



**LA BORDURE NORD DE LA PLAQUE IBÉRIQUE À L'ALBO-CÉNOMANIEN  
ARCHITECTURE D'UNE MARGE PASSIVE DE TYPE DUCTILE  
(CHAINONS BÉARNAIS, PYRÉNÉES OCCIDENTALES)**

Thèse financée par le Programme RGF Pyrénées,  
BRGM

**Benjamin CORRE**

Sous la direction de : LAGABRIELLE Yves (Géosciences Rennes) et LABAUME Pierre (Géosciences Montpellier)

*Soutenue à Géosciences Rennes le 1<sup>er</sup> décembre 2017*

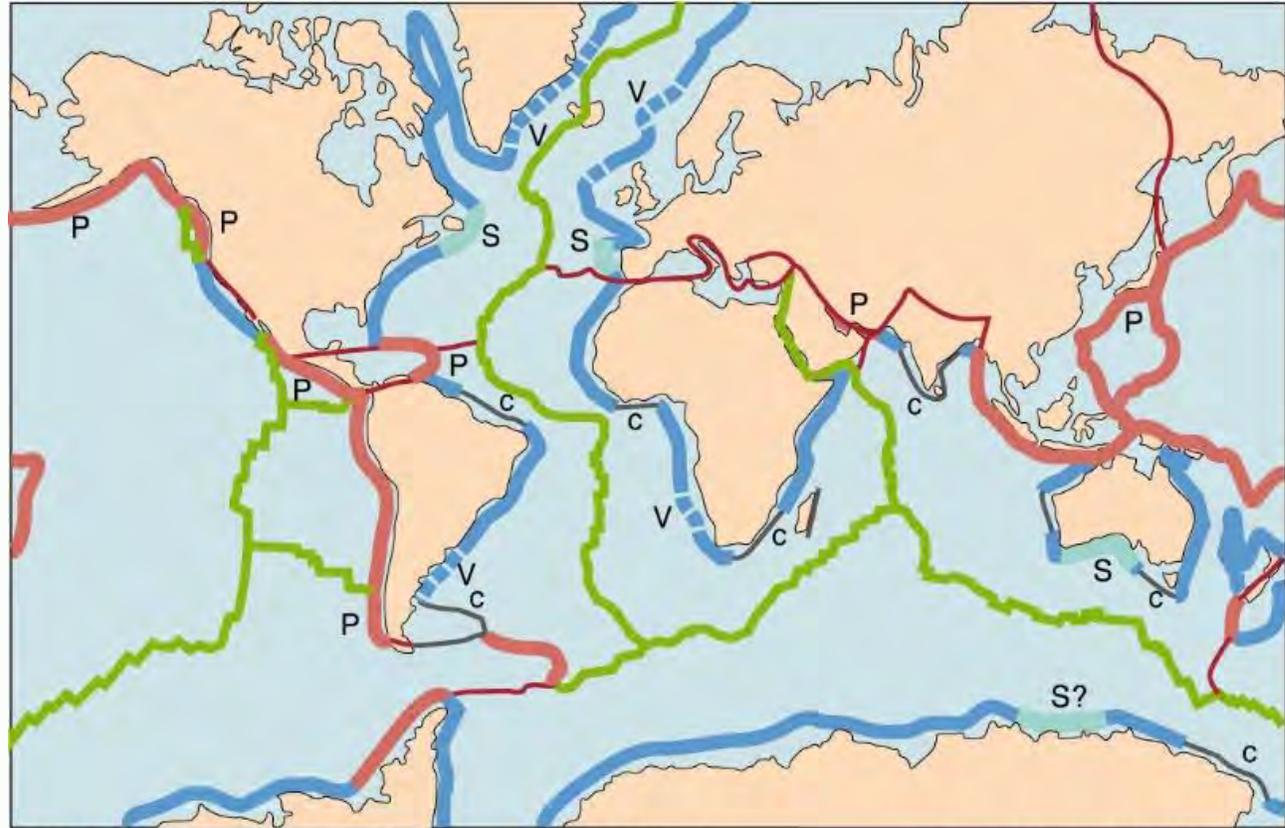




# Partie I

## INTRODUCTION

## Qu'est-ce qu'une marge continentale passive?



### Marges passives de divergence

- type non volcanique
- type volcanique
- avec dénudation du manteau

### Marges passives de coulissement

### Marges actives

-  sans prisme d'accrétion
-  V (érosion tectonique possible)
-  S en accrétion tectonique
-  C (avec prisme d'accrétion)

### Axes des dorsales océaniques

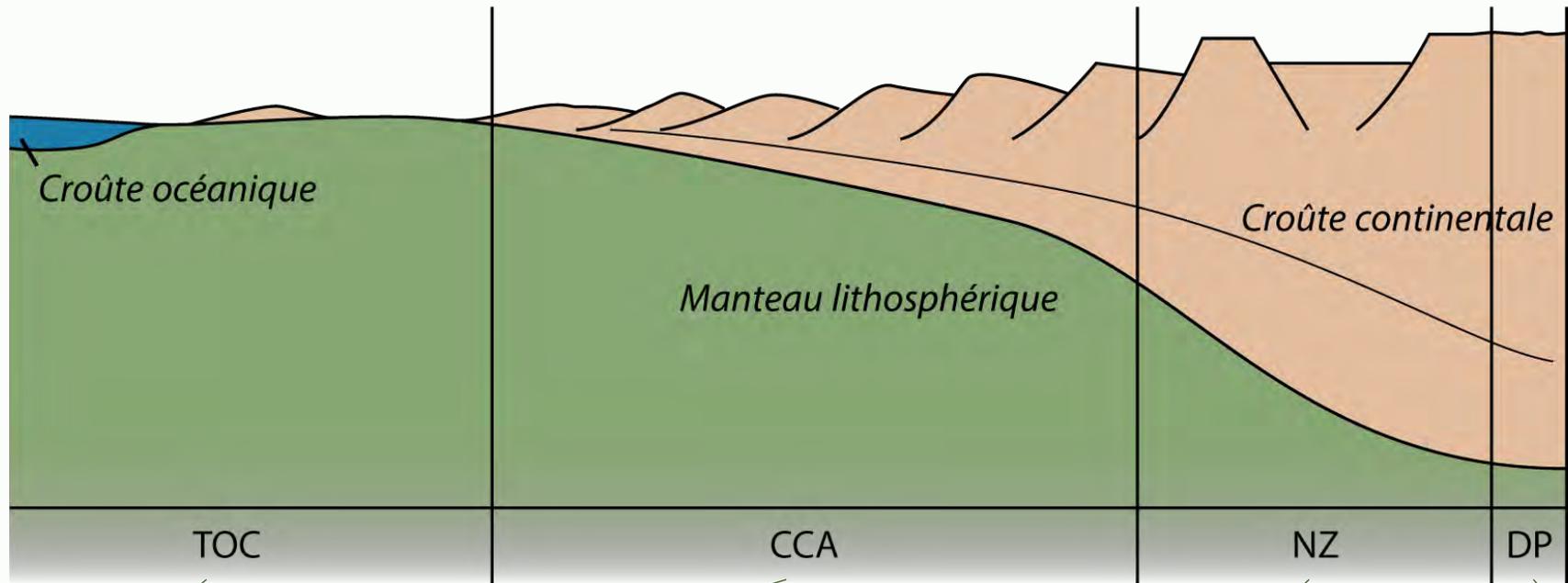
-  P
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## Diversité des marges continentales passives

:

- Marges passives non-volcaniques
- Marges passives volcaniques
- Marges passives à manteau exhumé

# Qu'est-ce qu'une marge continentale passive?



TOC

CCA

NZ

DP

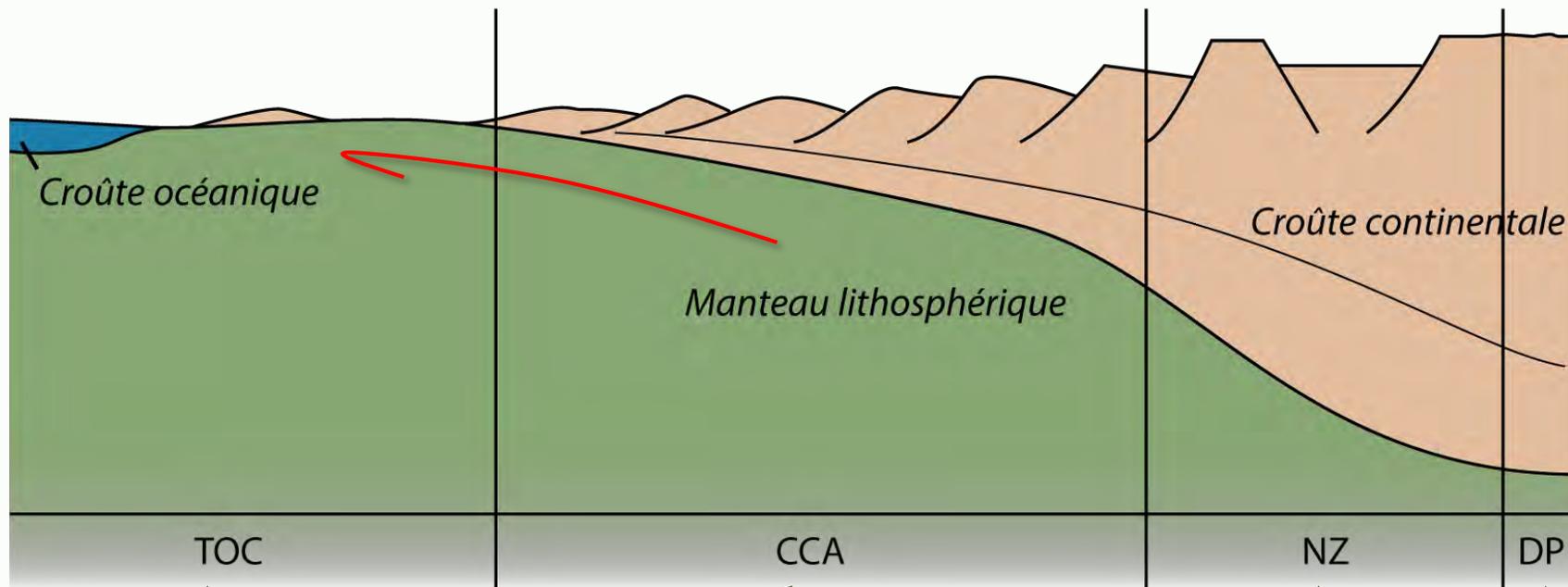
**Croûte Continentale Amincie**

**Domaine Proximal**  
(croûte continentale normale)

**Transition Océan-Continent**  
(zone à manteau exhumé)

**Necking Zone**  
(zone d'étranglement)

# Qu'est-ce qu'une marge continentale passive?



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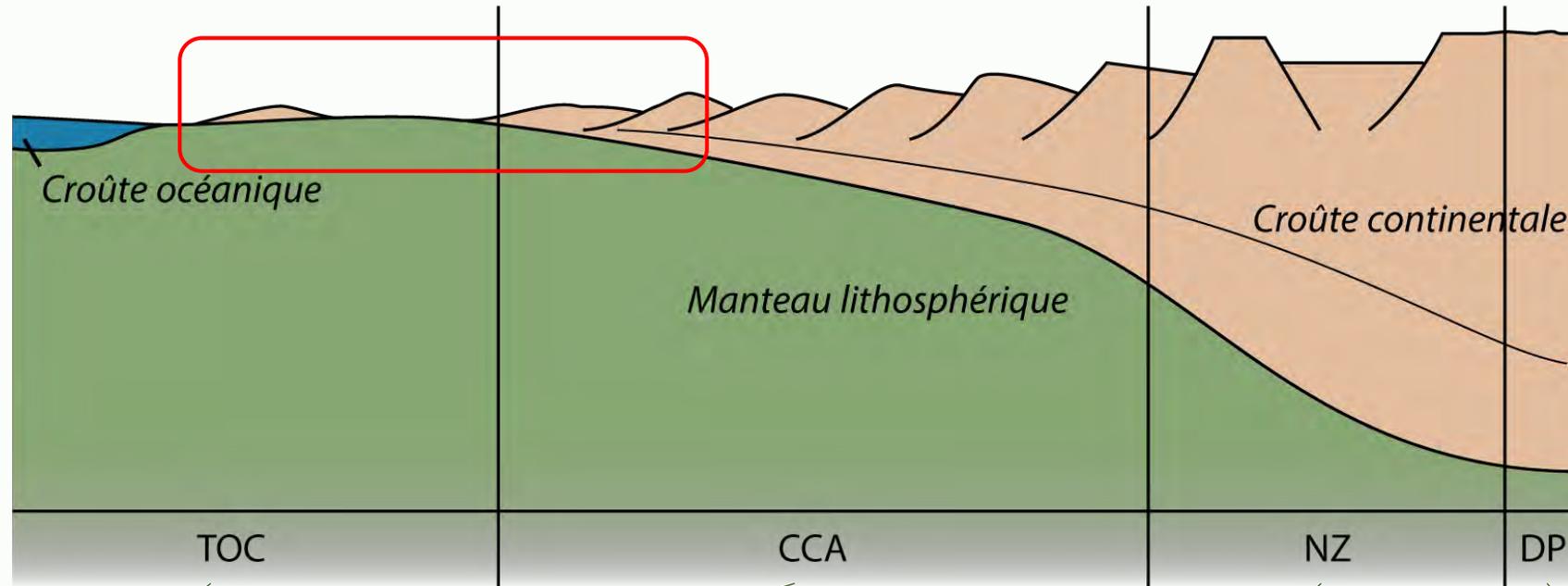
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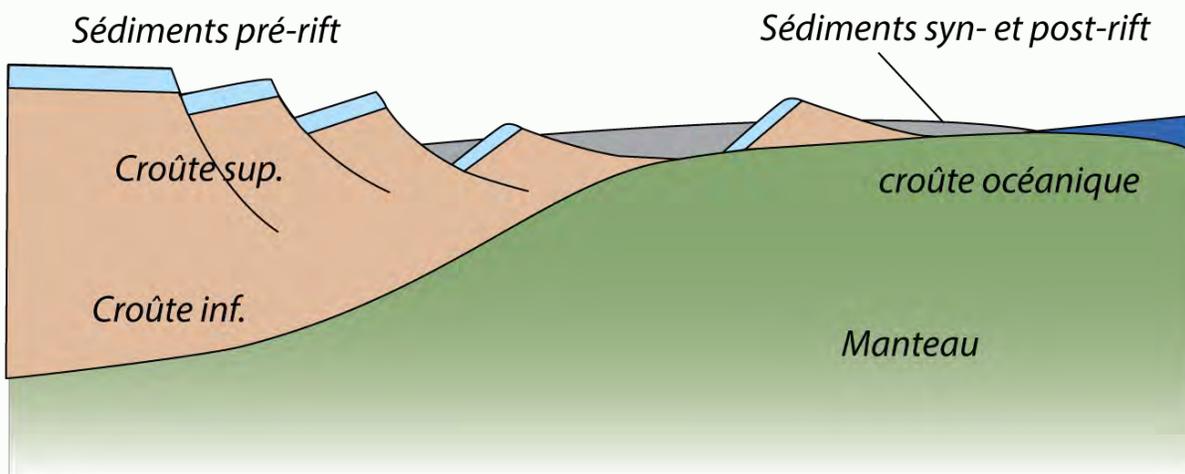
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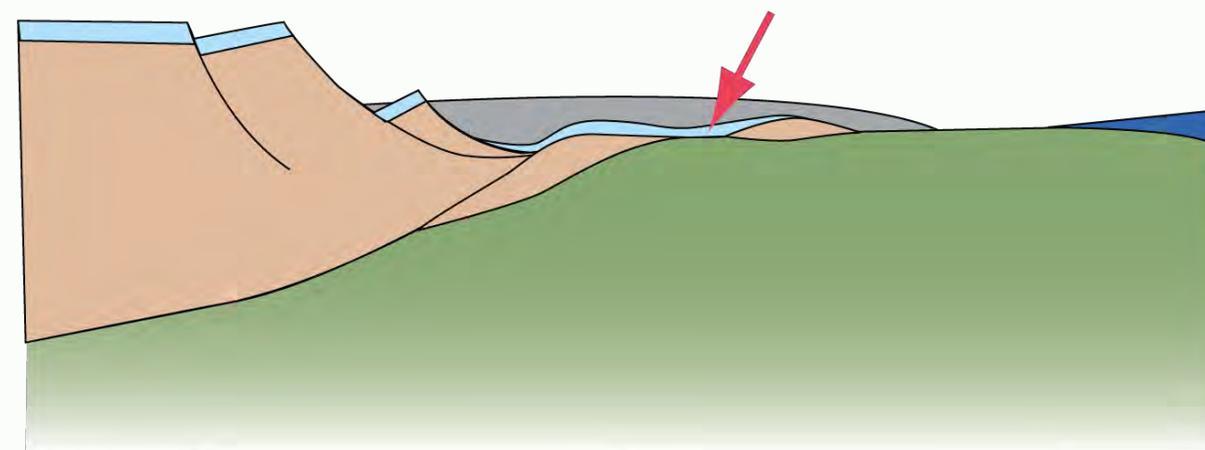
## Problématique



*Clerc & Lagabrielle, 2014*

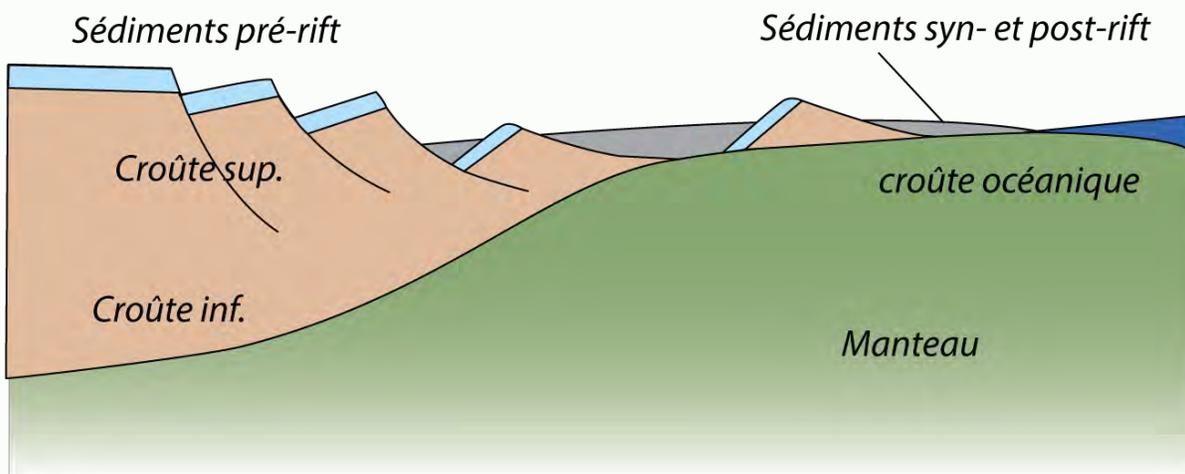
Marge continentale passive «**froide**»  
(basée sur des études des Alpes et de la marge  
Ibérique)

Marge continentale passive  
«**chaude/ductile**»  
(basée sur des études des Pyrénées)



*Clerc & Lagabrielle, 2014*

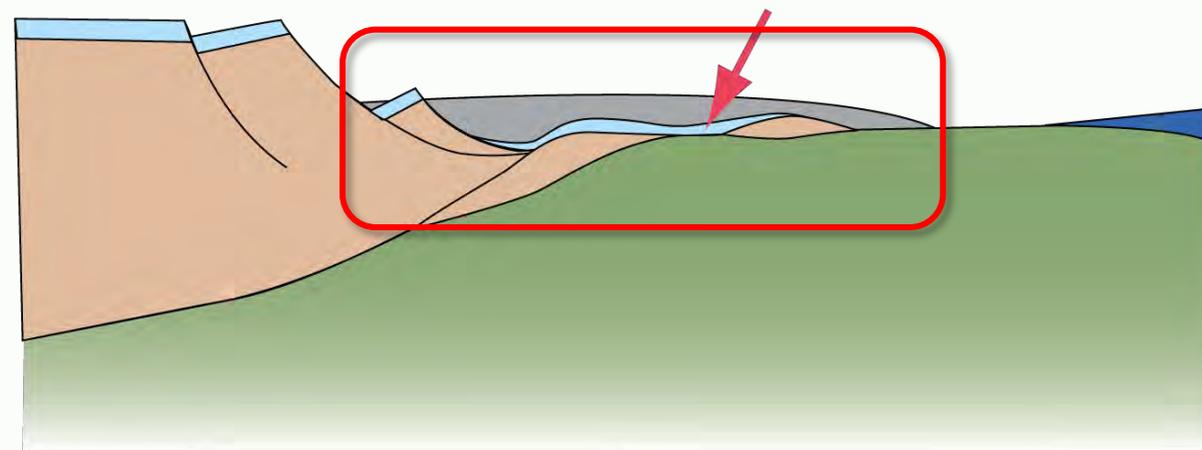
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*Clerc & Lagabrielle, 2014*

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*Clerc & Lagabrielle, 2014*

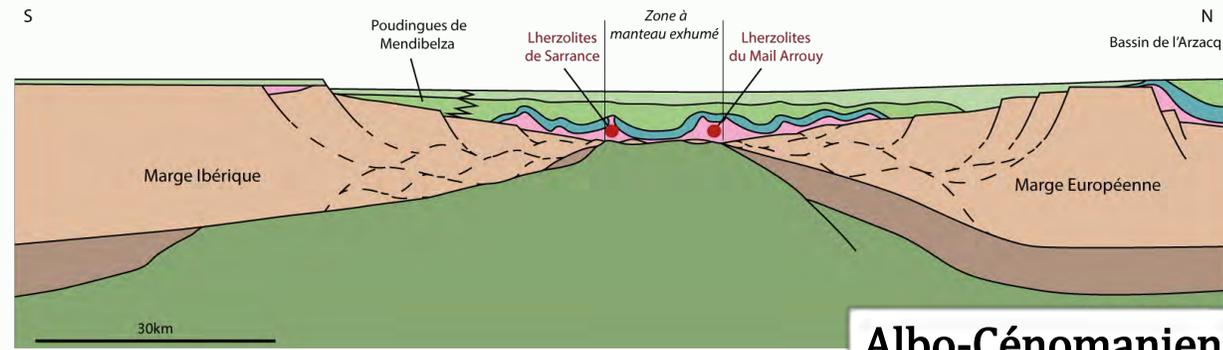
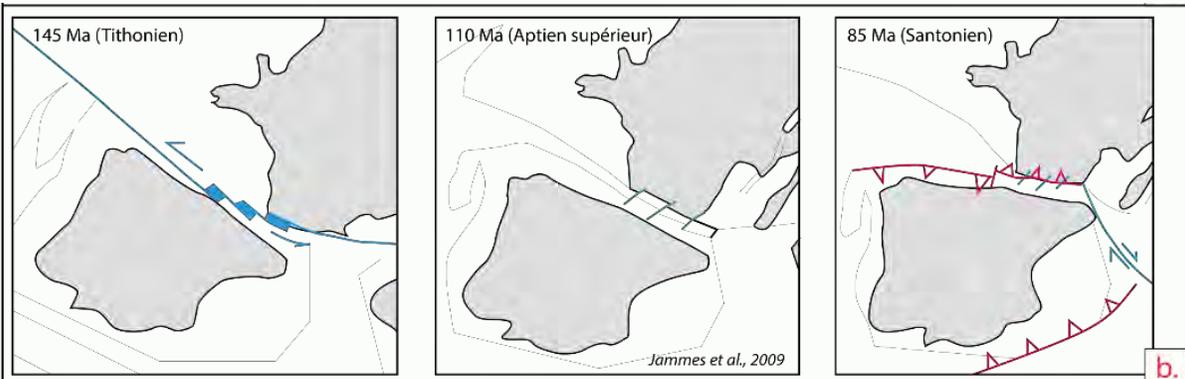
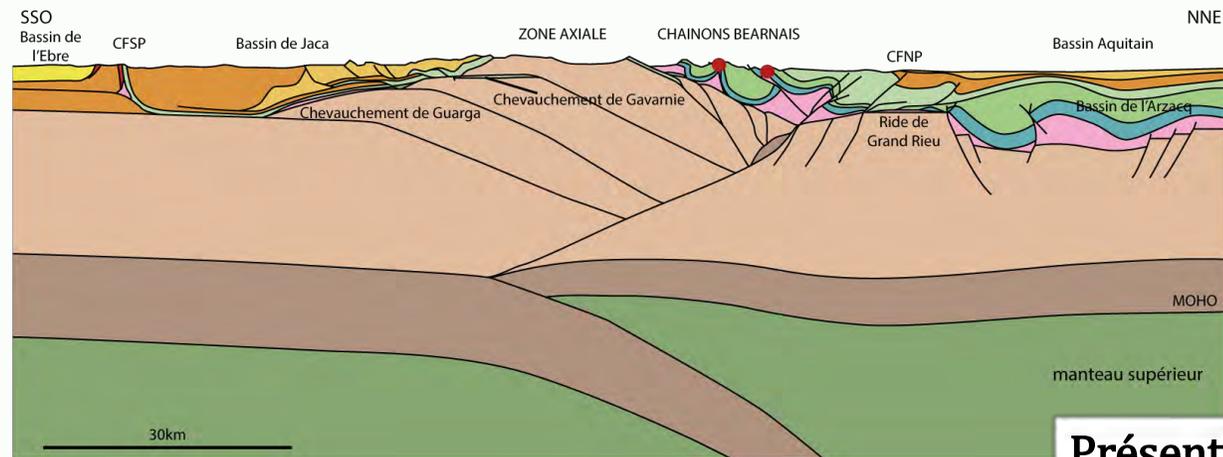
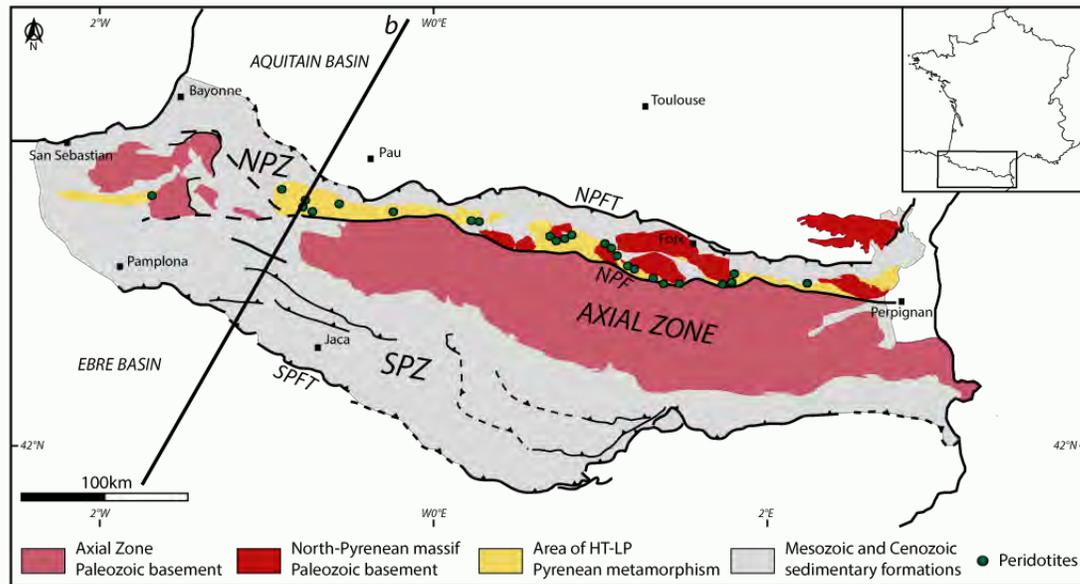


## Partie II

# CONTEXTE GEOLOGIQUE

## Les Pyrénées et les Chaînon Bérarnais

# Les Pyrénées et la Zone Nord Pyrénéenne

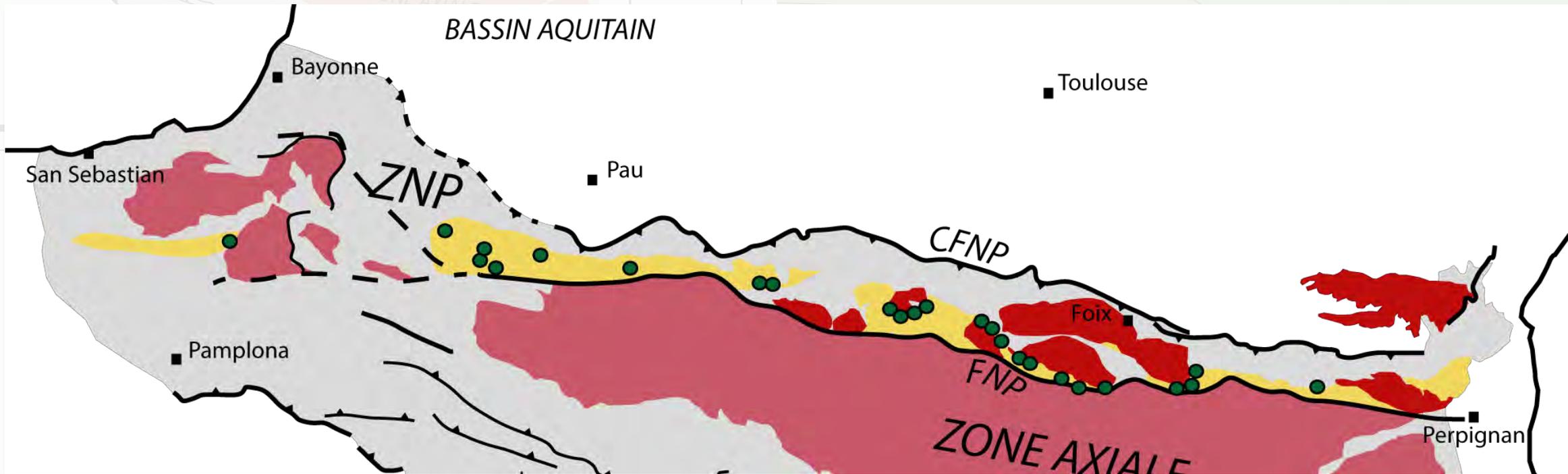


- Molasse Oligacène sup.-Miocène
- Molasse Eocène sup.-Oligocène inf.
- Calcaire et flysch Eocène
- Crétacé supérieur
- Crétacé inférieur
- Jurassique
- Trias supérieur (Keuper)
- Croûte supérieure et Trias inf. et Moy.
- Croûte inférieure

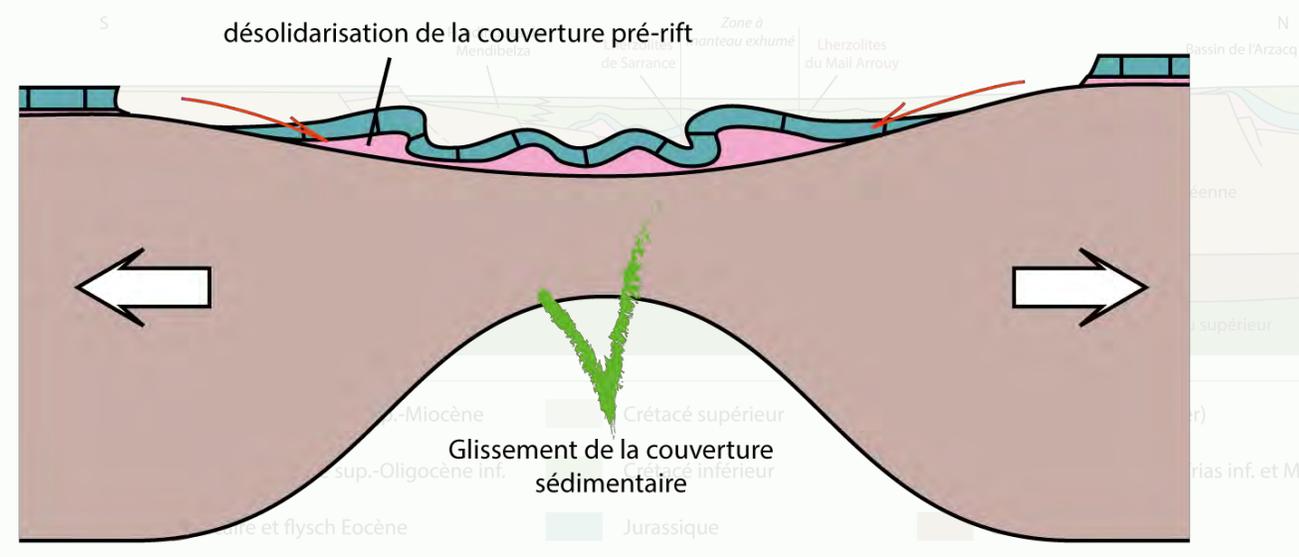
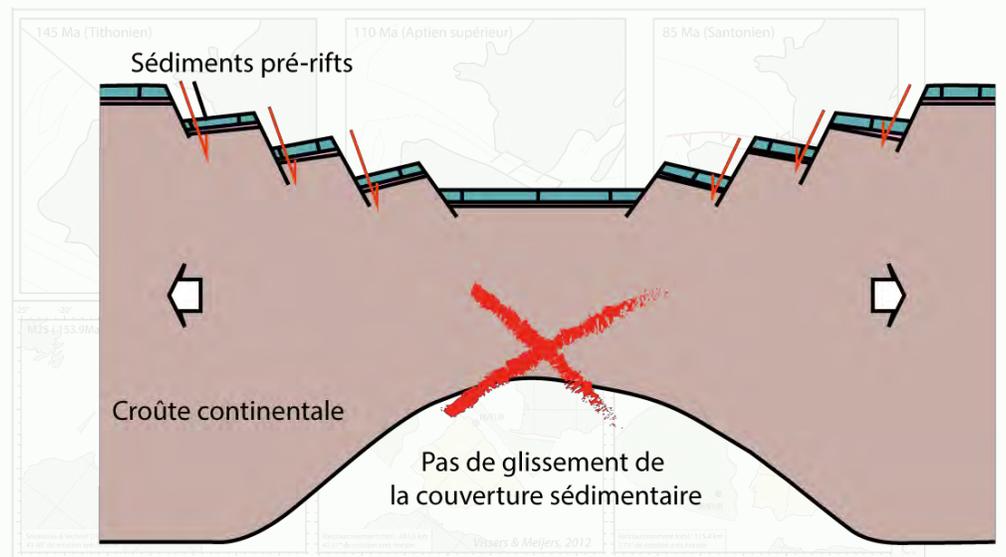
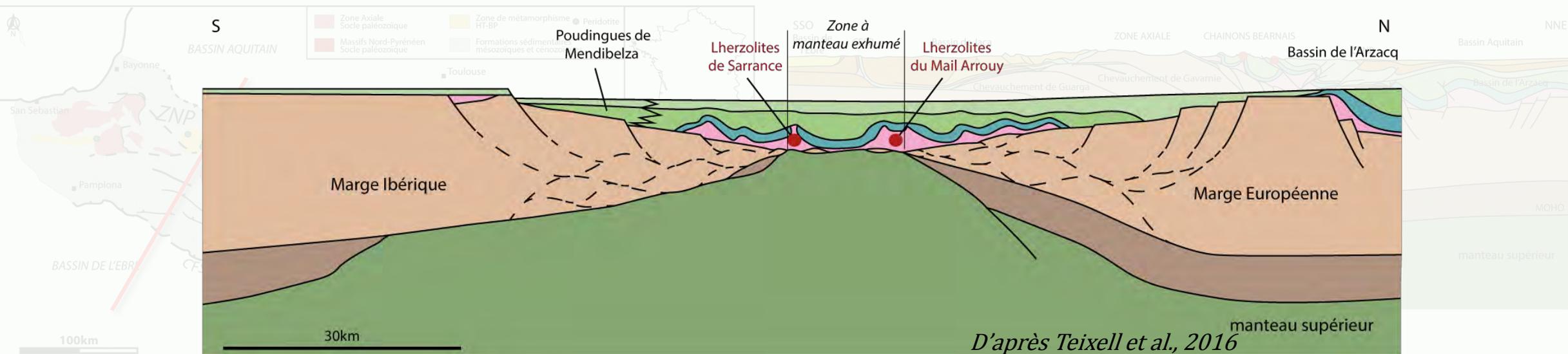
D'après Teixell et al., 201

# La Zone Nord Pyrénéenne

## Plus de 40 affleurements de manteau

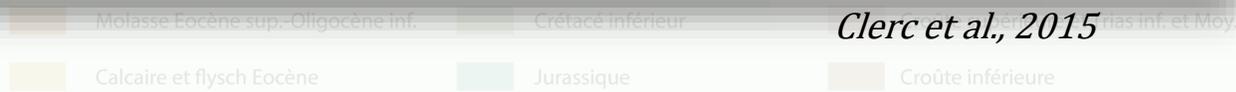
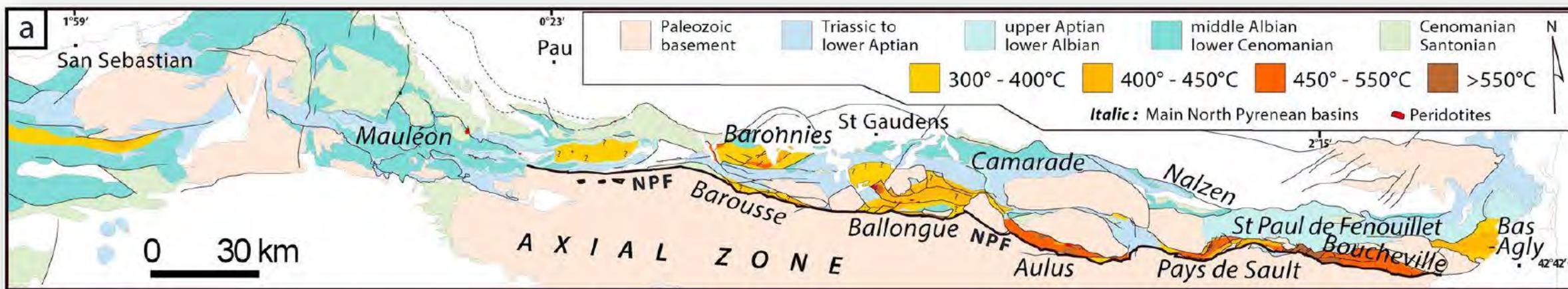
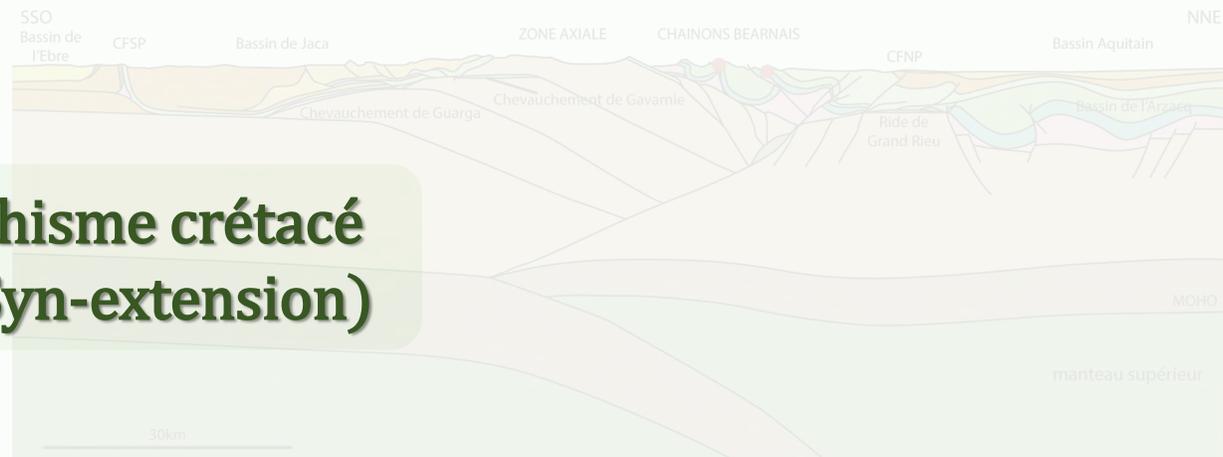
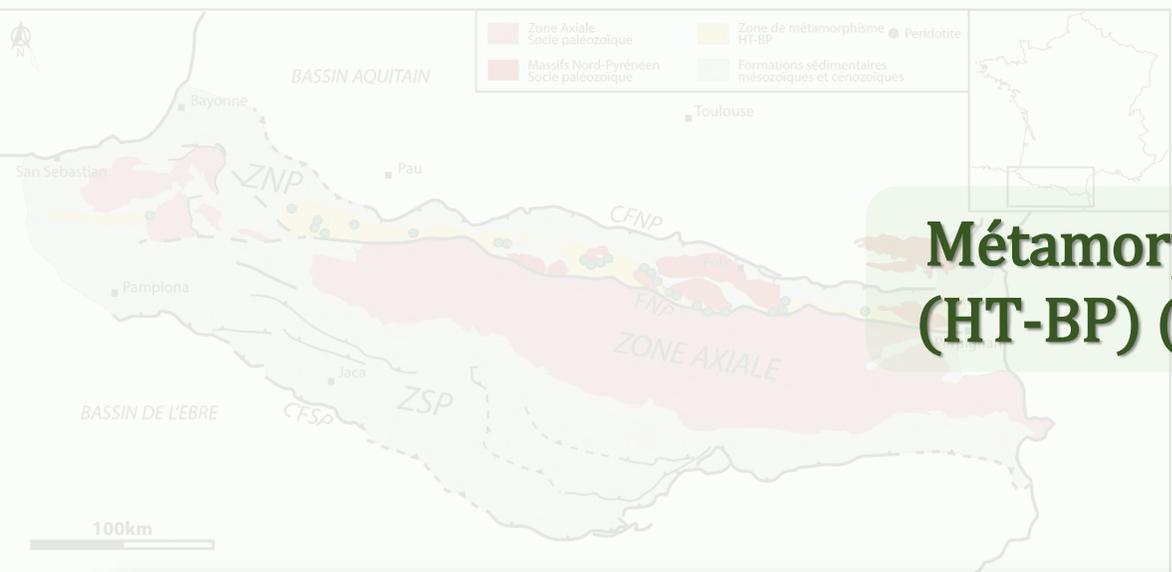


# La Zone Nord Pyrénéenne

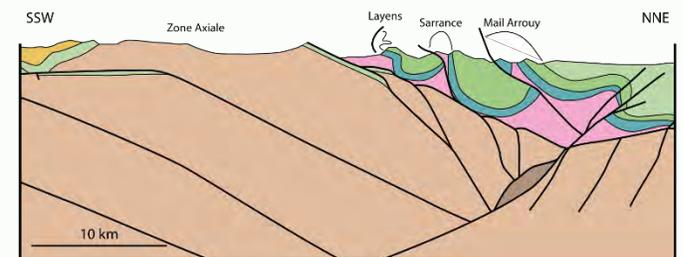
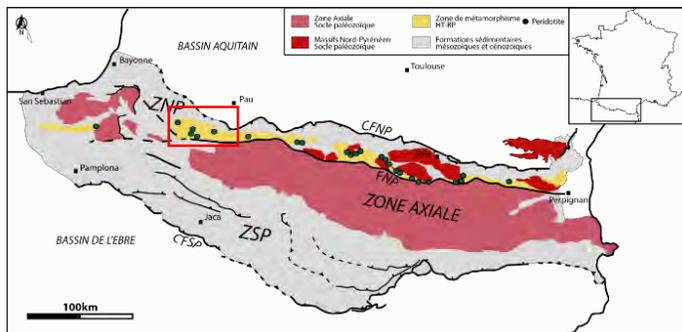


# La Zone Nord Pyrénéenne

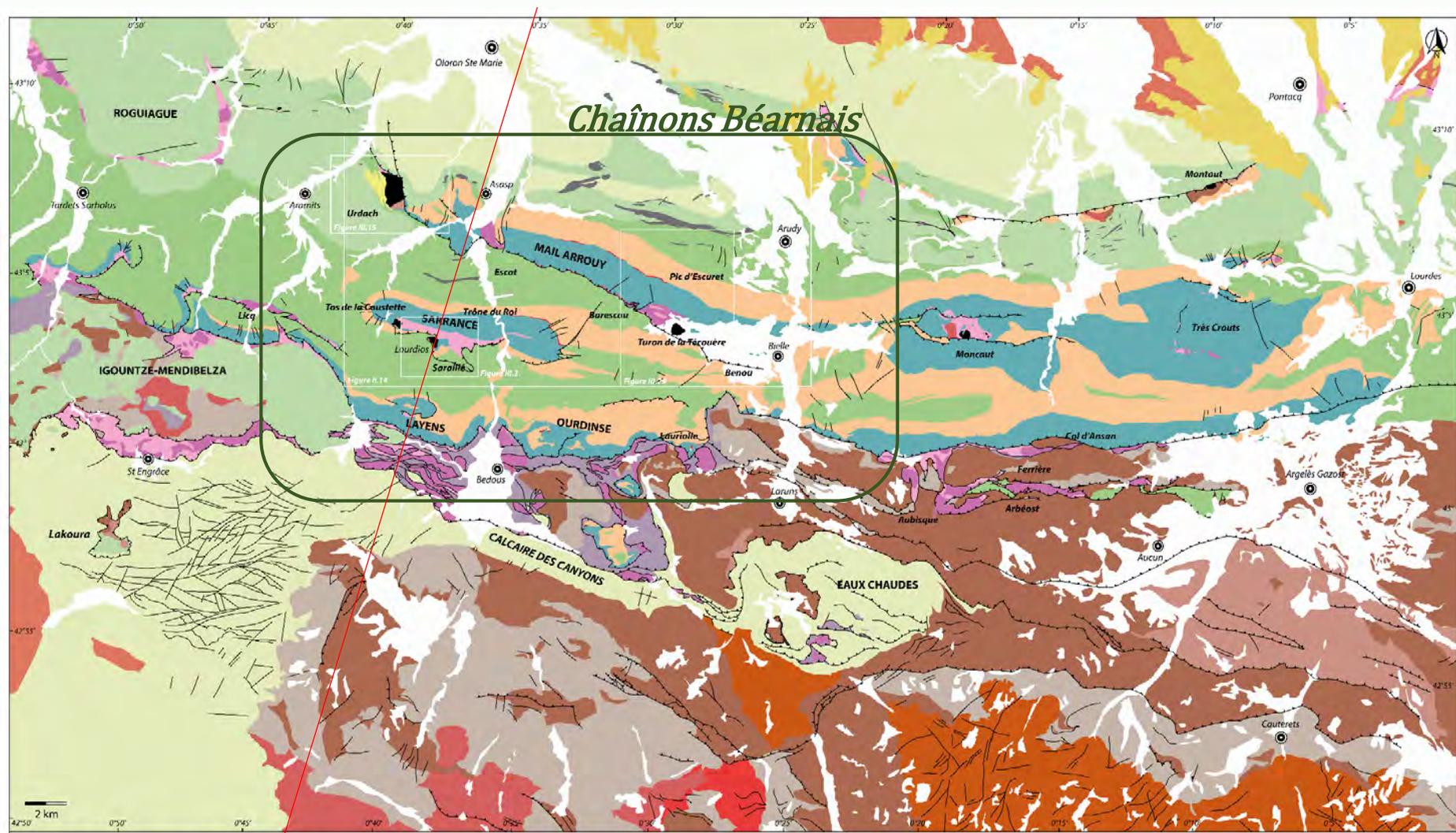
## Métamorphisme crétacé (HT-BP) (Syn-extension)



# Les Pyrénées Occidentales (Chaînon Béarnais)

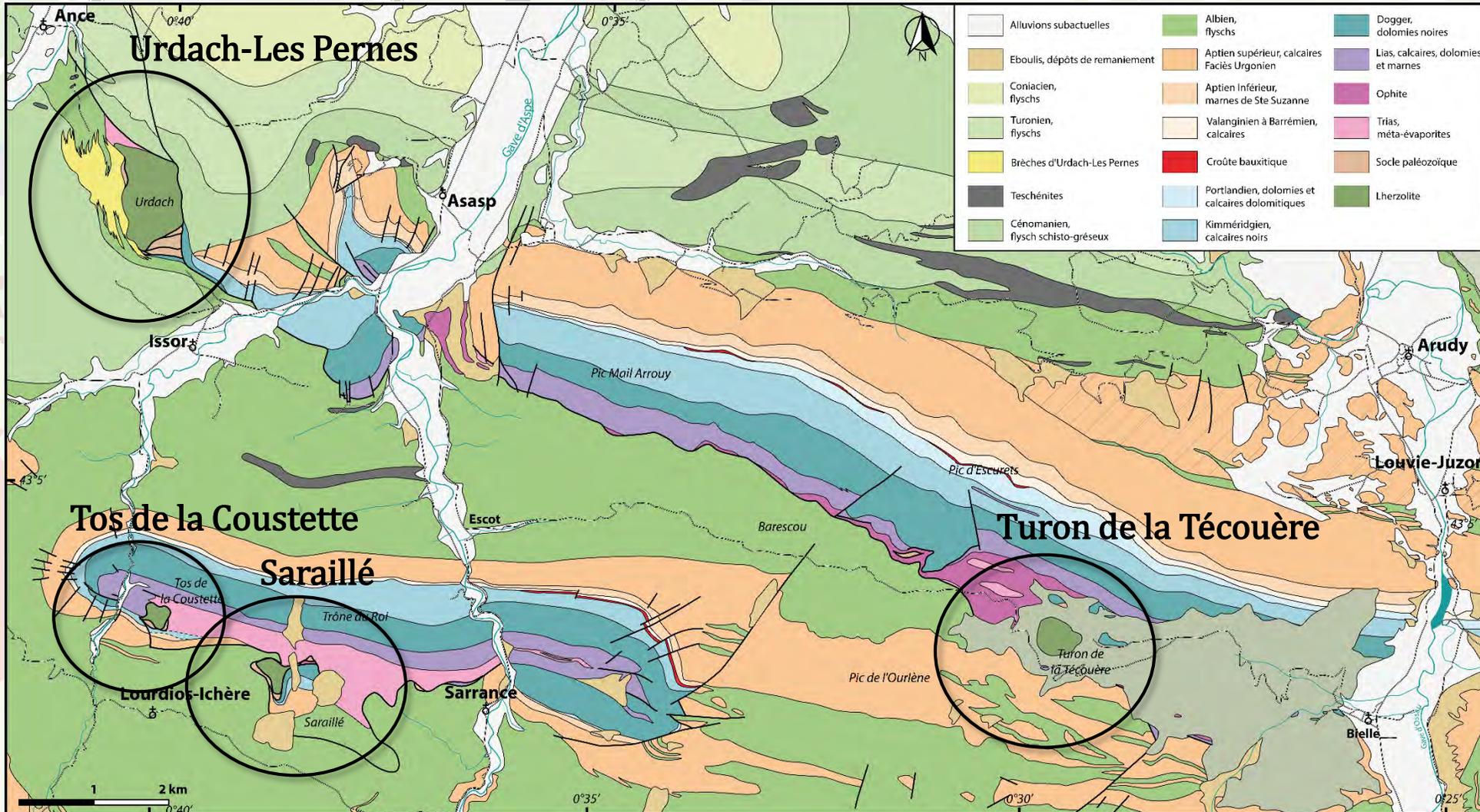


Labaume & Teixell, 2014



Cénozoïque :		Mésozoïque :		Paléozoïque :		Volcanisme et autres :	
Quaternaire	Crétacé Supérieur (Coniacien-Maastrichtien)	Albien	Jurassique (Hettangien-Tithonien)	Permien	Volcanisme Crétacé		
Néogène	Cénomano-Turonien	Crétacé Inférieur (Berriasien-Aptien)	Trias Supérieur (Keuper)	Carbonifère	Volcanisme Triasique et Permien		
Paléogène	Poudingue de Mendibelza	Bauxite	Trias Moyen et Inférieur (Buntsandstein-Muschelkalk)	Dévonien	Granites		
	Brèche d'Urdach			Silurien	Lherzolite		

# Les Chaînon Béarnais

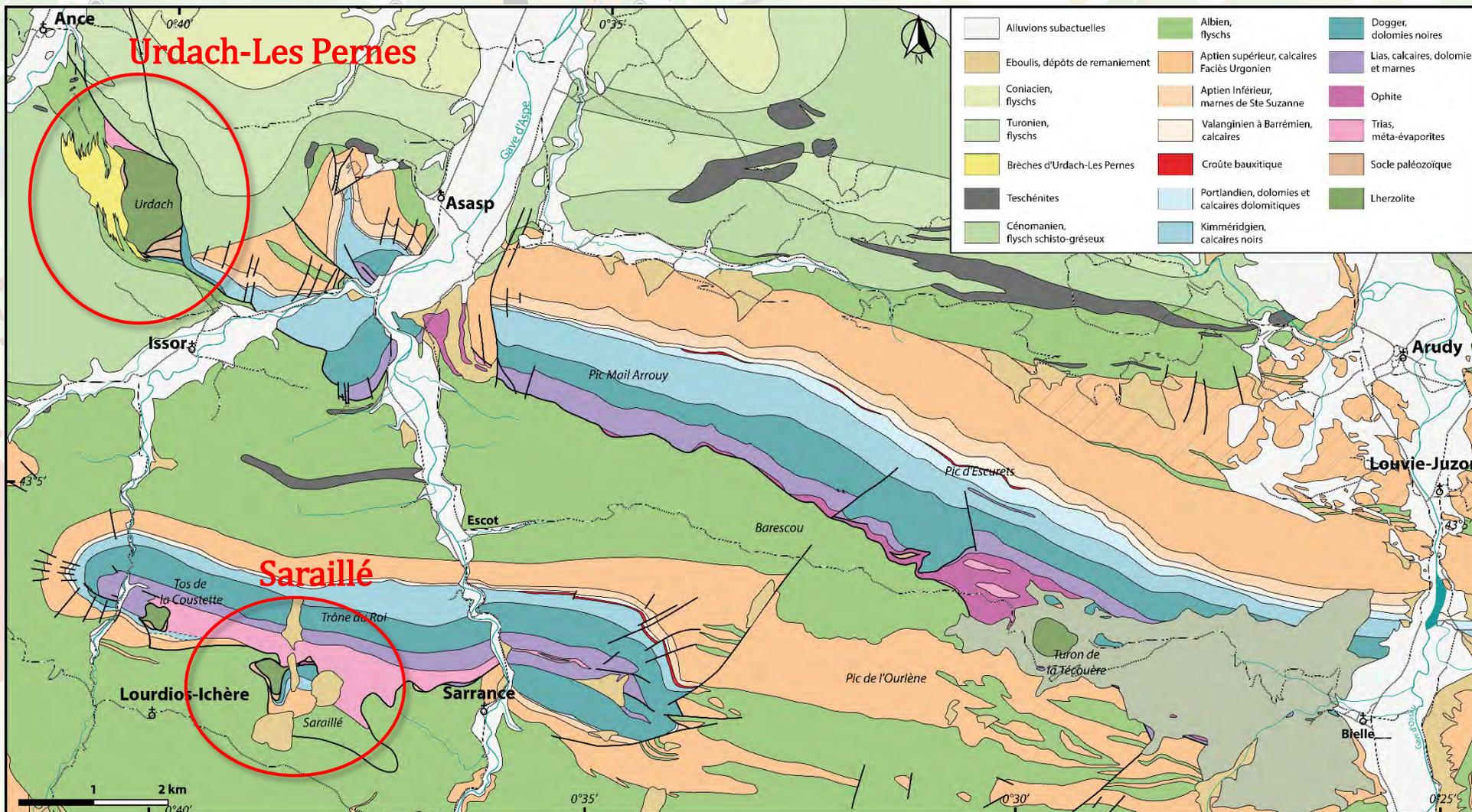


## Affleurements de manteau :

- Mail Arrouy : Urdach-Les Pernes Turon de la Técoùère

- Sarrance : Tos de la Coustette Saraillé

## Les Chaînon Béarnais



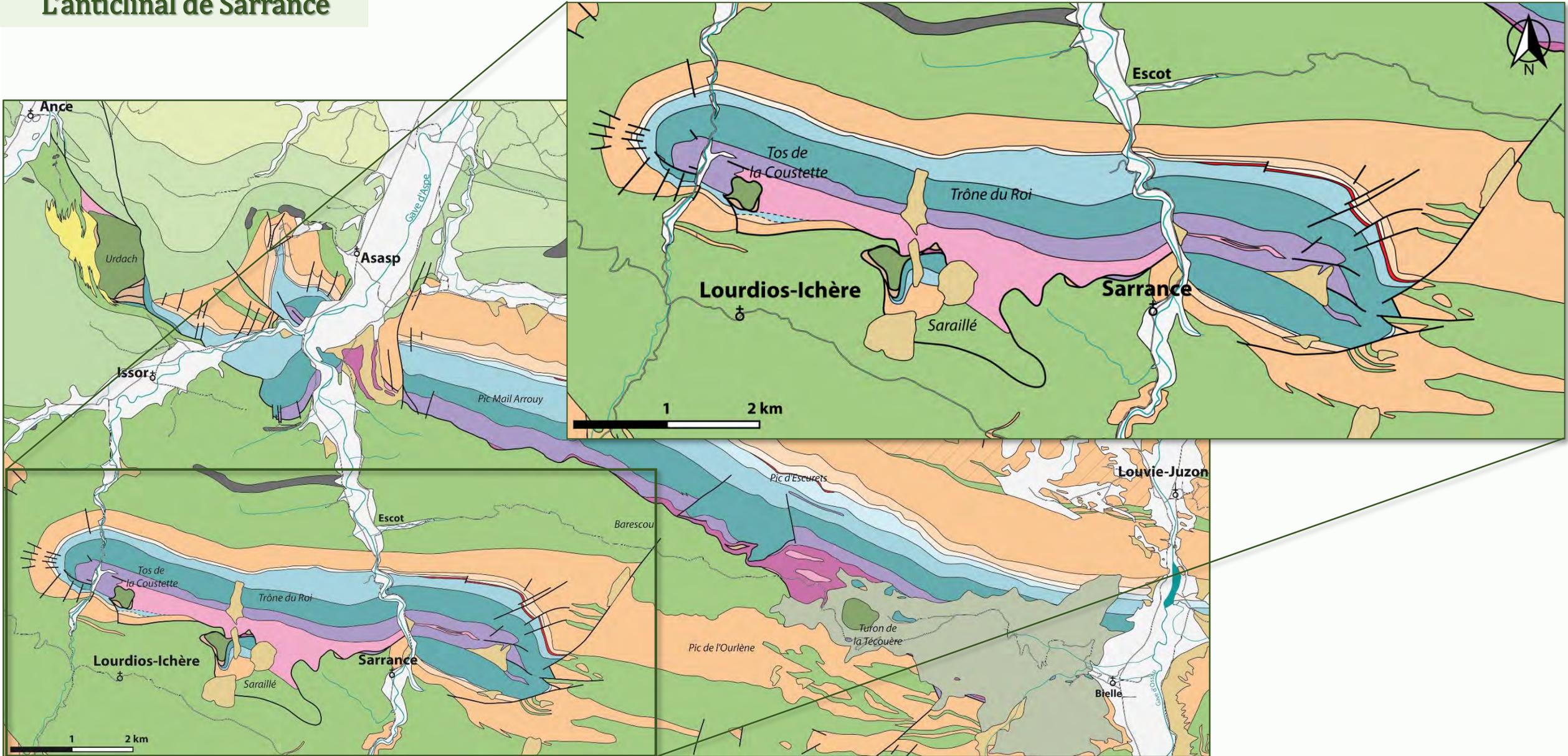
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- Mail Arrouy :  
Urdach-Les Pernes  
Turon de la Técoùère
- Sarrance :  
Tos de la Coustette  
Saraillé

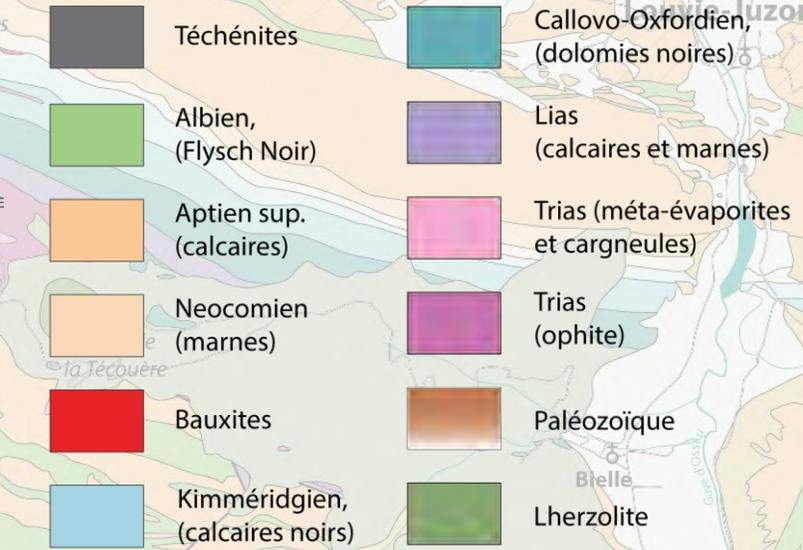
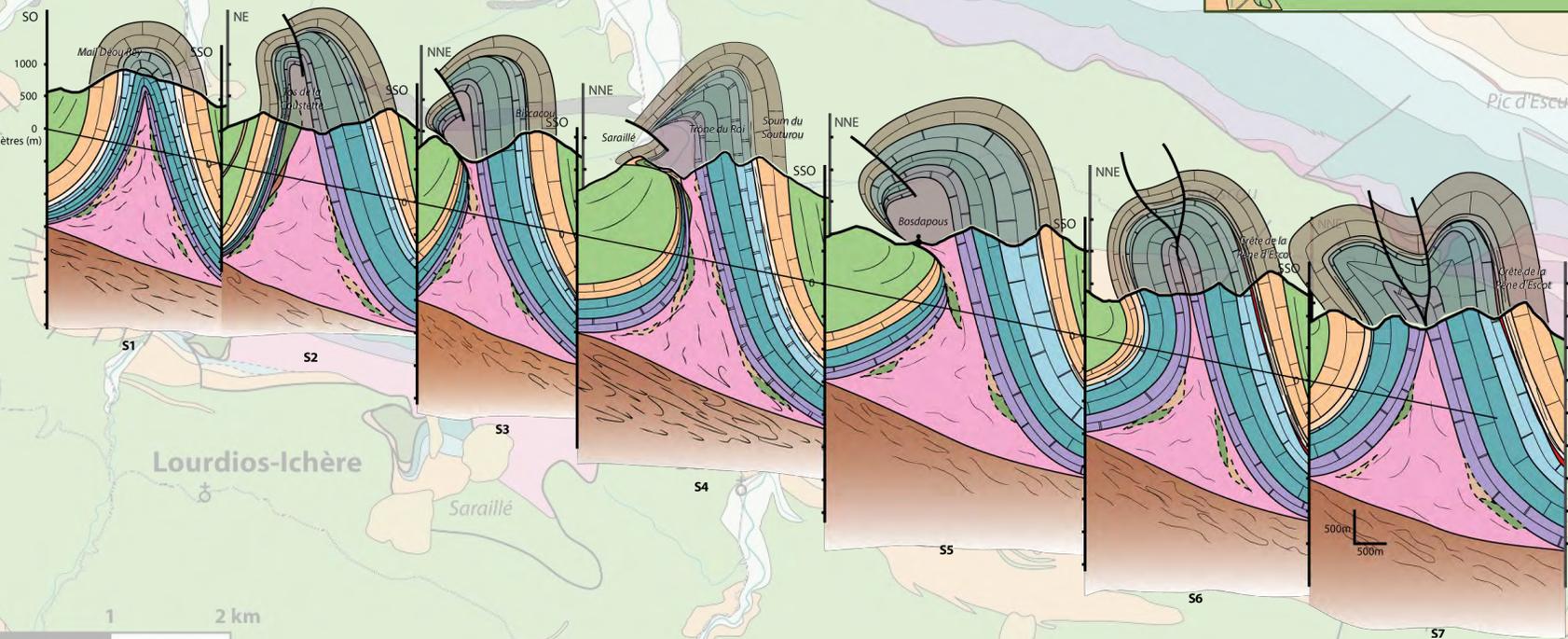
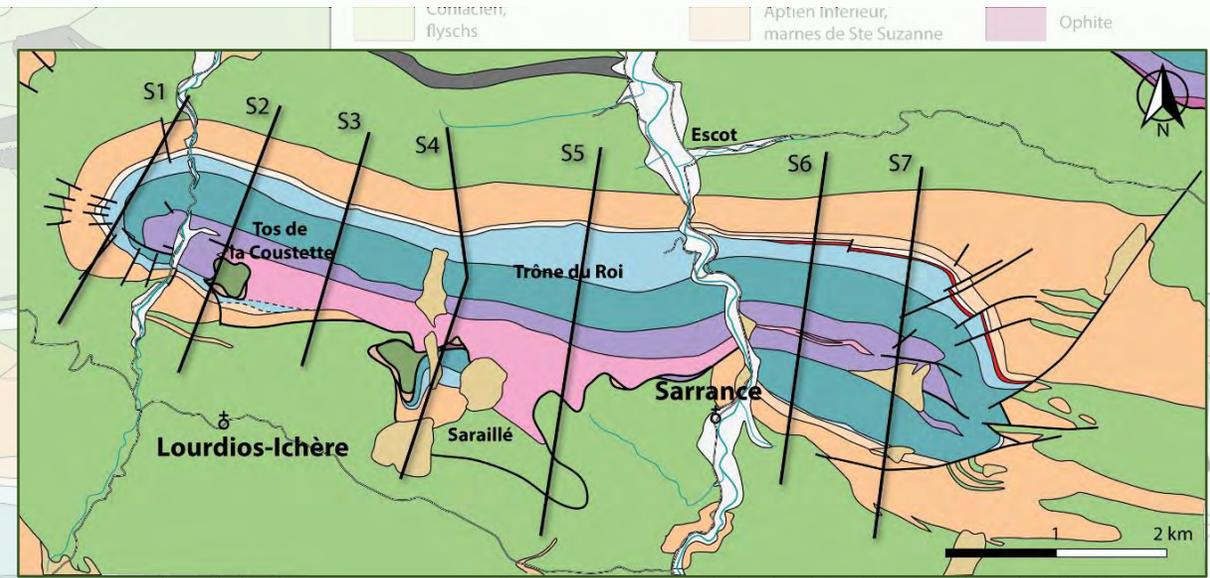
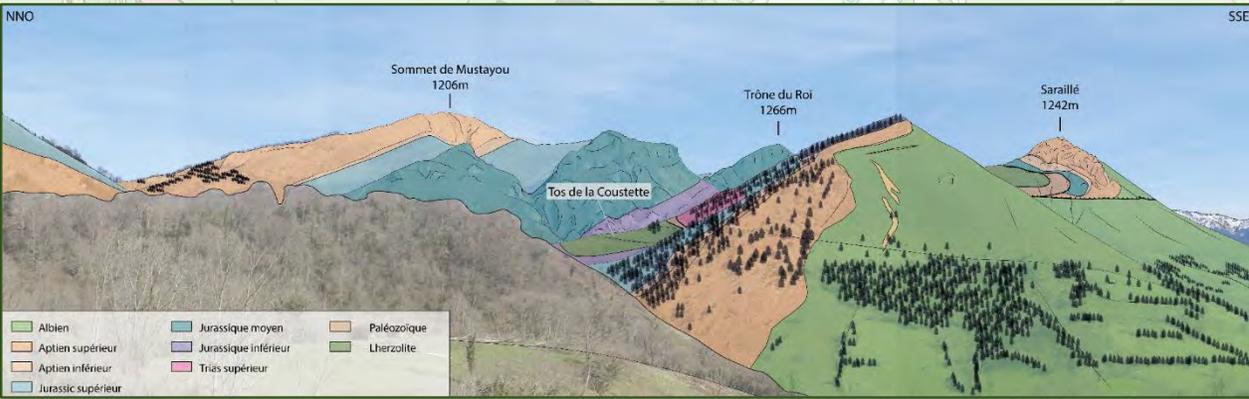


**Partie III**  
**STRUCTURE DE LA PALÉO-MARGE NORD-IBÉRIQUE**  
**ALBO-CÉNOMANIENNE**

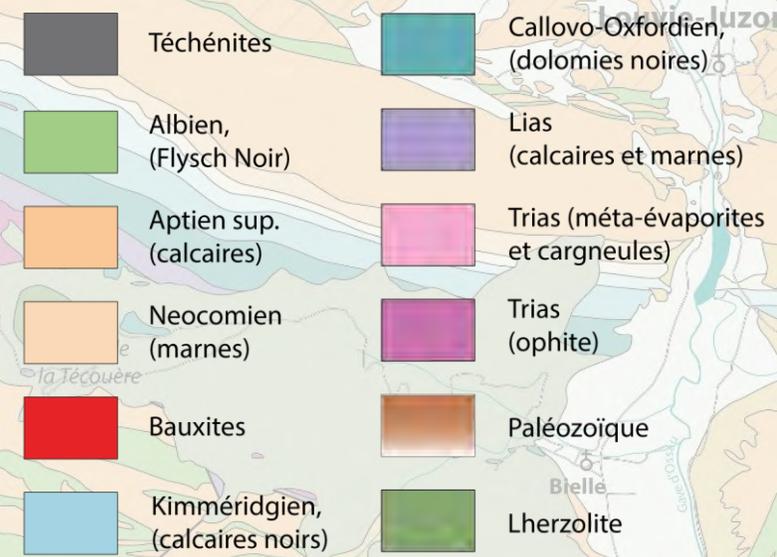
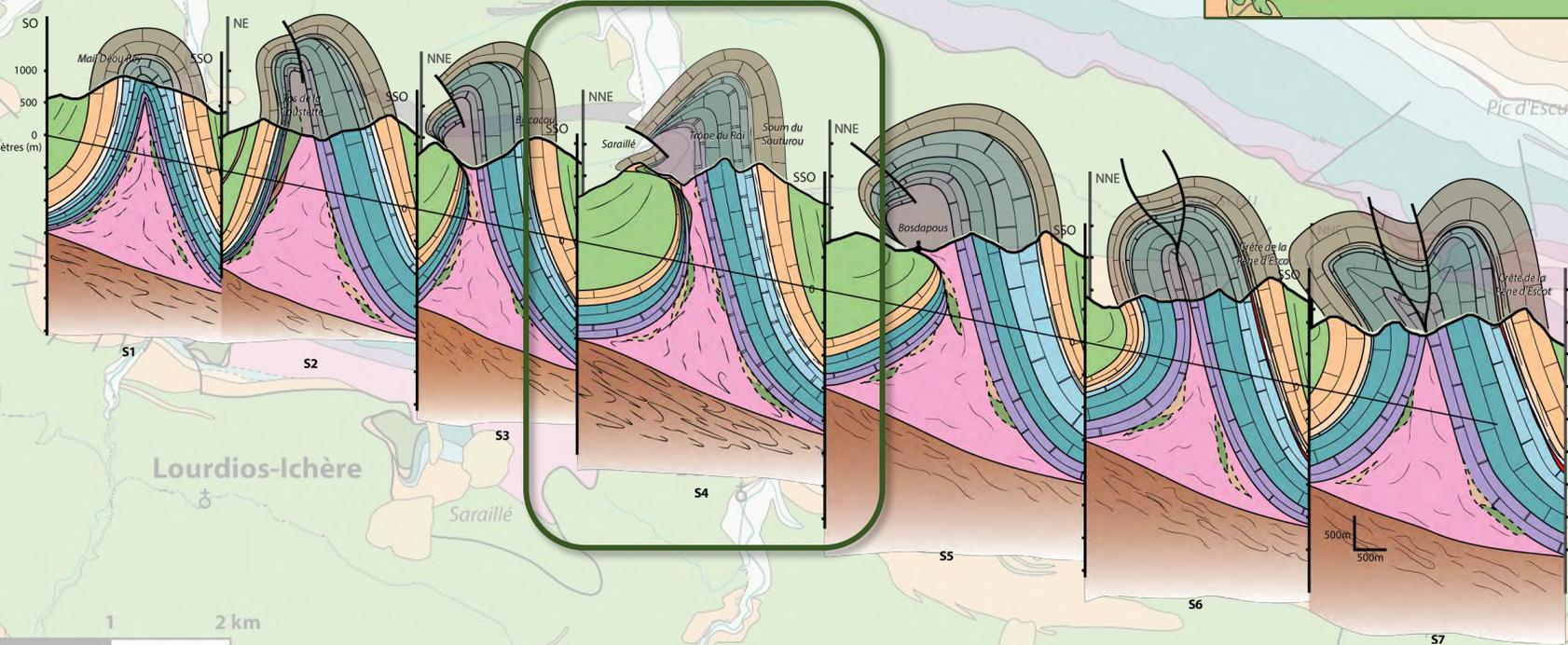
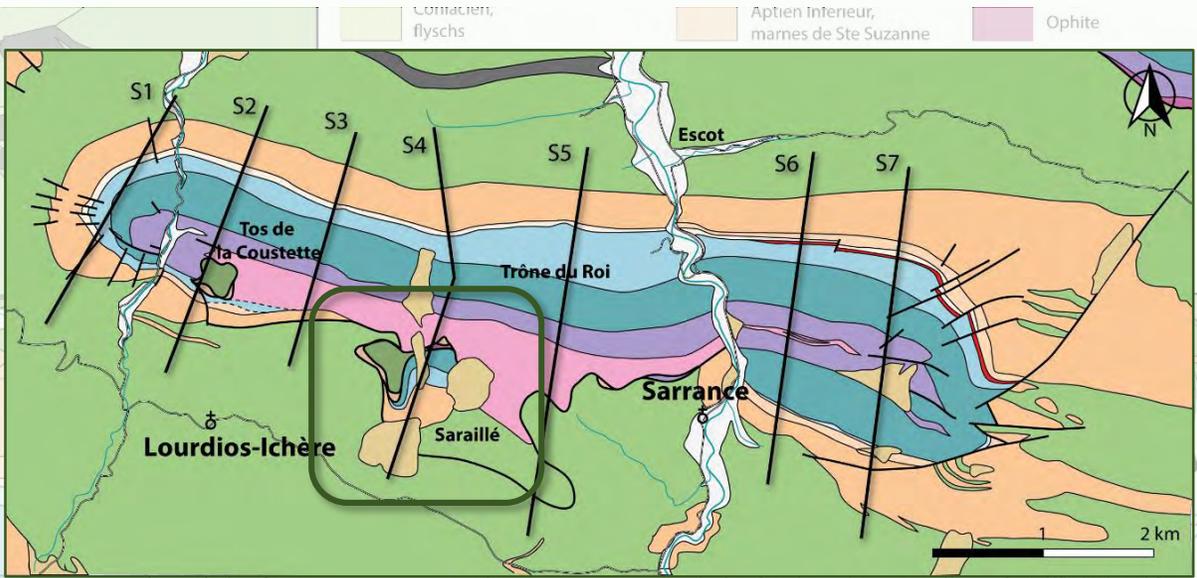
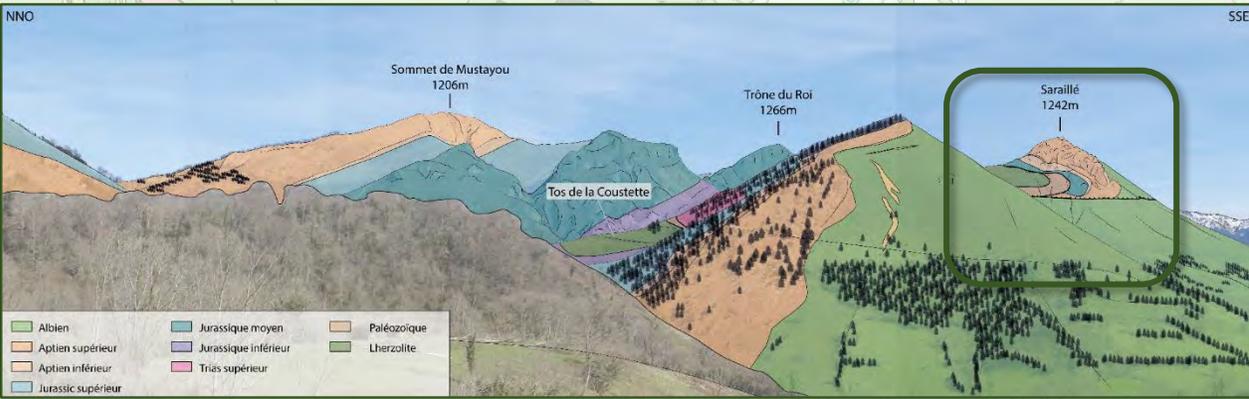
# L'anticlinal de Sarrance



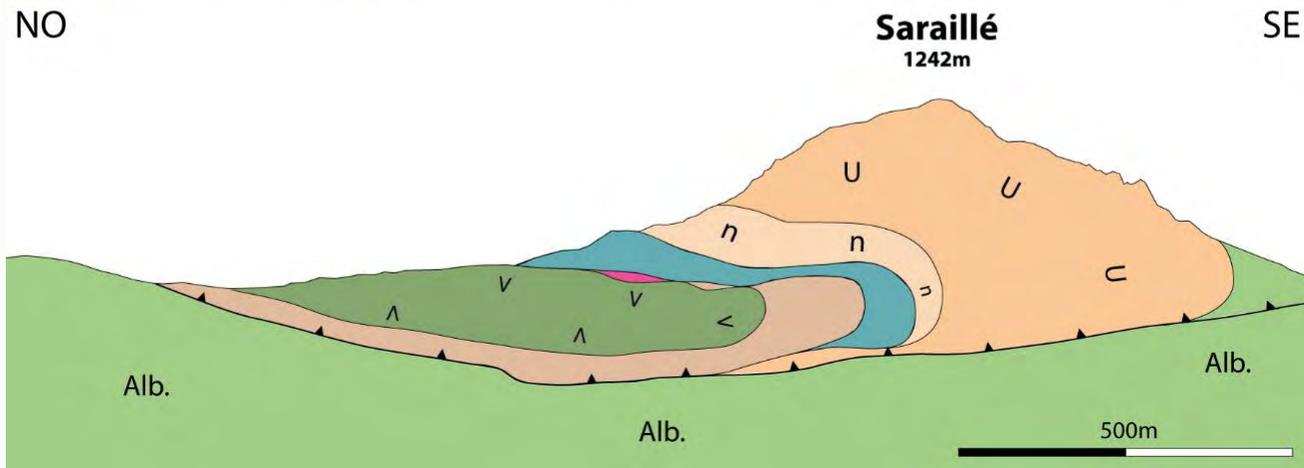
# L'anticlinal de Sarrance



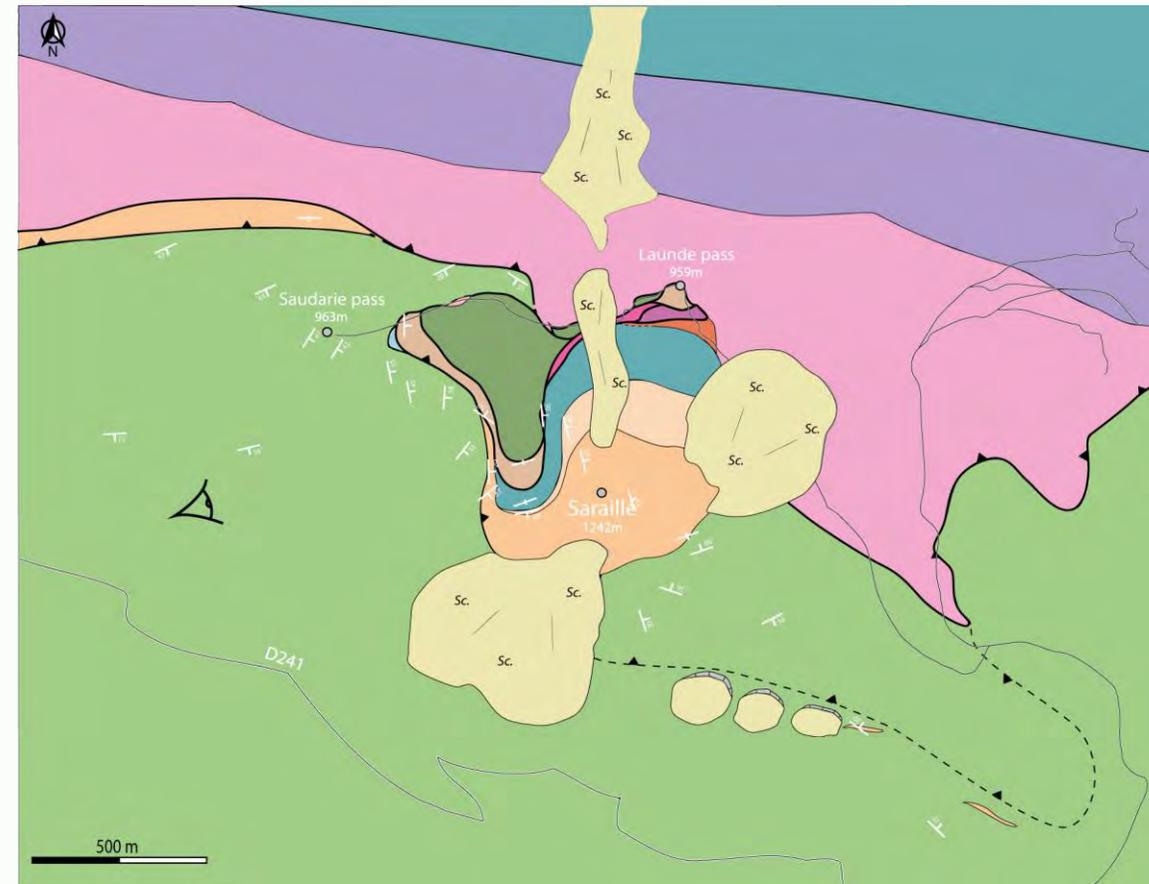
# L'anticlinal de Sarrance



# Le massif du Saraillé



- |   |   |  |
|---|---|--|
| <span style="display:inline-block; width:15px; height:15px; background-color:#90EE90; border:1px solid black;"></span> Albien           | <span style="display:inline-block; width:15px; height:15px; background-color:#ADD8E6; border:1px solid black;"></span> Jurassique moyen     | <span style="display:inline-block; width:15px; height:15px; background-color:#FF69B4; border:1px solid black;"></span> Trias             |
| <span style="display:inline-block; width:15px; height:15px; background-color:#FF8C00; border:1px solid black;"></span> Aptien supérieur | <span style="display:inline-block; width:15px; height:15px; background-color:#20B2AA; border:1px solid black;"></span> Jurassique inférieur | <span style="display:inline-block; width:15px; height:15px; background-color:#A0522D; border:1px solid black;"></span> Socle Paléozoïque |
| <span style="display:inline-block; width:15px; height:15px; background-color:#FFDAB9; border:1px solid black;"></span> Néocomien        | <span style="display:inline-block; width:15px; height:15px; background-color:#8A2BE2; border:1px solid black;"></span> Lias                 | <span style="display:inline-block; width:15px; height:15px; background-color:#90EE90; border:1px solid black;"></span> Lherzolite        |



# Le massif du Sarailé

## Déformation des lentilles de socle paléozoïque

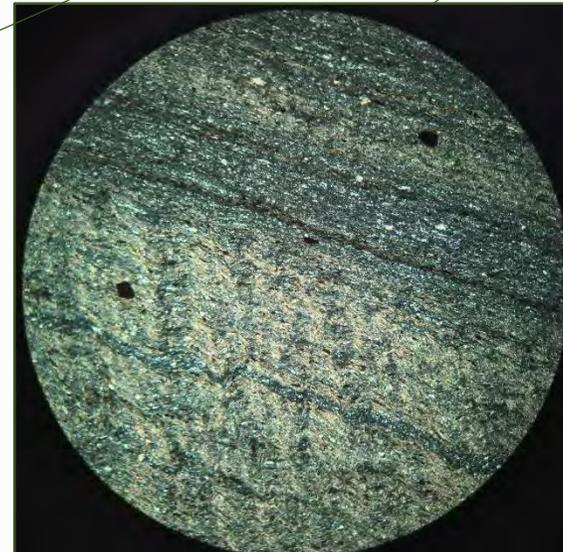
80% de mylonites sur 41 échantillons de socle



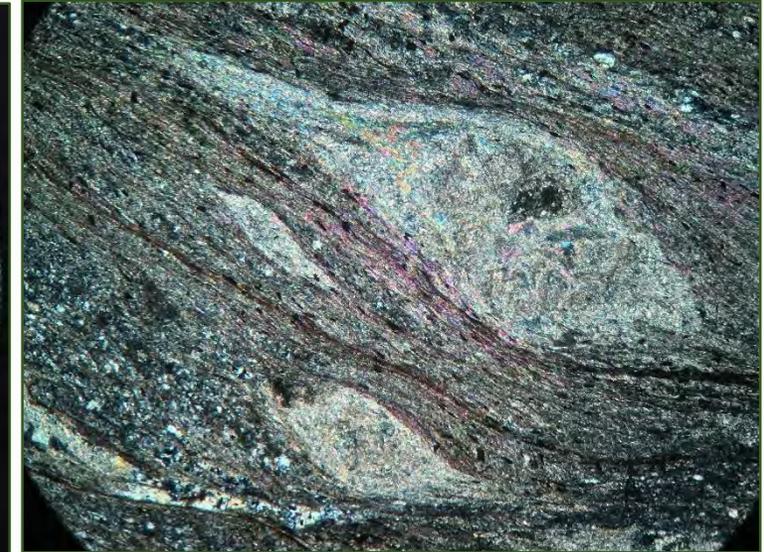
*Méta-sédiments paléozoïques foliés*



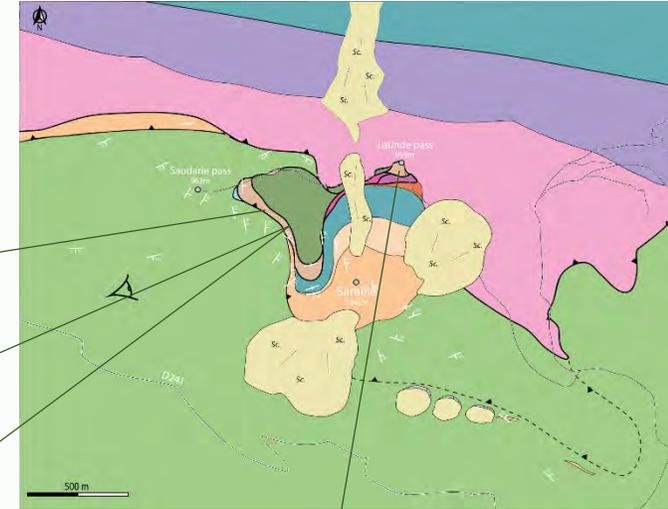
*Quartzite mylonitique*



*Méta-sédiments paléozoïques foliés*

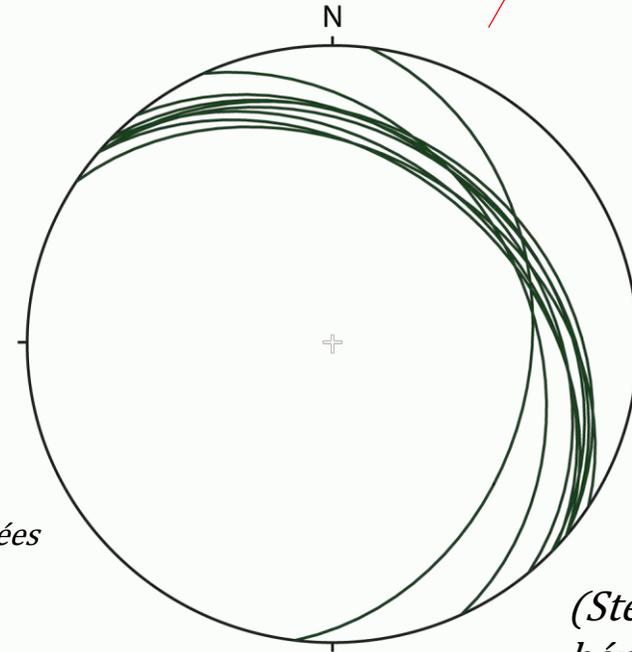


*Schiste à andalousites rétro-morphosées*



# Le massif du Saraillé

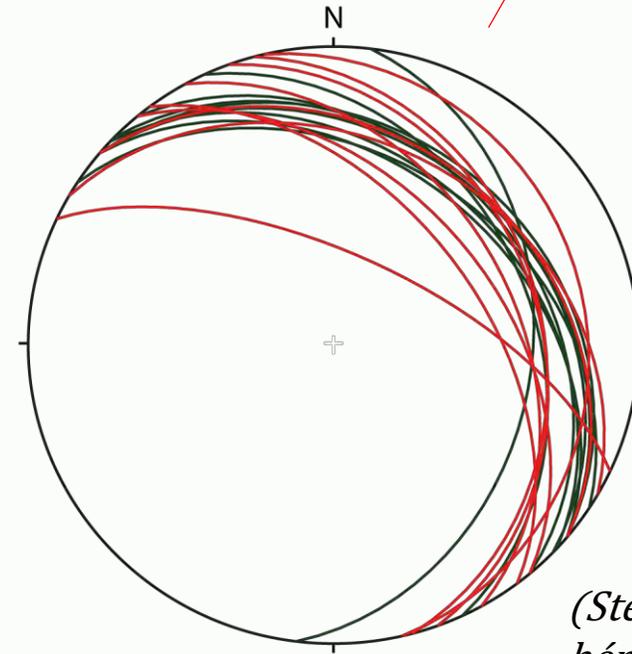
## Déformation du manteau



**VERT :**  
Orientation des  
pyroxénites  
dans le manteau

*(Stéréogramme, Schmitt, hémisphère inférieure)*

# Le massif du Sarailé



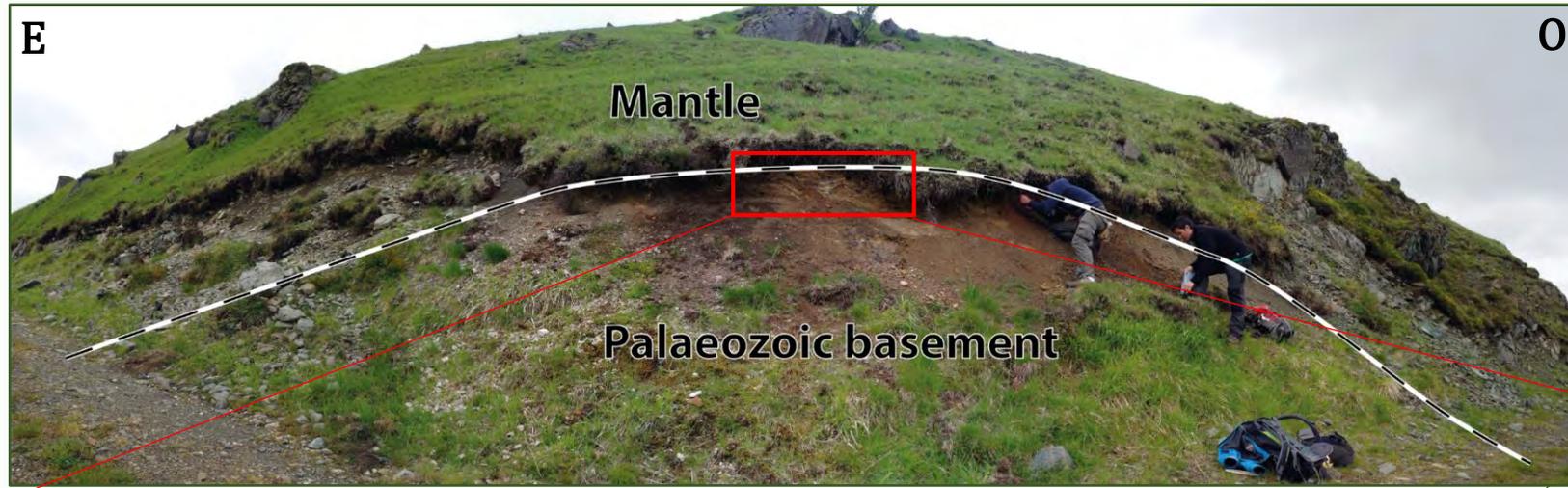
**VERT :**  
Orientation des  
pyroxénites  
dans le manteau

**ROUGE :**  
Foliation du  
socle  
paléozoïque

*(Stéréogramme, Schmitt, hémisphère inférieure)*

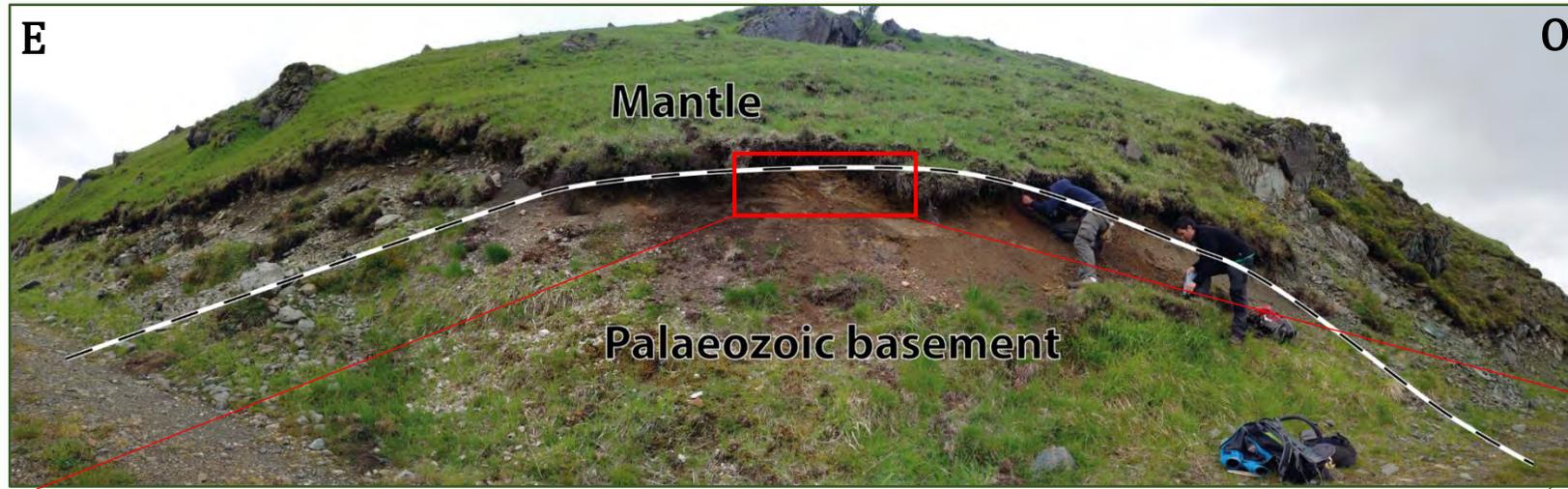
# Le massif du Saraillé

## Contact manteau/socle paléozoïque: Détachement



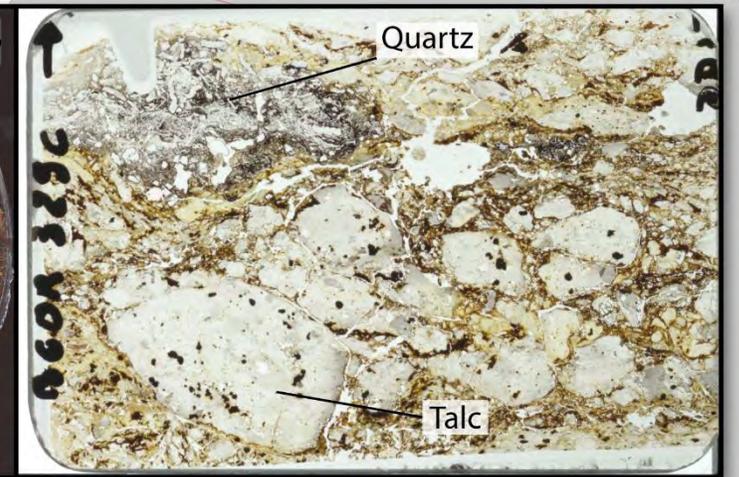
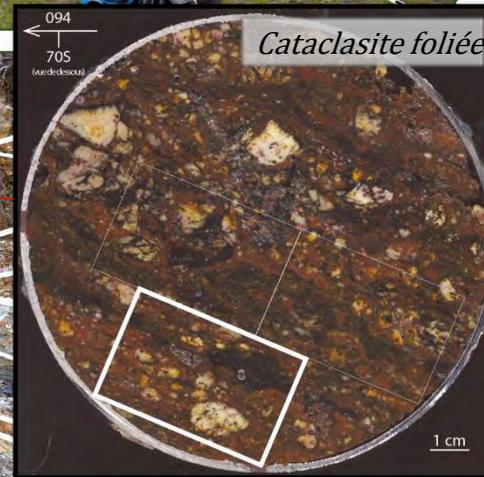
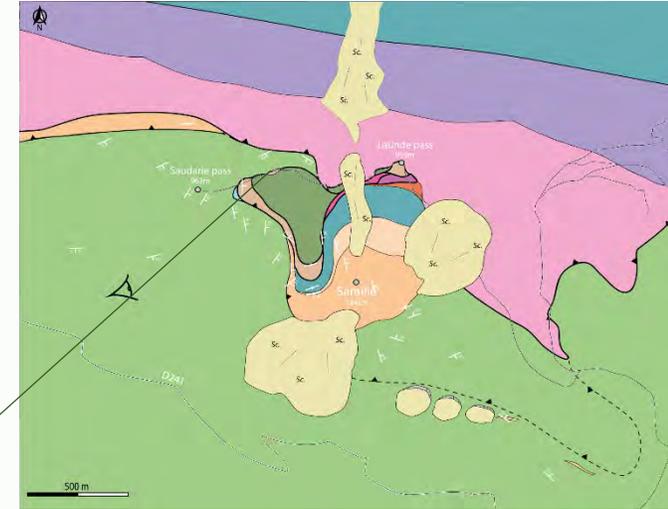
# Le massif du Saraillé

## Contact manteau/socle paléozoïque: Détachement



# Le massif du Saraillé

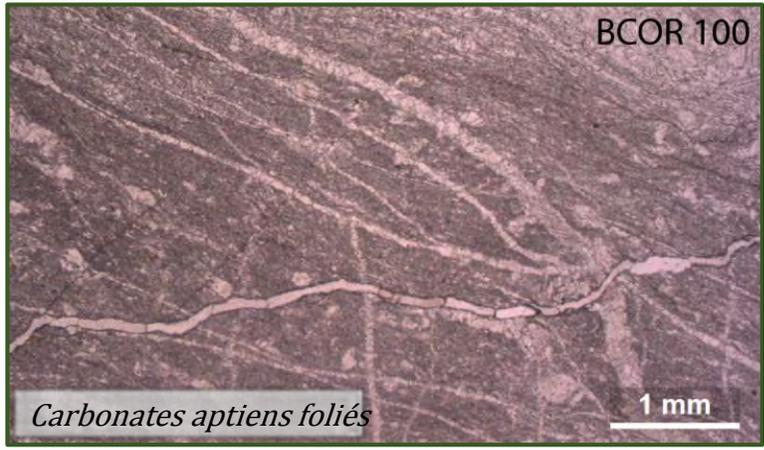
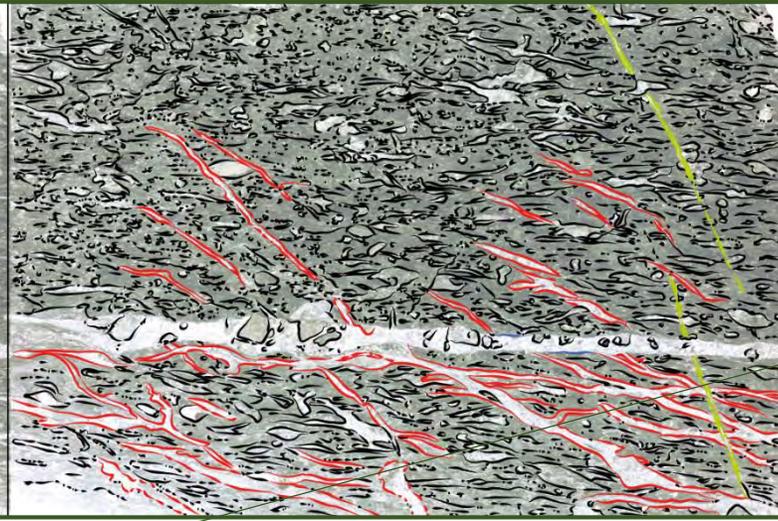
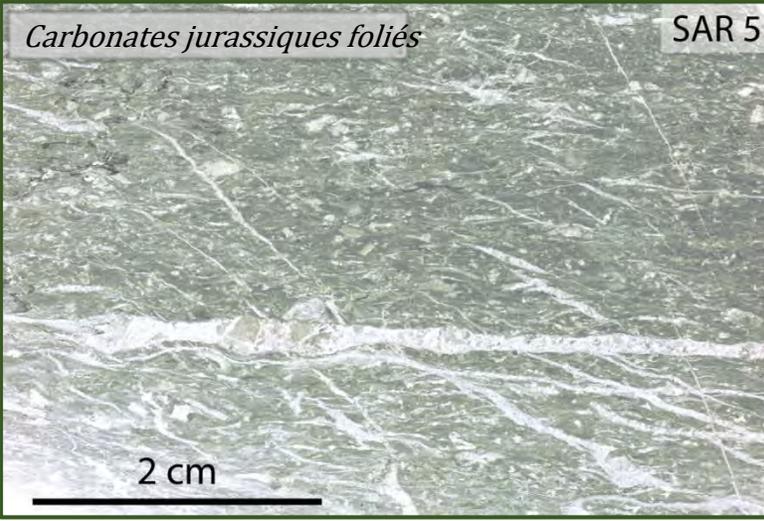
## Contact manteau/socle paléozoïque: Détachement



Zone de cisaillements anastomosés

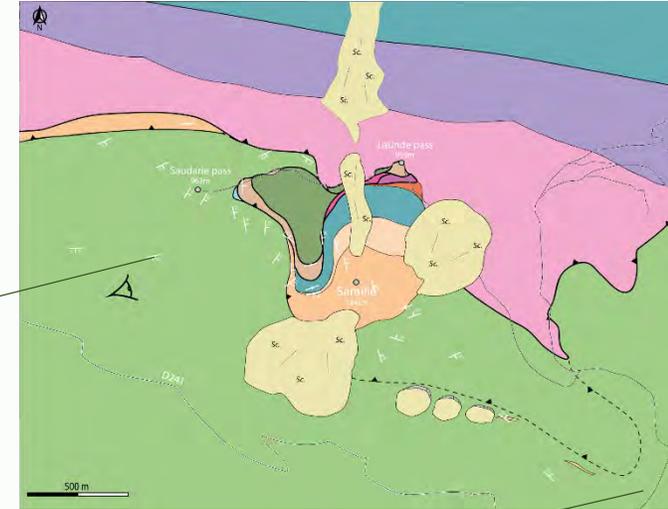
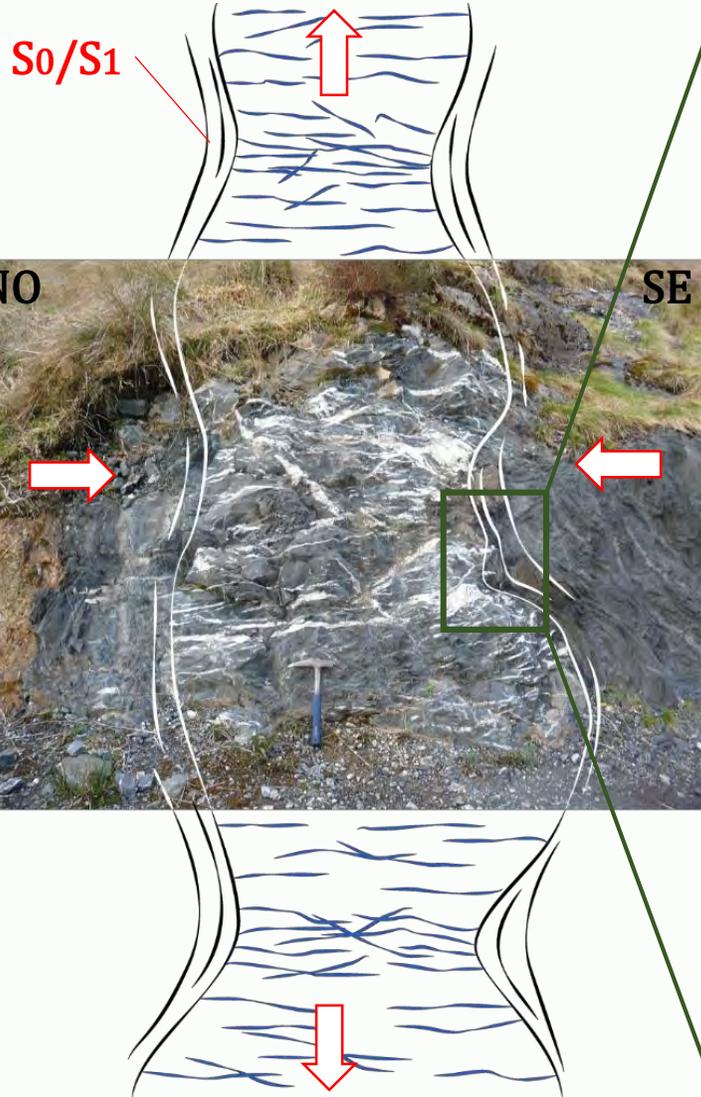
# Le massif du Sarailé

## Déformation de la couverture sédimentaire pré-rift



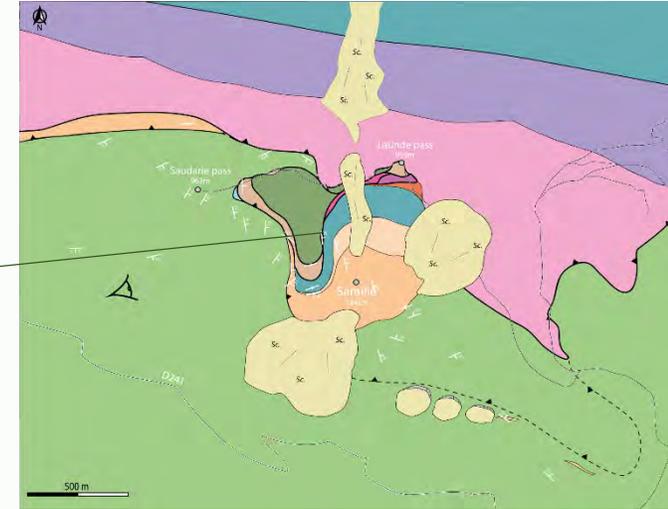
# Le massif du Saraillé

## Déformation de la couverture sédimentaire syn-rift



# Le massif du Sarailé

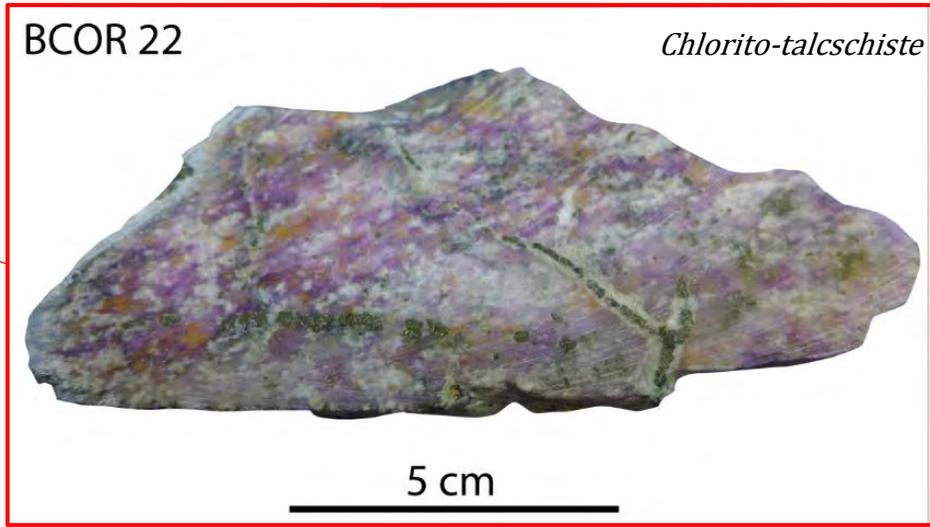
## Evidences d'interactions Fluide-Roche



Contact Manteau/Mésozoïque :  
Chlorito-talcschiste

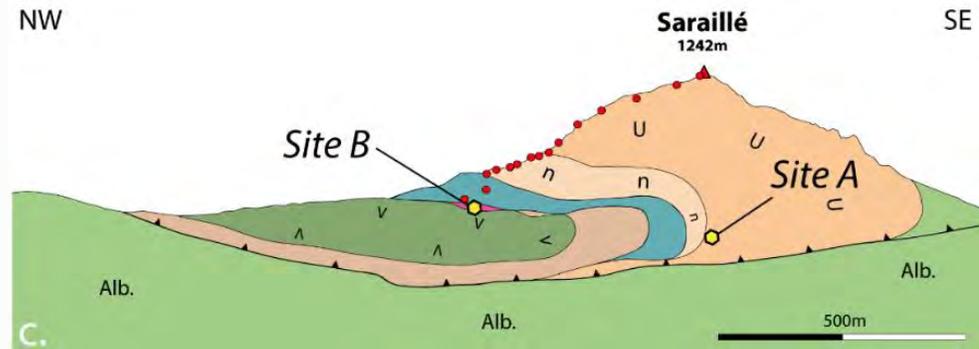
BCOR 22

*Chlorito-talcschiste*

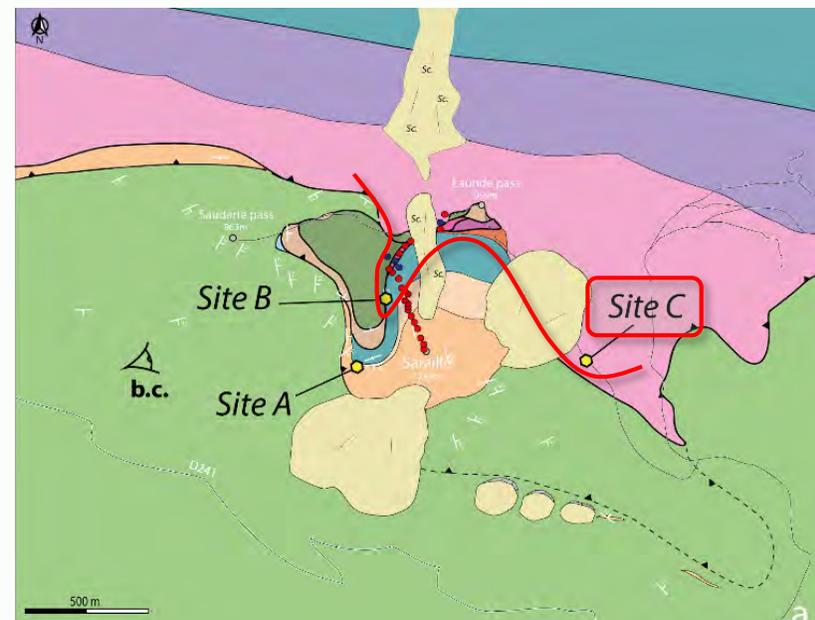
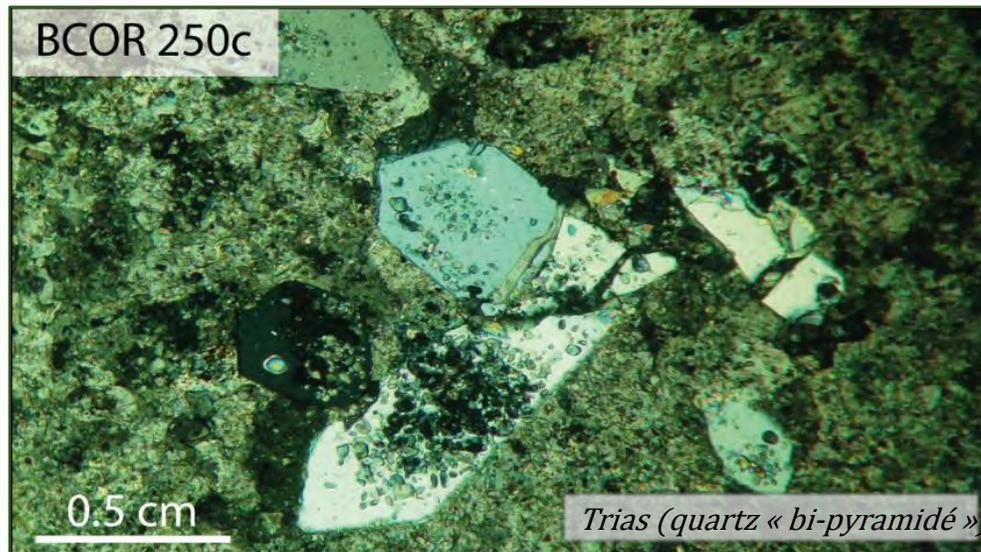
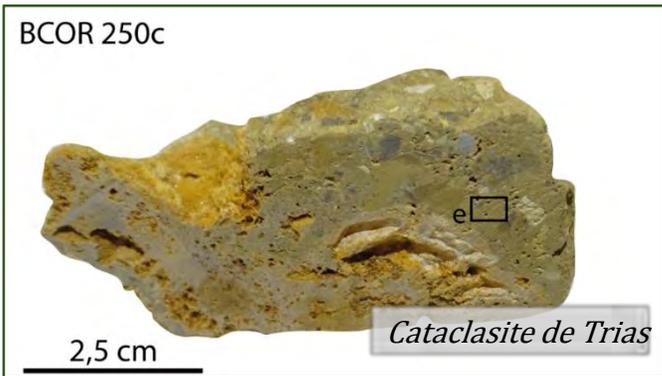


# Le massif du Saraillé

## Evidences d'interactions Fluide-Roche



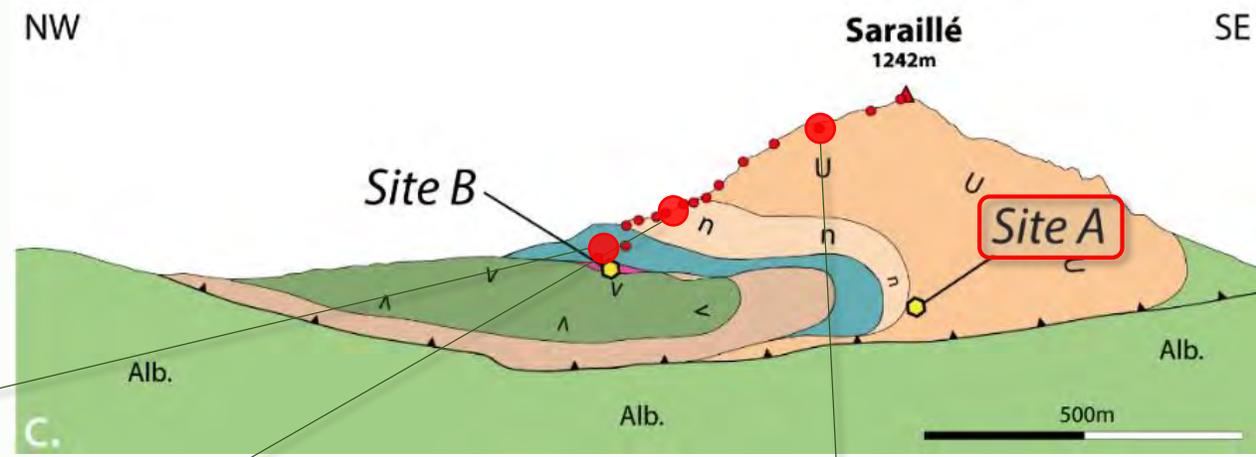
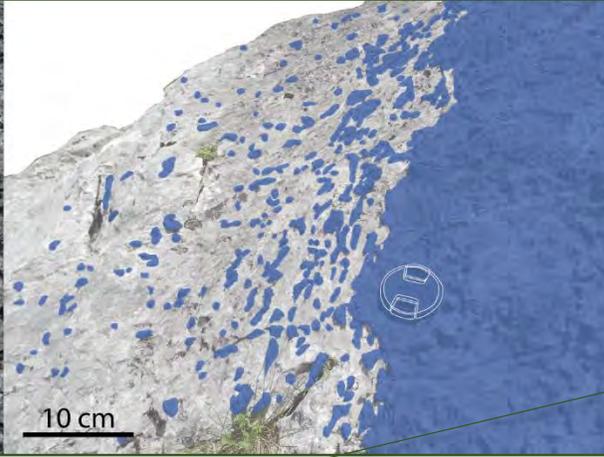
### Trias : Cataclasites et méta-évaaporites talcifiées



Corre et al., 2018

# Le massif du Saraillé

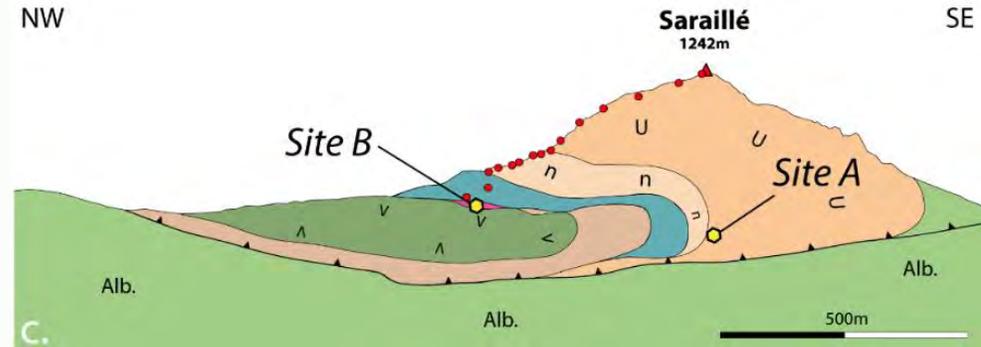
## Evidences d'interactions Fluide-Roche



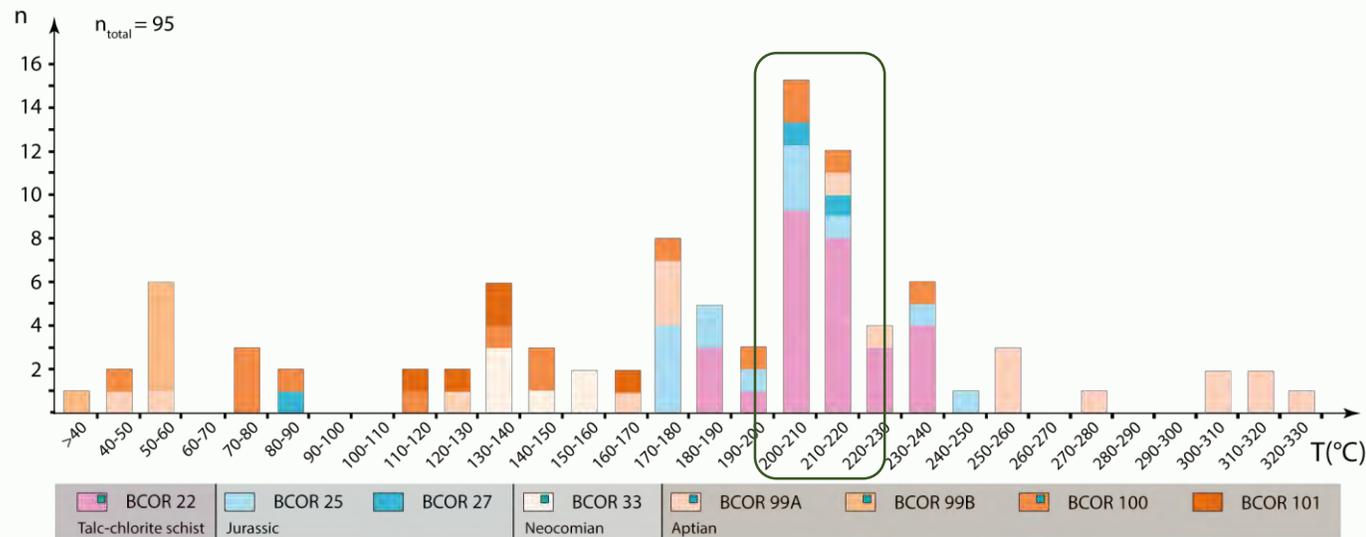
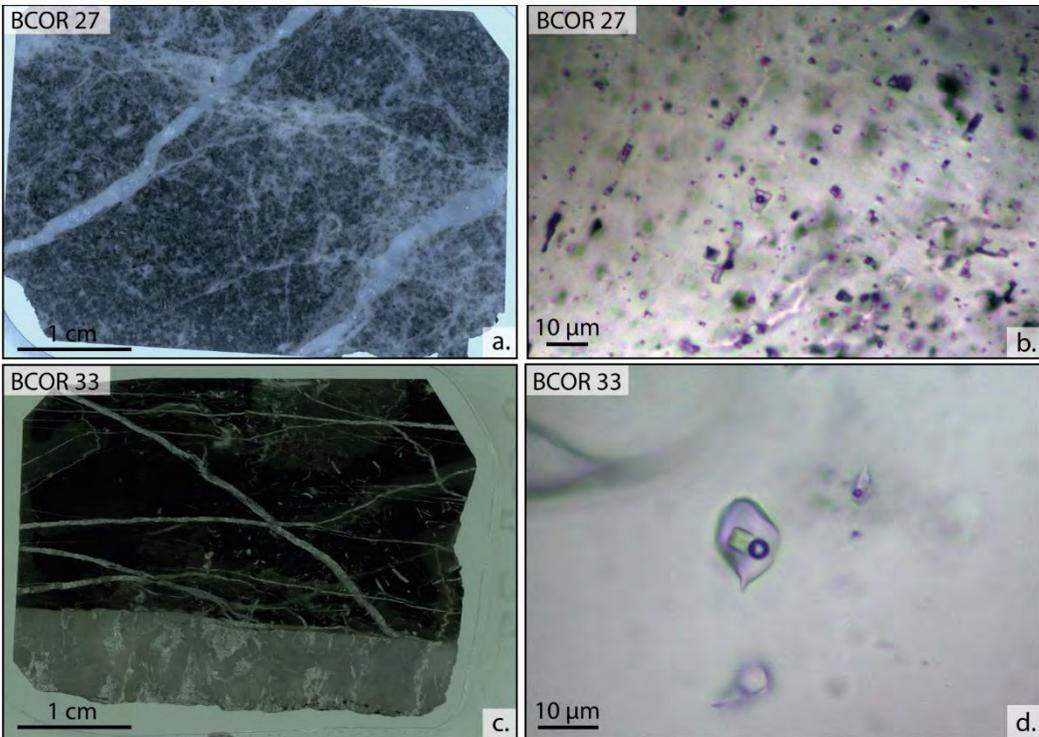
Corre et al., 2018

# Le massif du Saraillé

## Inclusions fluides *L. Marasi (2014) ANR Pyramid*



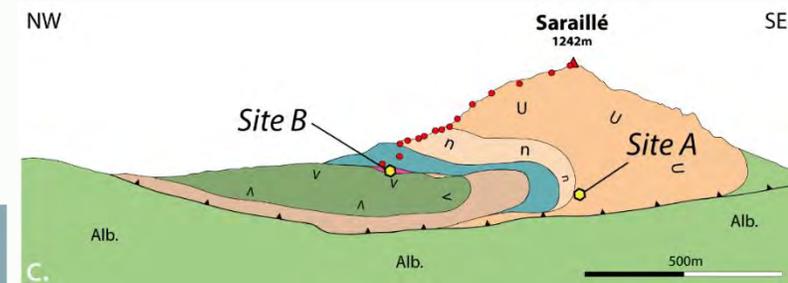
- Présence d'inclusions fluides tri-phasées
- Salinité entre 13wt% et 39wt% NaCl
- Températures d'homogénéisations, mode à 210°C



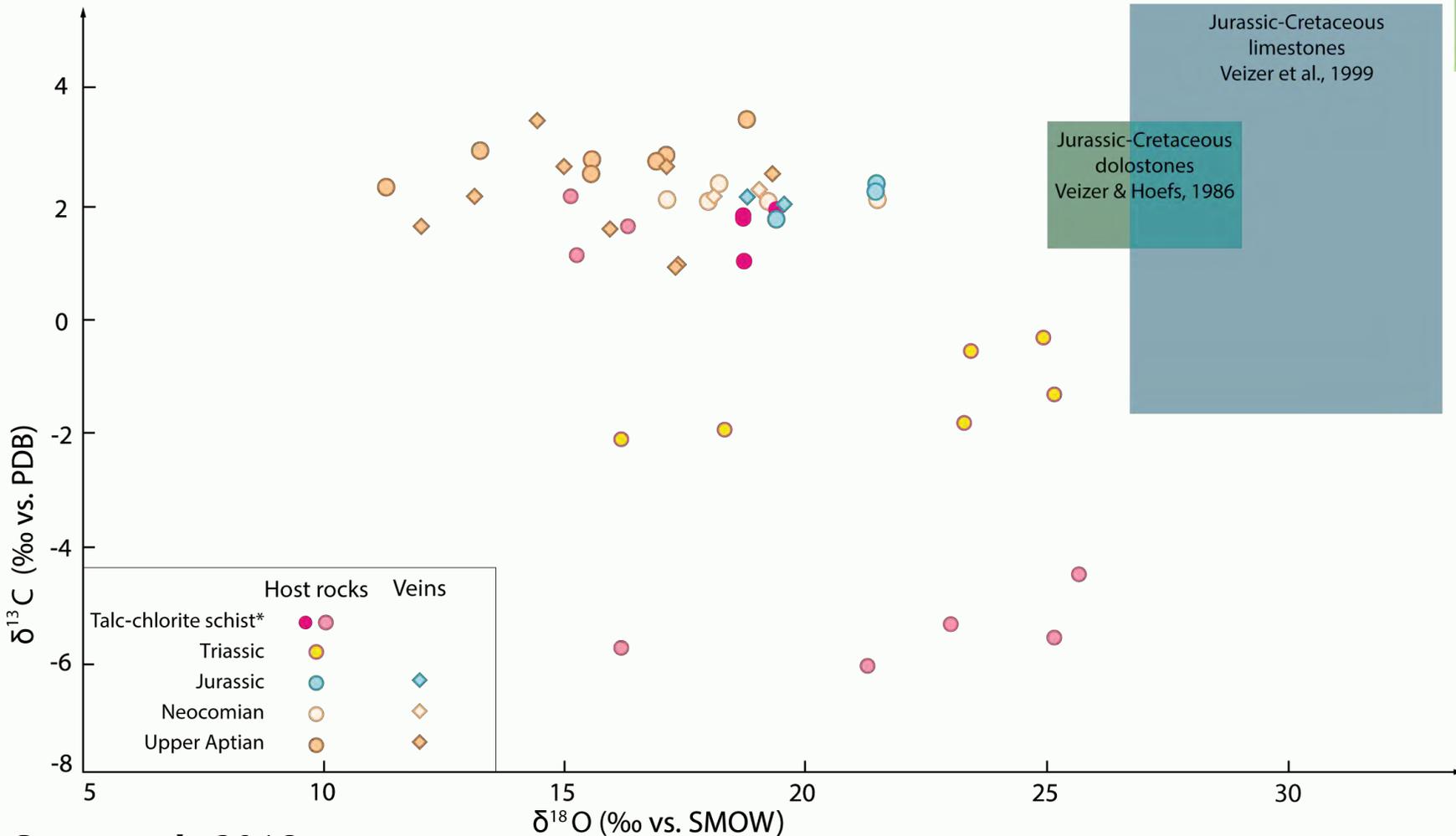
Corre et al., 2018

# Le massif du Saraillé

## Interactions fluide-roche : Isotopes stables (O,C)



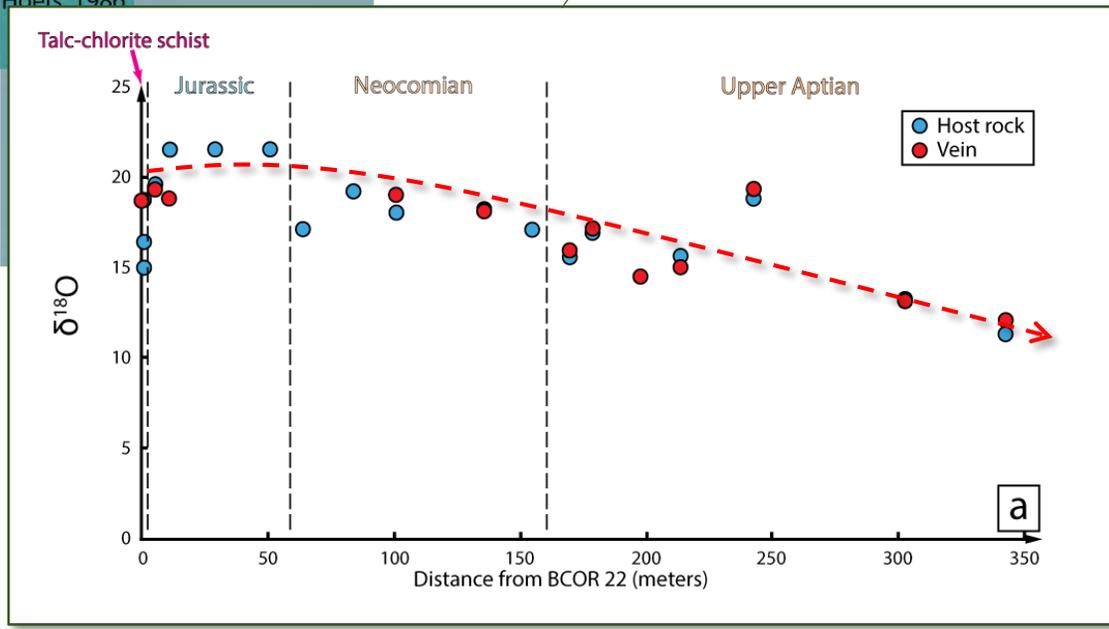
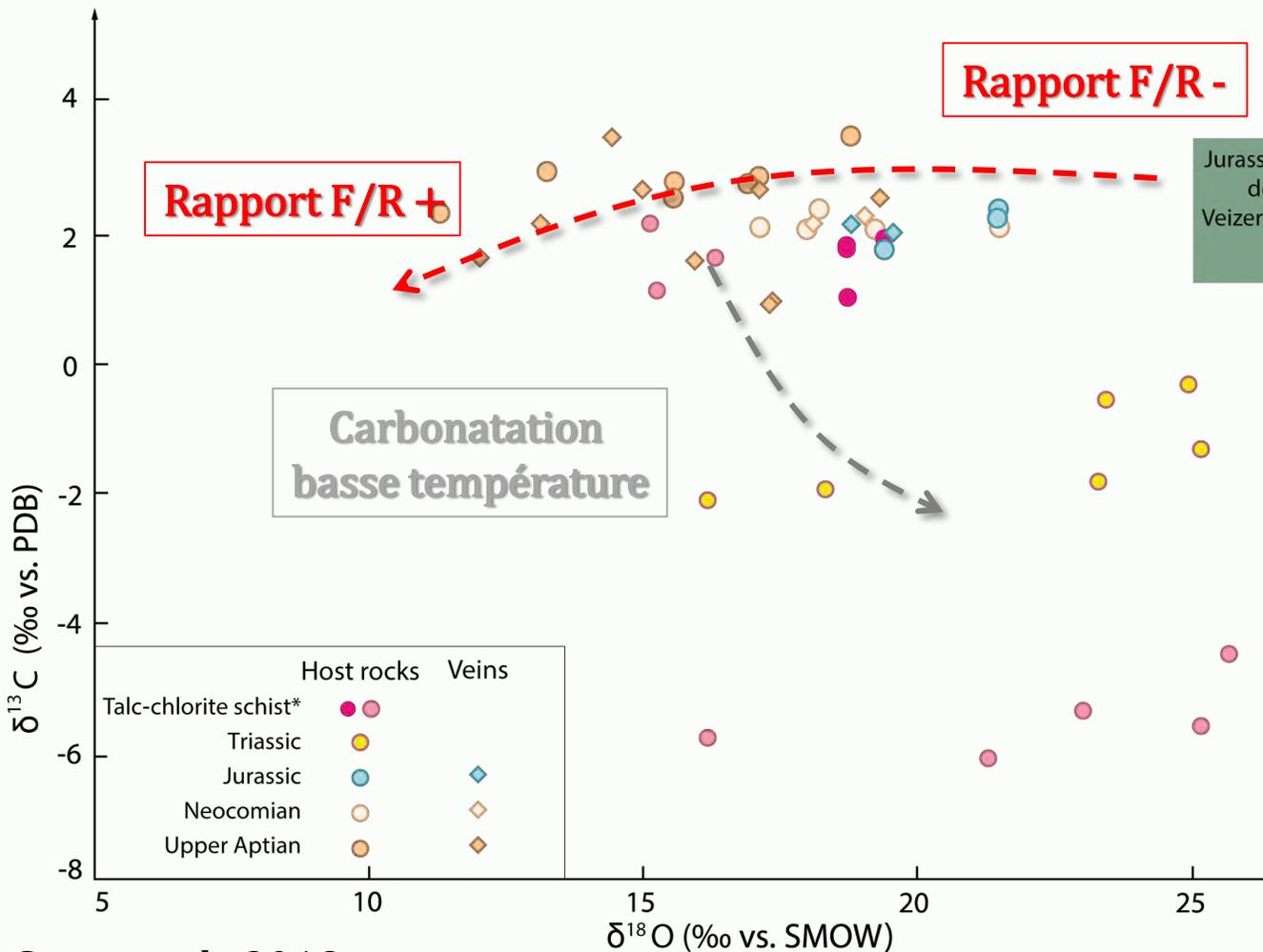
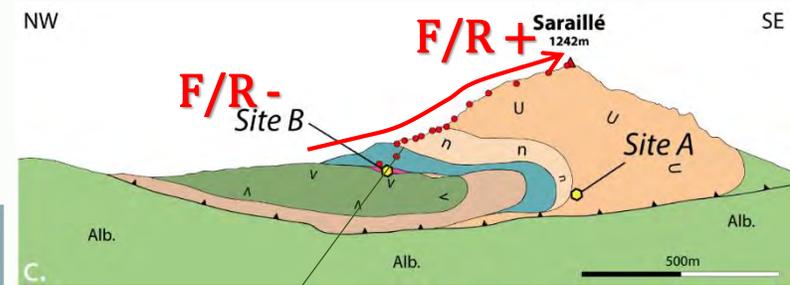
Compositions isotopiques en  $\delta^{13}\text{C}$  et  $\delta^{18}\text{O}$  de couples veines/encaissant de la couverture sédimentaire mésozoïque



Corre et al., 2018

# Le massif du Saraillé

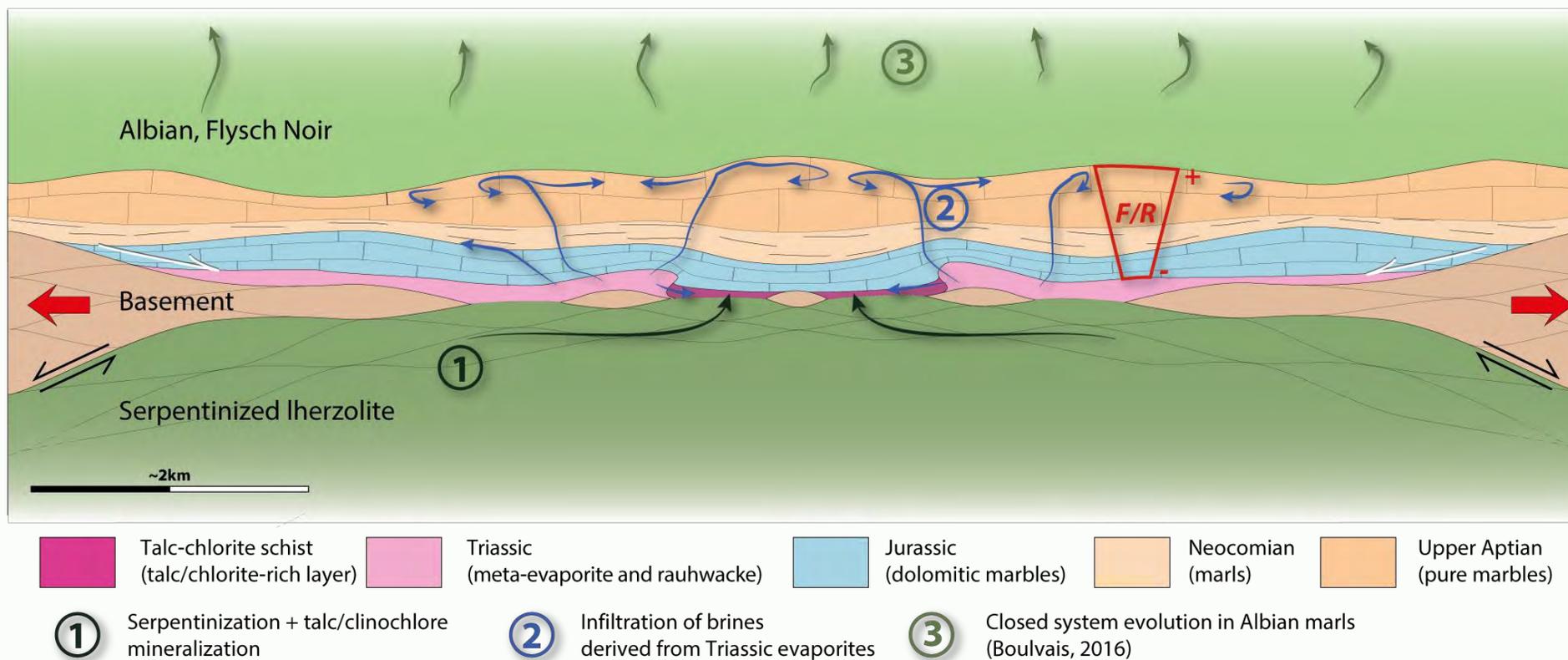
## Interactions fluide/roche : Isotopes stables (O,C)



Corre et al., 2018

# Le massif du Sarailé

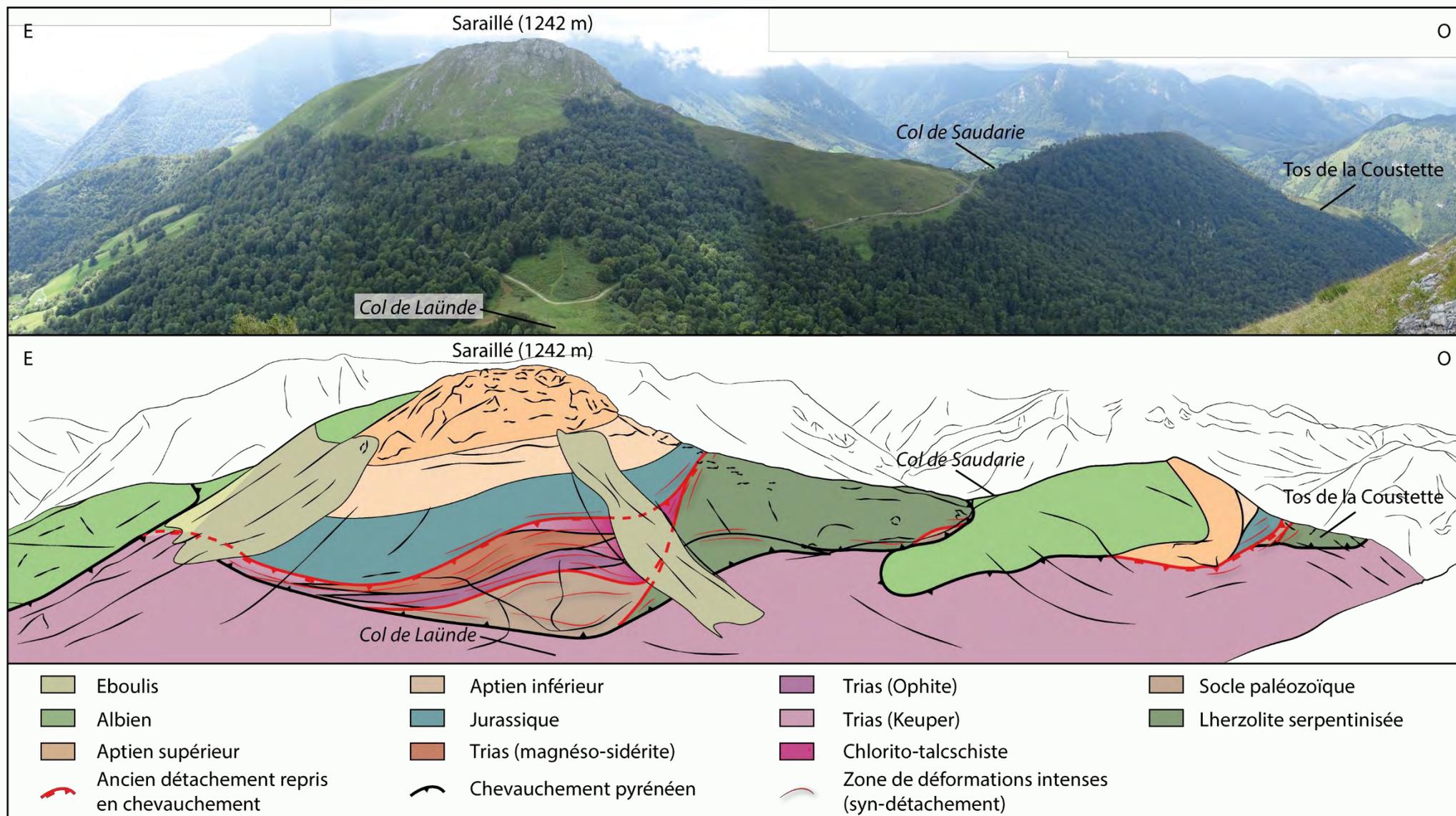
## Modèle conceptuel de circulations de fluides



Corre et al., 2018

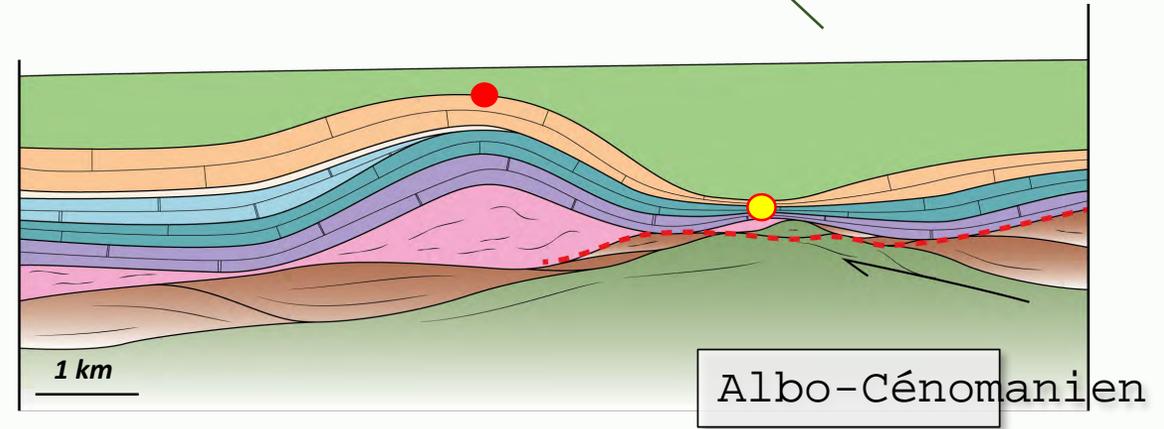
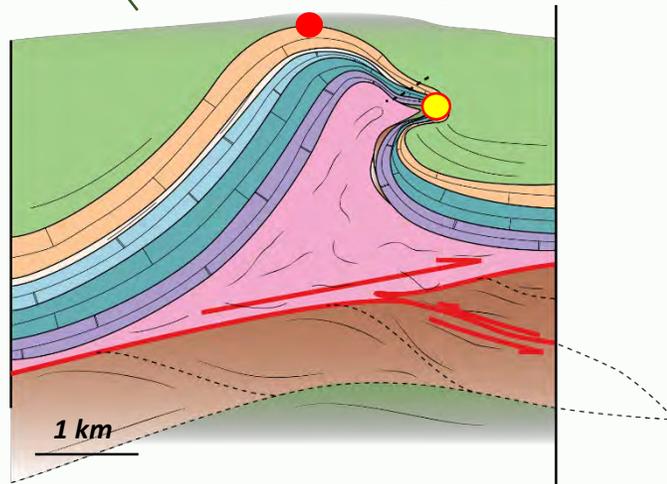
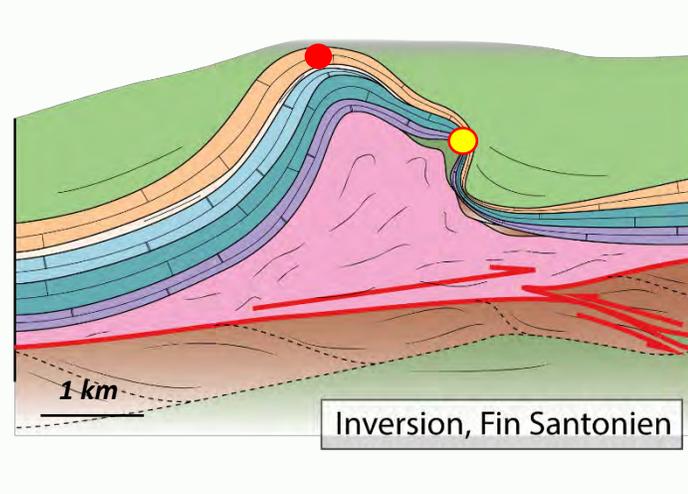
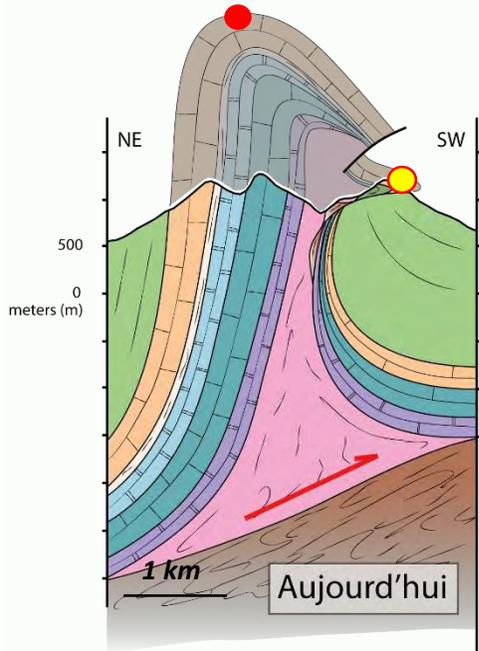
## Le massif du Sarailé

## Un paléo-détachement majeur



# Le massif du Sarailé

# Restauration du massif du Sarailé à l'Albo-Cénomaniien



Axe du Diapir



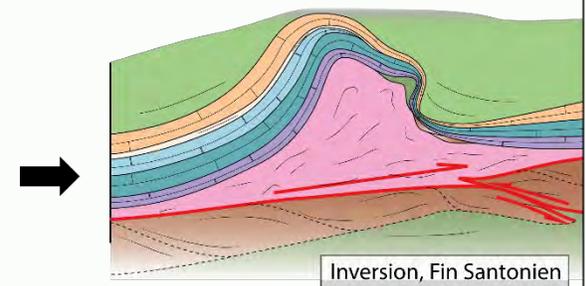
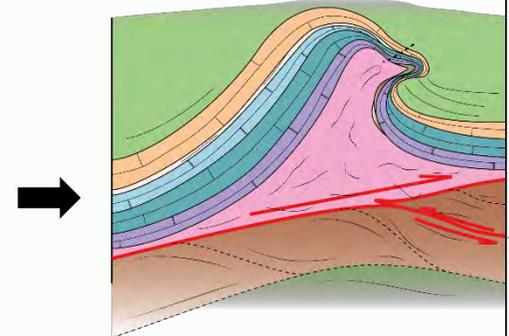
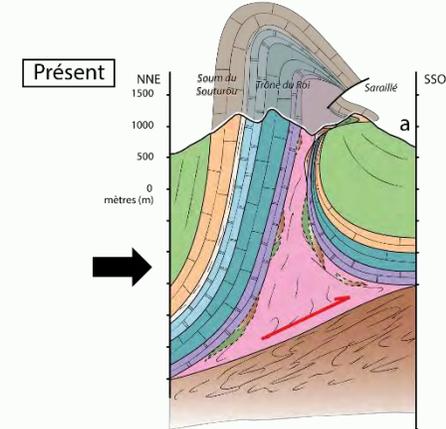
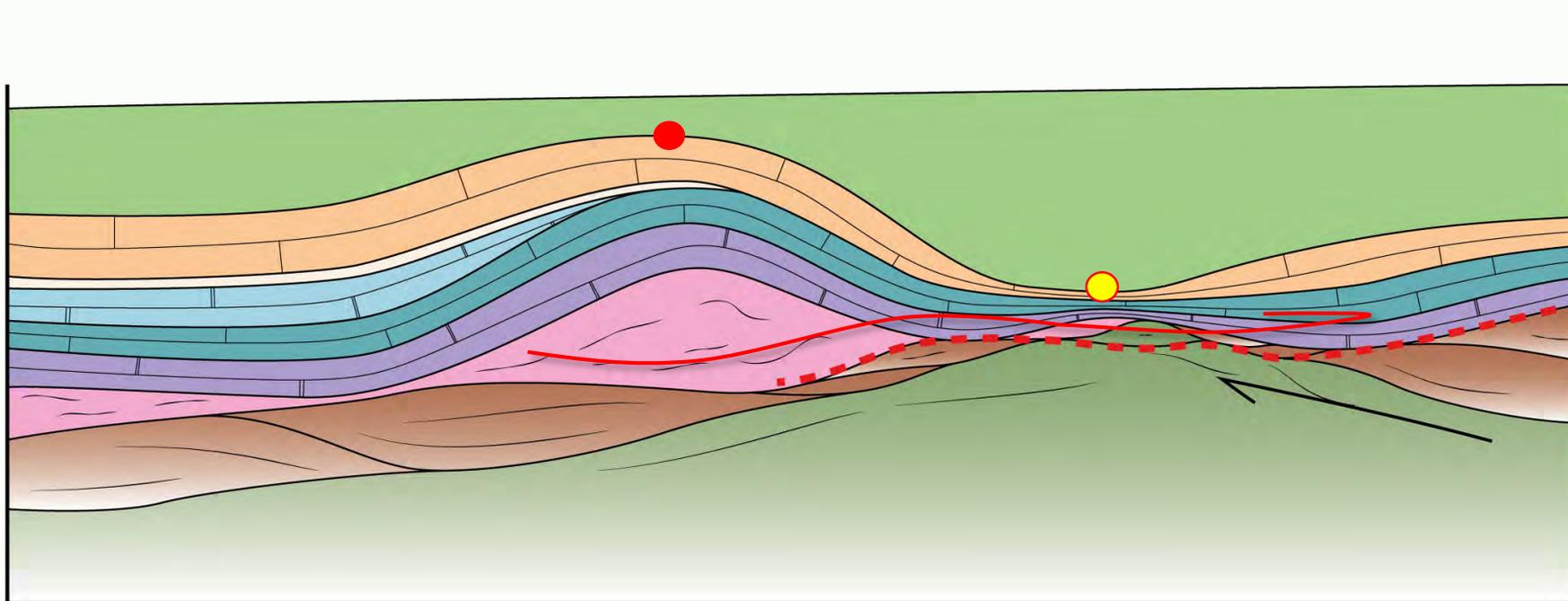
Axe du pli couché



# Le massif du Sarailé

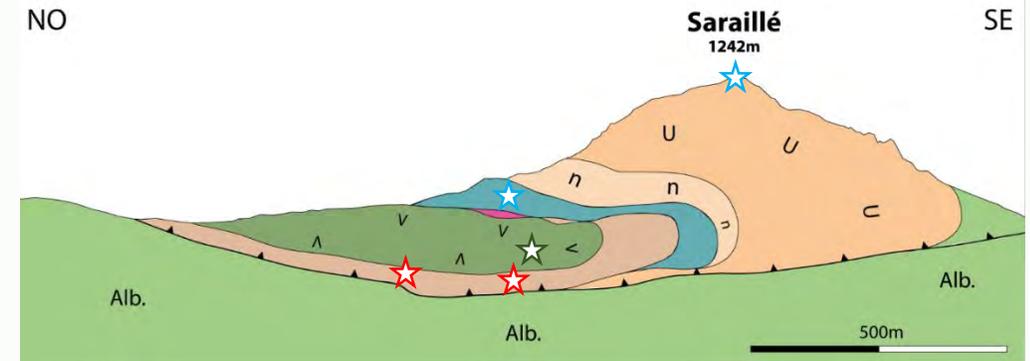
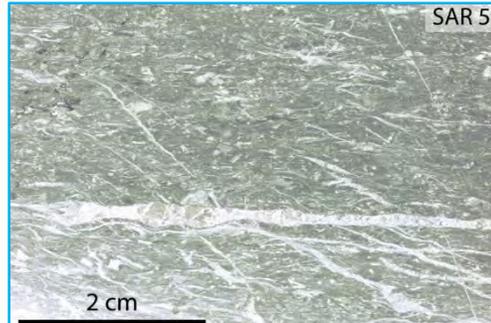
## Restauration du massif du Sarailé à l'Albo-Cénomanién

## Paléo-détachement préservé

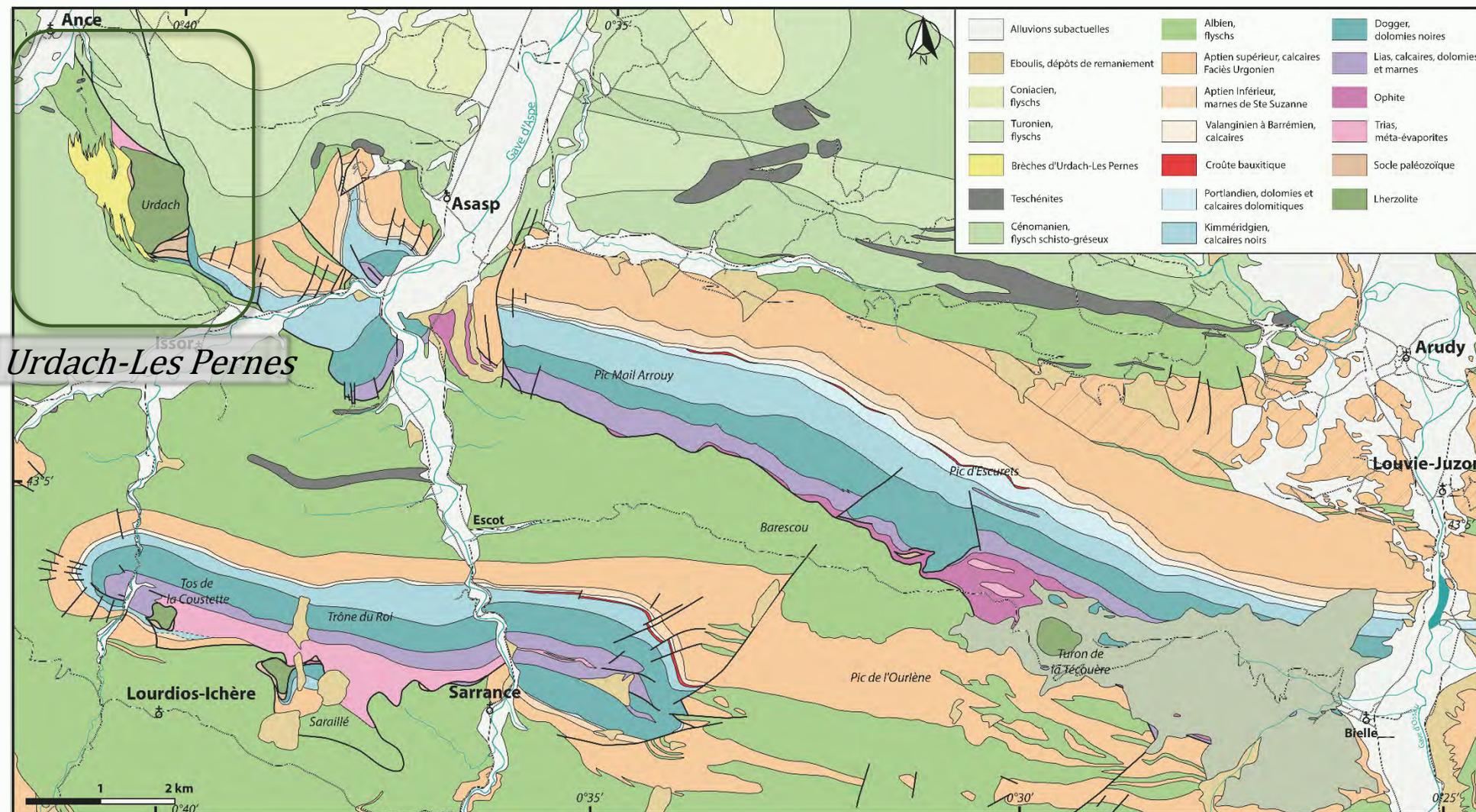


# Le massif du Sarailé

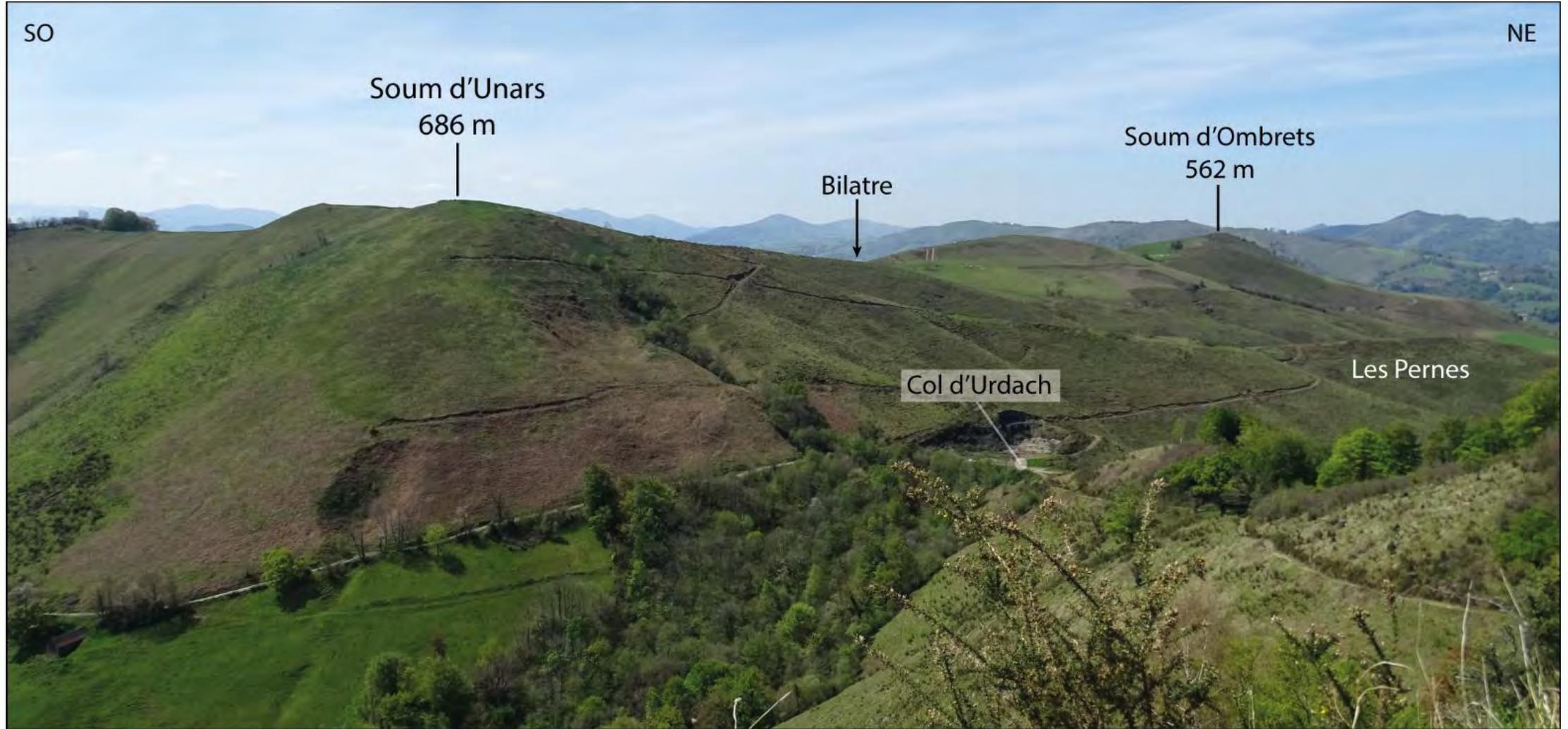
## Foliations mylonitiques parallèles (contact d'exhumation)



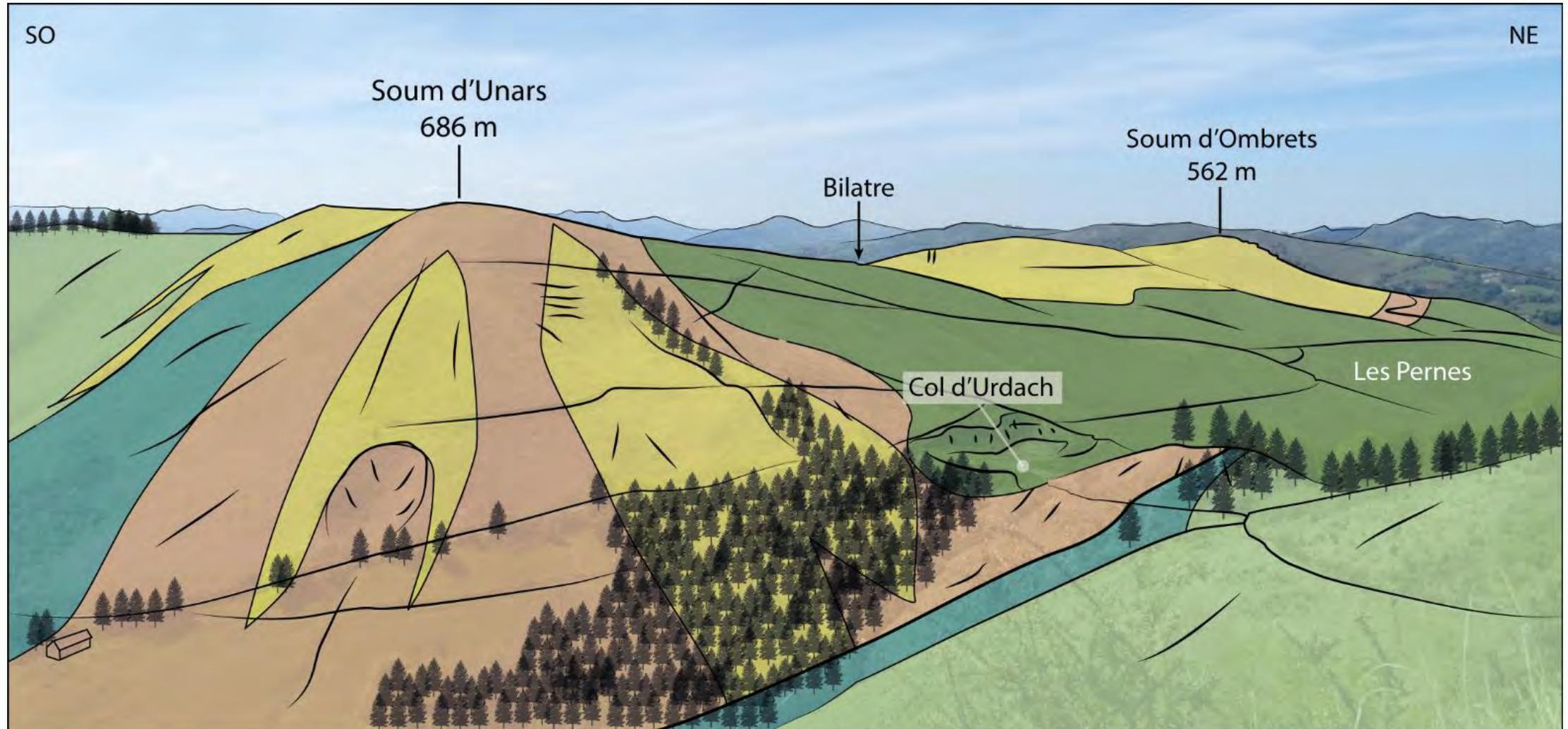
## Le chevauchement du Mail Arrouy



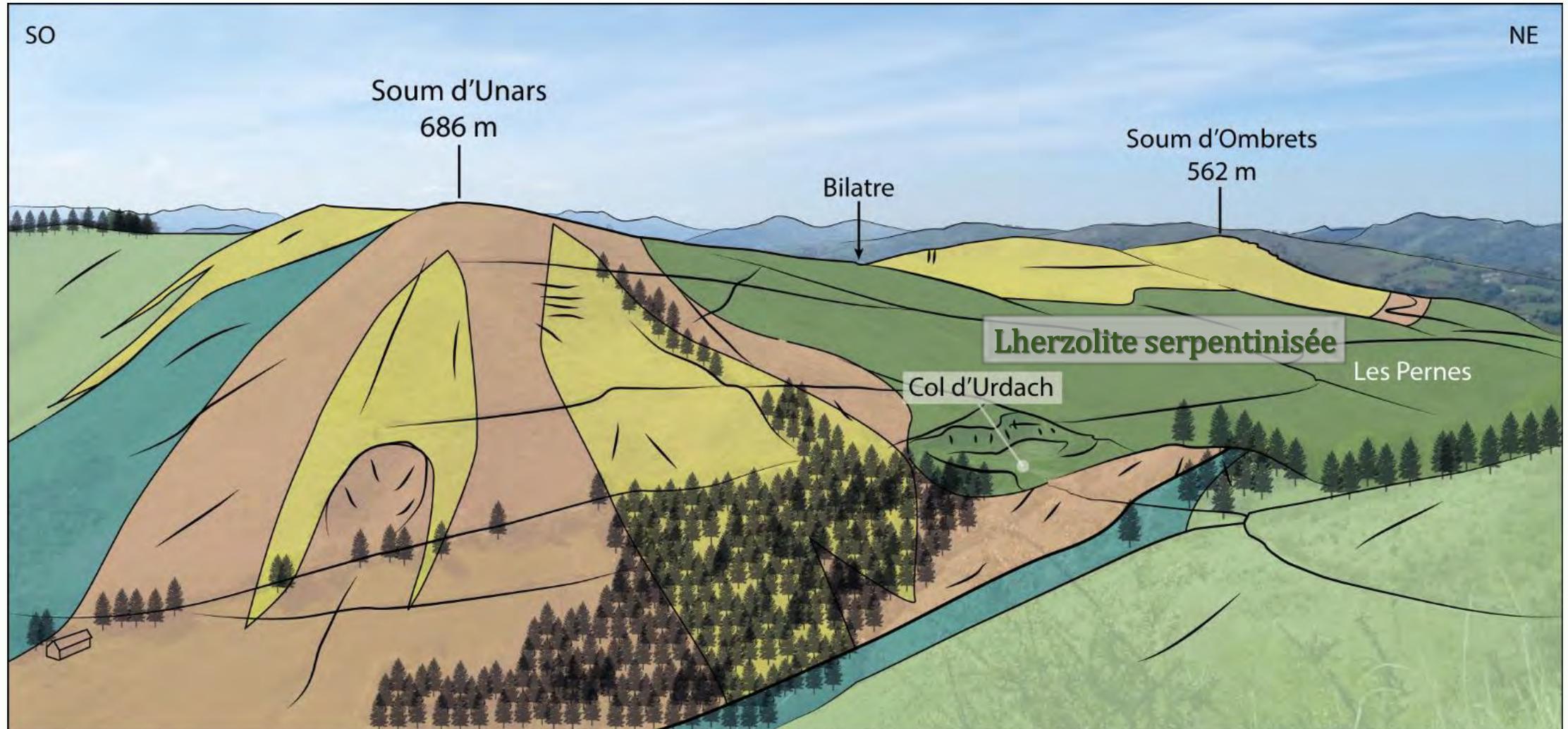
# Le massif d'Urdach-Les Pernes



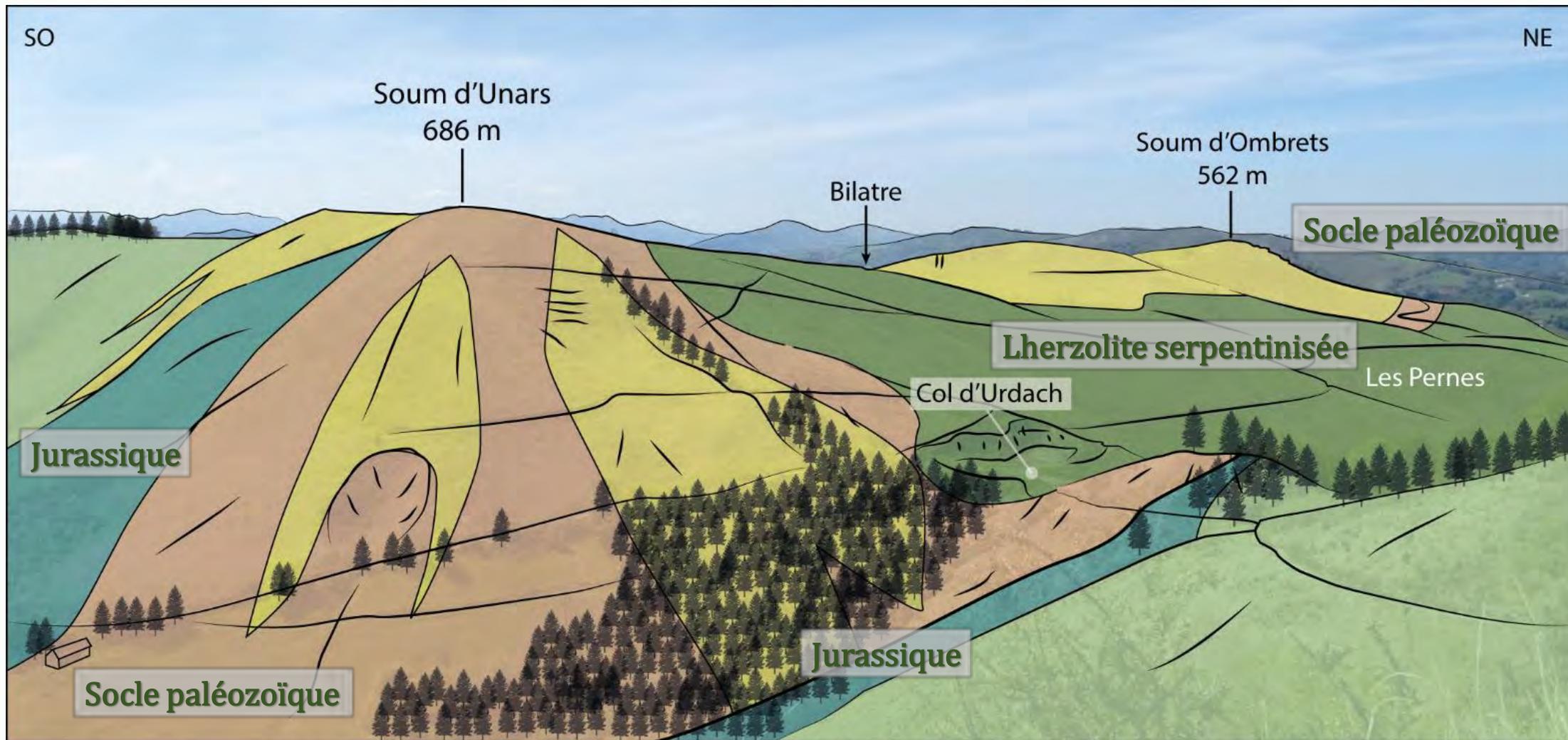
## Le massif d'Urdach-Les Pernes

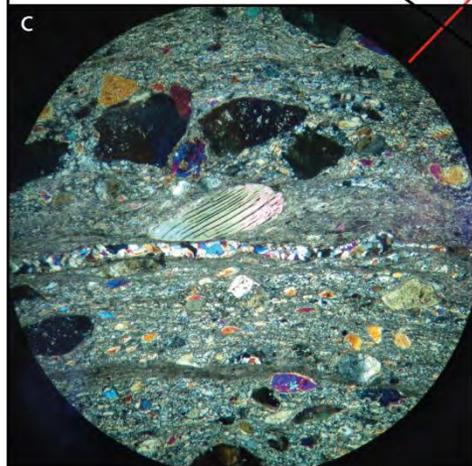
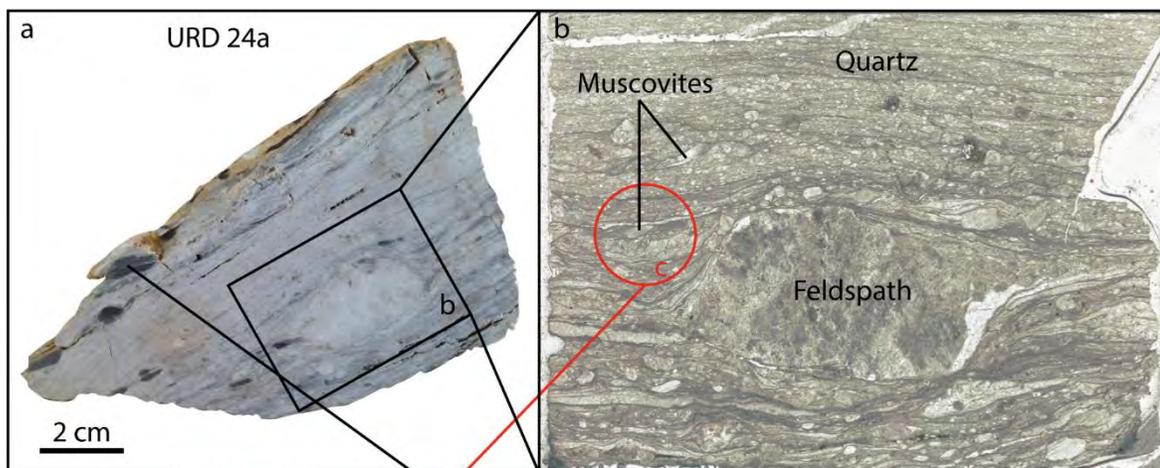


## Le massif d'Urdach-Les Pernes



# Le massif d'Urdach-Les Pernes

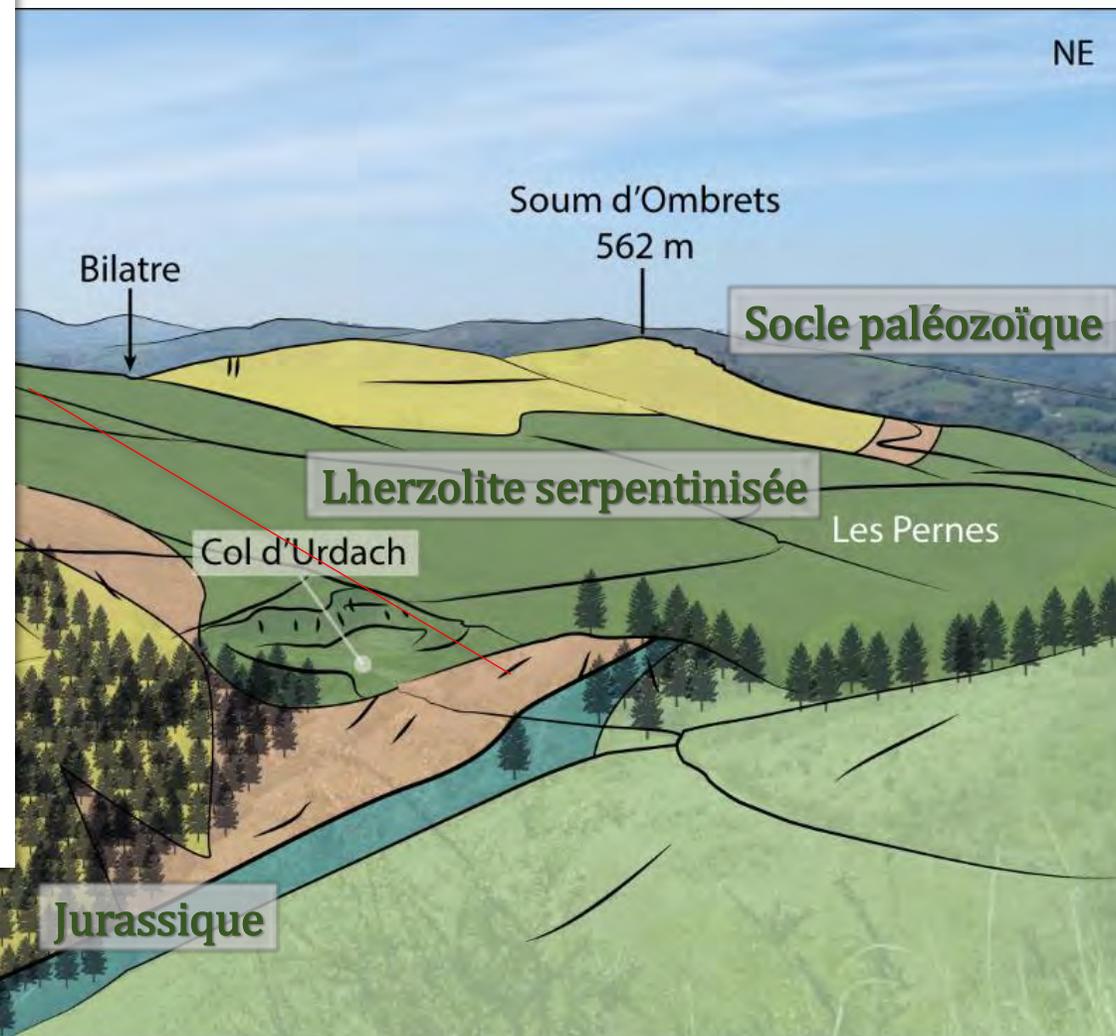




Age de la déformation mylonitique

**105.2 ± 0.5 Ma**

*<sup>40</sup>Ar/<sup>39</sup>Ar sur muscovite  
P. Monié (Géosciences Montpellier)*



Socle paléozoïque

Jurassique

Socle paléozoïque

Lherzolite serpentinisée

Col d'Urdach

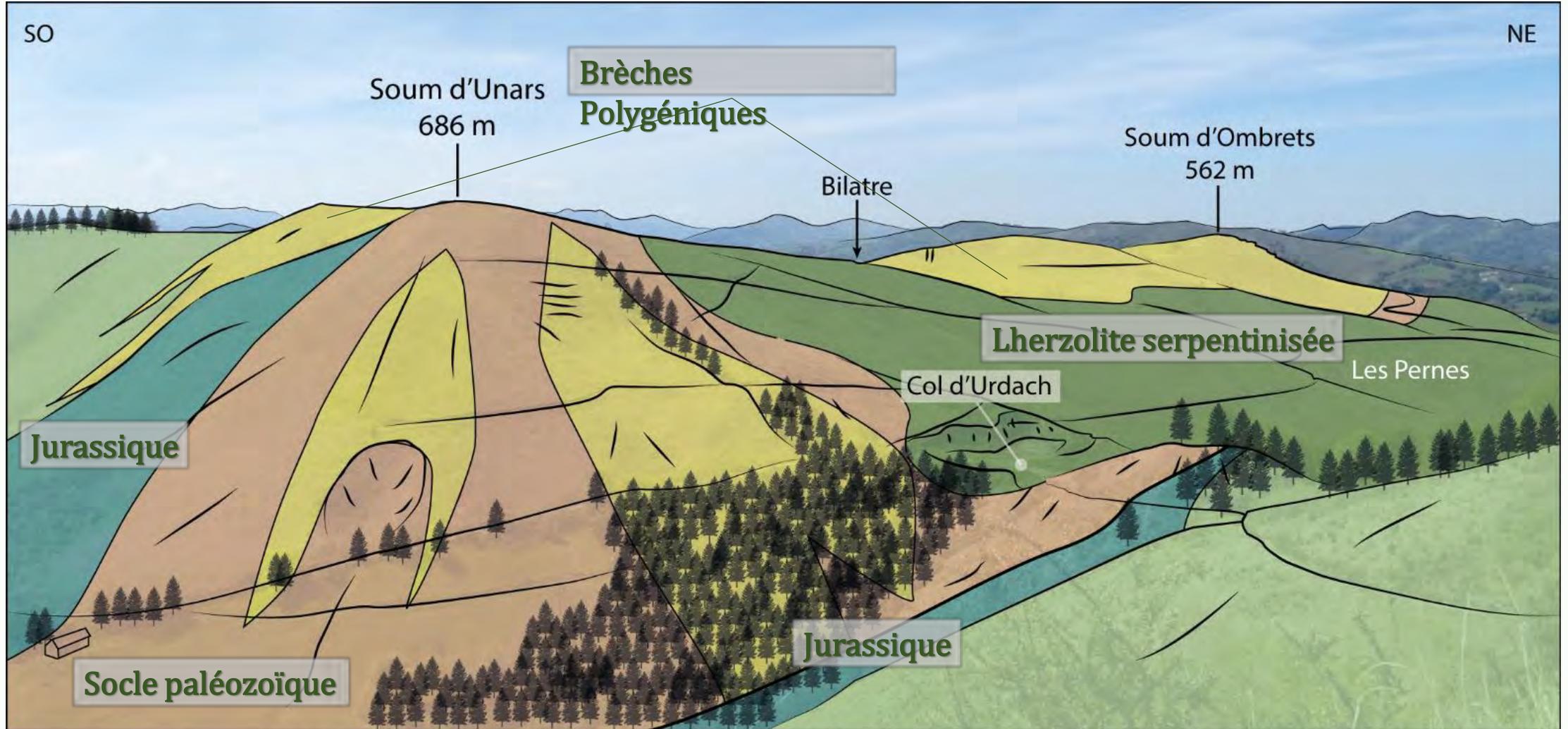
Les Pernes

Soum d'Ombrets  
562 m

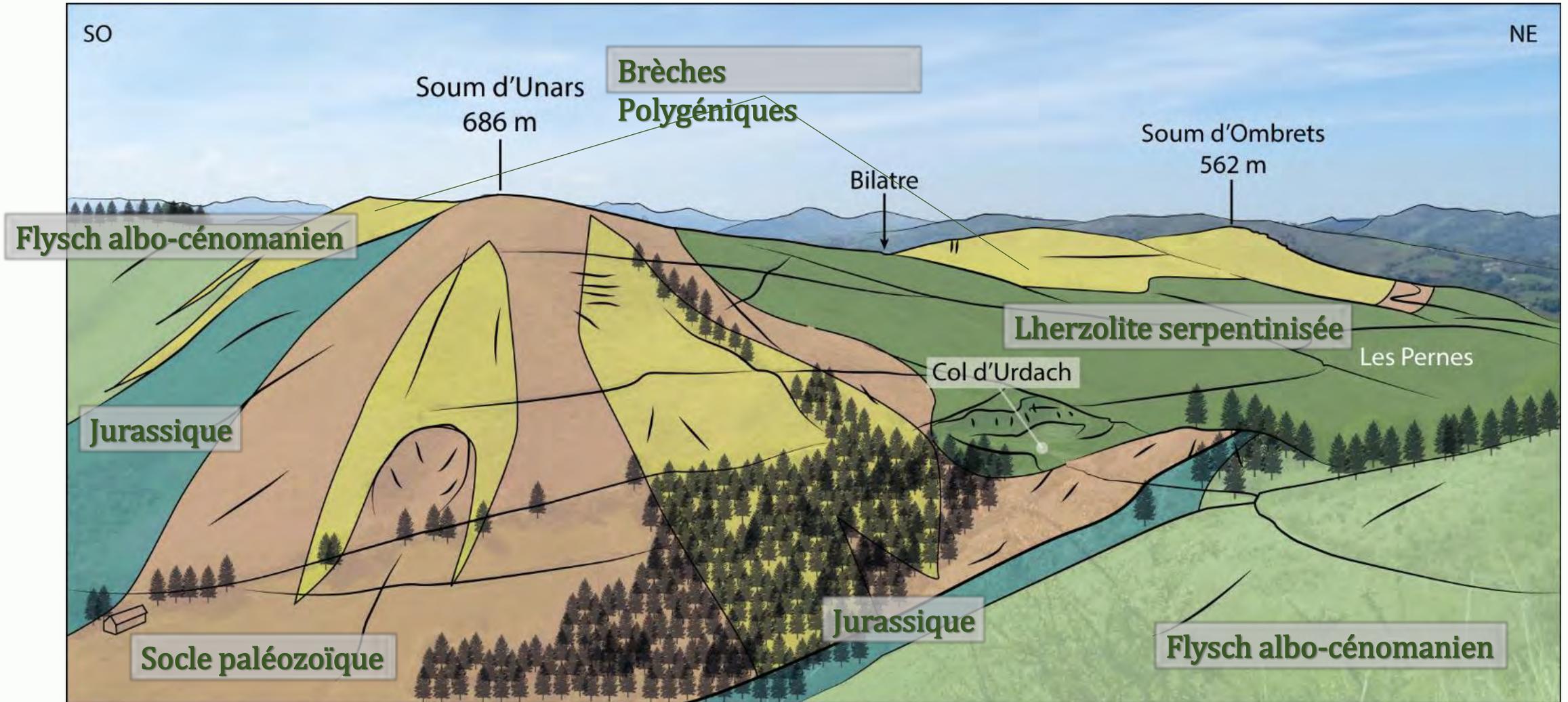
Bilatre

NE

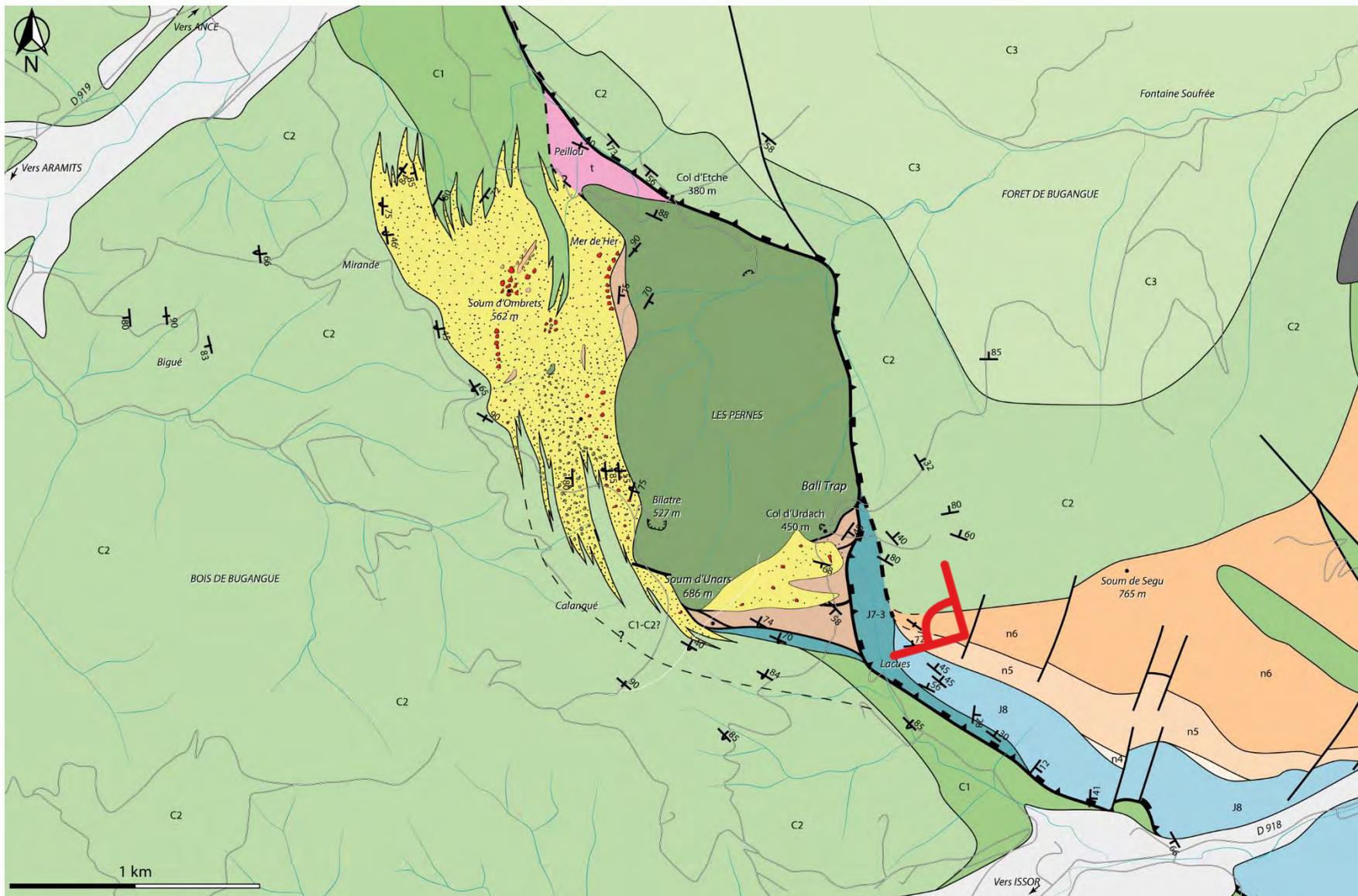
# Le massif d'Urdach-Les Pernes



# Le massif d'Urdach-Les Pernes



# Le massif d'Urdach-Les Pernes

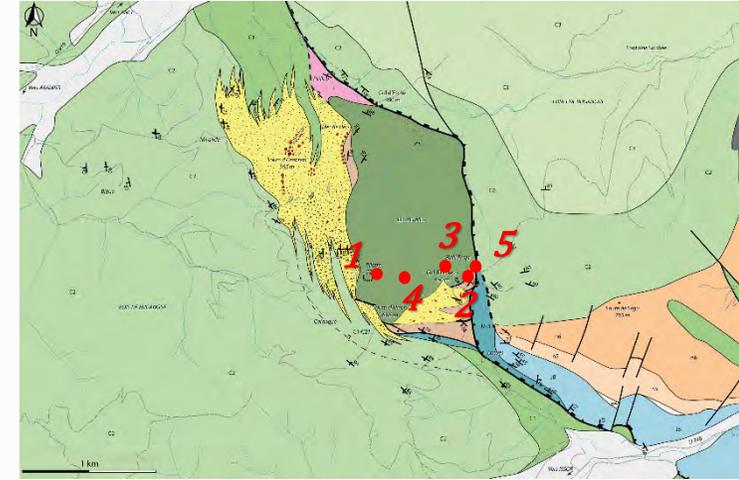
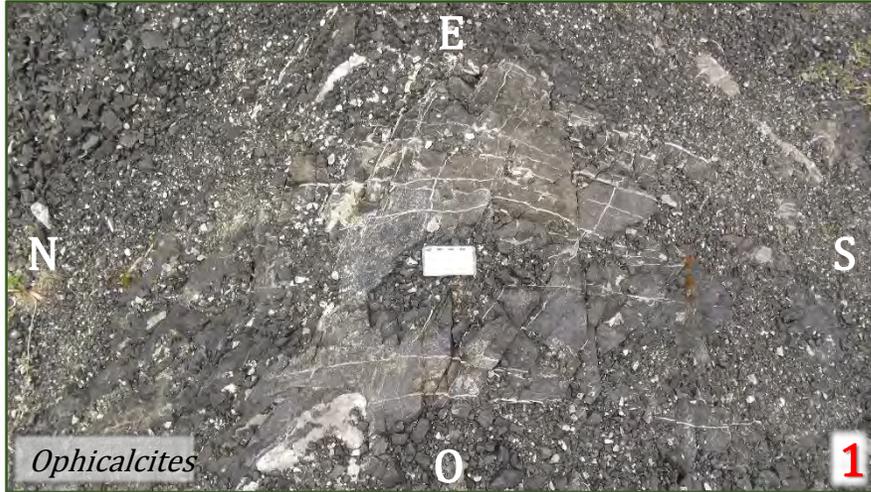


- Alluvions subactuelles
- Turonien (C3), flysch
- Brèche de base du Cénomanien (Urdach)
- Teschérites
- Valanginien à Barrémien (n4), calcaires
- Kimméridgien (J8), calcaires noirs
- Callovo-Oxfordien (J7-3), dolomies noires
- Trias (t), cataclastique, évaporites
- Contacts stratigraphiques
- Blocs de péridotite
- Blocs de brèche quartzitique (Ordovicien)
- Albo-Cénomanien (C2), flysch schisto-gréseux
- Albien Supérieur (C1), Flysch Noir
- Aptien supérieur (n6), calcaires, Faciès Urgonien
- Aptien Inférieur (n5), marnes
- Socle paléozoïque
- Péridotite
- Détachement repris en chevauchement
- Contacts tectoniques

**Dénudation et remaniement du manteau**

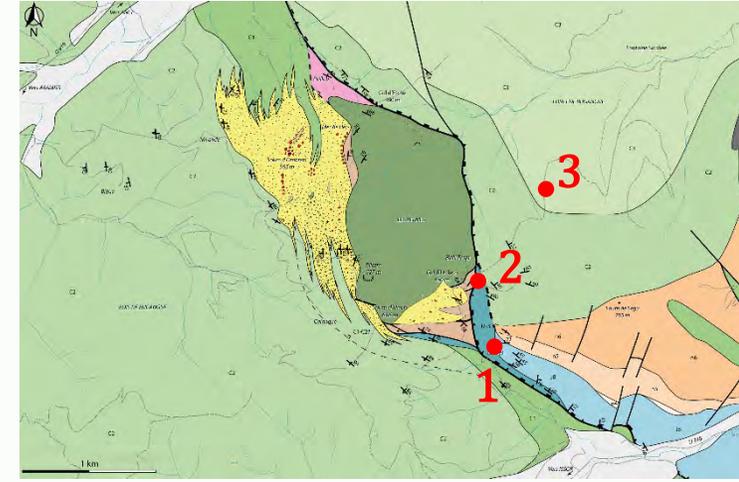
# Le massif d'Urdach-Les Pernes

## Lherzolite serpentinisée

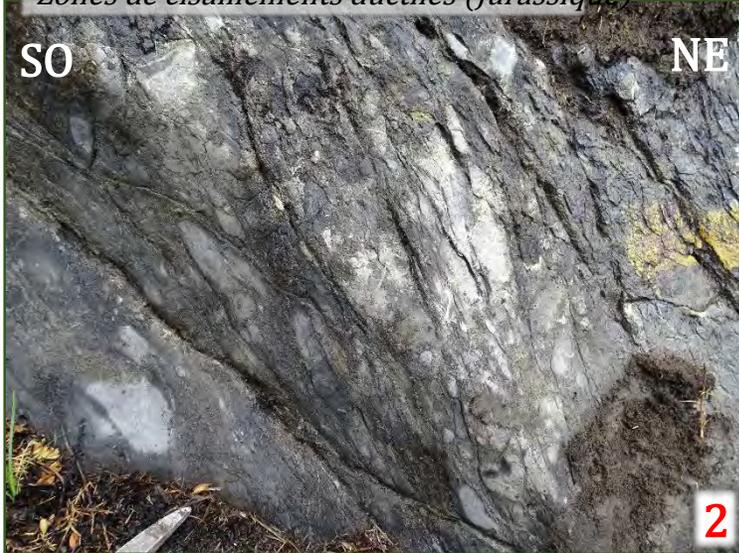


# Le massif d'Urdach-Les Perne

## Déformation de la couverture sédimentaire mésozoïque



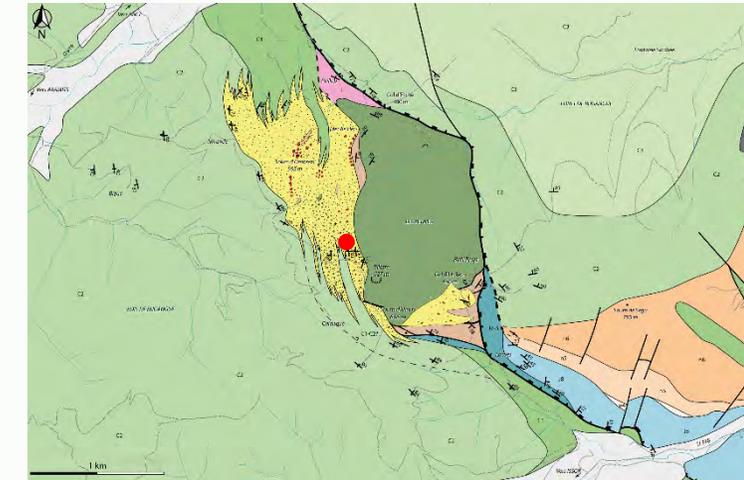
Zones de cisaillements ductiles (Jurassique)



Boudinage flyschs turoniens (post-r)



## Le massif d'Urdach-Les Pernes

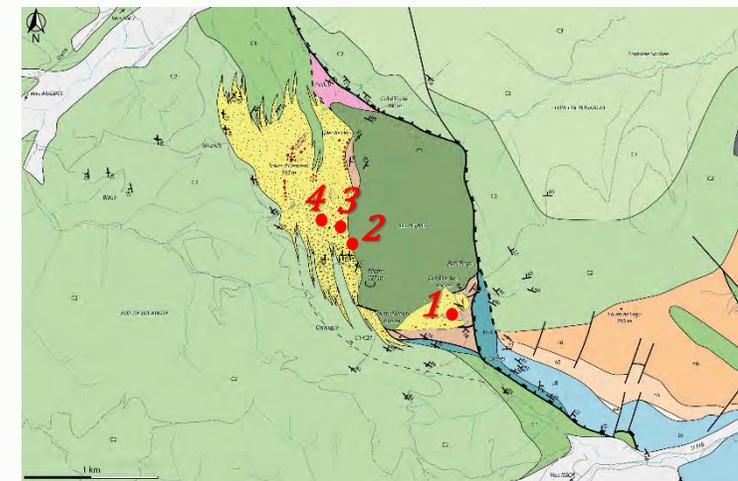
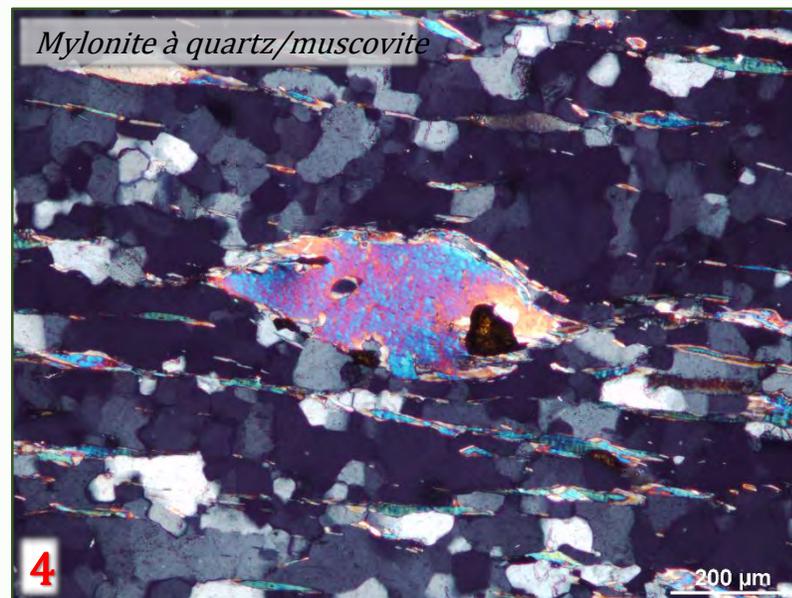
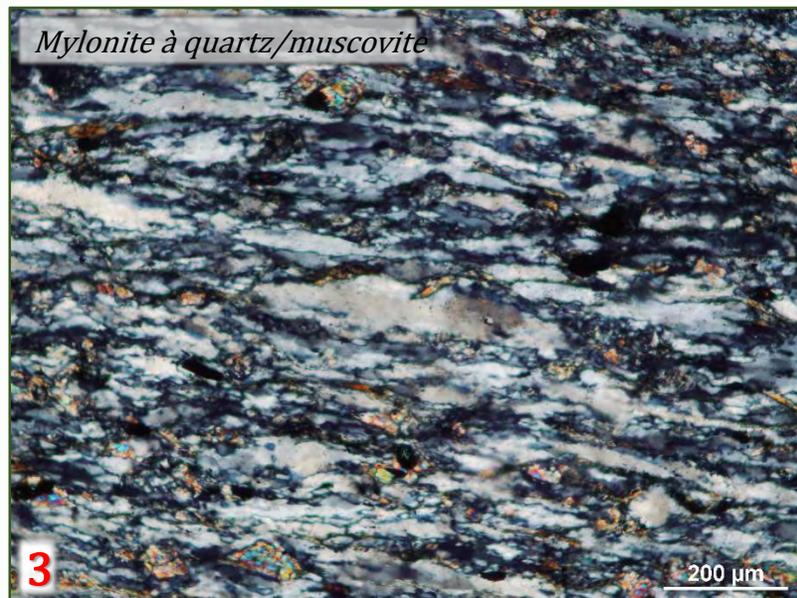
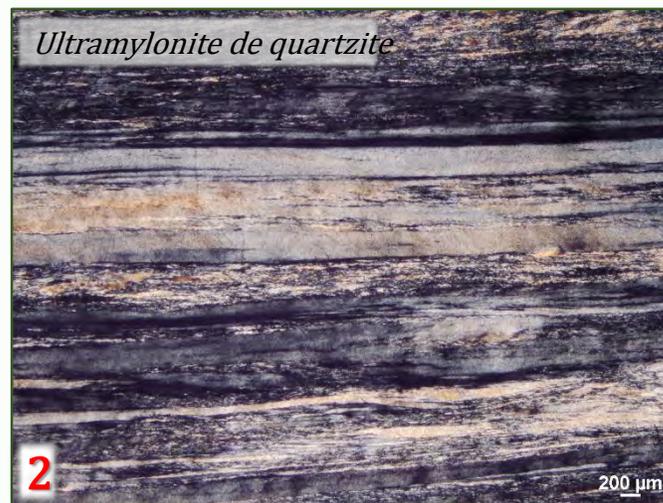


### Les Brèches d'Urdach

Brèches à éléments de  
manteau de socle paléozoïque  
et de sédiments mésozoïques

## Le massif d'Urdach-Les Pernes

## Fragments de socle paléozoïque



## Déformation du socle paléozoïque

70% de mylonites  
sur 55 échantillons de socle  
G. Bergamini (2015,2016)  
M1 et M2 RGF

Déformation mylonitique crétacé  
Autre âge crétacé

111±17 Ma (granitoïde: sphènes)

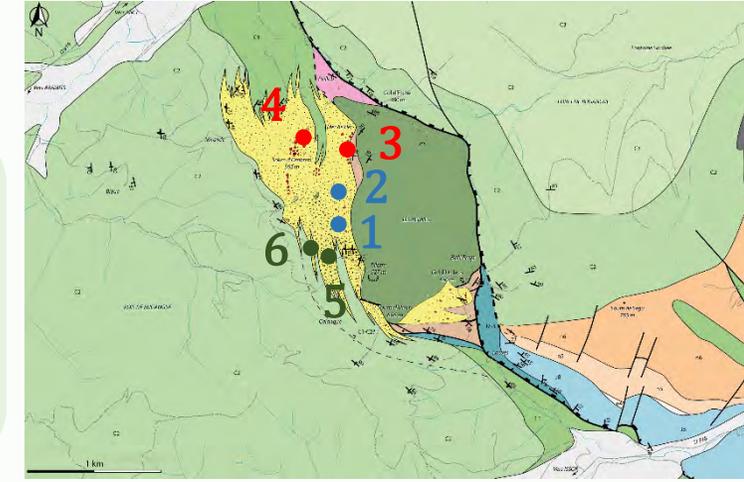
(Bergamini, 2016, M1 et M2 RGF, datation ICP-MS,  
Géosciences Rennes, M. Poujol)

## Le massif d'Urdach-Les Pernes



Brèches polygéniques  
à éléments de socle  
paléozoïque :

1. *Quartzite ordovicien*
2. *Schiste silurien*



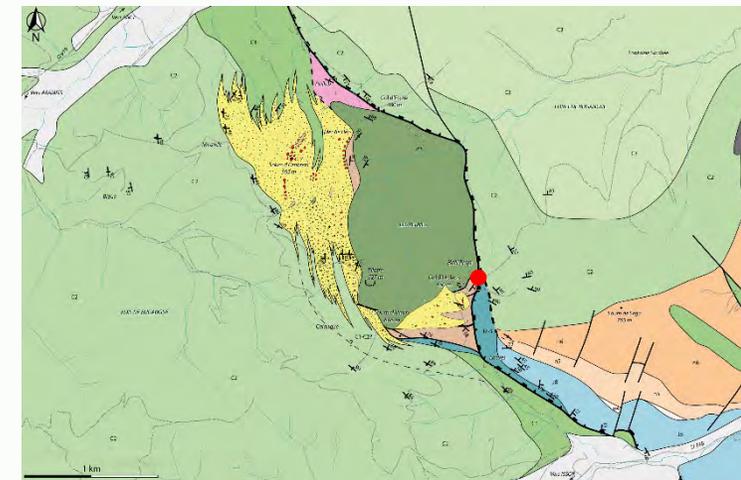
**Brèches cataclastiques:**

3. *Cataclasite de quartzites ordoviciens*
4. *Cataclasite de carbonates aptien*



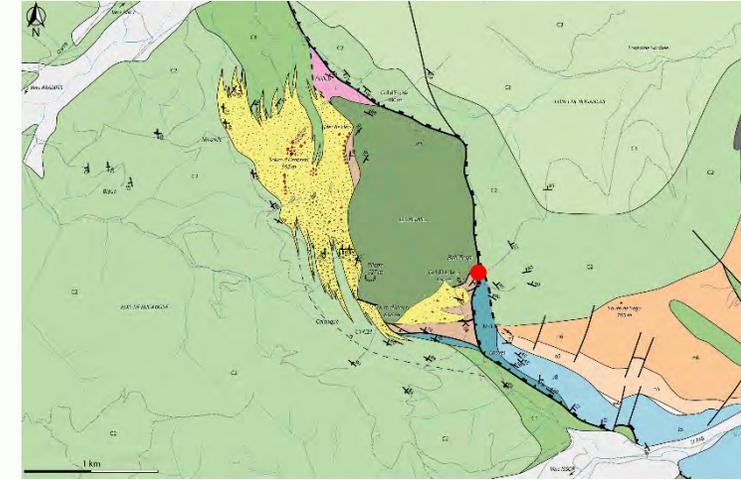
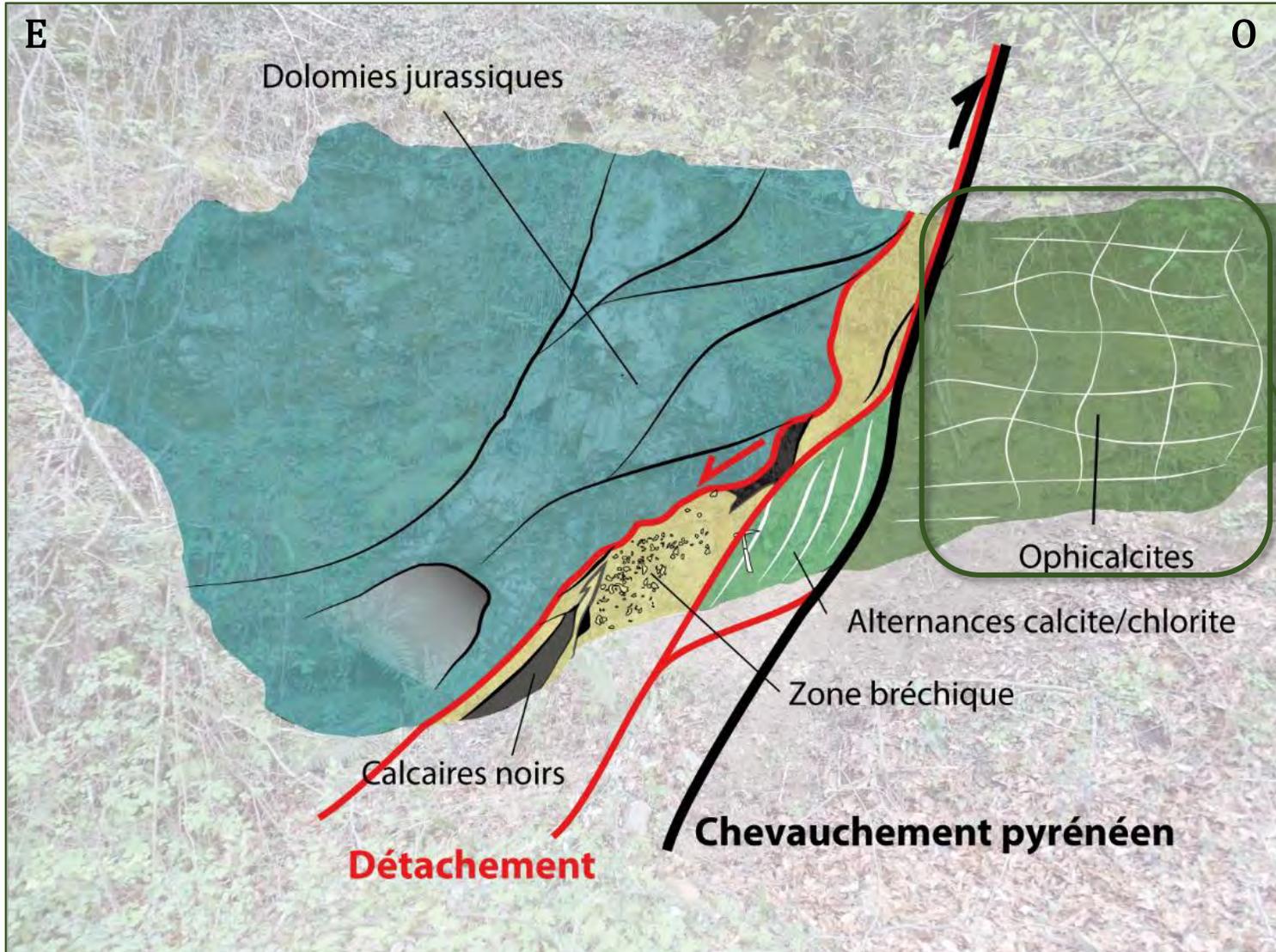
**Brèches à péridotites foliées**

# Le massif d'Urdach-Les Pernes

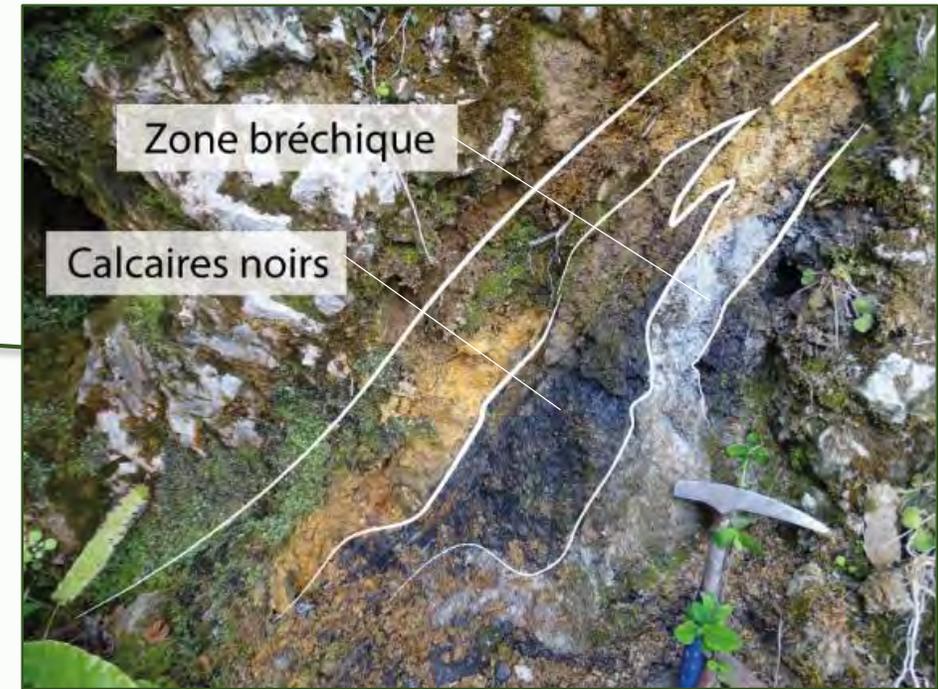
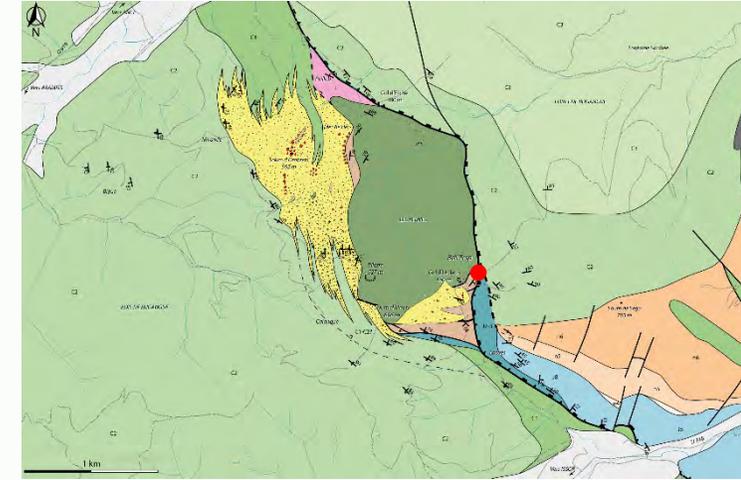
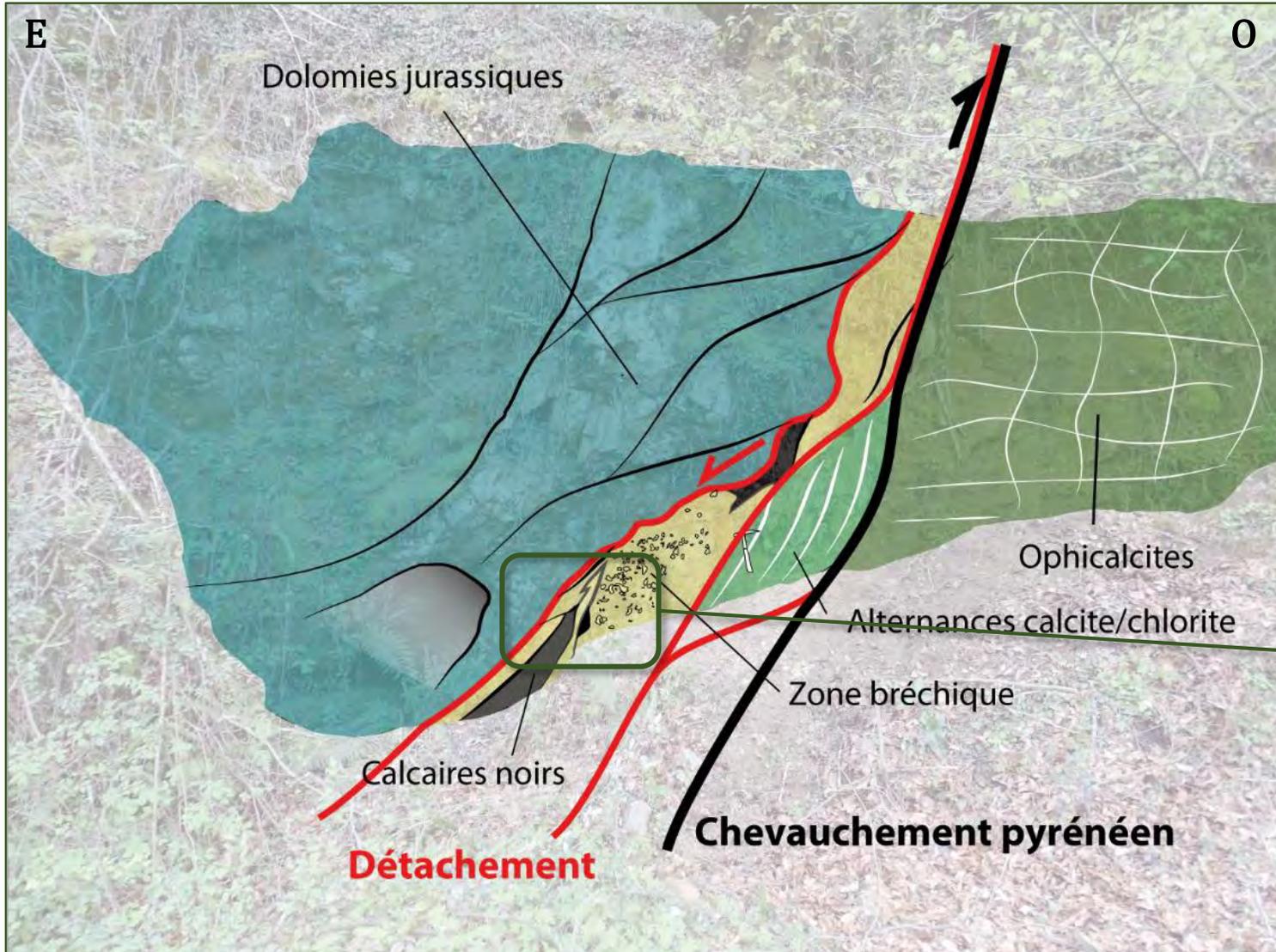


Un contact d'exhumation préservé

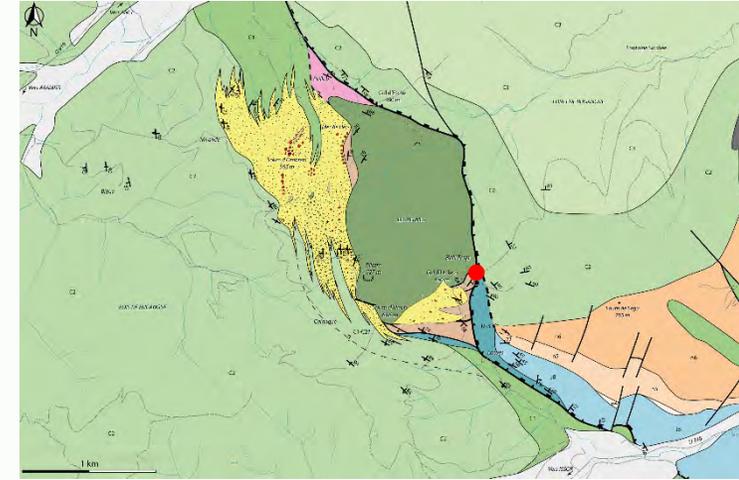
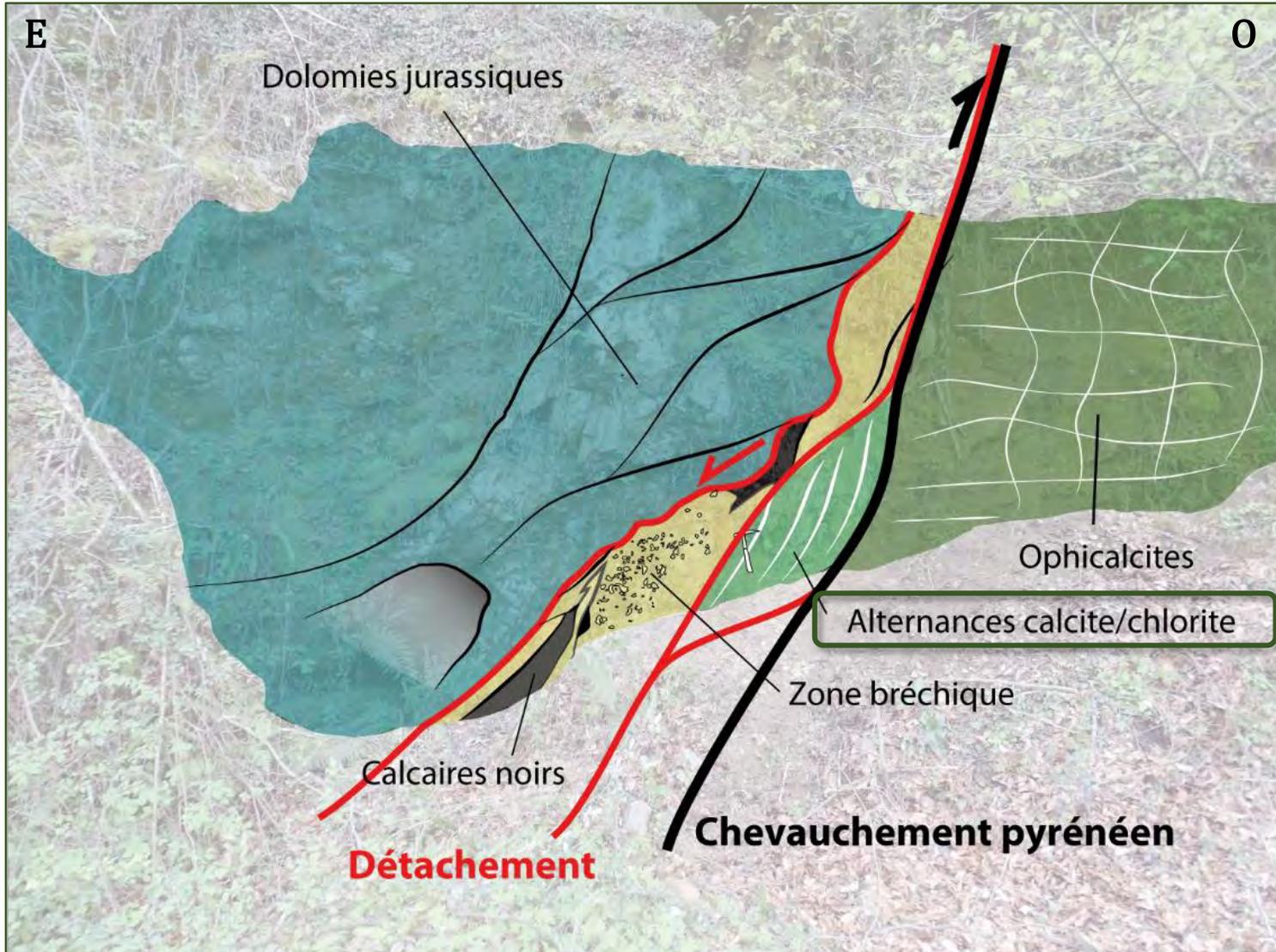
# Le massif d'Urdach-Les Pernes



# Le massif d'Urdach-Les Pernes

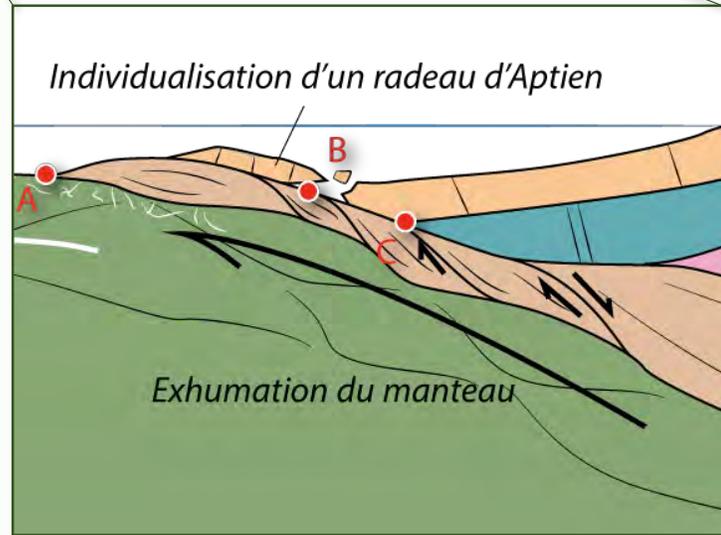
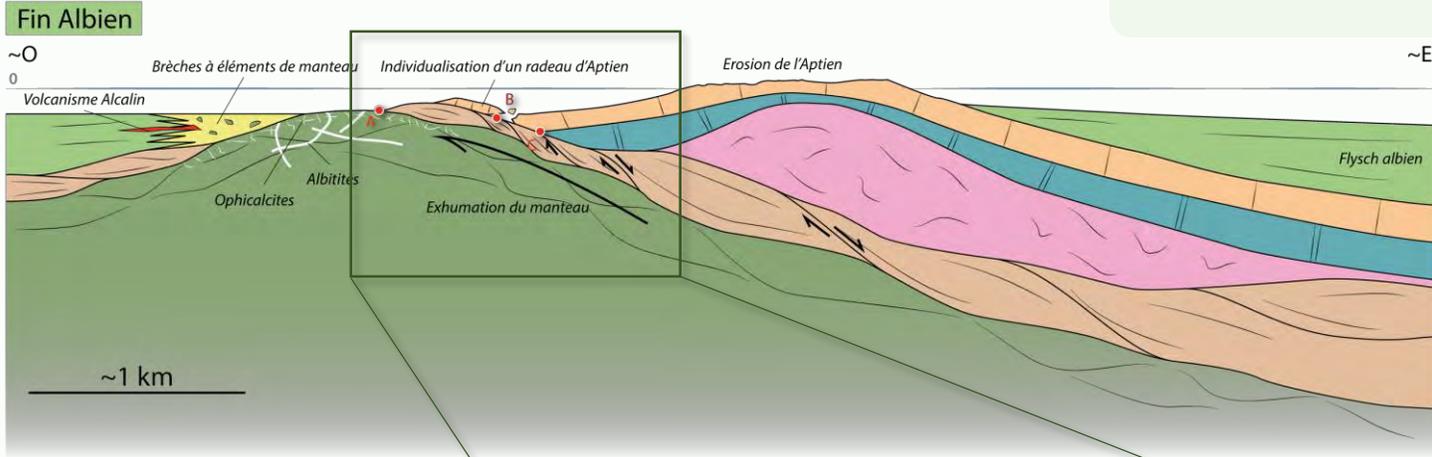


# Le massif d'Urdach-Les Pernes



# Le massif d'Urdach-Les Pernes

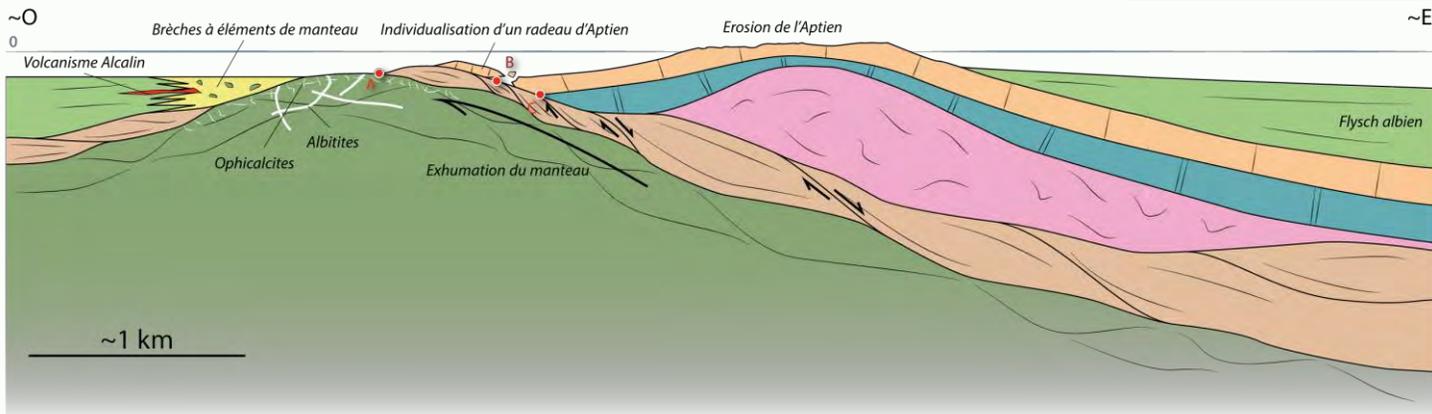
## Dénudation du manteau et remaniement du manteau et du socle paléozoïque



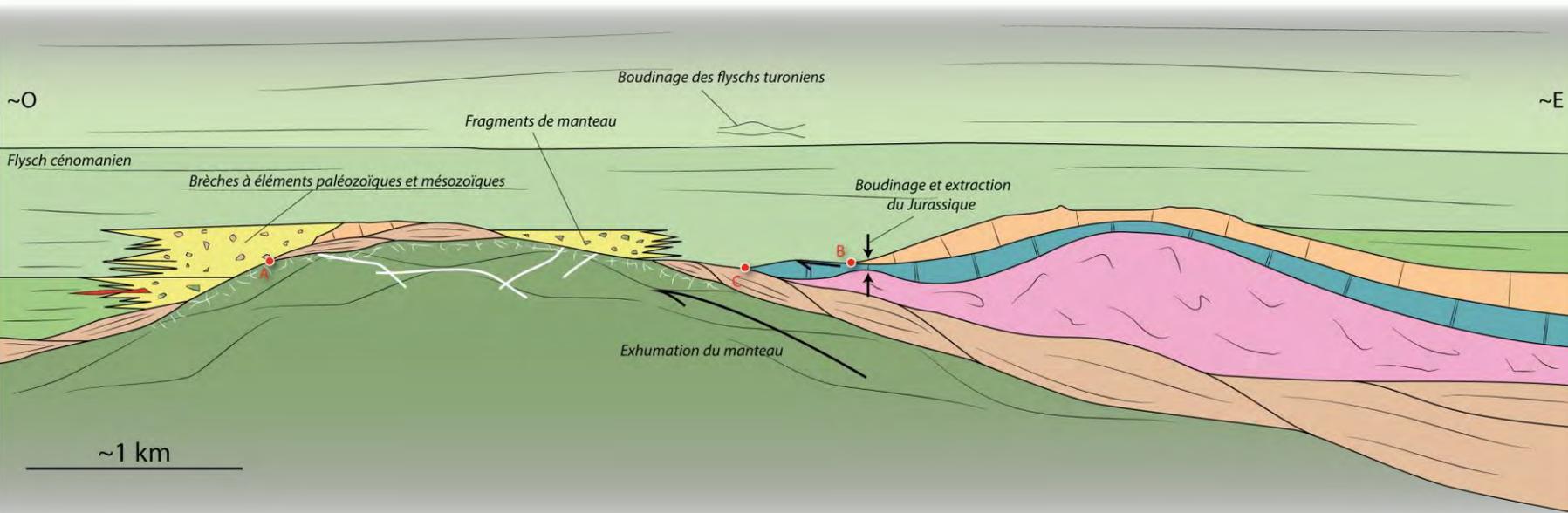
# Le massif d'Urdach-Les Perne

## Dénudation du manteau et remaniement du manteau et du socle paléozoïque

### Fin Albien

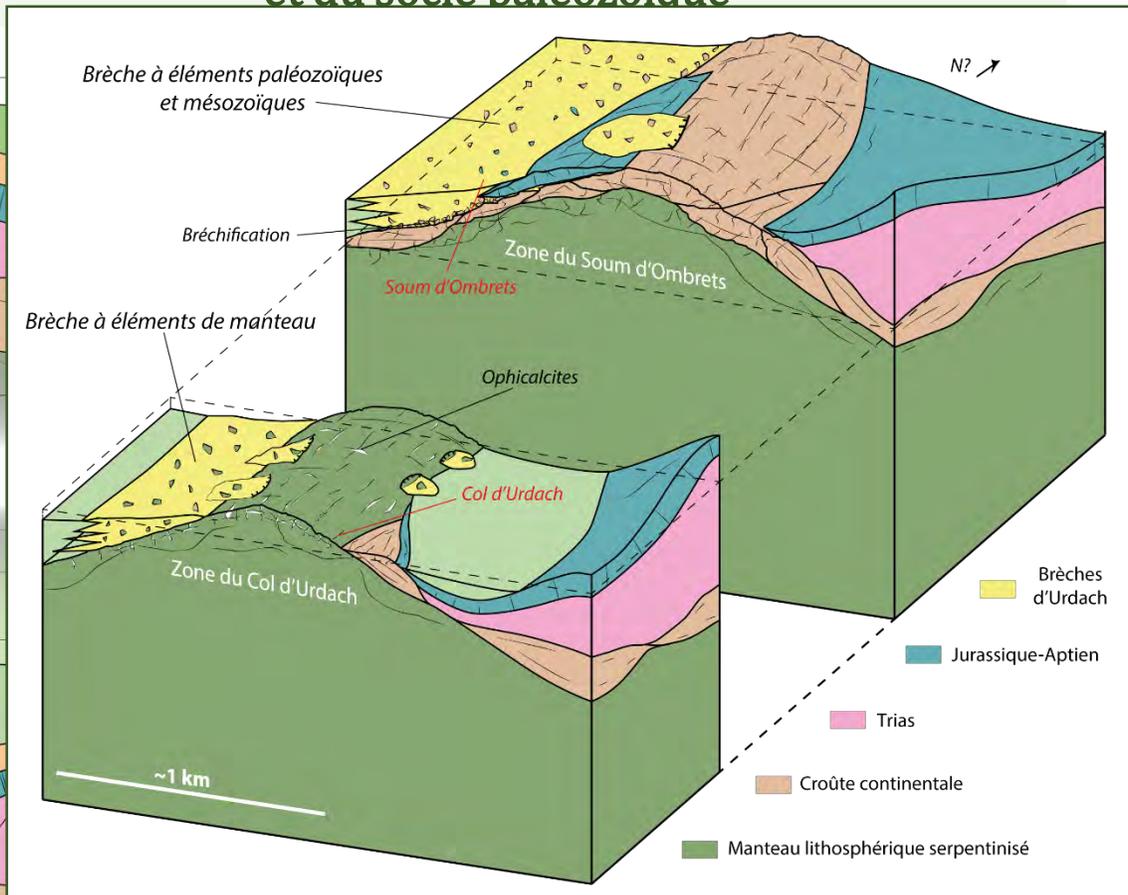
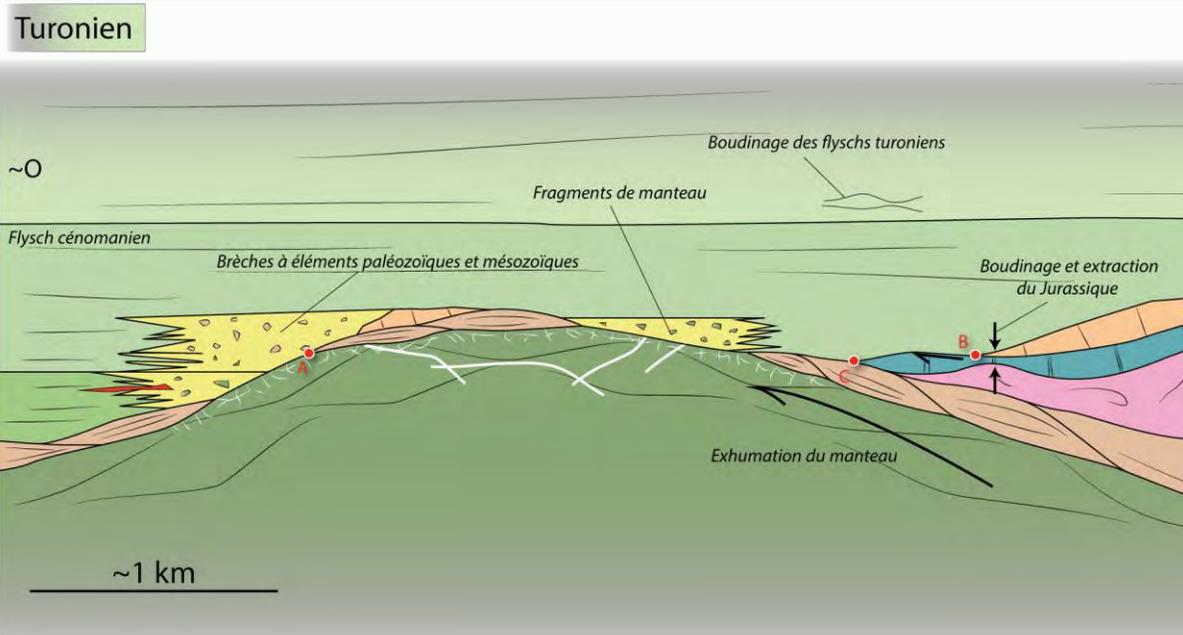
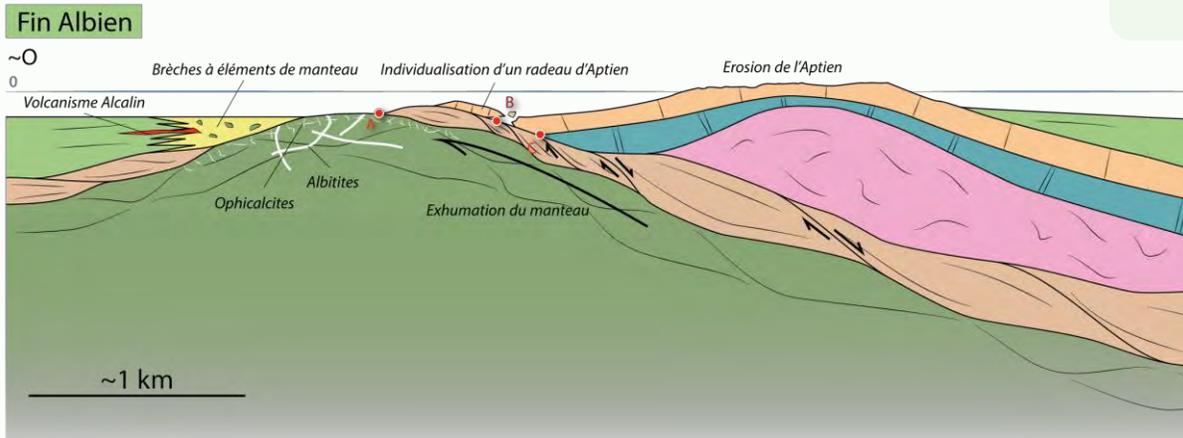


### Turonien



# Le massif d'Urdach-Les Pernes

## Dénudation du manteau et remaniement du manteau et du socle paléozoïque



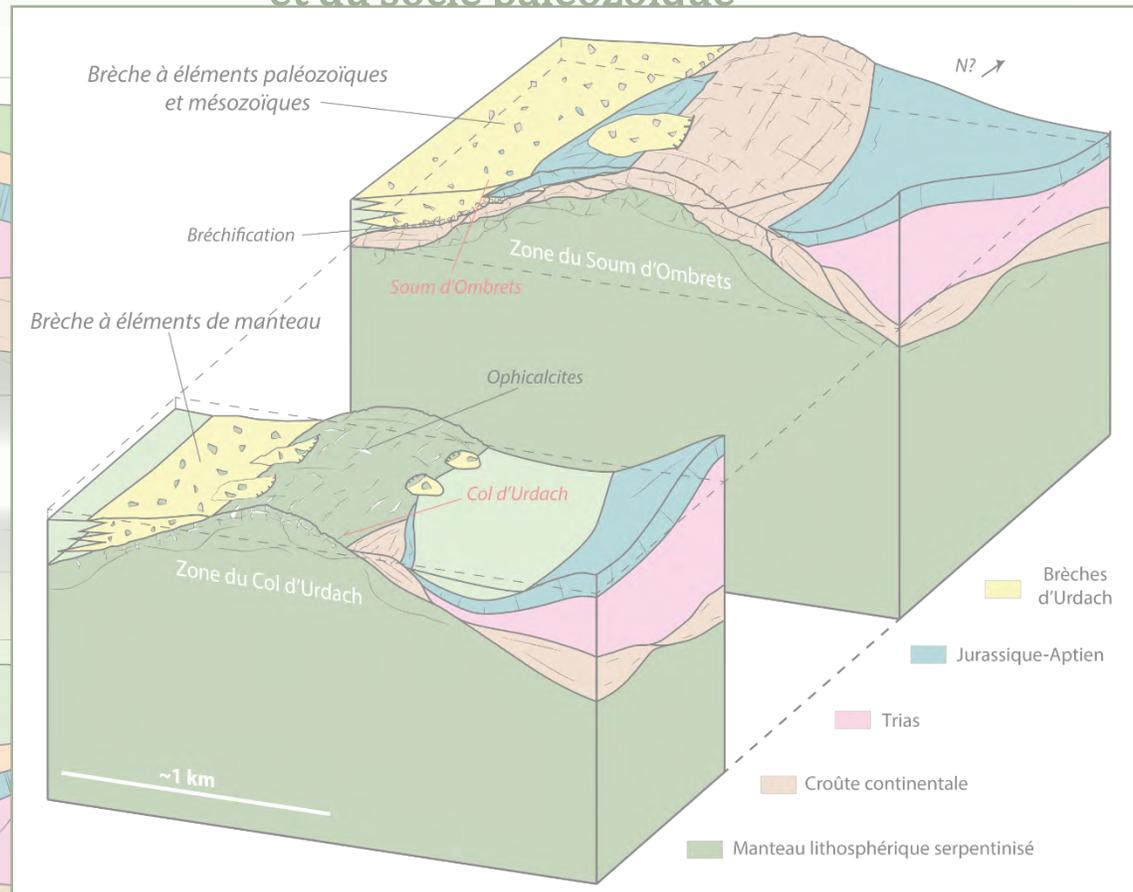
Reconstitution des fonds marins à l'Albo-Cénomaniien

# Le massif d'Urdach-Les Pernes



Mise en évidence de circulation de saumures au massif d'Urdach-Les Pernes (Nteme, 2017, M2 RGF)

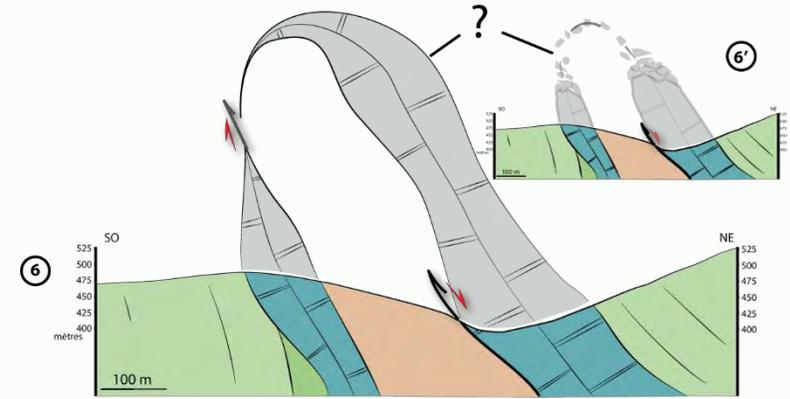
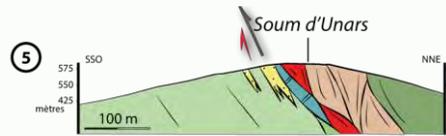
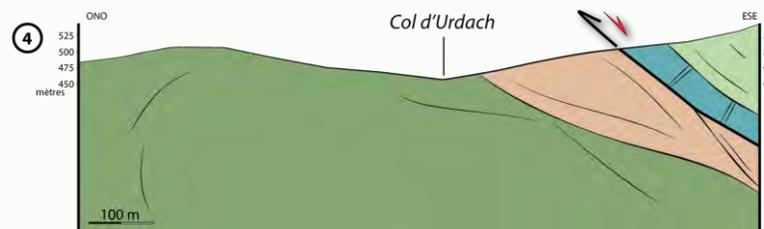
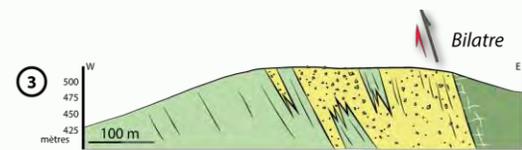
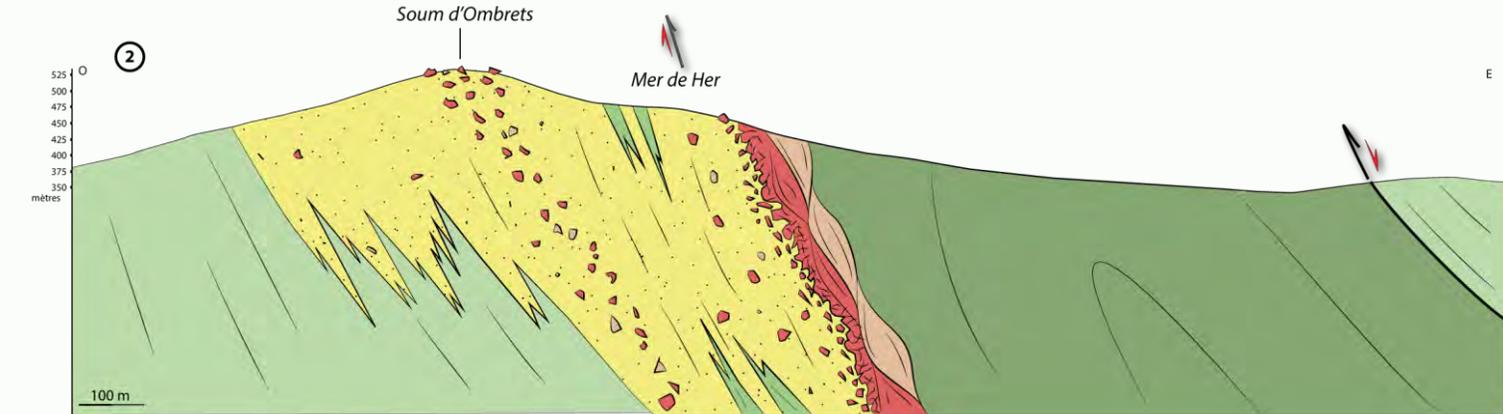
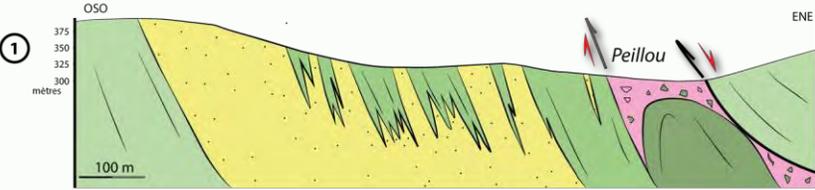
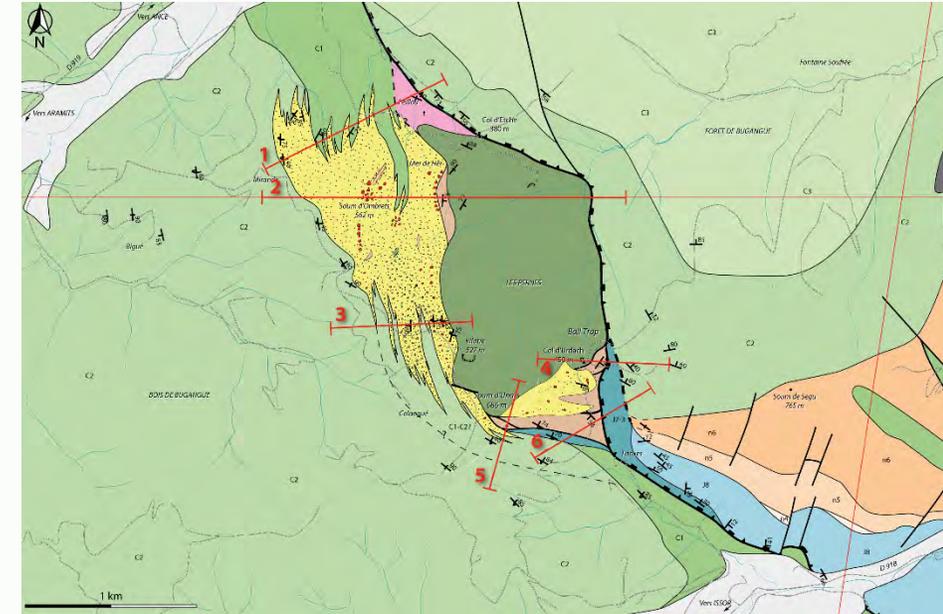
## Dénudation du manteau et remaniement du manteau et du socle paléozoïque



Reconstitution des fonds marins à l'Albo-Cénomaniien

# Le massif d'Urdach-Les Pernes

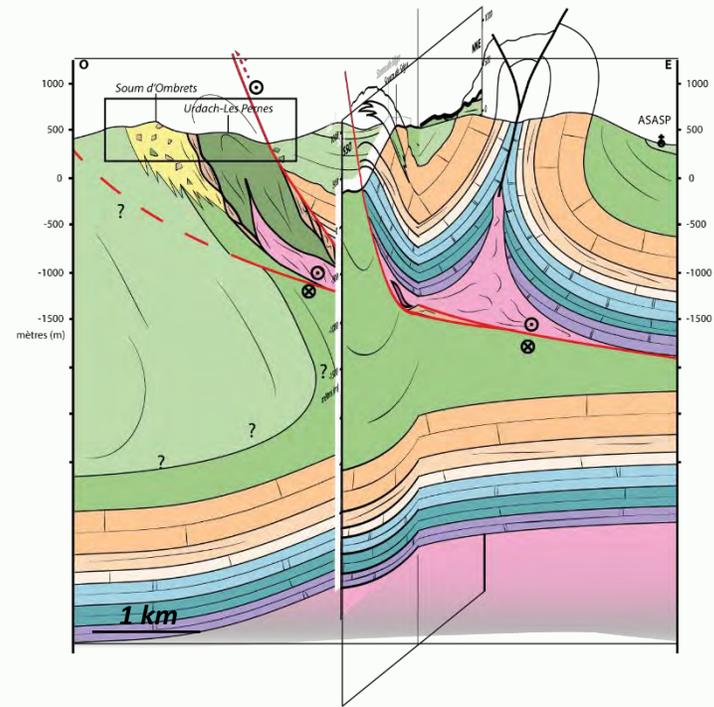
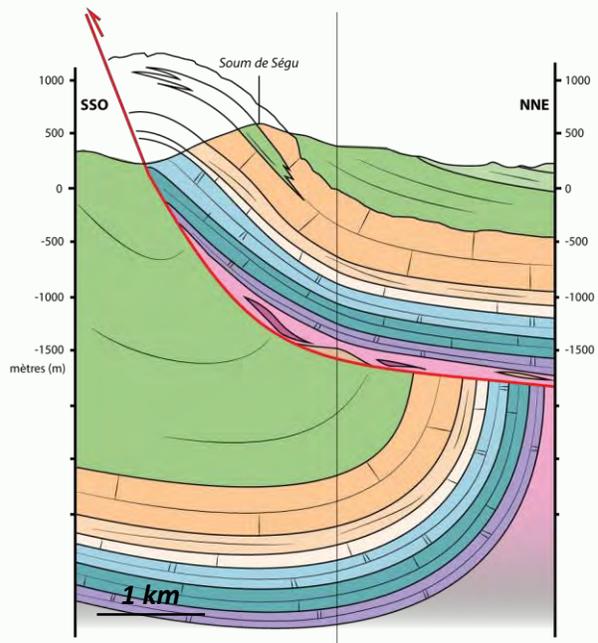
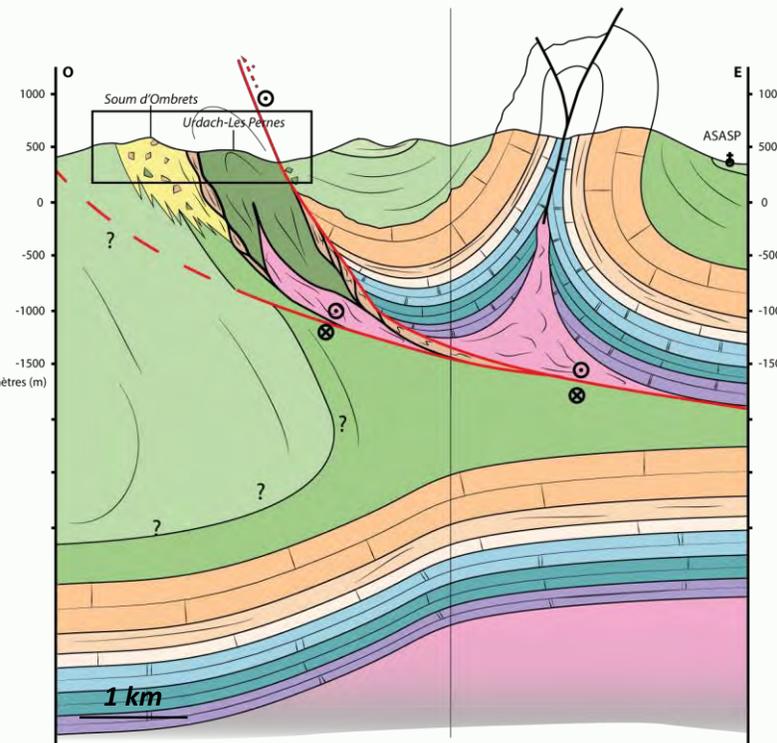
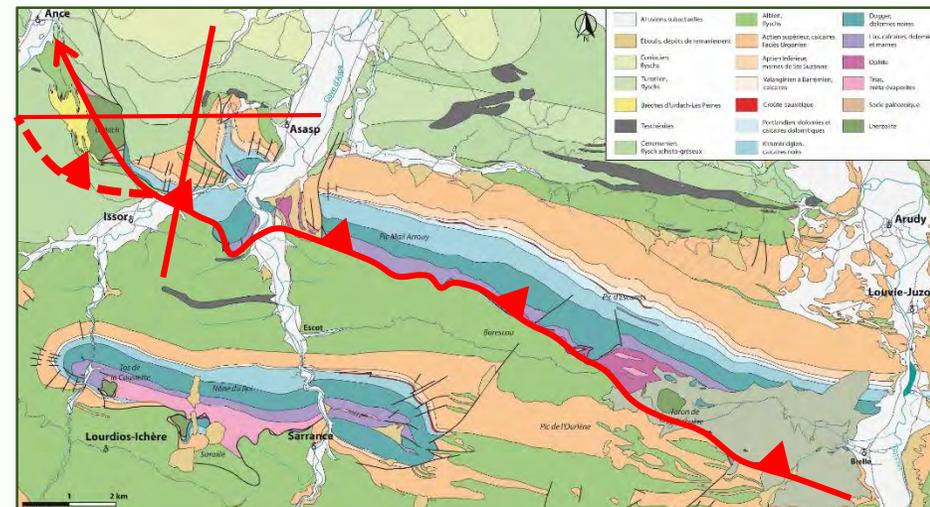
## Un contact d'exhumation plissé



- Alluvions subactuelles
- Turonien (C3), flysch
- Brèche de base du Cénomaniens (Urdach)
- Teschérites
- Albo-Cénomaniens (C2), flysch schisto-gréseux
- Albien Supérieur (C1), Flysch Noir
- Aptien supérieur (n6), calcaires, Faciès Urgonien
- Aptien Inférieur (n5), marnes
- Valanginiens à Barrémiens (n4), calcaires
- Kimméridgien (J8), calcaires noirs
- Callovo-Oxfordien (J7-3), dolomies noires
- Trias (t), cataclastique, évaporites
- Socle paléozoïque
- Périidotite
- Contacts stratigraphiques
- Blocs de périidotite
- Blocs de brèche quartzitique (Ordovicien)
- Détachement repris en chevauchement
- Contacts tectoniques

# Le massif d'Urdach-Les Pernes

# Rampe latérale de la structure du Mail Arrouy

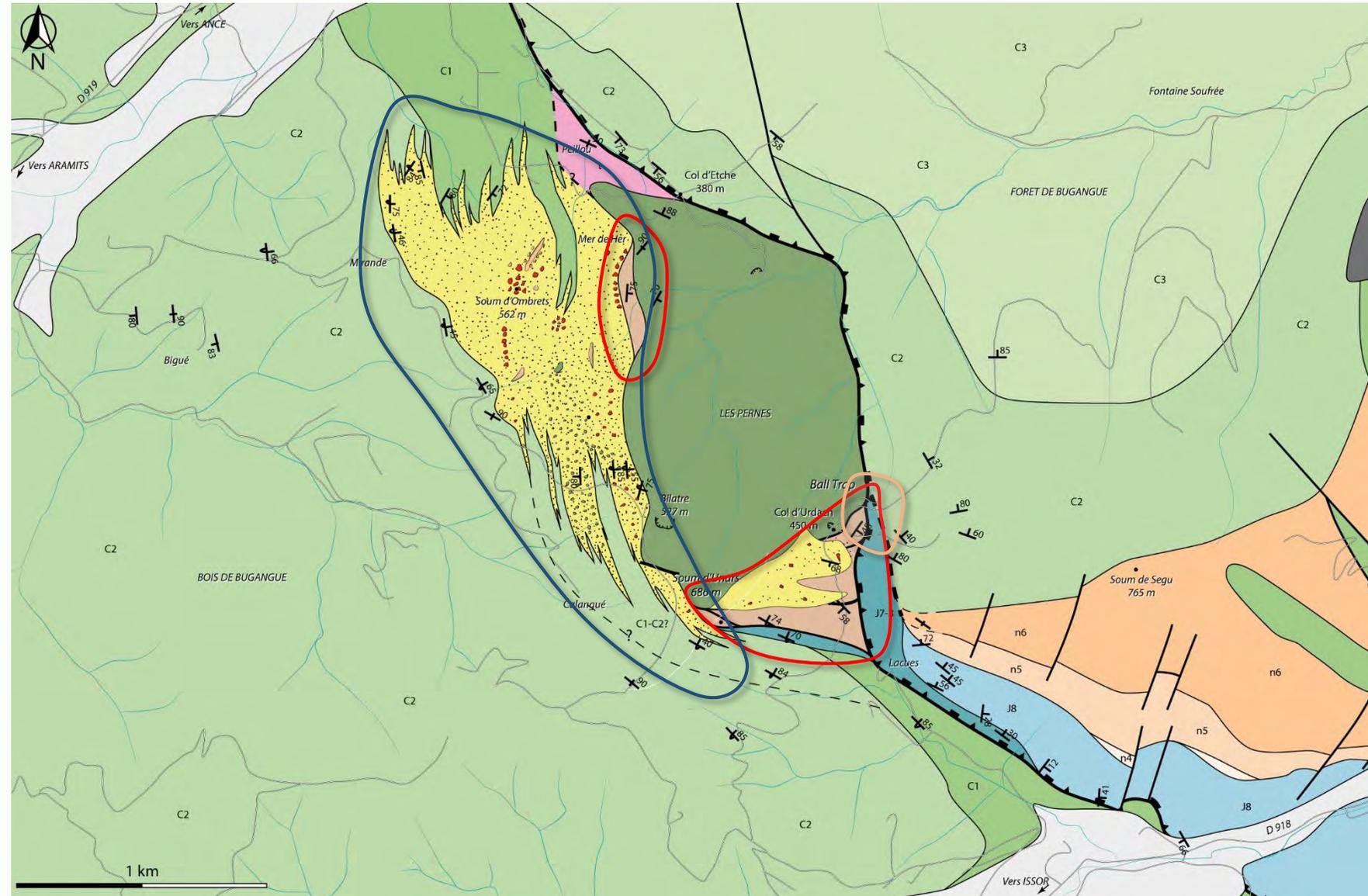


- |                      |                         |  |                |
|----------------------|-------------------------|--|----------------|
| Turonian, (flysch)   | Albiens, (Flysch Noir)  | Callovo-Oxfordien, (dolomies noires)   | Trias (ophite) |
| Cénomaniens (flysch) | Aptien sup. (calcaires) | Lias (calcaires et marnes)             | Paléozoïque    |
| Brèches d'Urdach,    | Neocomien (marnes)      | Trias (méta-évaaporites et cargneules) | Lherzolite     |

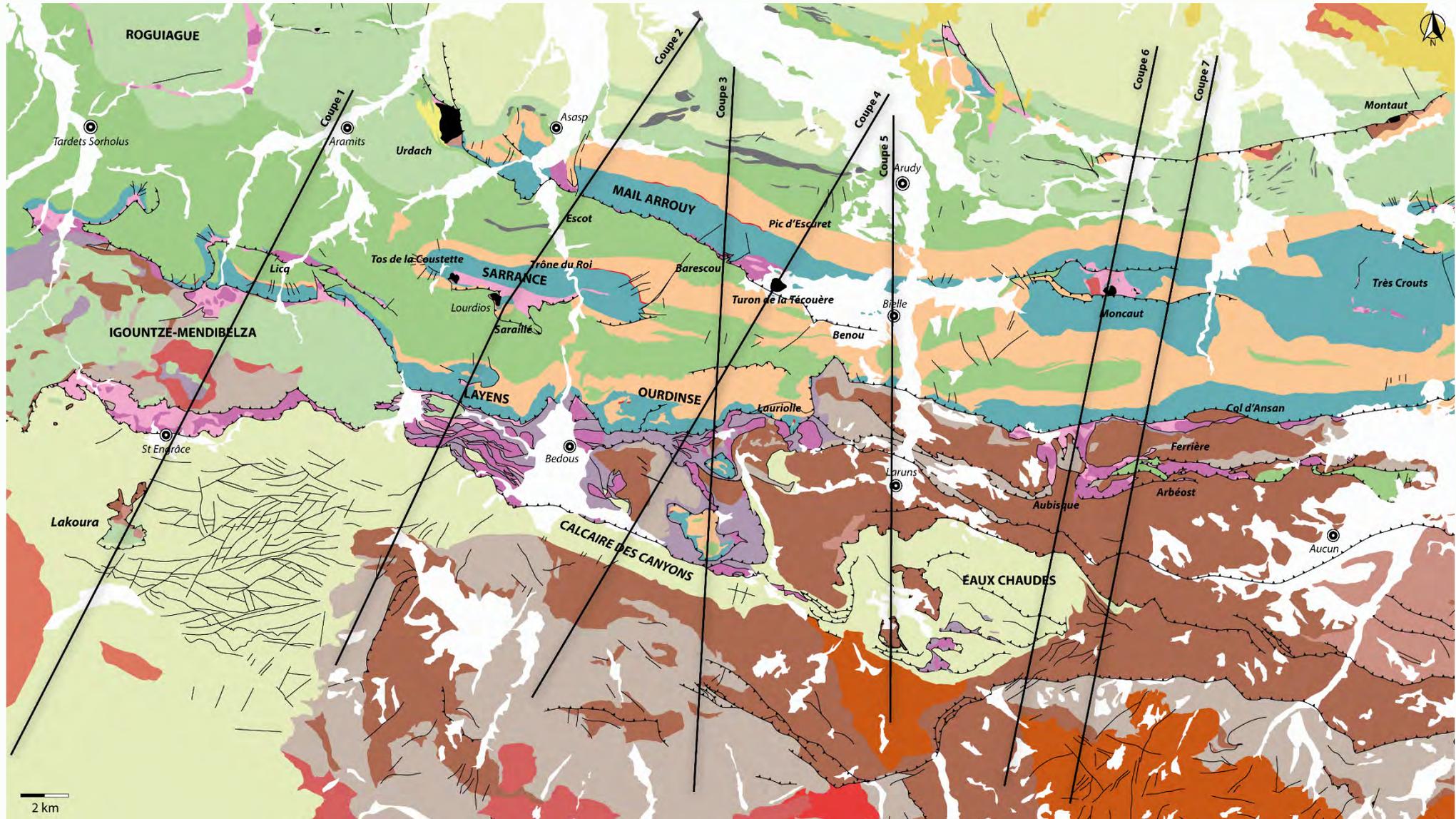
## Le massif d'Urdach-Les Pernes

### En résumé

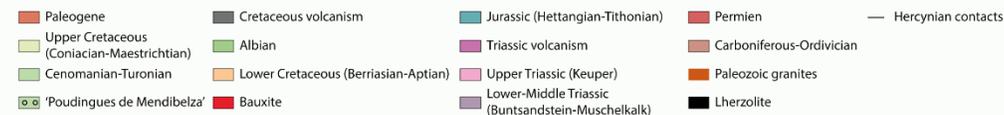
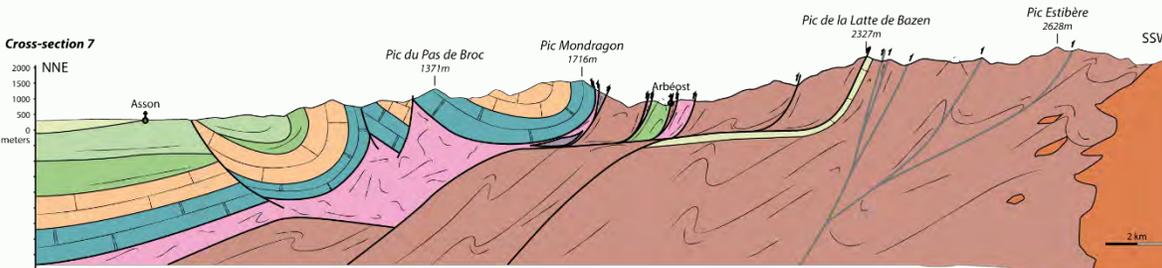
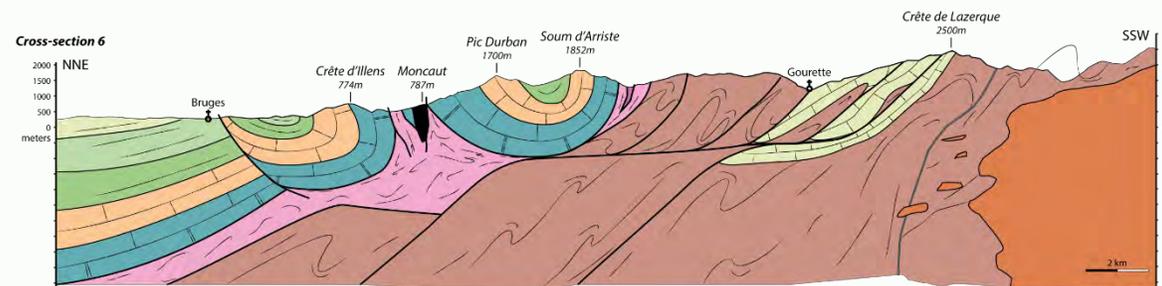
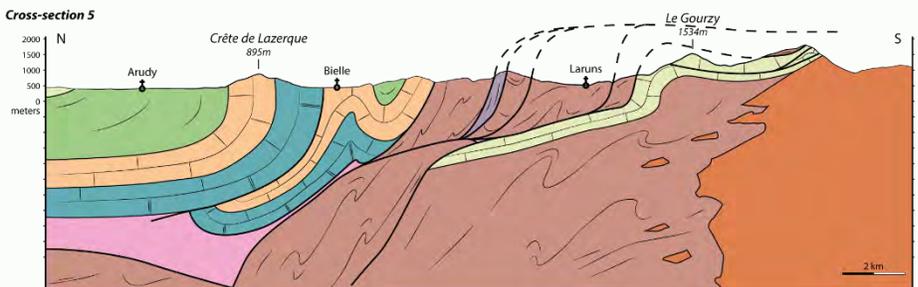
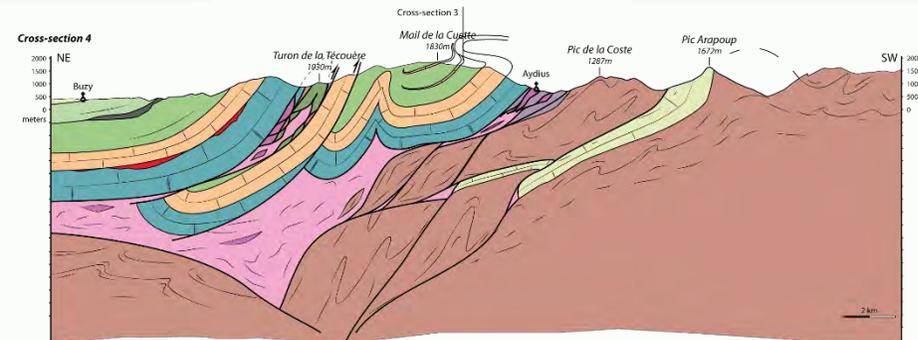
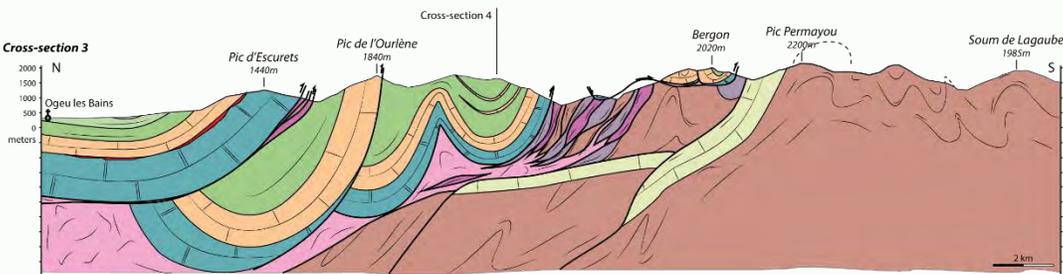
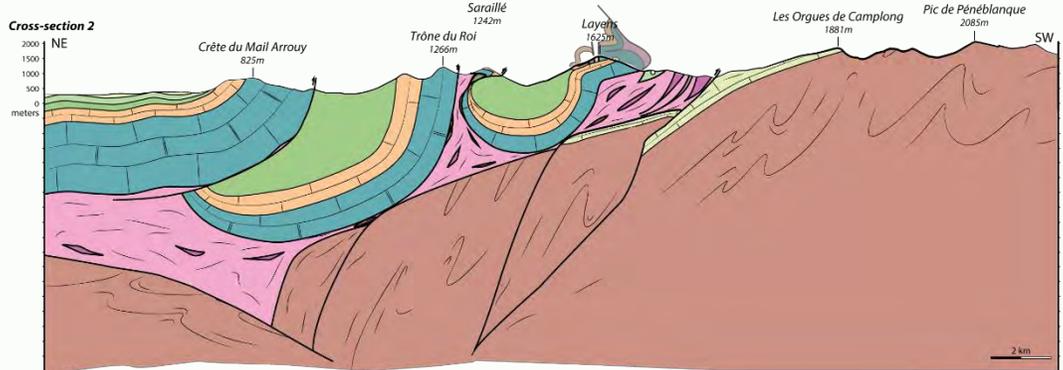
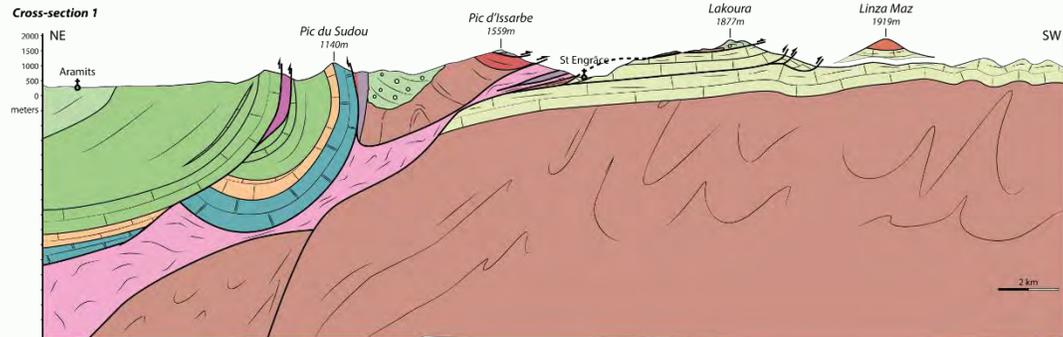
- Lherzolite d'Urdach-Les Pernes entourée de lentilles de socle paléozoïque déformées et cataclasées
- Brèches de cataclasites et d'éléments résédimentés en position inverse (manteau, socle, mésozoïque)
- Contact d'exhumation préservé au sud-est du massif



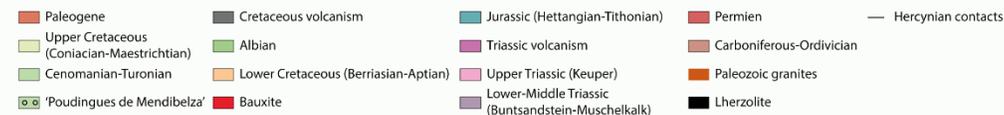
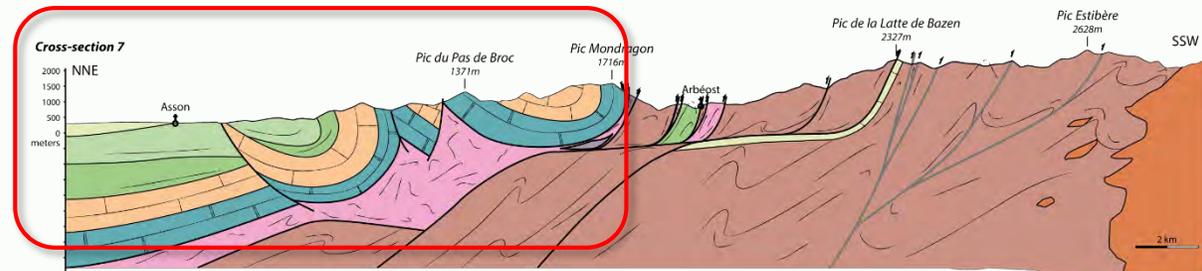
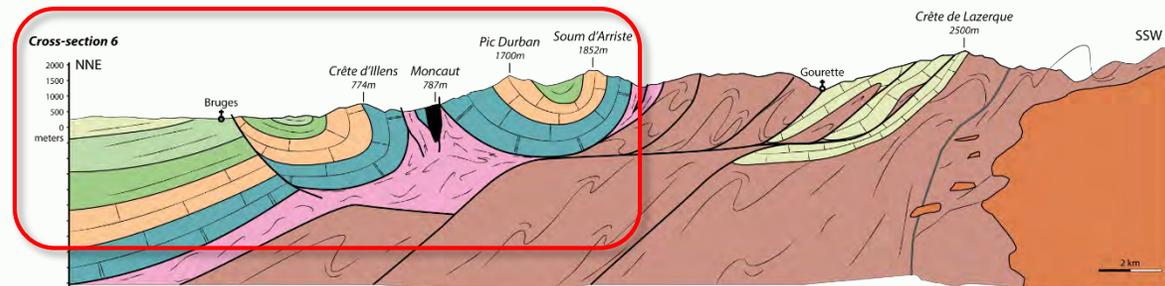
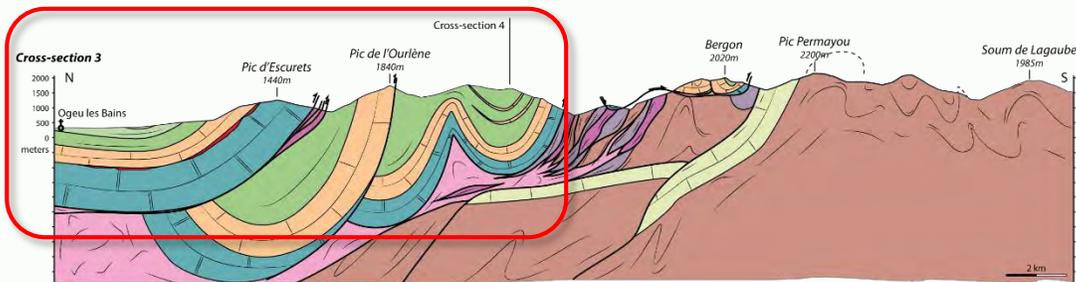
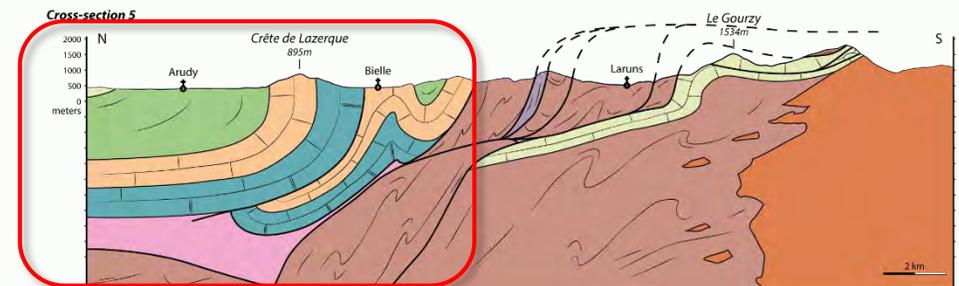
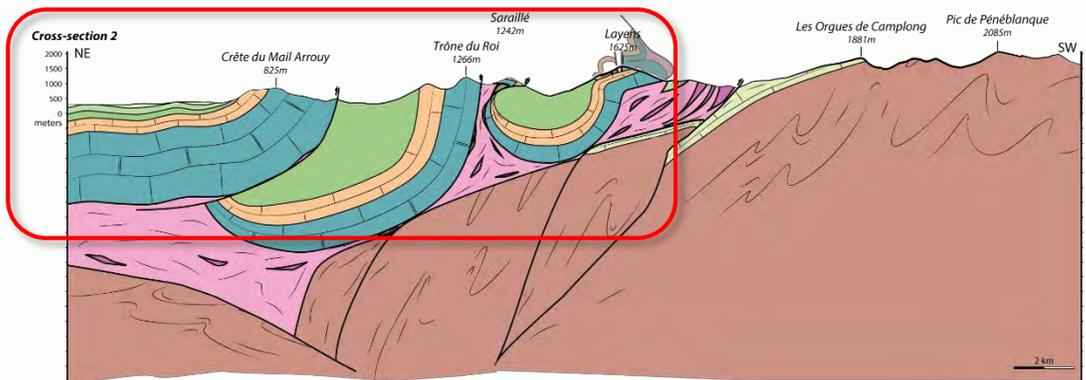
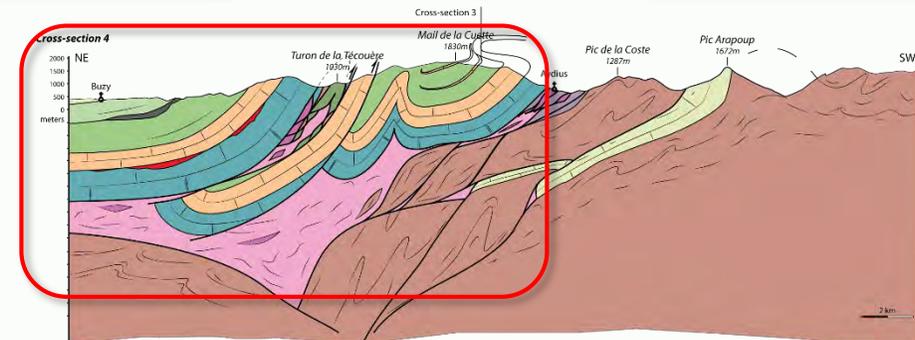
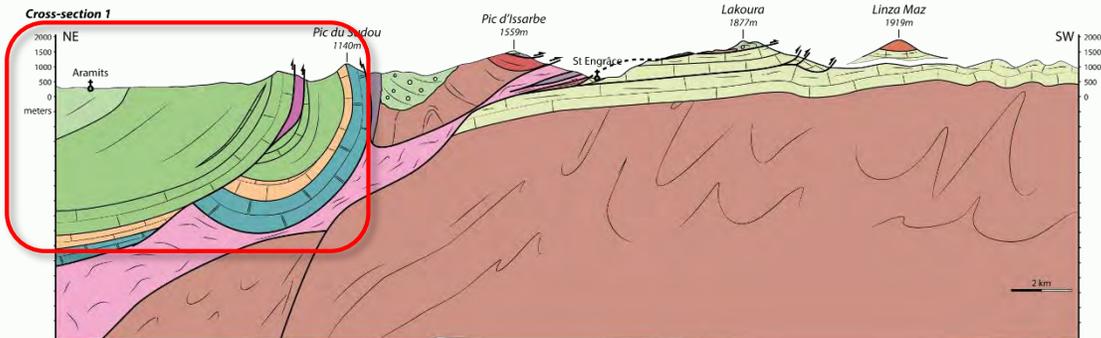
# La bordure sud des Chaînon Béarnais



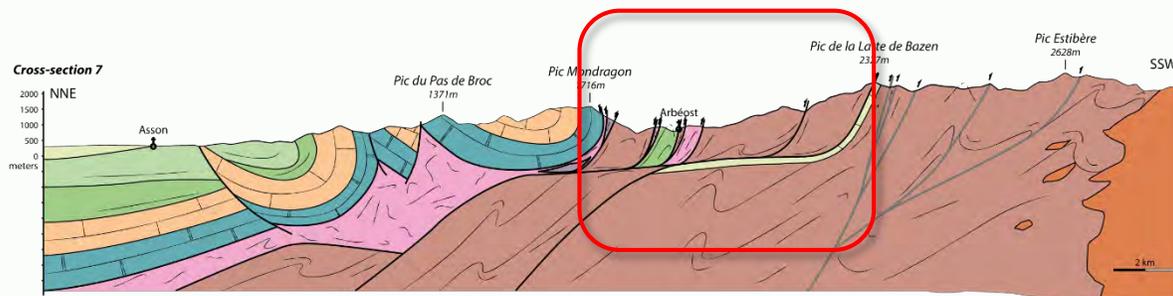
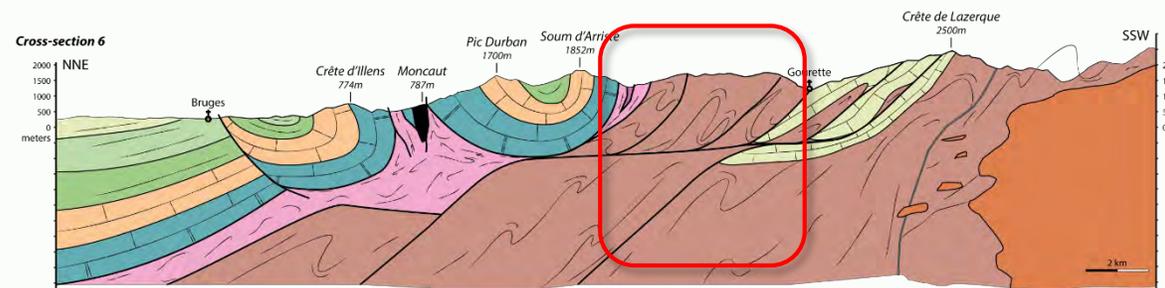
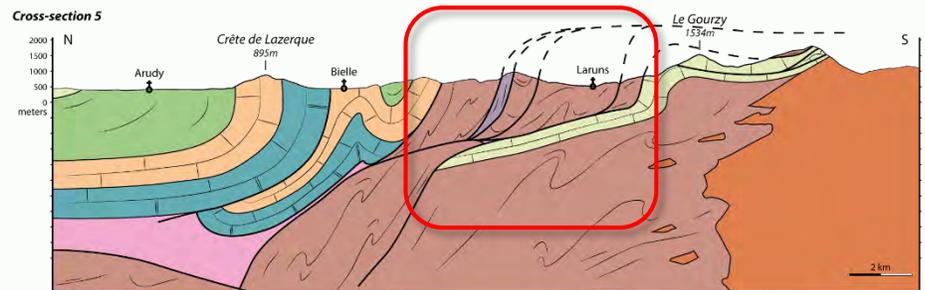
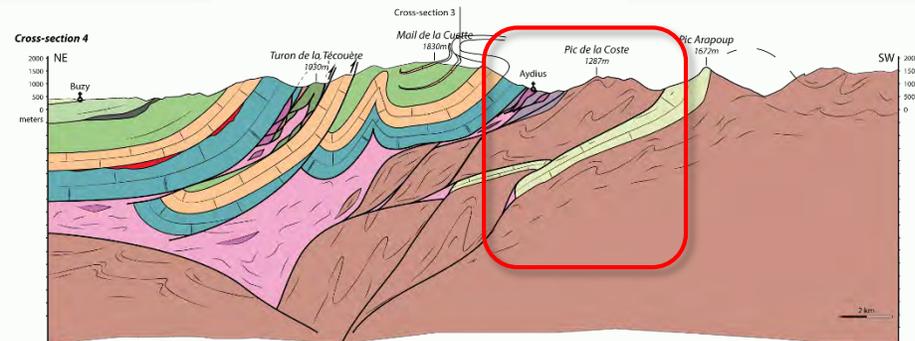
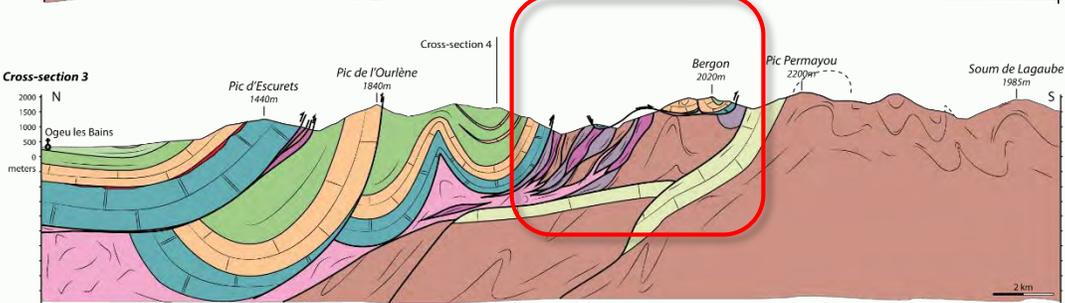
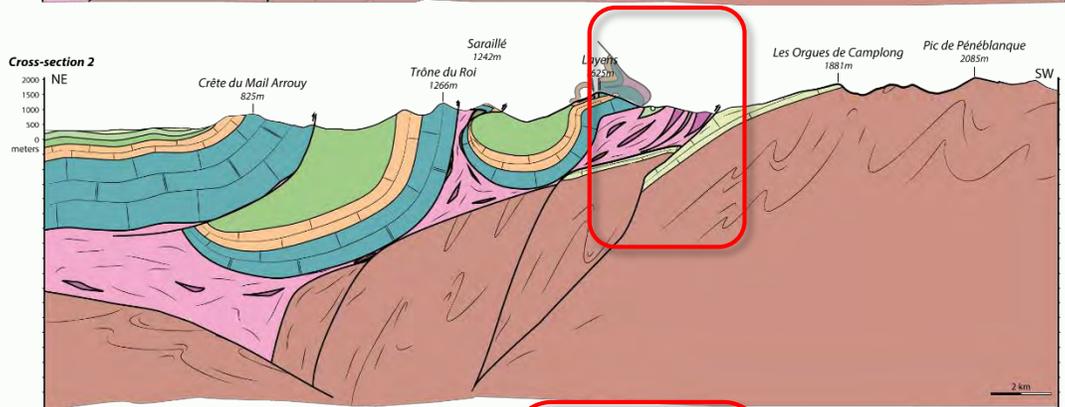
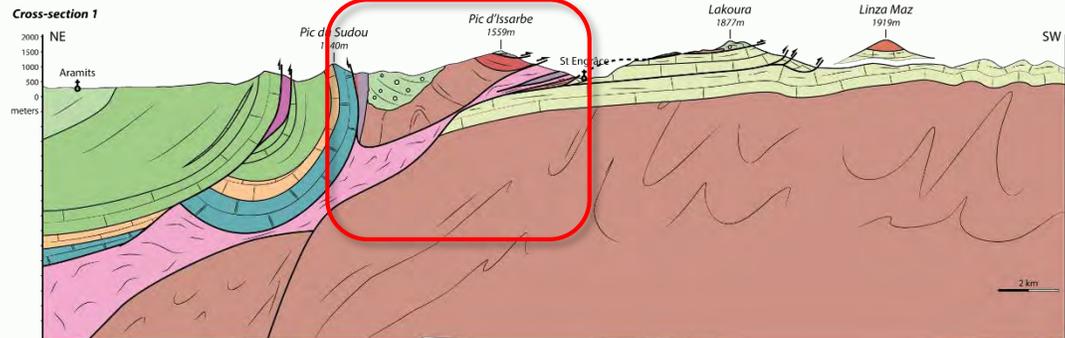
# La bordure sud des Chaînon Béarnais



# La bordure sud des Chaînon Béarnais

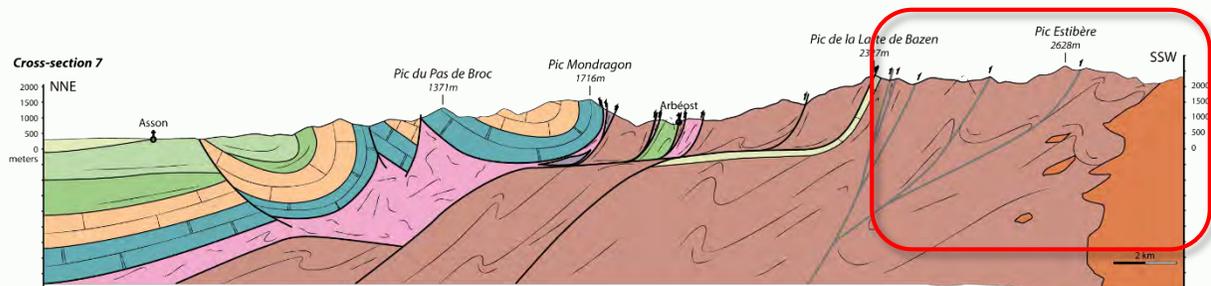
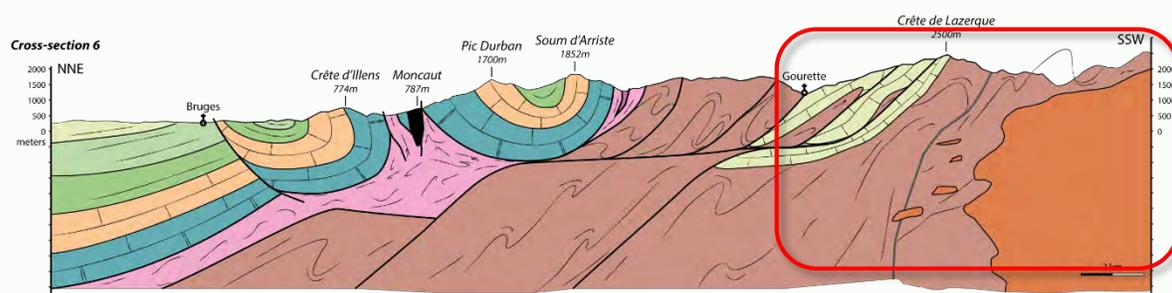
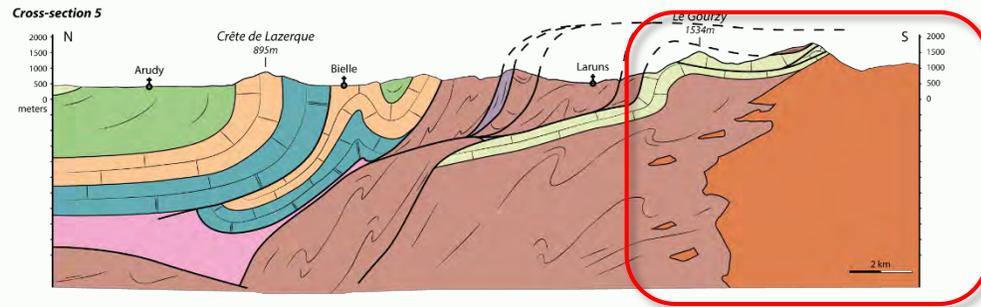
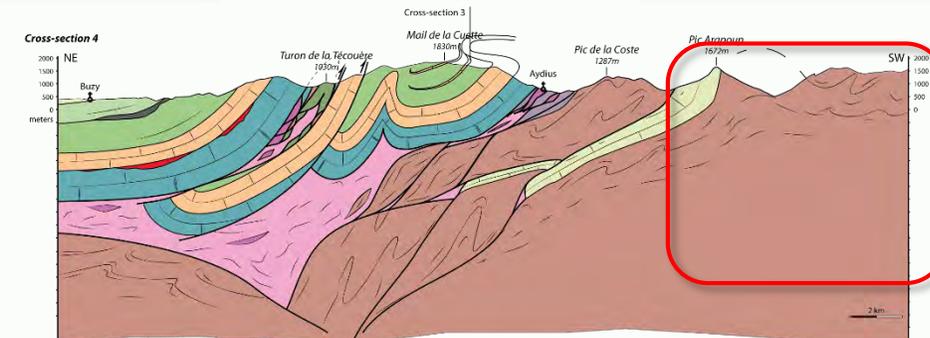
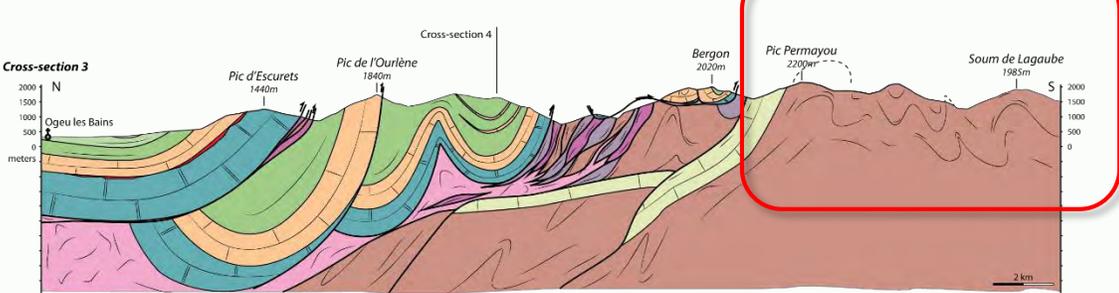
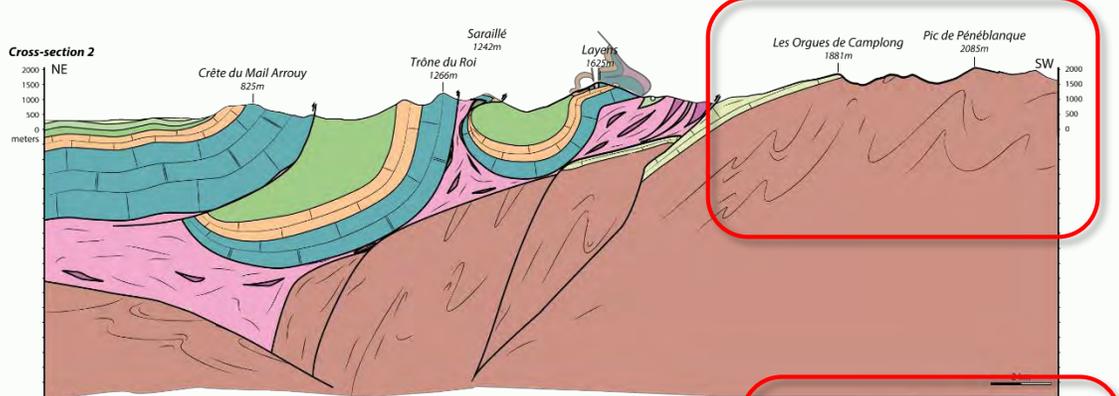
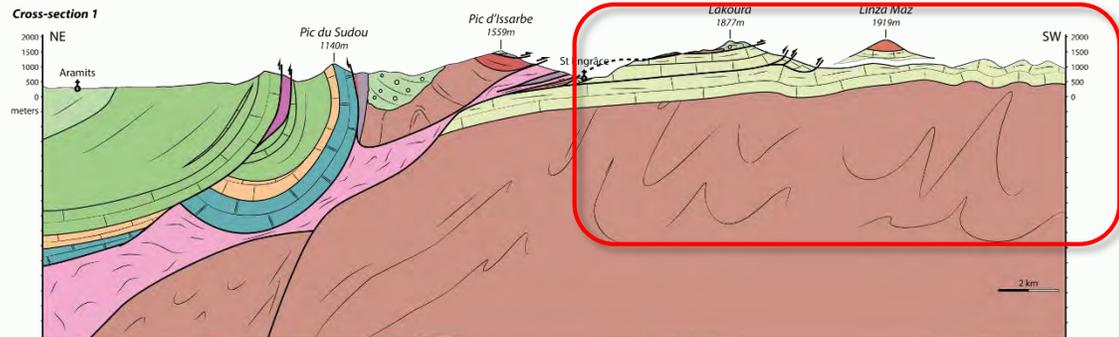


# La bordure sud des Chaînon Béarnais



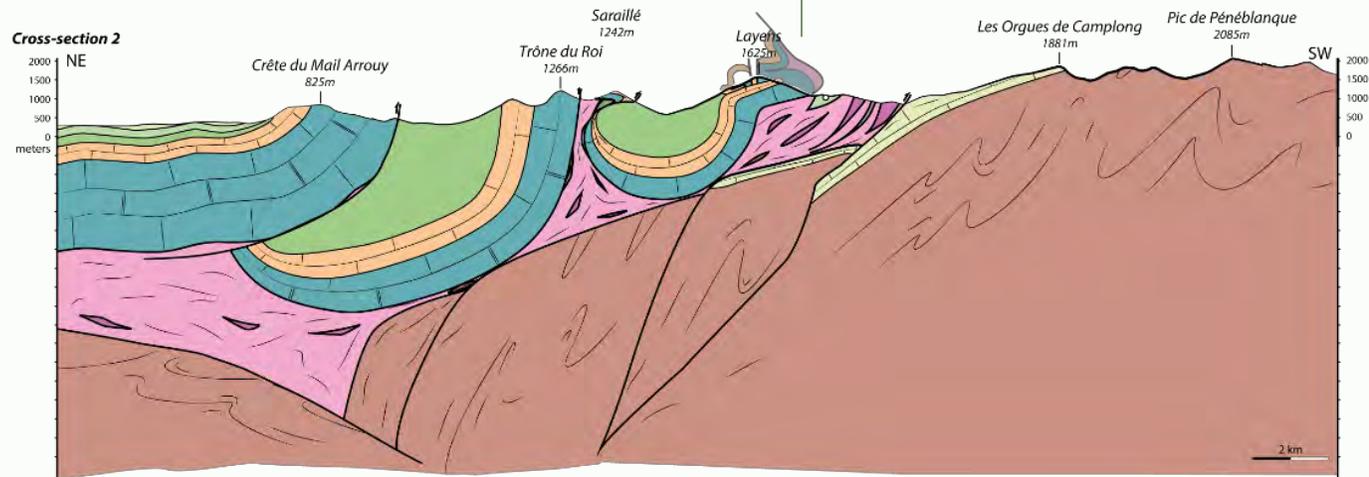
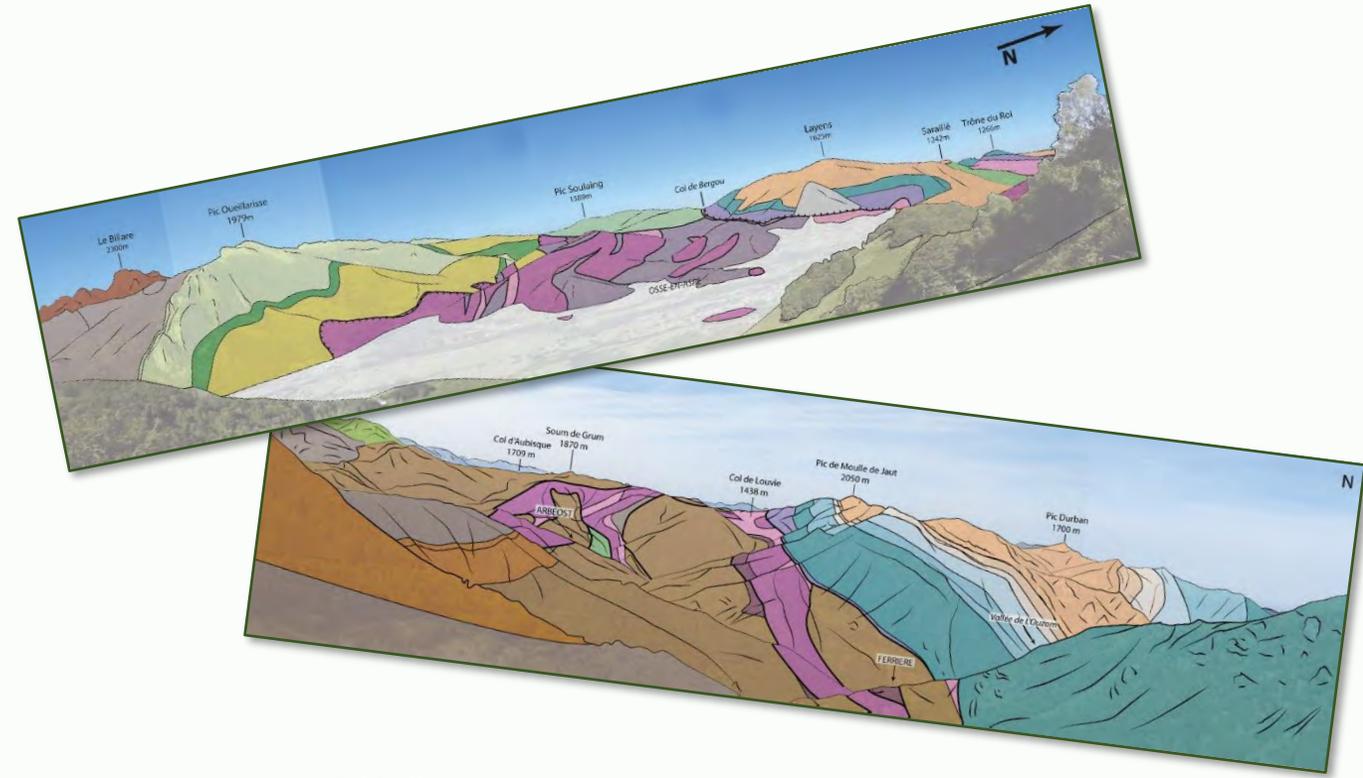
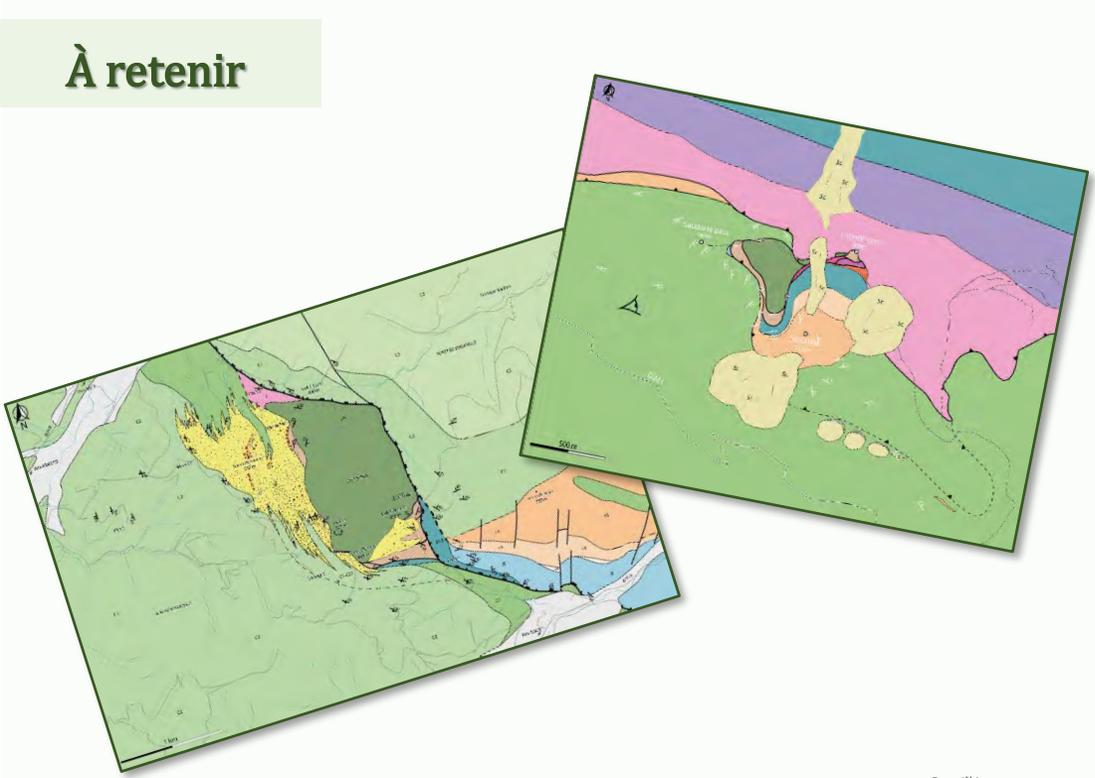
- Paleogene
- Cretaceous volcanism
- Jurassic (Hettangian-Tithonian)
- Permien
- Hercynian contacts
- Upper Cretaceous (Coniacian-Maestrichtian)
- Albian
- Triassic volcanism
- Carboniferous-Ordovician
- Cenomanian-Turonian
- Lower Cretaceous (Berriasian-Aptian)
- Upper Triassic (Keuper)
- Paleozoic granites
- Bauxite
- Lower-Middle Triassic (Buntsandstein-Muschelkalk)
- Lherzolite

# La bordure sud des Chaînon Béarnais



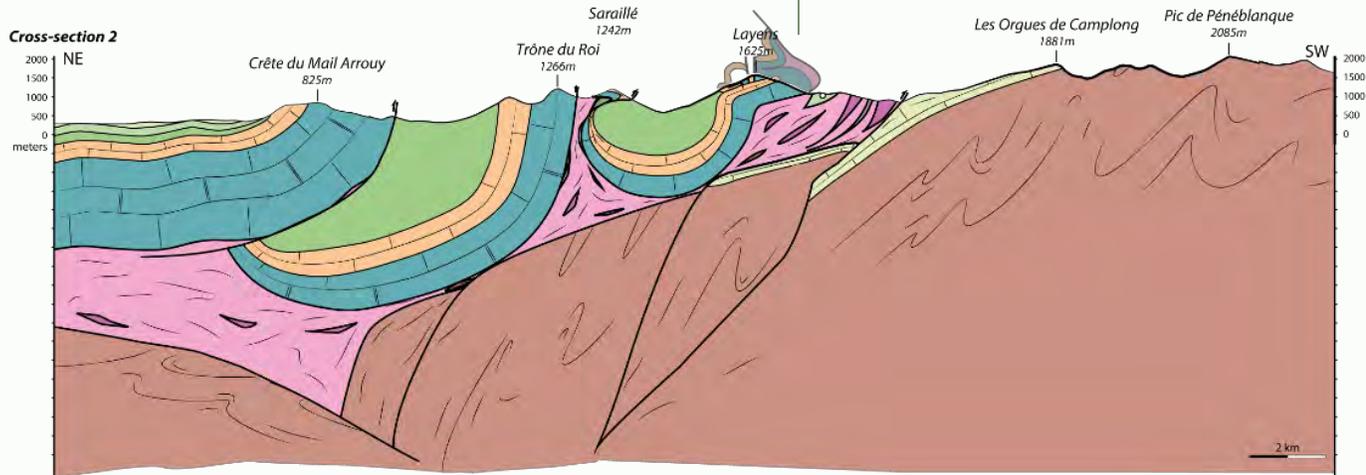
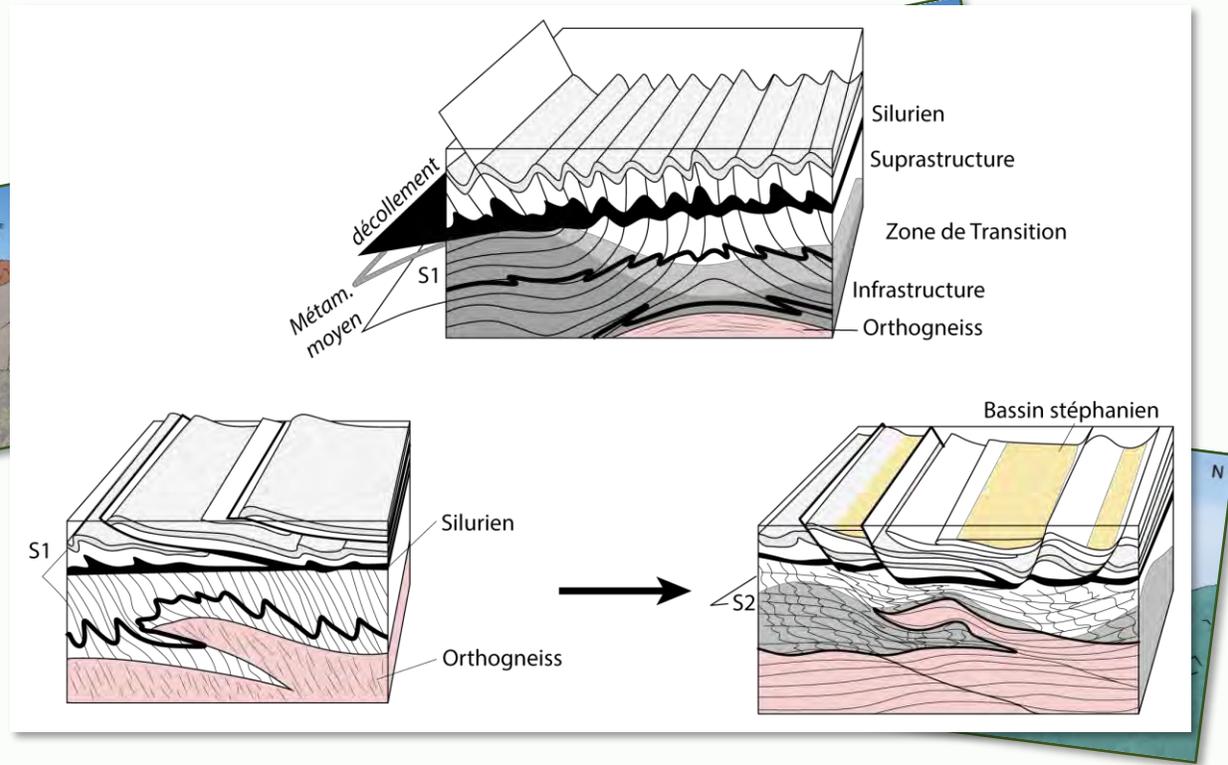
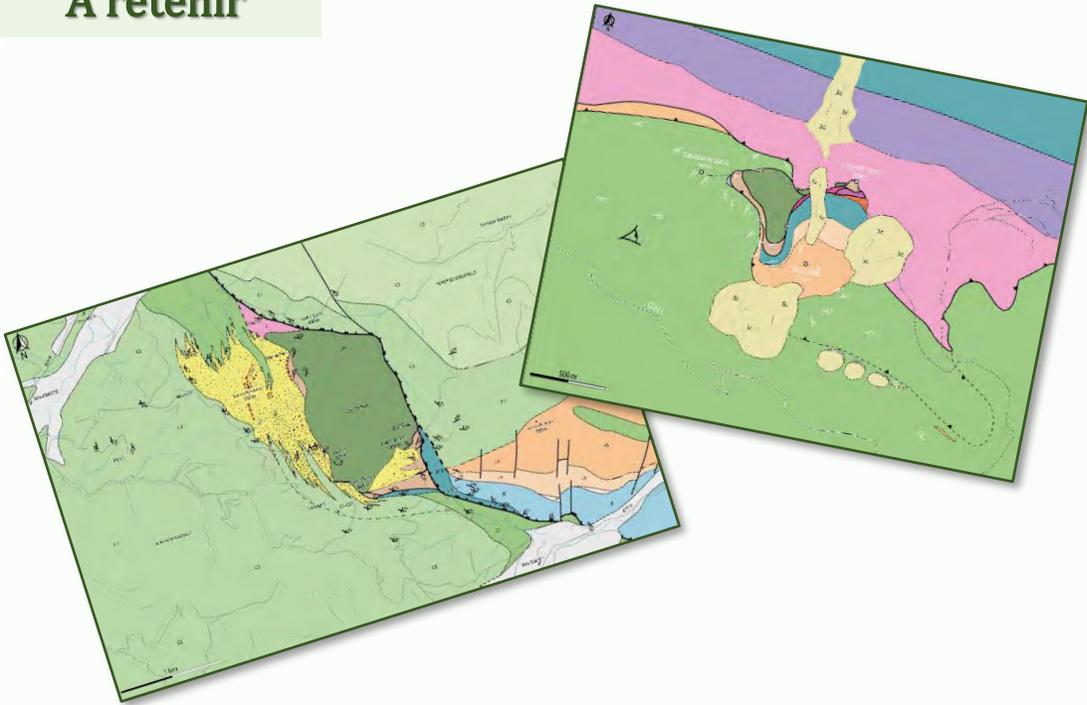
- Paleogene
- Cretaceous volcanism
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- Permien
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- Upper Cretaceous (Coniacian-Maestrichtian)
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- Upper Triassic (Keuper)
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- Bauxite
- Lower-Middle Triassic (Buntsandstein-Muschelkalk)
- Lherzolite

# À retenir



**La croûte continentale supérieure est absente dans les Chaînons !**

# À retenir



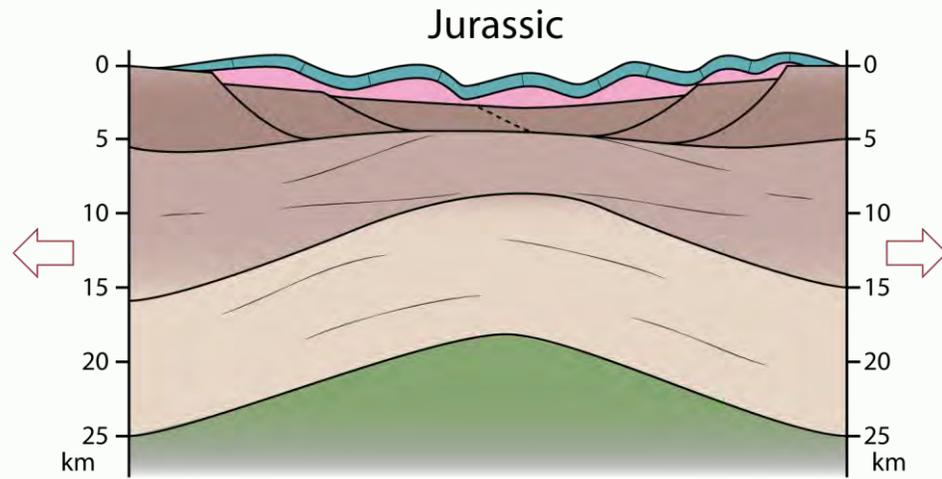
**La croûte continentale supérieure est absente dans les Chaînon !**



## Partie IV

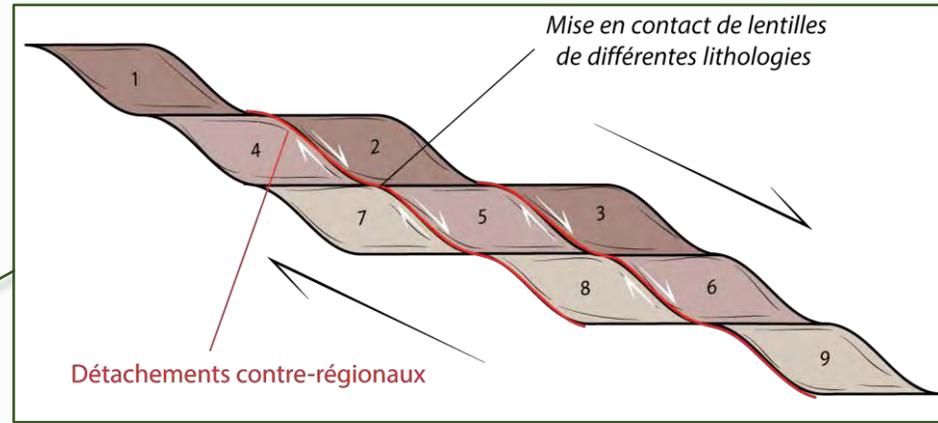
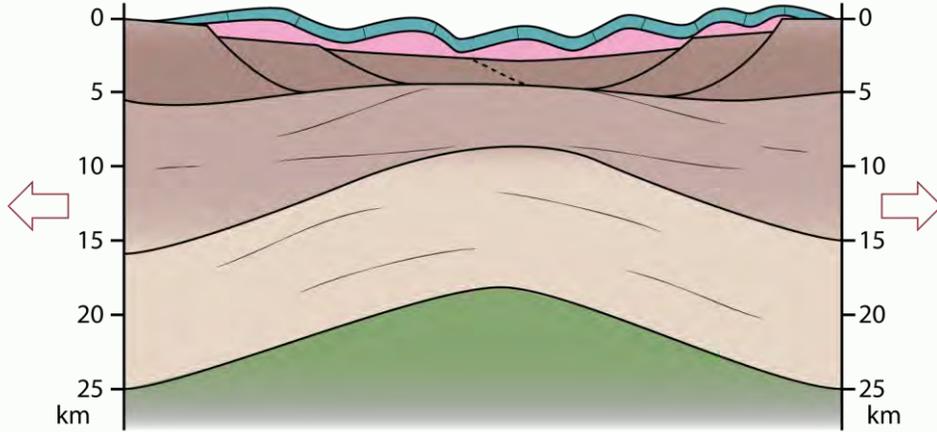
# RECONSTITUTION DE LA BORDURE NORD DE LA PLAQUE IBÉRIQUE À L'ALBO-CÉNOMANIEN ET COMPARAISON AVEC DES MARGES ACTUELLES

## Evolution structurale

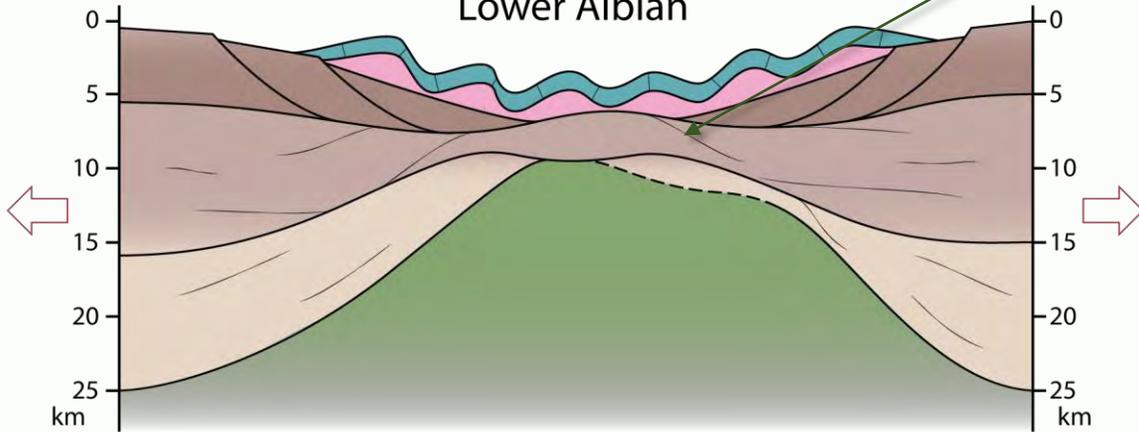


# Evolution structurale

### Jurassic

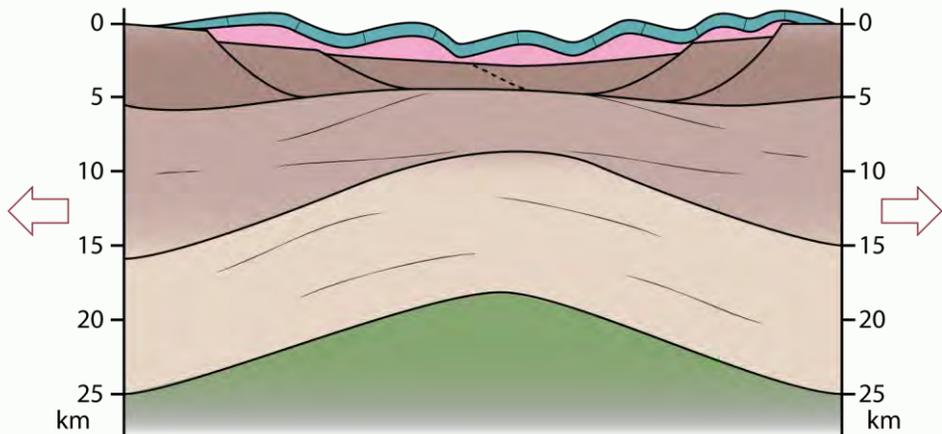


### Lower Albian

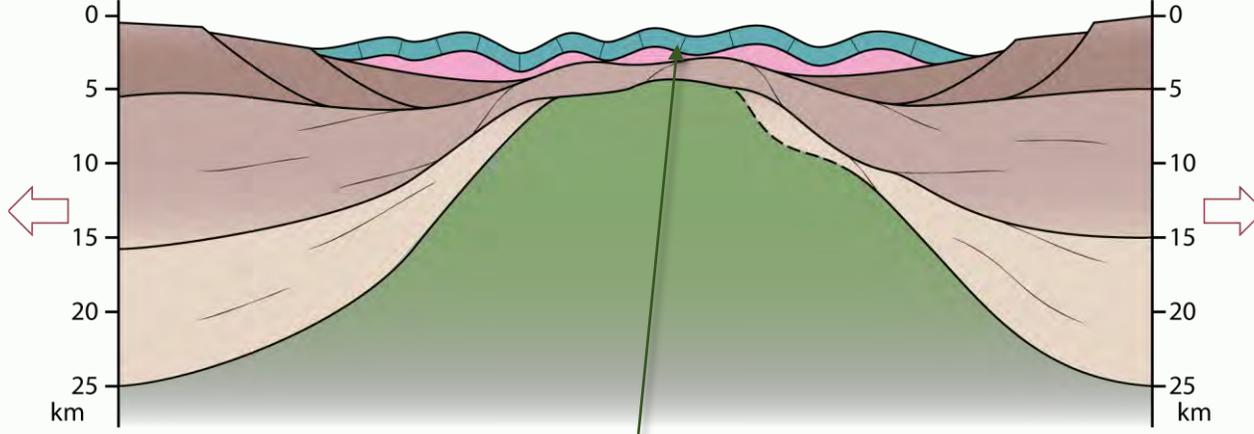


# Evolution structurale

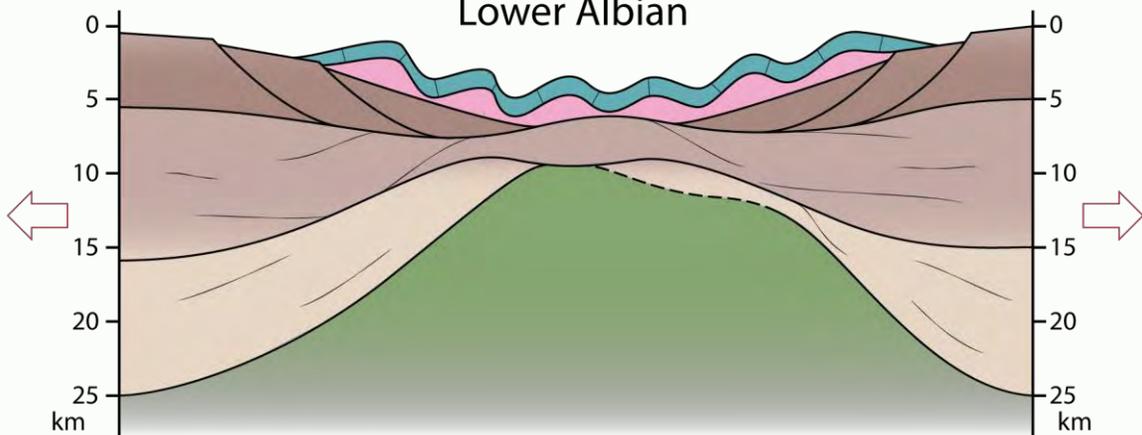
### Jurassic



### Albian

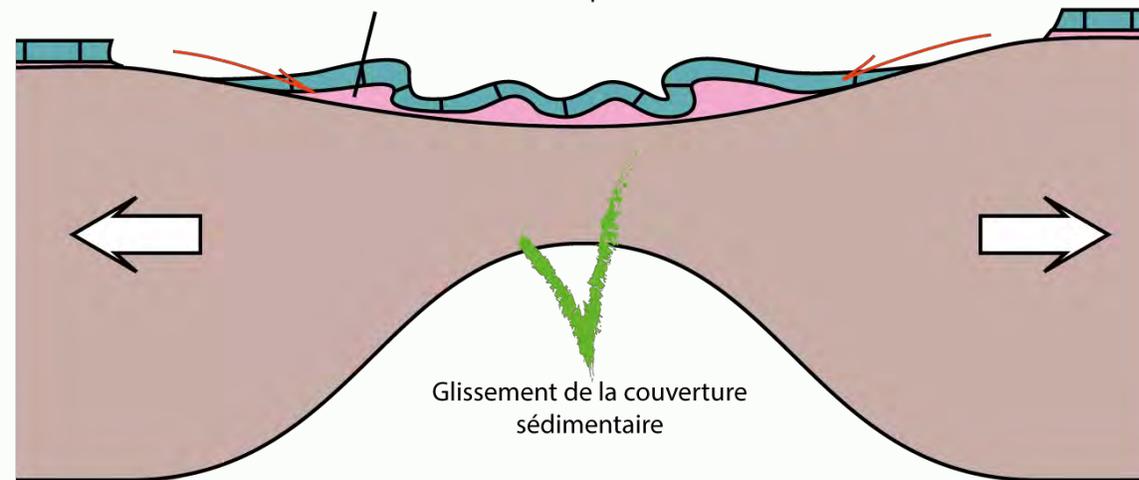


### Lower Albian



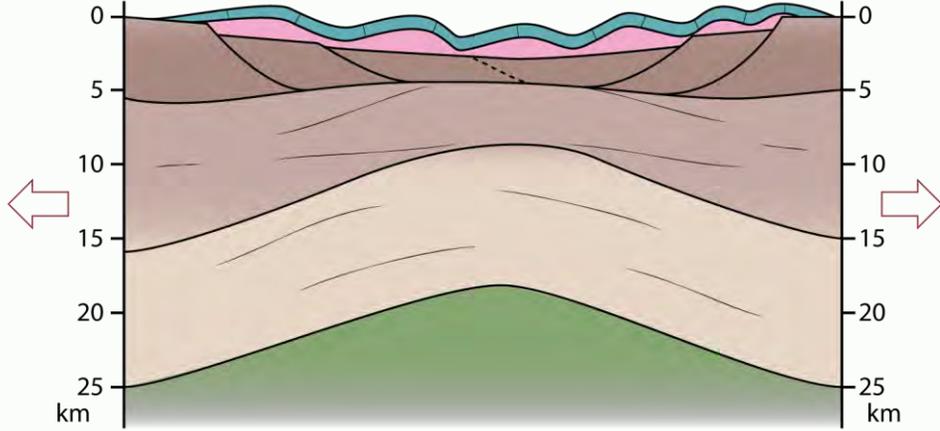
## Désolidarisation de la couverture sédimentaire pré-rift

désolidarisation de la couverture pré-rift

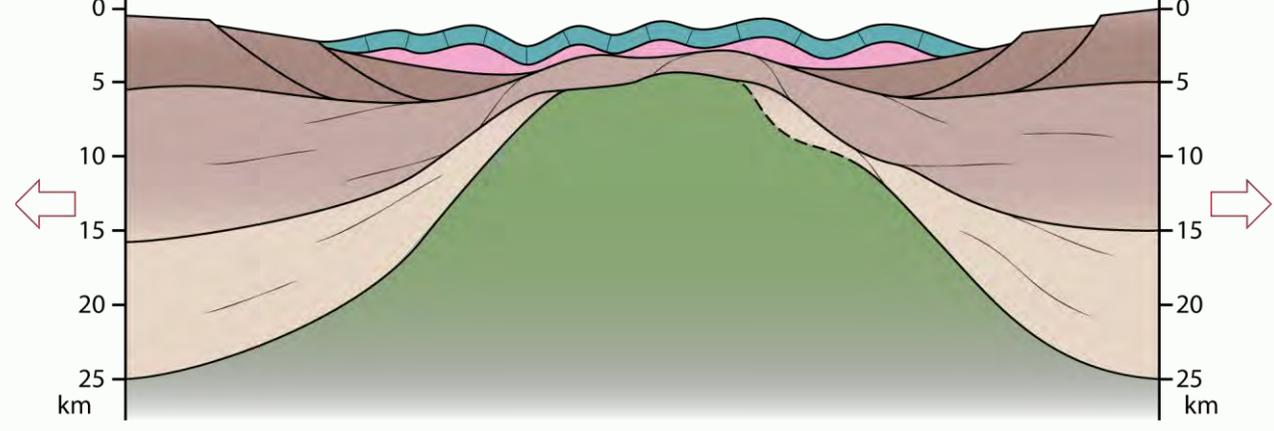


# Evolution structurale

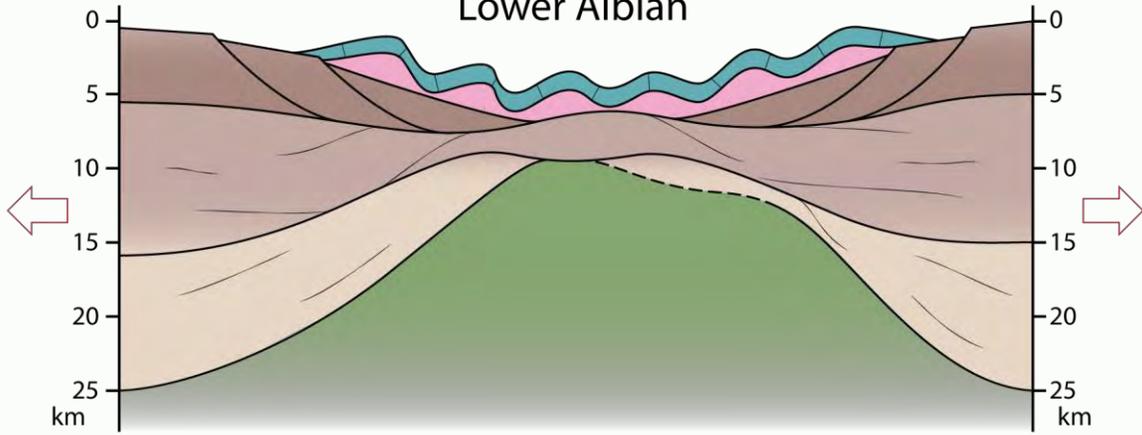
### Jurassic



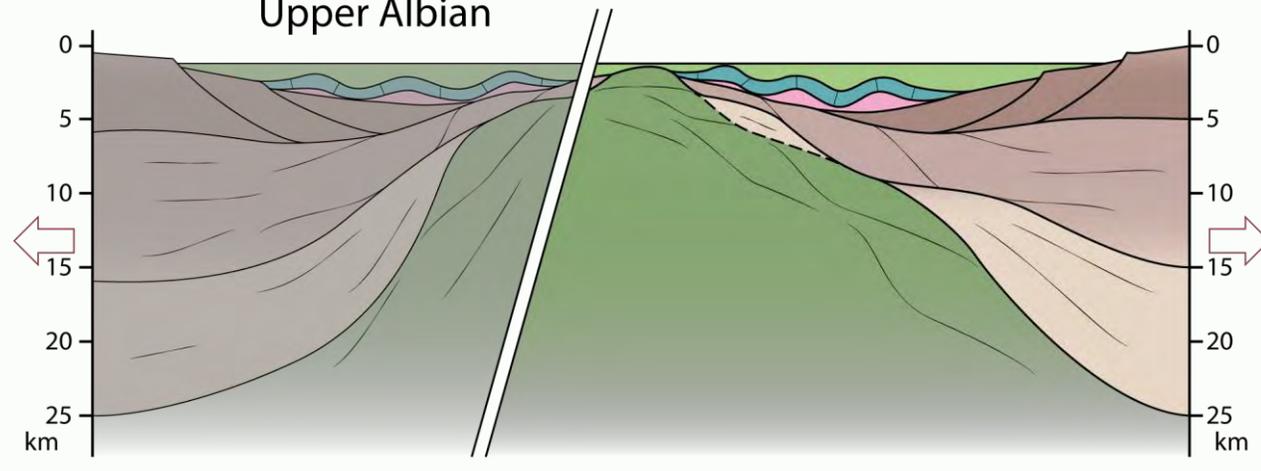
### Albian



### Lower Albian



### Upper Albian



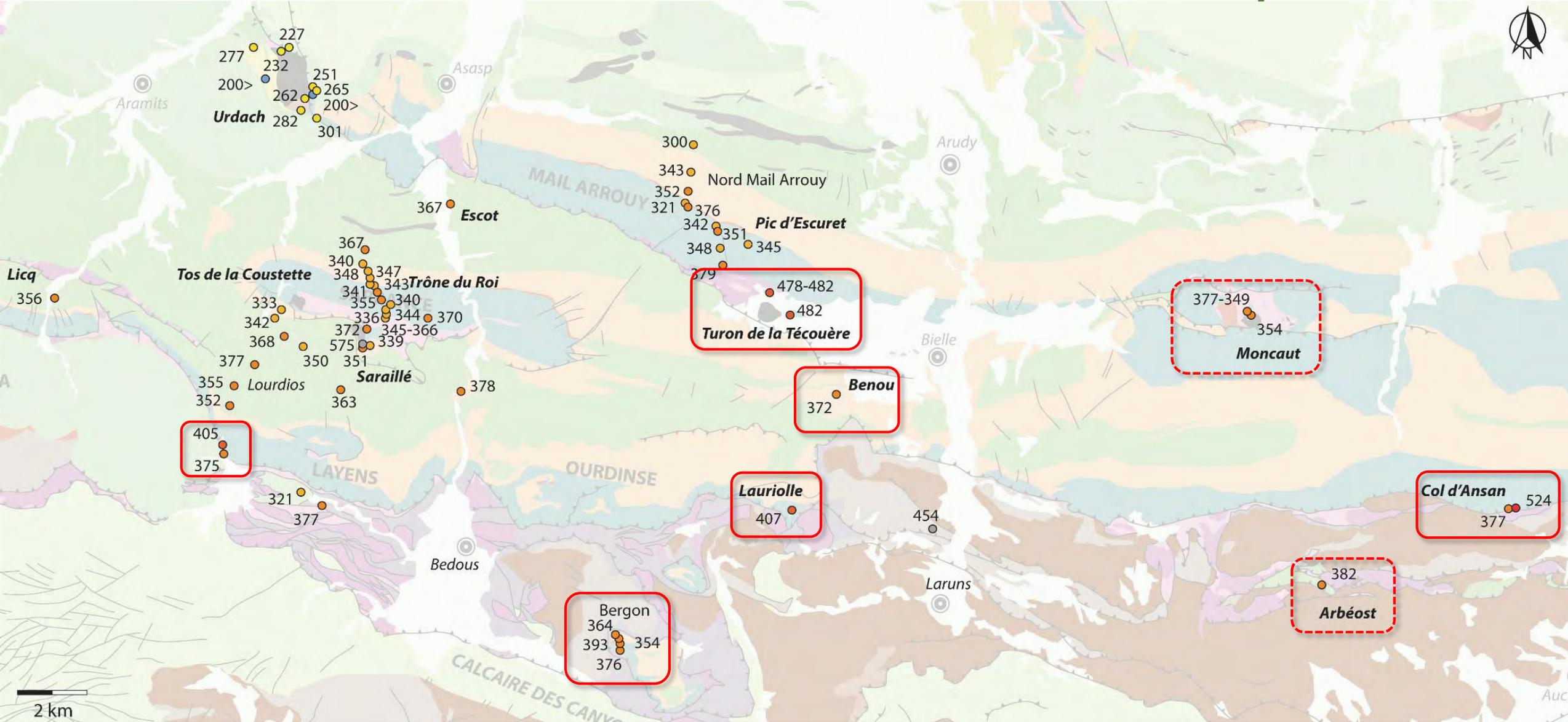
*\*Raman Spectroscopy on Carbonaceous Material*  
*Températures RSCM ~ ±17°C*

## Régime thermique lors du rifting albo-cénomaniens (Températures RSCM\*)



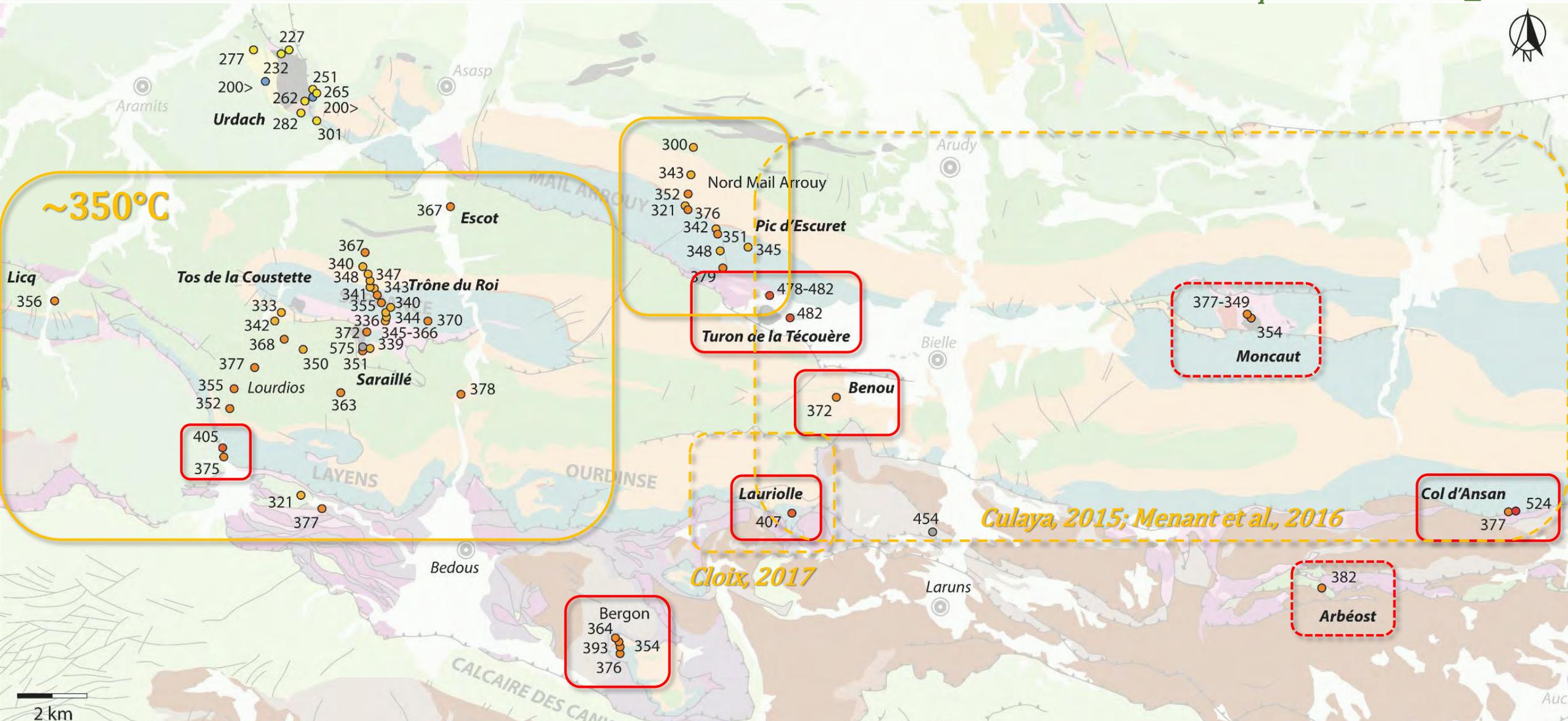
*\*Raman Spectroscopy on Carbonaceous Material  
Températures RSCM ~ ±17°C*

# Régime thermique lors du rifting albo-cénomannien (Températures RSCM\*)



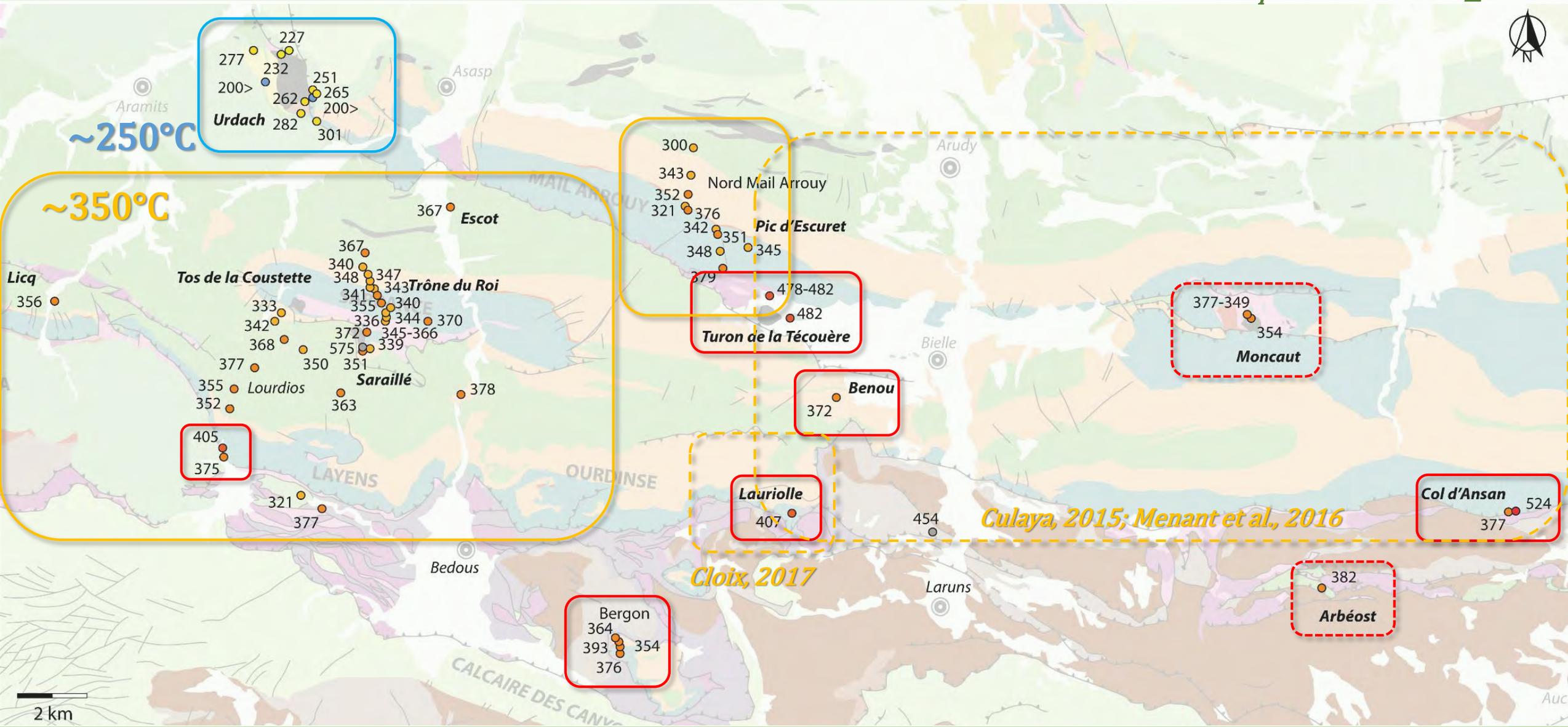
*\*Raman Spectroscopy on Carbonaceous Material  
Températures RSCM ~ ±17°C*

# Régime thermique lors du rifting albo-cénomanien (Températures RSCM\*)

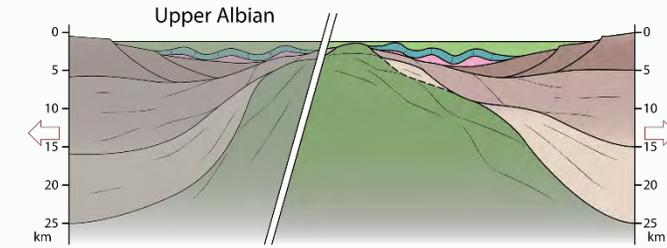
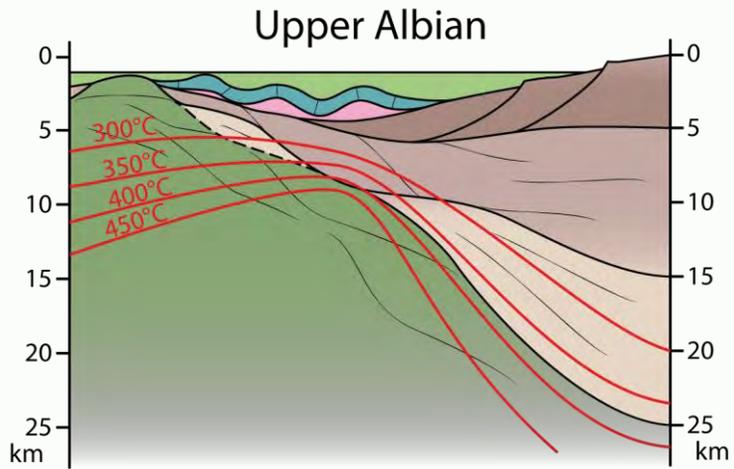


*\*Raman Spectroscopy on Carbonaceous Material  
Températures RSCM ~ ±17°C*

# Régime thermique lors du rifting albo-cénomanien (Températures RSCM\*)



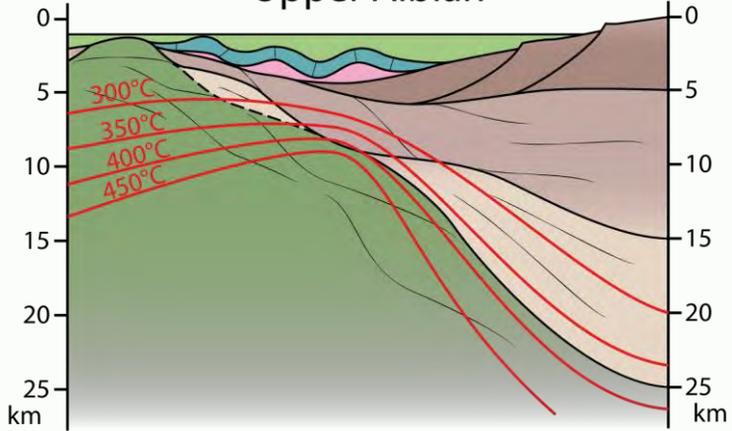
## Evolution structurale et thermique



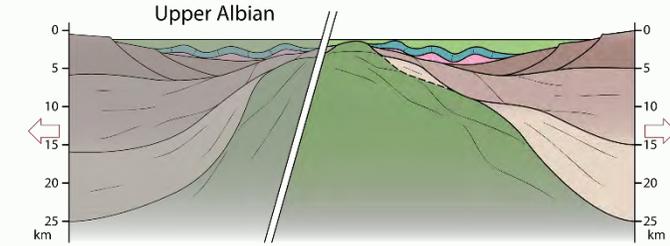
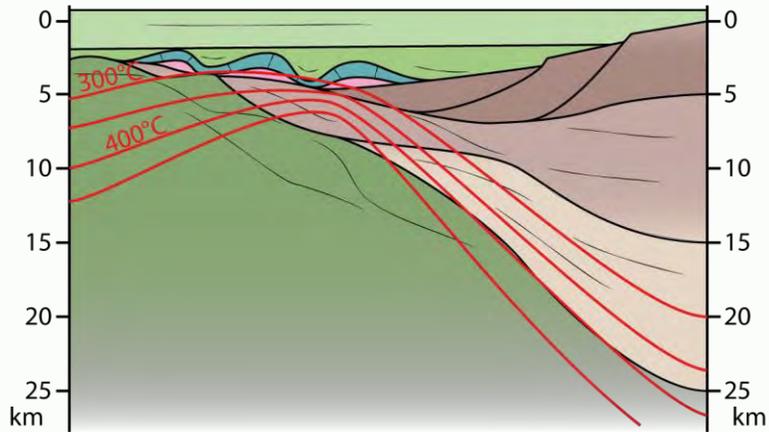
- Santonian-Maastrichtian
- Turonian-Coniacian
- Cenomanian
- Mendibelza conglomerates
- Albian
- Jurassic-Aptian
- Upper Triassic
- Upper continental crust
- Middle continental crust
- Lower continental crust
- Mantle rocks

# Evolution structurale et thermique

Upper Albian



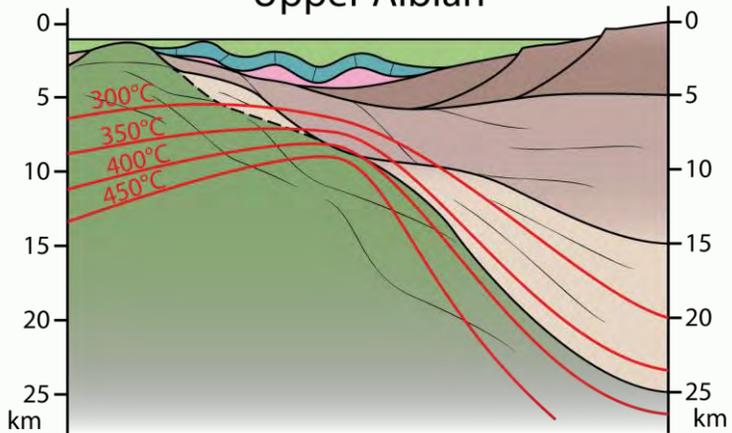
Upper Cenomanian



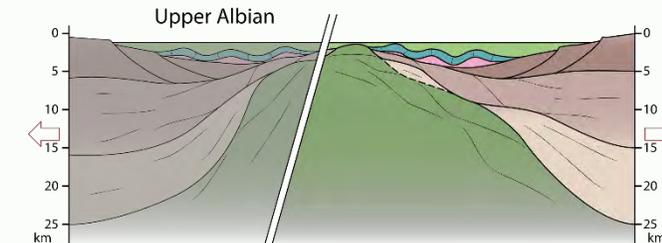
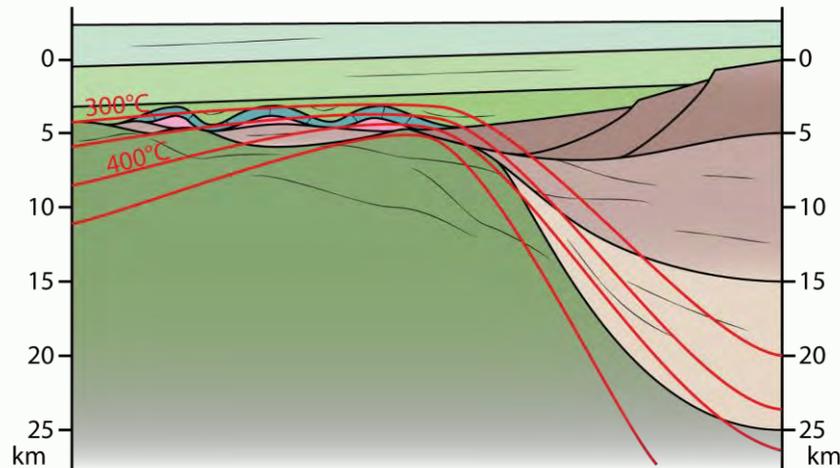
- Santonian-Maastrichtian
- Turonian-Coniacian
- Cenomanian
- Mendibelza conglomerates
- Albian
- Jurassic-Aptian
- Upper Triassic
- Upper continental crust
- Middle continental crust
- Lower continental crust
- Mantle rocks

# Evolution structurale et thermique

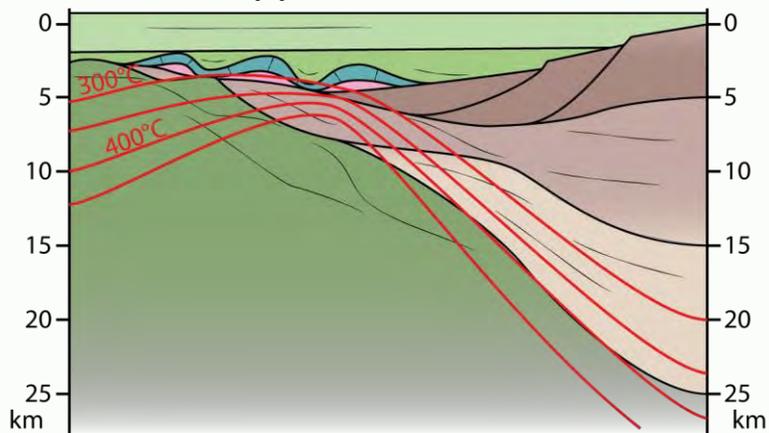
Upper Albian



Lower Santonian



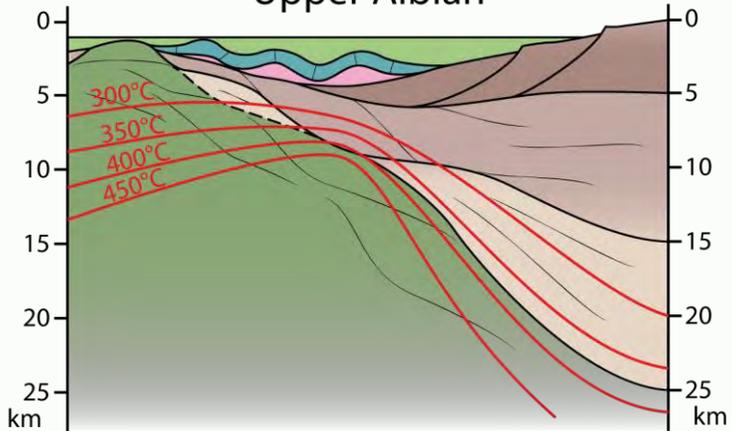
Upper Cenomanian



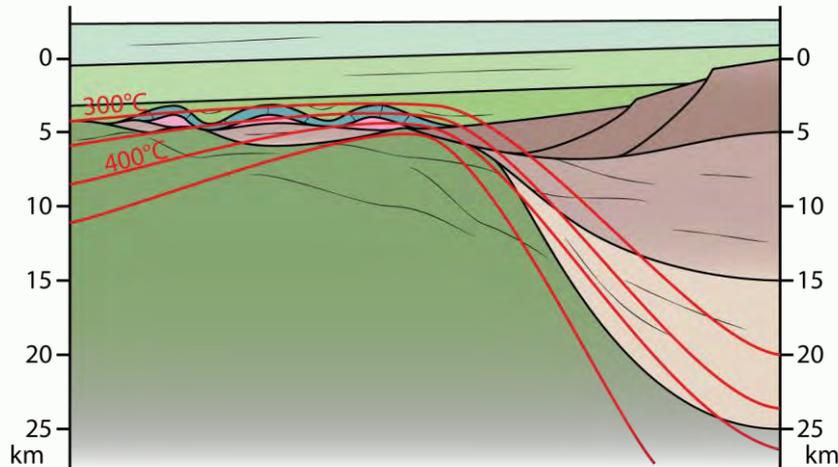
- Santonian-Maastrichtian
- Turonian-Coniacian
- Cenomanian
- Mendibelza conglomerates
- Albian
- Jurassic-Aptian
- Upper Triassic
- Upper continental crust
- Middle continental crust
- Lower continental crust
- Mantle rocks

# Evolution structurale et thermique

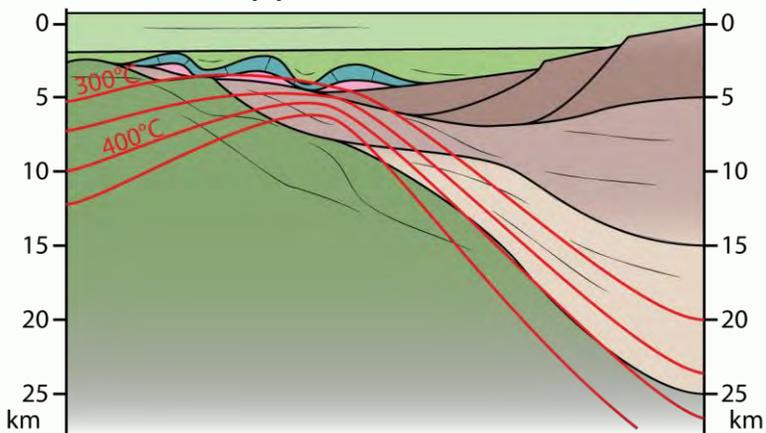
Upper Albian



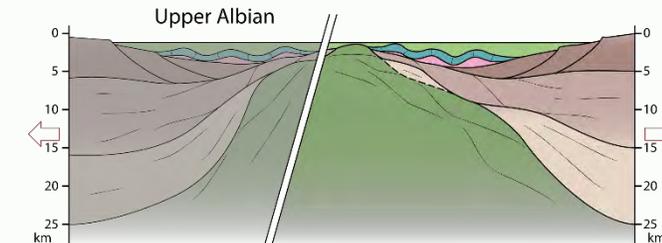
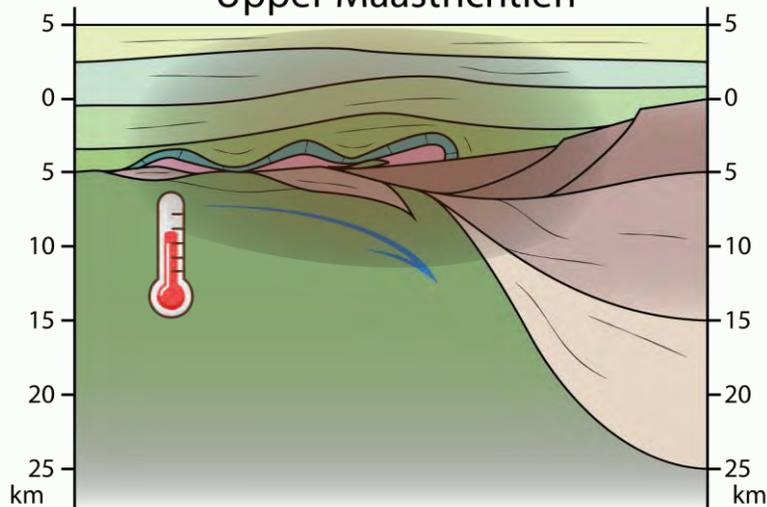
Lower Santonian



Upper Cenomanian



Upper Maastrichtien



- Santonian-Maastrichtien
- Turonian-Coniacian
- Cenomanian
- Mendibelza conglomerates
- Albian
- Jurassic-Aptian
- Upper Triassic
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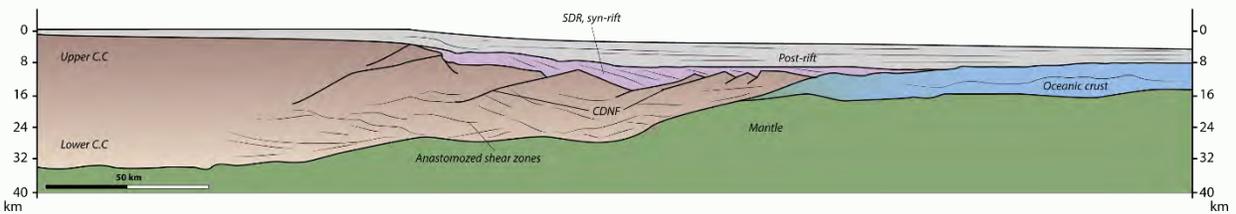
**Partie V**  
**COMPARAISONS AVEC DES MARGES CONTINENTALES PASSIVES**  
**ACTUELLES**

# La bordure nord de la plaque ibérique : un analogue de marges passives actuelles

## Marge passive d'Angola (Unternehr et al., 2010)

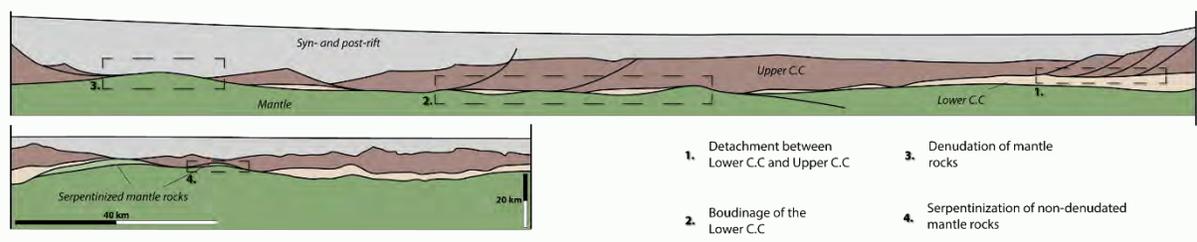
### Marge passive d'Uruguay (Clerc et al., 2015)

Détachements contre-régionaux

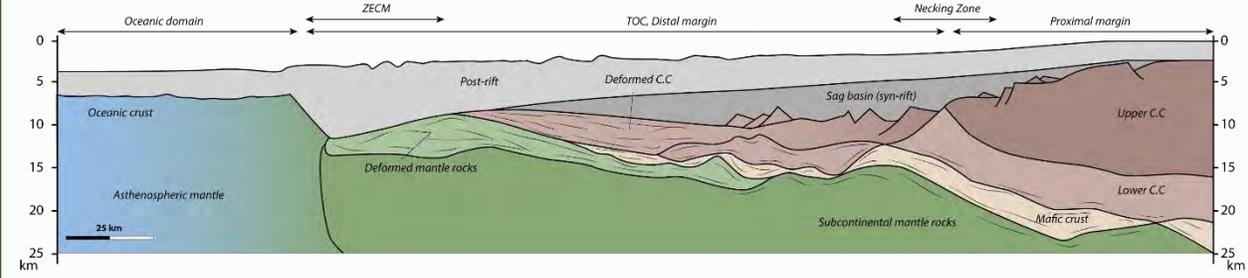


### Mer de Chine (Savva et al., 2013)

Exhumation du manteau entre des lambeaux de C.C. amincie

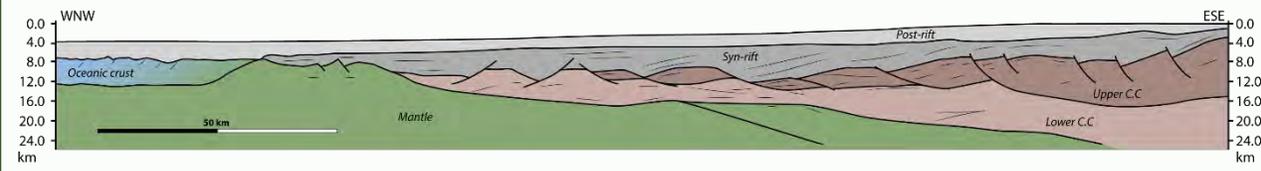


Manteau exhumé et déformé + Large zone de C.C. amincie

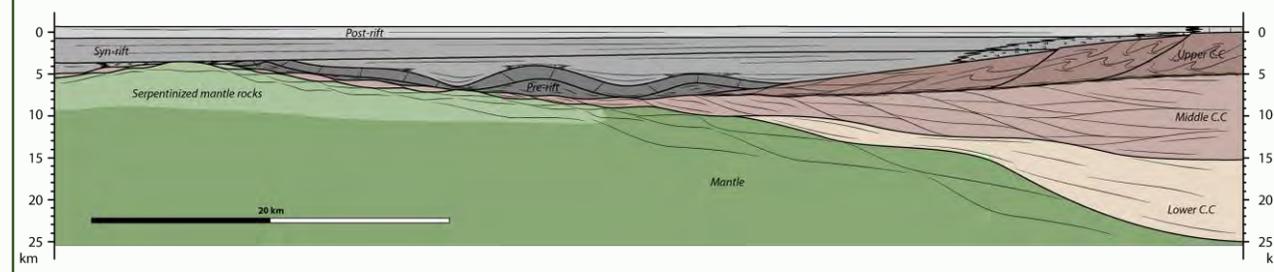


### Marge passive du Gabon (Clerc et al., 2017)

Lenticulation de la C.C. + blanketing effect

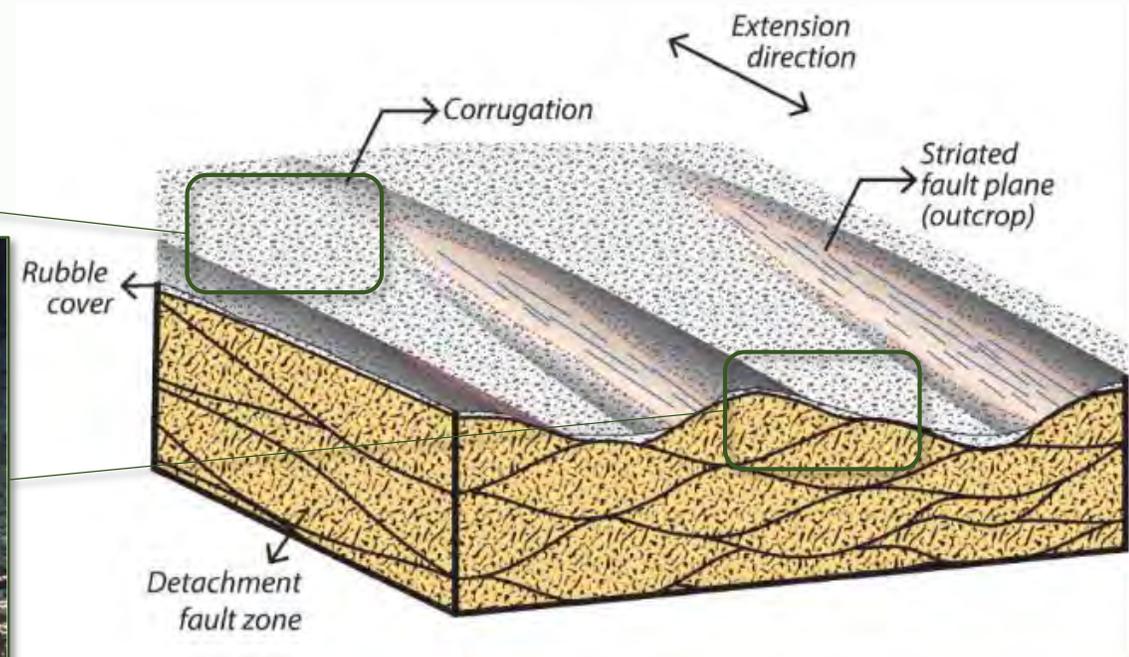
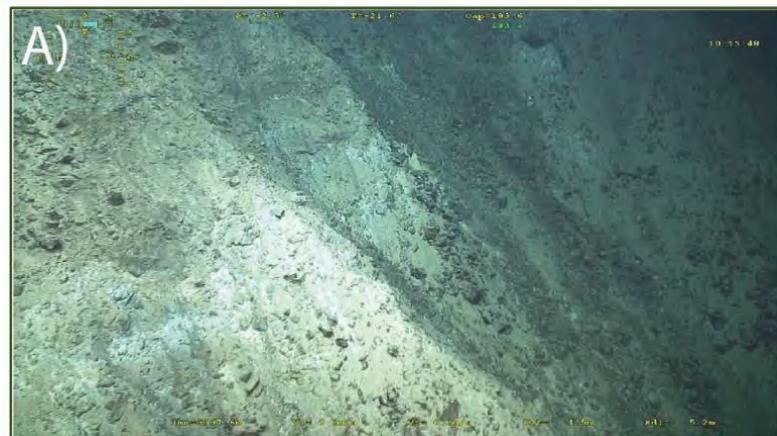
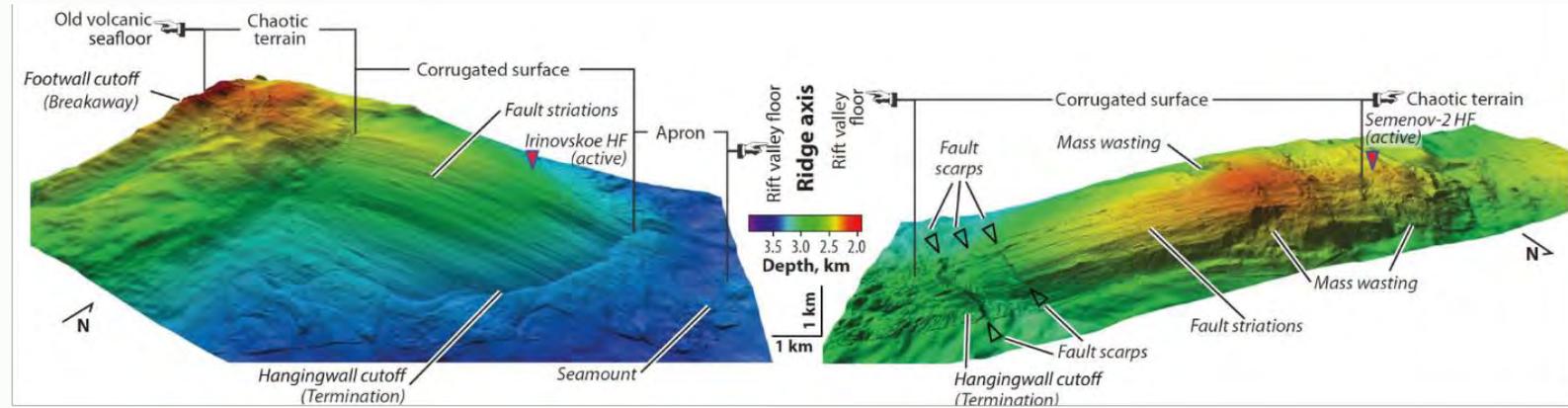


### Paléo-marge passive nord Ibérique



# La bordure nord de la plaque ibérique : un analogue de systèmes actuels

Dénudation d'un détachement  
Ride médio-océanique de l'Océan Atlantique  
(Similarités avec Urdach-Les Pernes)

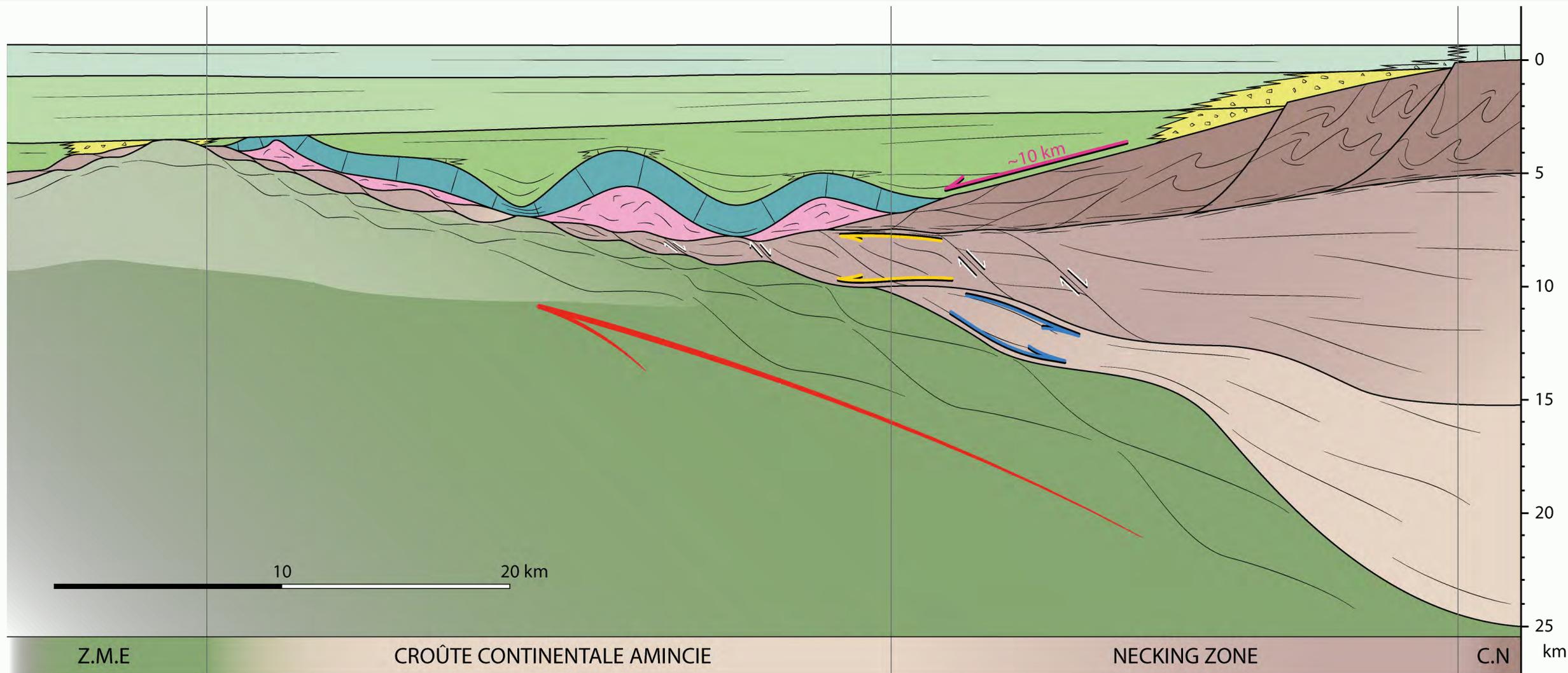


Escartin et al., 2017

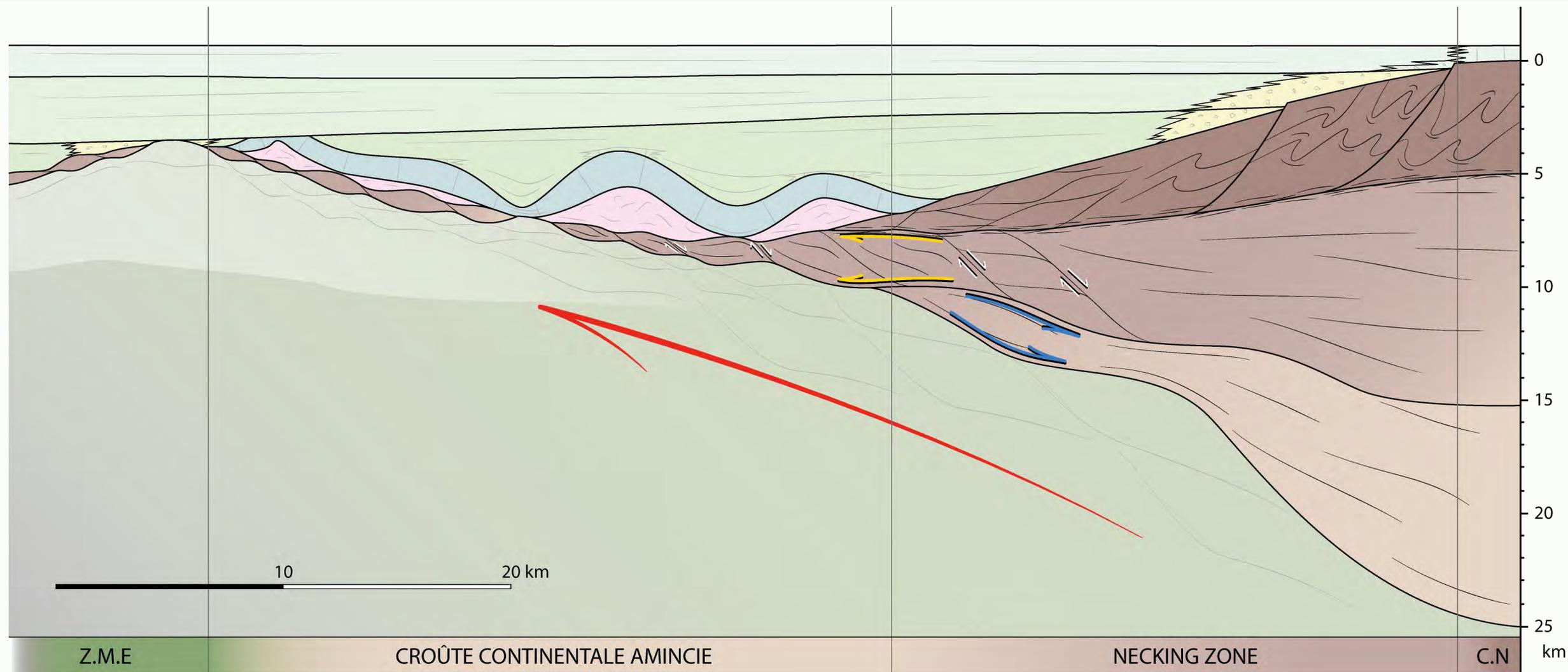


## Partie VII CONCLUSION

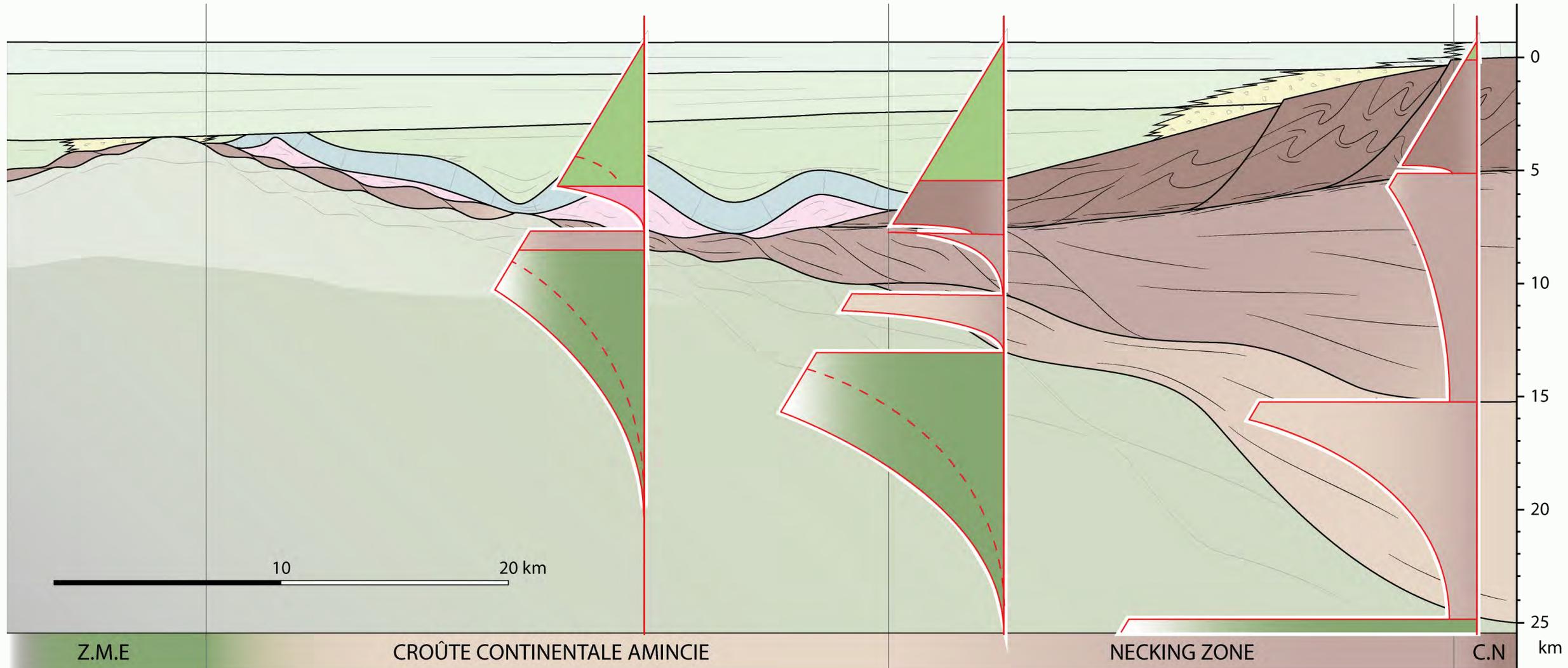
## Objectif de cette thèse : Quantifier et comprendre les principales caractéristiques géologiques permettant de reconstruire l'architecture de la bordure nord de la plaque ibérique à l'Albo-Cénomanien



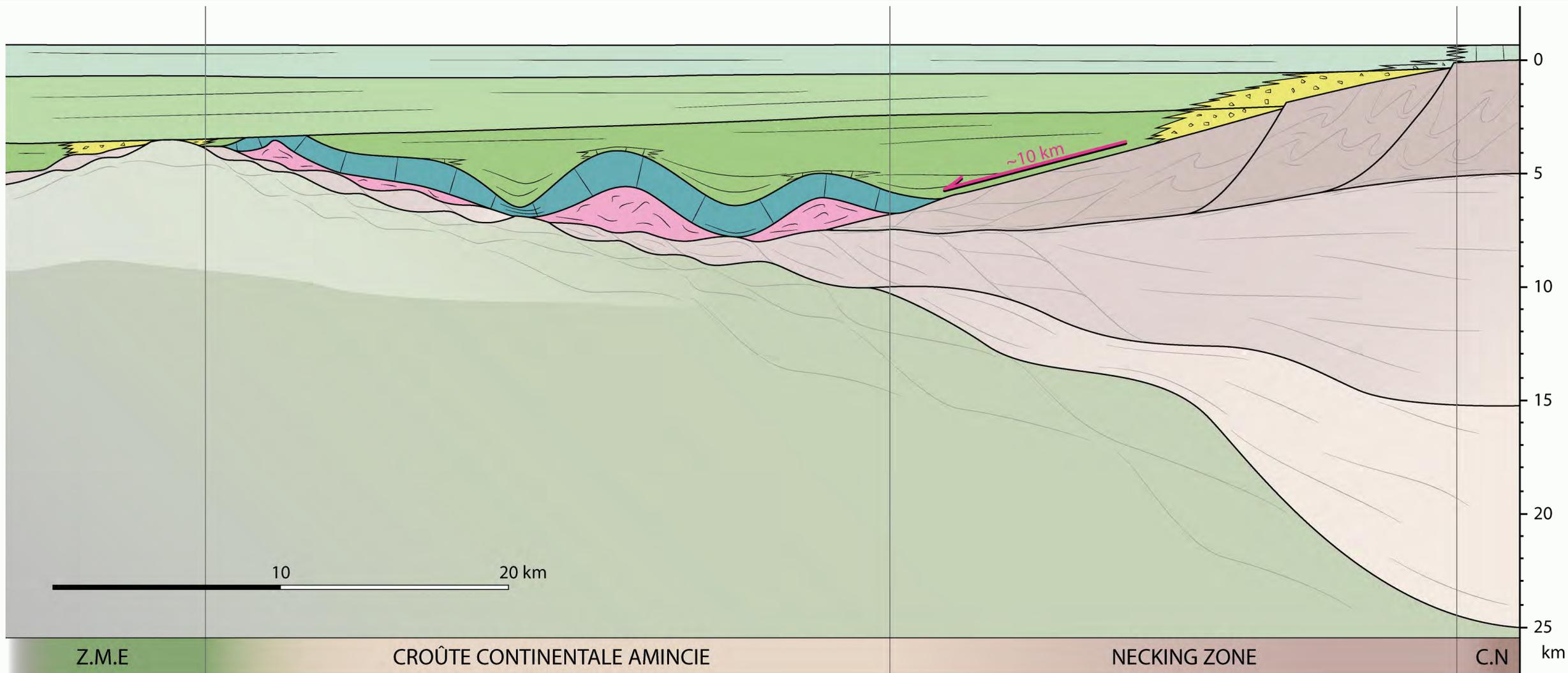
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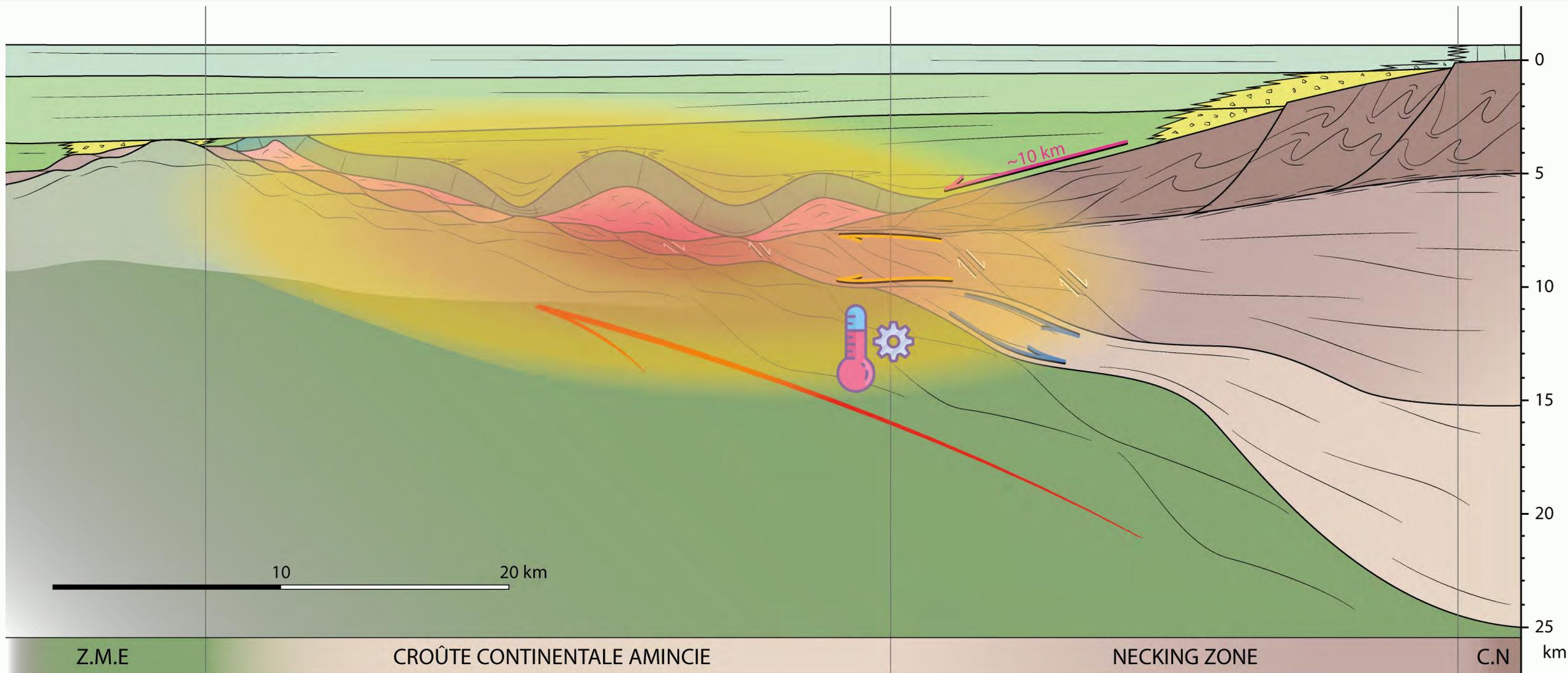
**Objectif de cette thèse : Quantifier et comprendre les principales caractéristiques géologiques permettant de reconstruire l'architecture de la bordure nord de la plaque ibérique à l'Albo-Cénomanien**



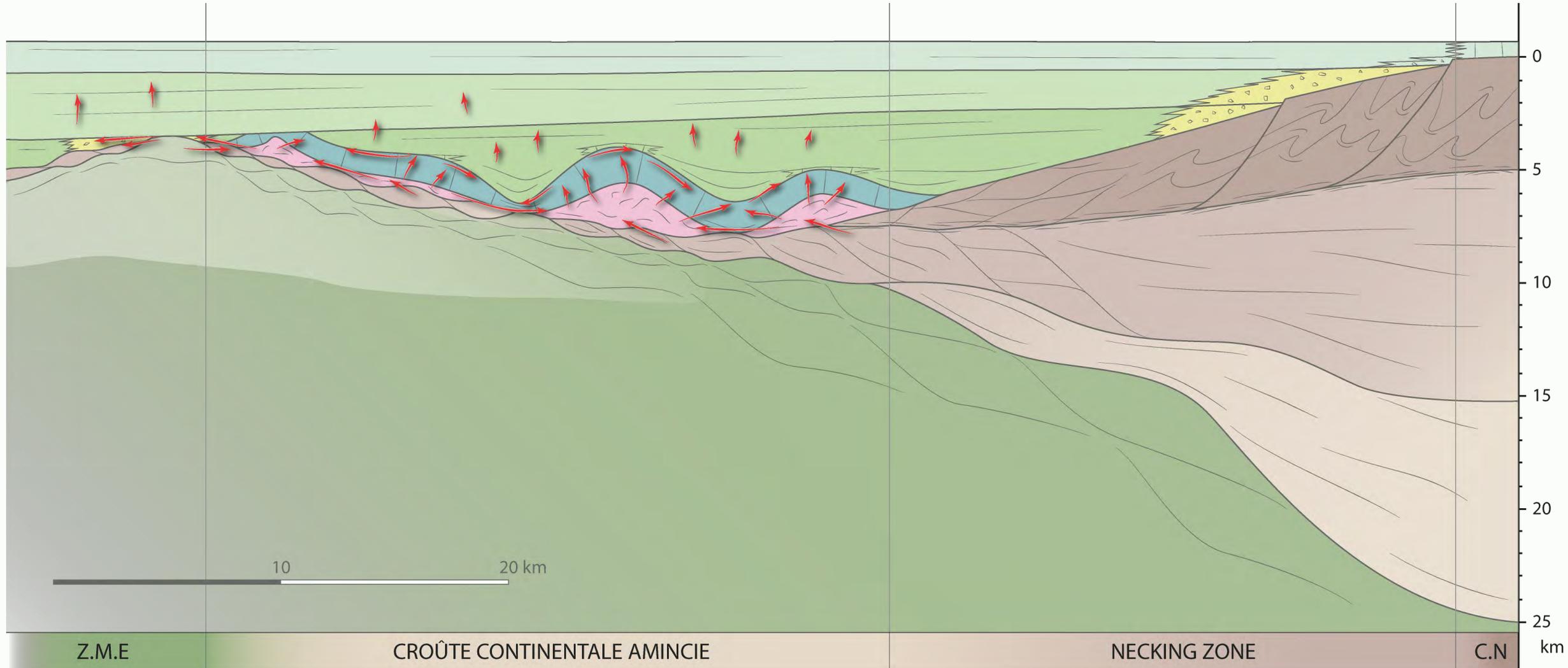
**Objectif de cette thèse : Quantifier et comprendre les principales caractéristiques géologiques permettant de reconstruire l'architecture de la bordure nord de la plaque ibérique à l'Albo-Cénomanien**



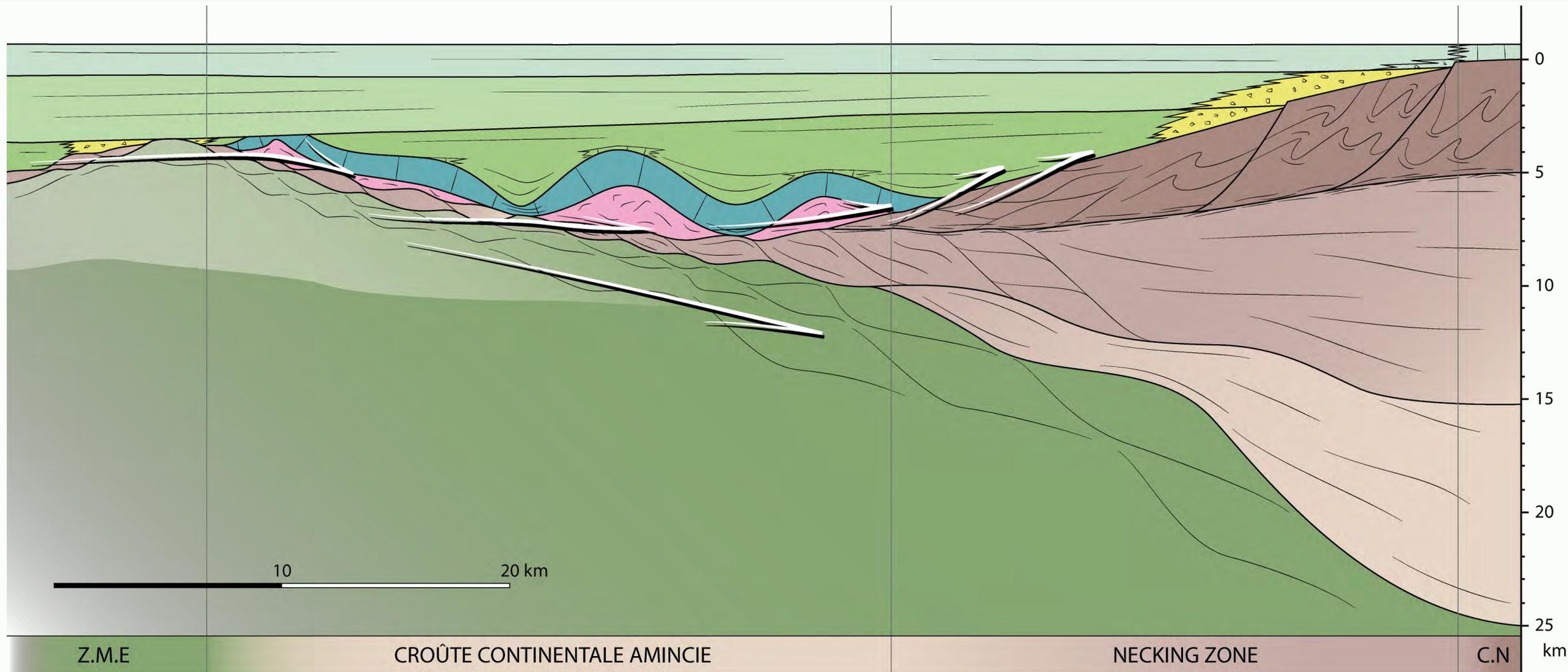
## Objectif de cette thèse : Quantifier et comprendre les principales caractéristiques géologiques permettant de reconstruire l'architecture de la bordure nord de la plaque ibérique à l'Albo-Cénomanien



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LA BORDURE NORD DE LA PLAQUE IBÉRIQUE À L'ALBO-CÉNOMANIEN  
ARCHITECTURE D'UNE MARGE PASSIVE DE TYPE DUCTILE  
(CHAÎNONS BÉARNAIS, PYRÉNÉES OCCIDENTALES)

Merci pour votre attention