

Sobrarbe Delta Complex

Google Earth

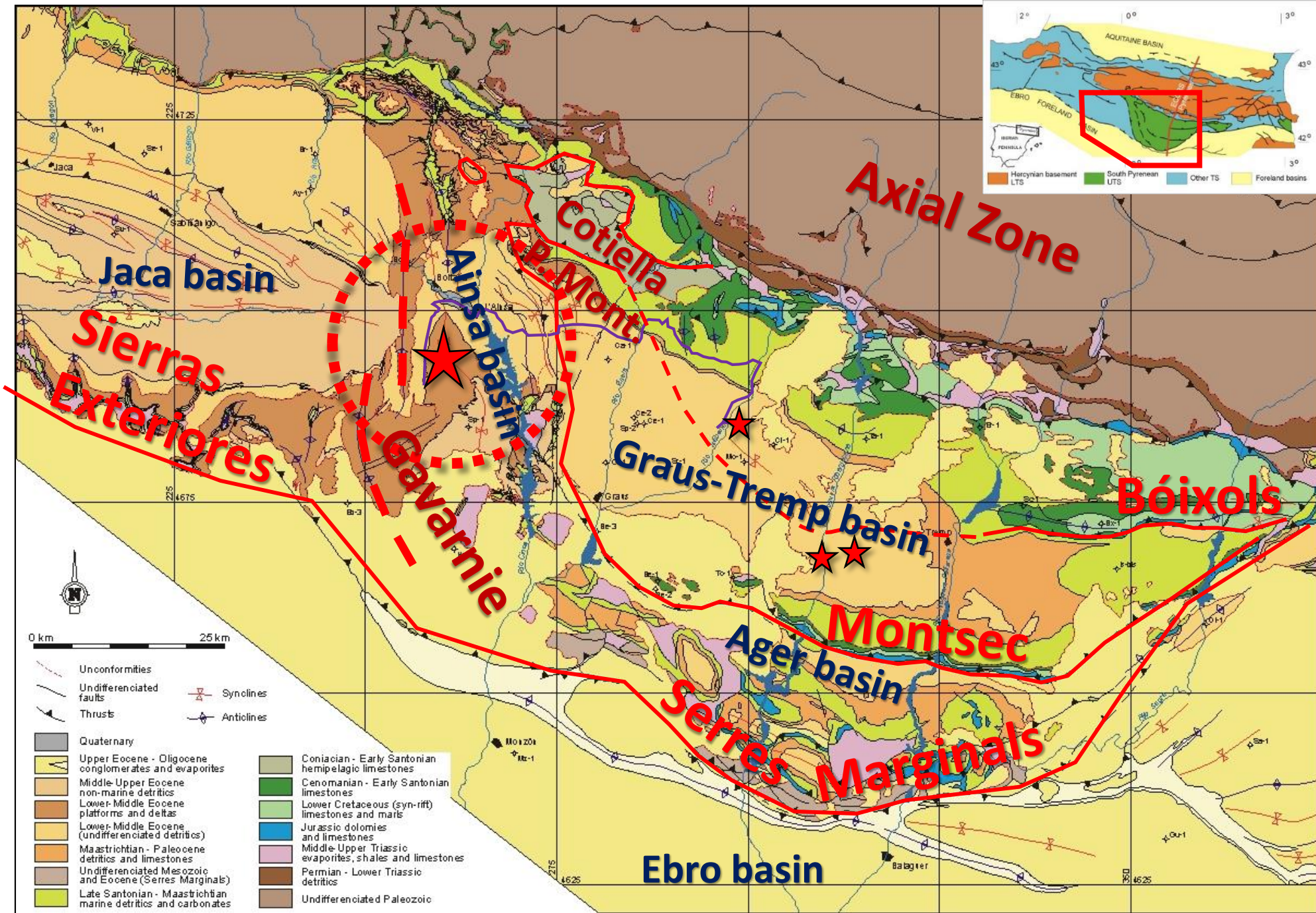
© 2020 Google
Image Landsat / Copernicus
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

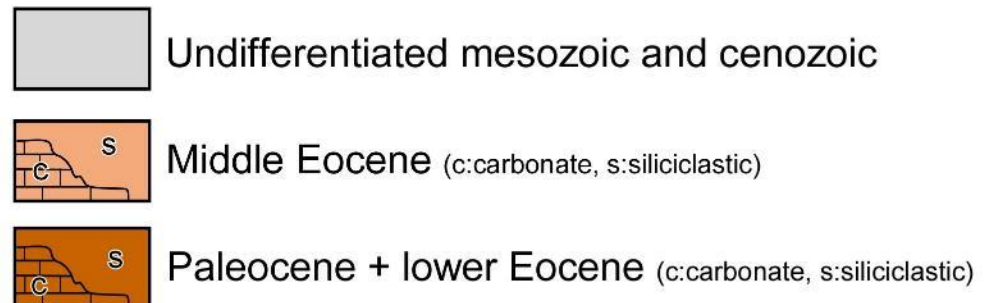
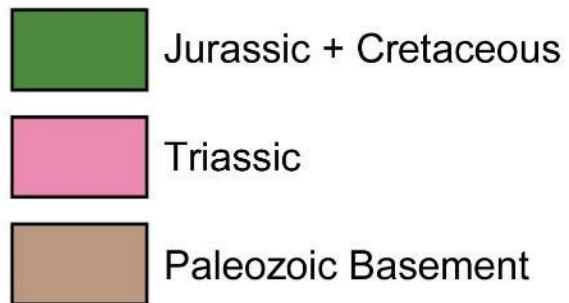
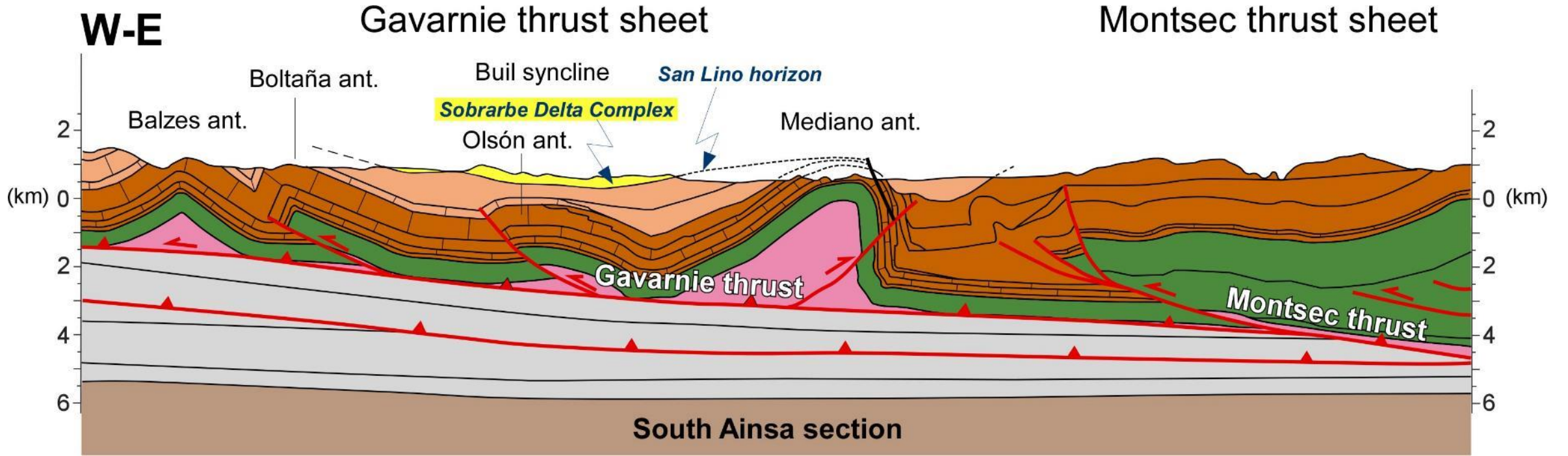
A-2205

Galls Arcusa



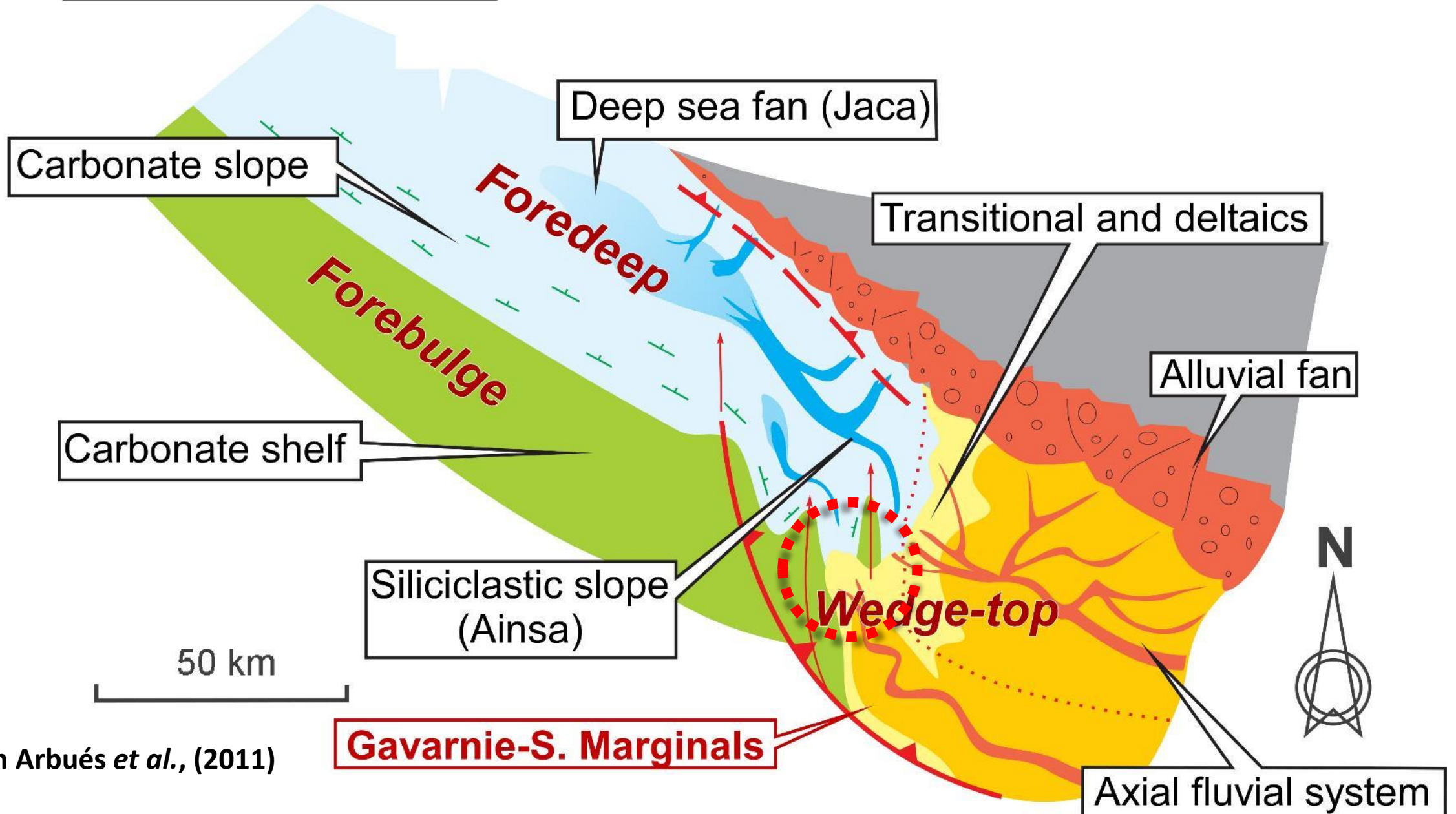
500 m



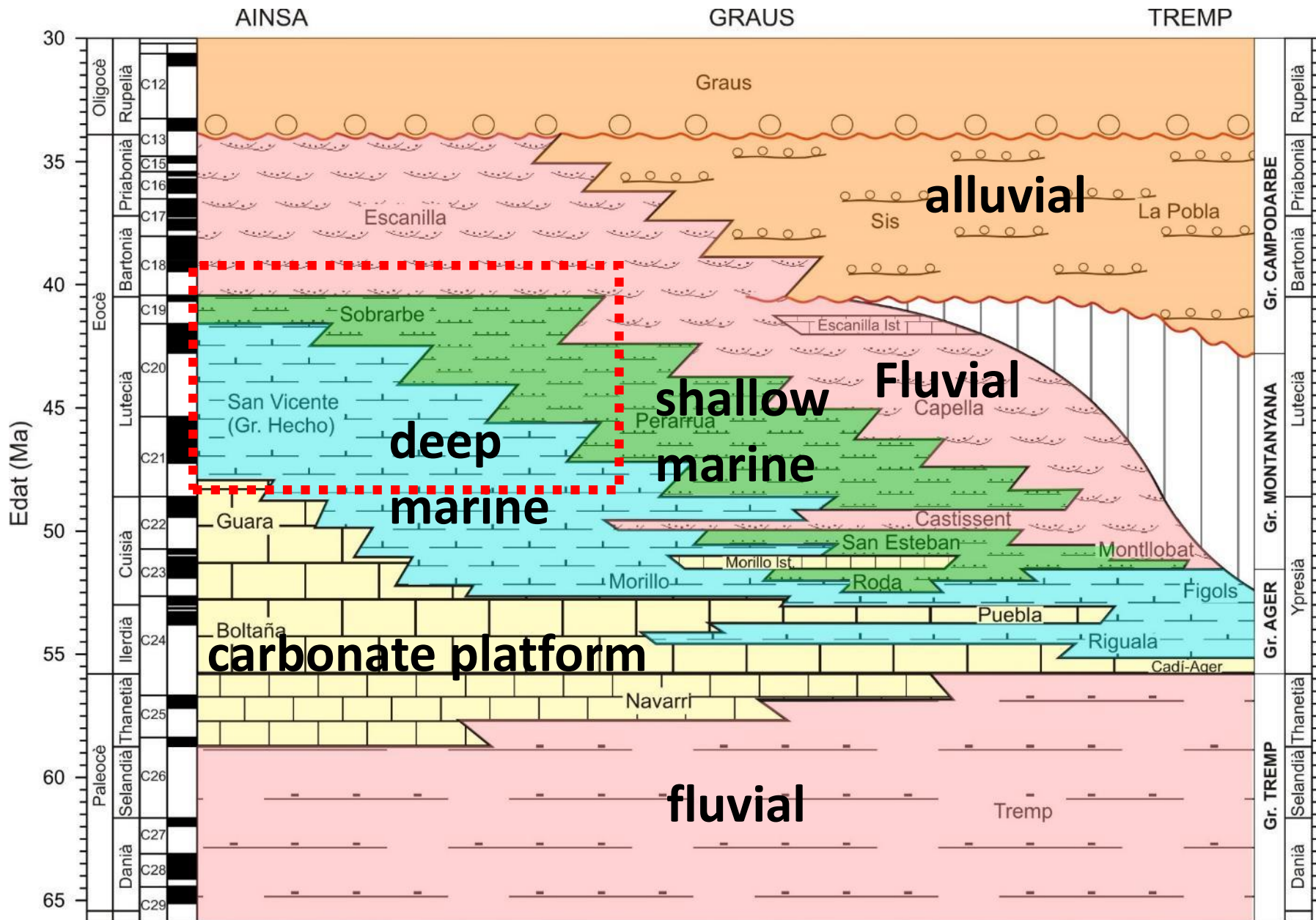


Modified from Muñoz *et al.*, (2013)

Middle Eocene



From Arbués *et al.*, (2011)

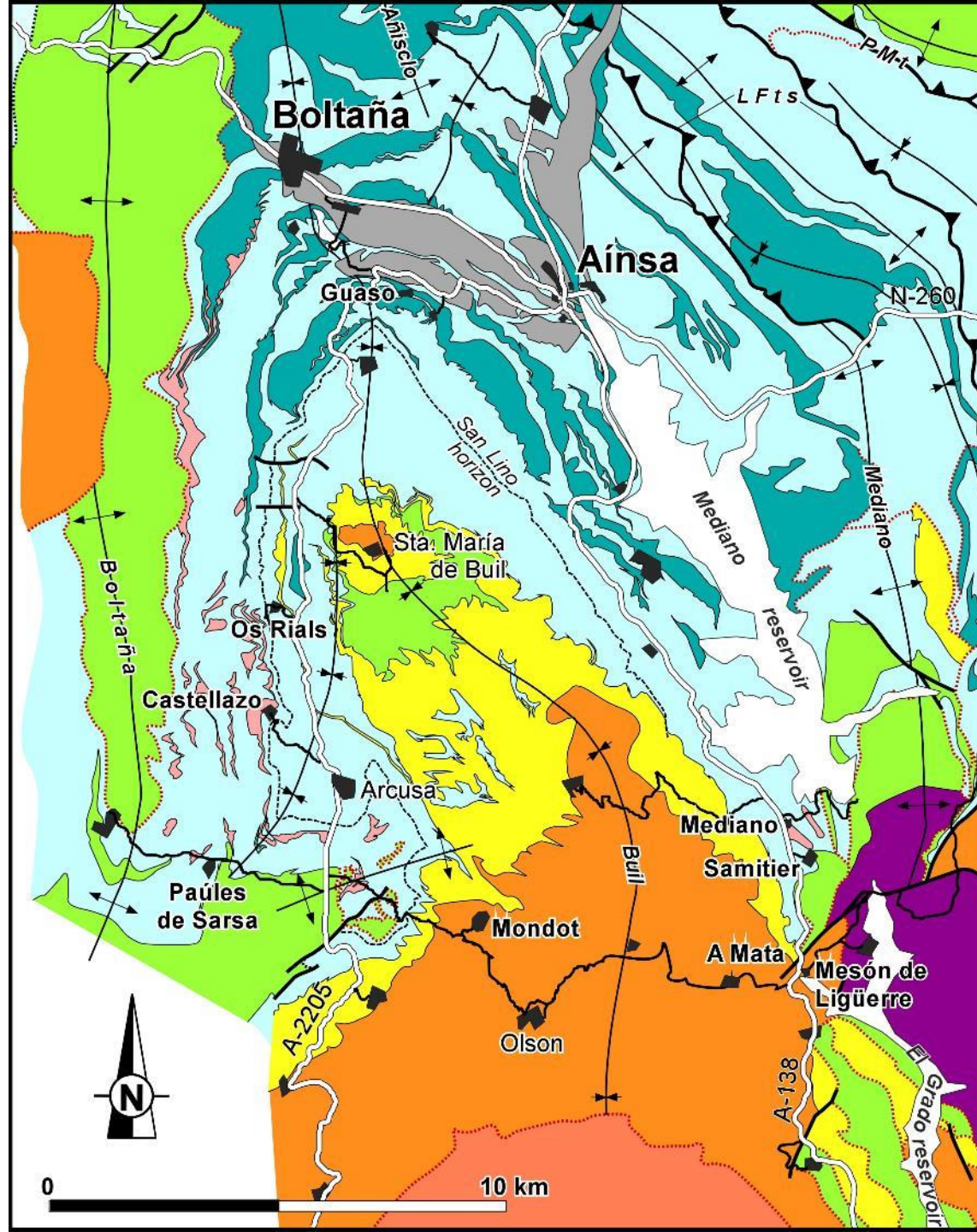


Guara formation
(carbonates)

San Vicente formation
(deep marine)

Sobrarbe formation
(deltaics)

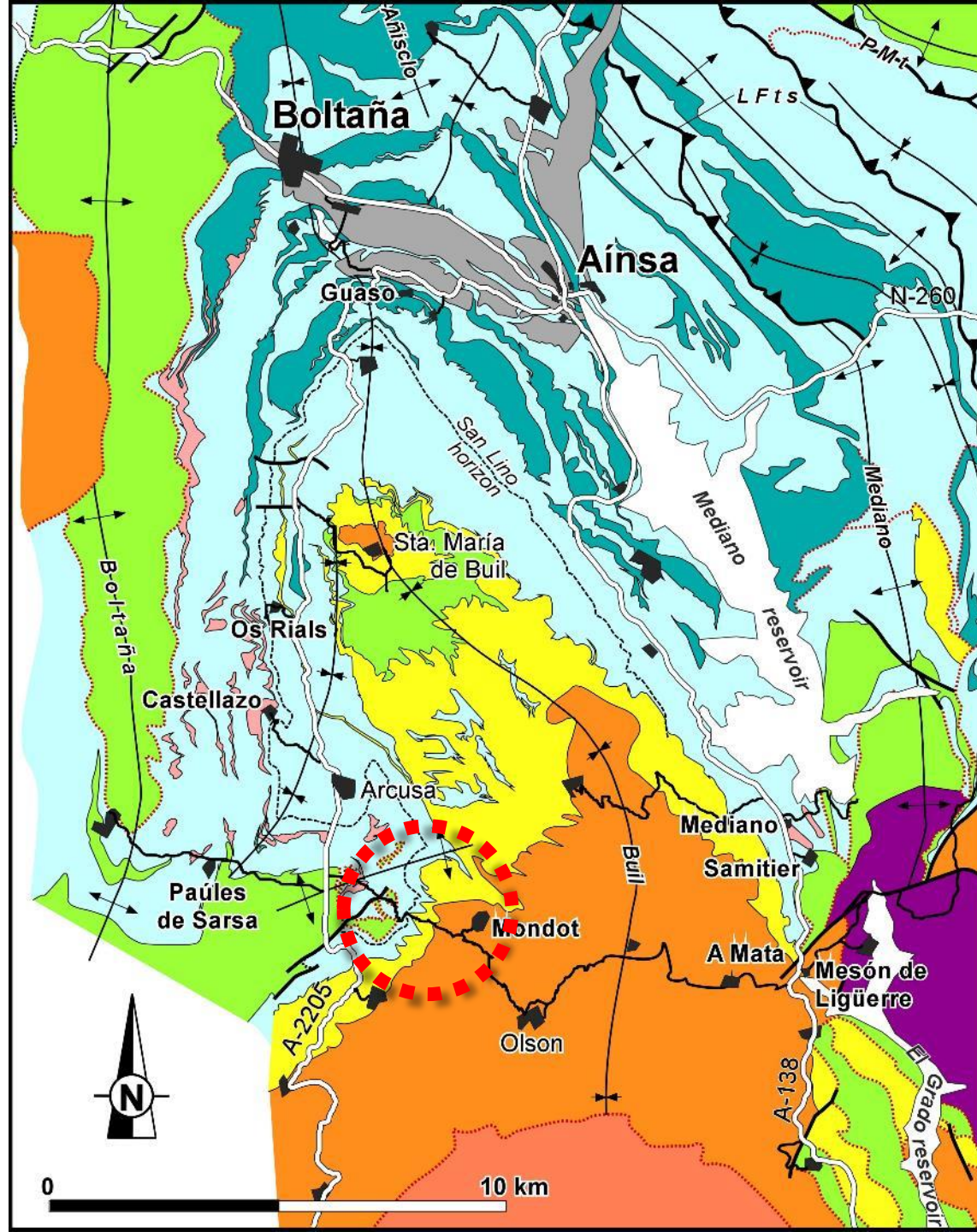
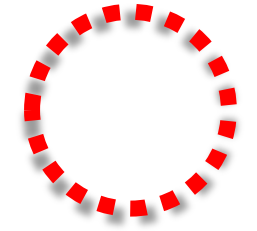
Escanilla formation
(fluvial)



















- Palaeogene**
- Quaternary and water reservoirs
 - Alluvial fan conglomerates
 - Fluvial
 - Delta-front / transitional
 - Carbonate platform
 - Slope carbonates
 - Offshore / prodelta and slope marls
 - Slope turbidites
 - Mesozoic
- fault
 thrust fault
 unconformity
 anticline
 syncline
 main road
 secondary road

From Arbués *et al.*, (2011)

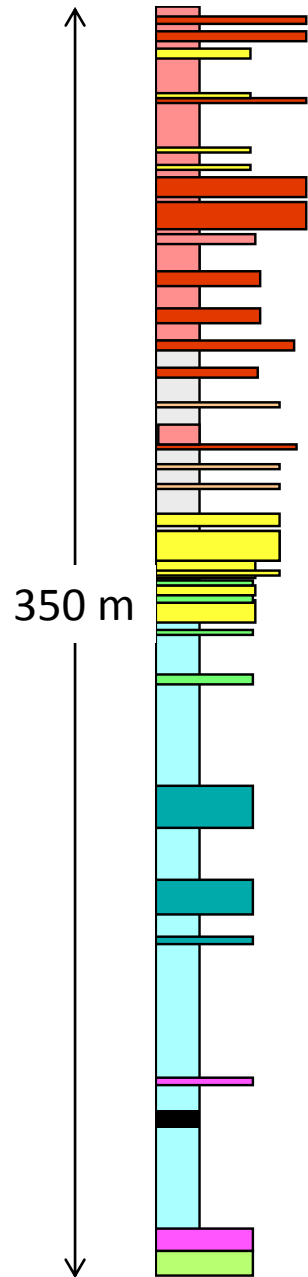
Mondot road succession



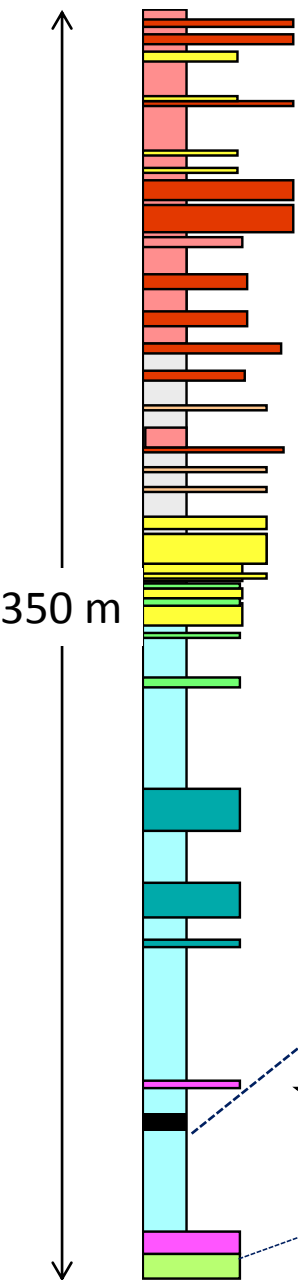
-  Quaternary and water reservoirs
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-  main road
-  secondary road

From Arbués *et al.*, (2011)

Mondot road succession



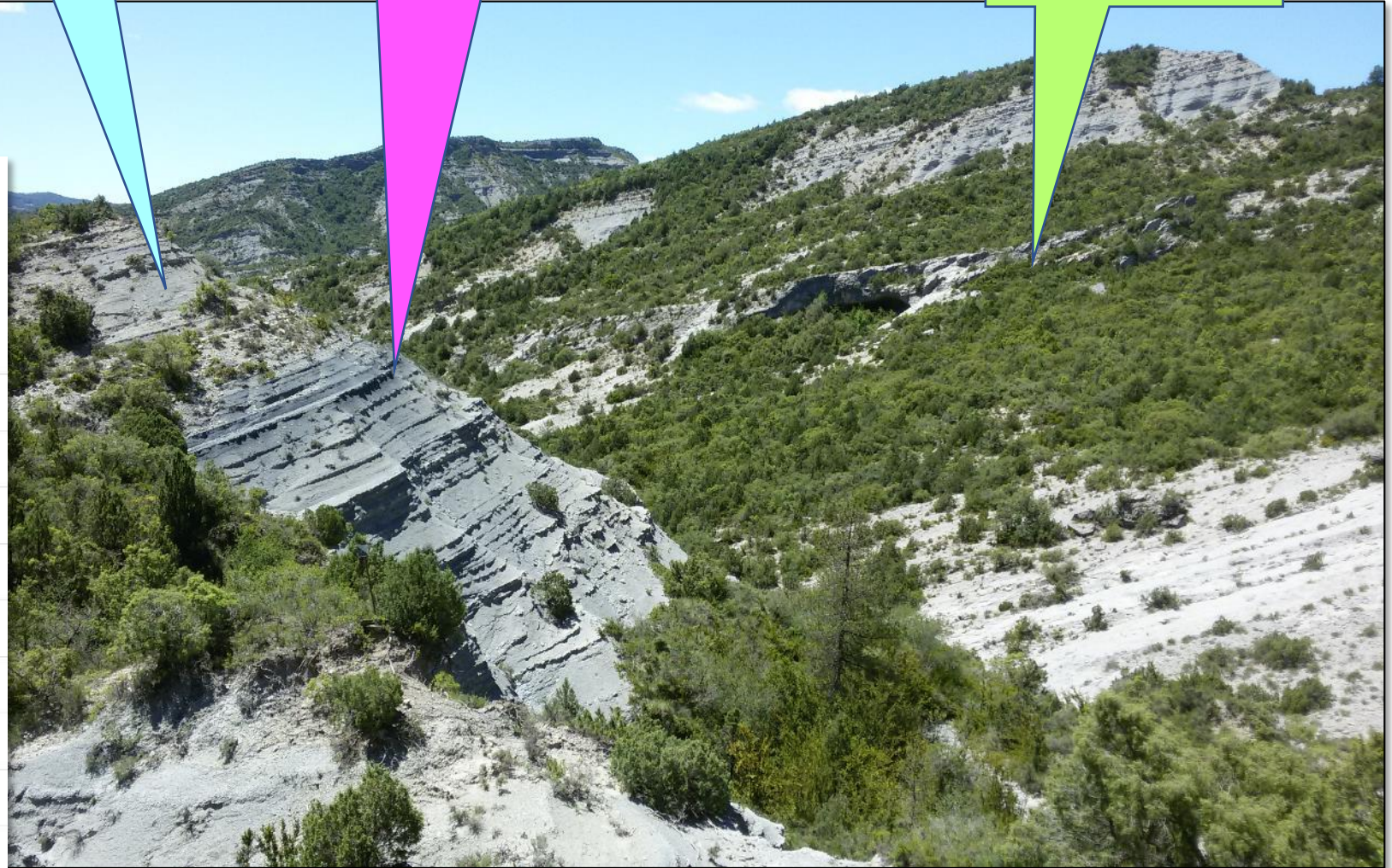
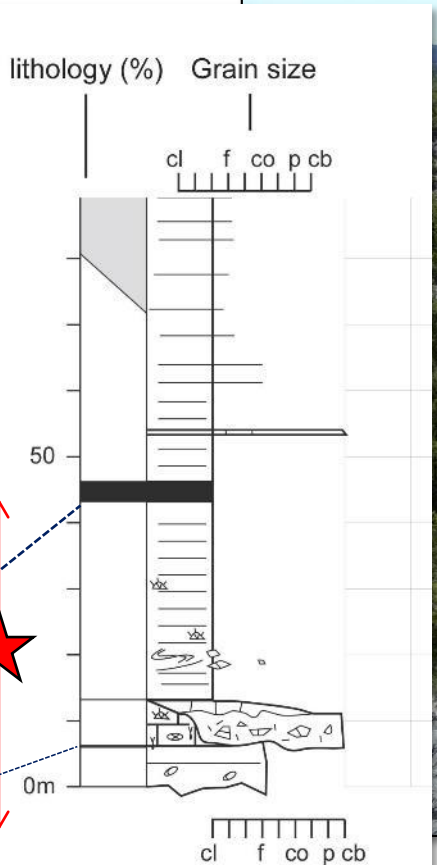
Mondot road succession



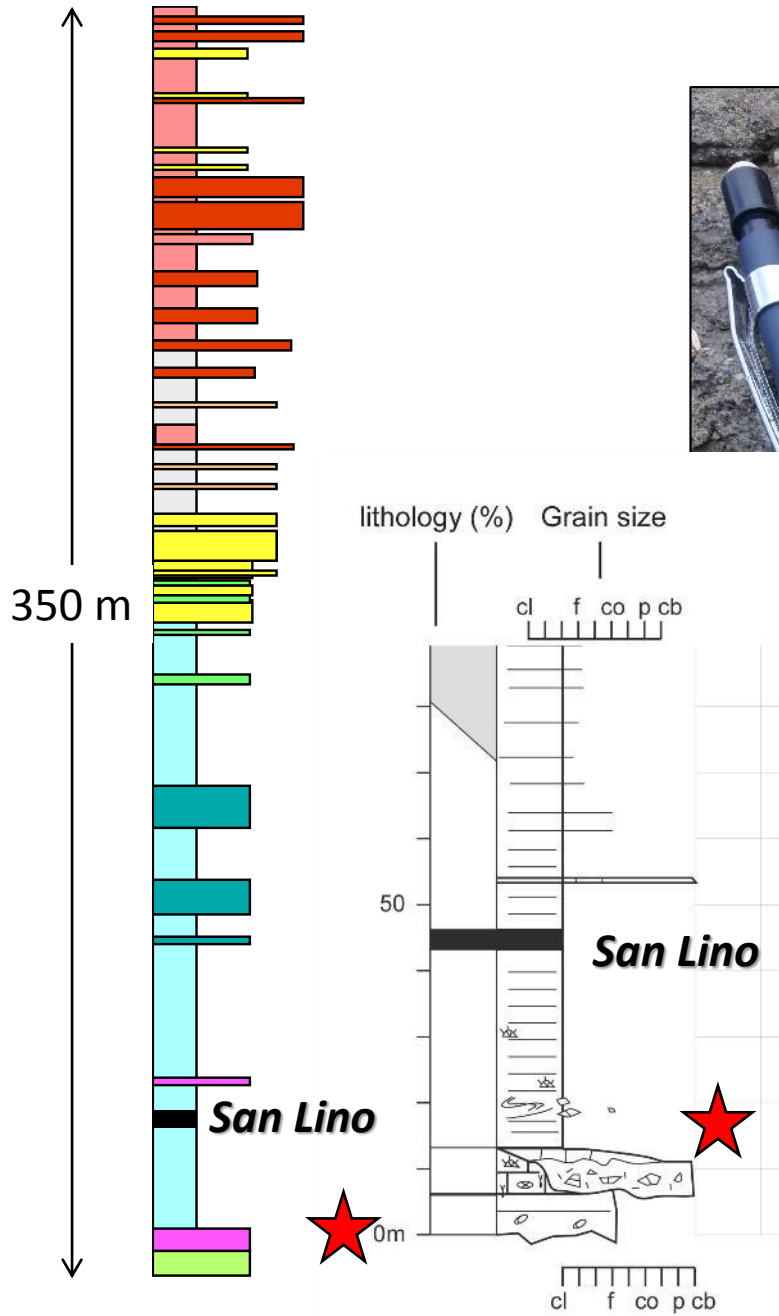
Blue-grey marls
Offshore-slope

Carbonate breccias and calcareous sandstones
Carbonate slope

Limestones
Carbonate shelf

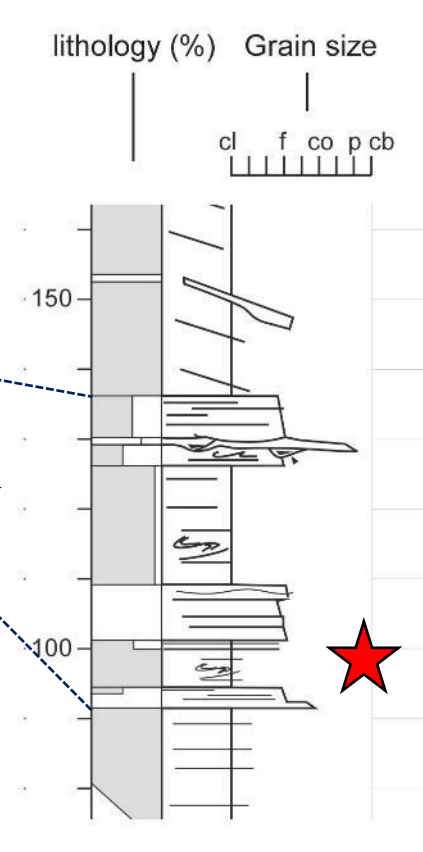
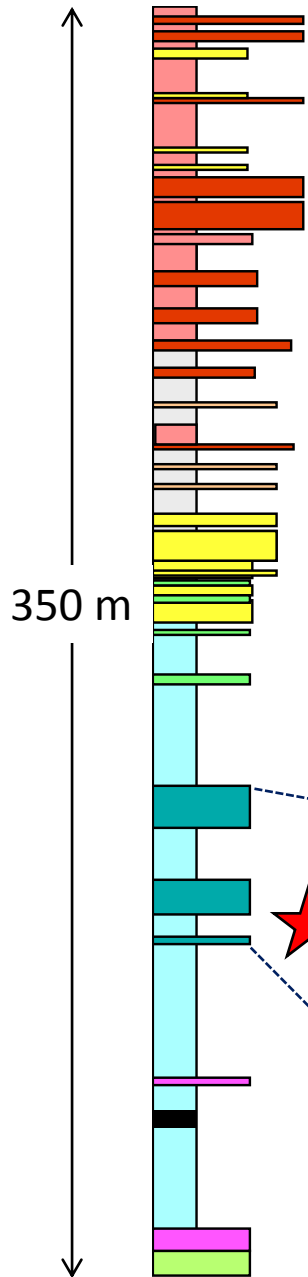


Mondot road succession



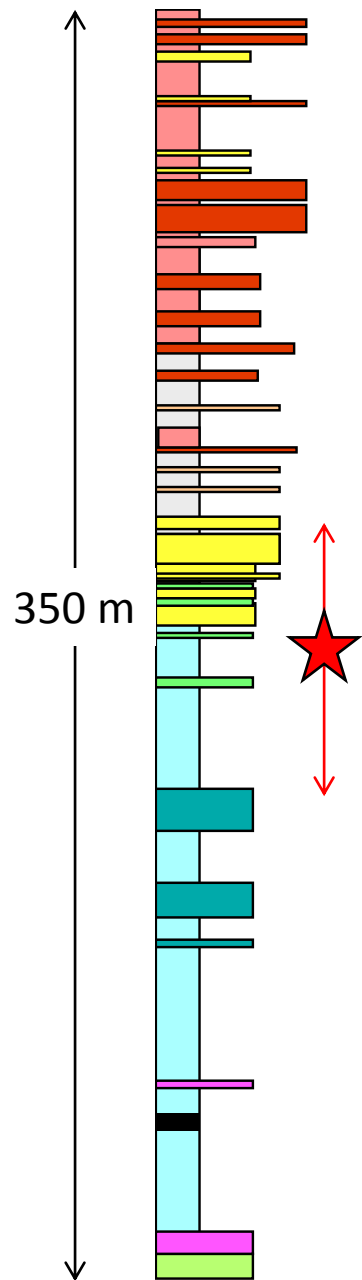
Mondot road succession

Blue-grey marls
With open marine fauna and
thin beds (siliciclastic and
calcareous sandstones)
intercalations



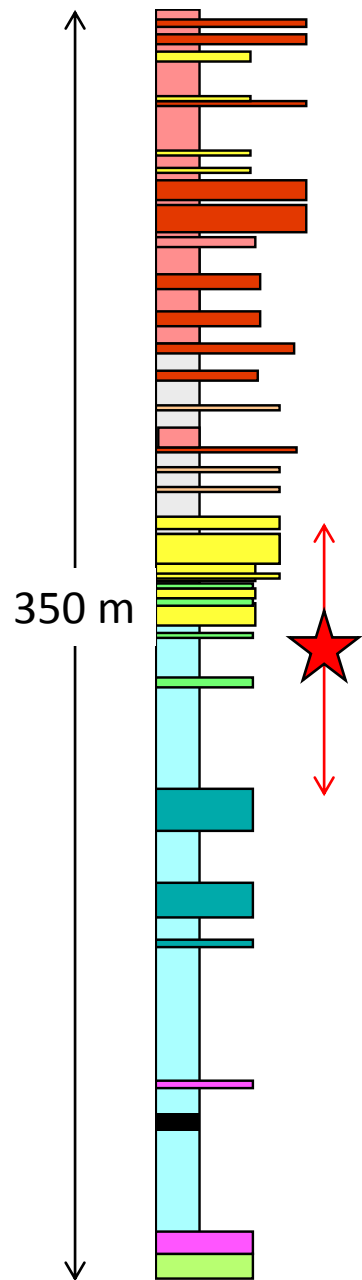
Tabular sandstones:
Cm-thick beds with
fining-upwards
gradation or non
graded alternating
with marls.
Sharp base, tool
marks, Flute casts,
current ripples...

Mondot road succession



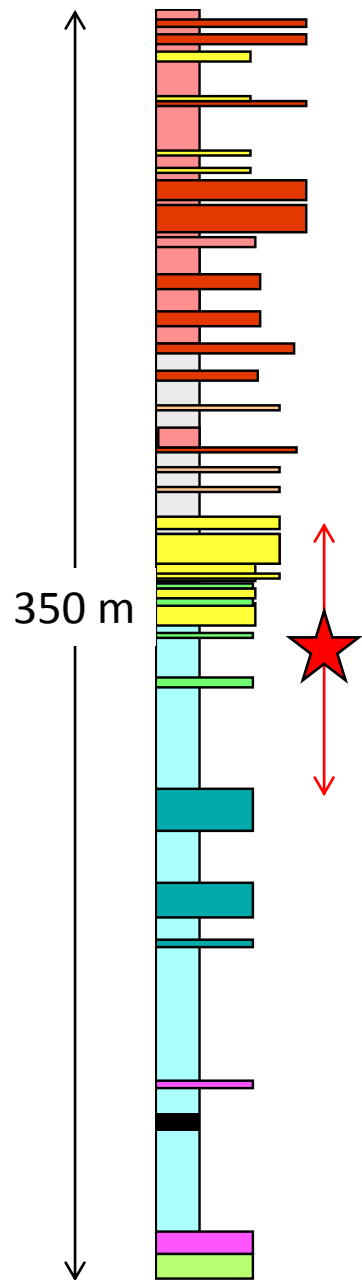
- Draw the stratification surfaces and pay attention to stratal terminations (*truncation, onlap, downlap, toplap...*)

Mondot road succession

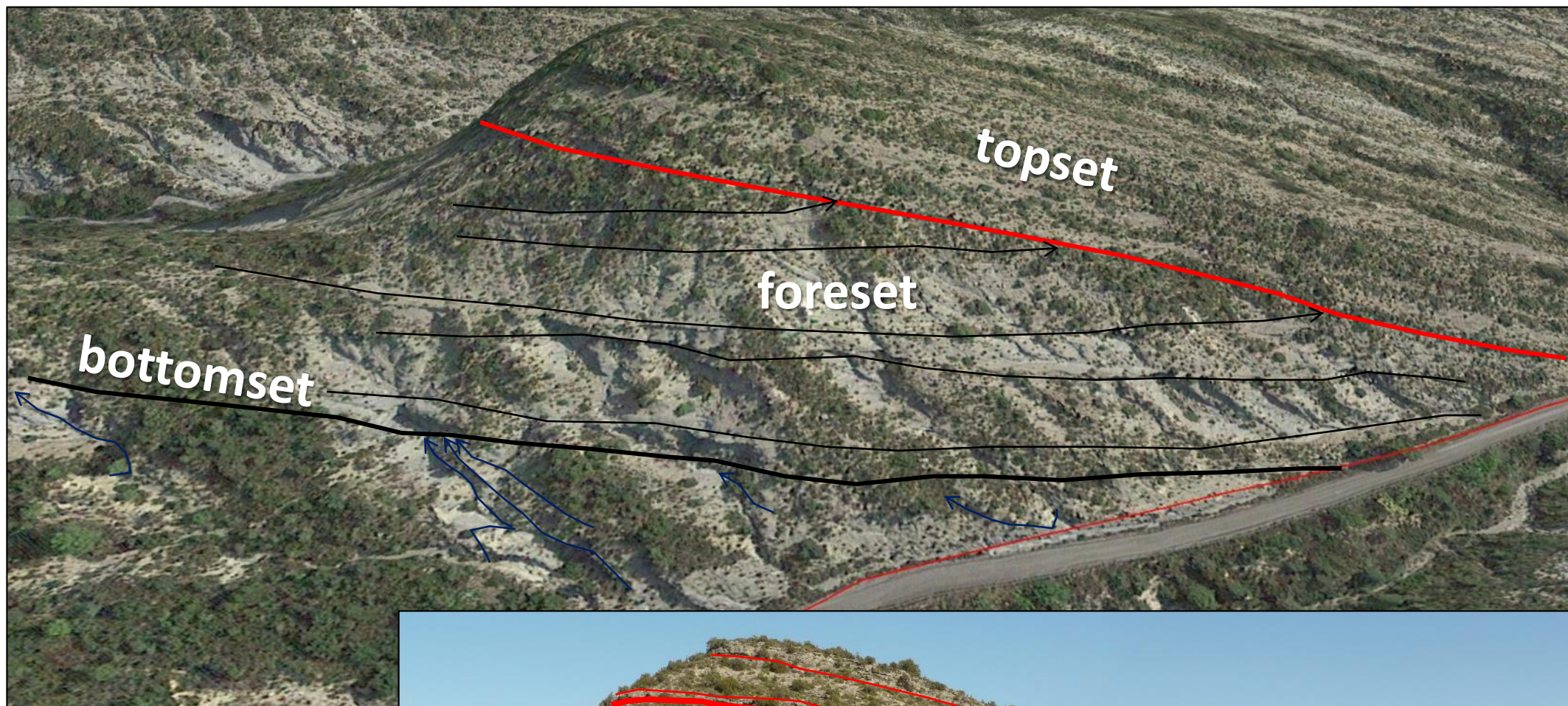
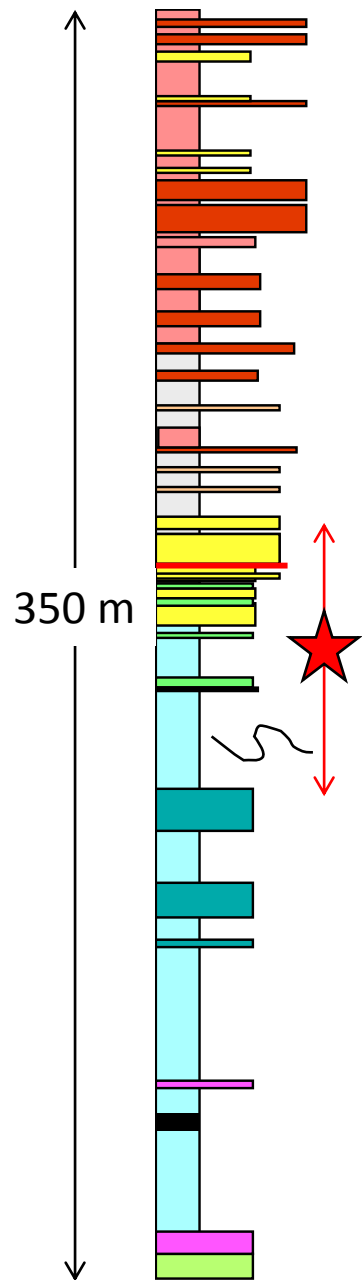


- Differentiate packages with the same bedding orientation

Mondot road succession



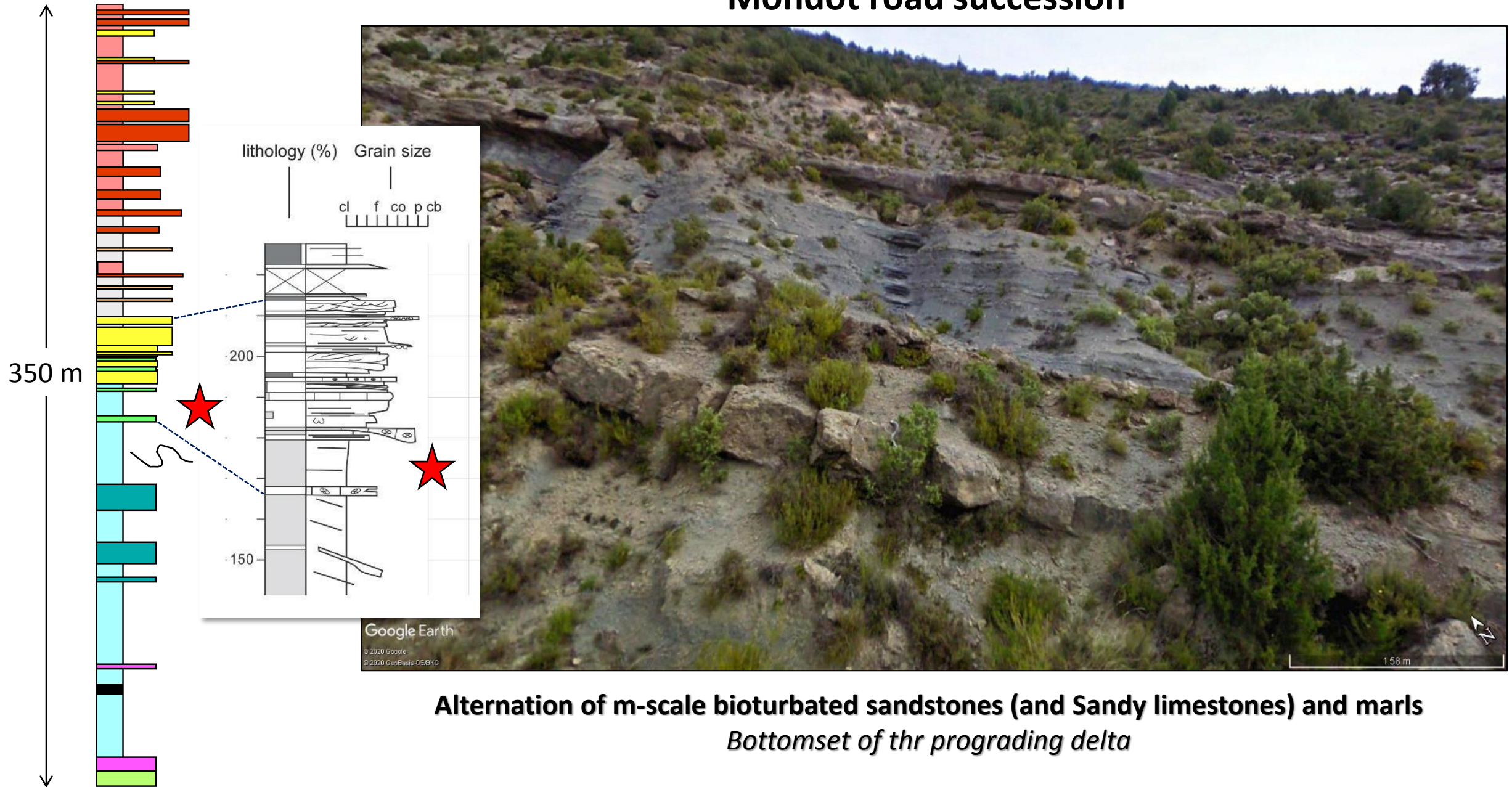
- What is the origin of these angular relations?



***Prograding delta front
above a
Slided and tilted delta
front and slope unit***



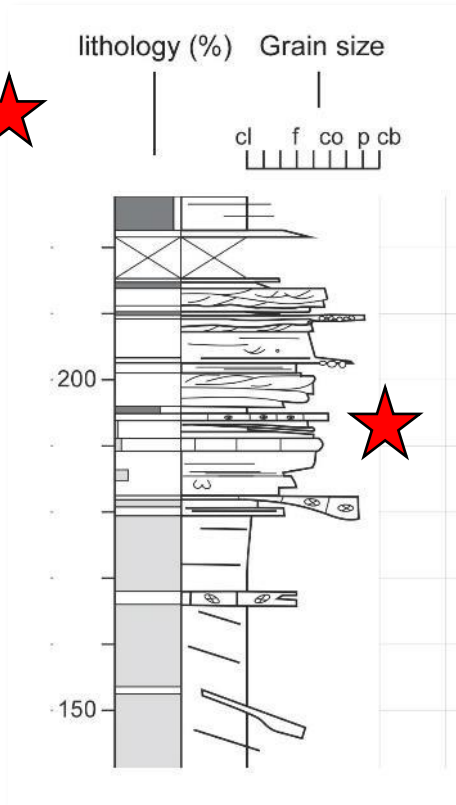
Mondot road succession



Alternation of m-scale bioturbated sandstones (and Sandy limestones) and marls
Bottomset of thr prograding delta

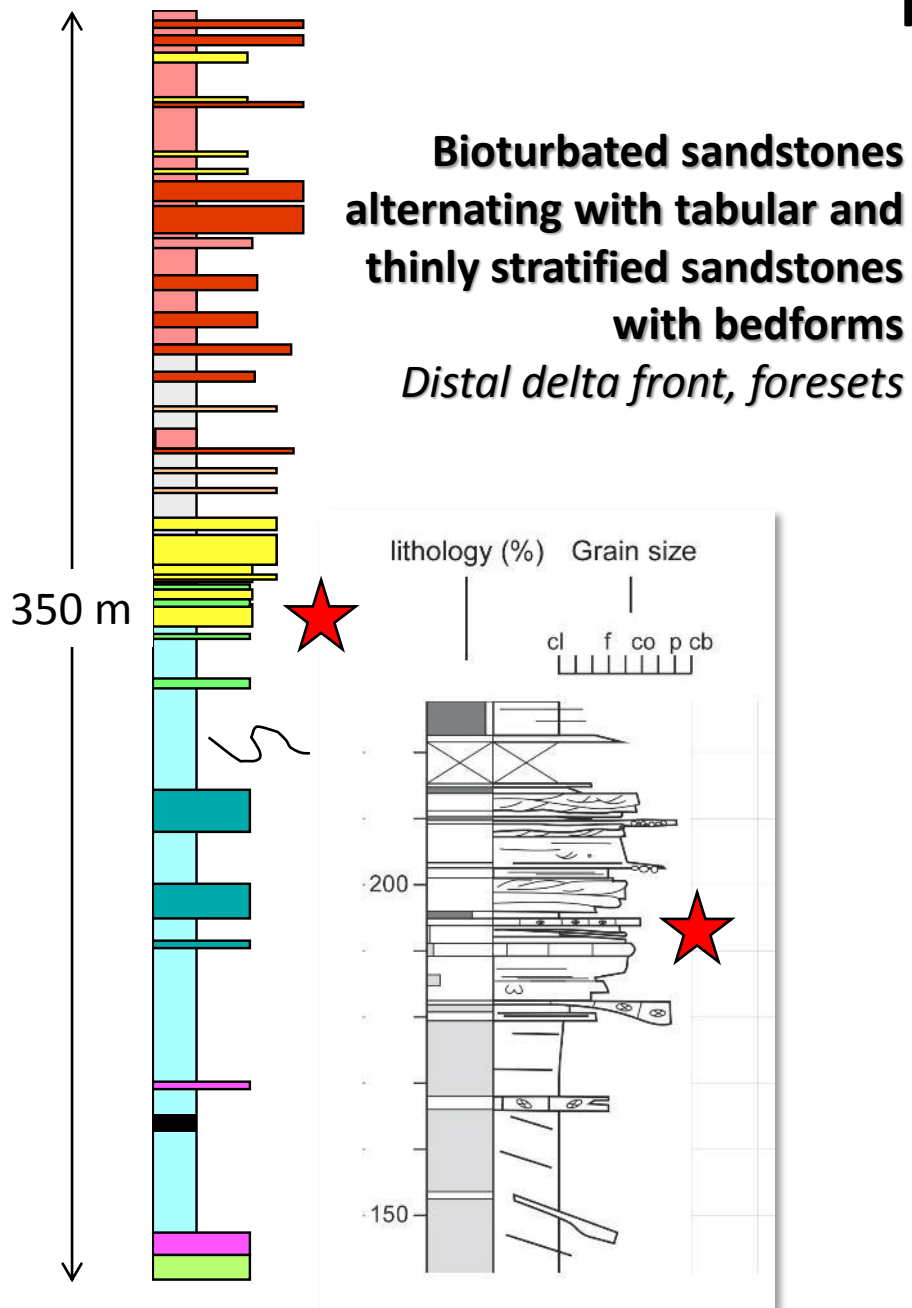
Mondot road succession

Bioturbated sandstones alternating with tabular and thinly stratified sandstones with bedforms
Distal delta front, foresets

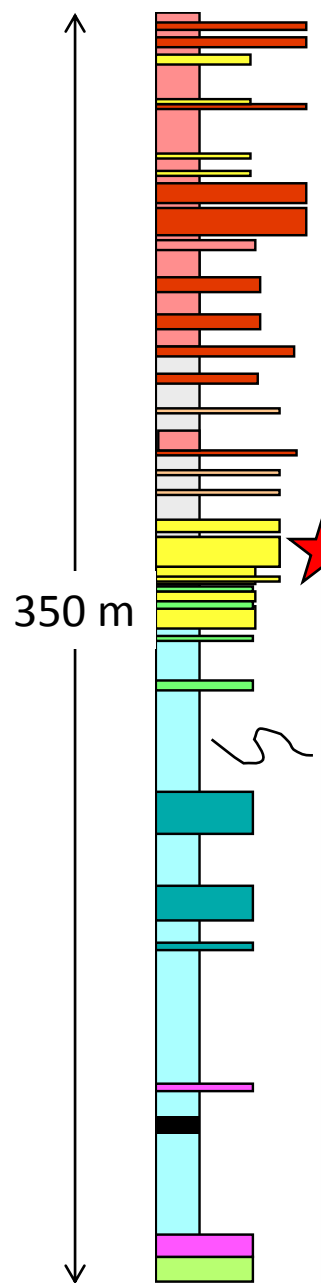


Sandy limestones
Carbonate shelf. Transgressive events or transition between delta front and carbonate shelf within foresets

Mondot road succession

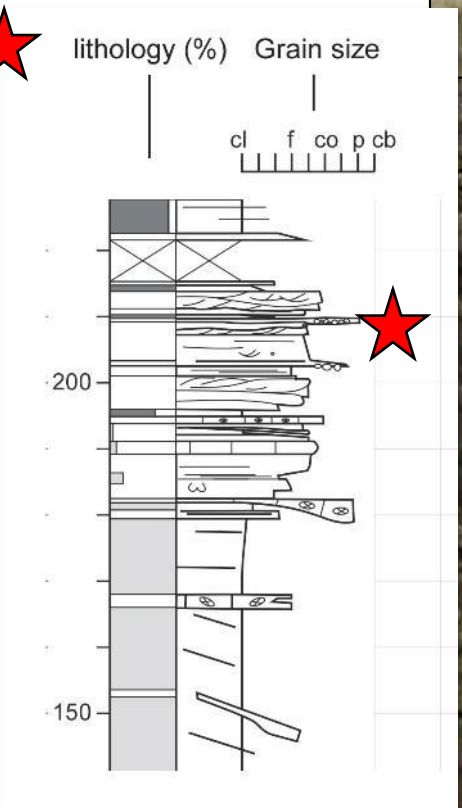


Sandy limestones Carbonate shelf. Transgressive events or transition between delta front and carbonate shelf within foresets



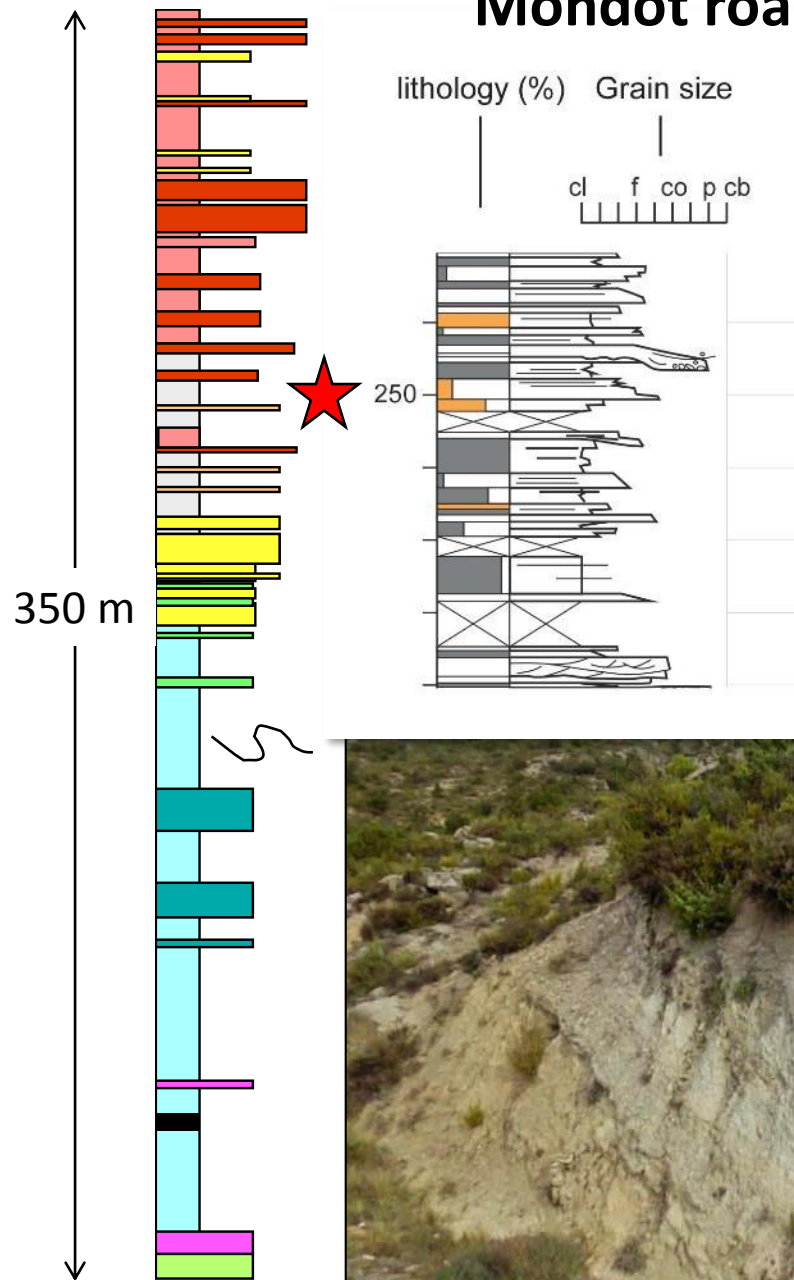
Trough cross-bedded sandstones

Proximal delta front, topsets



Sandy limestones
Carbonate shelf.
Transgressive events
or transition between
delta front and
carbonate shelf
within topsets

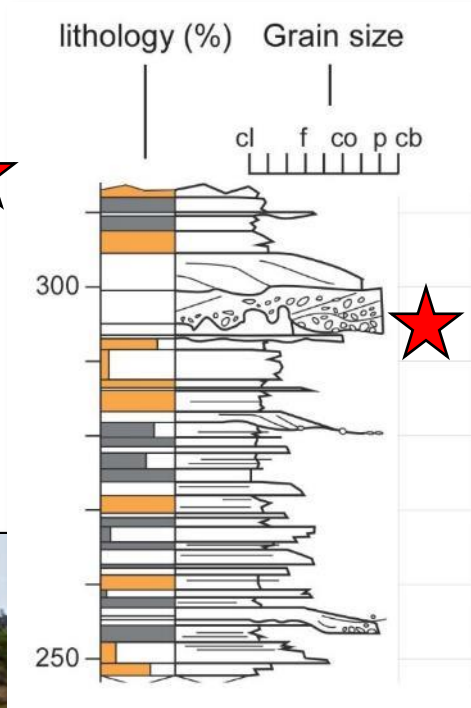
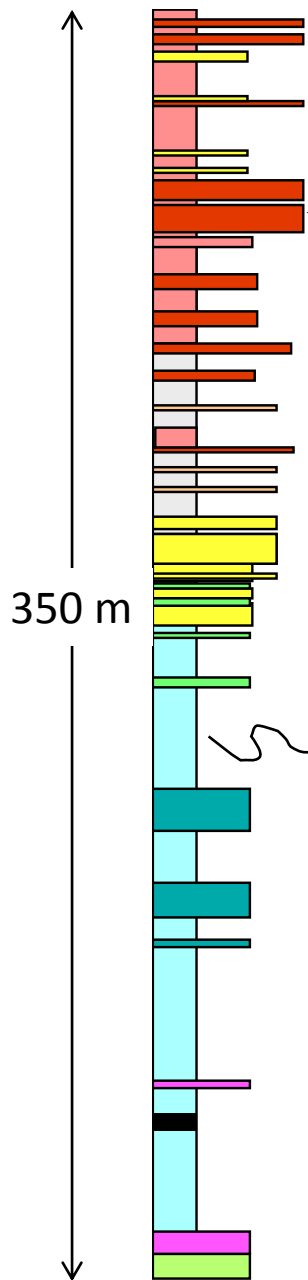
Mondot road succession



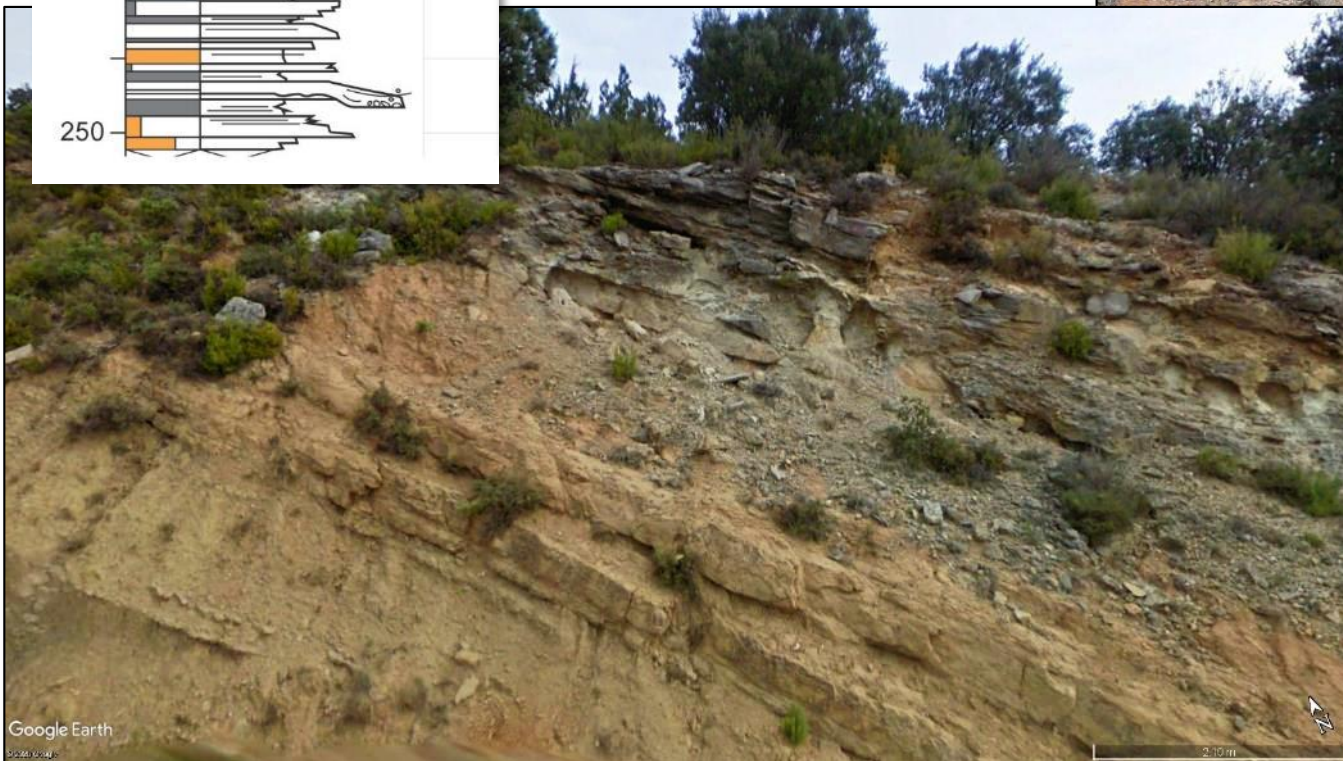
Grey mustones and siltstones with tabular and channeled sandy (local conglomeratic) intercalations
Lower delta plain



Mondot road succession



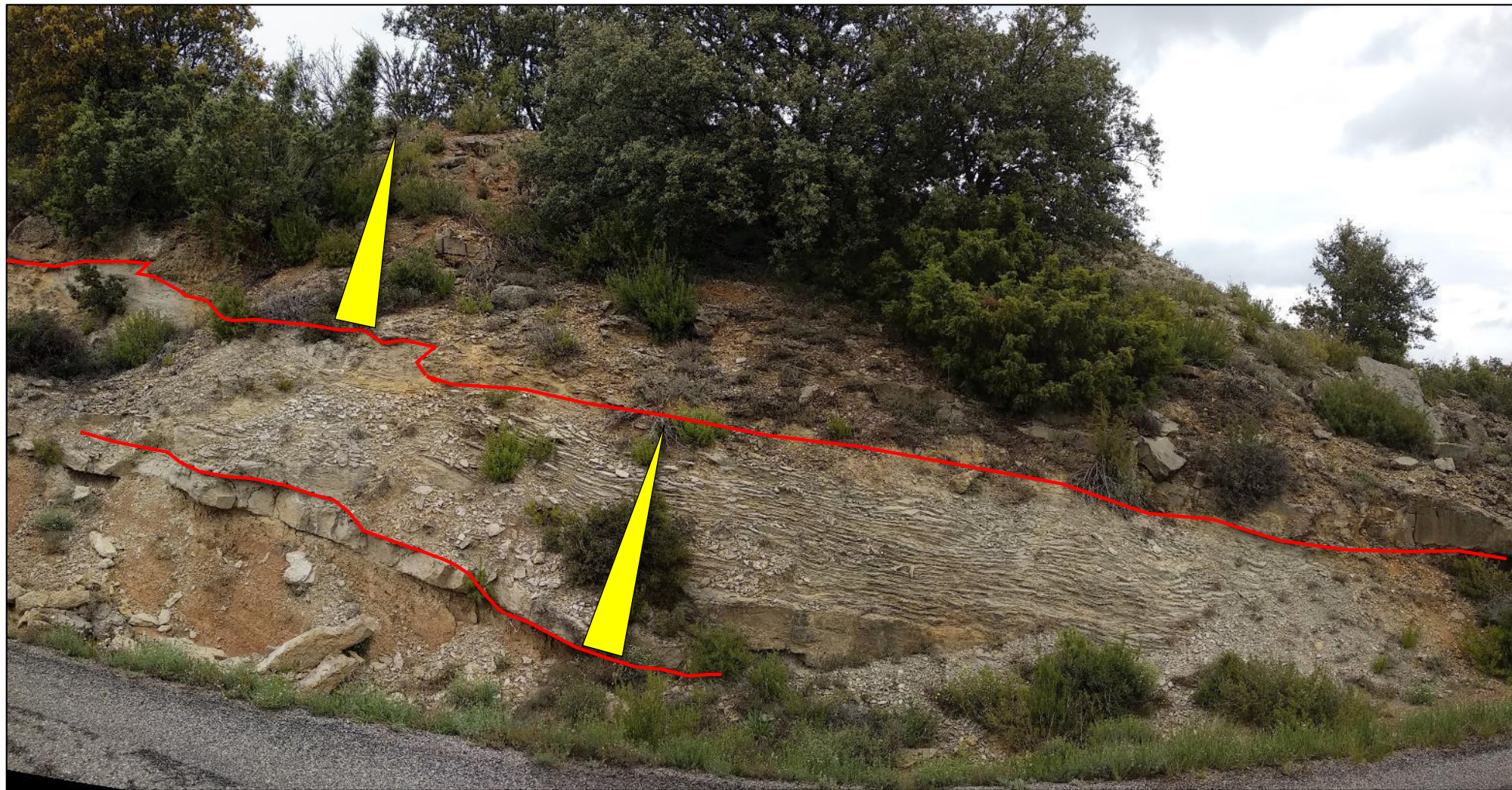
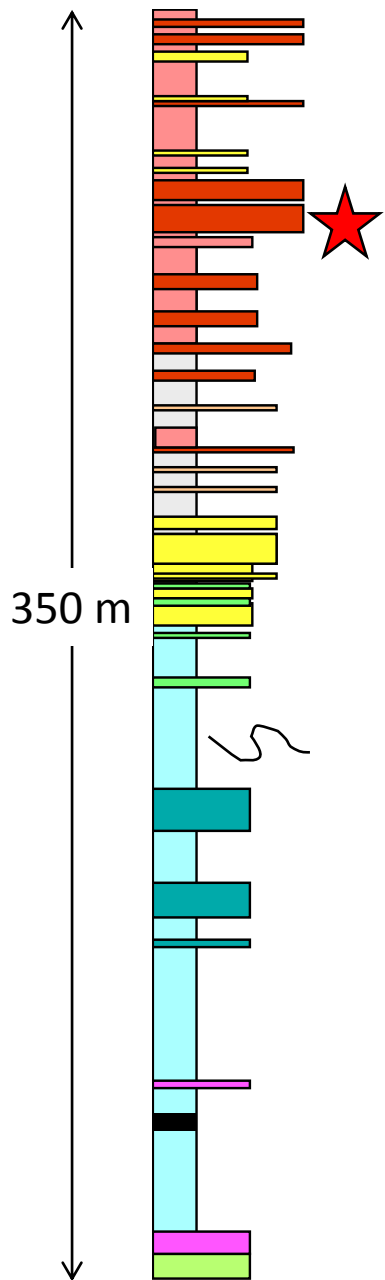
Reddish mudstones and siltstones with paleosoil horizons and intercalations of tabular and channelled sandstones and conglomerates
Upper delta plain

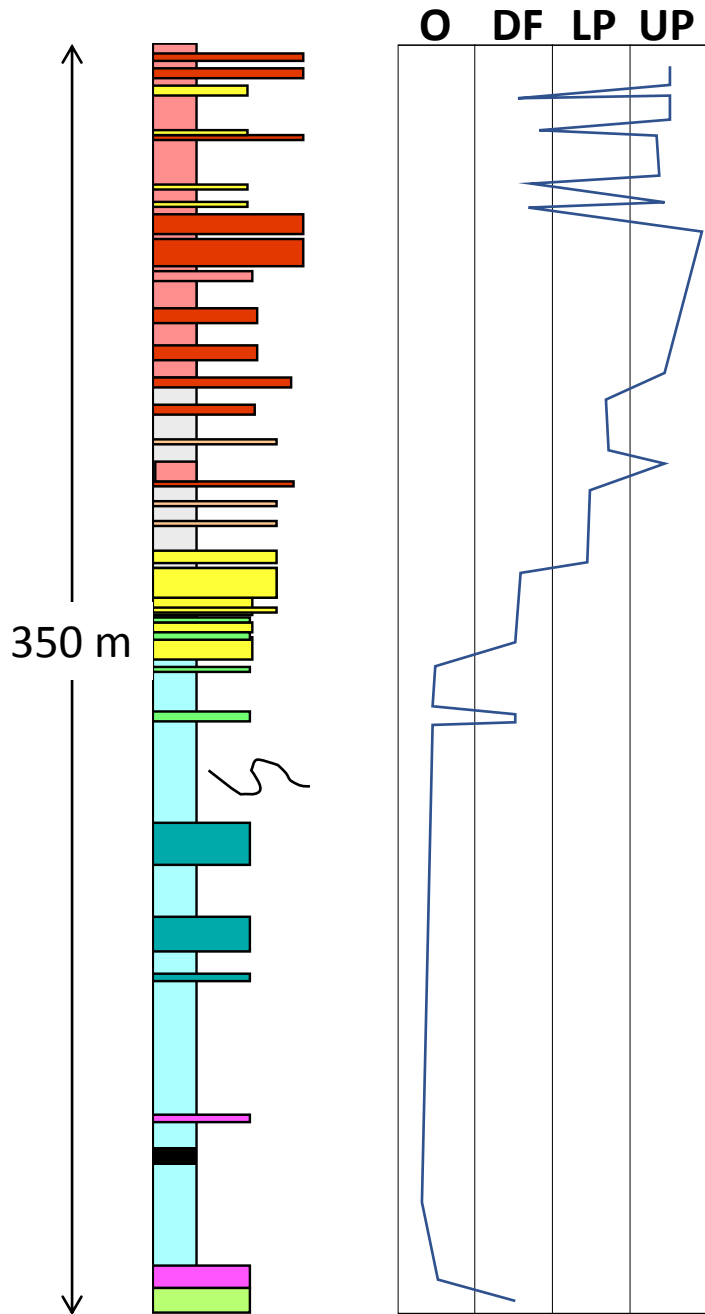


Mondot road succession

Channeled sandstones and conglomerates

Braided and meandering fluvial systems, Proximal delta plain

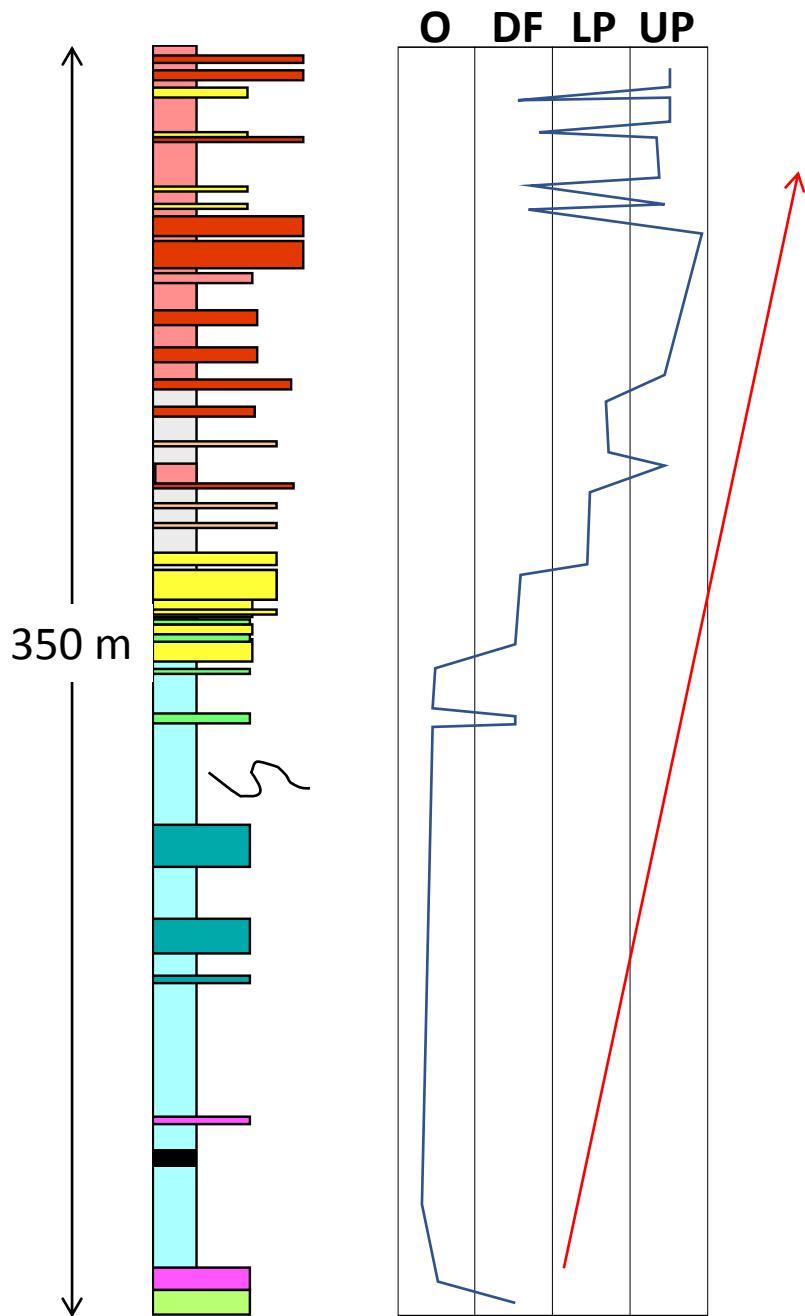




Mondot Road Log Exercise

1. Draw a line indicating the environment of the different lithologic units or sections to show the paleoenvironmental evolution.
2. Analysis of shallowing and deepening upwards trends (draw red arrows for the shallowing-upwards and blue arrows for the deepening-upwards sections)
3. How is the GENERAL trend, shallowing or deepening upwards?
4. Can you differentiate smaller-scale trends? If so... do it!
5. Locate Key surfaces highlighting changes in the observed trends with sequential meaning (maximum flooding surfaces, transgressive/maximum regression surfaces)

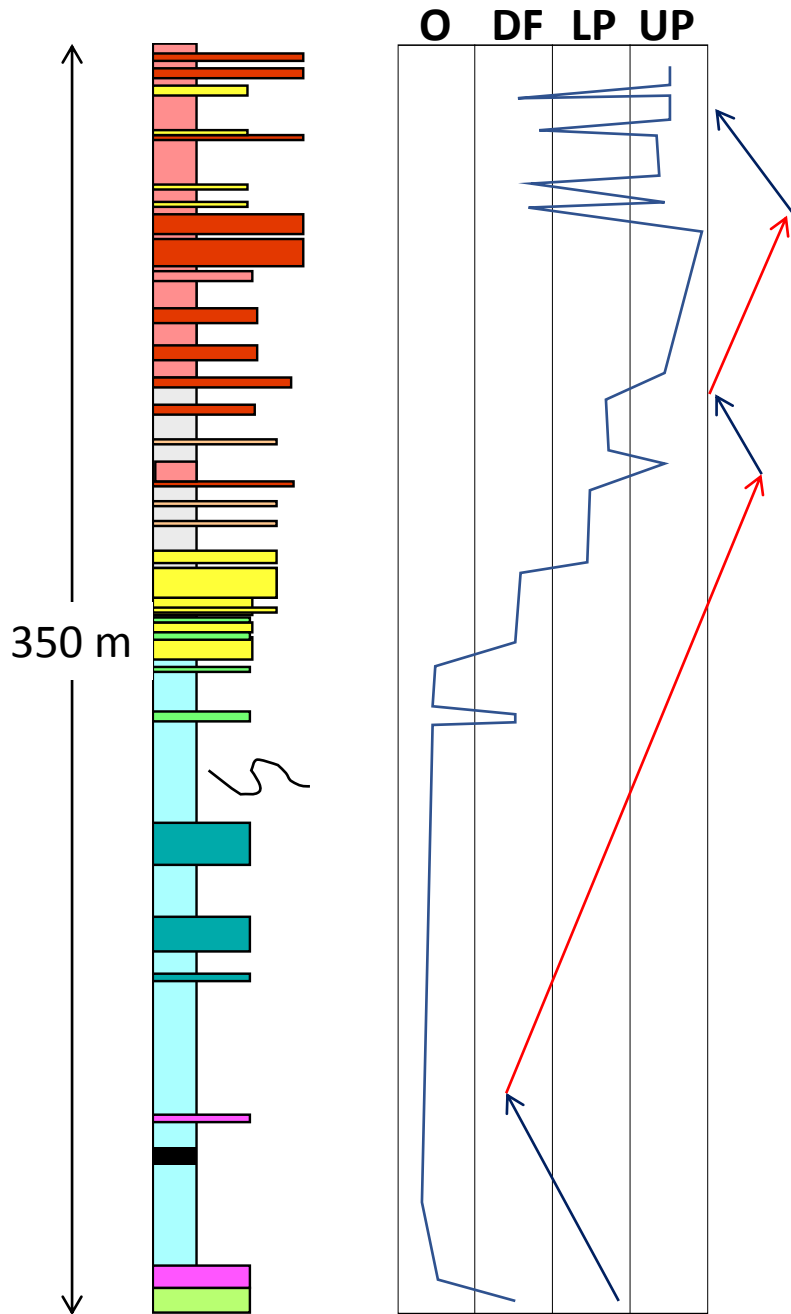
UP: Upper delta plain
LP: Lower delta plain
DF: Delta front-shelf
O: Slope-offshore



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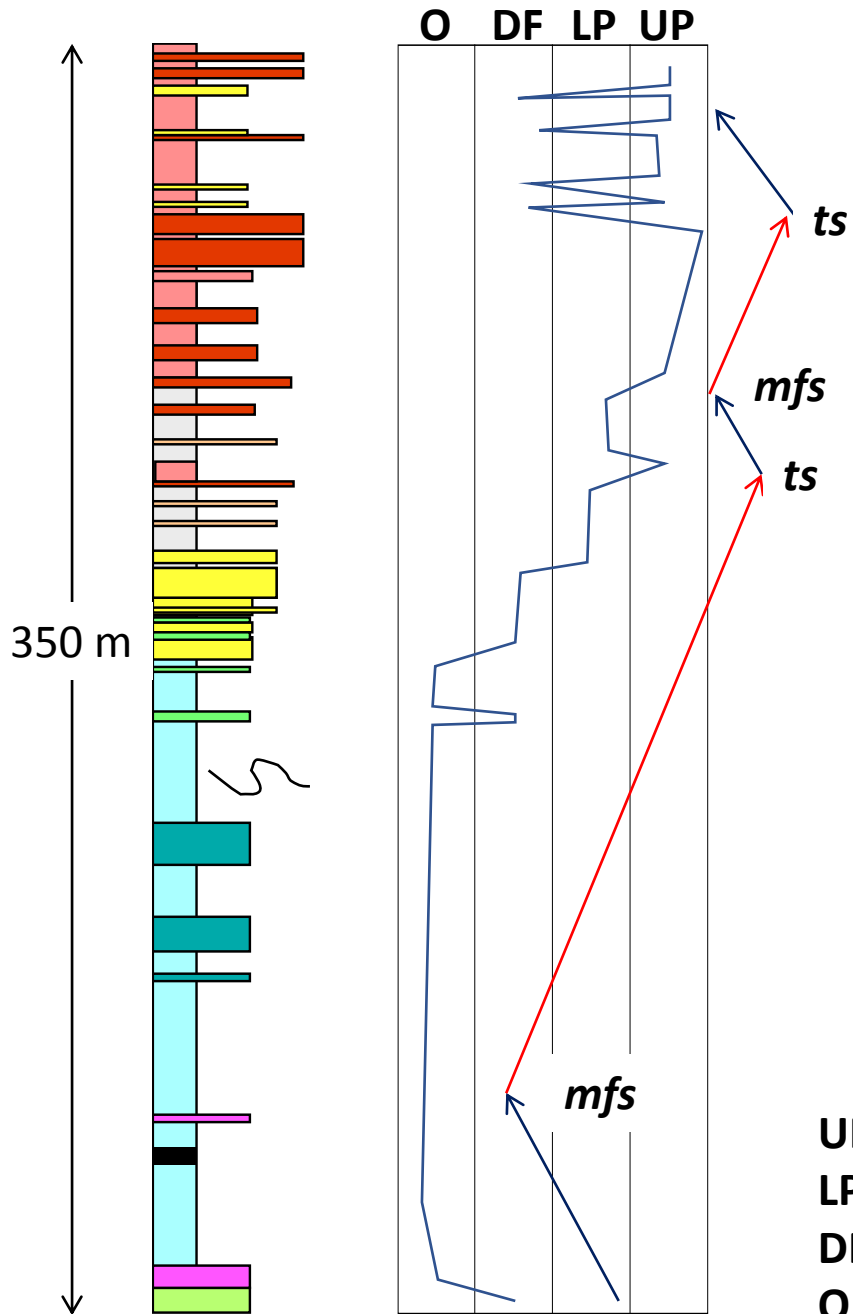
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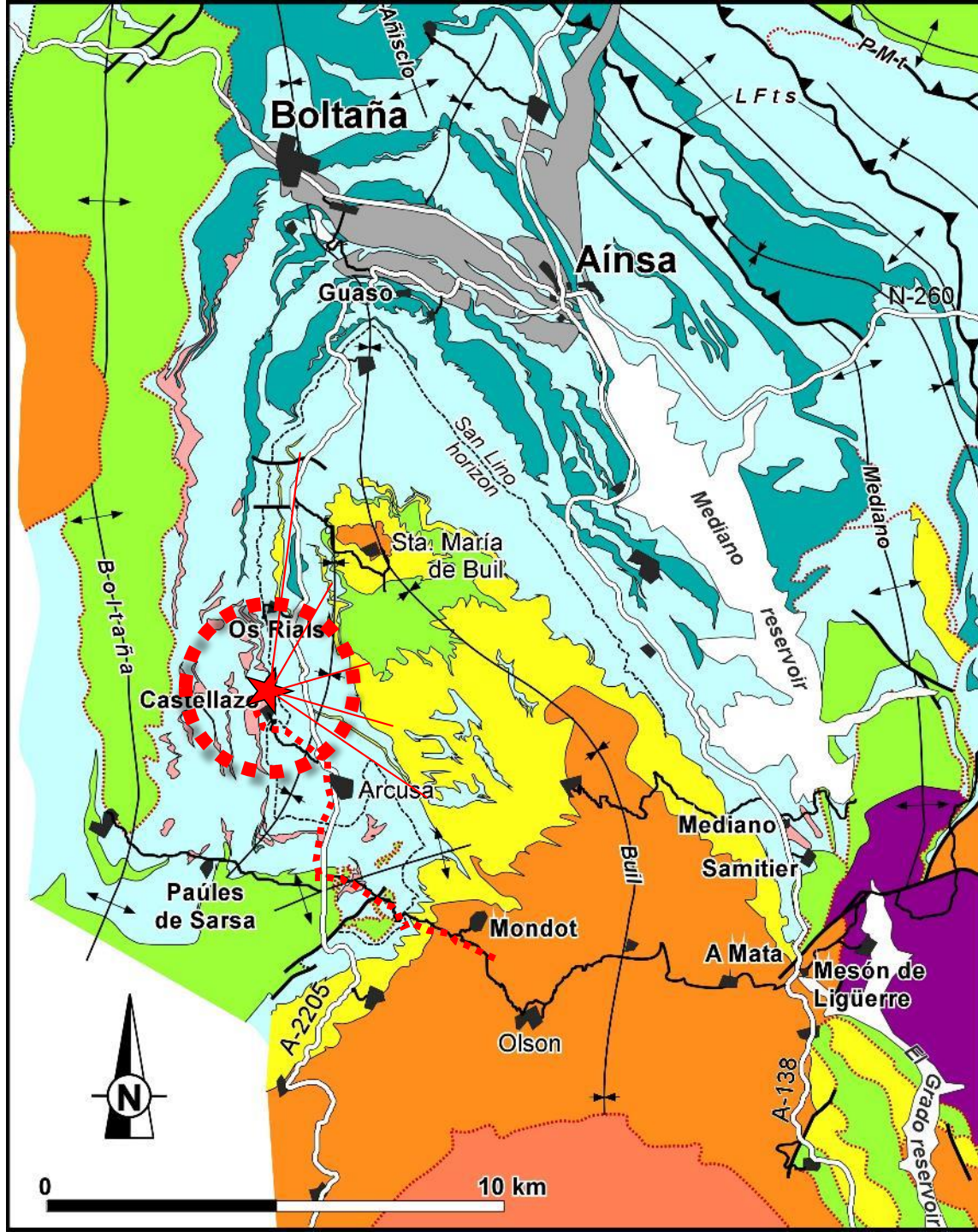


Mondot Road Log Exercise

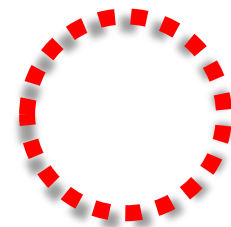
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From Arbués et al., (2011)



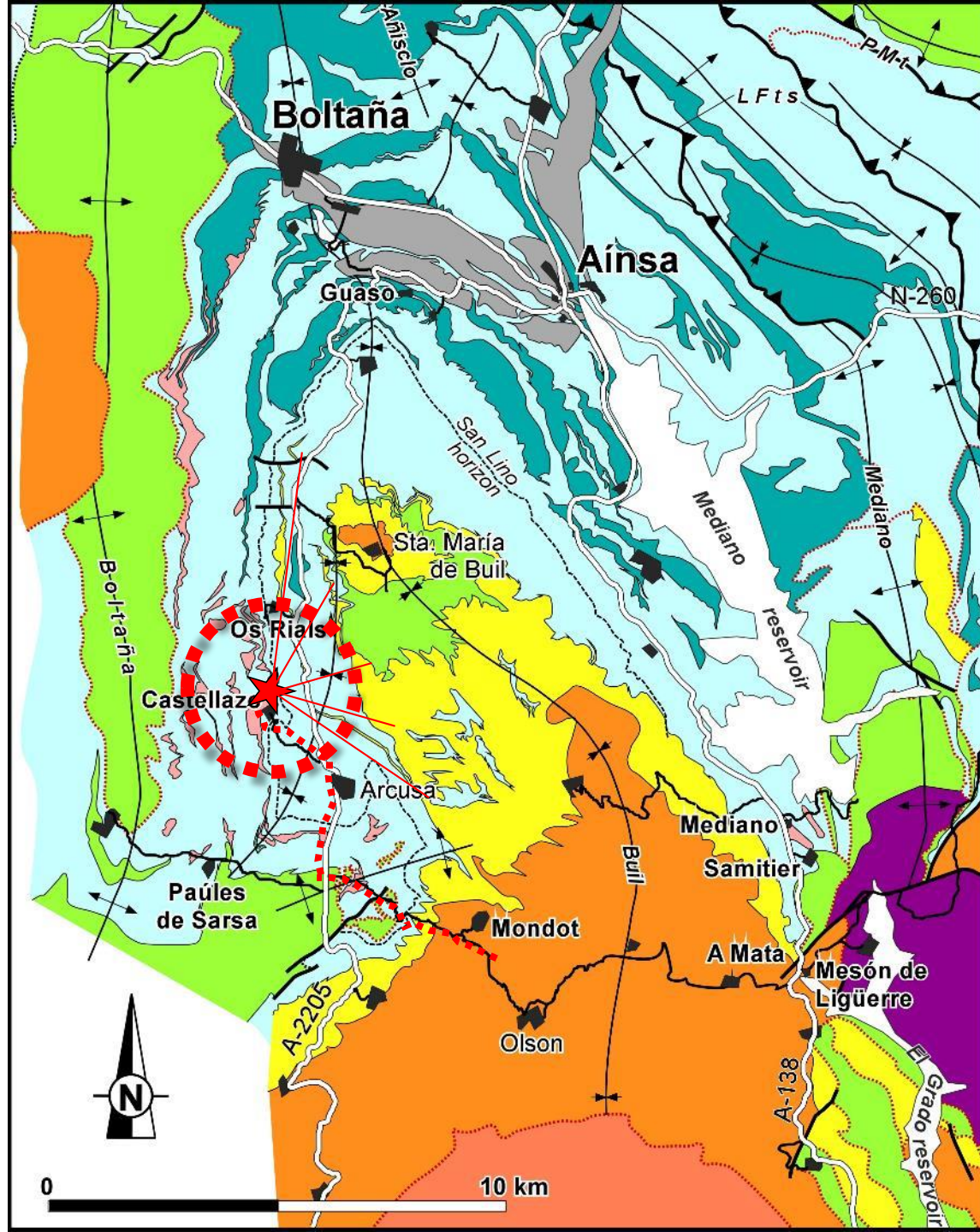
from Mondot to Castellazo



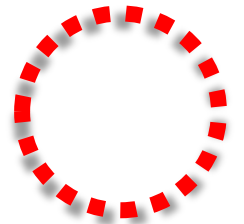
- Quaternary and water reservoirs
 - Alluvial fan conglomerates
 - Fluvial
 - Delta-front / transitional
 - Carbonate platform
 - Slope carbonates
 - Offshore / prodelta and slope marls
 - Slope turbidites
 - Mesozoic
 - fault
 - thrust fault
 - unconformity
 - anticline
 - syncline
 - main road
 - secondary road
- Palaeogene



From Arbués et al., (2011)



from Mondot to Castellazo



- Quaternary and water reservoirs
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- Palaeogene

Castellazo panoramic view



Castellazo panoramic view

NNW-

-SSE



TASK: Sketch a geological cross-section from the landscape

1. Draw stratigraphic surfaces (*line-drawing*)
2. Differentiation of lithologies from the landscape
3. Interpretation of the depositional environments
4. Architectural, Paleogeographic and sequential interpretation

Castellazo panoramic view

NNW-

-SSE



Castellazo panoramic view

NNW-

-SSE



Castellazo panoramic view

NNW-

-SSE



Castellazo panoramic view

NNW-

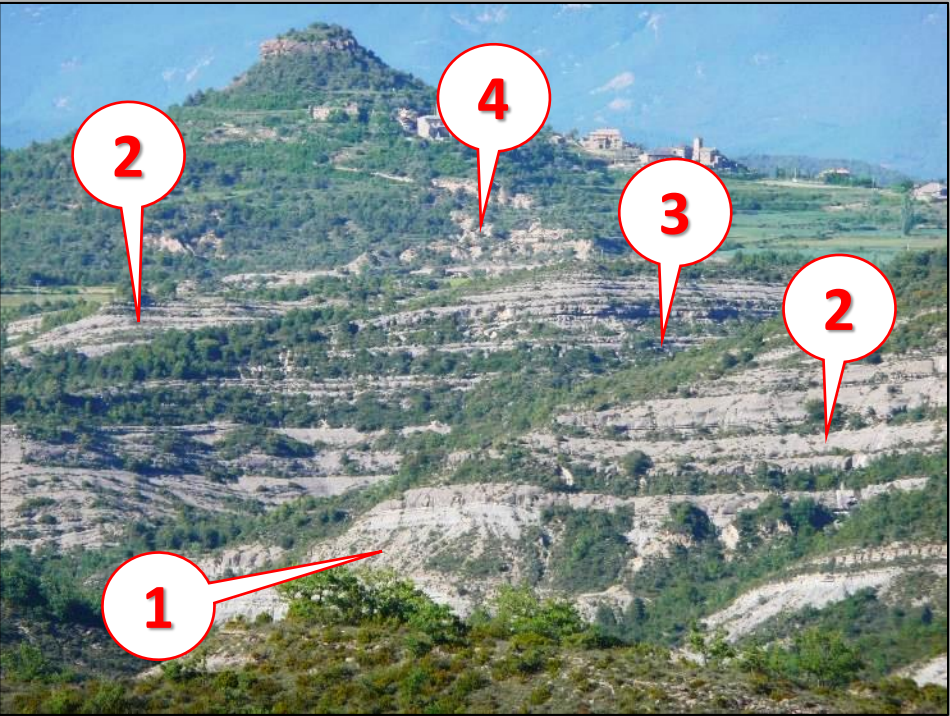
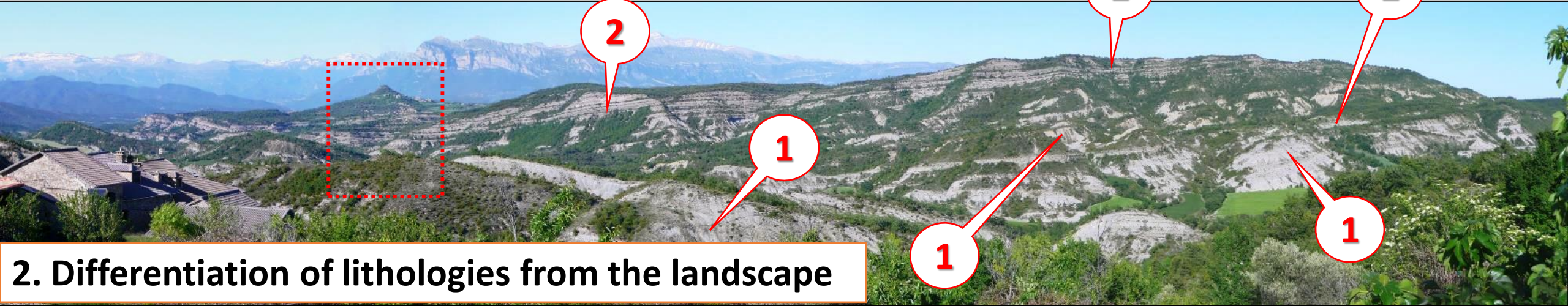
-SSE



Castellazo panoramic view

NNW-

-SSE



Castellazo panoramic view

NNW-

-SSE



2. Differentiation of lithologies from the landscape



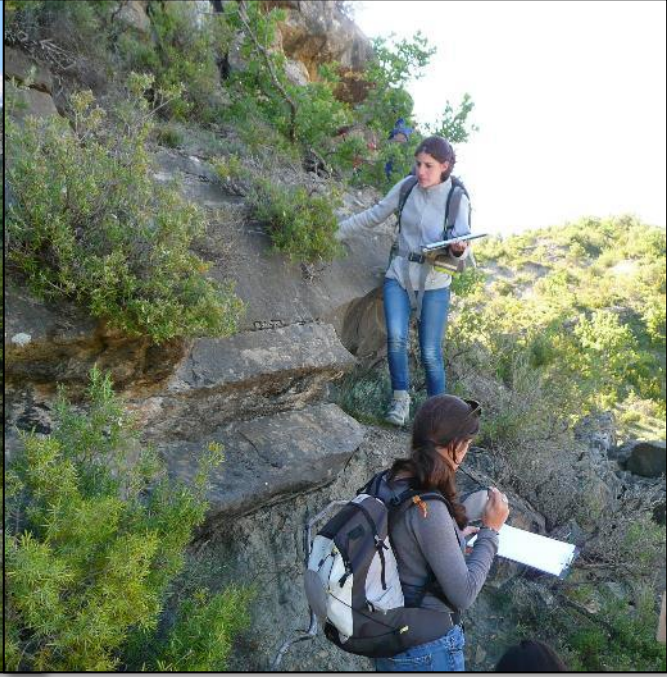
Castellazo panoramic view

NNW-

-SSE



2. Differentiation of lithologies from the landscape



Castellazo panoramic view

NNW-

-SSE



2. Differentiation of lithologies from the landscape



Castellazo panoramic view

NNW-

-SSE



2. Differentiation of lithologies from the landscape



Castellazo panoramic view

NNW-

-SSE



2. Differentiation of lithologies from the landscape



- 1: Blue-grey marls (*off-shore /deep marine*)
- 2: Sandstones (*delta front*)
- 3: Bioclastic limestones (*carbonate platform*)
- 4: Reddish mudstones with coarser-grained intercalations (*delta plain*)

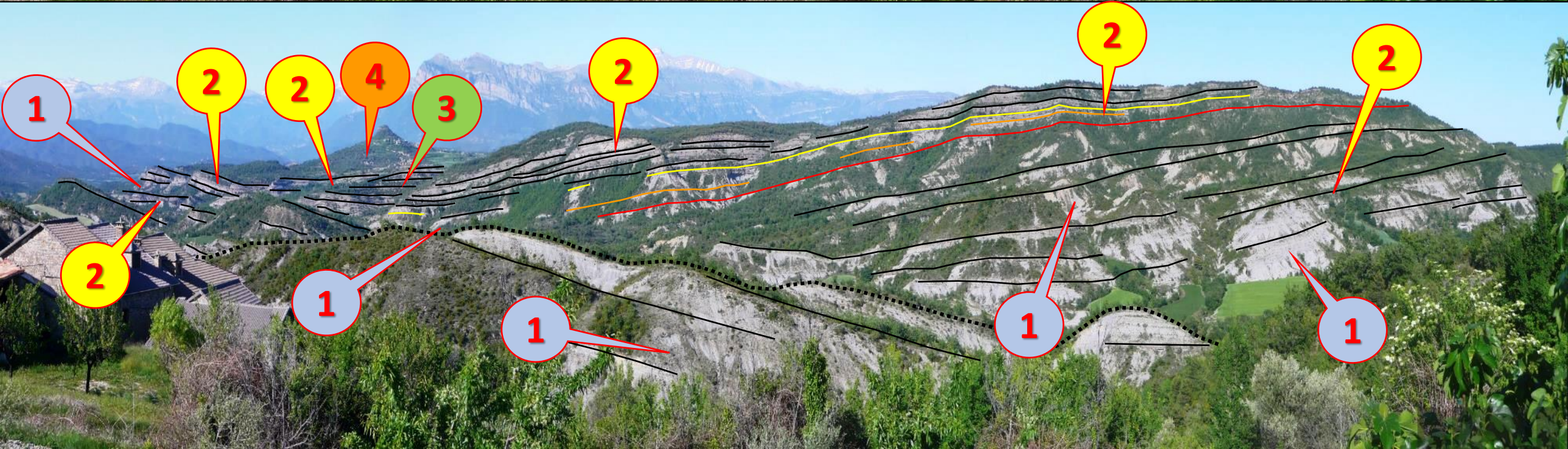
Castellazo panoramic view

NNW-

-SSE



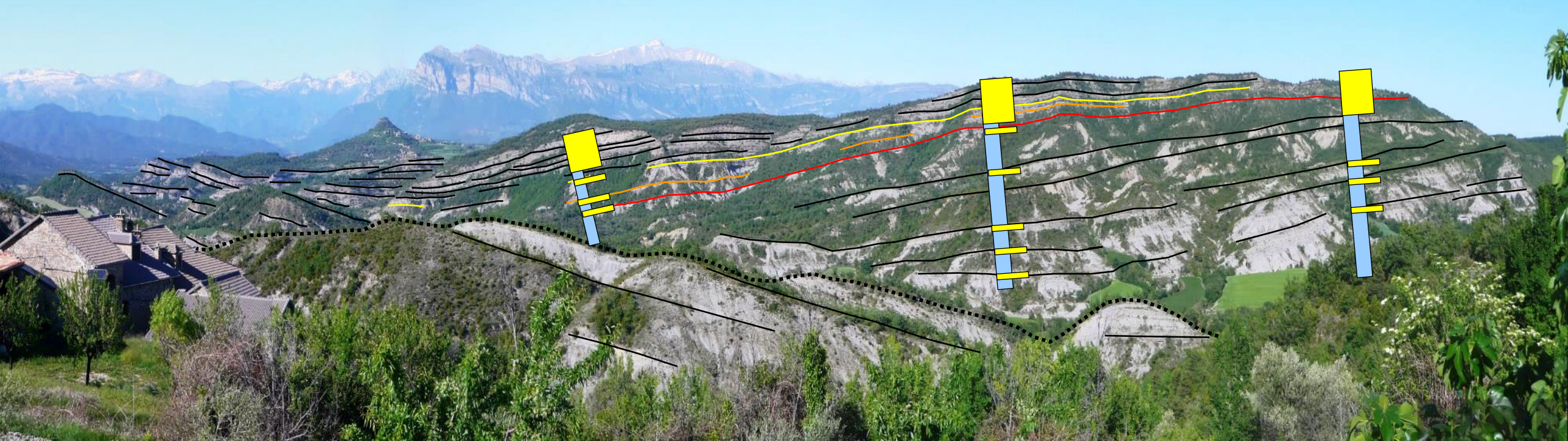
Relations among lithosomes and sedimentary environments



Castellazo panoramic view

NNW-

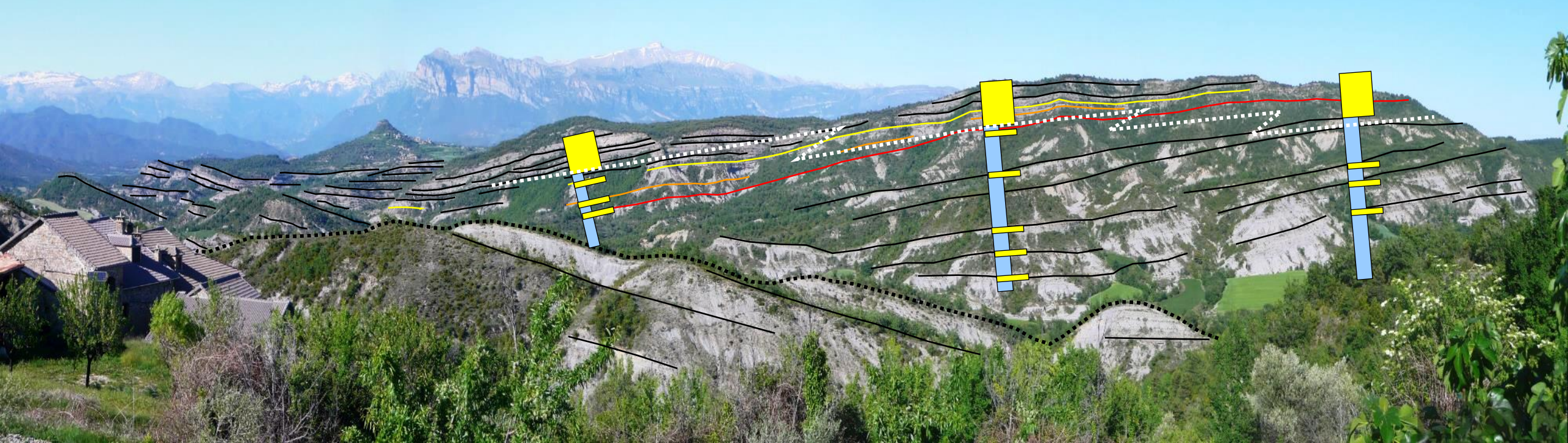
-SSE



Castellazo panoramic view

NNW-

-SSE



Castellazo panoramic view

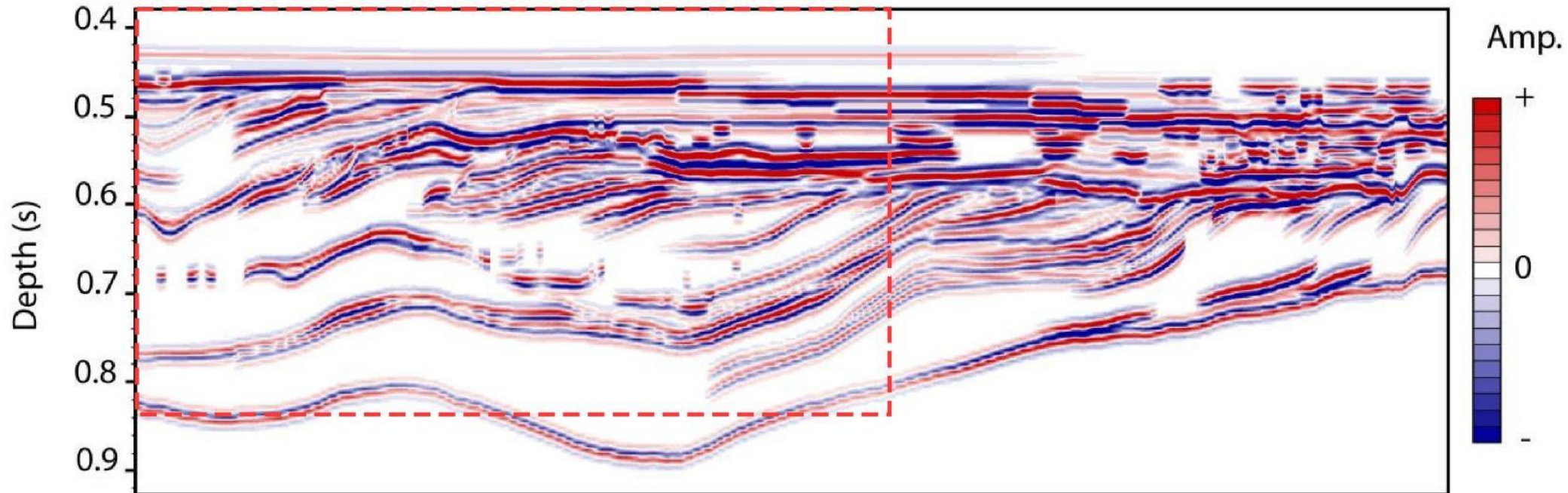
NNW-

-SSE

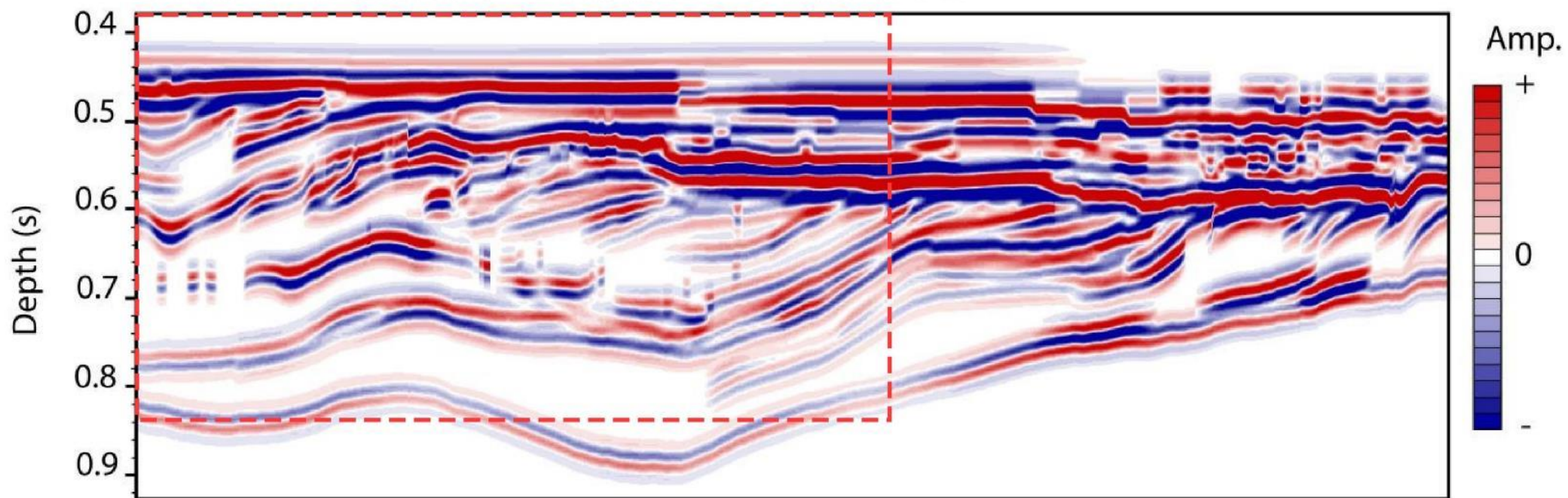


4. Architectural, Paleogeographic and sequential interpretation

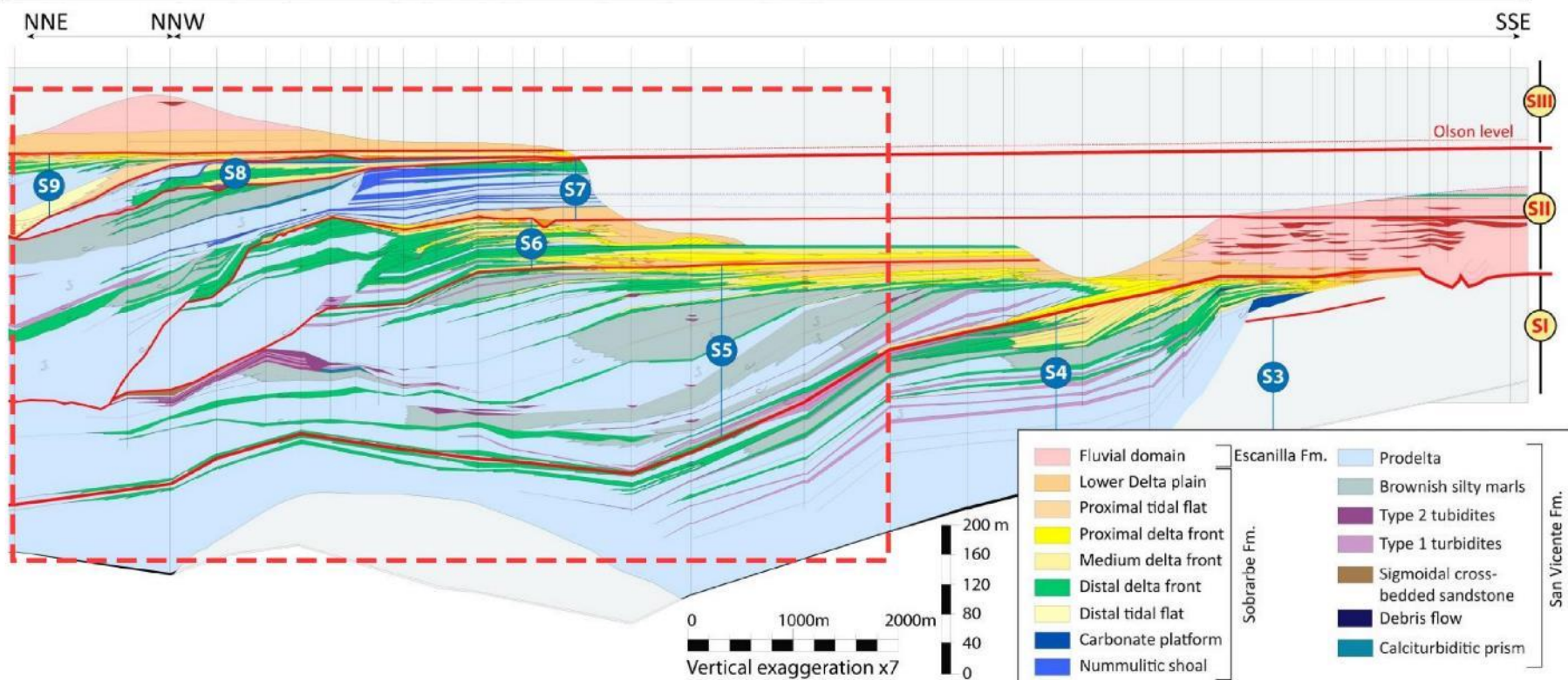
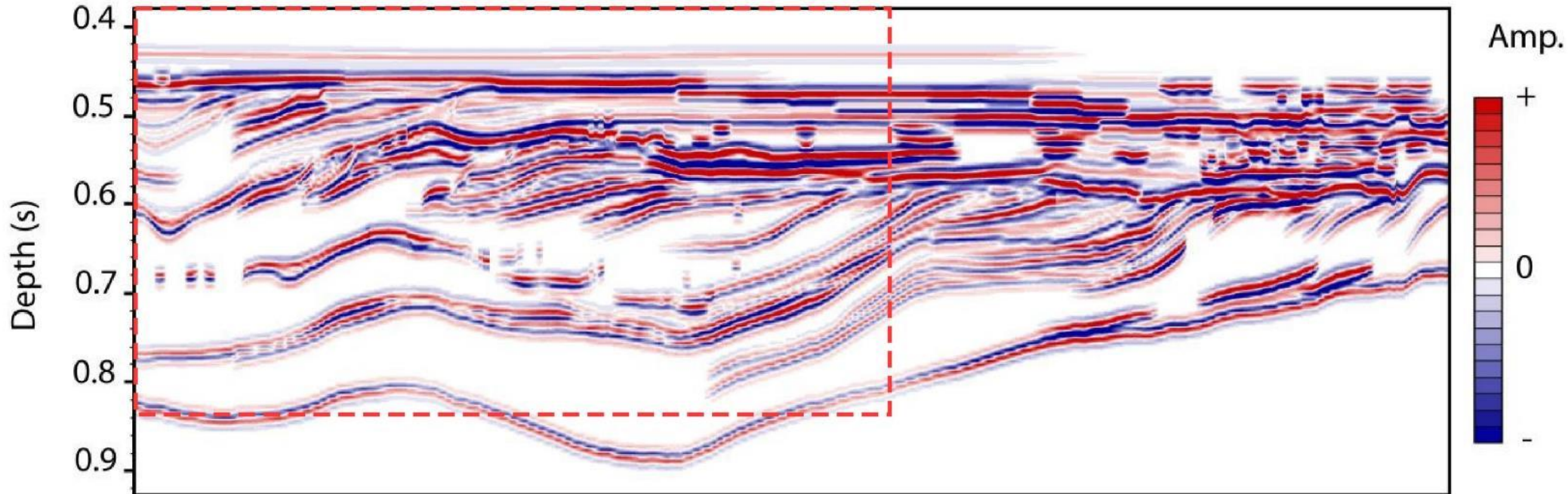
1. What is the general vertical trend? Shallowing or Deepening-upwards?....
Regressive or Transgressive?
2. Can you differentiate higher frequency or lesser scale trends?
3. Taking into account the lateral facies changes observed... Where was the land and where was the sea?

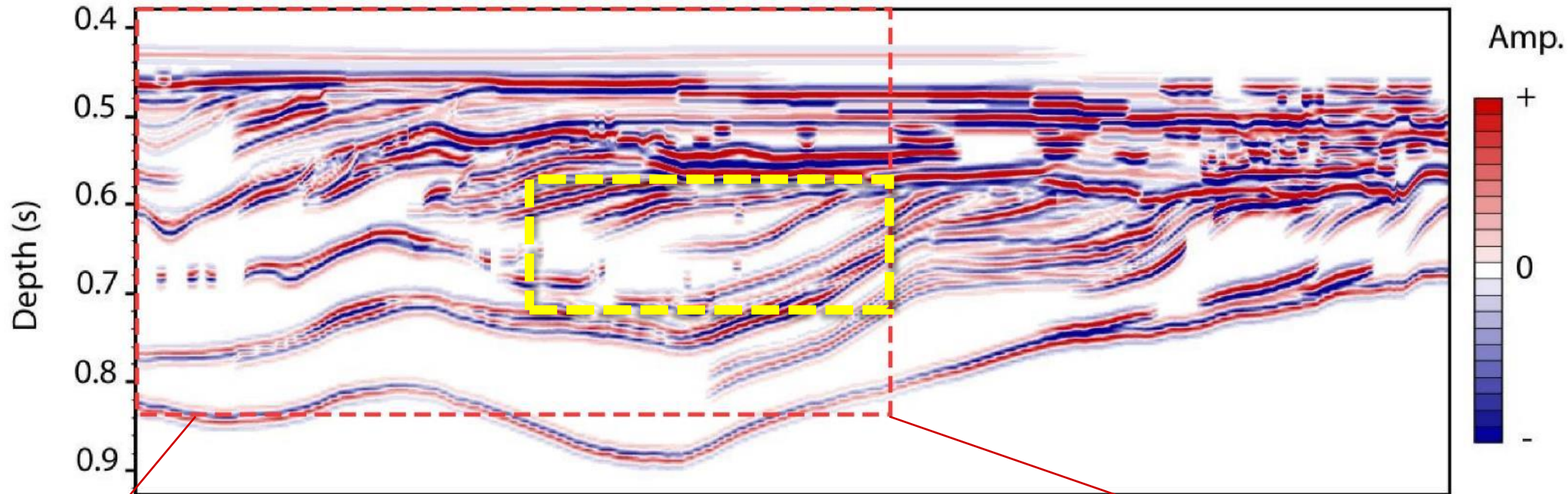


b. Forward seismic model: 60 Hz. Seismic resolution: 12 m

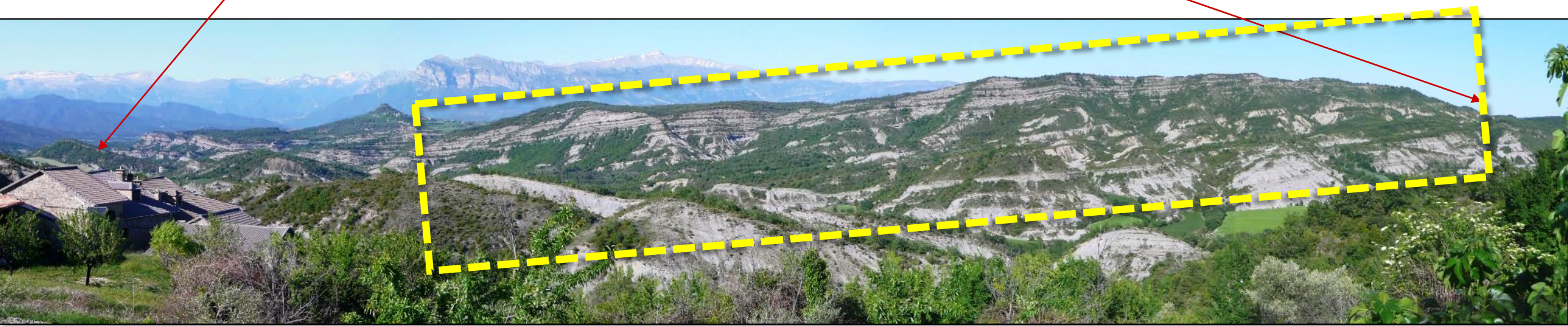


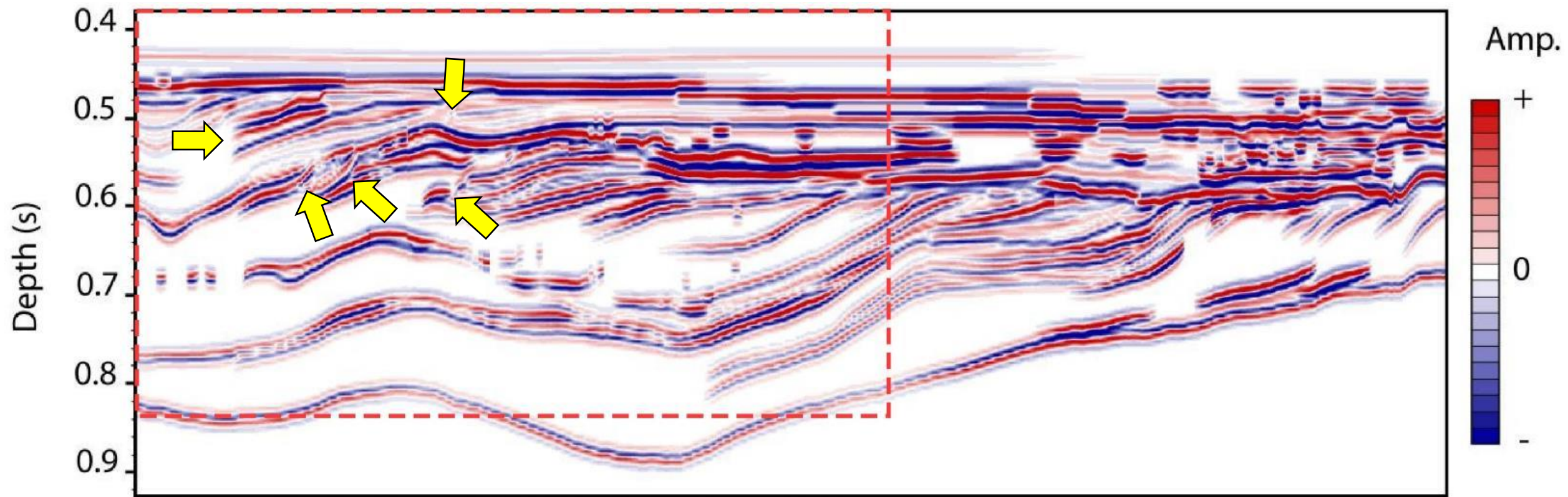
c. Forward seismic model: 30 Hz. Seismic resolution: 24 m





b. Forward seismic model: 60 Hz. Seismic resolution: 12 m





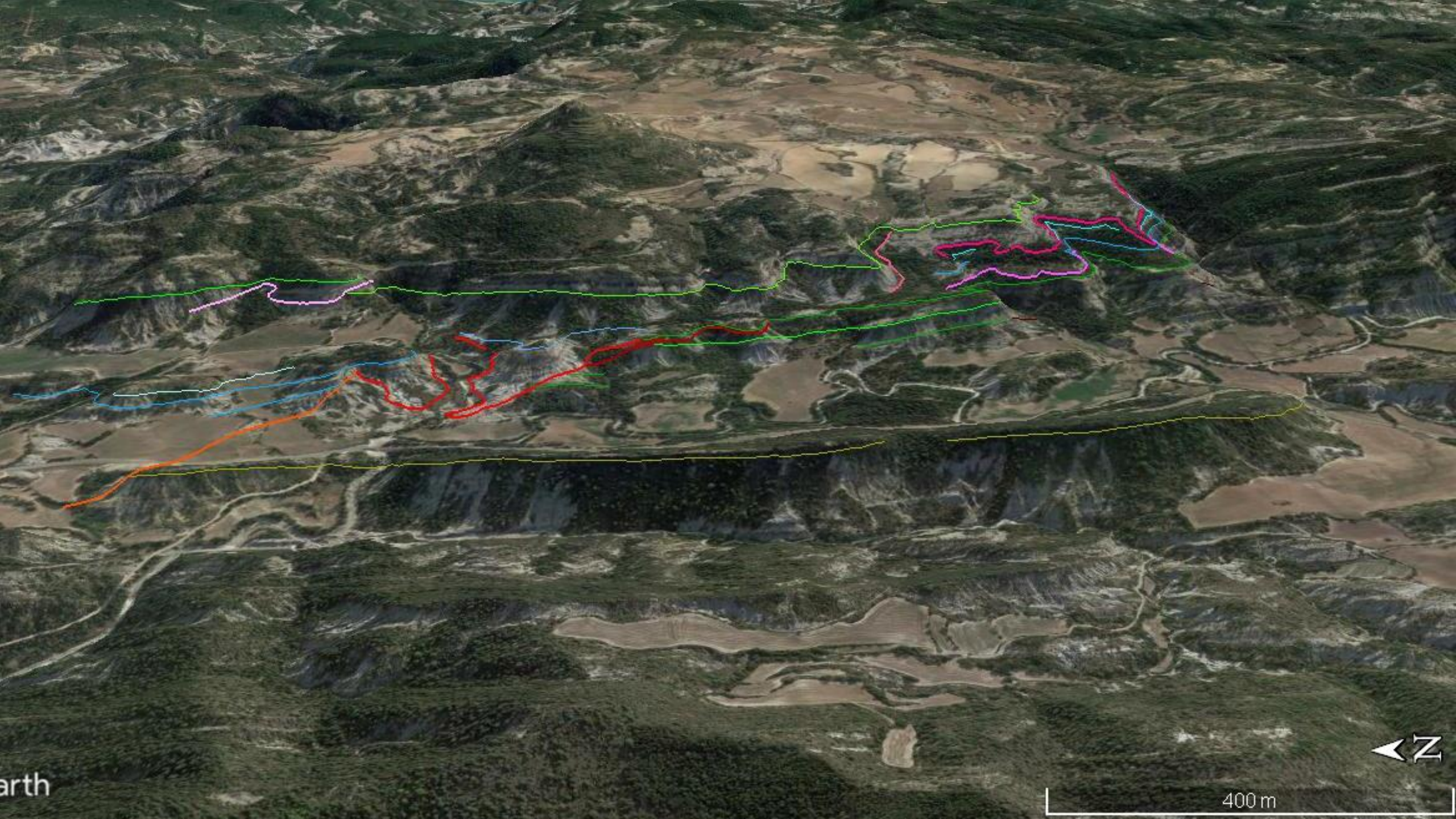
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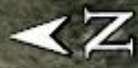
Earth

700 m





earth



400 m



NNW-

-SSE

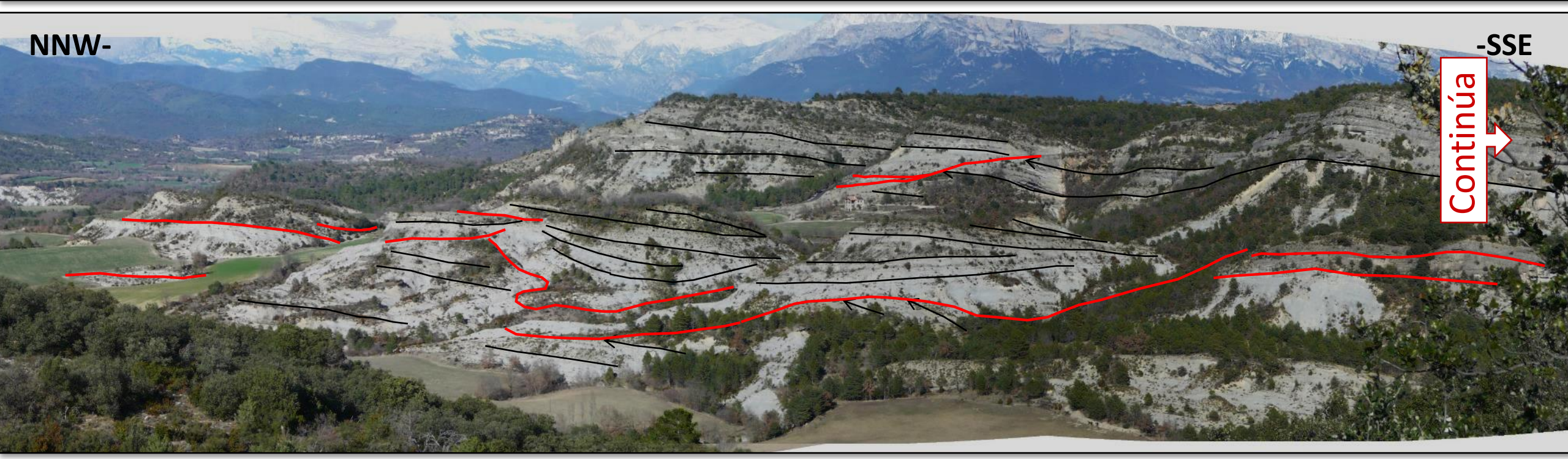
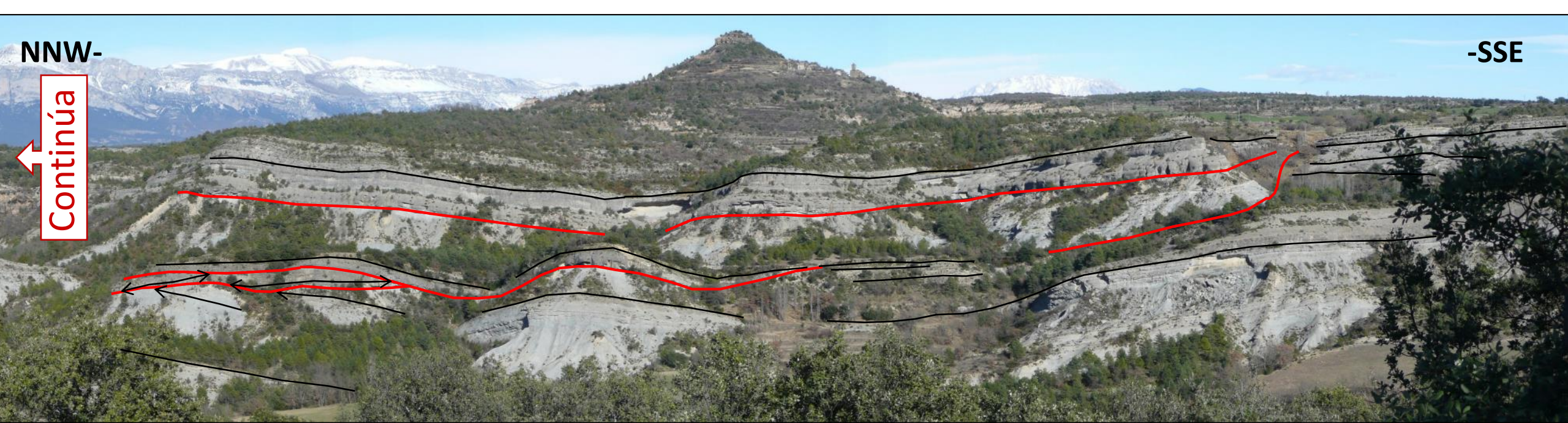
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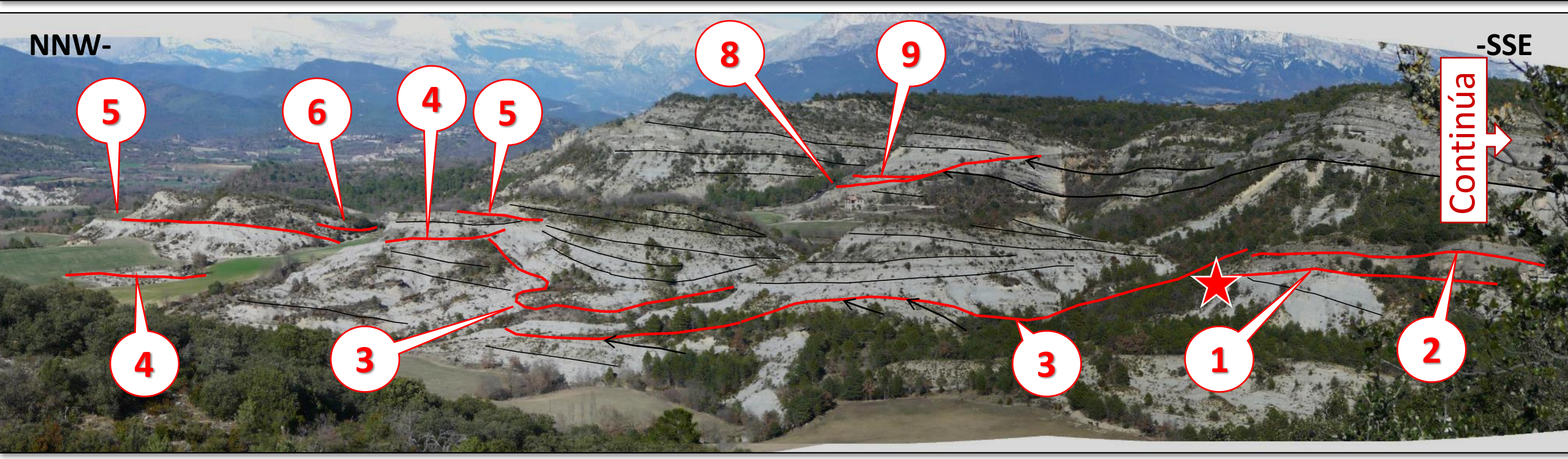


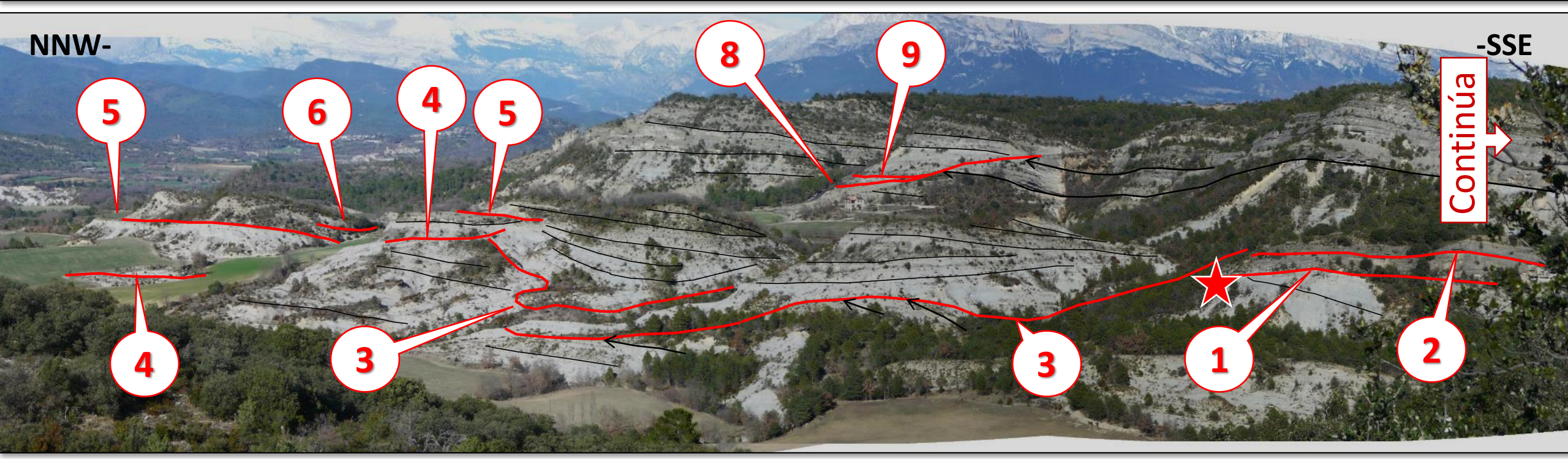
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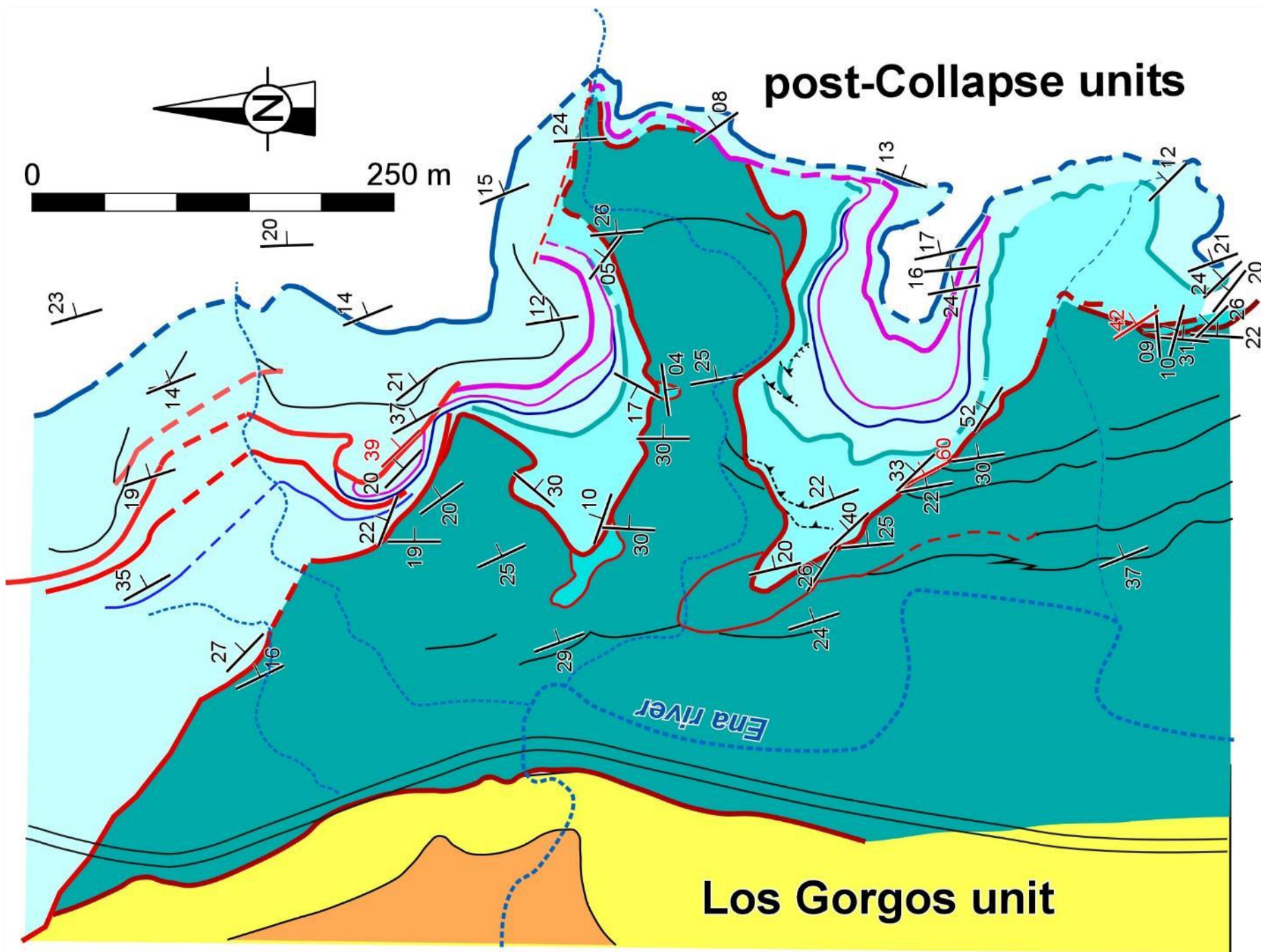
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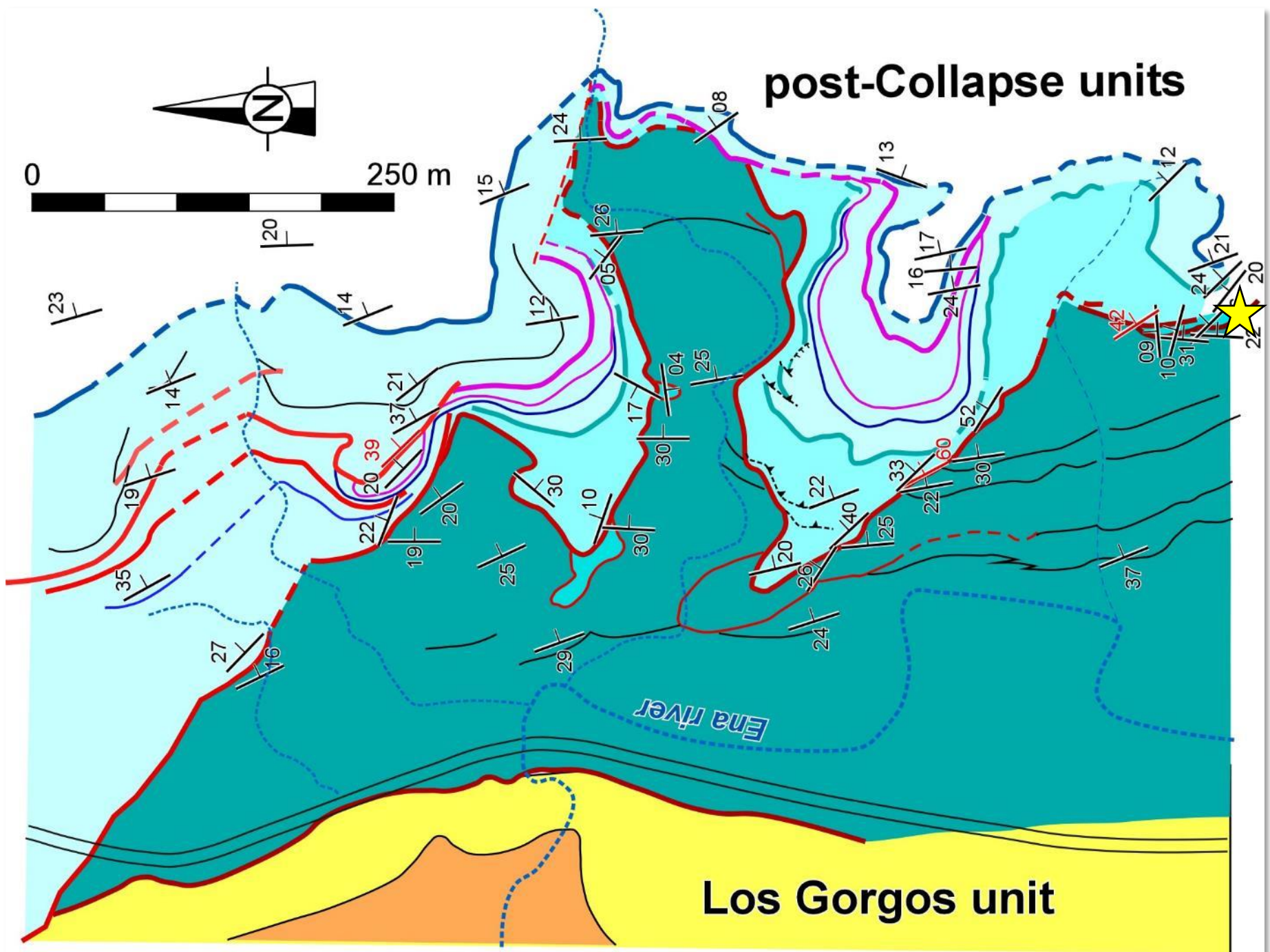
Continúa





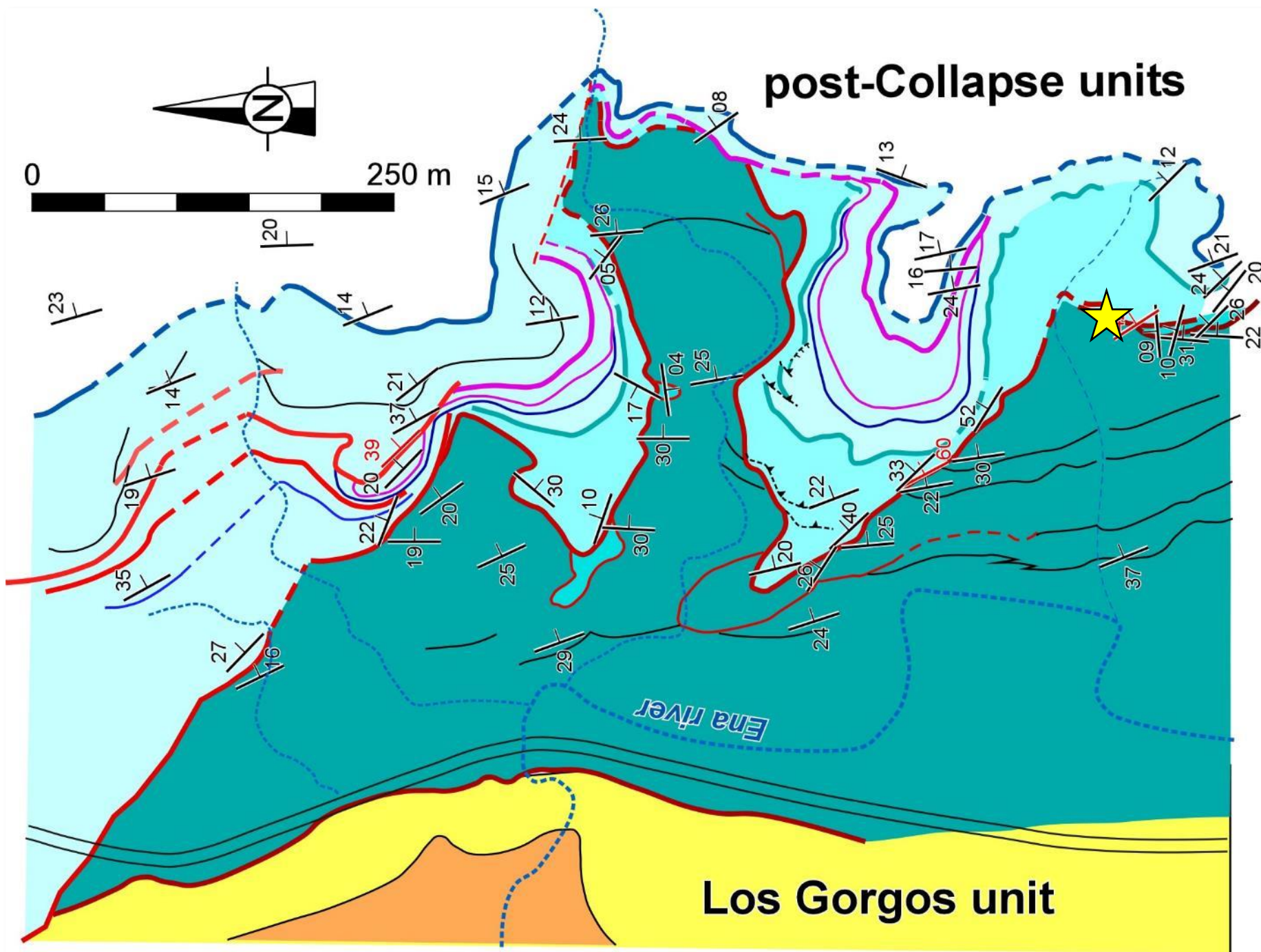






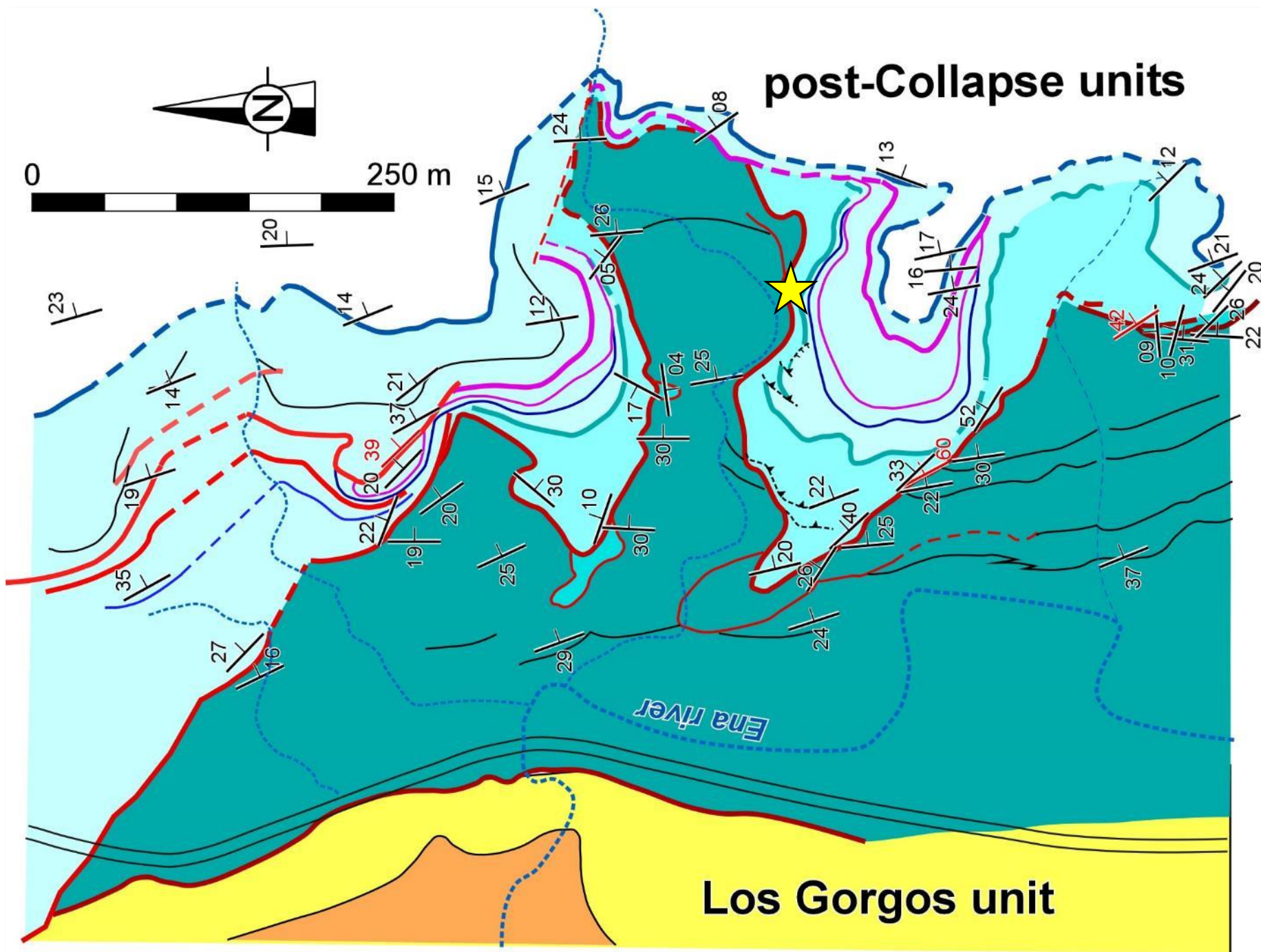
Truncation and onlap terminations





Scouring and infilling (exposed slide-scar Surface)

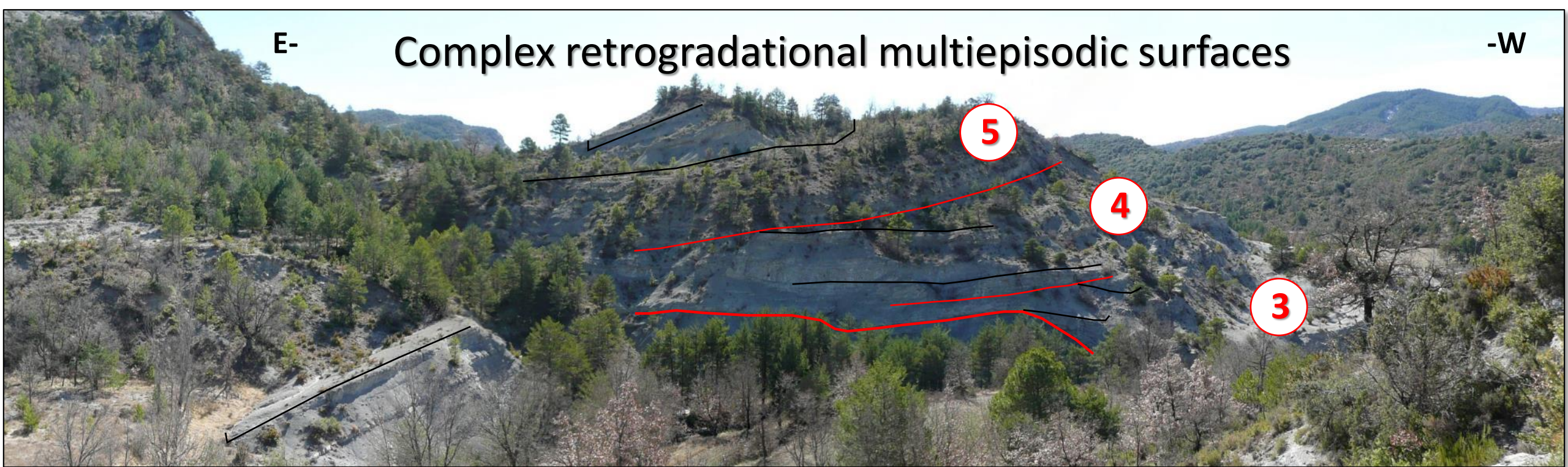




E-

Complex retrogradational multiepisodic surfaces

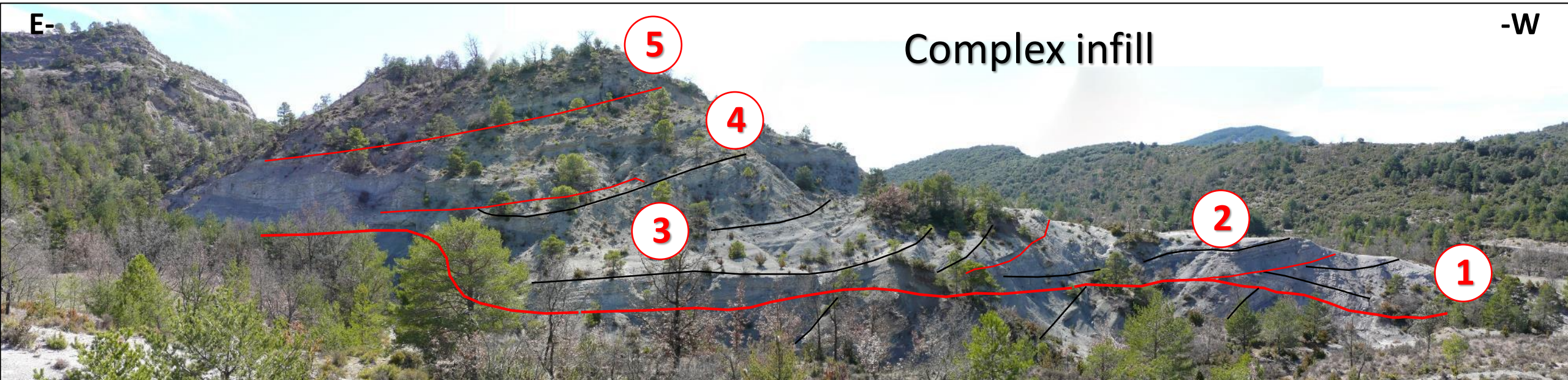
-W

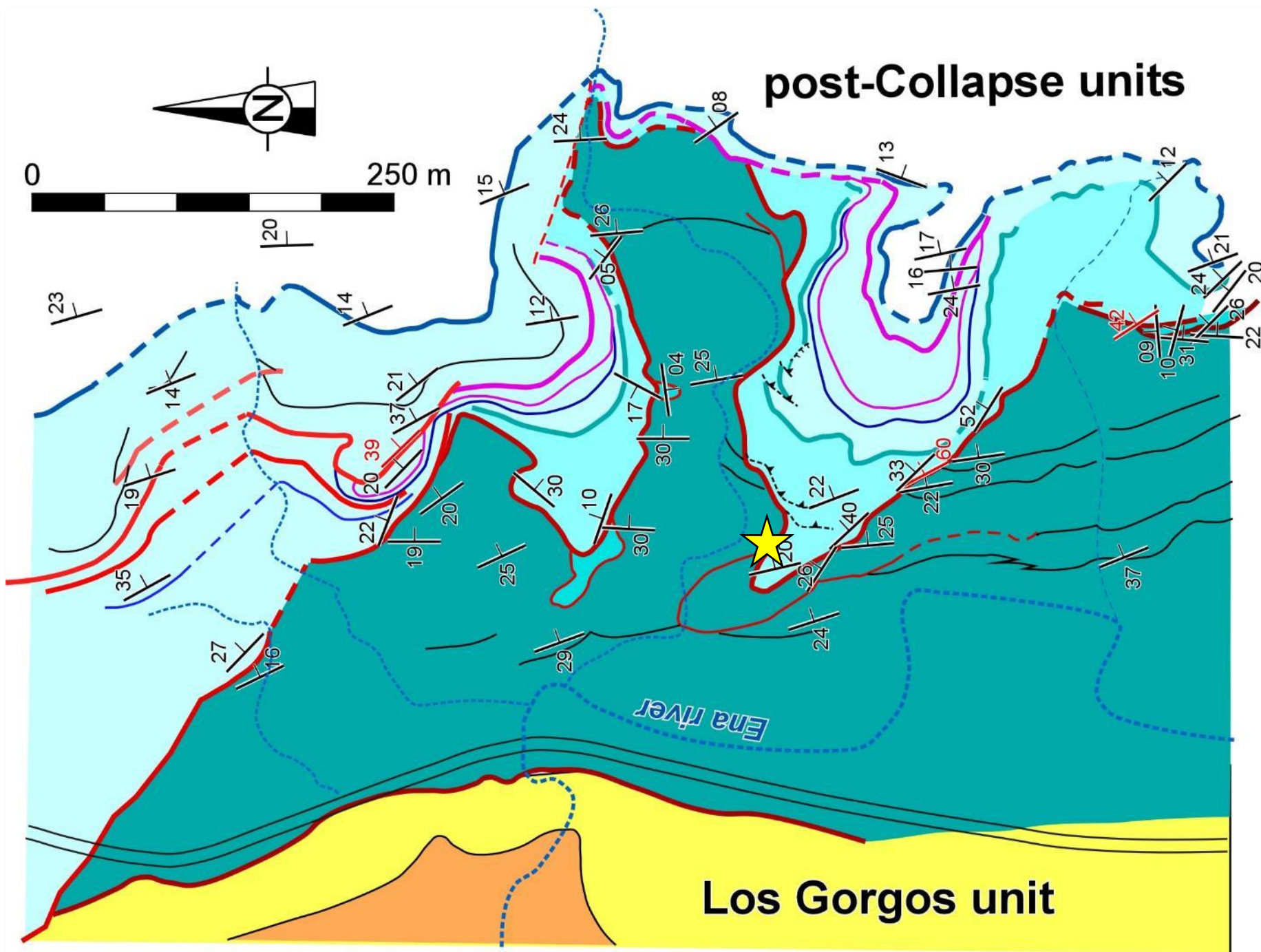


E-

Complex infill

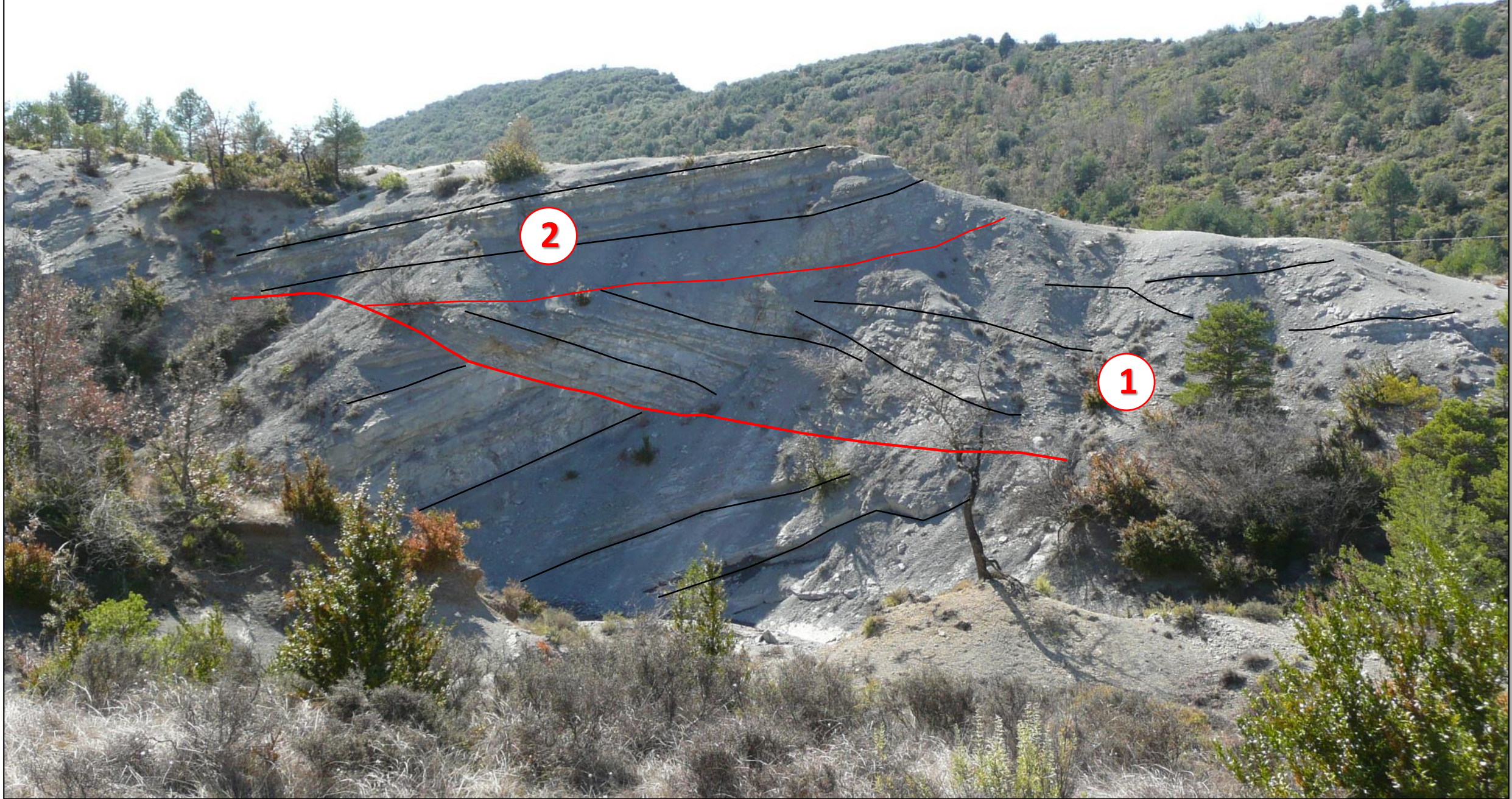
-W





ESE-

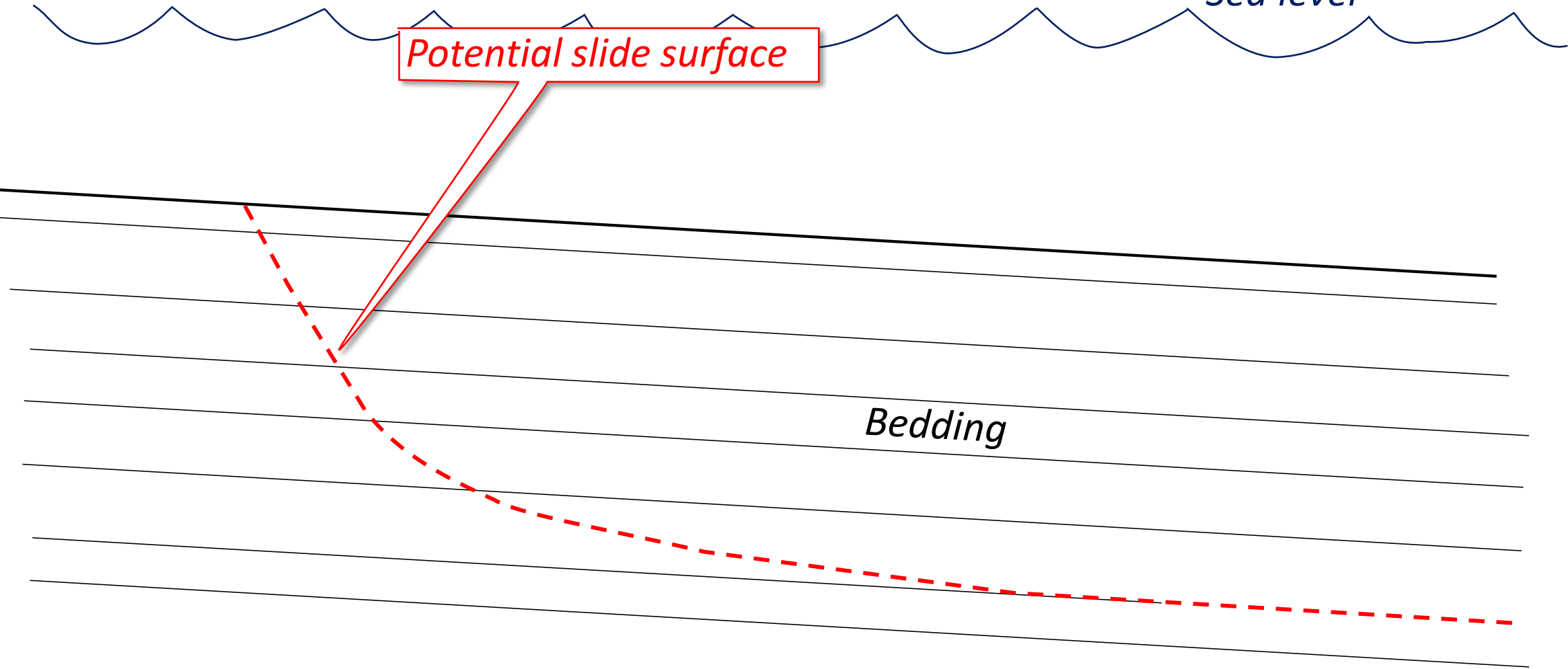
-WNW

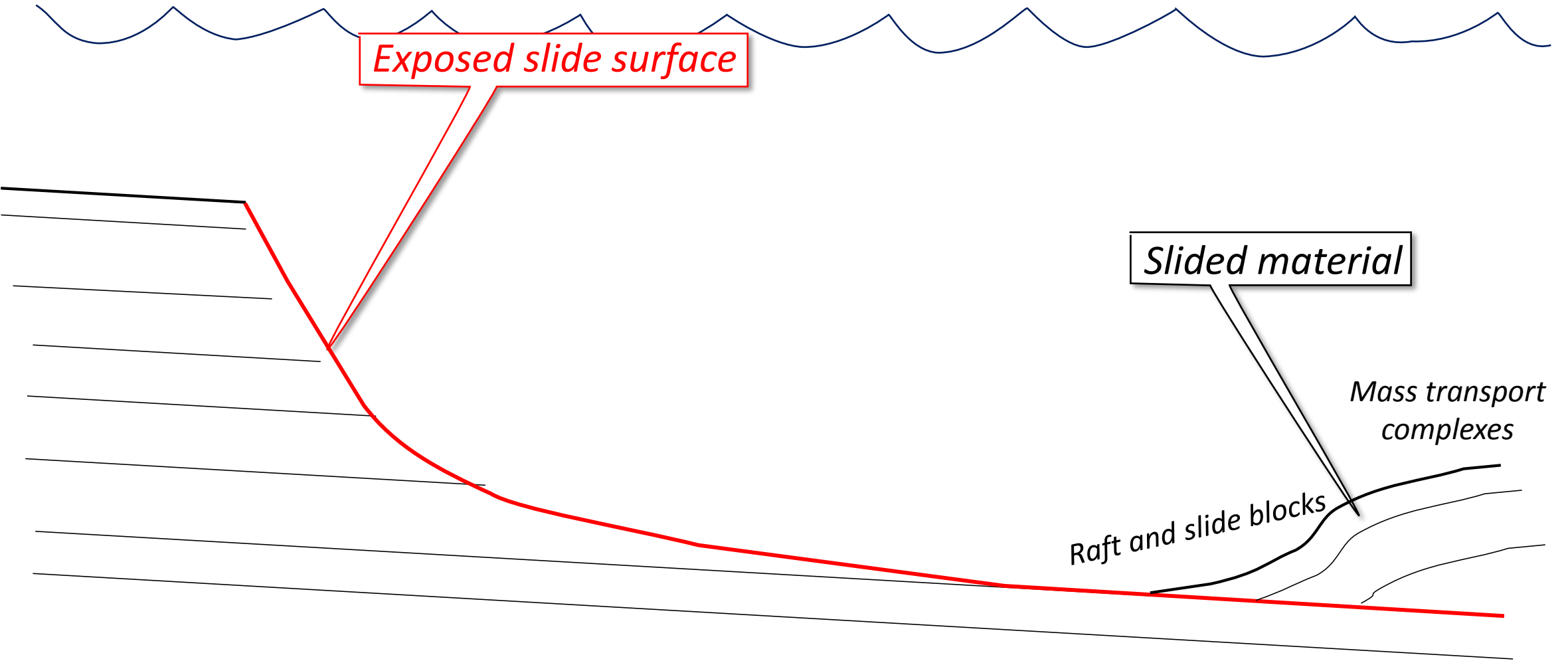


Sea level

Potential slide surface

Bedding



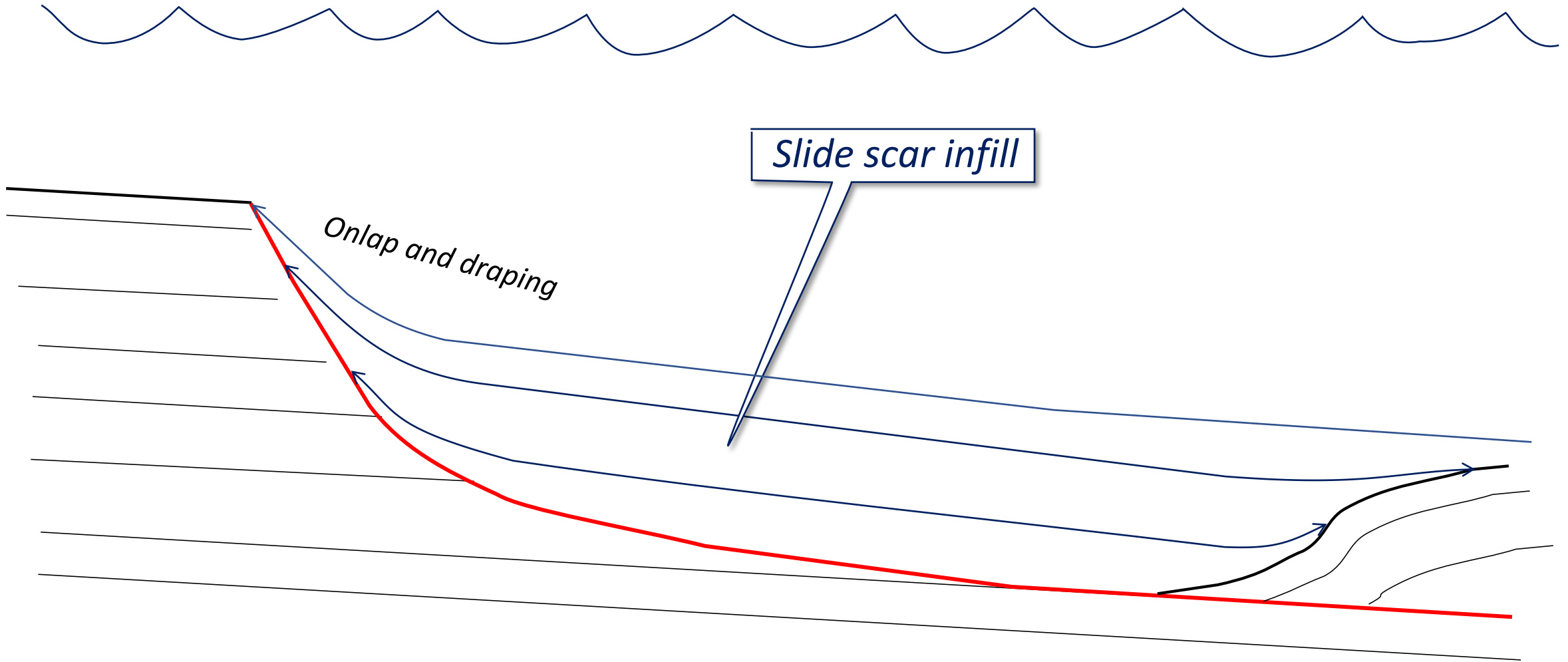


Exposed slide surface

Slided material

Mass transport complexes

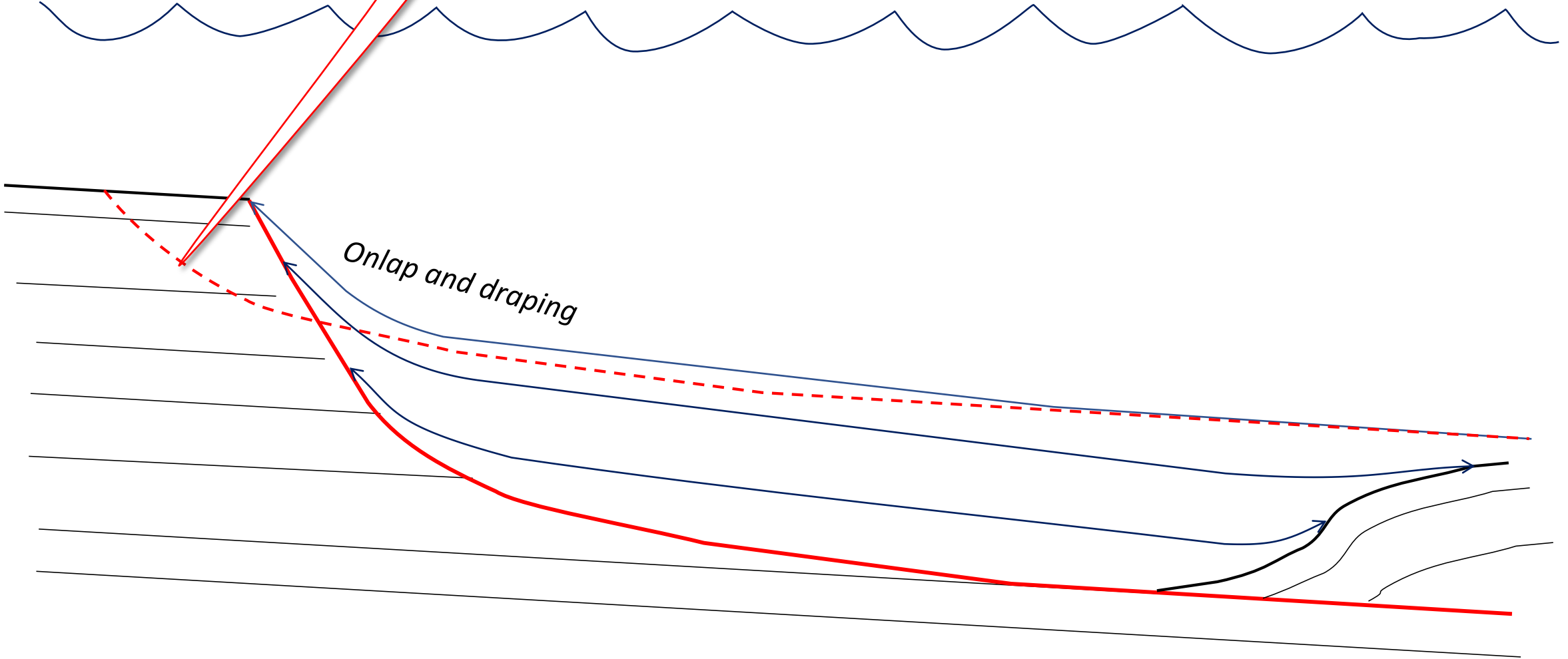
Raft and slide blocks



Slide scar infill

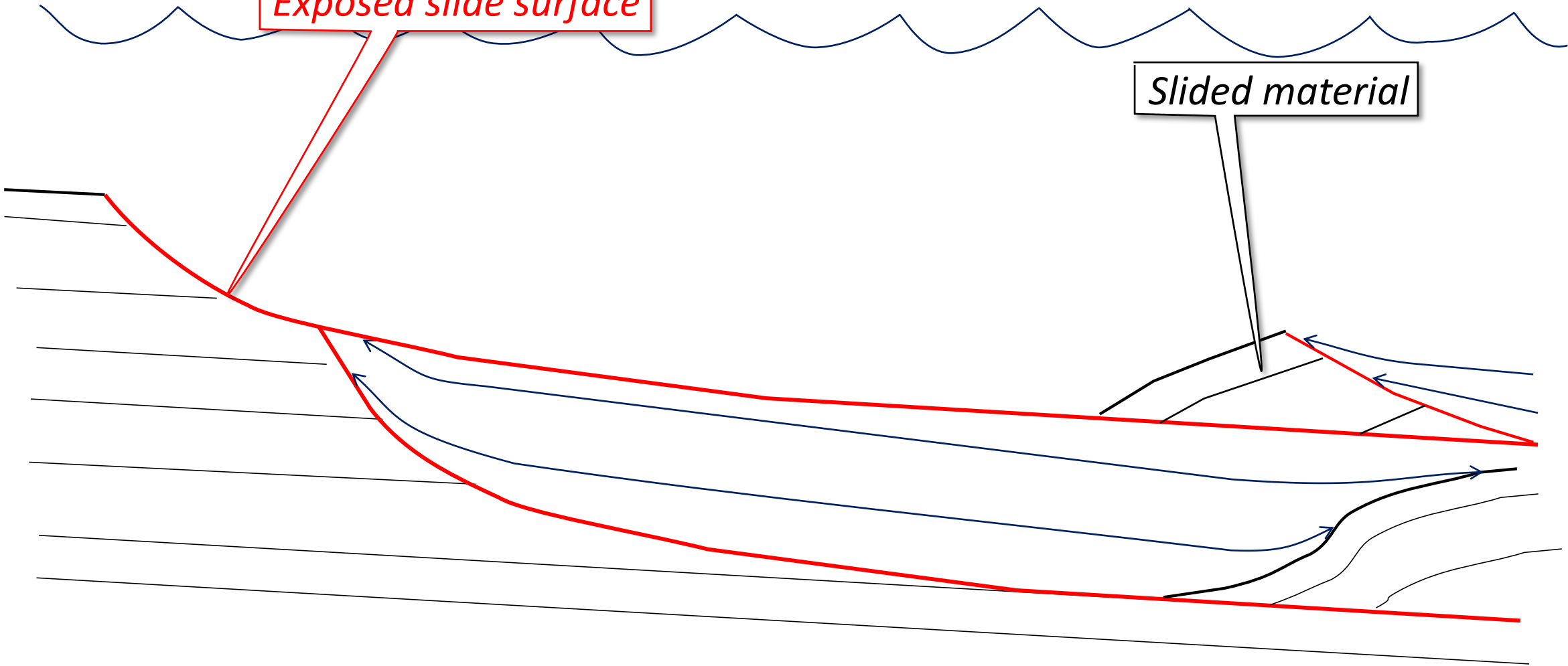
Onlap and draping

New Potential slide surface

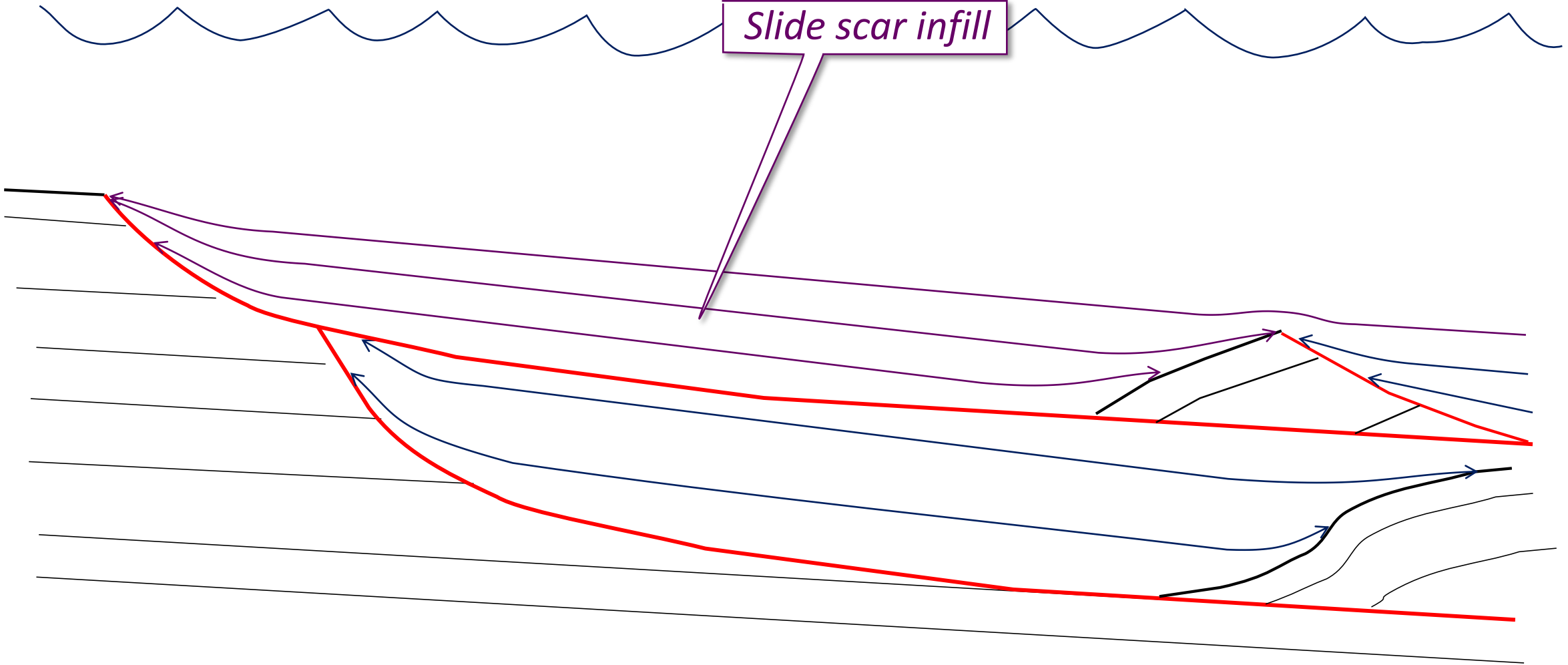


Exposed slide surface

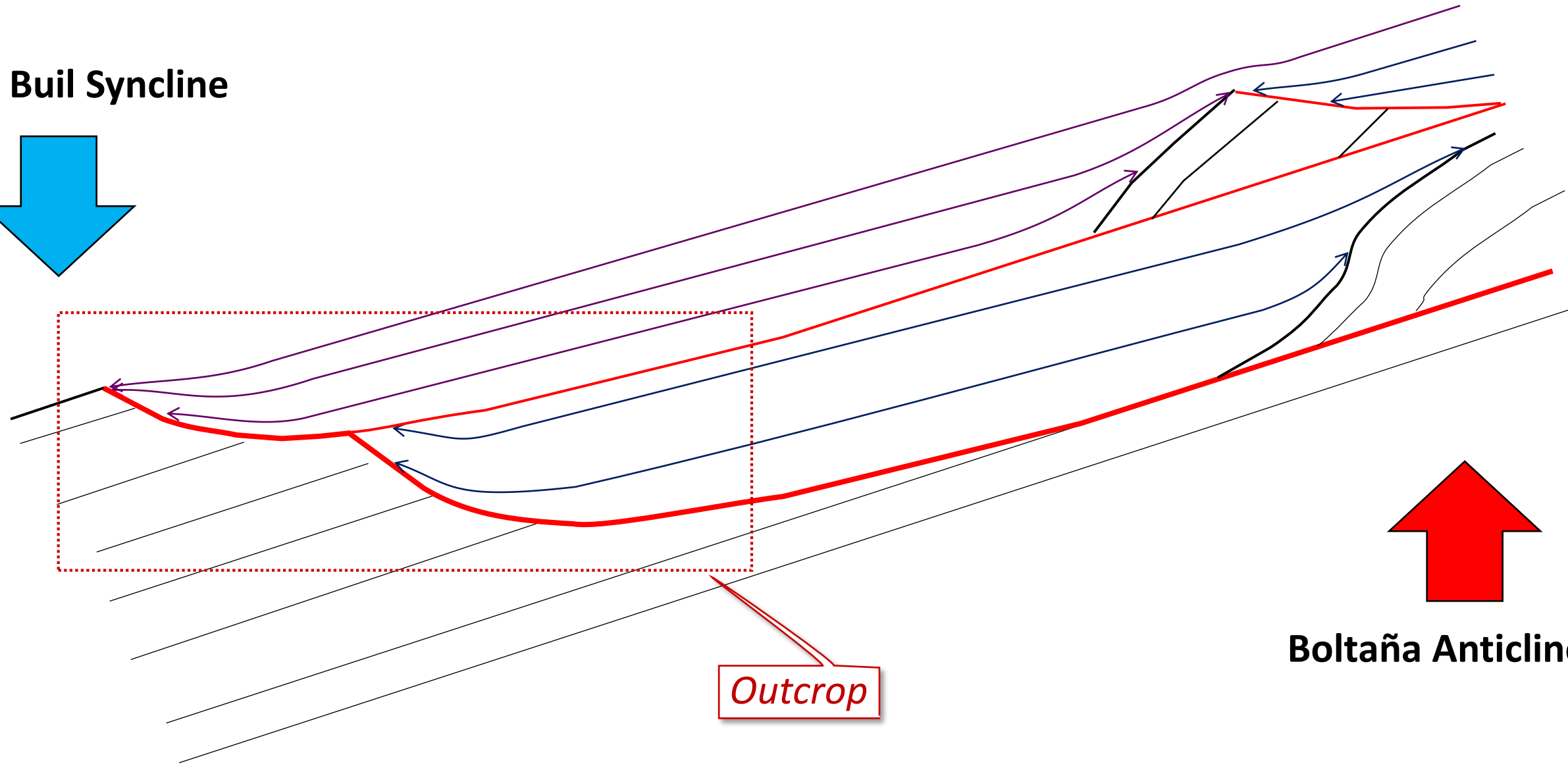
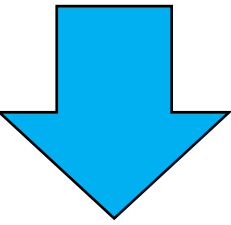
Slided material



Slide scar infill

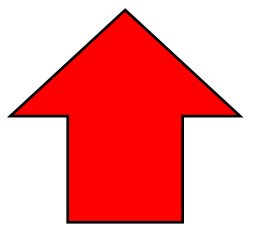


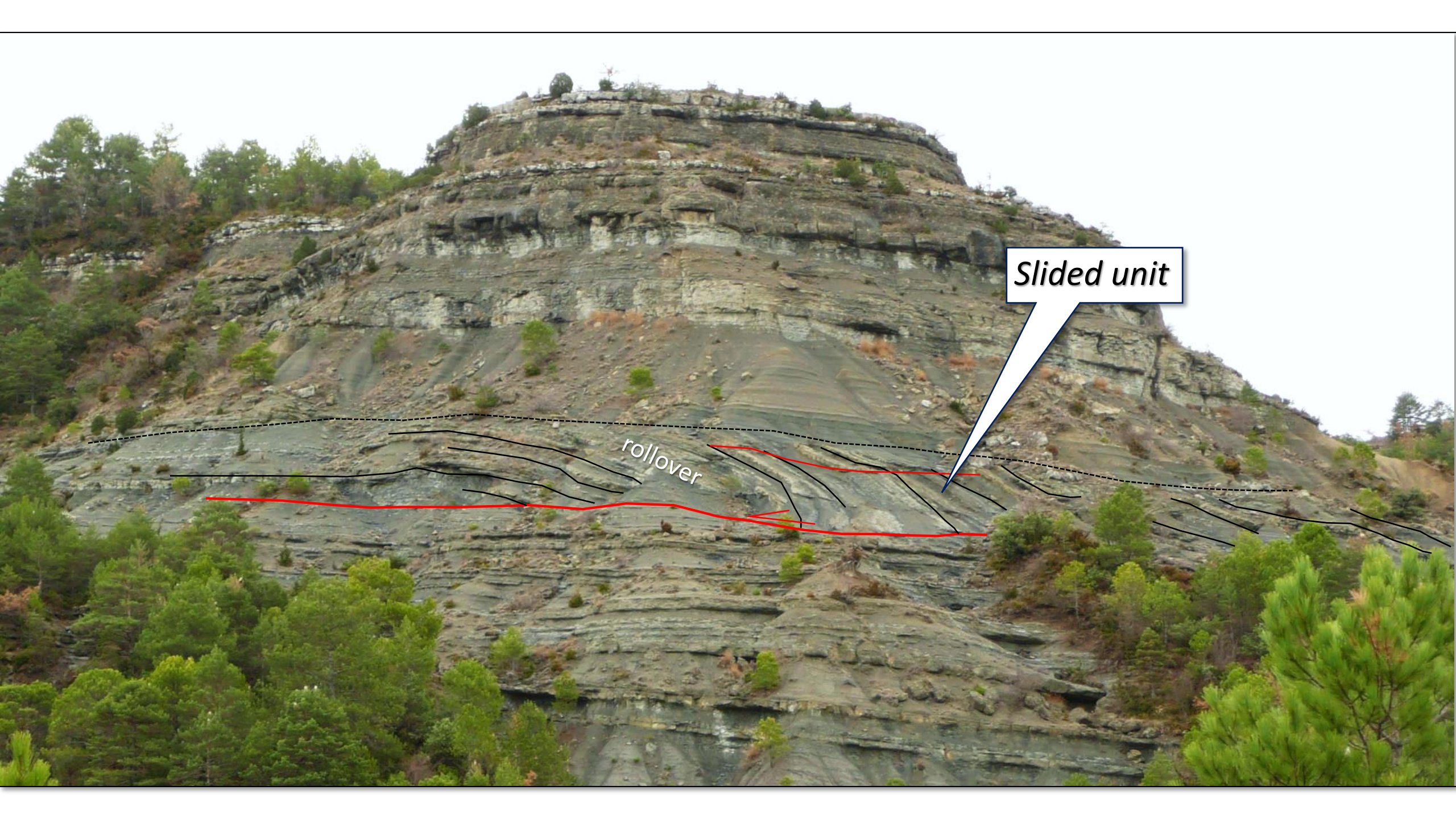
Buil Syncline



Outcrop

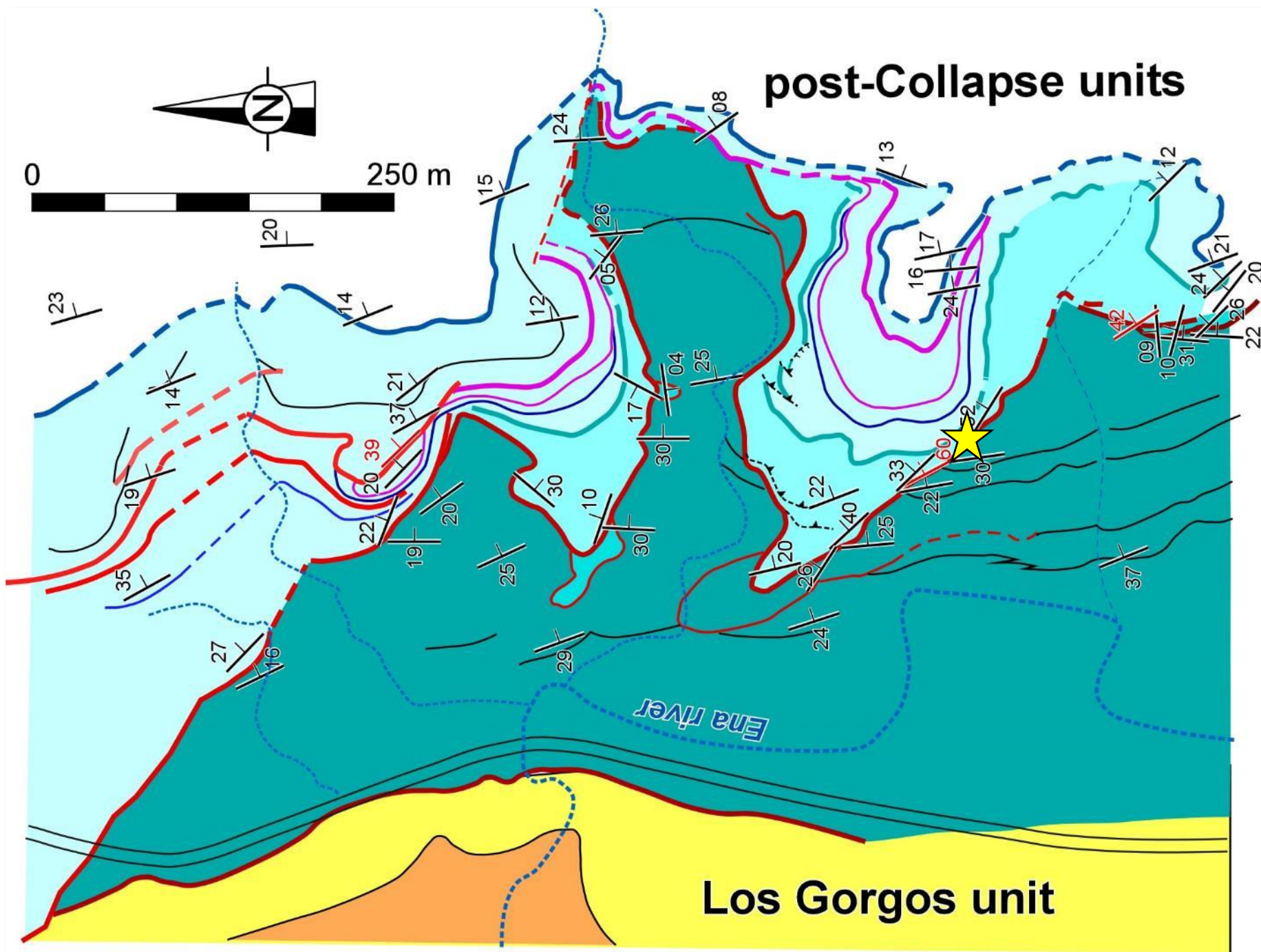
Boltaña Anticline





Slided unit

rollover

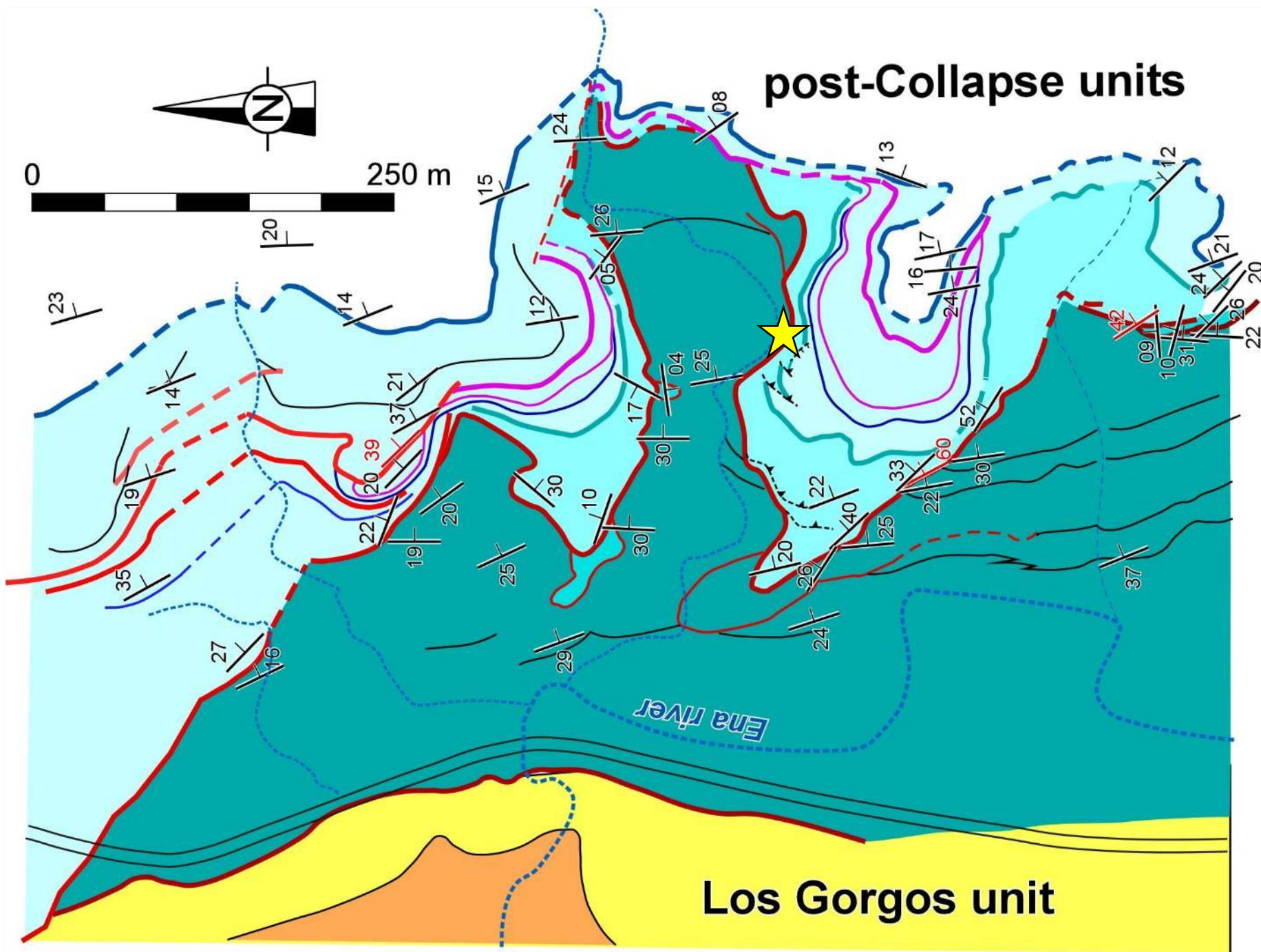


ENE-

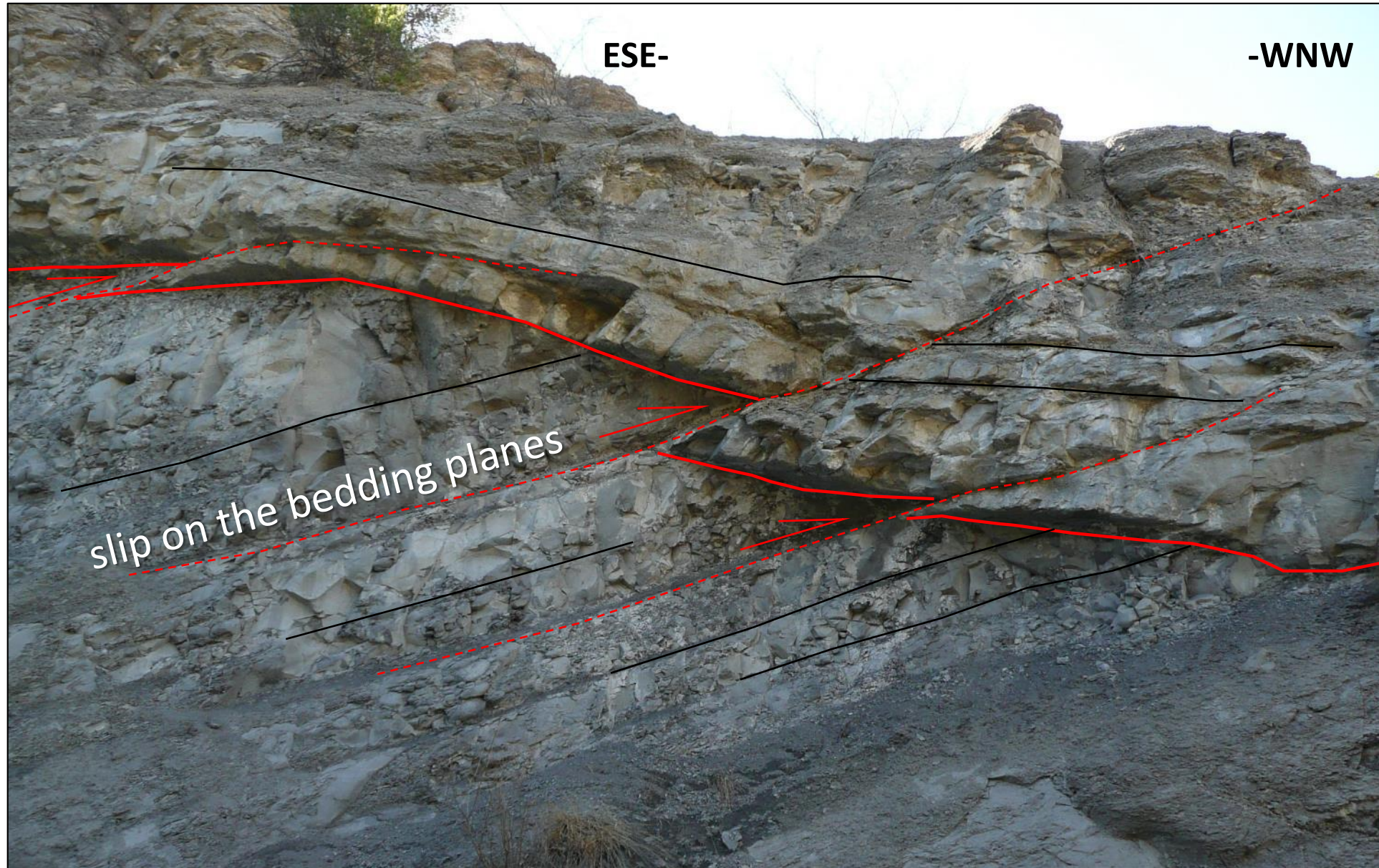


-WSW





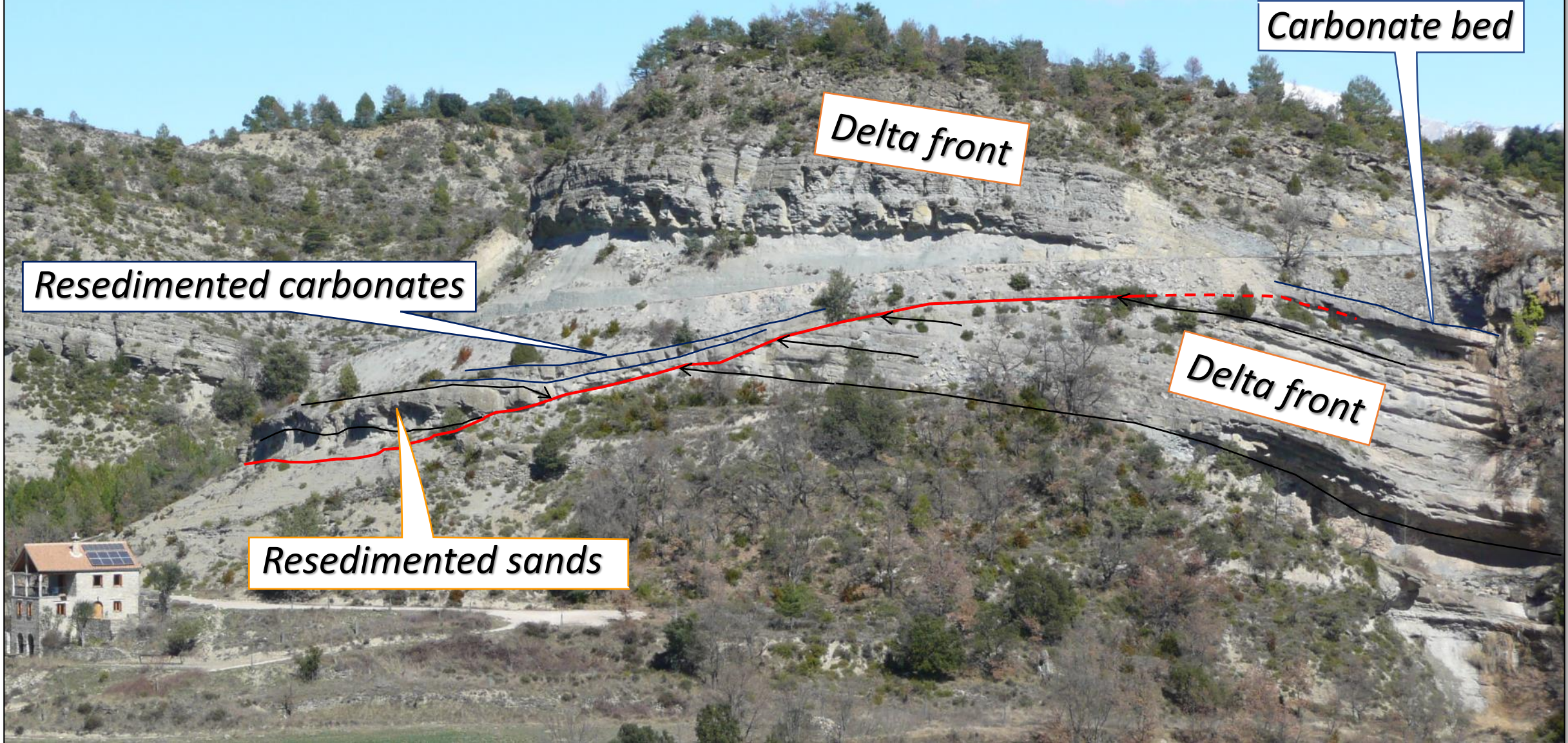
Flexural-slip folding-related minor structures



NNW-

Mixed detrital and carbonate infill

-SSE



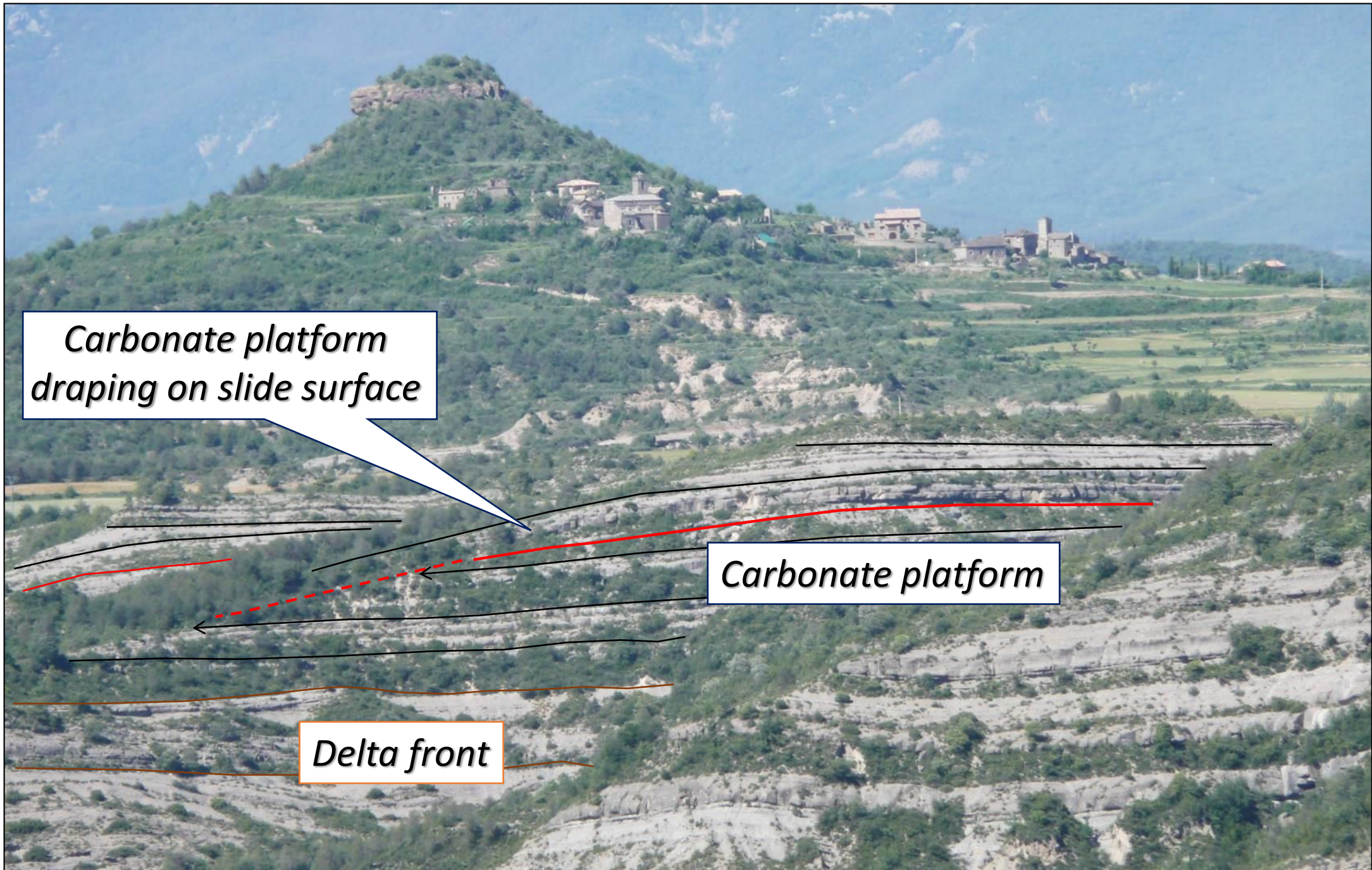
Carbonate bed

Delta front

Resedimented carbonates

Delta front

Resedimented sands



*Carbonate platform
draping on slide surface*

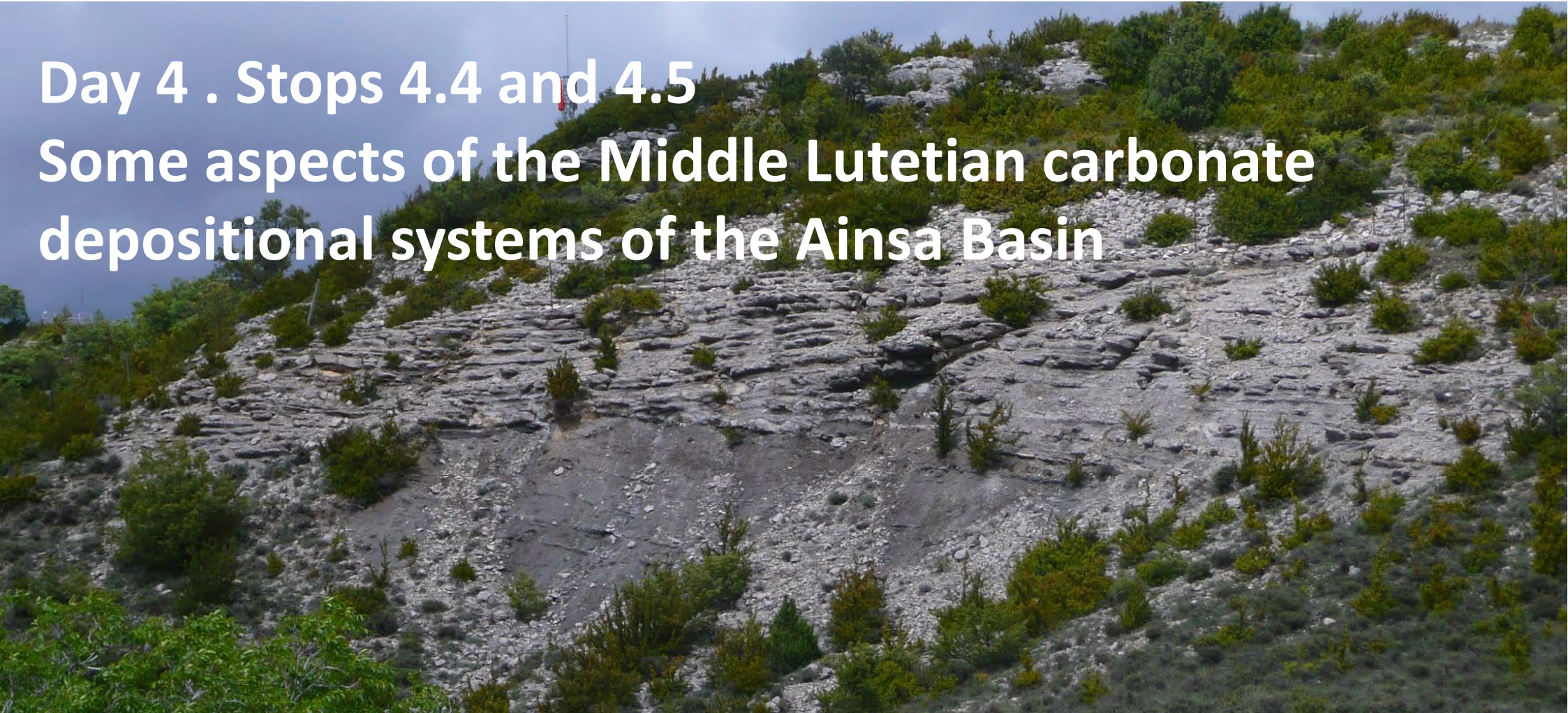
Carbonate platform

Delta front



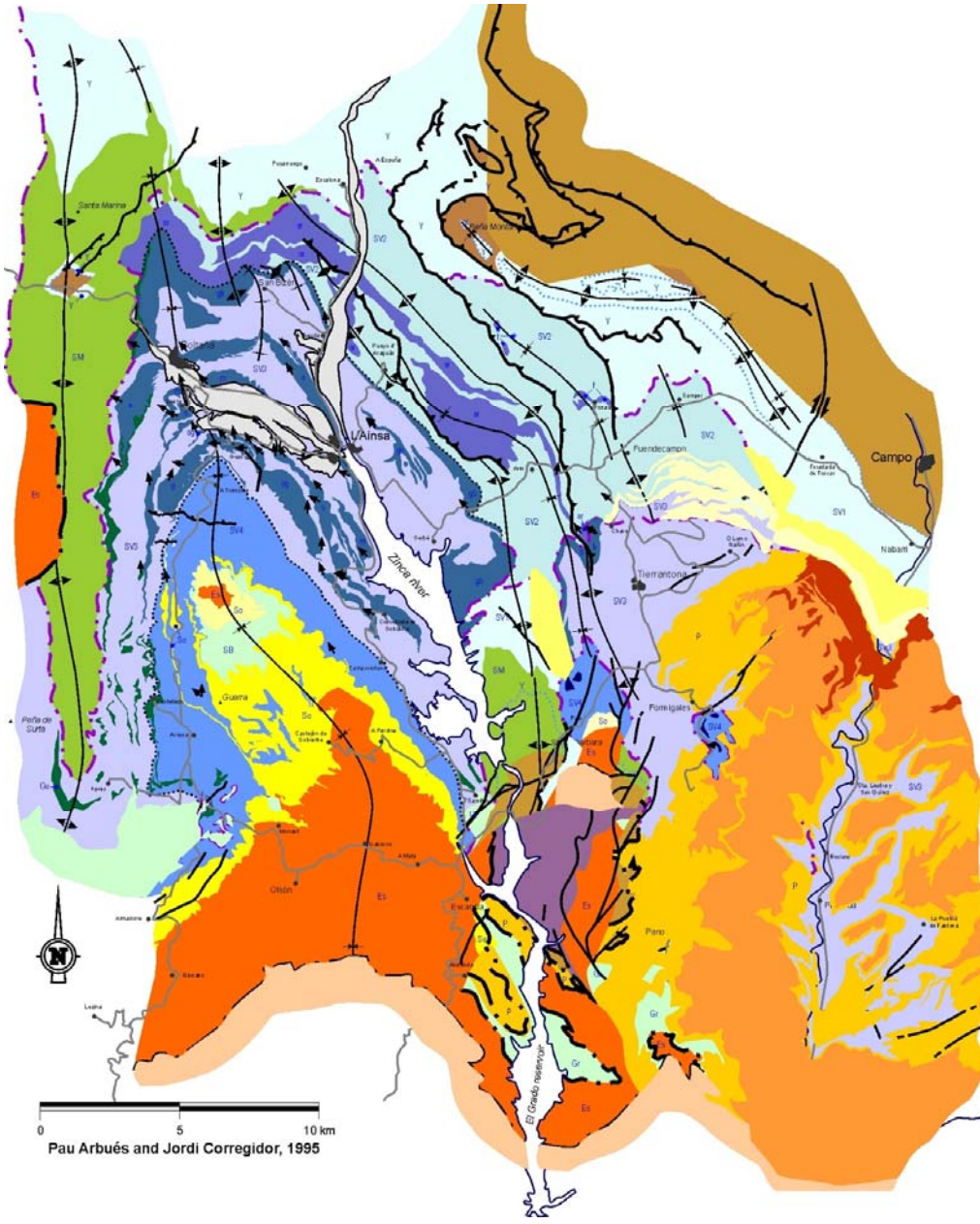
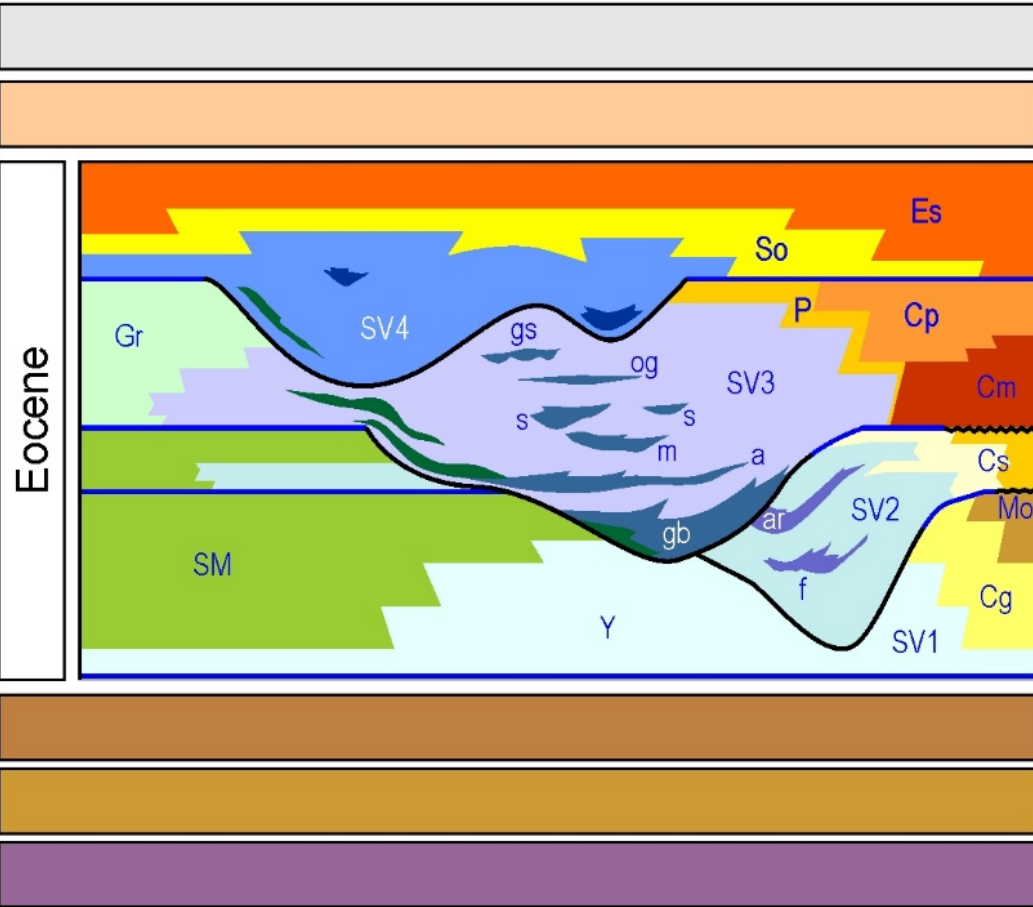
Day 4 . Stops 4.4 and 4.5

**Some aspects of the Middle Lutetian carbonate
depositional systems of the Ainsa Basin**

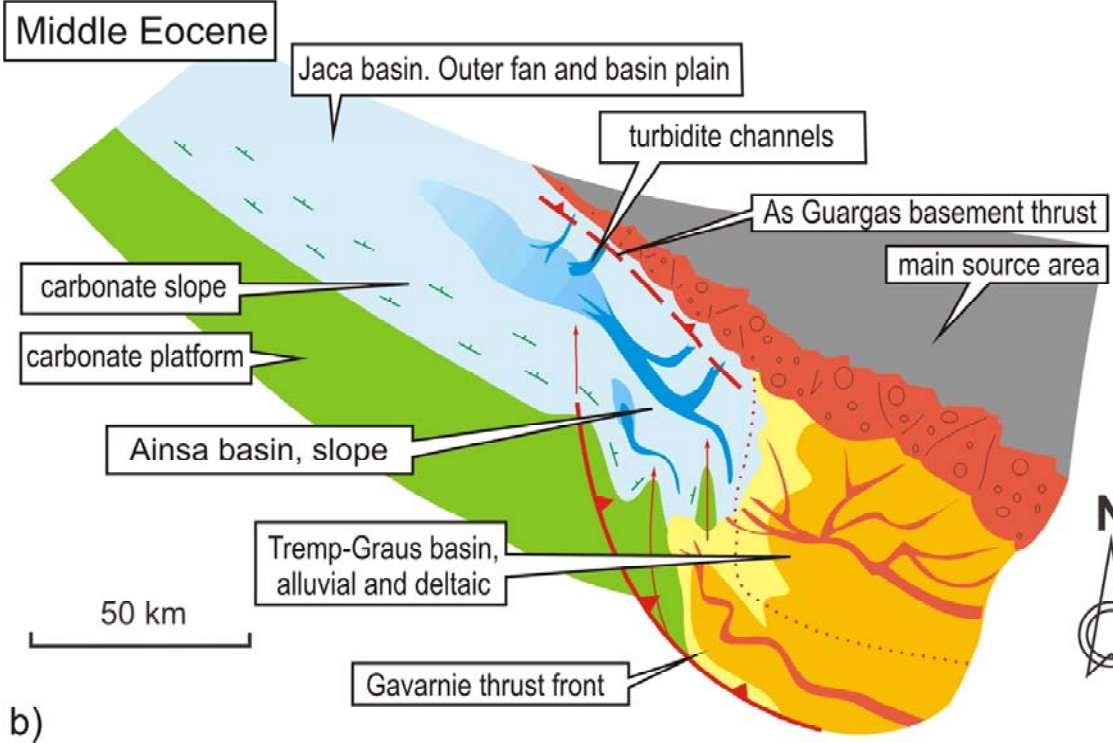


Day 4. Carbonate systems

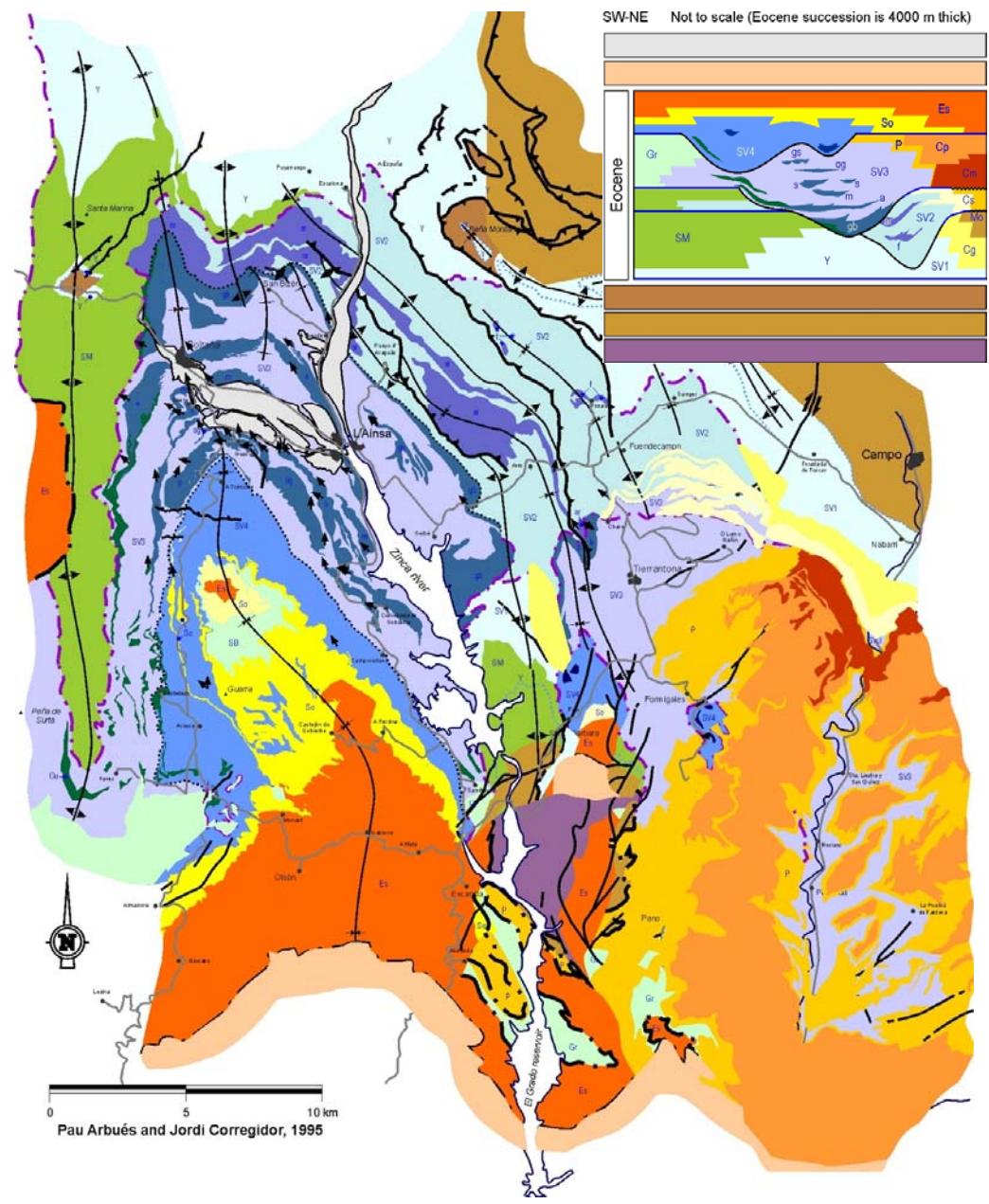
SW-NE Not to scale (Eocene succession is 4000 m thick)



Day 4. Carbonate systems



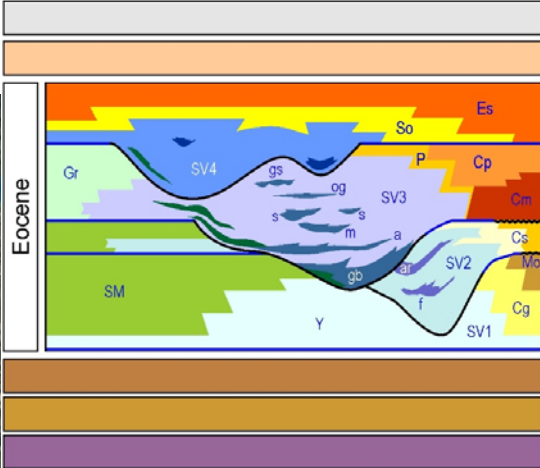
b)



Day 4. Carbonate systems



SW-NE Not to scale (Eocene succession is 4000 m thick)



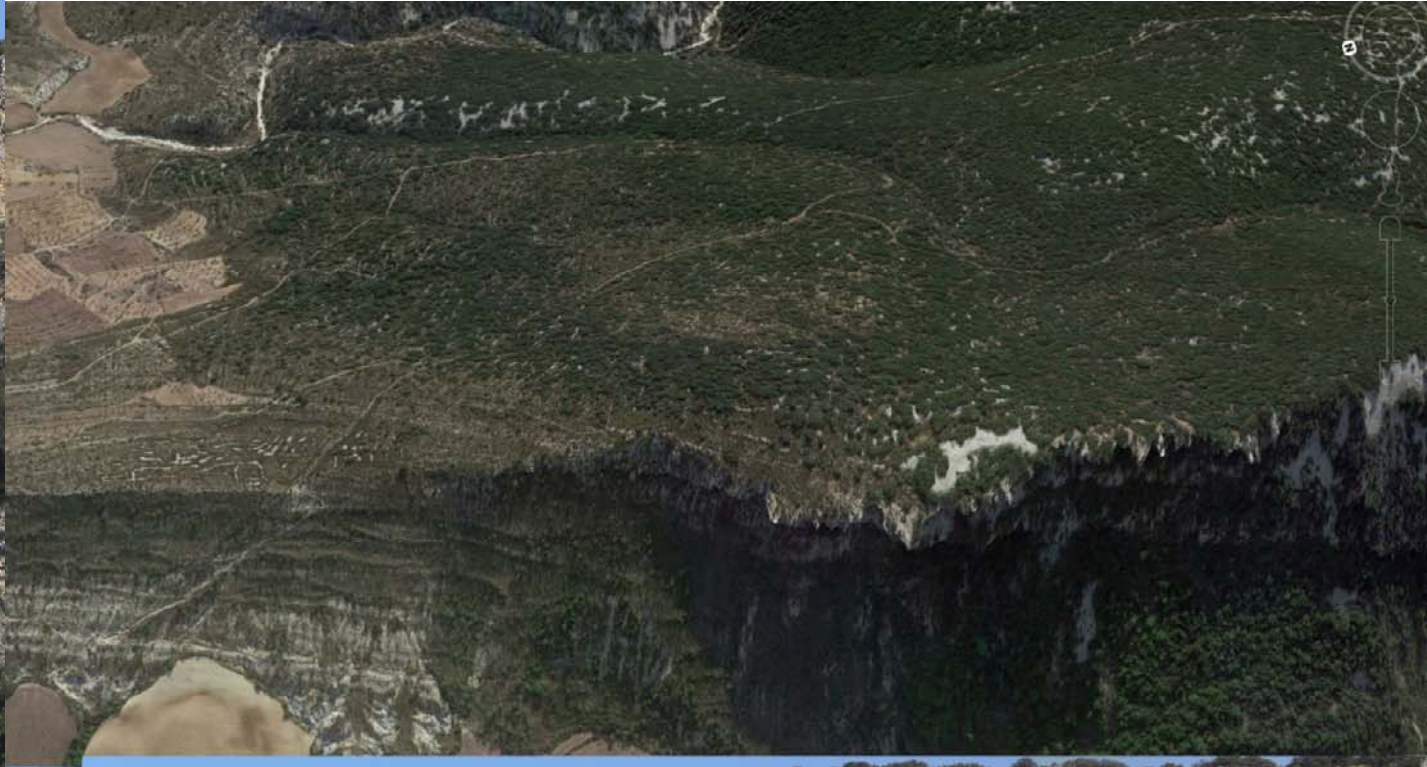
Google Earth

1332 m

Day 4. Carbonate systems



Day 4. Carbonate systems



Day 4. Carbonate systems



Day 4. Carbonate systems



Day 4. Carbonate systems.



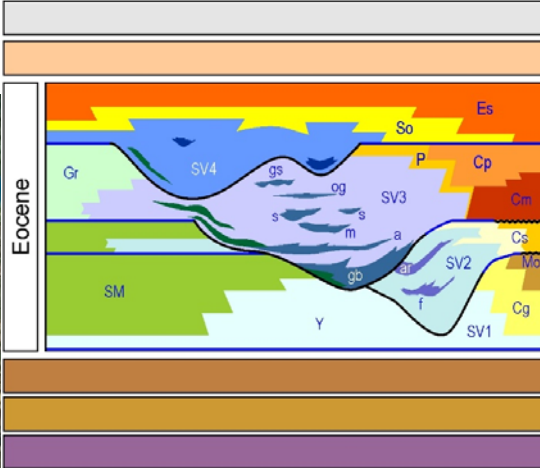
Day 4. Carbonate systems



Day 4. Carbonate systems



SW-NE Not to scale (Eocene succession is 4000 m thick)



Google Earth

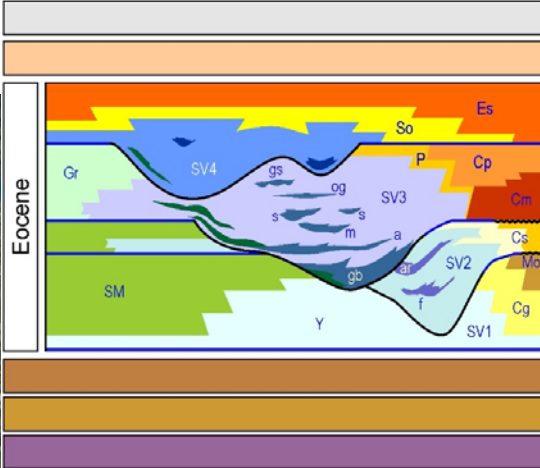
Day 4. Carbonate systems



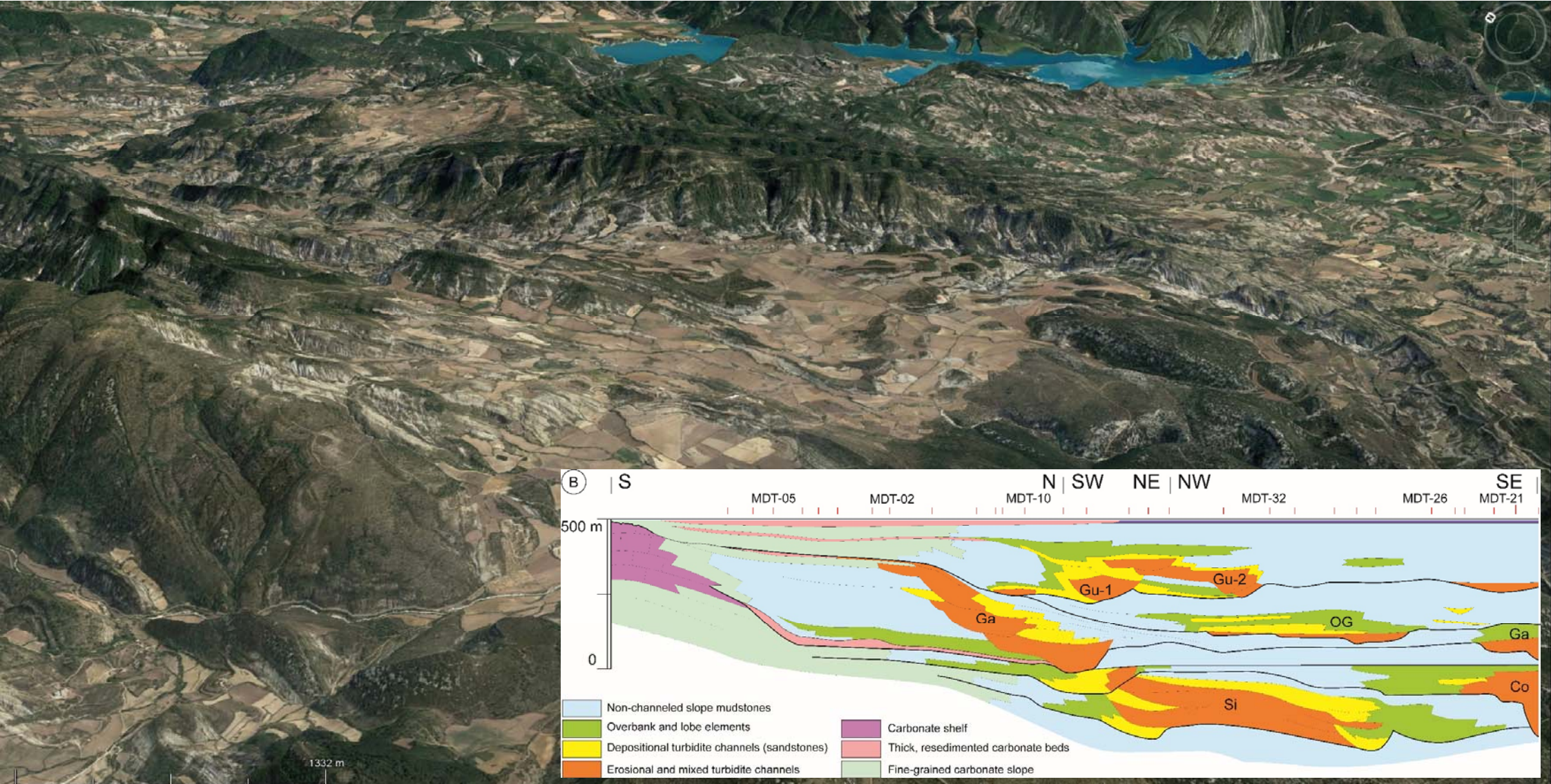
Day 4. Carbonate systems



SW-NE Not to scale (Eocene succession is 4000 m thick)



Day 4. Carbonate systems



Day 4. Carbonate systems



Day 4. Carbonate systems.



Day 4. Carbonate systems



Day 4. Carbonate systems



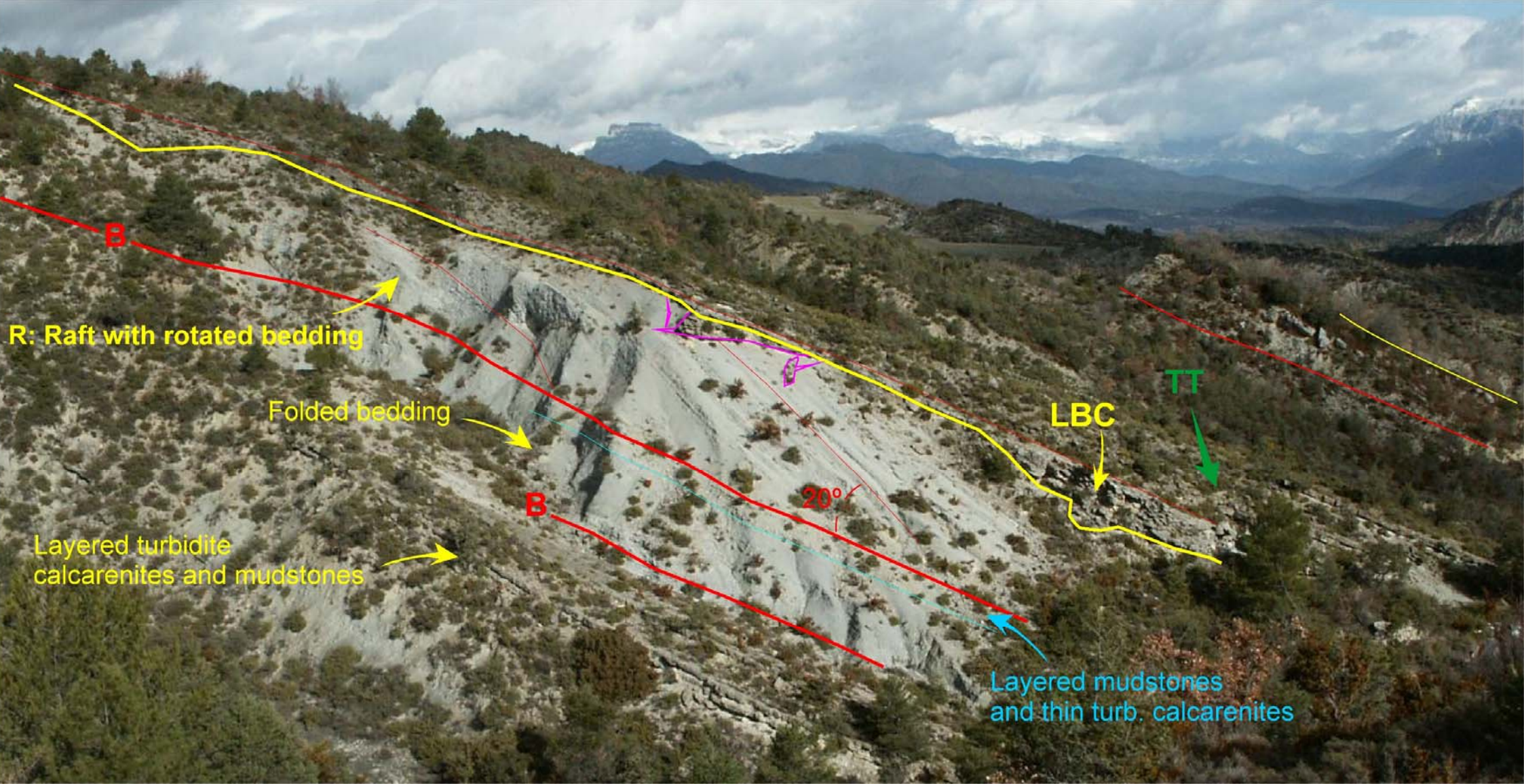
Day 4. Carbonate systems.



Day 4. Carbonate systems.



Day 4. Carbonate systems



Day 4. Carbonate systems



SW- NE

Carbonate platform

fine-grained carbonate slope (facies LM)

Limestone breccia

Slide blocks

Terrigenous slope mudstone (FA-1)

Bioclastic turbidite

Bioclastic-filled faults and fractures

Terrigenous turbidites

15°

Slump folds

> 120 m

C

5- 15 Km

