Madrid. Centro de Ciencias Humanas y Sociales (CSIC).
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USUARIOS ASD I Jornada

Spectral analysis for geological mapping in the Montsec Area (Pyrenees, Spain) using hyperspectral AISA Eagle II data

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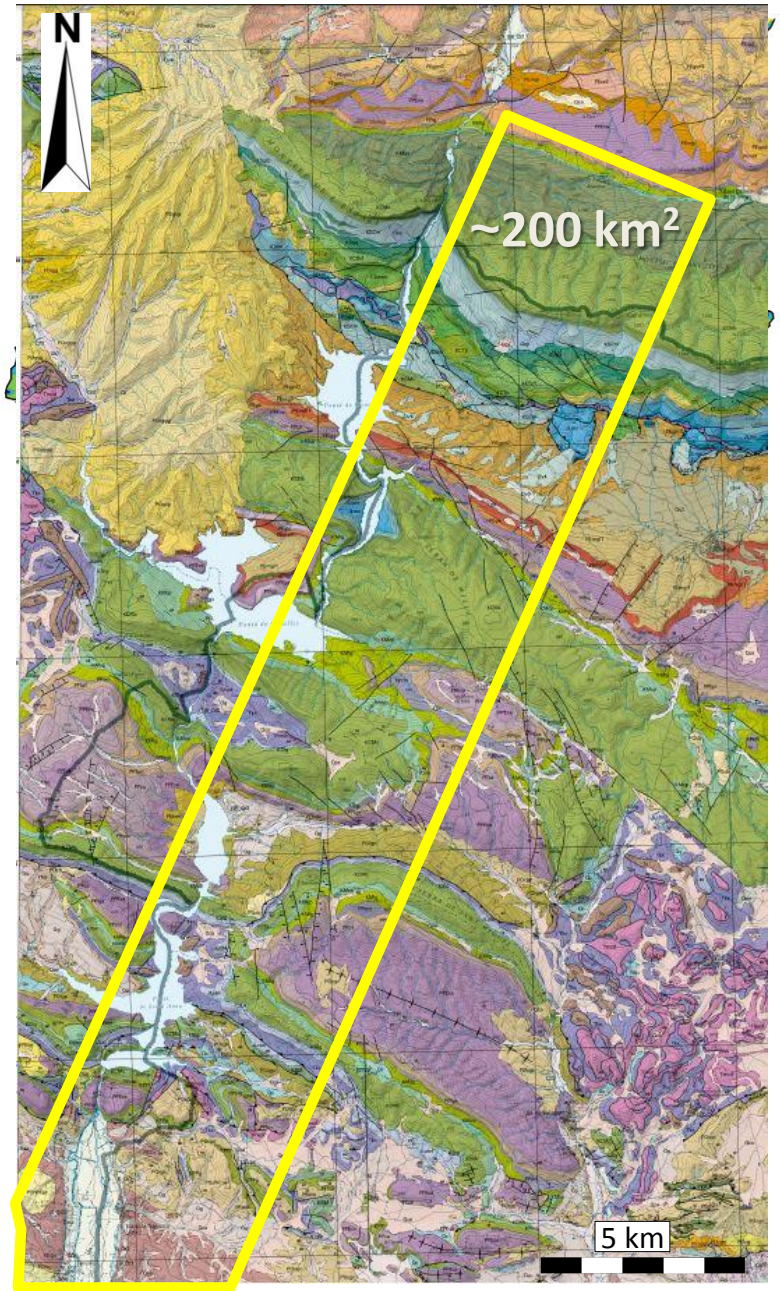
1. OBJECTIVE

Assess the potential of hyperspectral remote sensing applied to geological mapping in complicated areas (high reliefs, vegetation).

- ✓ **Get ground truth data using a ASD FieldSpec3.**
  - **Spectral signatures of the representative lithologies.**
  - **Spectral data for atmospheric corrections.**
- ✓ **Process the AISA Eagle II images using field spectral libraries.**

2. THE STUDIED AREA



LOCATION

Montsec (Pre-Pyrenees range)

This area has been selected due to:

- Diverse clastic and carbonatic lithology.
- Good knowledge of the geological context.
- Relatively good access to the area (4WD).

3. METHOD: Data sources

Aisa Eagle II Hyperspectral sensor

Flight campaign: July 2014
Sensor : Aisa EAGLE II (Specim)
Spatial resolution: 1 m
Spectral resolution: 128 bands
Spectral range: 400-970 nm (VNIR)
Bandwidth: 4.4 - 4.9 nm

ASD FiedSpec 3 Spectroradiometer

Field campaigns: September 2014, July 2015

Wavelength	Bandwidth	Resolution
VNIR (350-1050 nm)	1.4 nm	3 nm
SWIR 1 (900-1850 nm)	2 nm	10-12 nm
SWIR 2 (1700-2500 nm)	2 nm	10-12 nm

ICGC
Institut
Cartogràfic i Geològic
de Catalunya

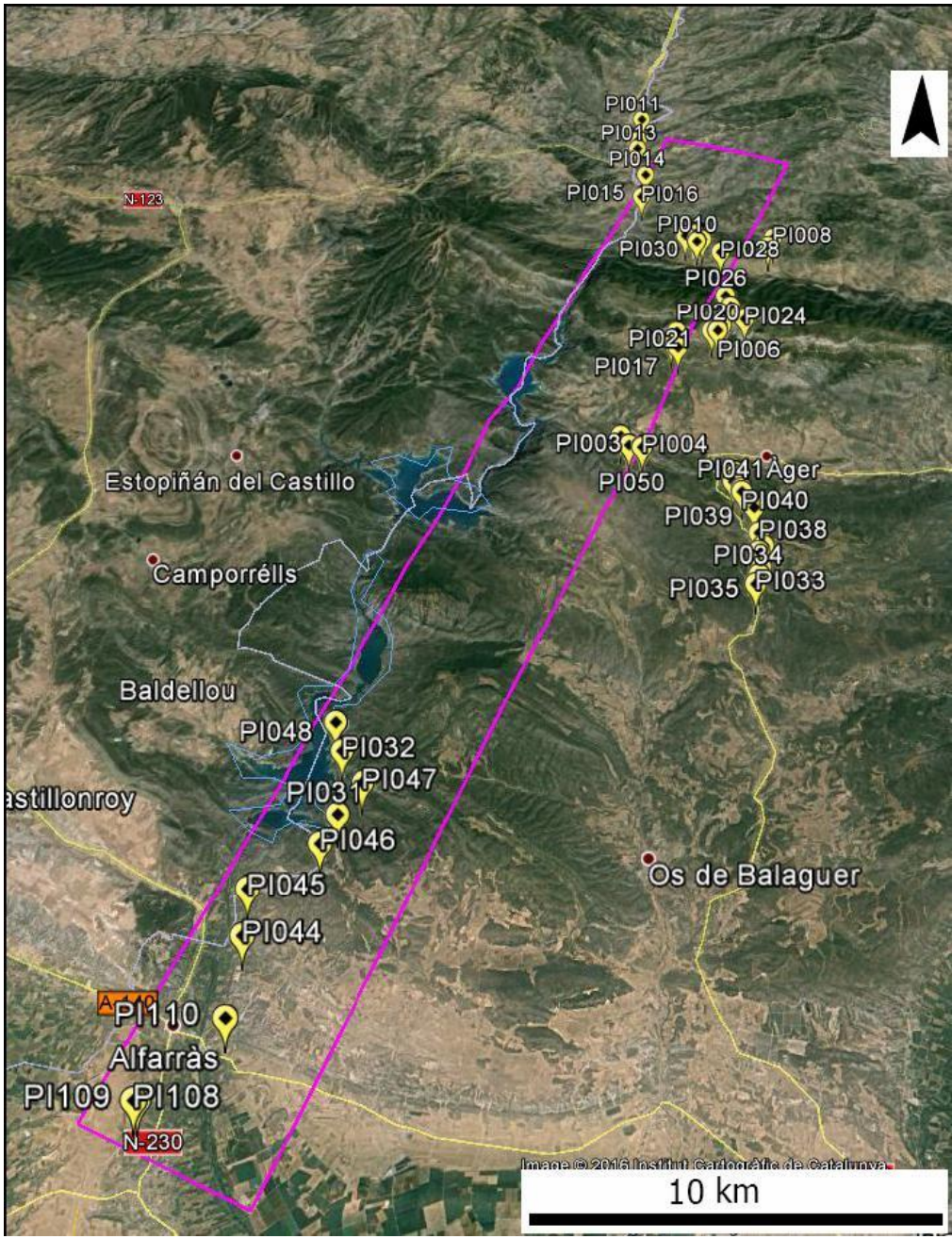
3. METHOD: Field spectral sampling

2014

303 spectral signatures.
40 stations.
Only contact probe.

2015

306 spectral sign. 12 stations.
307 atm. corr. measurements.
Contact probe and pistol grip.



3. METHOD: Field spectral sampling

ASD FieldSpec 3 measurement protocol

Turn ON

20’

Optimize

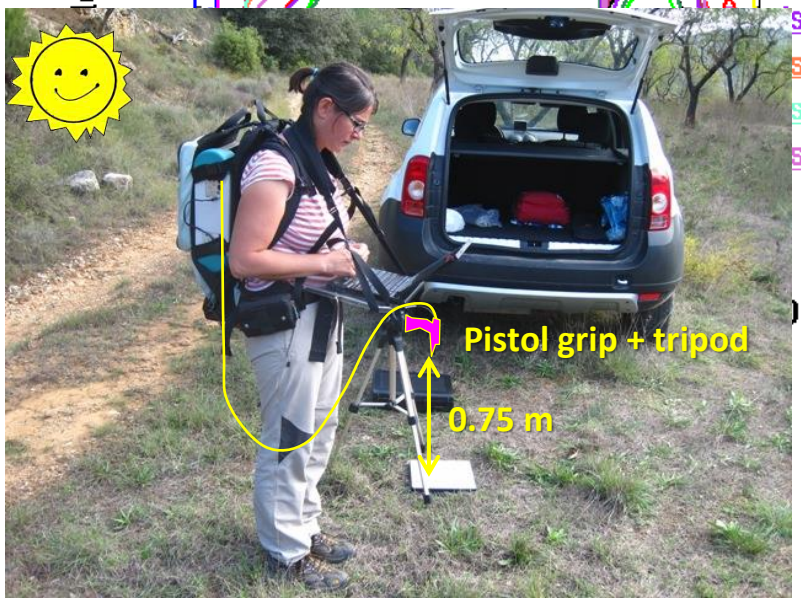
Withe reference

ASD raw data (3 measurements)

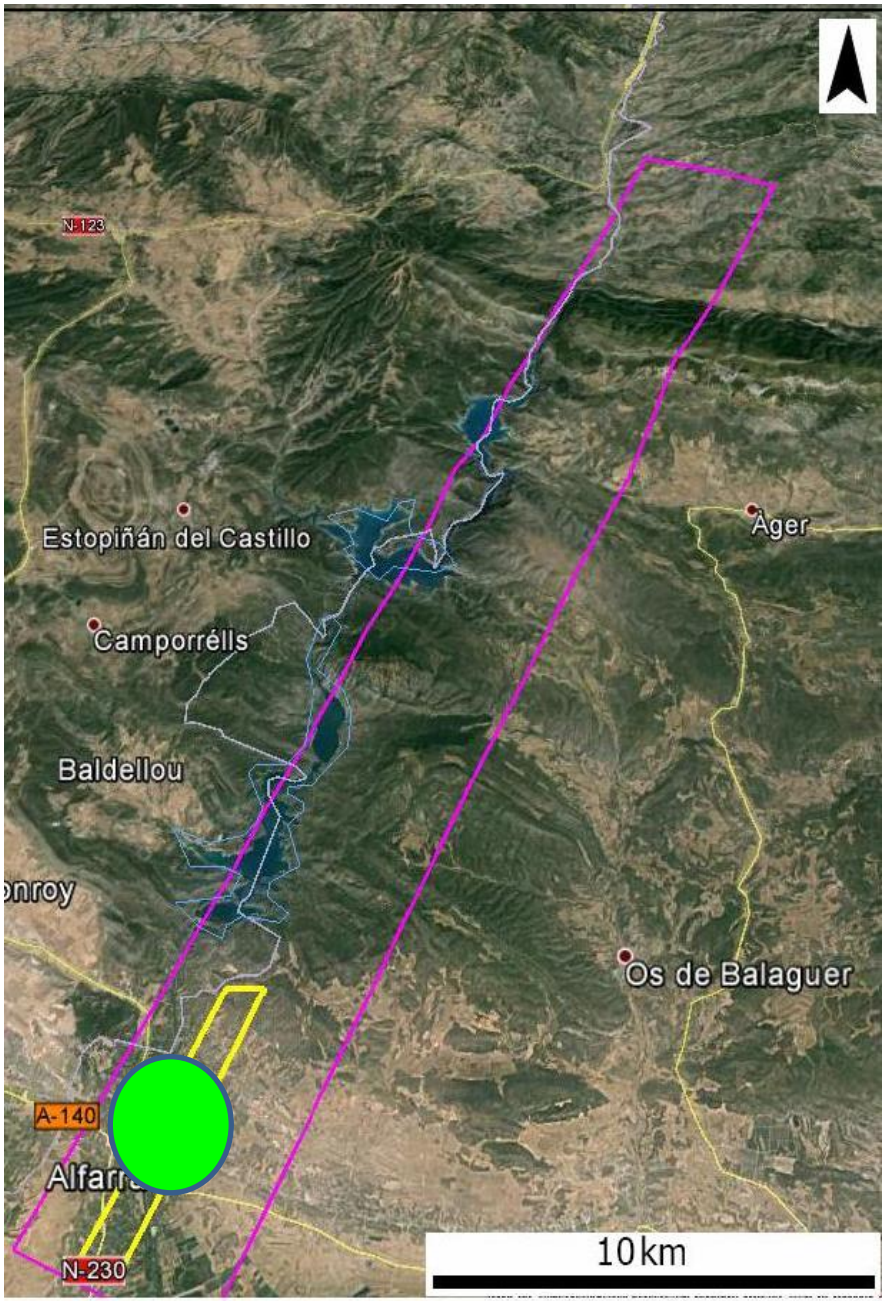
Reflectance

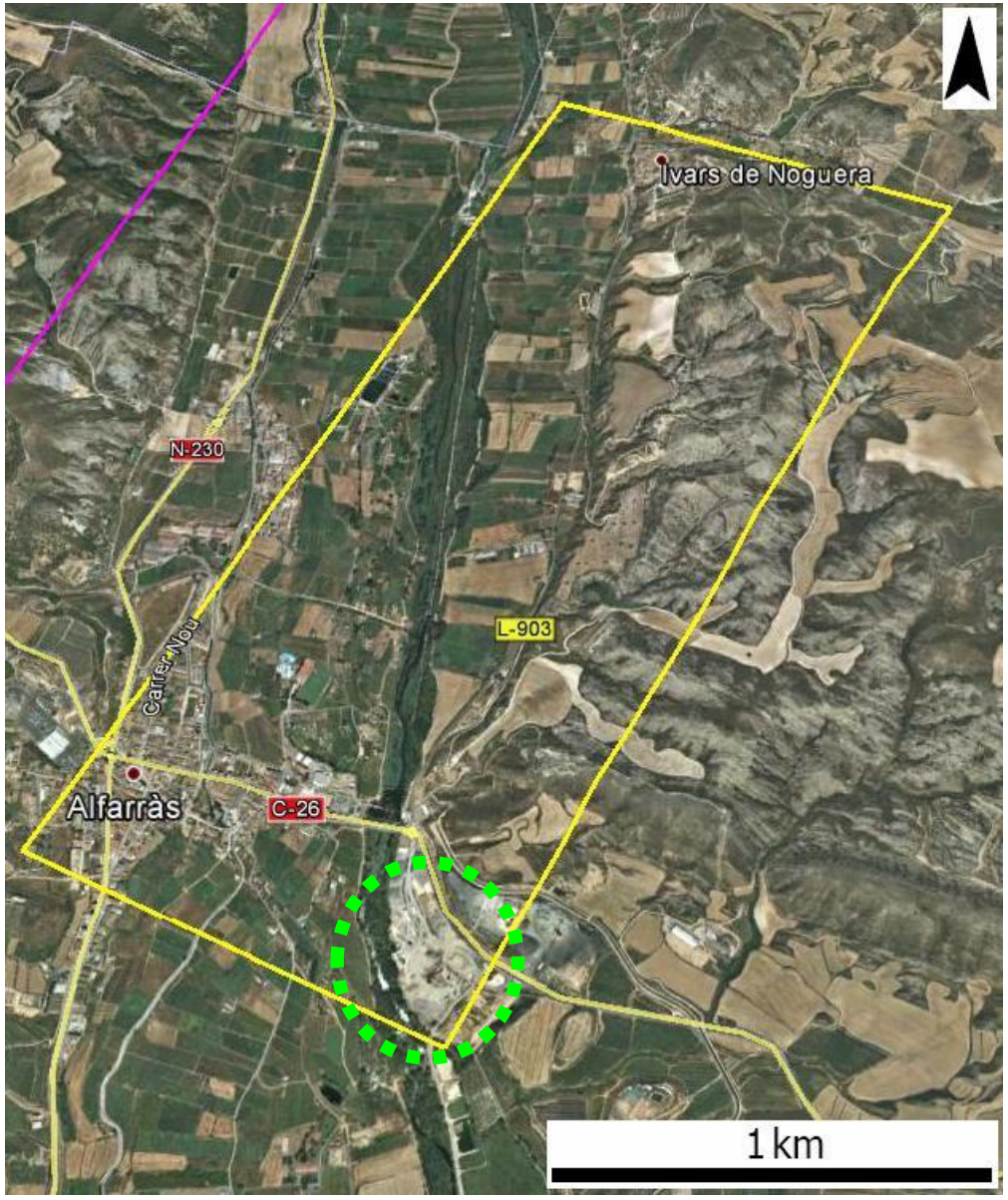
Splice correction Statistics (mean)

ENVI spectral libraries

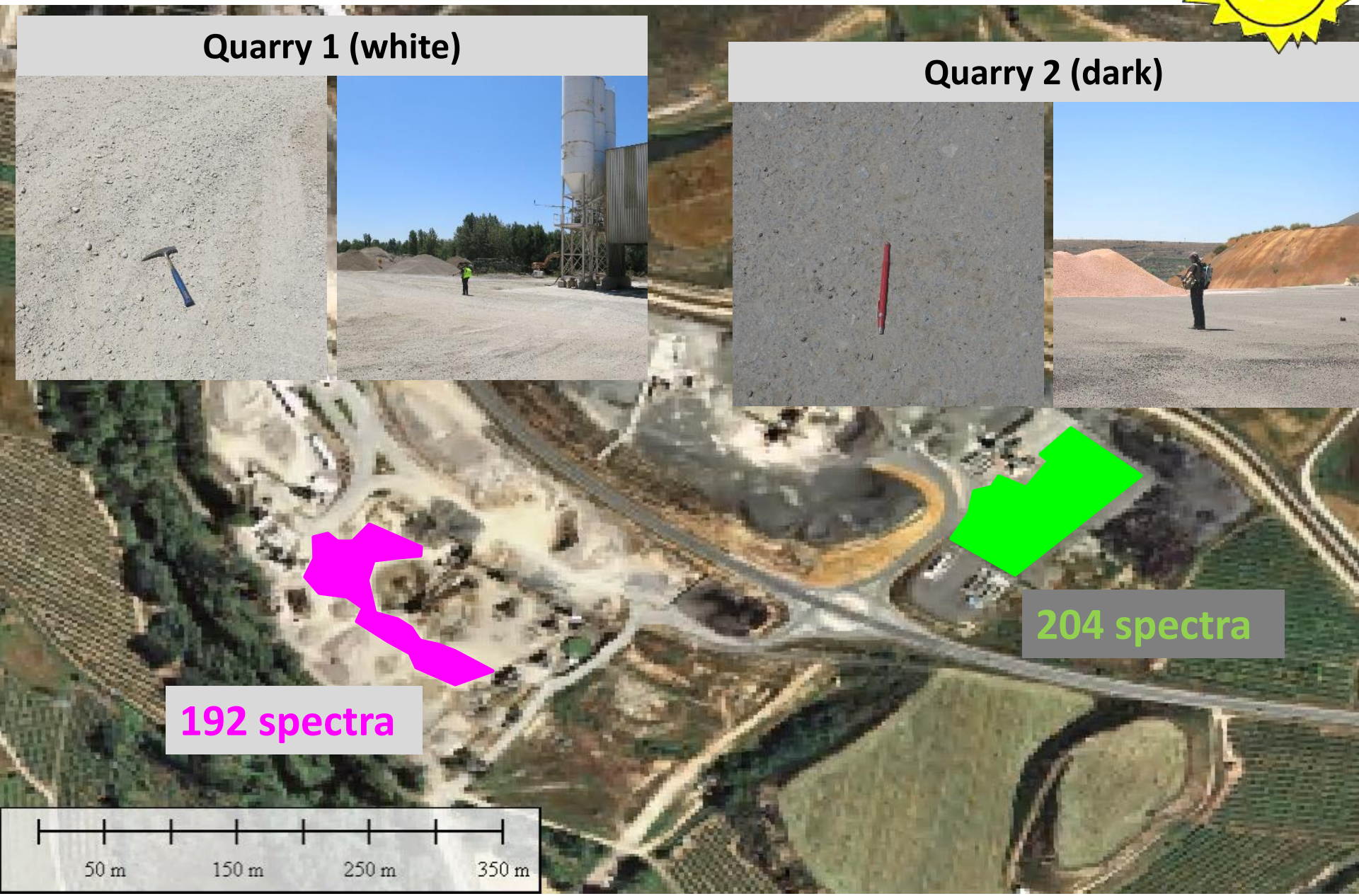


3. METHOD: Atmospheric correction





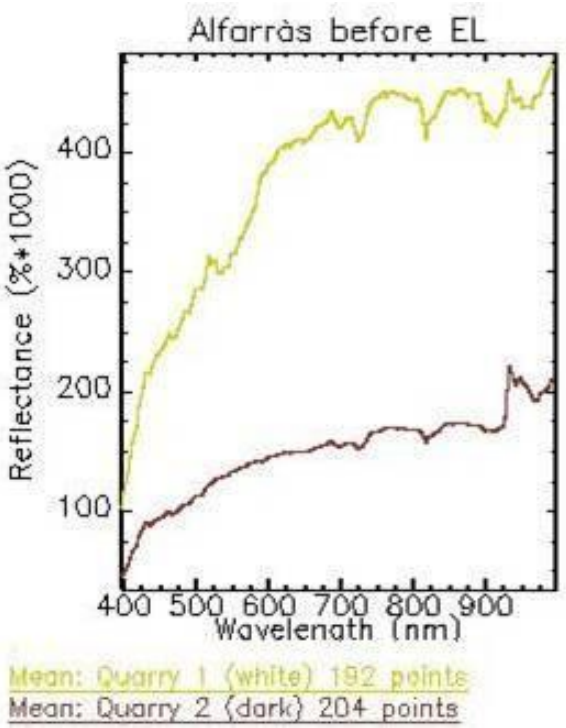
3. METHOD: Atmospheric correction

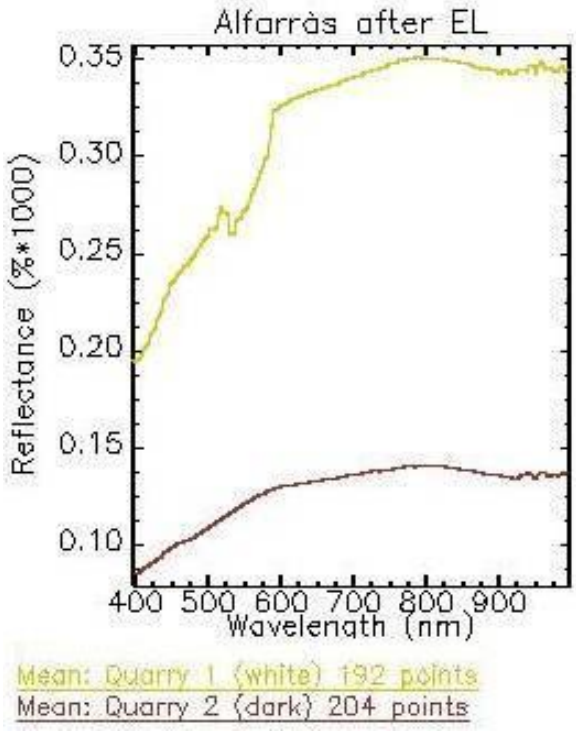


3. METHOD: Atmospheric correction

Atmospheric correction: EMPIRICAL LINE

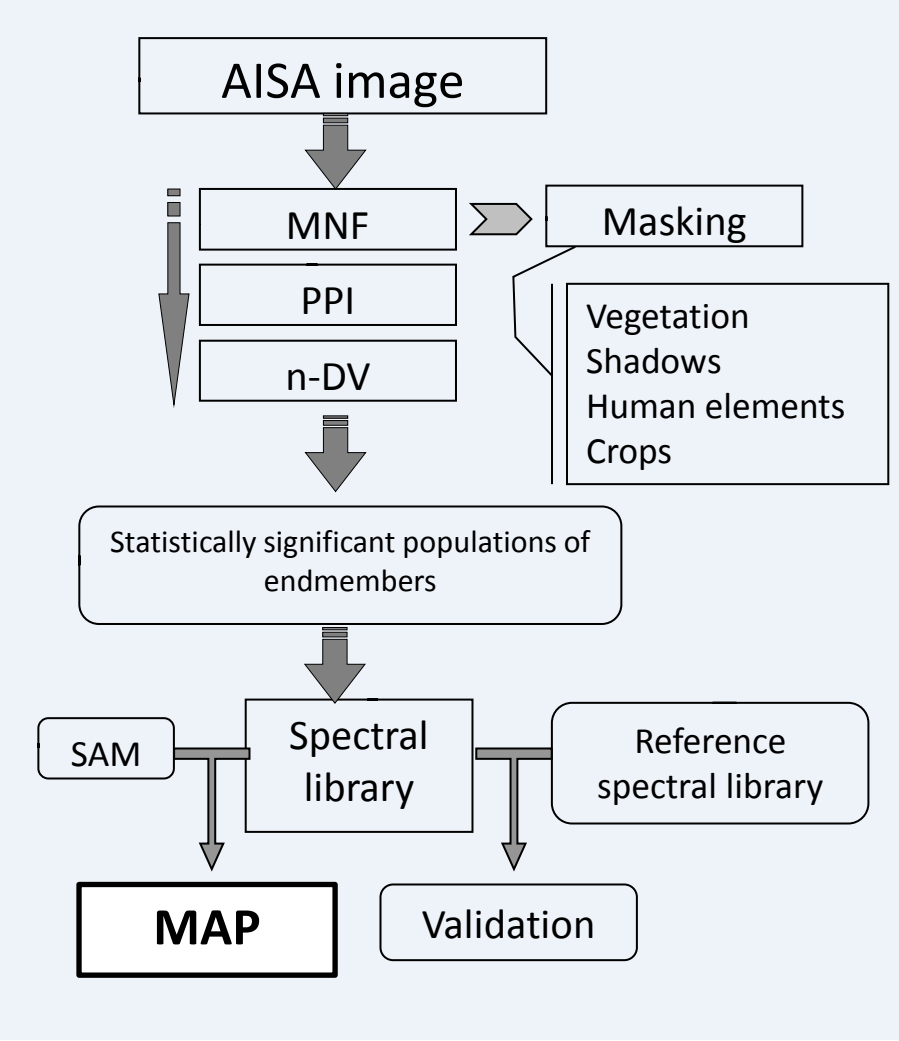
Forces the spectral data of the image to match selected field reflectance spectra using a linear regression for each band to equate DN and reflectance.

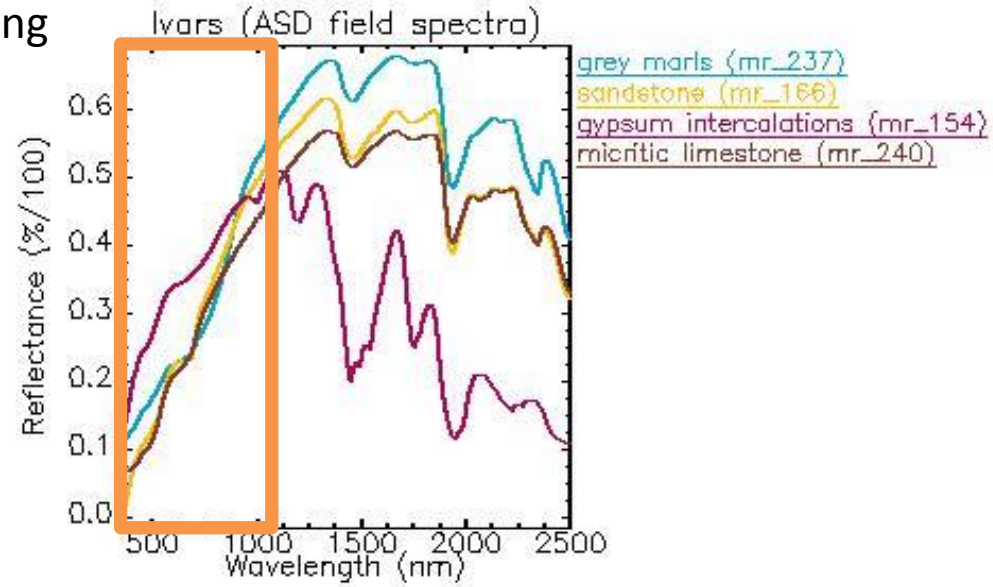


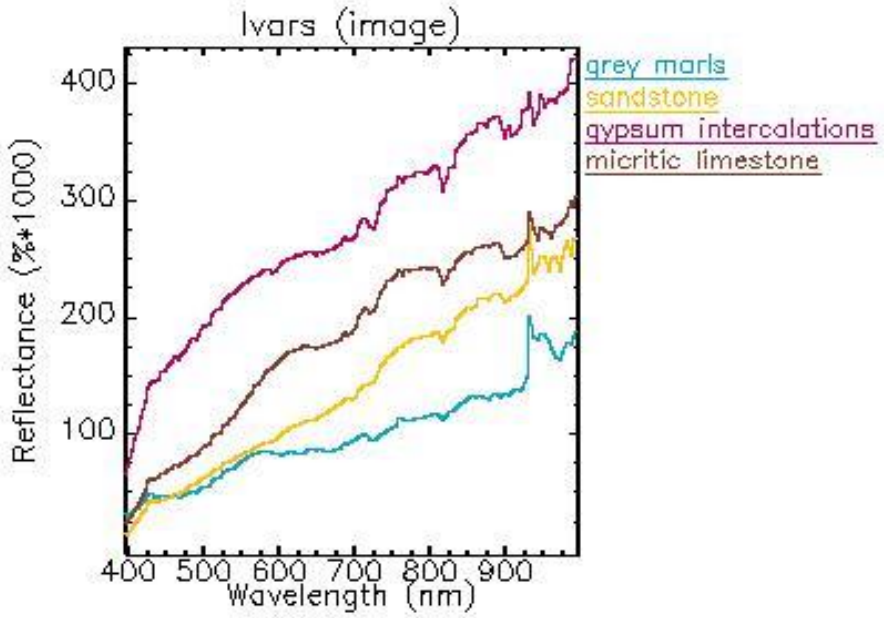


3. METHOD: Image processing

Sequential algorithm chain for spectral unmixing

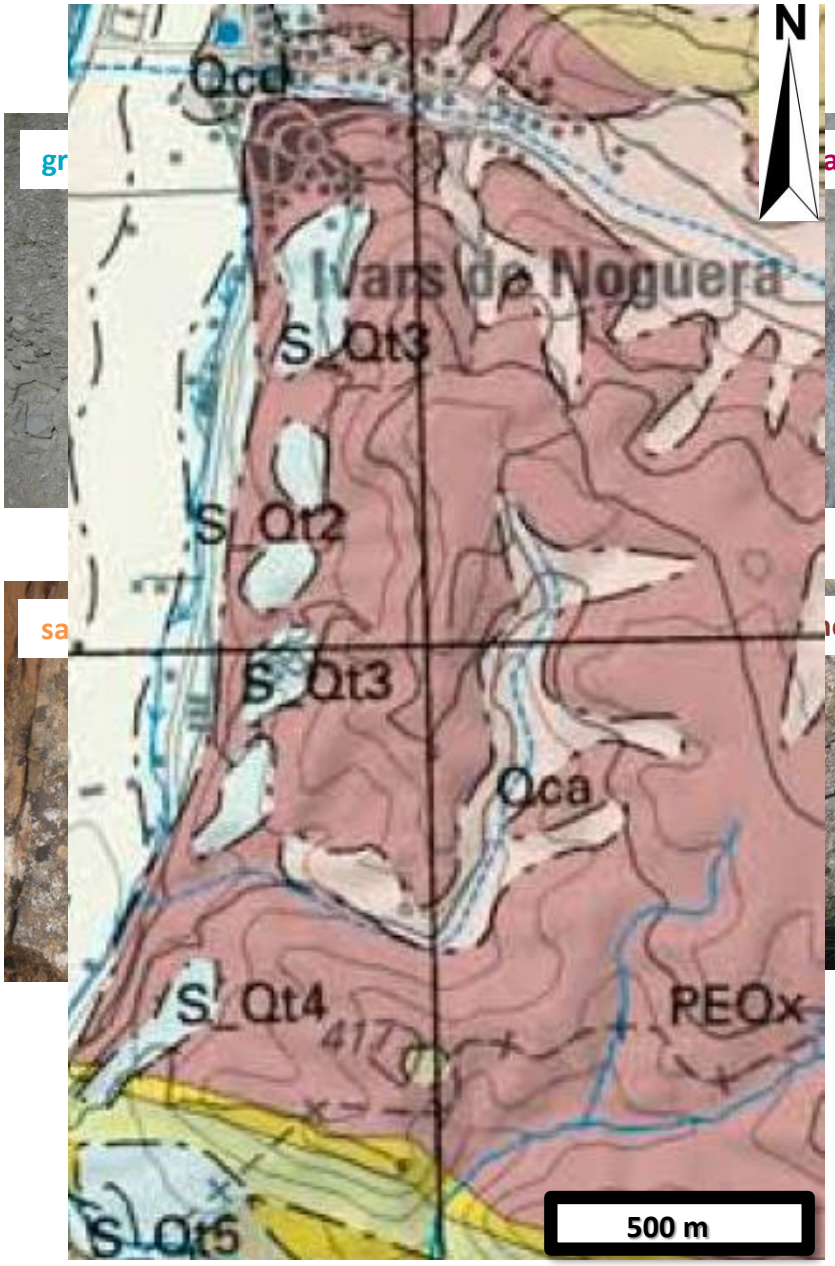




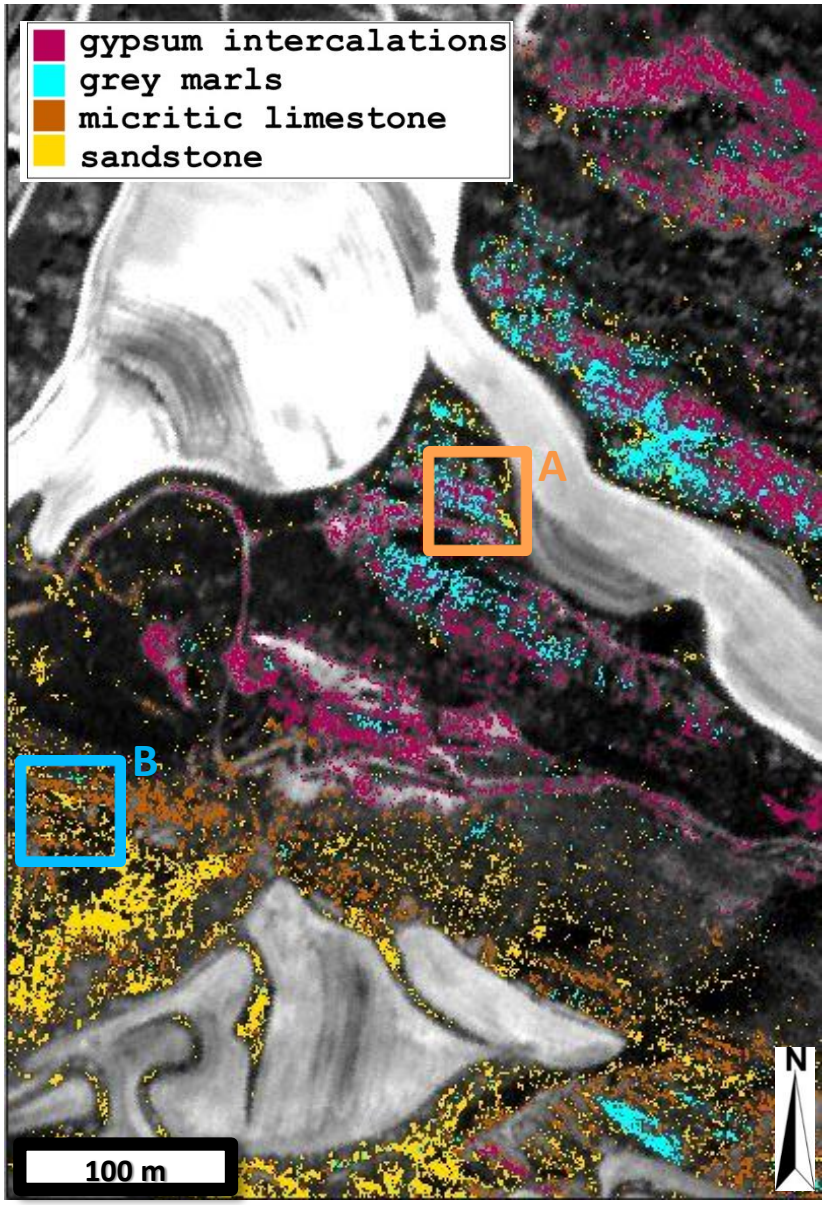


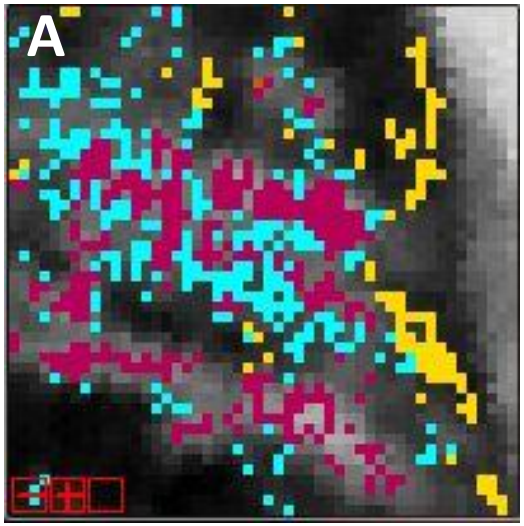
4. RESULTS

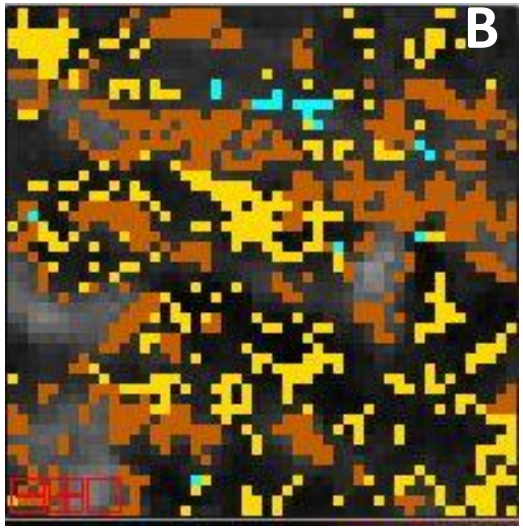

N
gypsum intercalations
grey marls
micritic limestone
sandstone

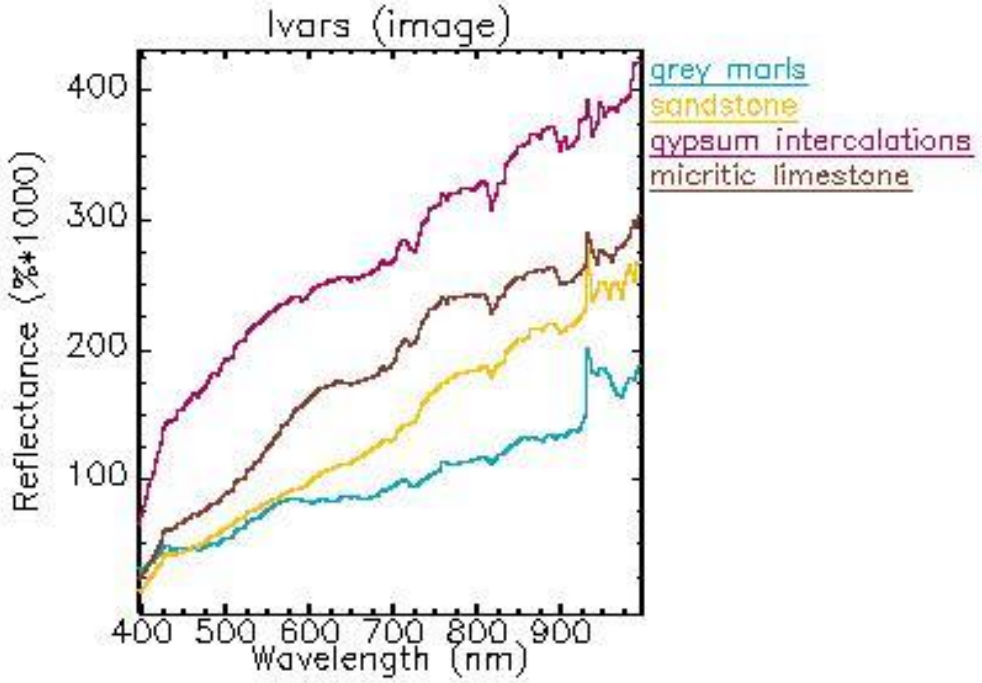

N
Qcd
Vans de Noguera
S_Qt3
S_Qt2
S_Qt3
Qca
S_Qt4
PEOx
S_Qt5
500 m

4. RESULTS


gypsum intercalations
grey marls
micritic limestone
sandstone
A
B
N
100 m


A


B


Ivars (image)
Reflectance (%*1000)
400
300
200
100
400 500 600 700 800 900
Wavelength (nm)
grey marls
sandstone
gypsum intercalations
micritic limestone

5. CONCLUSSIONS

- **Precise and accurate field work is key to get adequate spectral libraries, which allow producing geological maps. Following a measuring protocol is mandatory to get good spectra.**

- **There are unavoidable limitations (weather, data, vegetation hiding the geology) that must be overcome through a fine and specifically-aimed work.**

- **Conventional geological mapping skills are required to validate the maps generated by hyperspectral image processing.**

- **Spectral and spatial resolution of the data has clearly allowed to map inner stratification and lateral facies changes at lower scales than the conventional geological maps scale (MAGNA Series 1:50000).**