



Light in the cave How to see the invisible !

Technical & Methodologic development of UV light observation and analysis at Grotte aux Points (Gard, France)

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The site

« Les Gorges de l'Ardèche »





The site

« Les Gorges de l'Ardèche »





The site

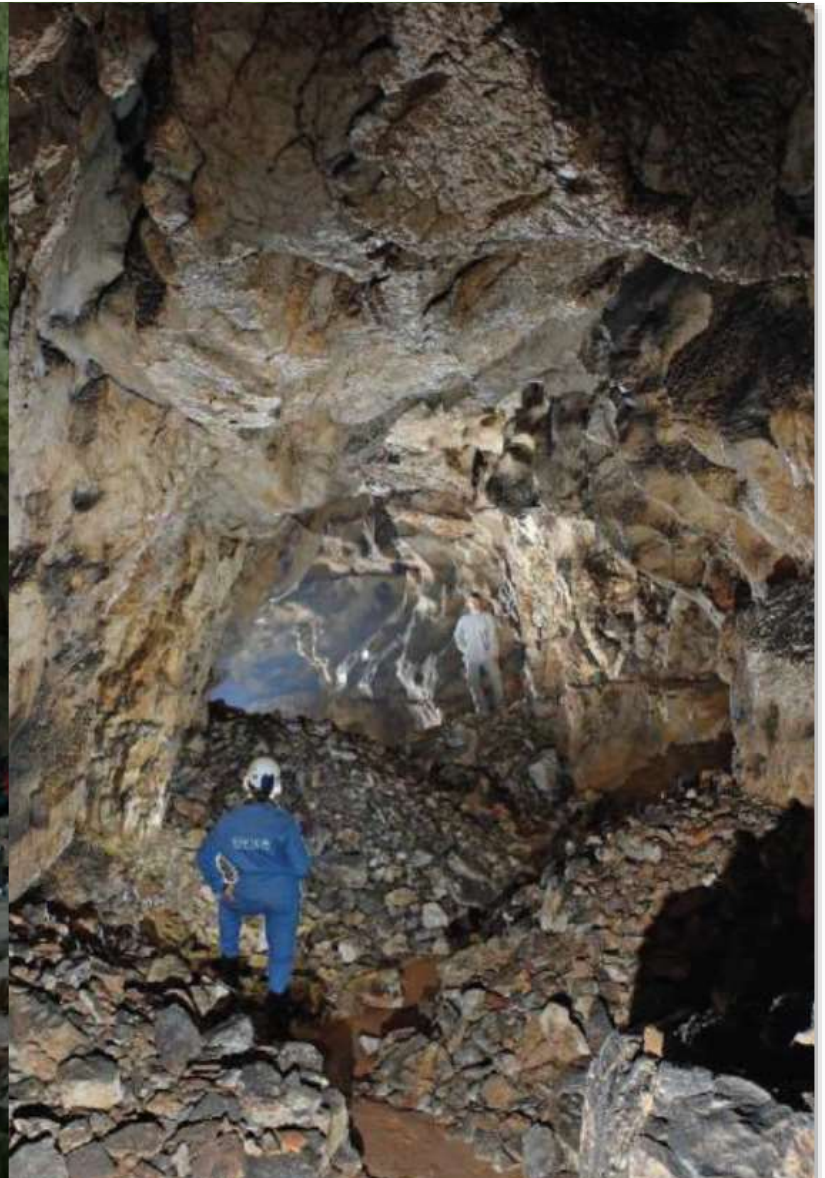
Points Cave





The site

Points Cave

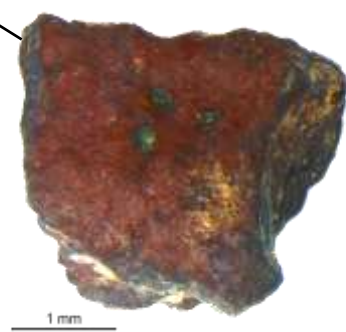




Points Cave



Topographic map of Points Cave



1 mm

Photogrammetric model of the Niche aux Points



0 1 m

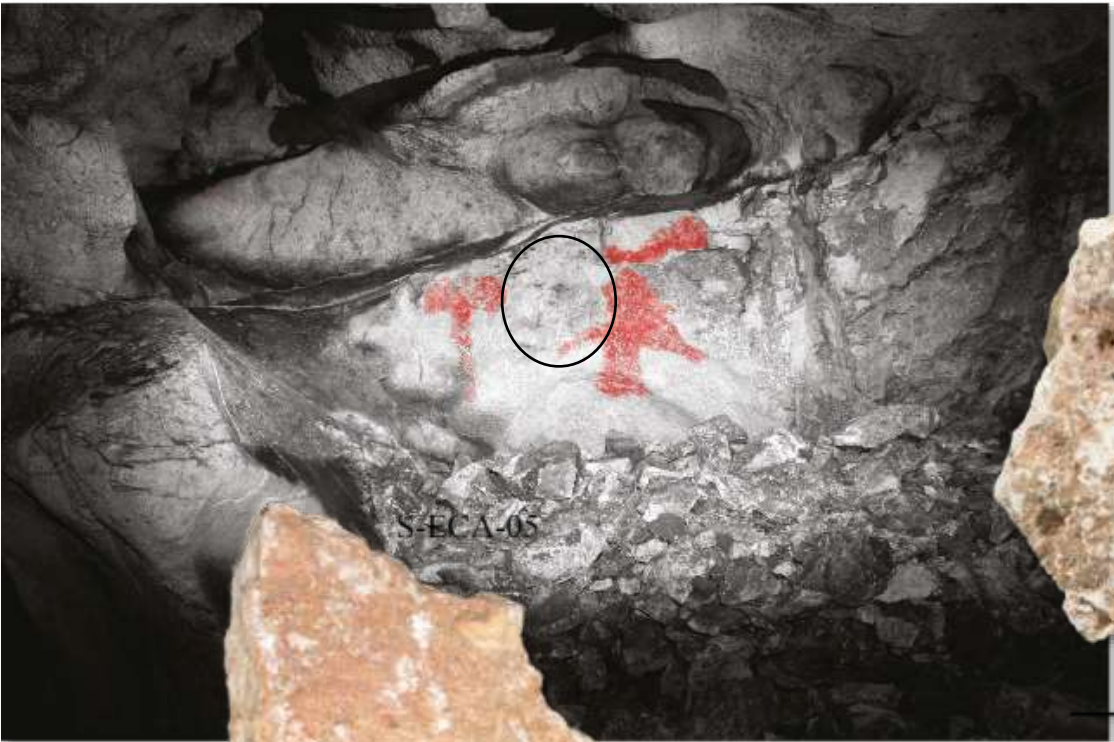
S. Jailliet

J. Monney



Points Cave

Flakes from the painted walls of Points Cave



S-ECA-03



10 cm



S-ECA-05

5 cm

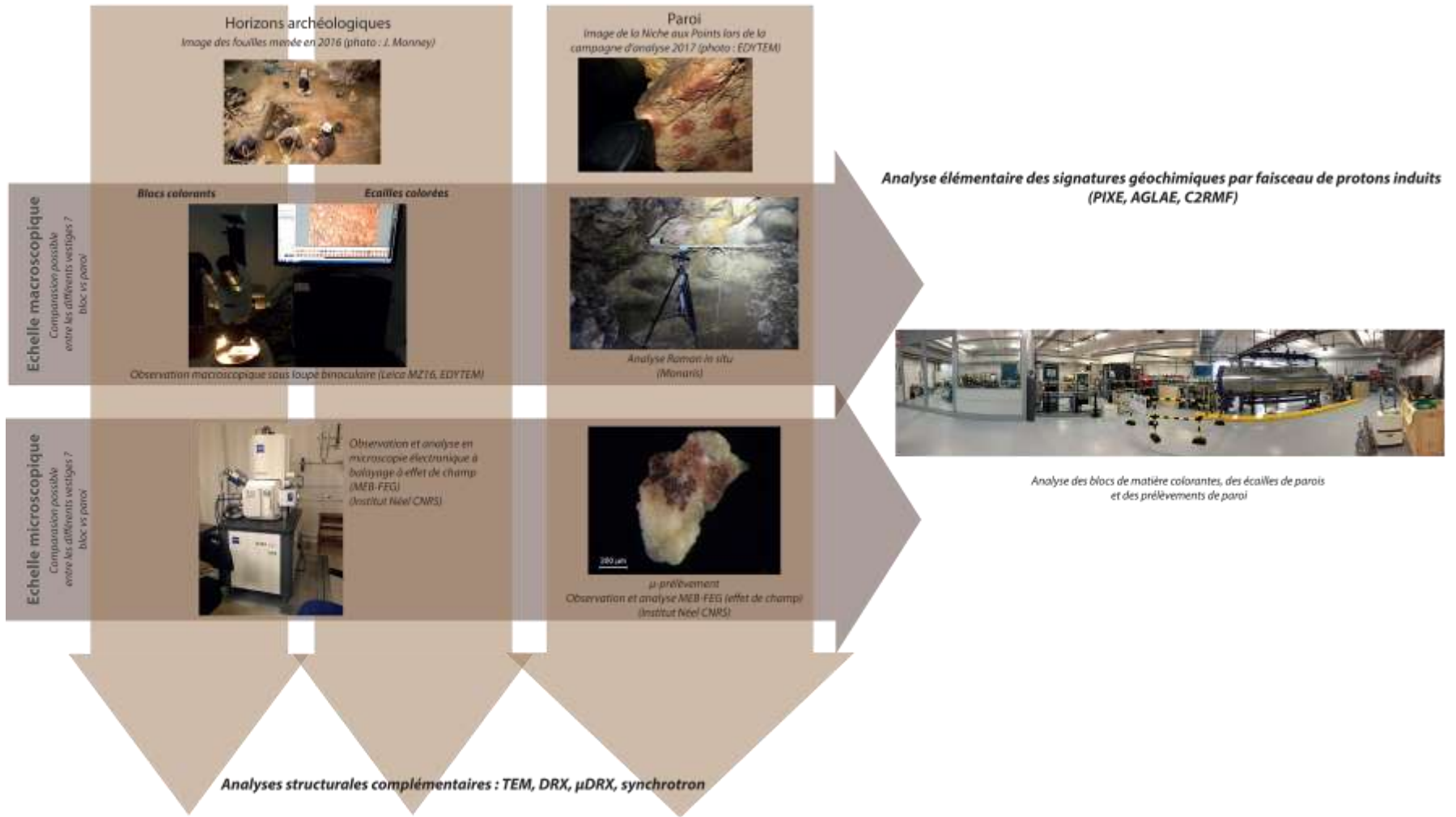


Scientific context

Objectives :

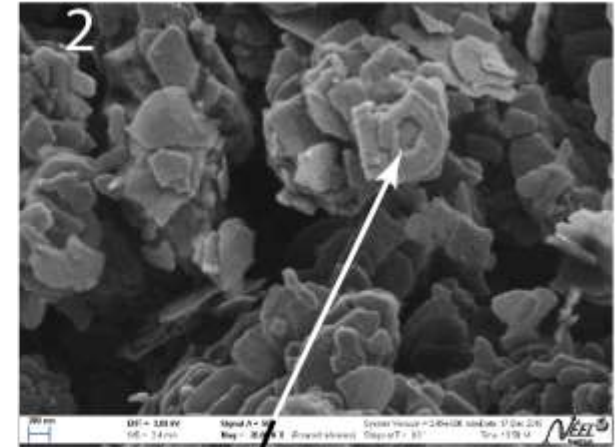
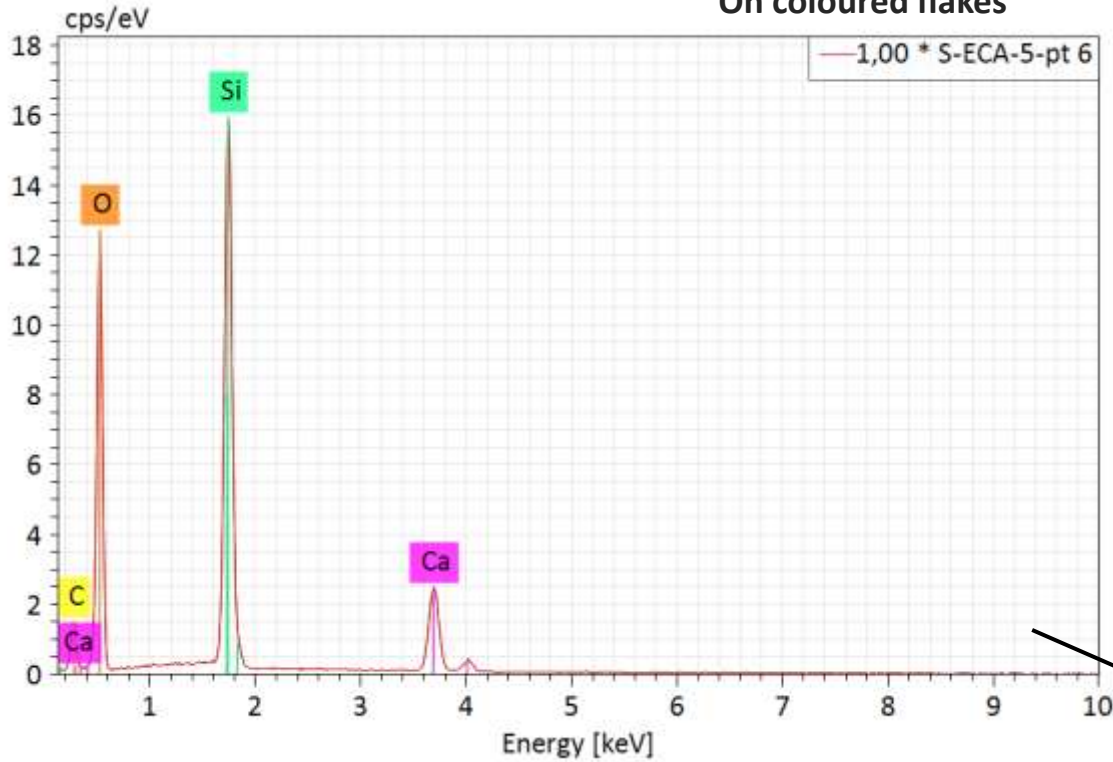
Identified and characterized pictorial matters on the cave's walls to compared it with raw material in the archaeological sequence

Méthodologie analytique multi échelle des matières colorantes

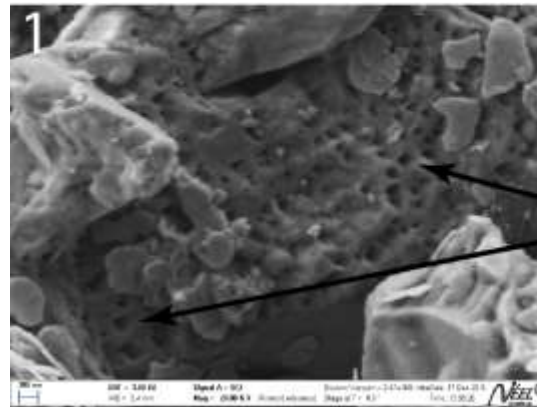


First results

On coloured flakes

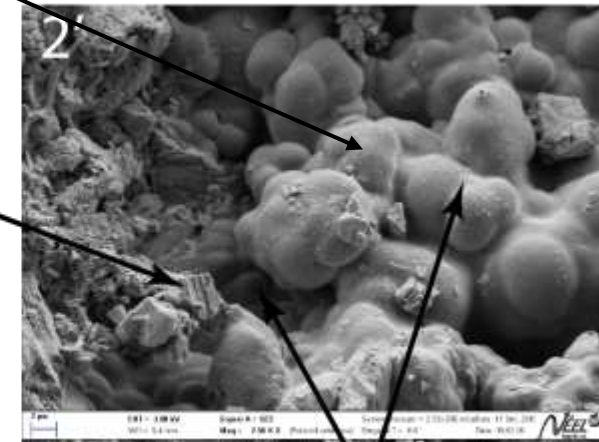


Plaquette pseudo hexagonale (fe) avec golf de dissolution



Morphologie anguleuse (Ca)

Trace de dissolution (Ca)



Morphologie mamelonée (Si)

> Observation of silicium coating with micro hummocked shape characteristics of opale

SEM-EDS observation and analysis



Locks

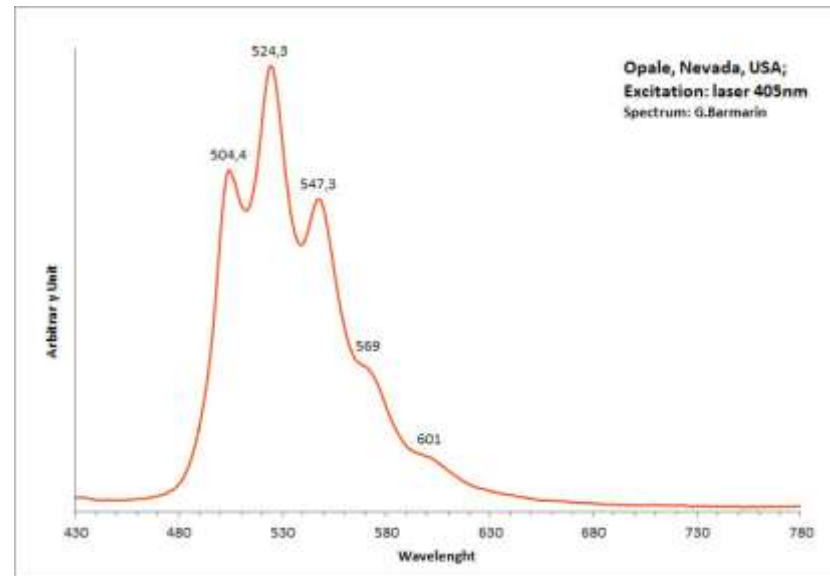
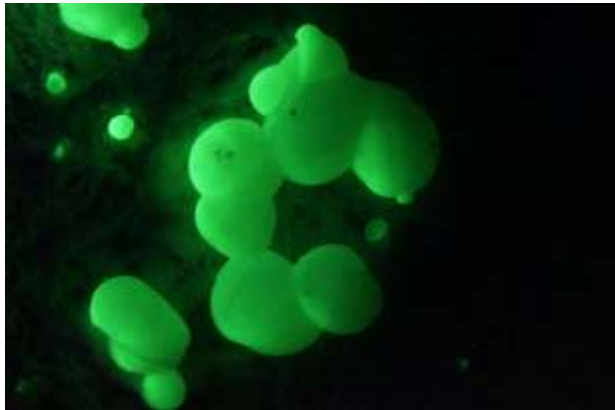
How to detect these invisible minerals on the walls without touching or sampling ?



Locks

How to detect these invisible minerals on the walls without touching or sampling ?

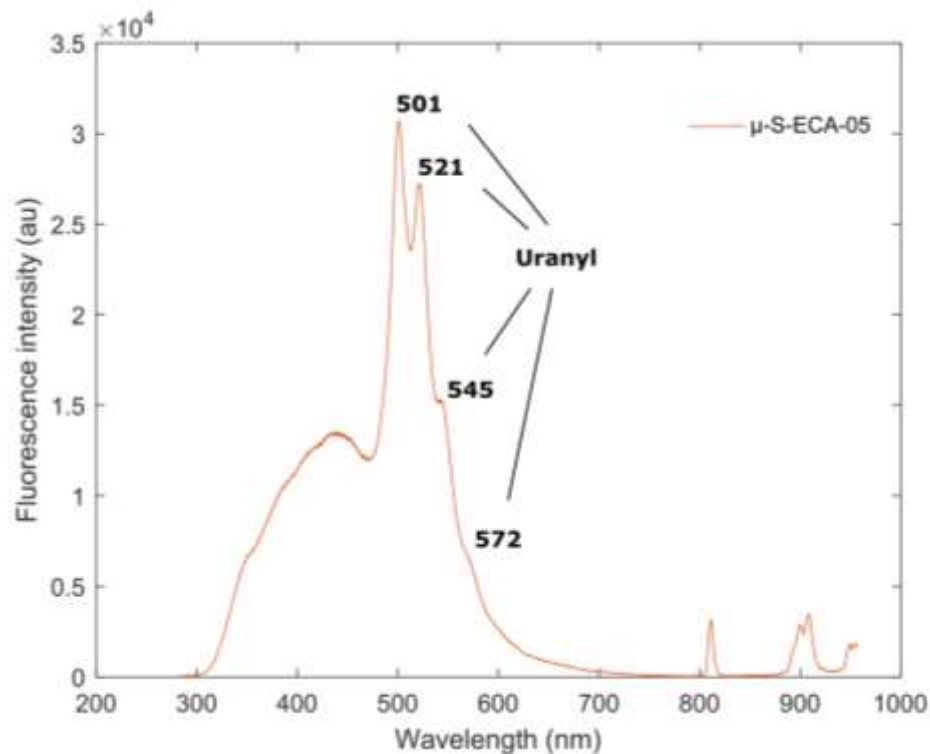
> Arbitrary research on google



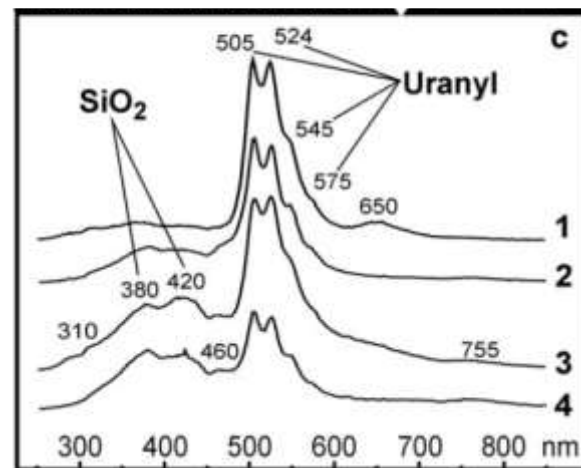
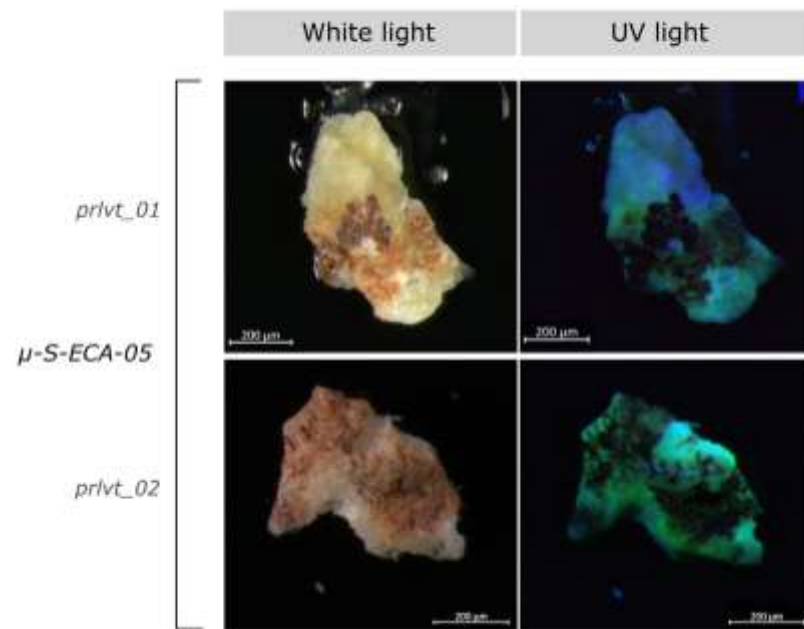
*Opale UV fluorescence picture and spectra
www.fluomin.org*

Opal identification by UV-fluorescence

> UV fluorescence measurements on Points cave μ -samples



Fluorescence spectra (266 nm exc., left) and UV-light photographs (280 nm, right top) of Points cave μ samples (Quiers et al., under review). Fluorescence spectra of opal in Castanar cave (bottom right, Garcia-Guinea et al., 2013).



From lab to cave : instrumental methodology

LAB EXPERIMENT



UV-LIF spectrometer –
solid phase (MUESLI)

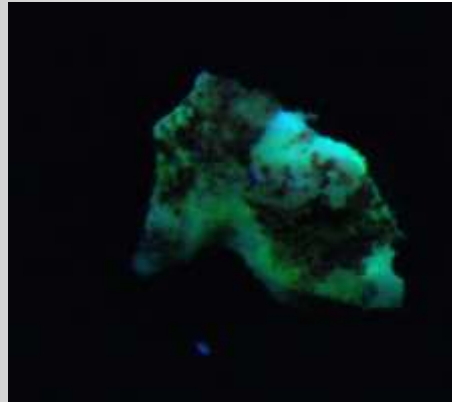
Non destructive
Single point or map
Emission spectra or decay

Spectral identification

Optical detection

UV-LED illumination

Photo under binocular
Non destructive
Rapid larger scale



IN SITU EXPERIMENT

Optical in situ detection

Camera +
280 nm LED
Wall scale UV
illumination



In situ spectral validation

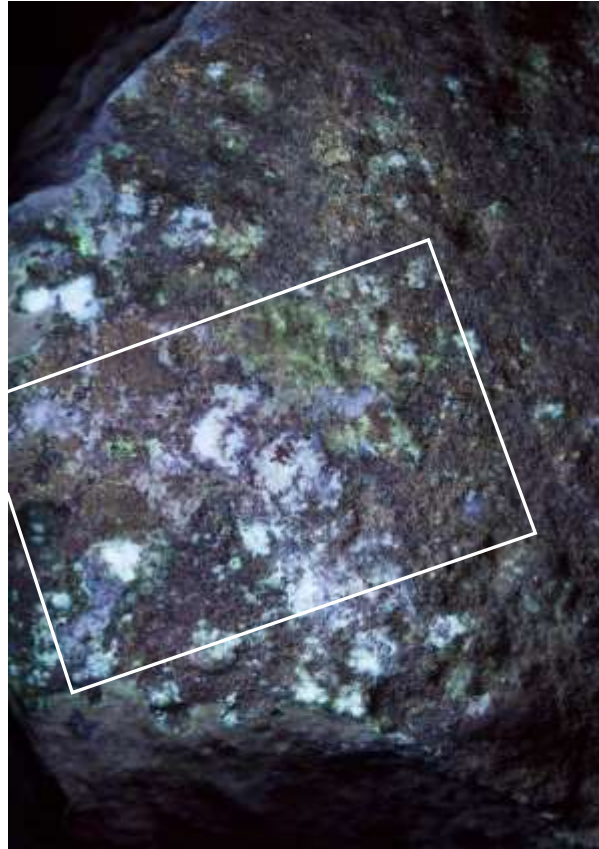


Non destructive, no contact
Portable UV-LIF spectrometer –
LUCIOL

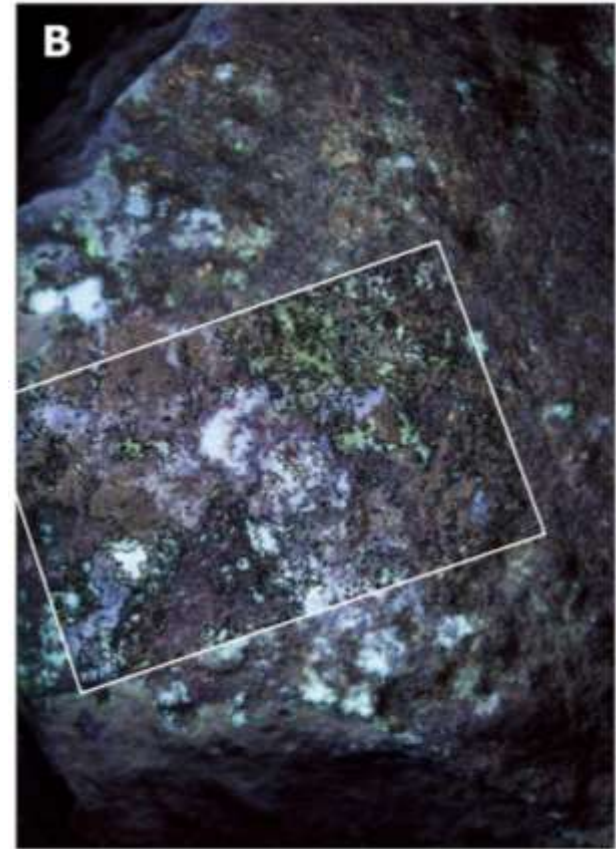
From lab to cave : Fluorescence imaging



White light picture of coloured surface of flakes

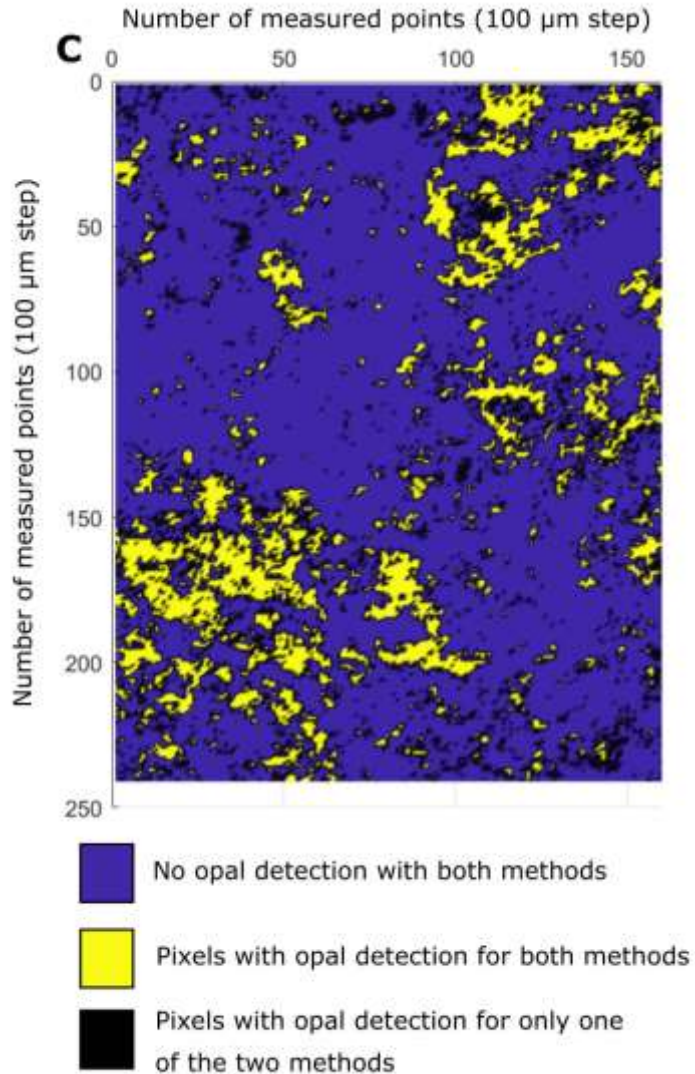


UV light picture of coloured surface of flakes (278 nm)



Opal contribution of at least 25% of the total fluorescence based on fluorescence spectra (266 nm excitation, Quiers et al., under review))

From lab to cave : Fluorescence imaging

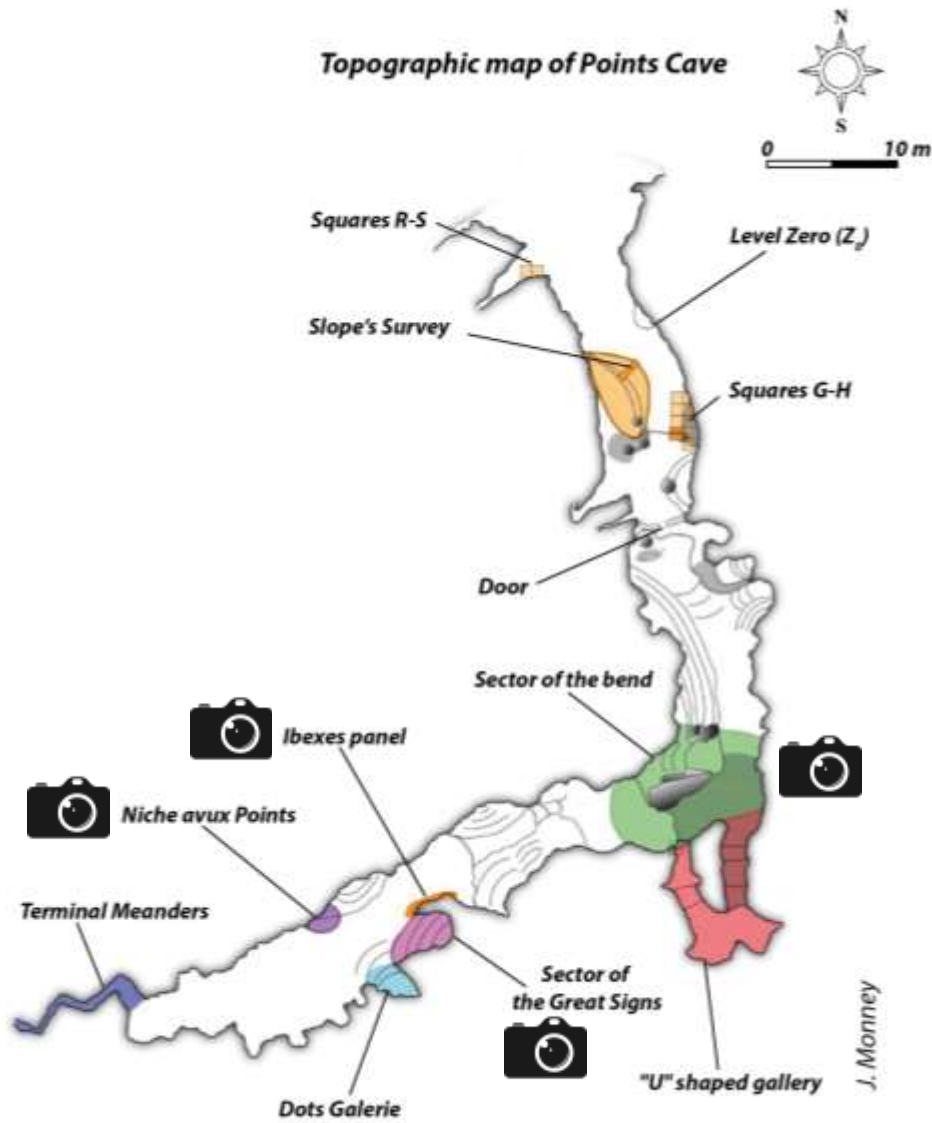


Methods comparison:

- More sensitive detection with UV-LIF method
- BUT good concordance
- Best when opal fluorescence contributes at least to 25% of the total fluorescence signal

Cartography of pixels associated with the presence of opal comparing A and B (no geometric transformation; Quiers et al., under review)

From lab to cave : Field experiment



Instrumentation for UV photographs

ibexes panel



5 cm





5 cm

From lab to cave : Field experiment

- Amorphous Opal type A, film deposition under or at the interface with pigments
- Important spread of opal coating on Points Cave walls, especially on rock art panels.
- Opal formation probably occurred principally before cave flaking period (subsequent to ornamentation)

Ongoing questions:

- Wall cave taphonomy
- Dating (Direct or indirect)
- Geochemical interaction with pigment and rock art conservation

*Great Signs Pannel
Old surface / interface / Flaked surface*



Photographs of the flaking zone under white and UV light (Quiers et al., under review)

From lab to cave :
Upcoming

luciol 

SPEC SOLE

*En collaboration
avec*



museum 


Geological Survey
of Belgium

Belgian Science Policy Office

belspo



Thanks to

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SpecSolE project

