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## De la sélection des ressources à la production d'art rupestre : liens entre fouilles et parois ornées à la grotte aux Points (Aiguèze, Gard, France)

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**Scientific question:** The Grotte aux Points shows Upper Palaeolithic wall paintings and drawings in the cave, and an archaeological sequence with cohesive coloring materials.

**Were the cohesive colouring materials used to produce rock art in the cave?**

Because of the petrographic information loss during pigment processing, geochemistry is the way to investigate this possible link. However this connection can be tricky to establish because of environmental input in applied pigment geochemical fingerprint.

**Methodological development:**

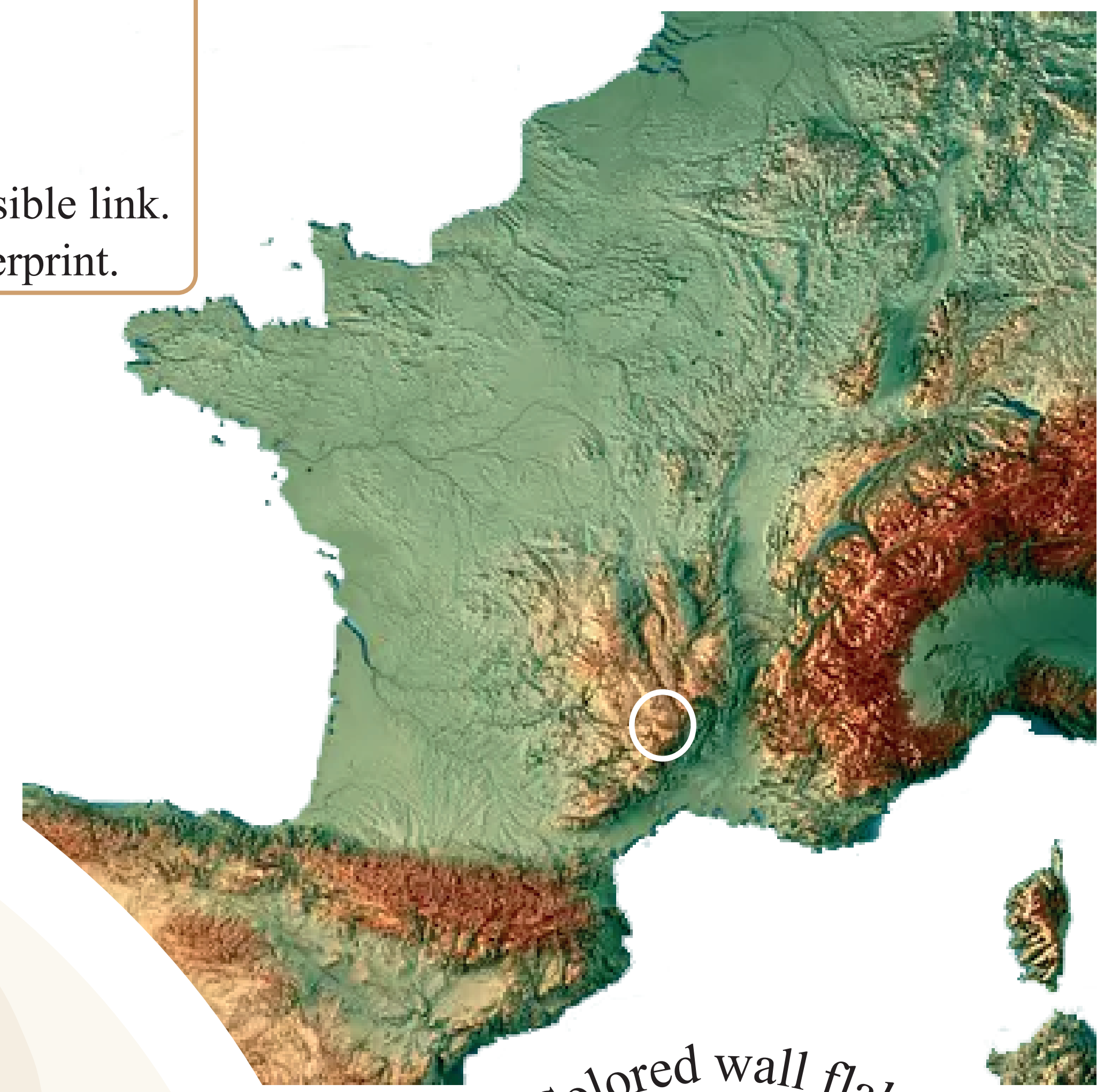
Is it possible to identify a **common** geochemical fingerprint of **raw colouring materials** and applied **pigments** on the walls ?

**Method:**

PIXE: External Induced Ion beam X ray fluorescence (geochemical surface mapping with a 10 µm beam)

Iron rich Pixel selection - elemental quantification extraction

Data treatment and analysis (multivariate statistics)

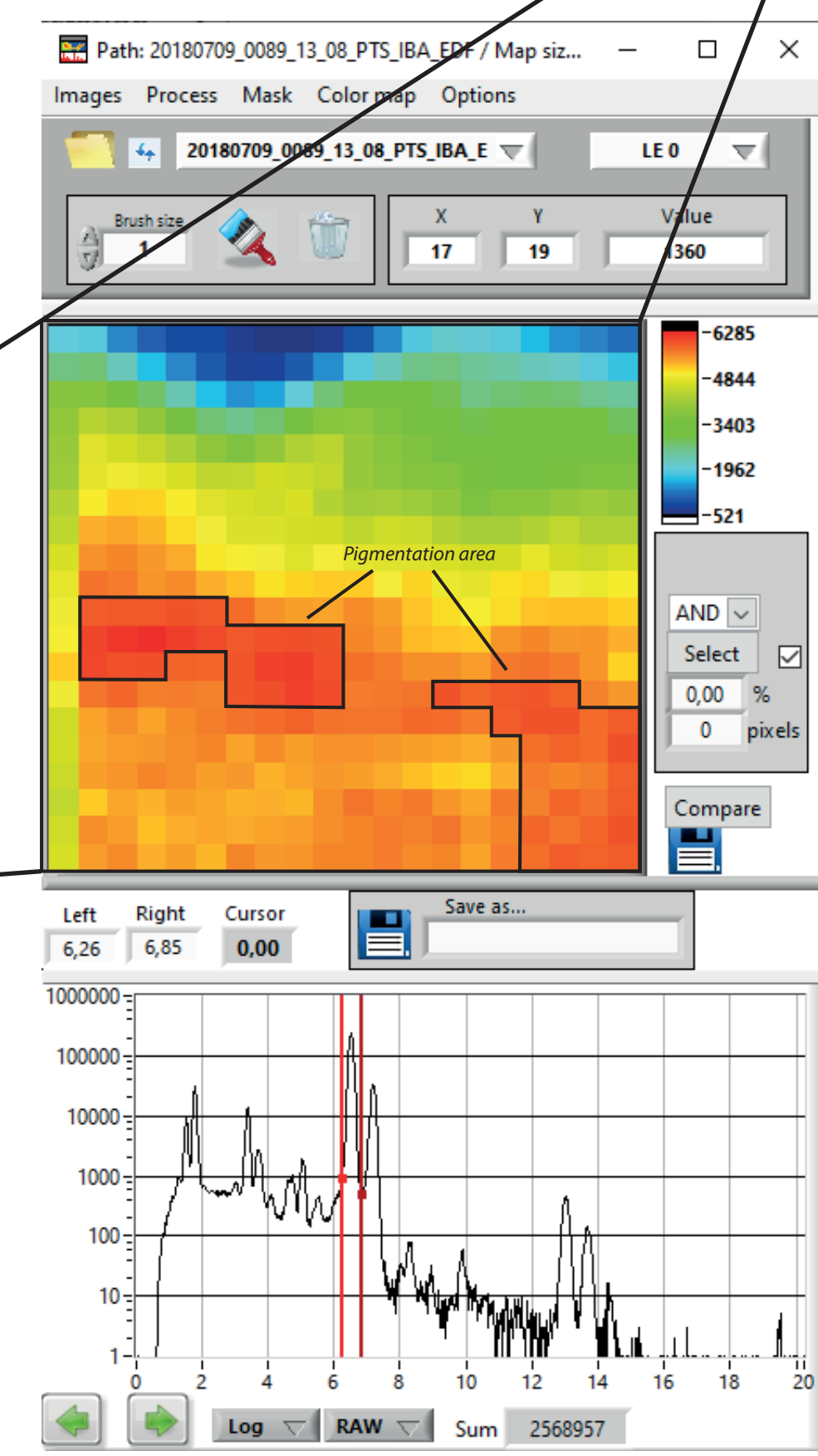
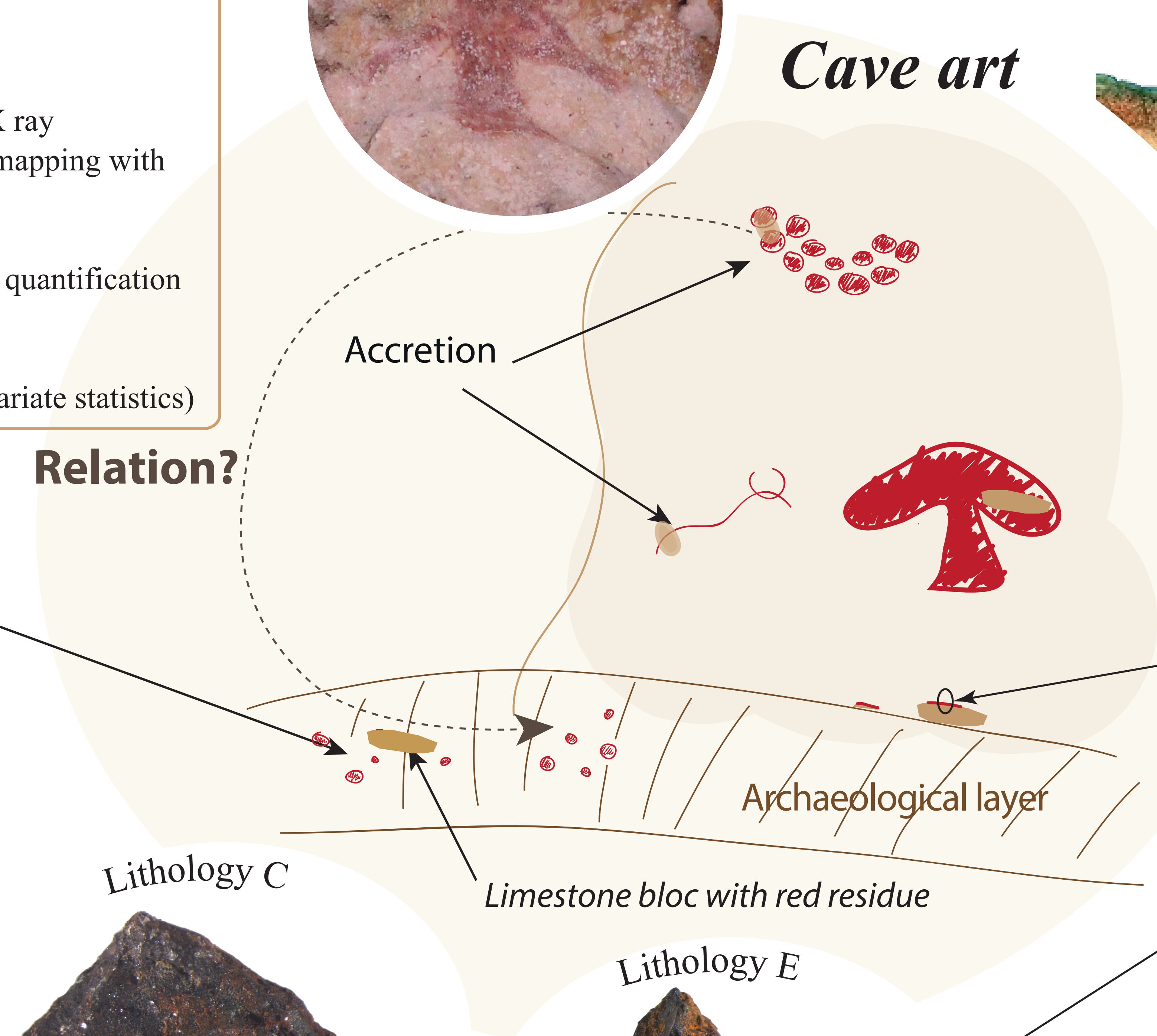
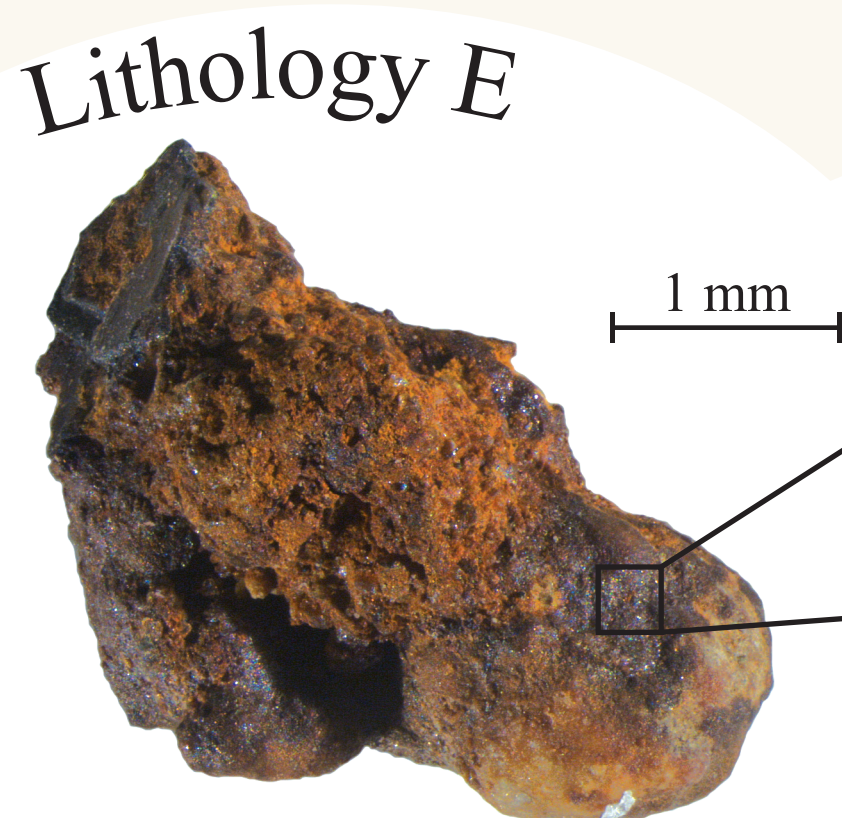
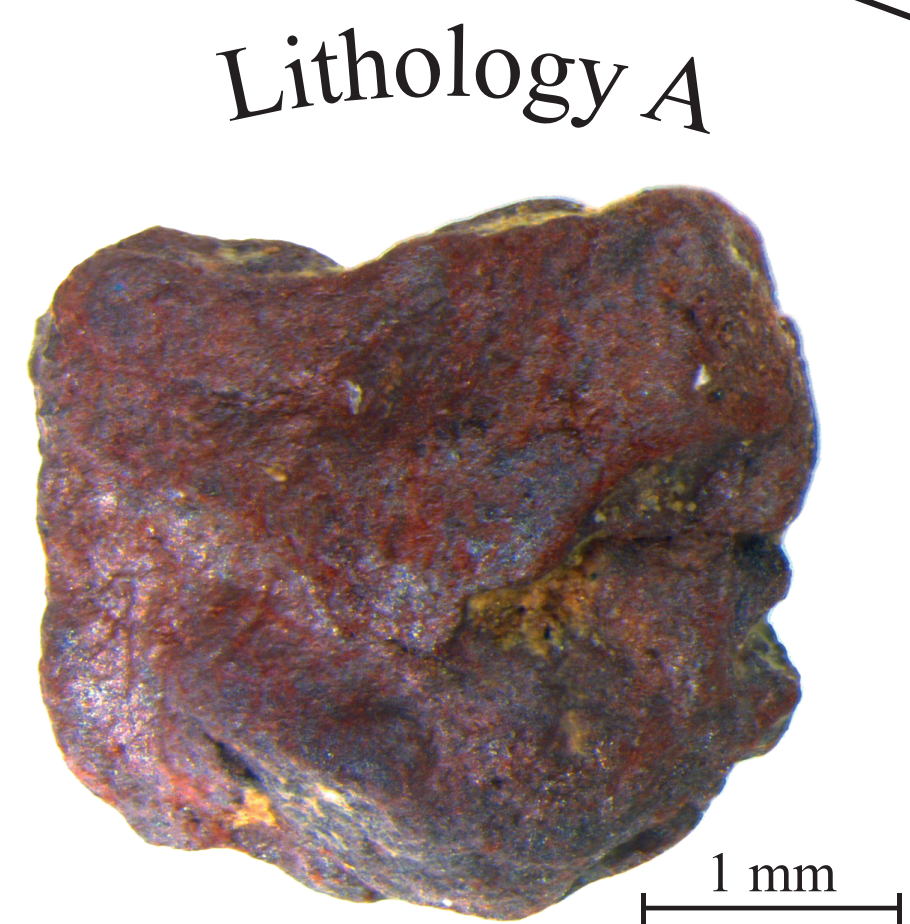


**Cave art**

**Colored wall flake**

**Relation?**

**Colouring material**



**Environmental Input control**

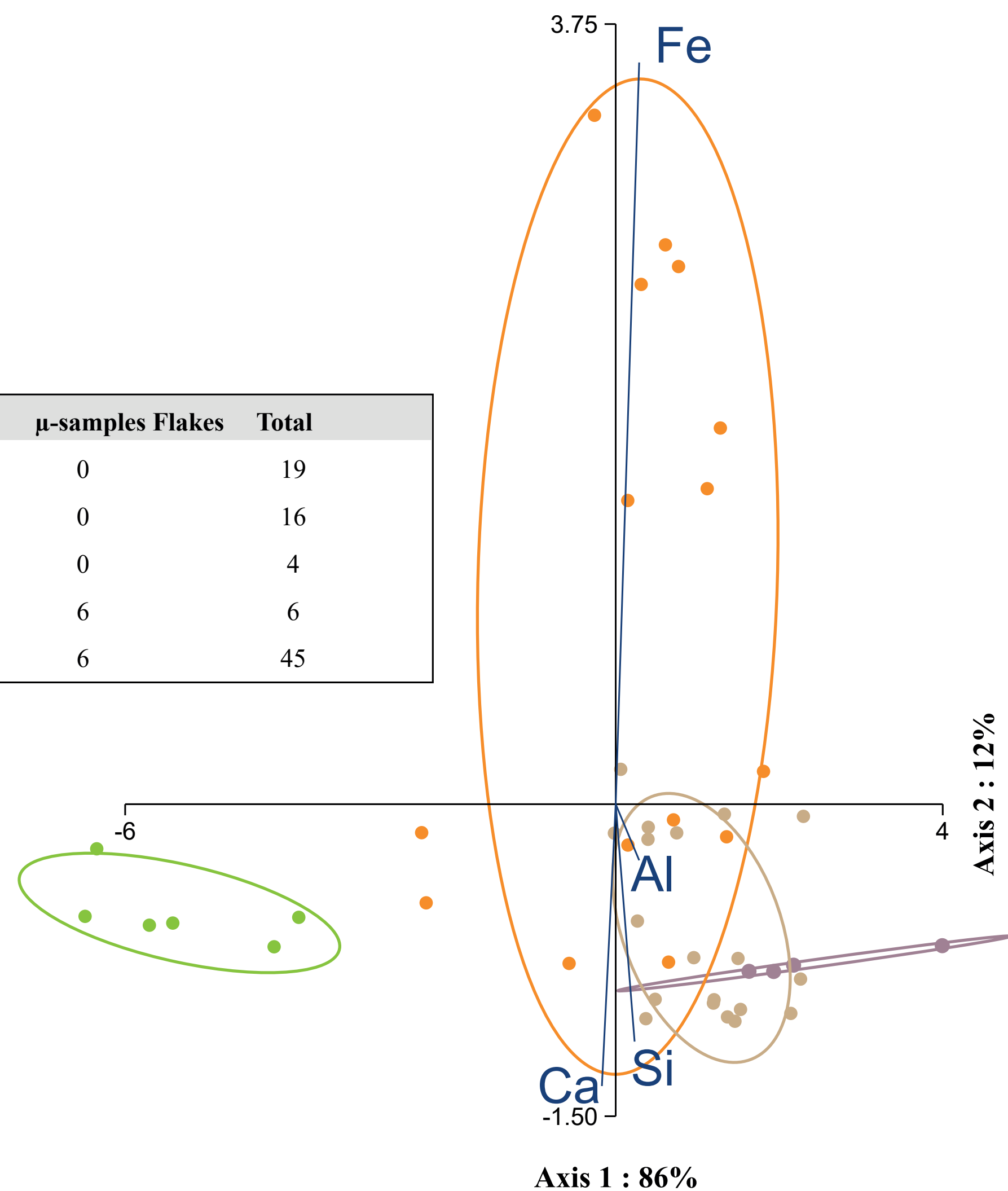
LDA on non-normalize PIXE data

Loadings

	Axis 1	Axis 2
Al	0.00026886	6.373E-07
Si	0.00022176	-1.2128E-06
Ca	0.00015315	1.4032E-06
Fe	0.00014816	9.2572E-06

Confusion matrix

	Sediment	Residue	Wall Blank	µ-samples Flakes	Total
Sediment	15	1	3	0	19
Residue	6	10	0	0	16
Wall Blanc	0	0	4	0	4
Colored Flakes	0	0	0	6	6
<b>Total</b>	<b>21</b>	<b>11</b>	<b>7</b>	<b>6</b>	<b>45</b>



**Colouring material geochemical signature comparison**

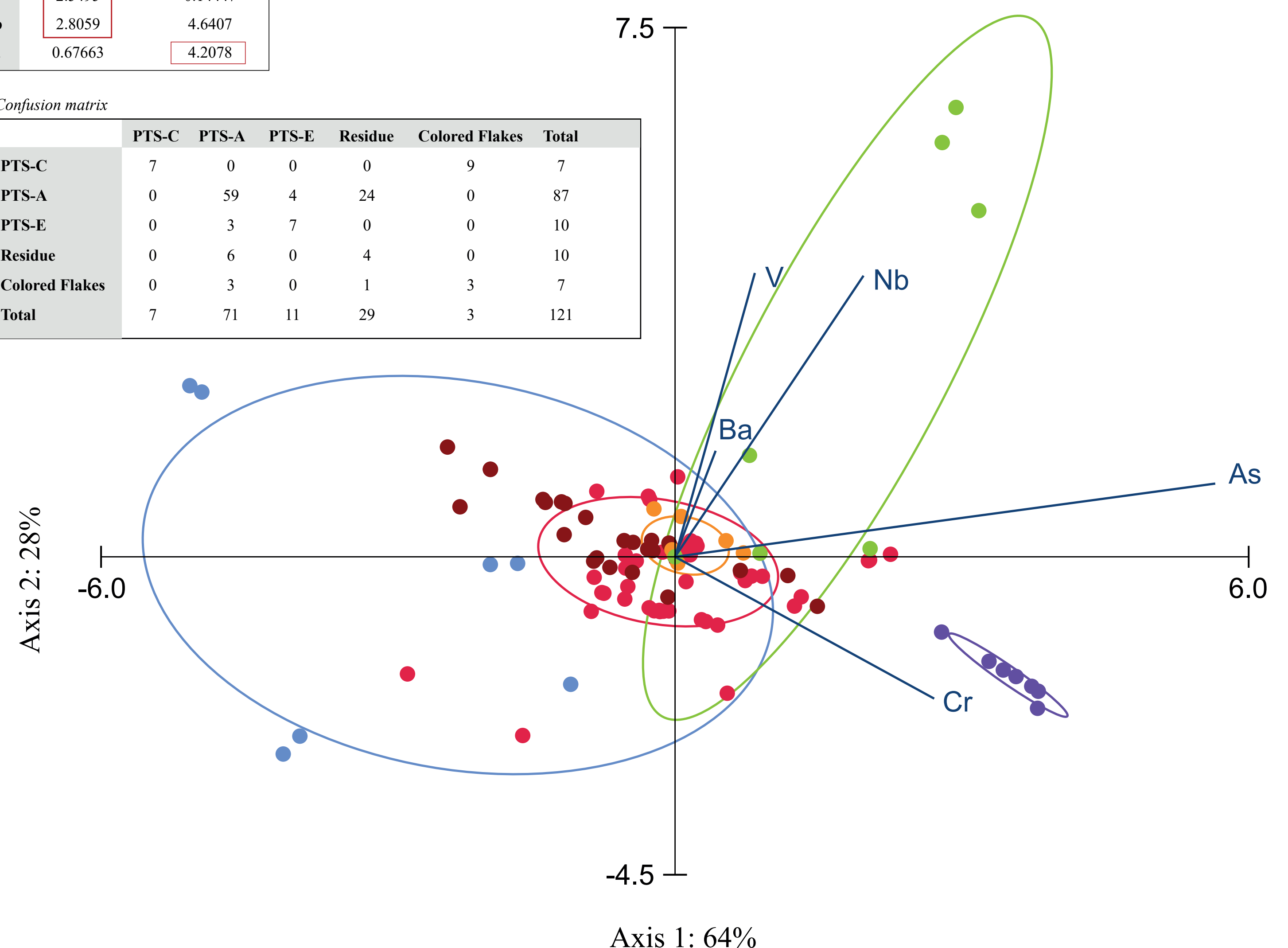
LDA on Fe normalize PIXE data

Loadings

	Axis 1	Axis 2
V	-0.43451	1.3337
Cr	6.6921	-4.7863
As	2.5495	0.14447
Nb	2.8059	4.6407
Ba	0.67663	4.2078

Confusion matrix

	PTS-C	PTS-A	PTS-E	Residue	Colored Flakes	Total
PTS-C	7	0	0	0	9	7
PTS-A	0	59	4	24	0	87
PTS-E	0	3	7	0	0	10
Residue	0	6	0	4	0	10
Colored Flakes	0	3	0	1	3	7
<b>Total</b>	<b>7</b>	<b>71</b>	<b>11</b>	<b>29</b>	<b>3</b>	<b>121</b>



**Conclusion:**

- Strong impact of the environmental input on wall flakes - difficulty to separate the pigment (Fe) and substrate (Ca) fingerprint even though the pixel rich in iron of the map are selected
- High Fe signal difference between colored wall flakes and raw colouring material fragment.
- Possible impact of opal coating on the walls.