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## Mise en évidence des relations entre morphologie des côtes rocheuses et héritage géologique, à l'aide de méthodes de photogrammétrie par drone et d'imagerie hyperspectrale panoramique des falaises

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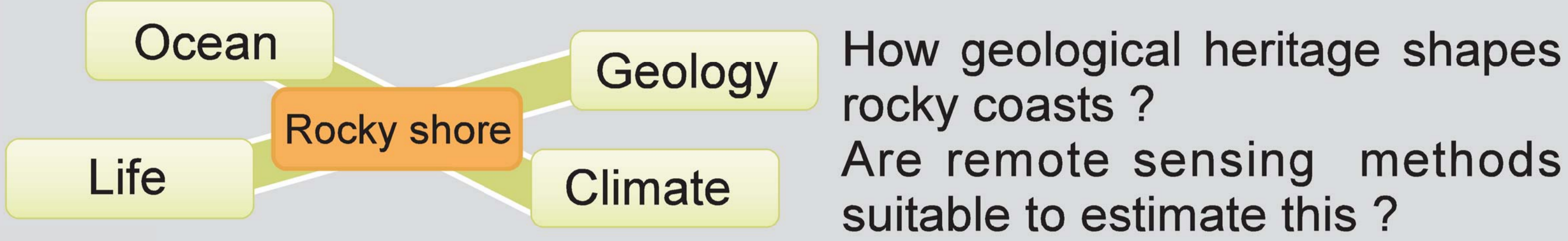
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# Relationships between morphology of rocky coasts and geological heritage, using drone photogrammetry methods and panoramic hyperspectral imagery of cliffs

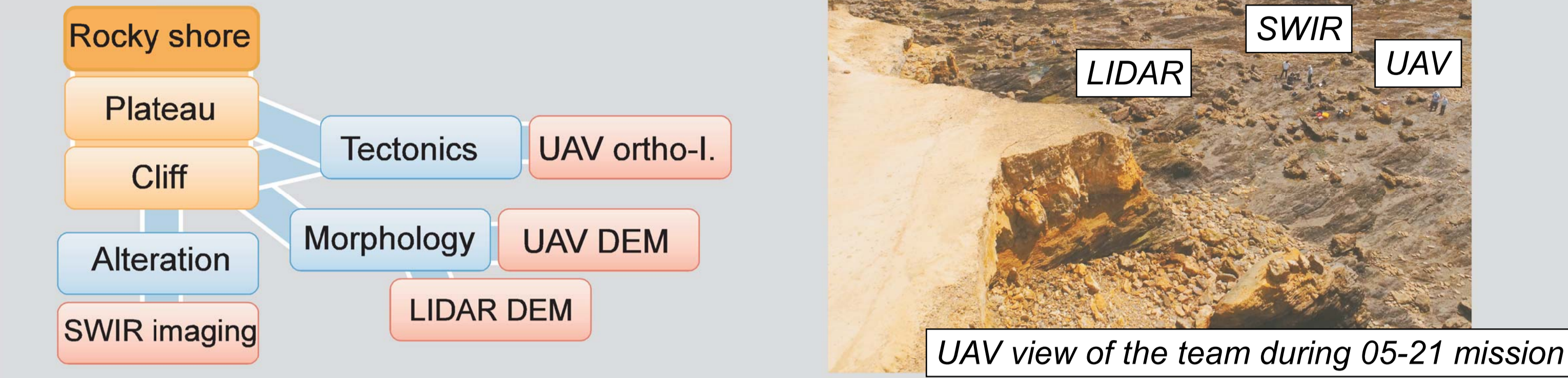
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Loïc Bouat<sup>1</sup>, Manuel Giraud<sup>3</sup>, Ghyslain Ferré<sup>2</sup>, Giovanni Frati<sup>3</sup>



## Introduction



## Remote sensing data and methods



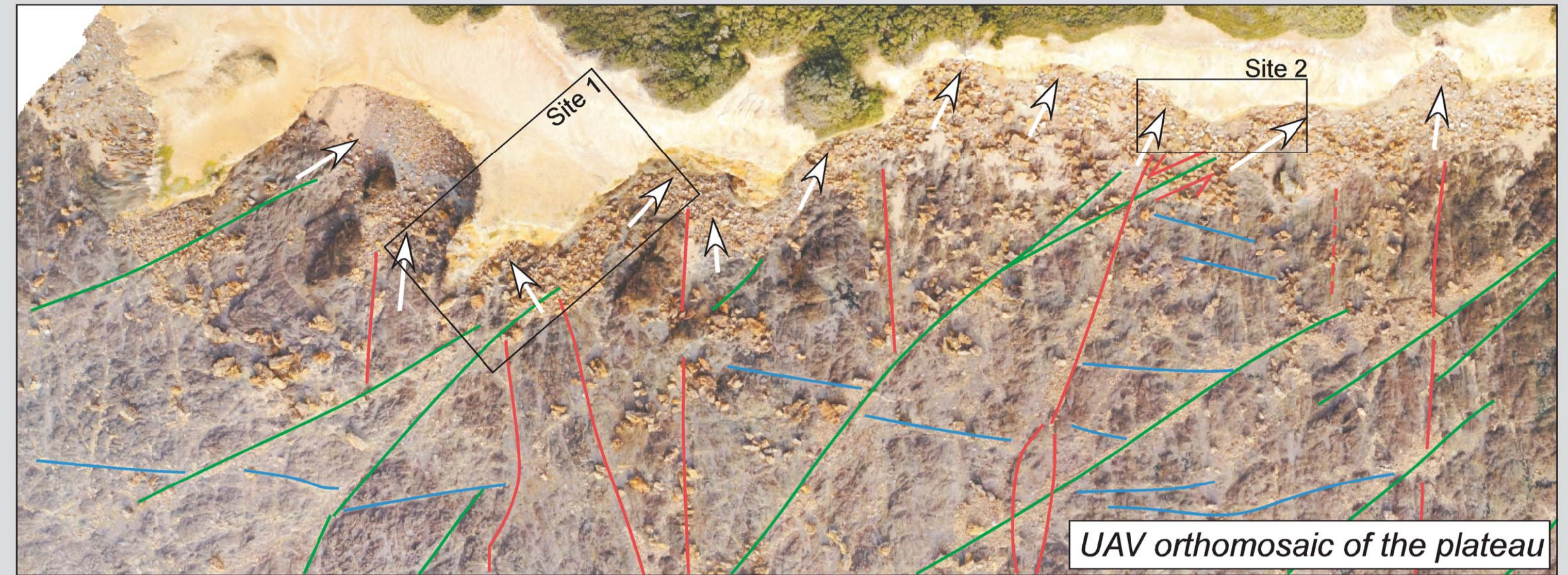
## Overview of the Pointe du Payré area

### - Coastal cliff morphology



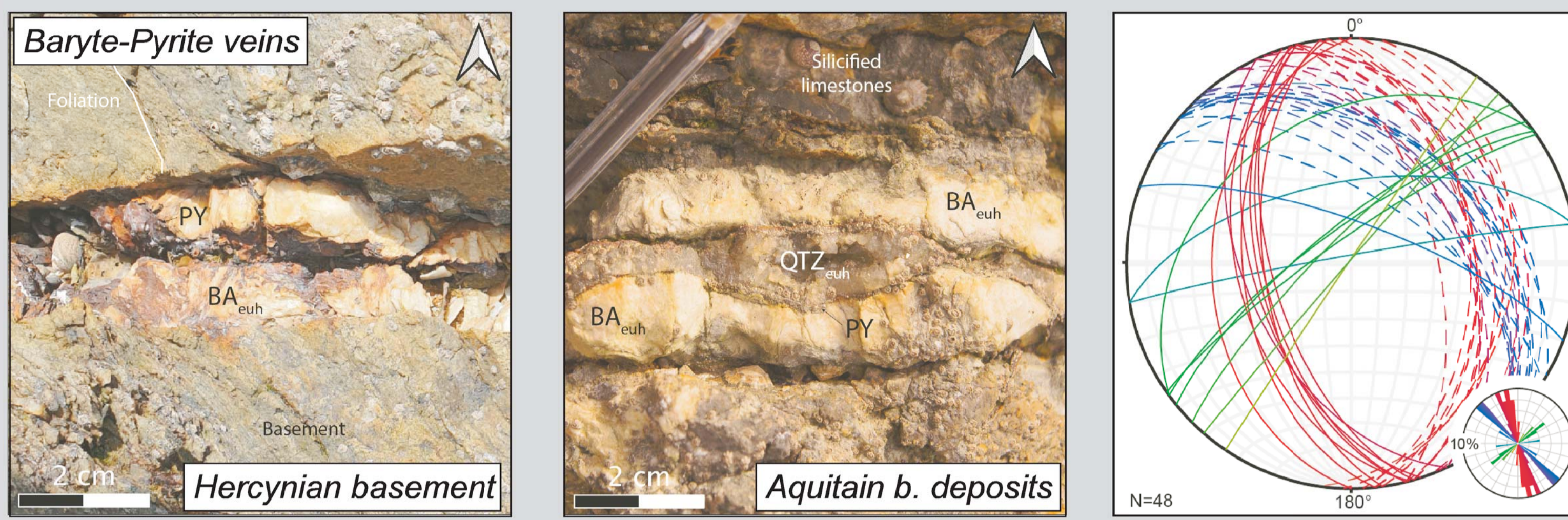
The Pointe du Payré coastal cliff  
- exposed well the Armorican massif -Aquitain basin unconformity  
- presents several caves and arches located below the unconformity

### - Geological structures on the rocky plateau



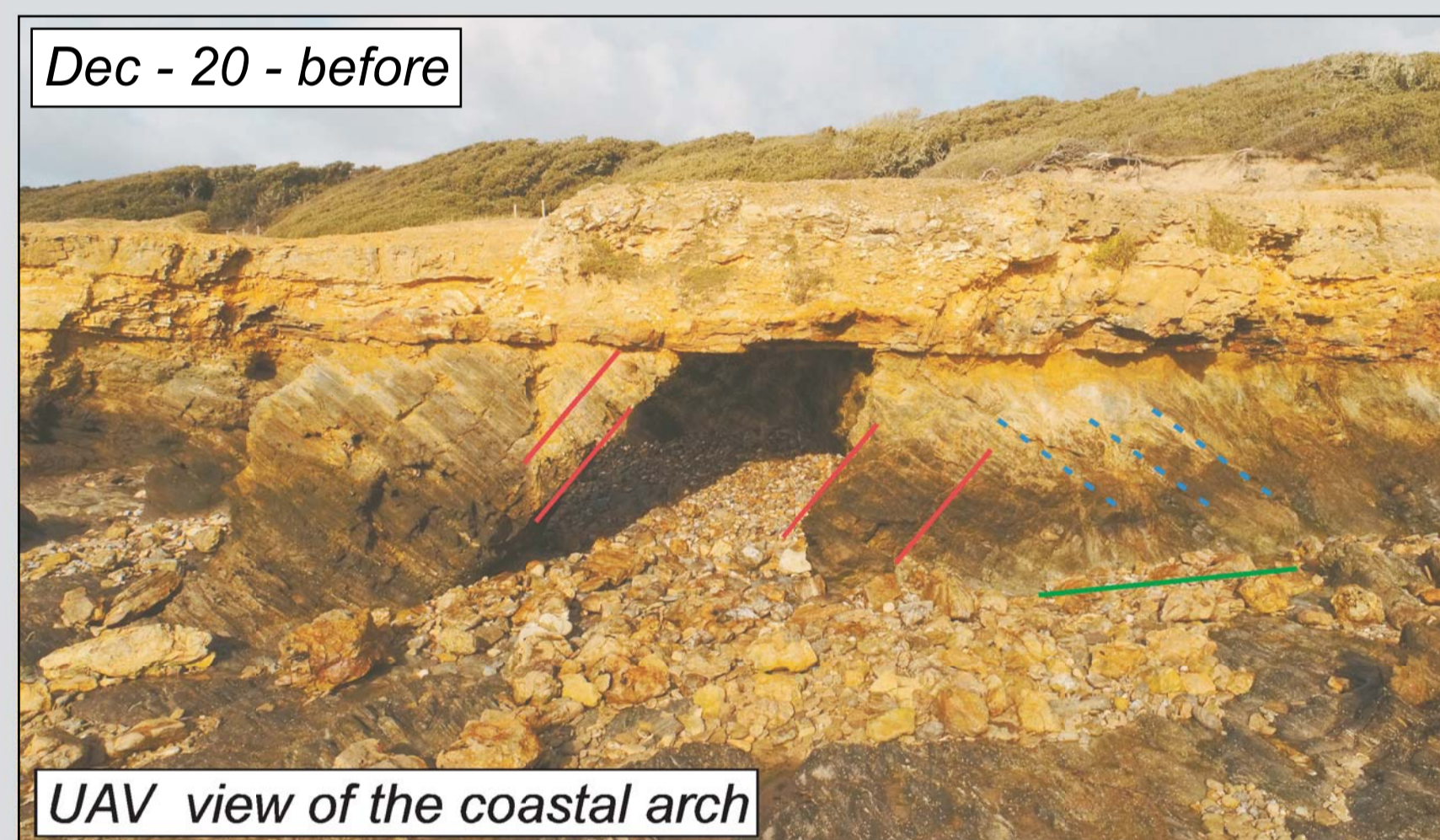
The position and orientation of caves are in good agreement with main late Hercynian N50 and N160 fractures.

### - Late Jurassic fluid event

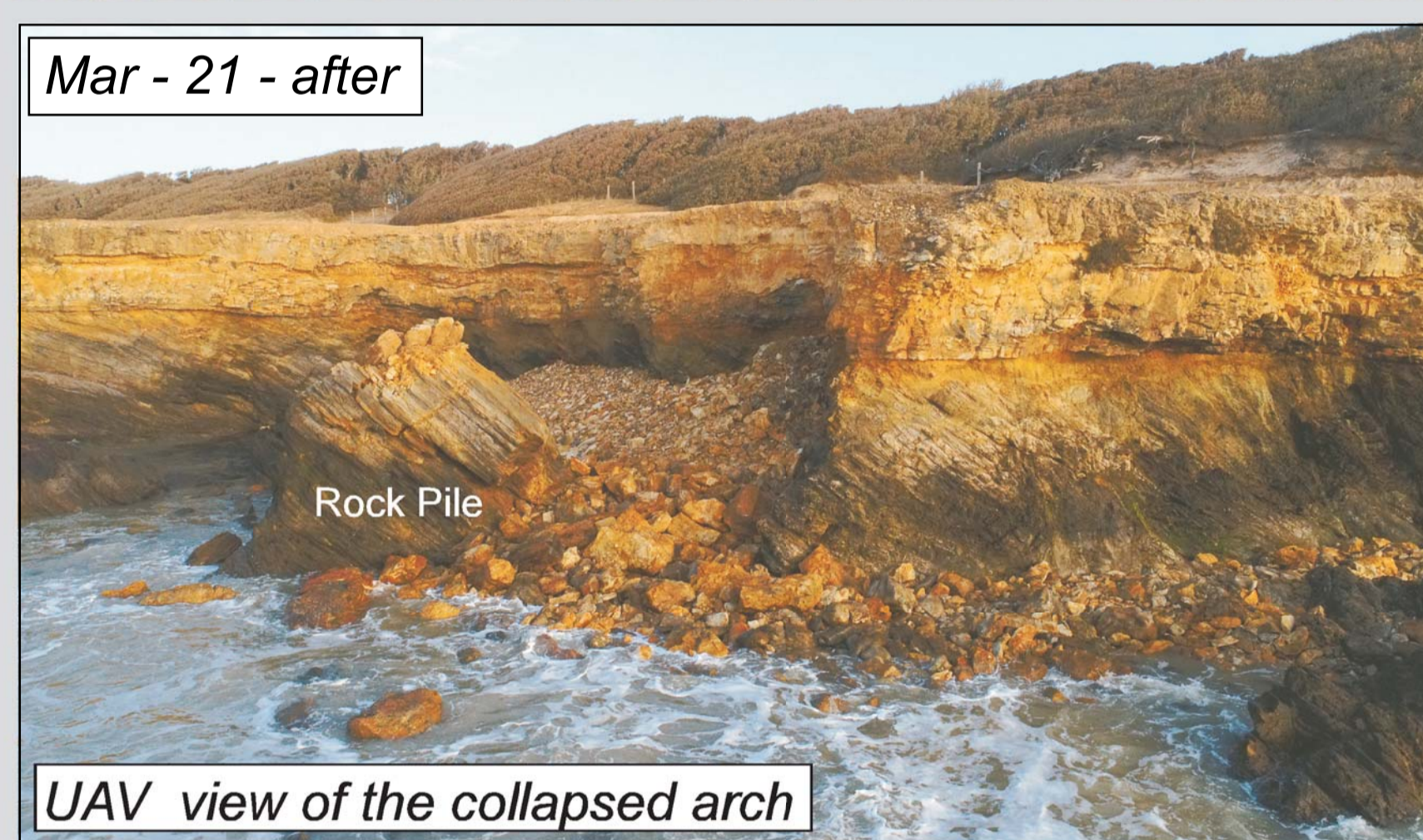


N100 Jurassic normal faults and veins are related to a fluid event leading to the silicification of the Aquitain b. deposits and the precipitation of baryte, Fe-sulfur and Quartz. (to learn more please see Bouat et al., on Tuesday PM talk)

### Site 1: collapsing coastal arch

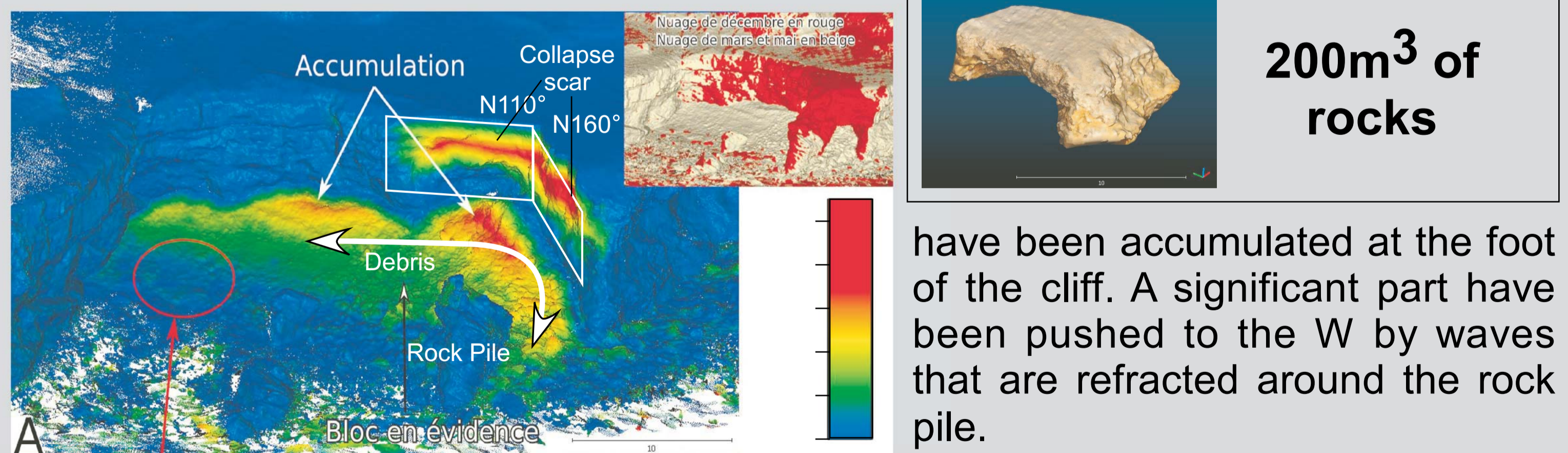


Coastal arch is limited to the top by highly silicified Aquitain deposits and to the left and right by N160 late Hercynian faults. The main cliff is bounded by a N50 late Hercynian faults.



Arch collapse is caused by the rupture of the Hercynian basement rock pile all along the micaschists foliation plane. The collapse scar is limited to the Aquitain B. deposits. From N to S, it first strikes First N160°, parallel to the boundaries of arch, and then N110°, in a same way than Jurassic normal faults and veins.

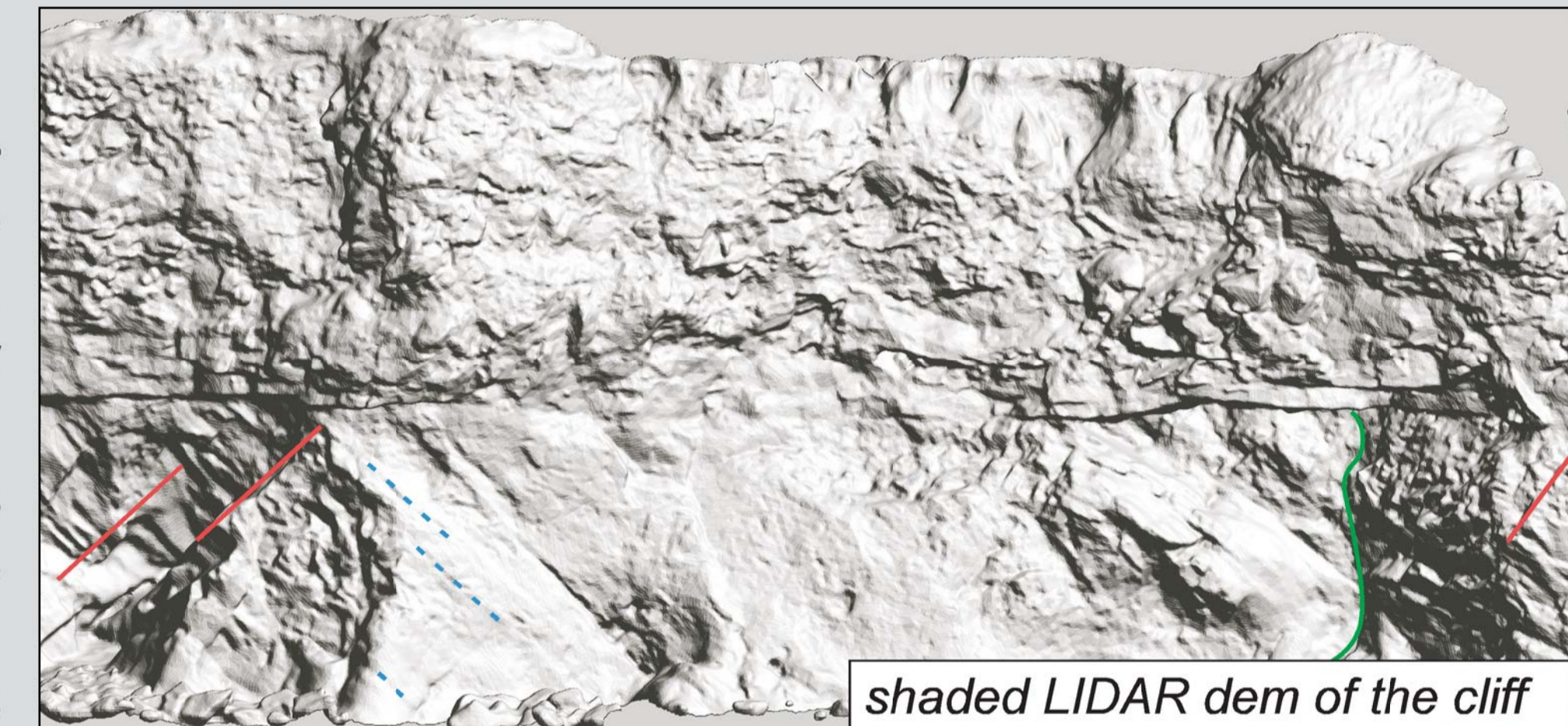
### - Debris volume and fate



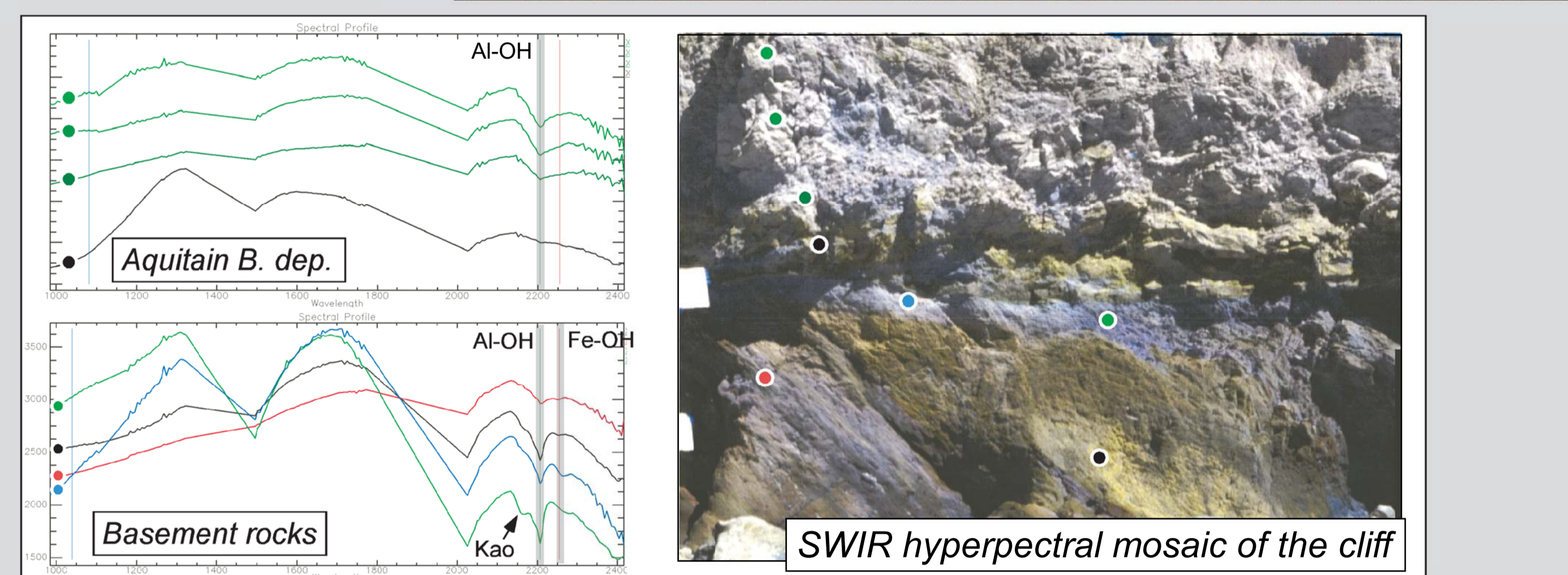
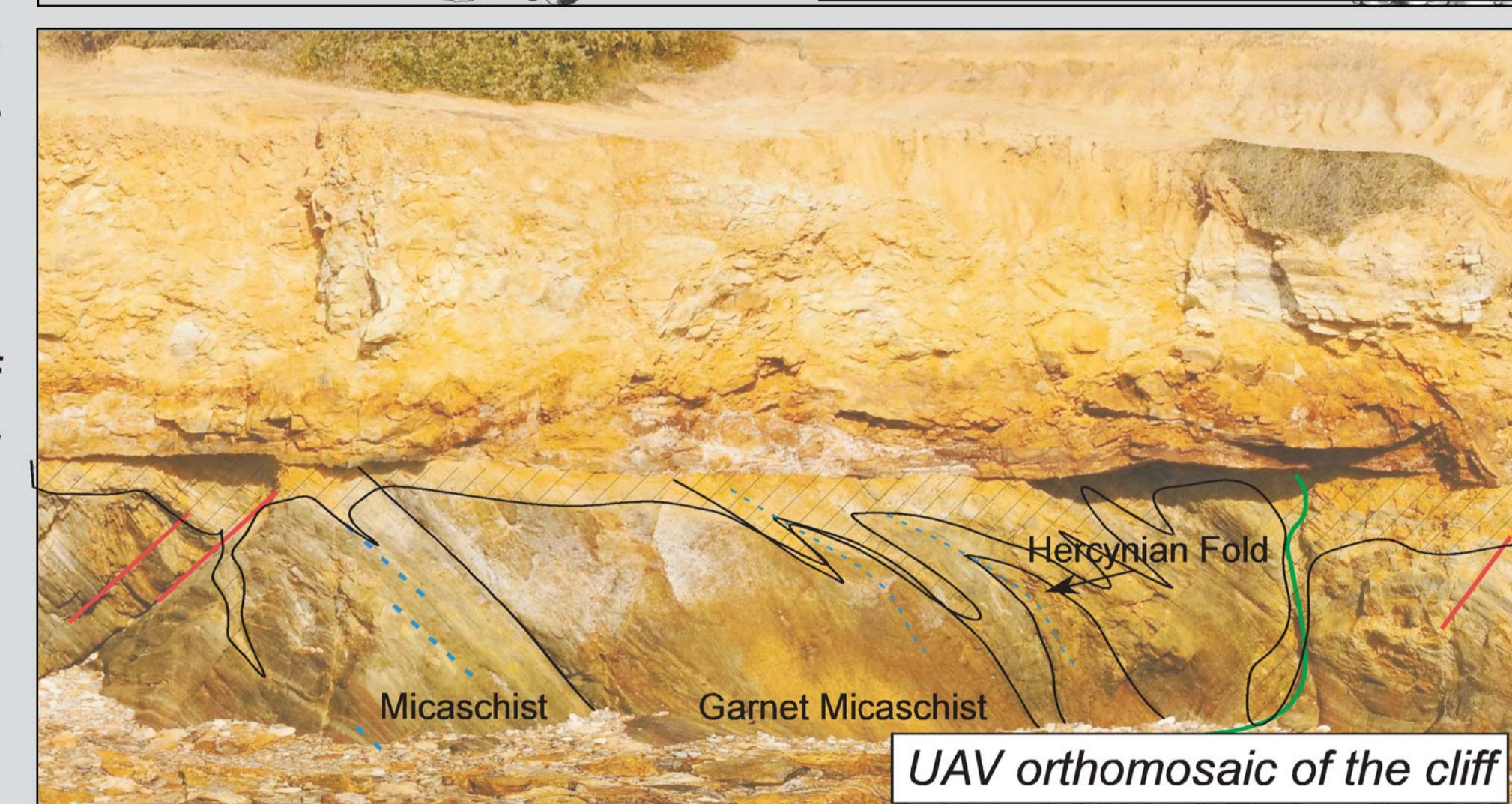
have been accumulated at the foot of the cliff. A significant part have been pushed to the W by waves that are refracted around the rock pile.

### Site 2: Alteration processes

**Hercynian basement :**  
Non altered basement spectra is characterized by the occurrence of a Al-OH phase (Muscovite or slightly altered albite).  
The alteration zone follows the unconformity, late Hercynian faults and foliation. SWIR spectra are compatible with kaolinite and a Fe-OH phase (Fe-Chlorite or Jarosite).



**Aquitain basin deposits :**  
Clay present in the first m of deposits are kaolinite. They are progressively replaced by Montmorillonite to the top of the cliff.



## Concluding remarks

Building and collapse of coastal arches of the Pointe du Payré area is promoted by processes related to late Hercynian tectonics and Late Jurassic fluid event affecting rocks in different ways:

- the Aquitain b. deposits undergoes hardening processes (i.e. silicification), following the first meter of the series.
- the Hercynian basement are softened (i.e. altered) below the unconformity and along late Hercynian faults.

The occurrence of several rock piles striking N50 strongly suggests that several arches may have been build and have collapsed. The combination of field study with remote sensing methods including LIDAR, UAV and Hyperspectral imaging is a high potential approach for better understanding the links between geological heritage and coastal morphology.

