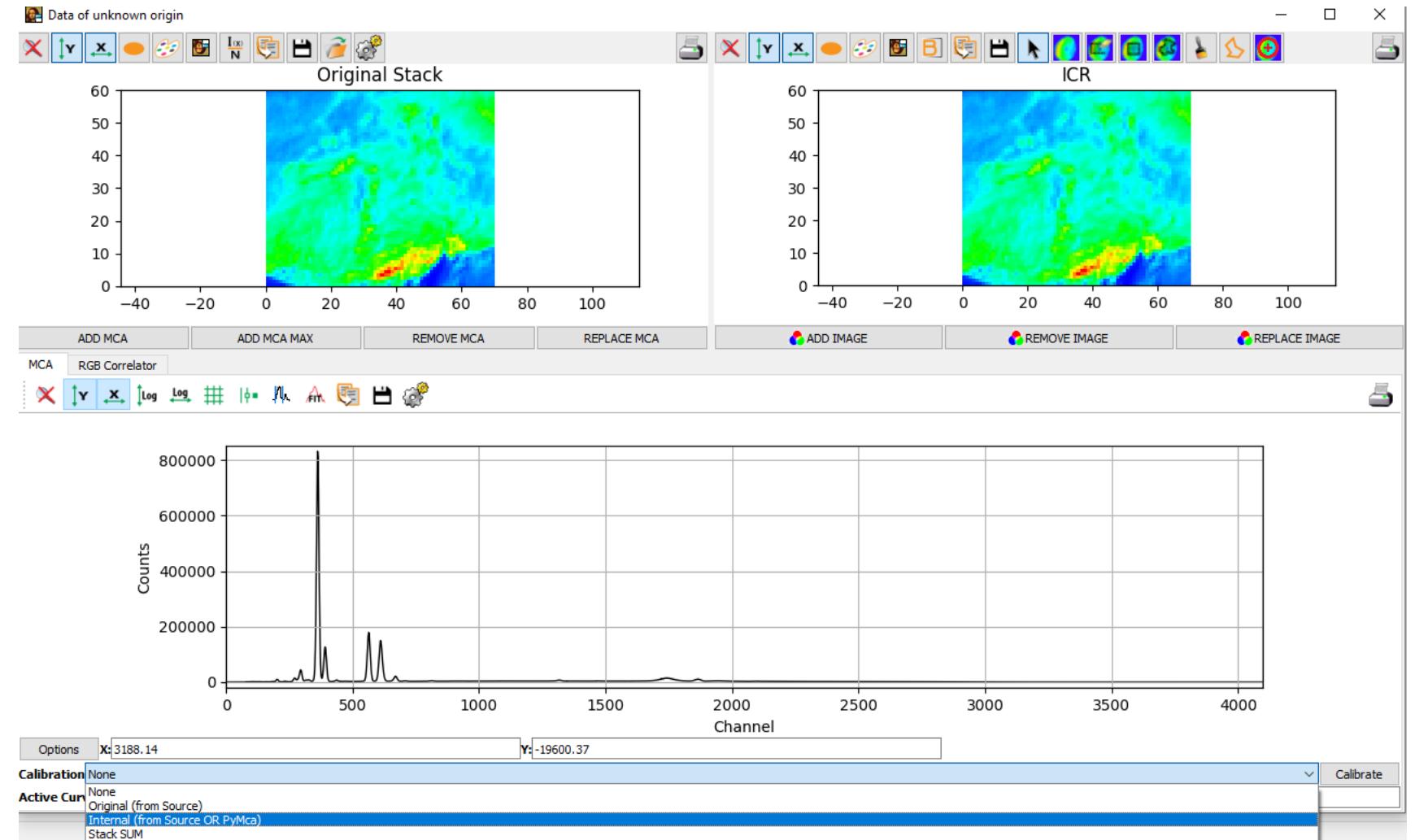
PyMca



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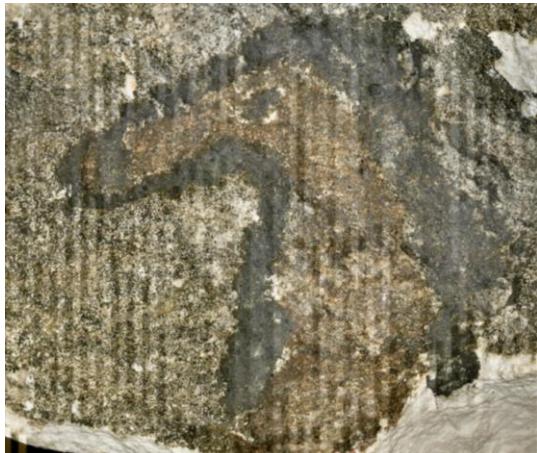


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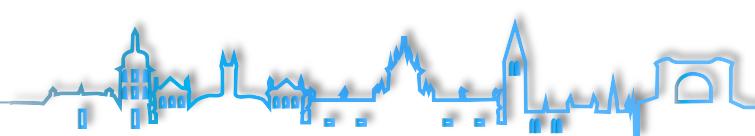
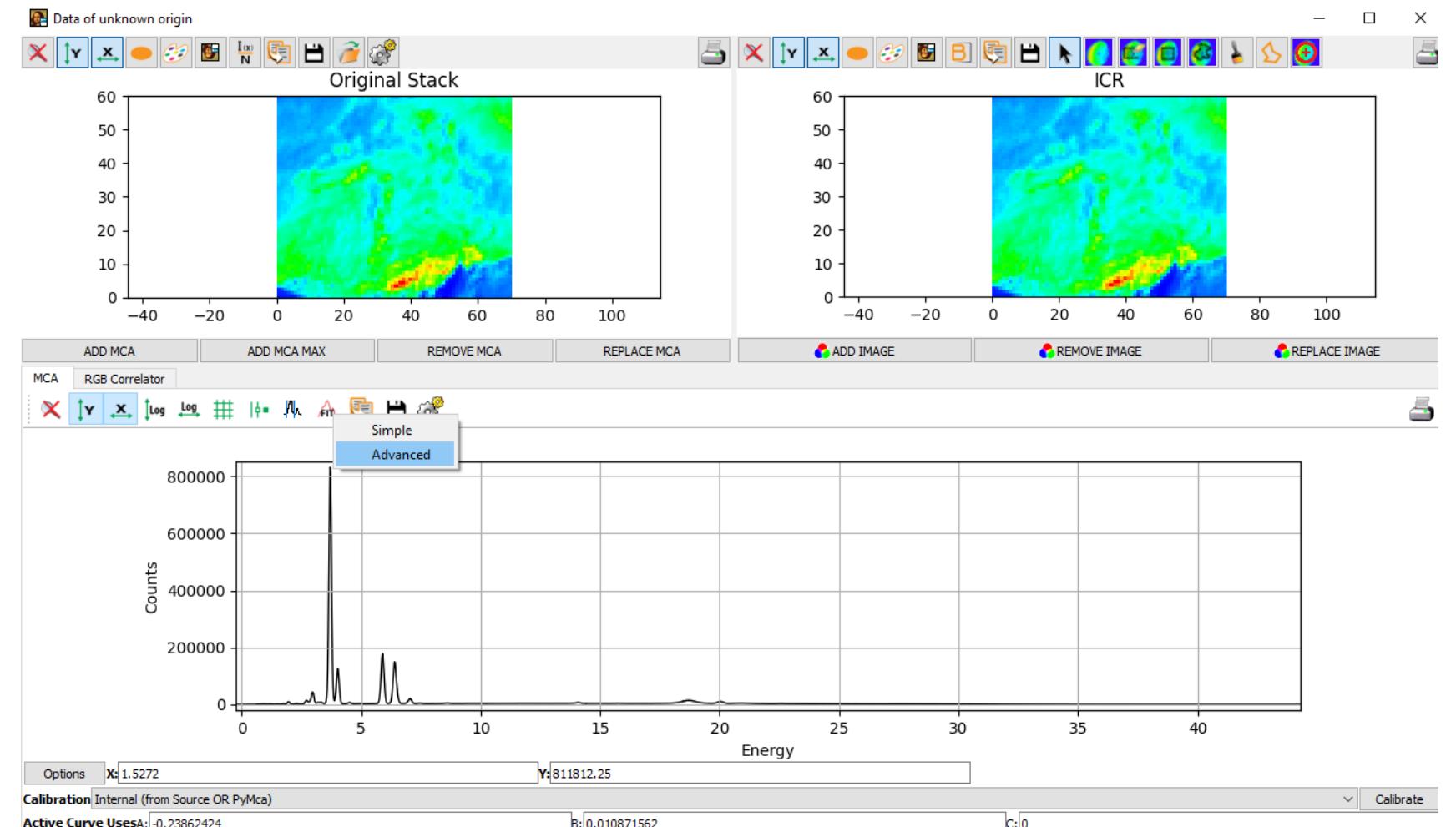
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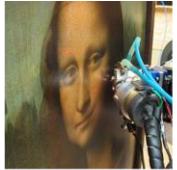
Junta de
Castilla y León



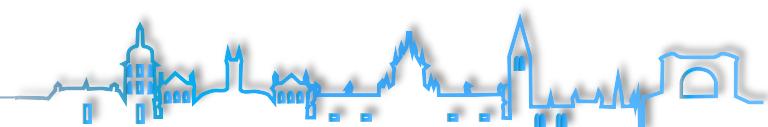
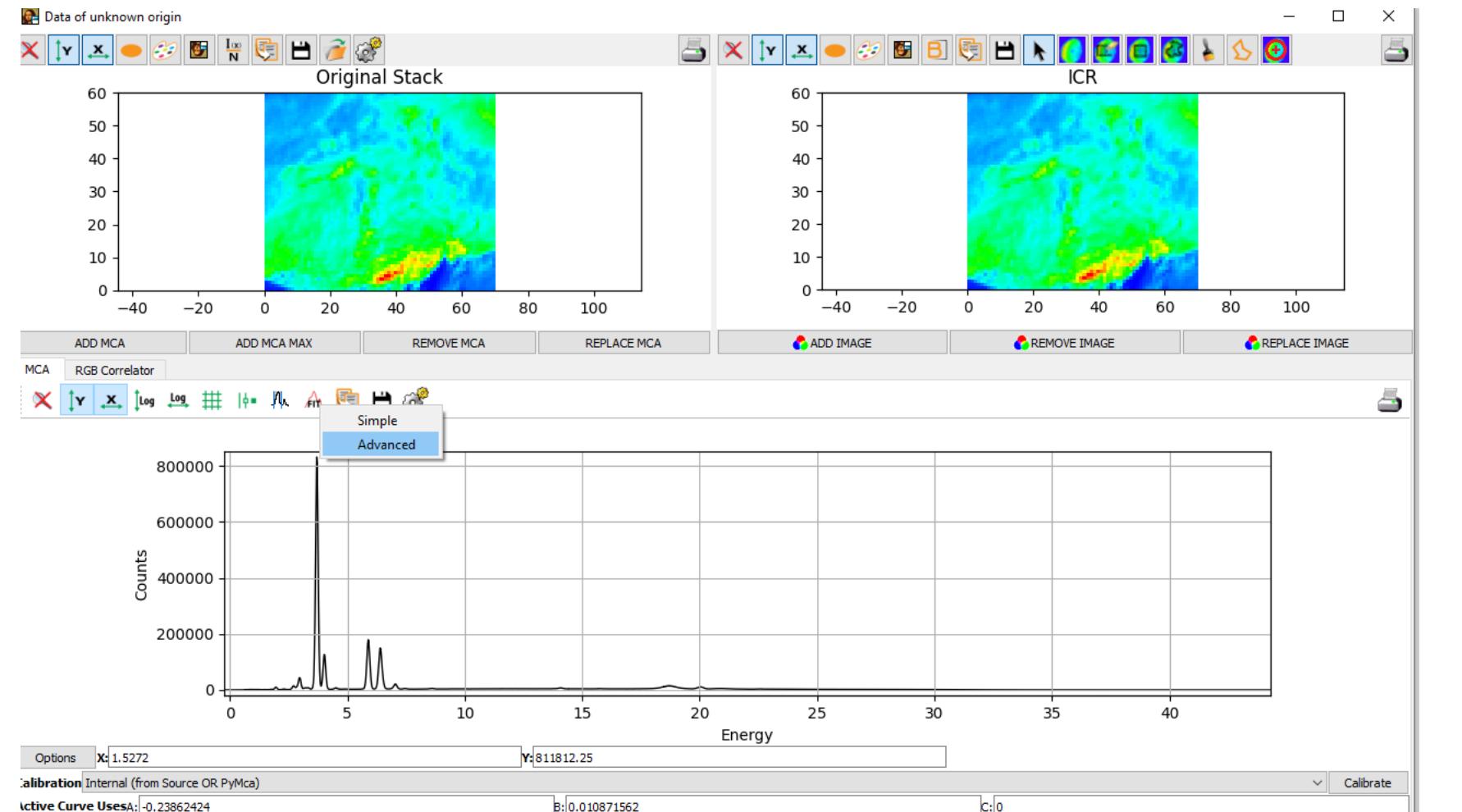
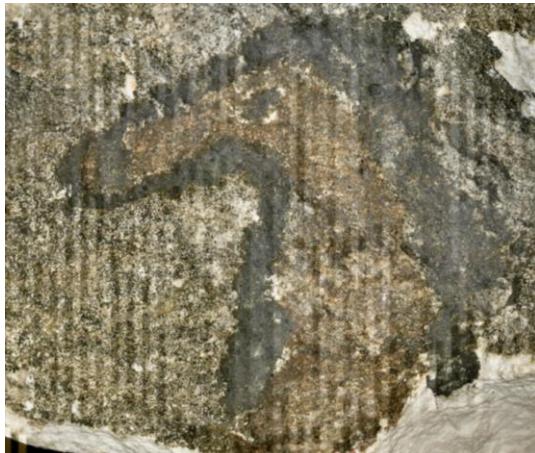


Introducción al trabajo con mapas hiperespectrales

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PyMca - MCA Fit Parameters

FIT DETECTOR BEAM PEAKS PEAK SHAPE ATTENUATORS MATRIX CONCENTRATIONS XRFMC

Fit Function: Mca Hypermet

Continuum type: NO Continuum

Polynomial order: 1

Non-analytical (or estimation) background algorithm: SNIP

SNIP Background Width: Strip

Strip Background Width: SNIP

Strip Background Iterations: 1

Strip Background Smoothing Width (Savitsky-Golay): 20000

Strip Background use Anchors: 0 0 0 0

Statistical weighting of data: Poisson (1/Y)

Number of fit iterations: 10

Minimum chi^2 difference (%): 0.001

Perform a fit using the selected strategy

Perform a Linear Fit Fixing non-linear Parameters to Initial Values

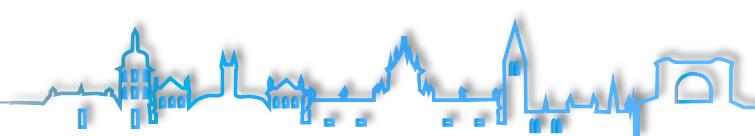
Limit fitting region to : First channel: 0 Last channel: 4095

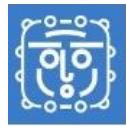
Include:

Stripping Escape peaks Pile-up peaks Scattering peaks

Short tail Long tail Step tail

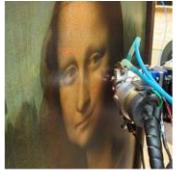
Load From Fit Load Save Cancel OK



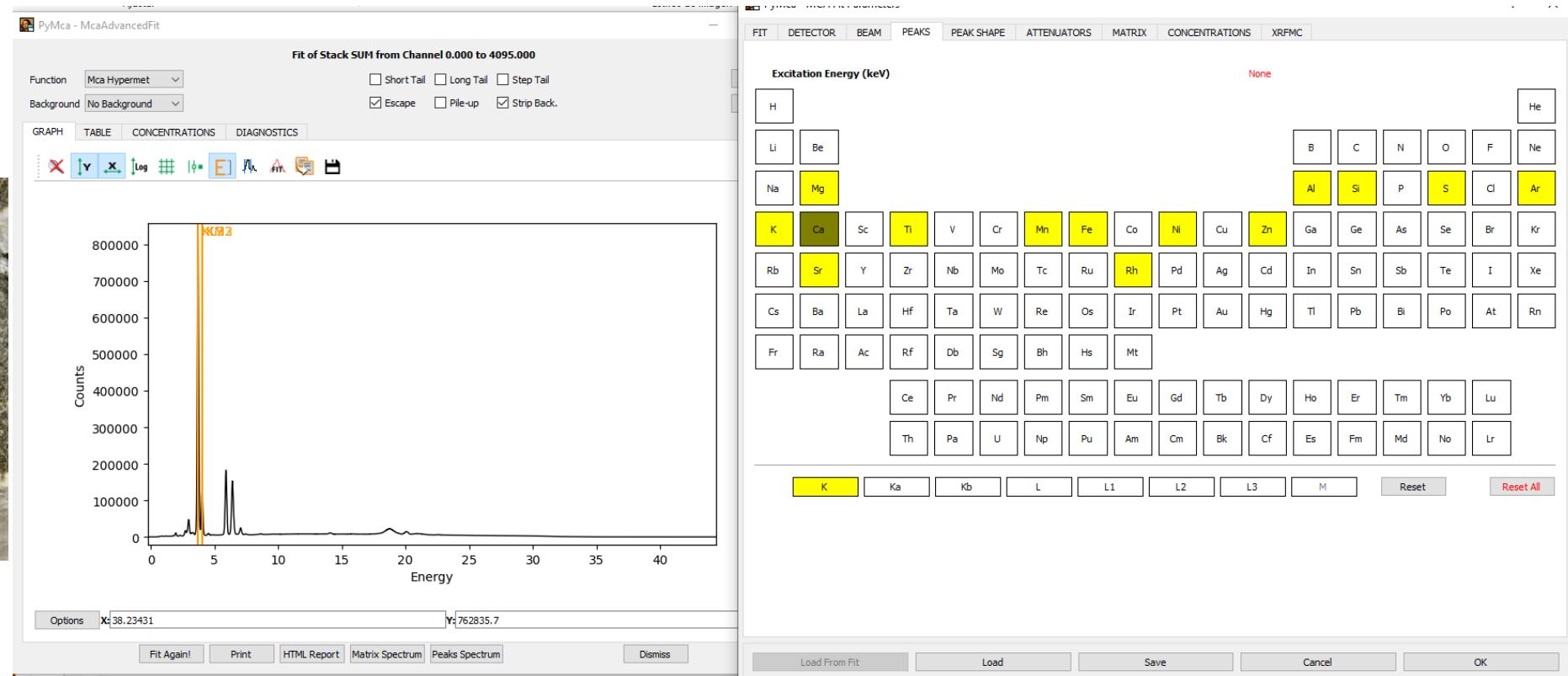


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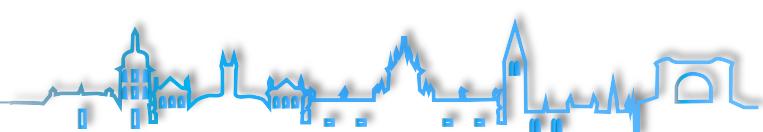
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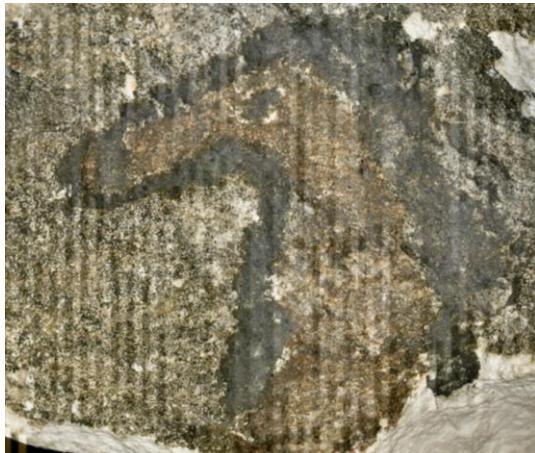




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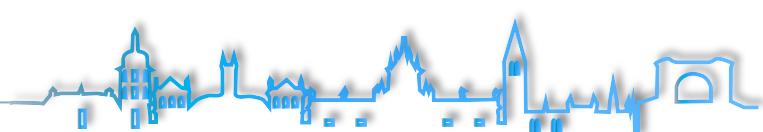
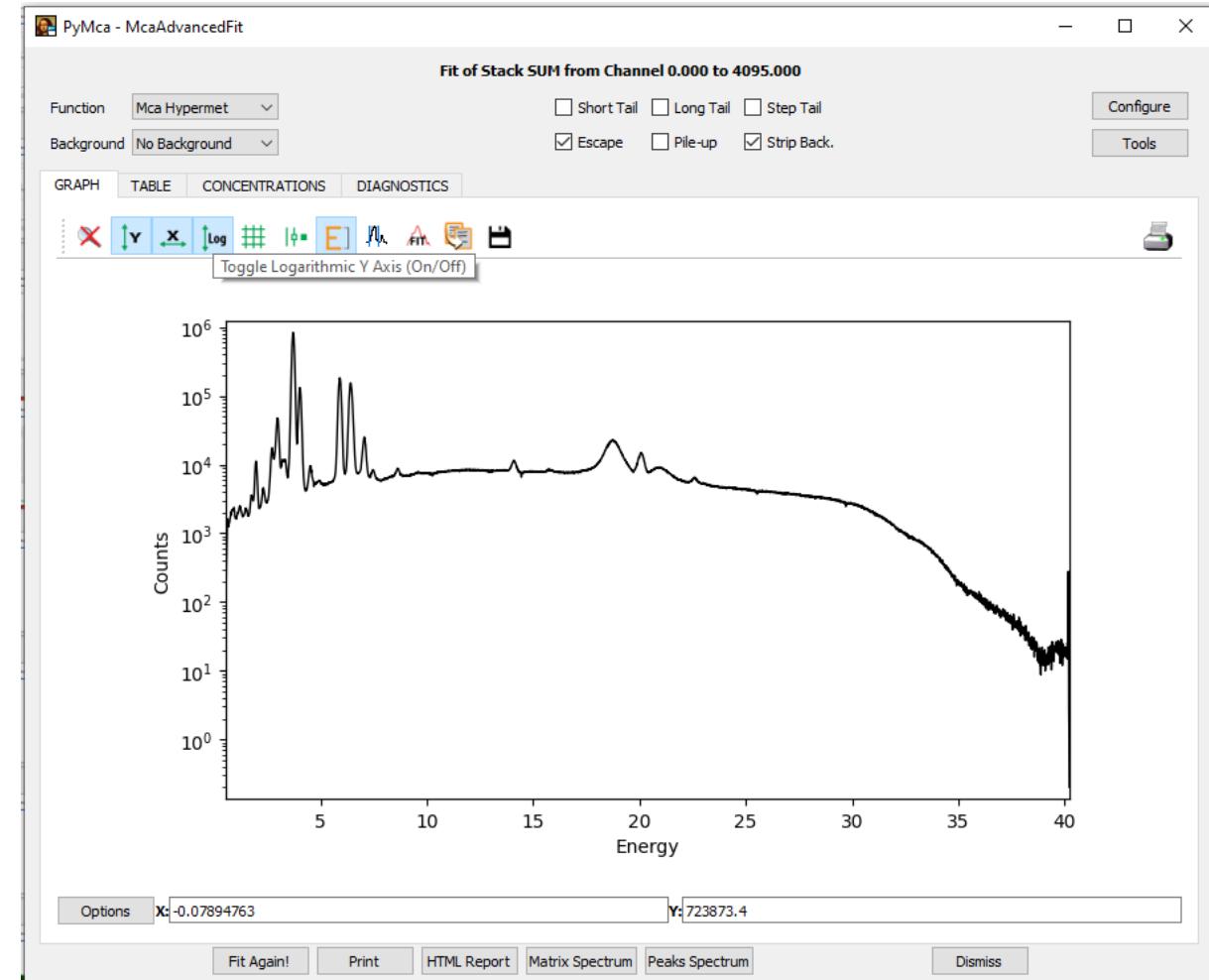
PyMca



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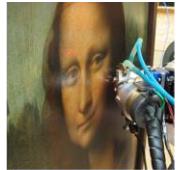


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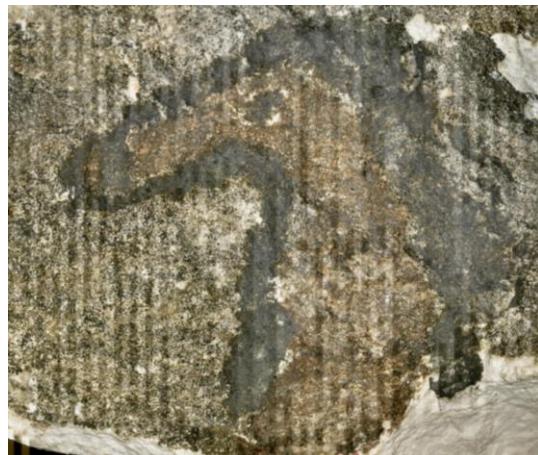




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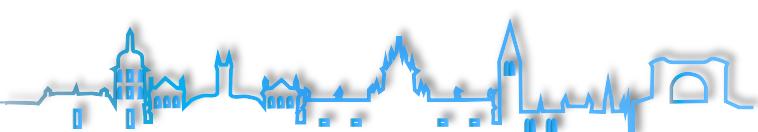
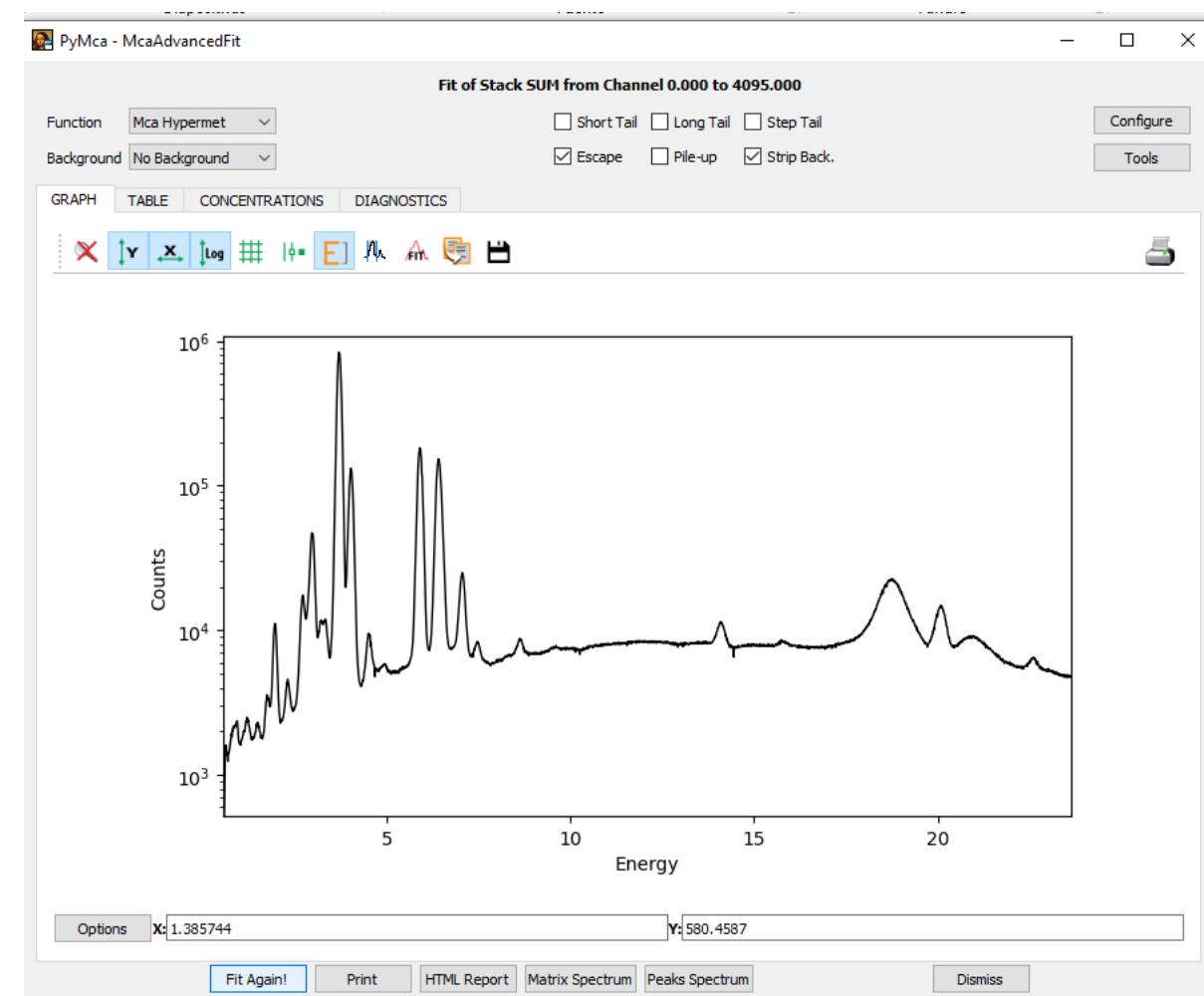
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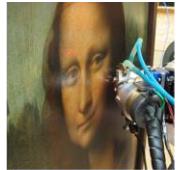


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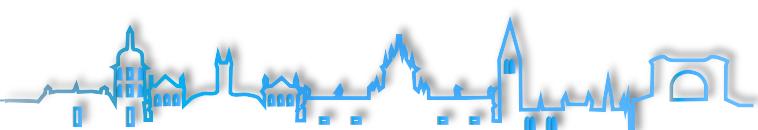
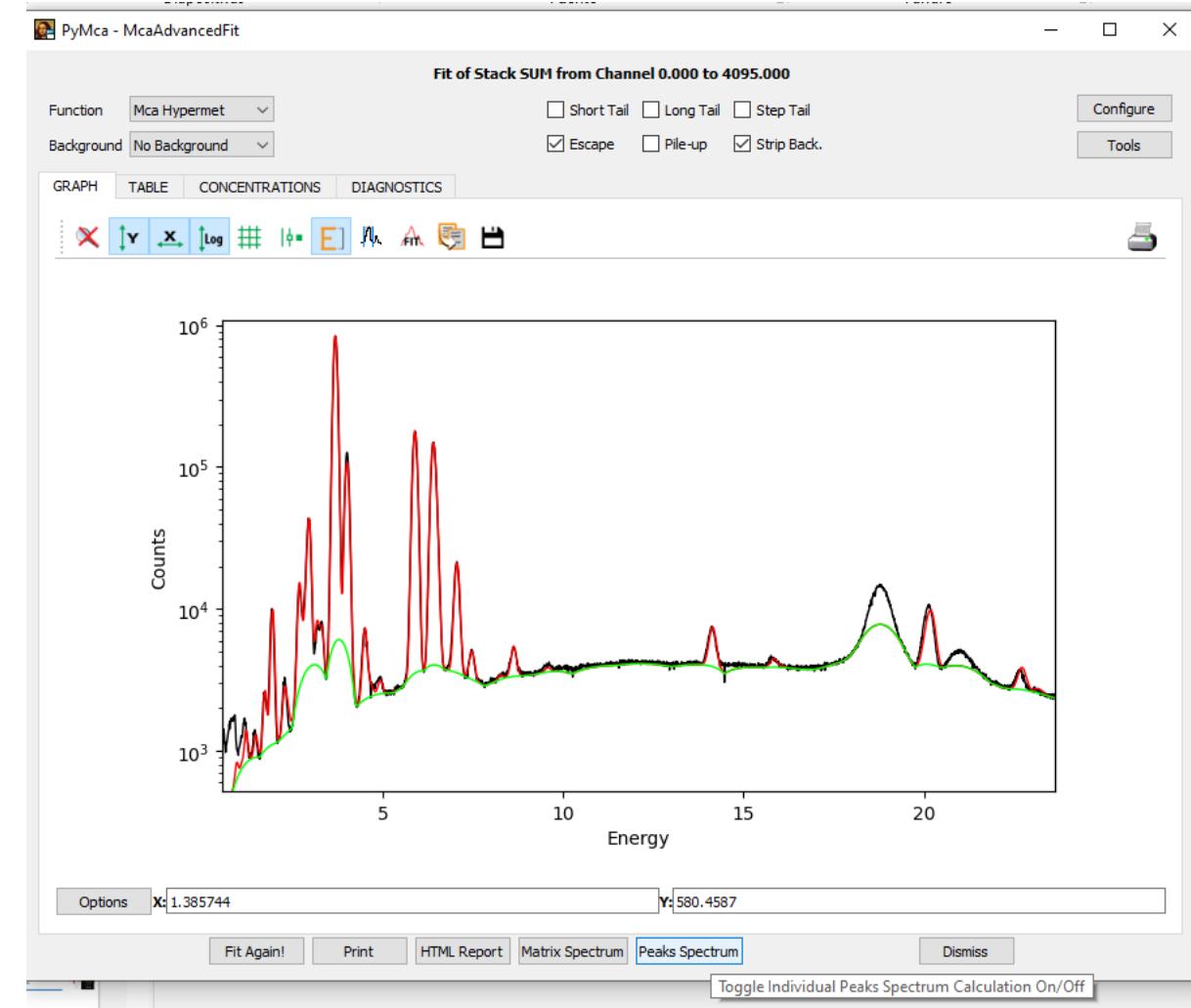
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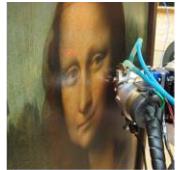


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AHMat



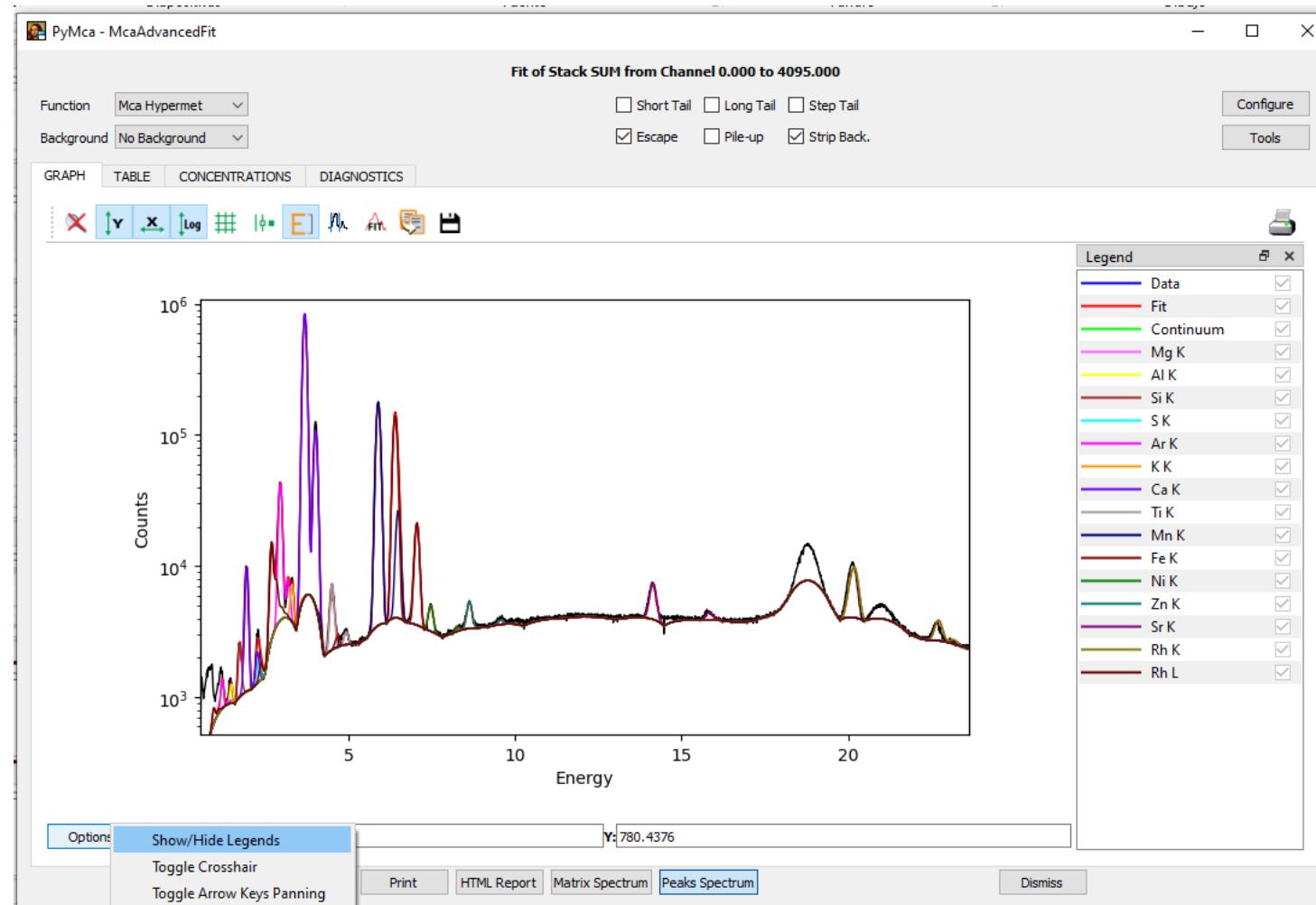
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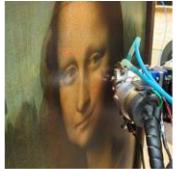
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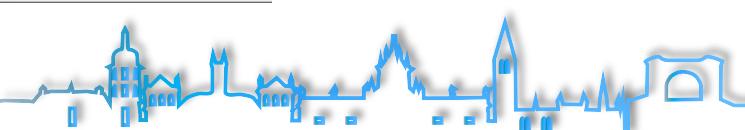


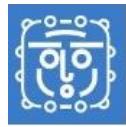
Introducción al trabajo con mapas hiperespectrales

AHMat



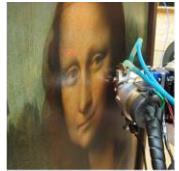
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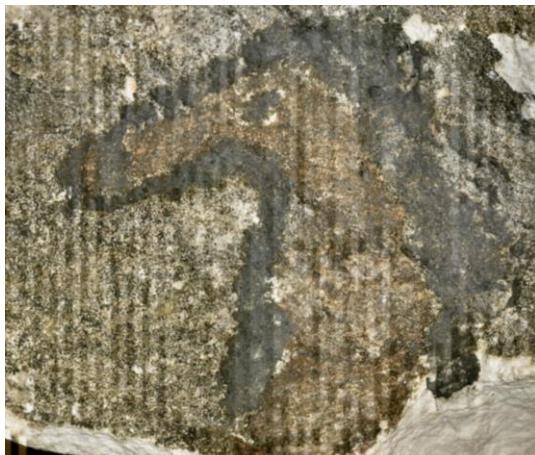


Introducción al trabajo con mapas hiperespectrales

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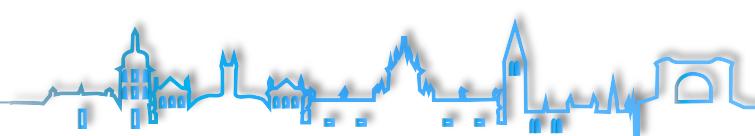
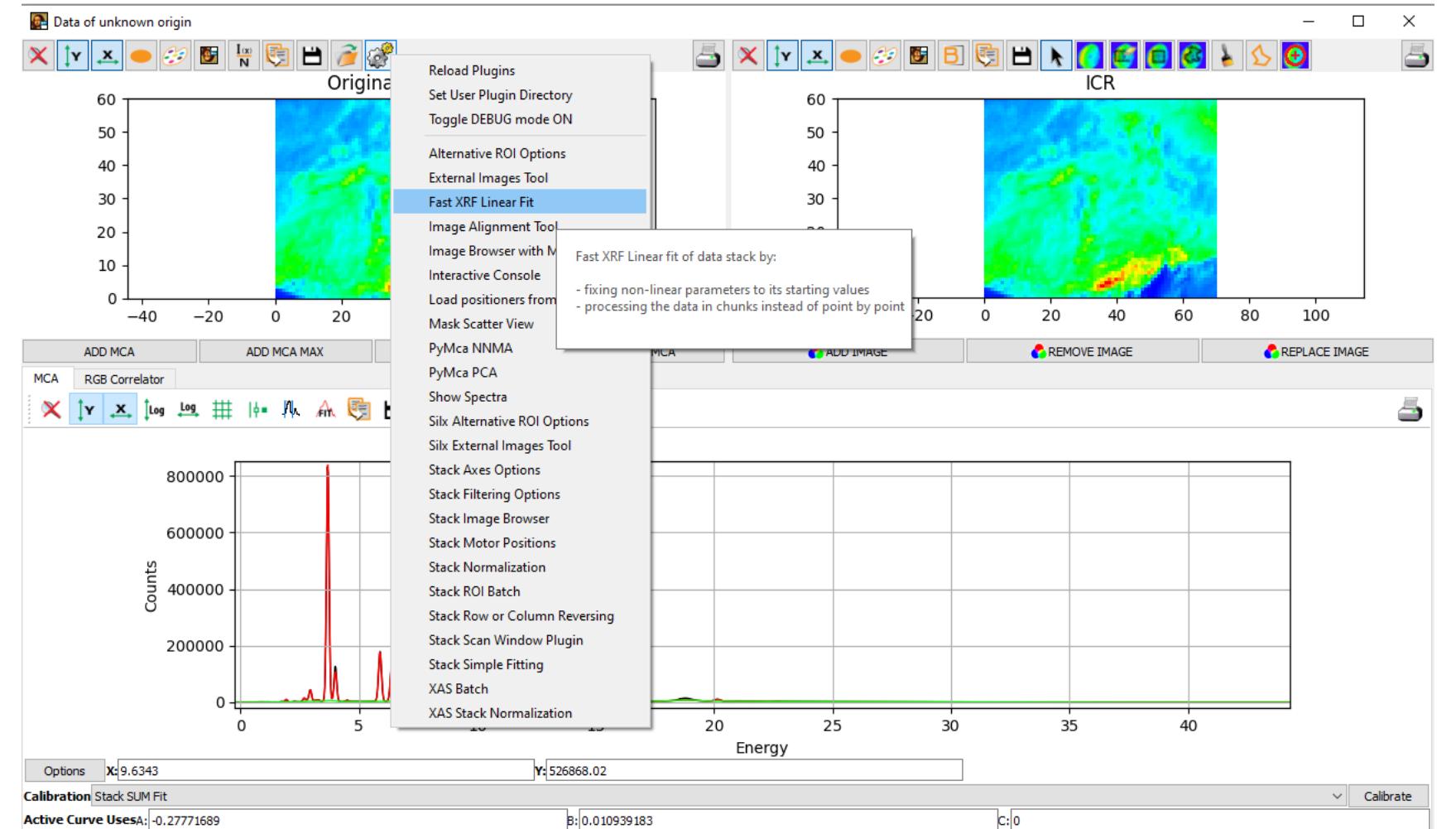
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Fast XRF Linear Fit Dialog

Fit Configuration File: E:/pinturas_rupestres/mapa_3.cfg

Output dir: E:/pinturas_rupestres/prueba

Output root: IMAGES

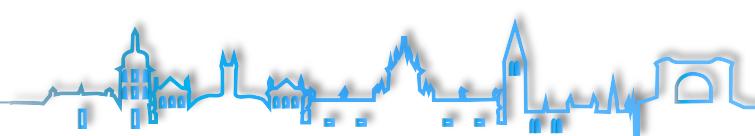
Output entry: images

Output process: fast_xrf_fit

Weight policy: No Weight (Fastest) Average Weight (Fast) Individual Weights (slow)

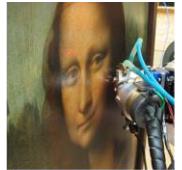
Fit options: Concentrations Repeat fit on negative contributions Diagnostics

Save options: HDF5 EDF CSV DAT TIFF Overwrite Multipage





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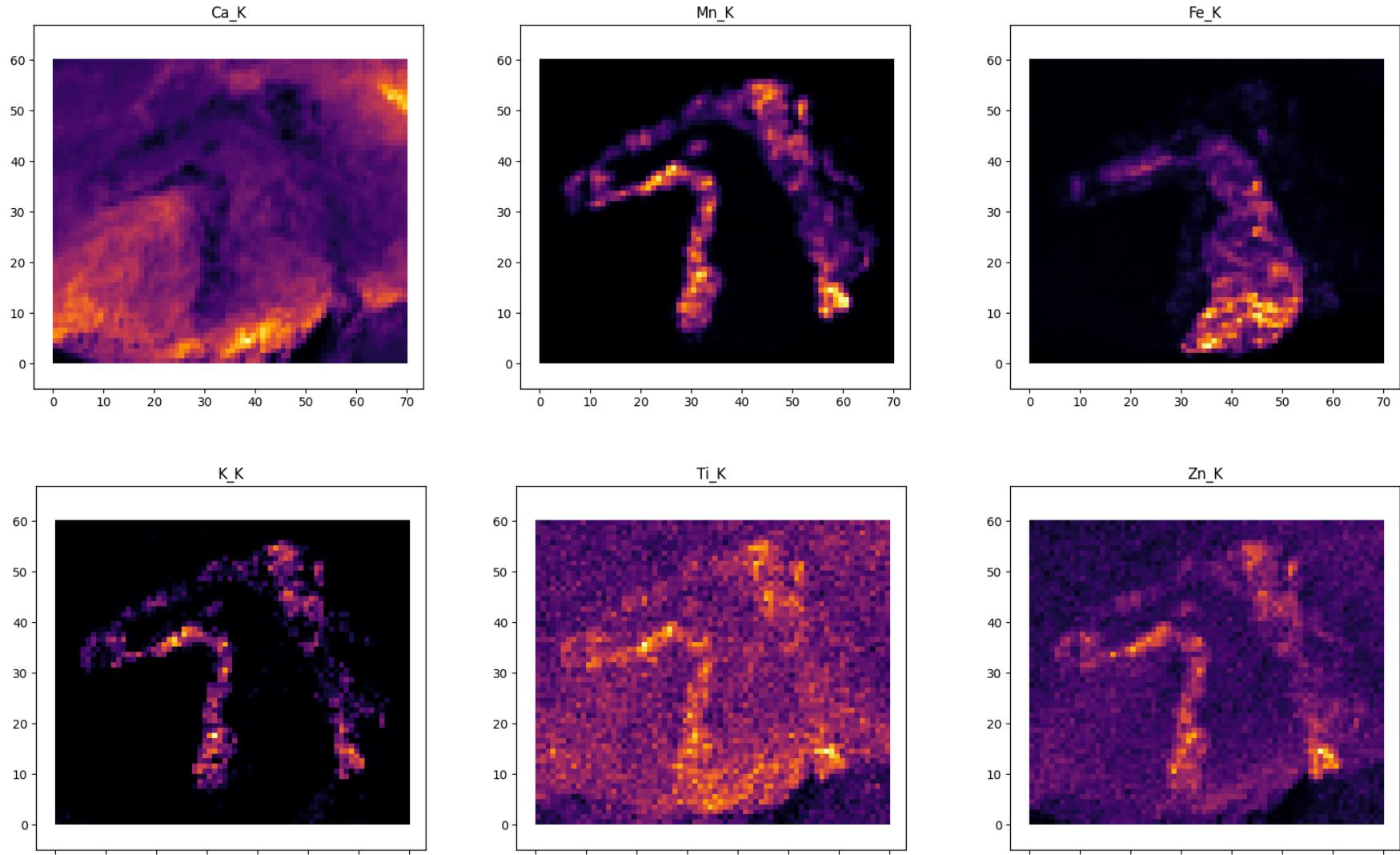


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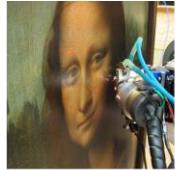
Introducción al trabajo con mapas hiperespectrales



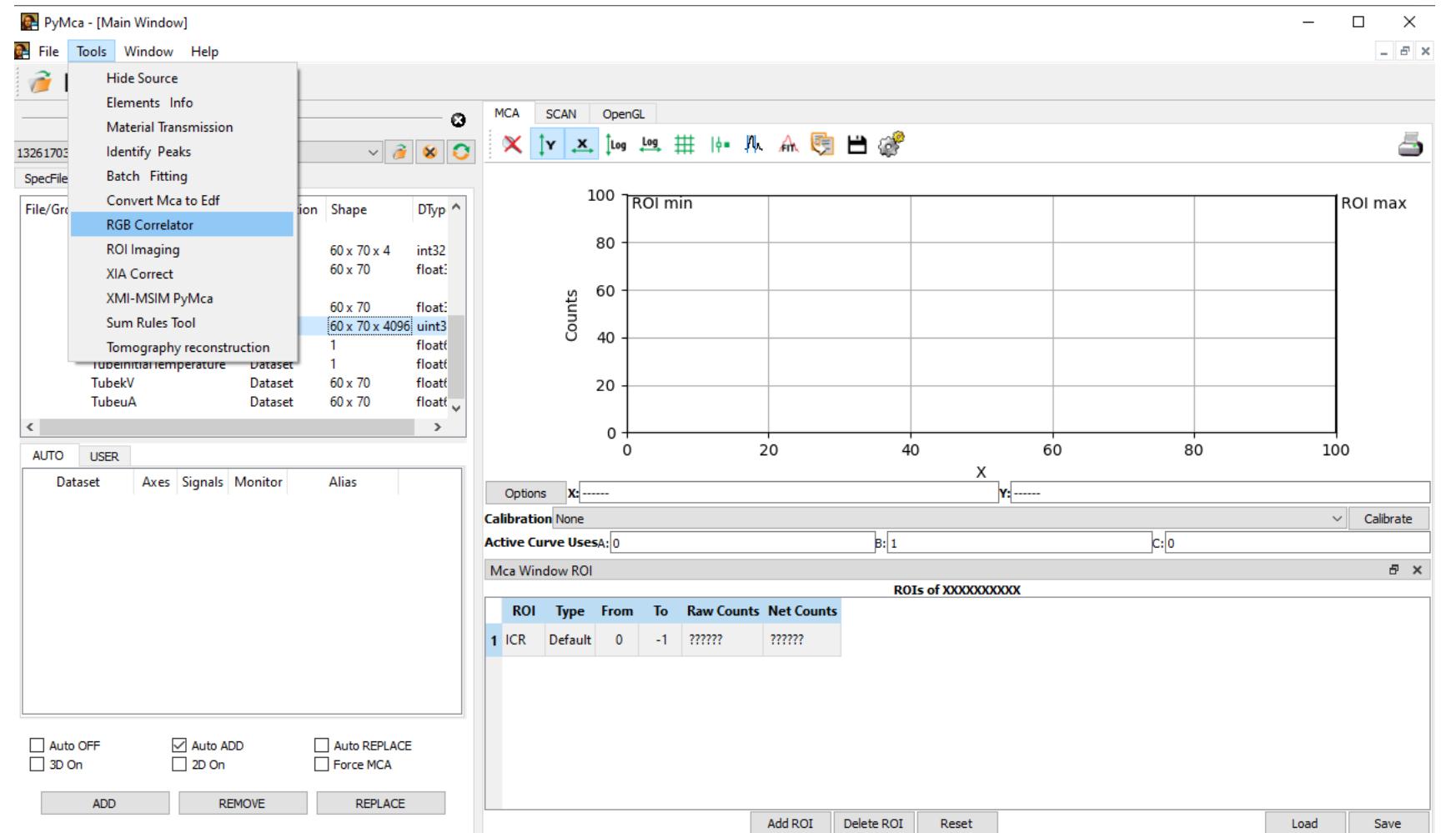


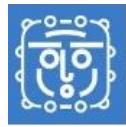
Introducción al trabajo con mapas hiperespectrales

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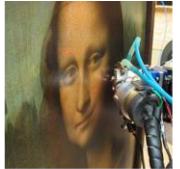
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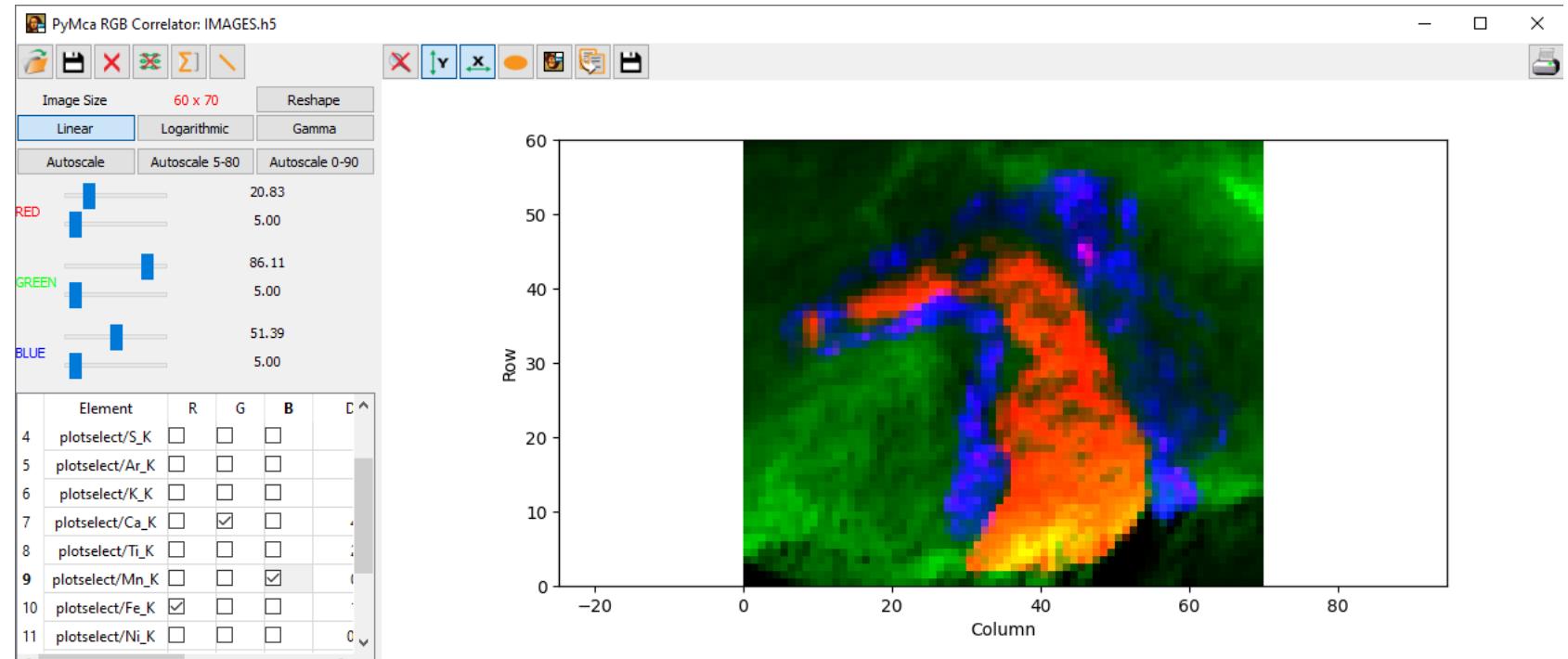
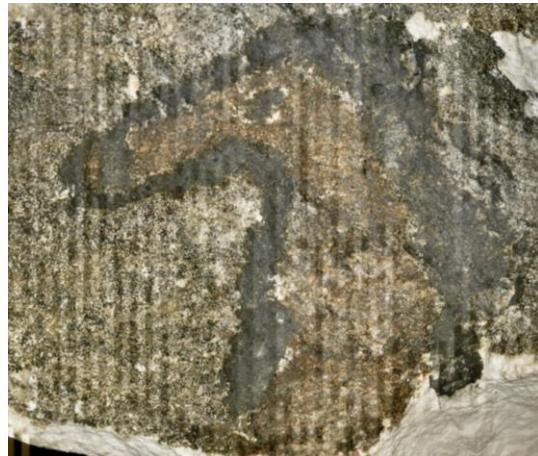


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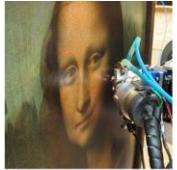
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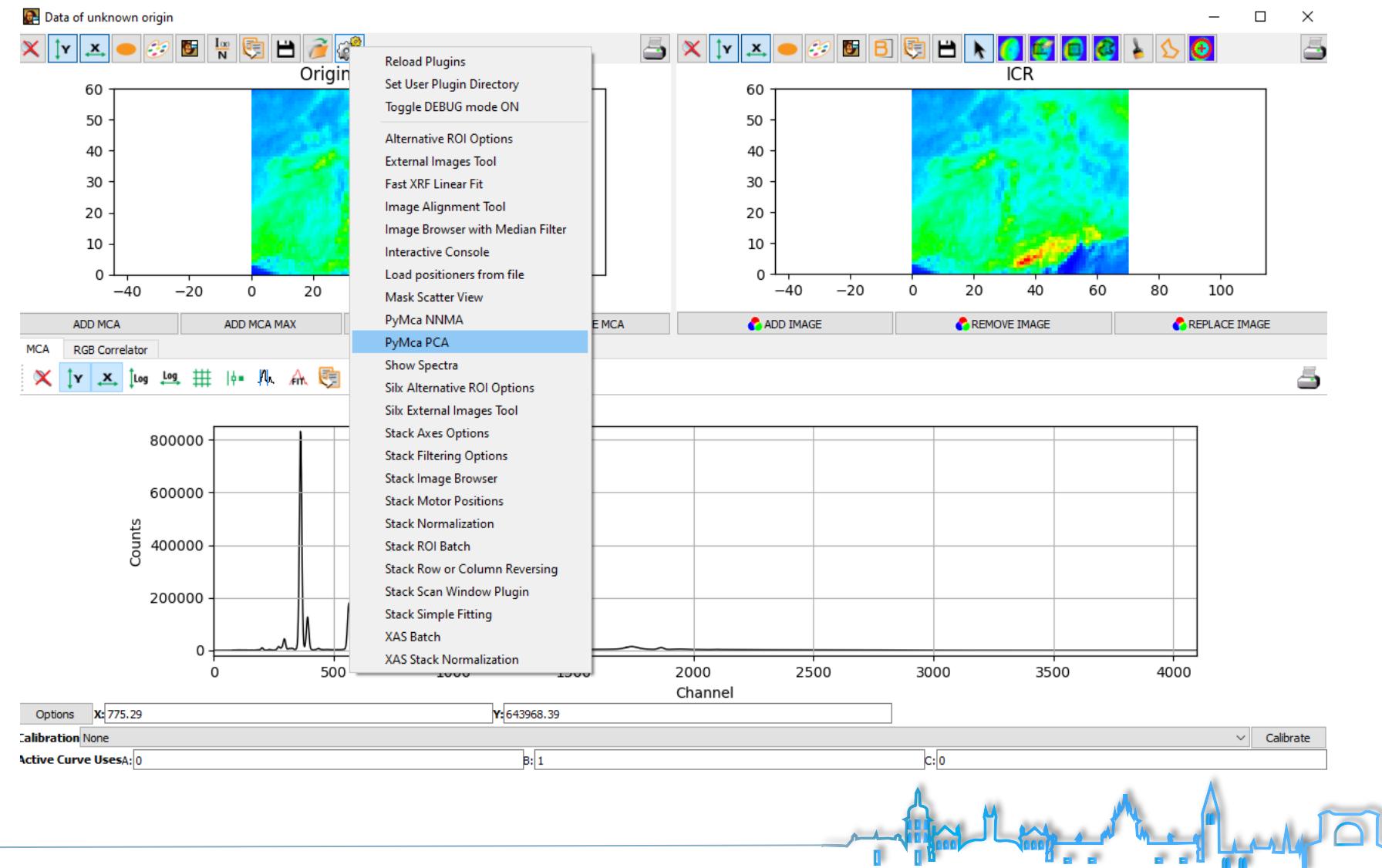
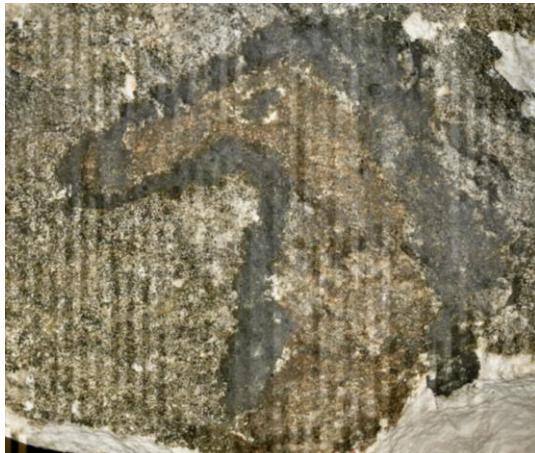


Introducción al trabajo con mapas hiperespectrales

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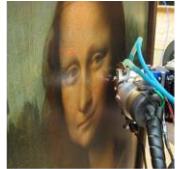


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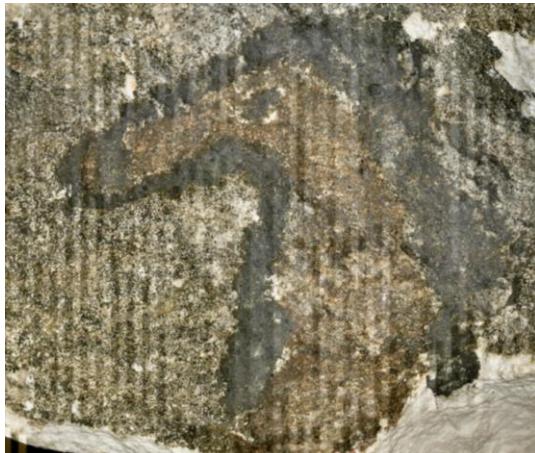




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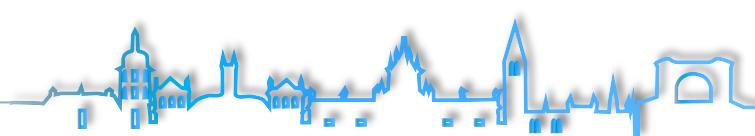
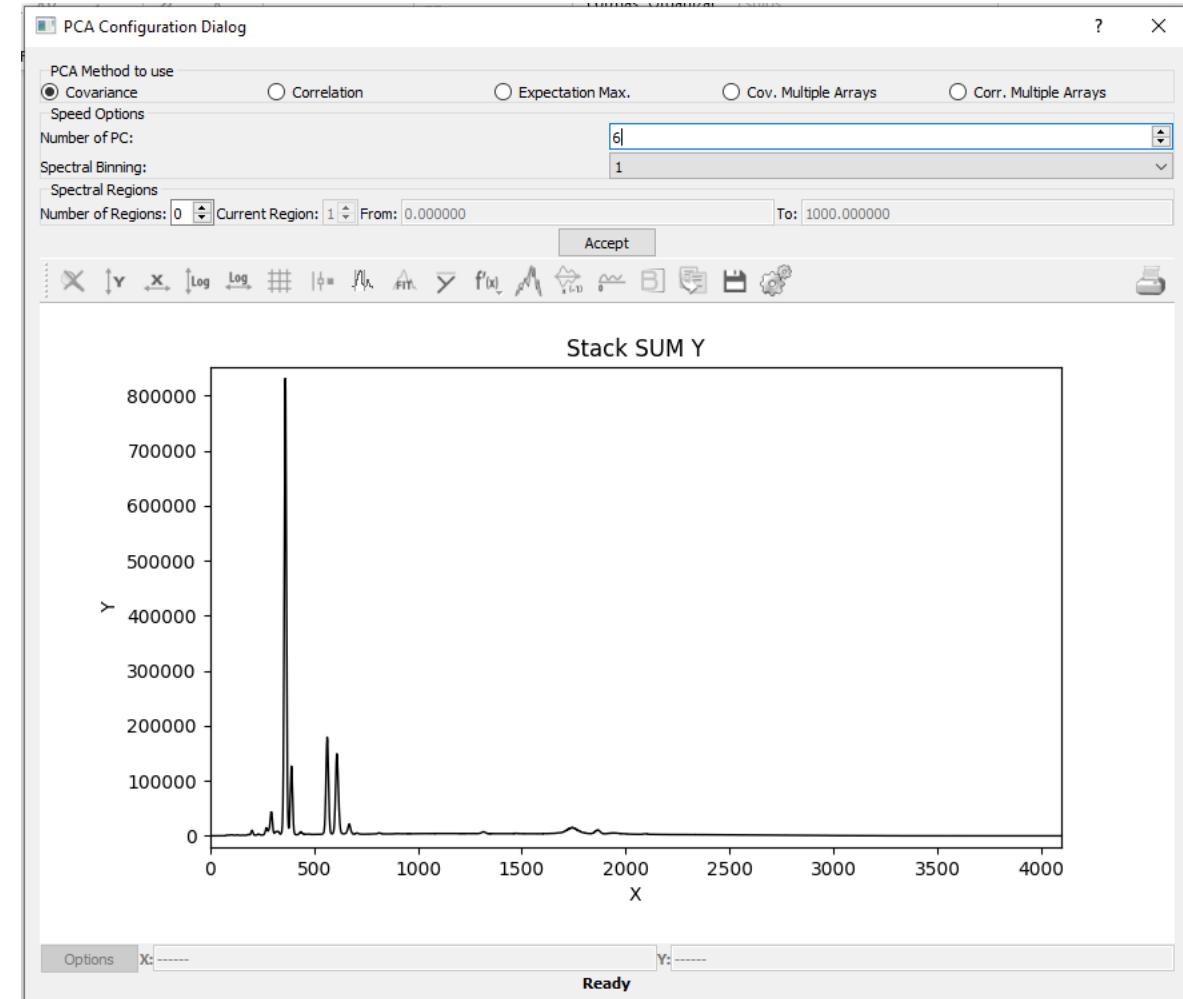
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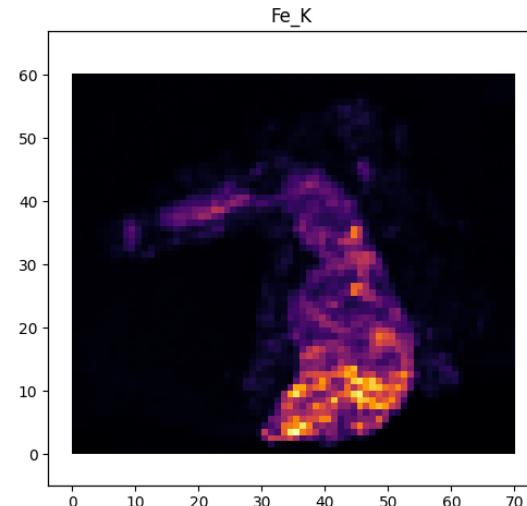
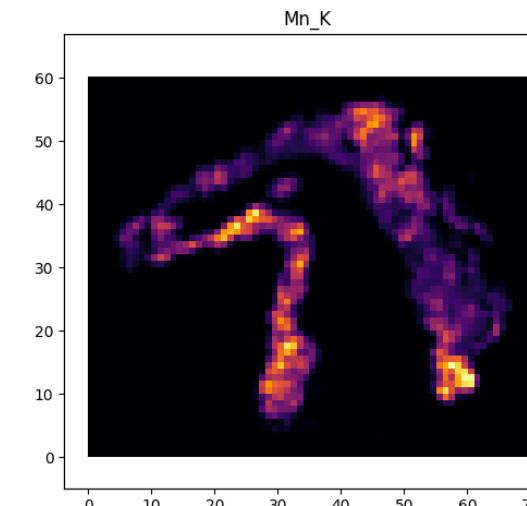
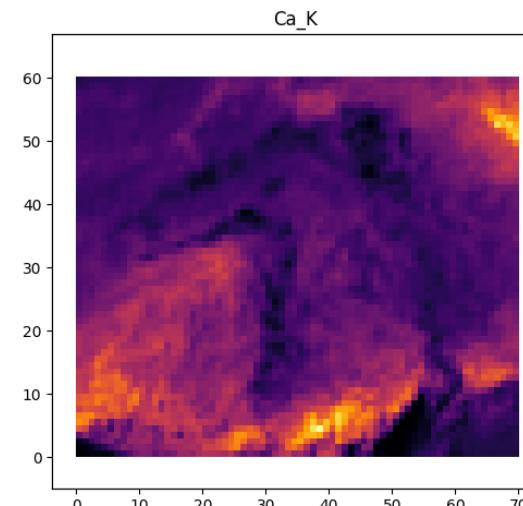
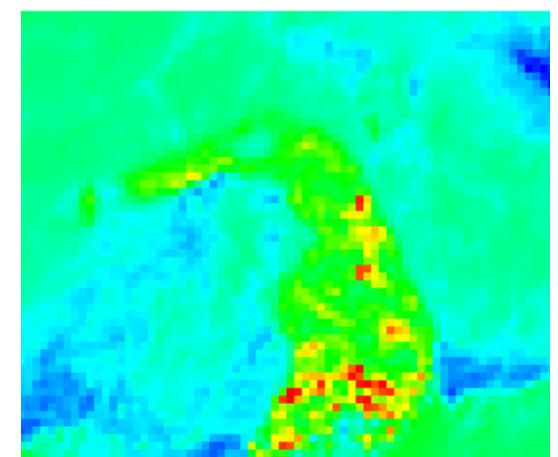
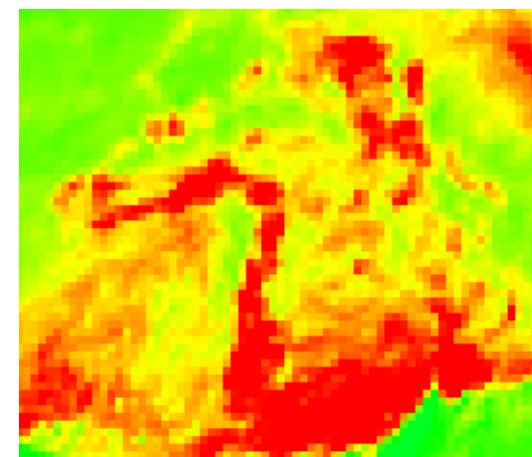
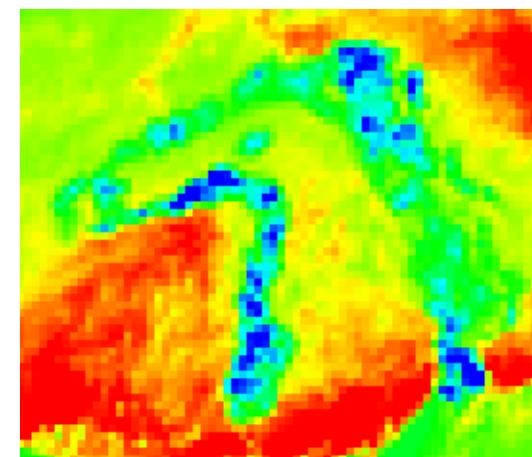
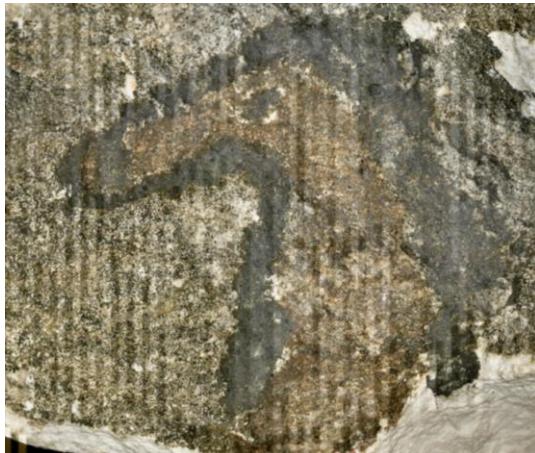




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STUDY, PRESERVATION
AND RECOVERY OF HERITAGE

Introducción al trabajo con mapas hiperpectrales

Alberto Plaza Ebrero (Centro de Conservación y Restauración de Bienes Culturales)

Suset Barroso Solares y Javier Pinto Sanz (AHMat-UVa)

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