Lithofacies and depositional settings of the Coniacian- Campanian Chalk in the Mons Basin

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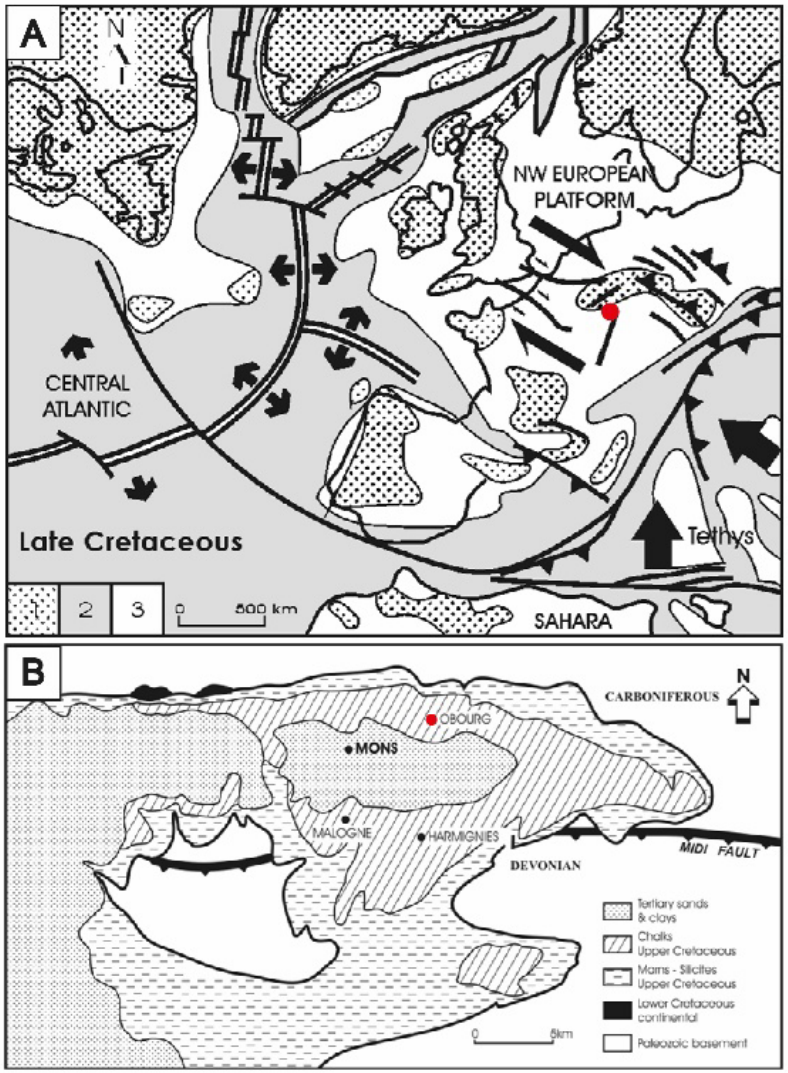
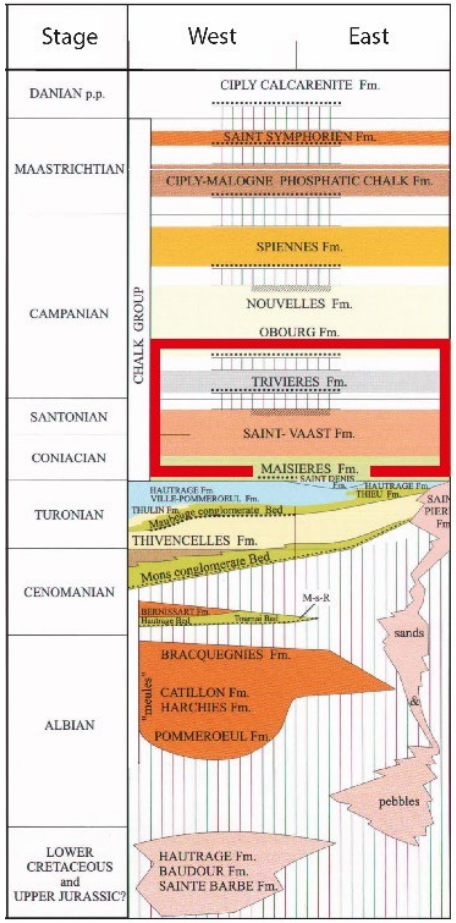
Geological setting: Mons Basin



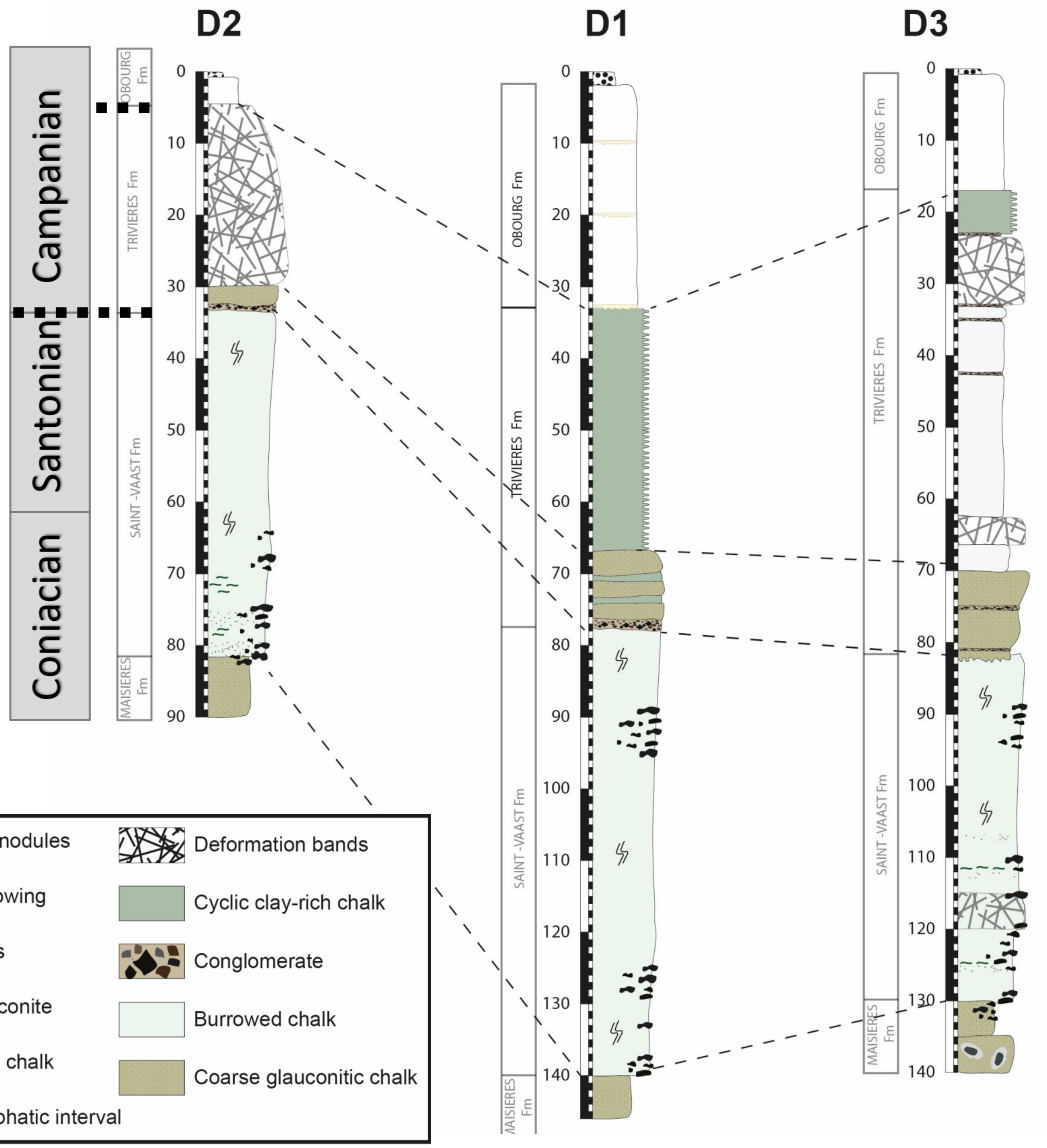
Vandycke, 2002

- Cement plant
- 3 drillholes (+350 m)
- Characterize the chalk beneath the exploited Campanian “white chalk”

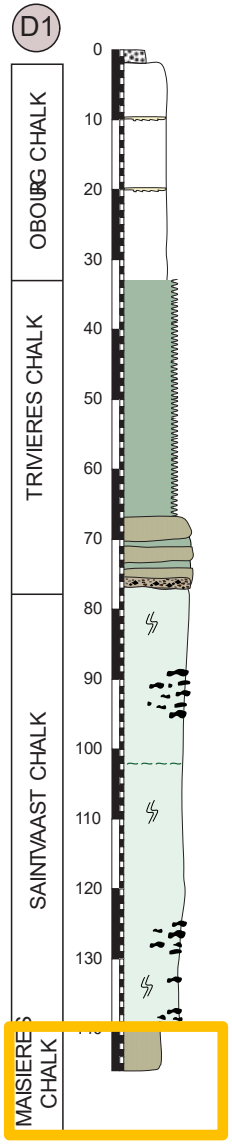
Stratigraphy of the Mons Basin



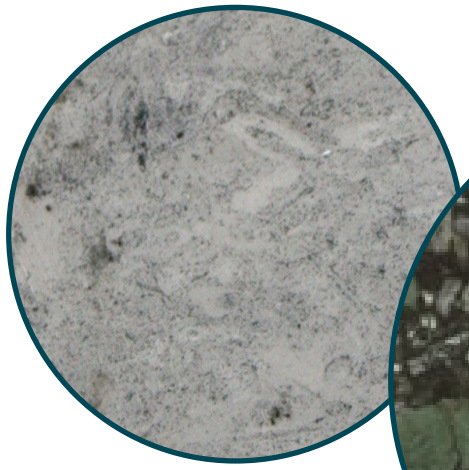
Robaszynski et al., 2001

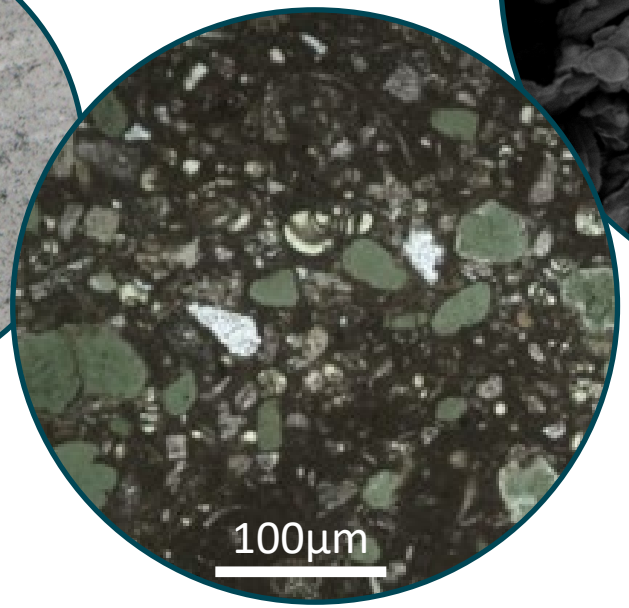


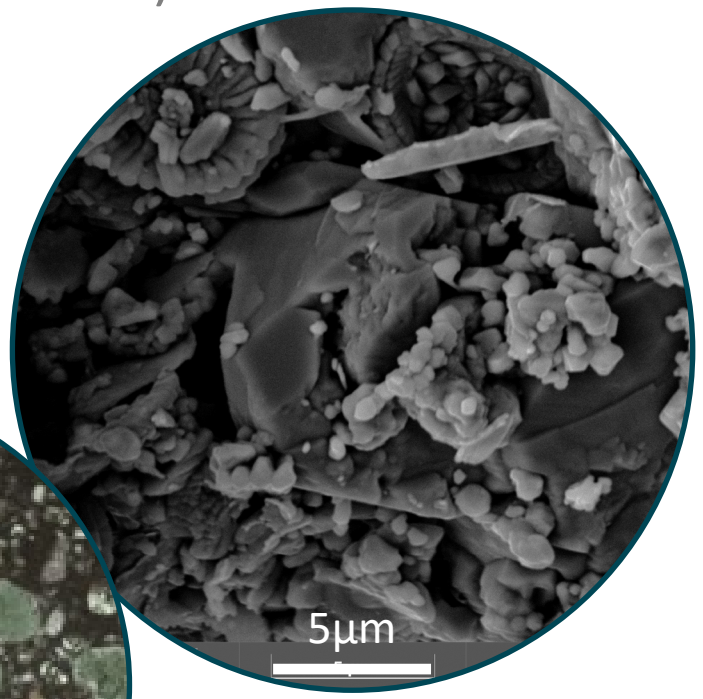
Maisières Chalk

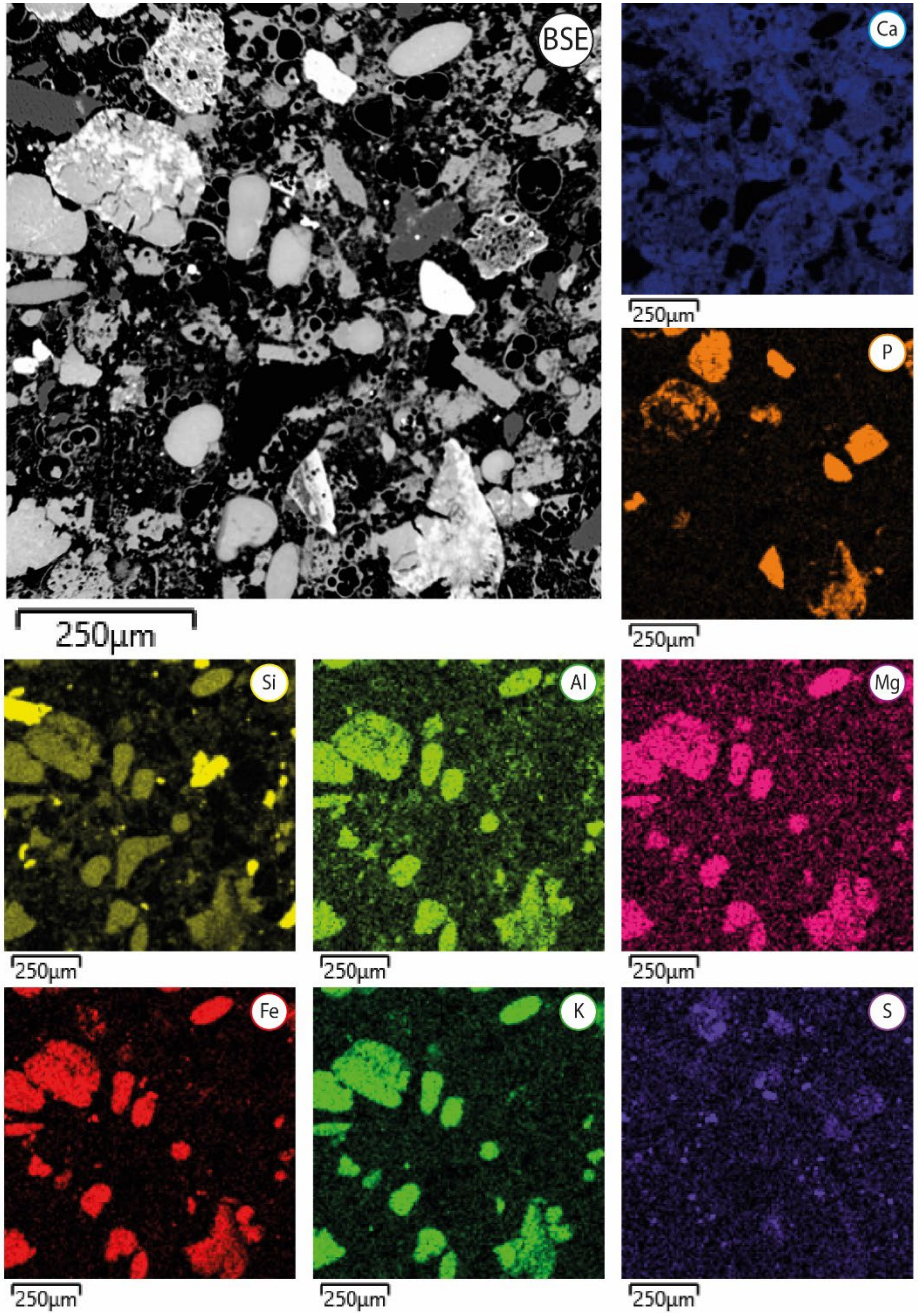


- Base of the Chalk Group in the Mons Basin
- Bottom of each drillhole (5-7 m thick)
- Glauconitic calcarenitic chalk
- Wack- to packstone texture
- Calcite cementation (SEM)









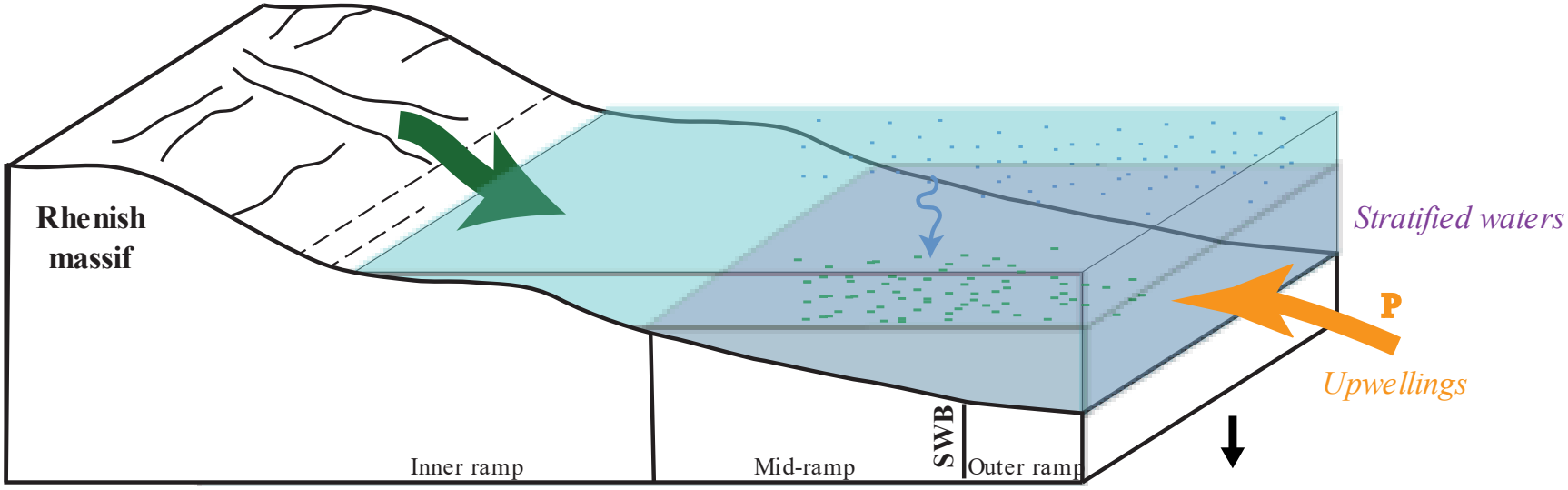
→ **Anoxic to dysoxic environment**: framboid pyrite, glauconite

→ **Upwelling currents**: phosphate, reduced sedimentation rate, radiolaria boom (cryptocrystalline silica)

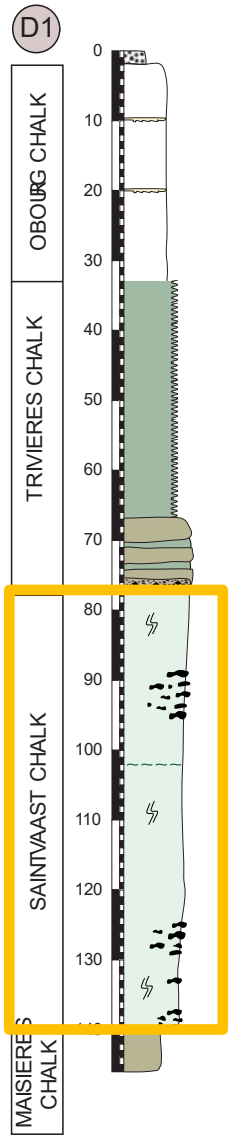
→ **Low sedimentation rate** : increased chemical exchanges at the seawater - sediment interface: formation of glauconite, early calcite cement

→ Shallow environment : **lower offshore**

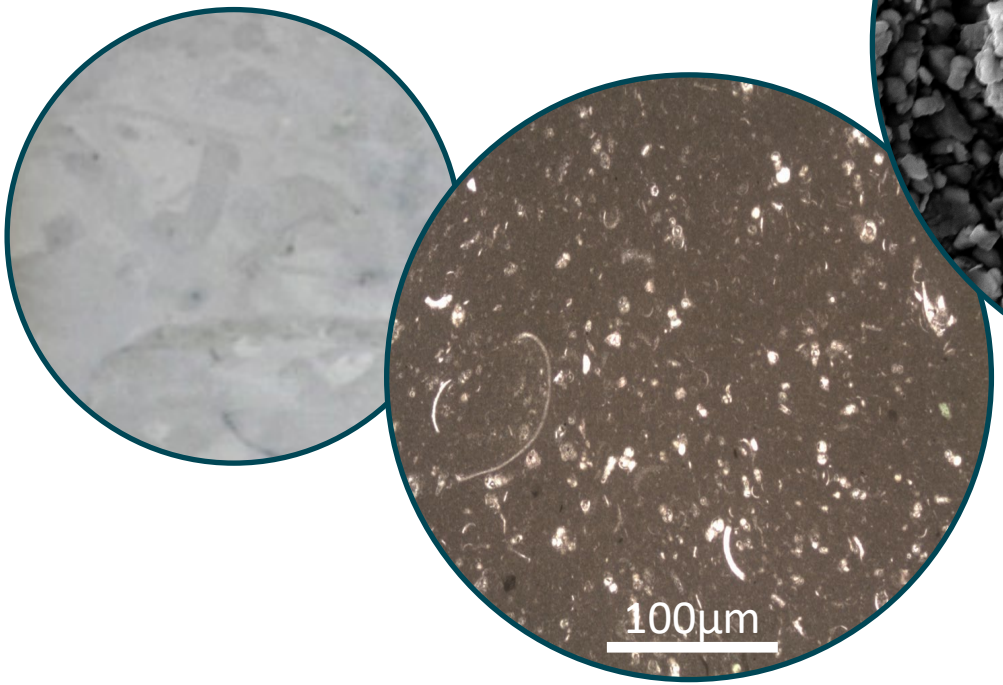
Depositional facies classification by Lasseur et al. (2009)

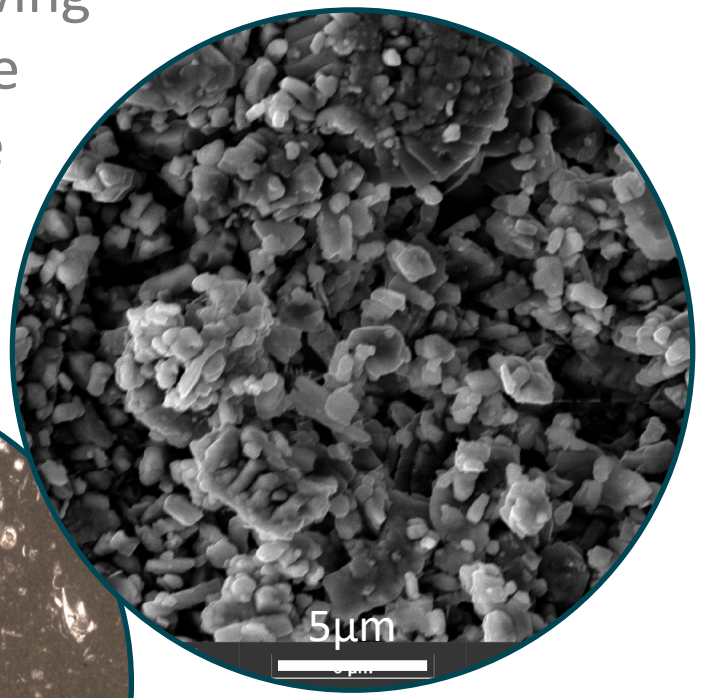


Saint Vaast Chalk



- Stacked sedimentary cycles
- Softground/ Intense burrowing
- Mud- to wackestone texture
- Microrhombic microtexture (SEM)

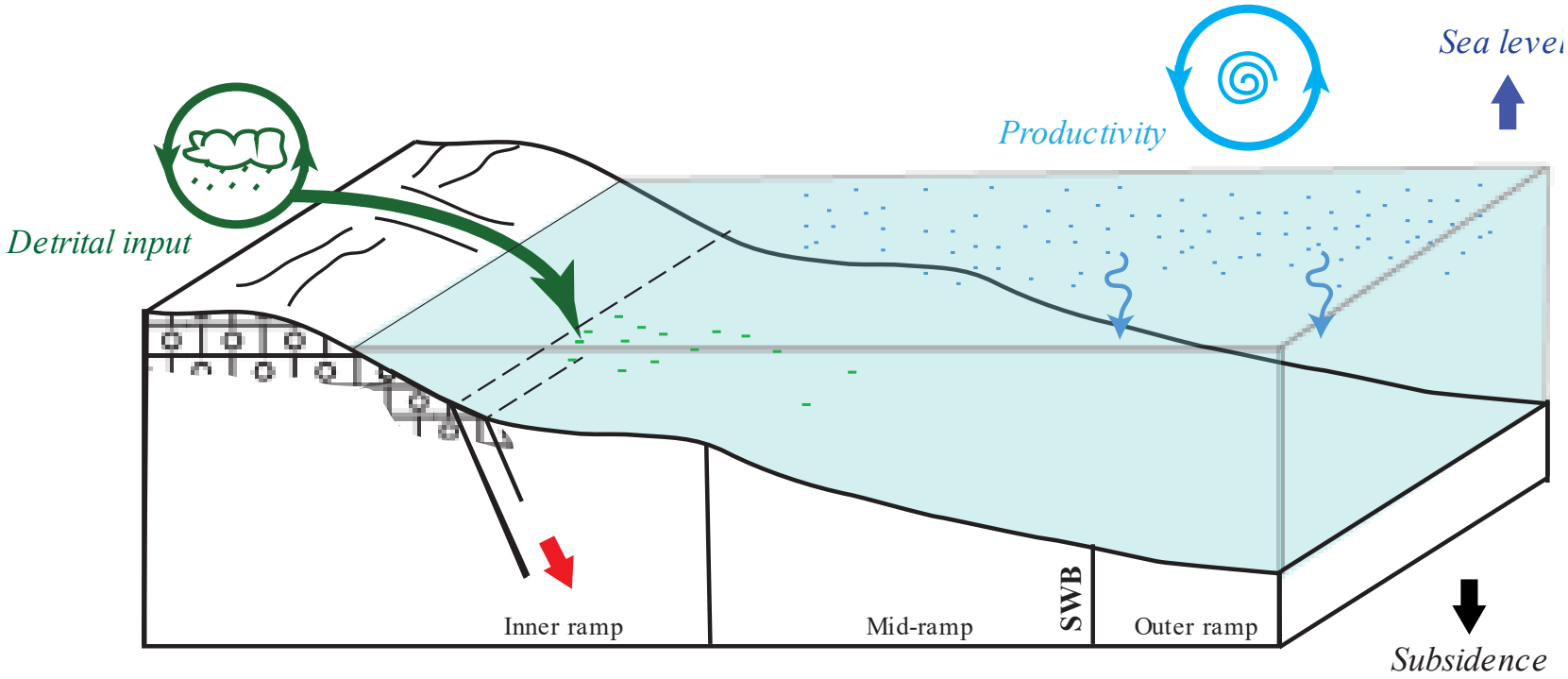




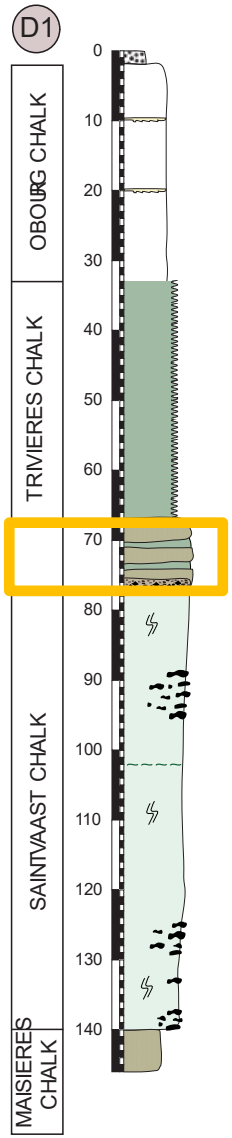
→ **Upper offshore deposits** (below SWB) – poorly expressed hiatal surfaces (Lasseur et al., 2009)

→ **Sea level rise**

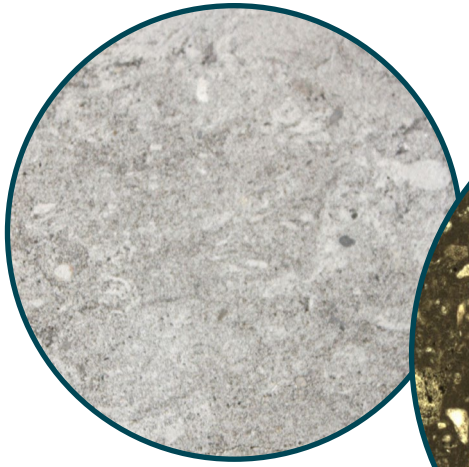
- change in the circulation patterns **&** reduction of upwellings
- connected to the chalk sea toward Paris Basin

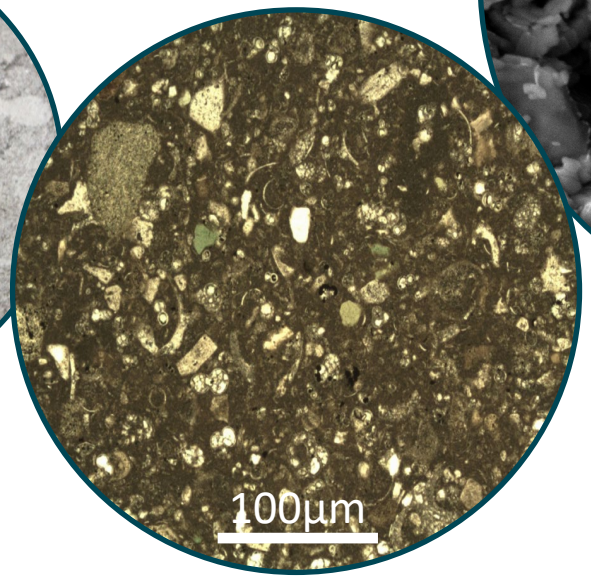


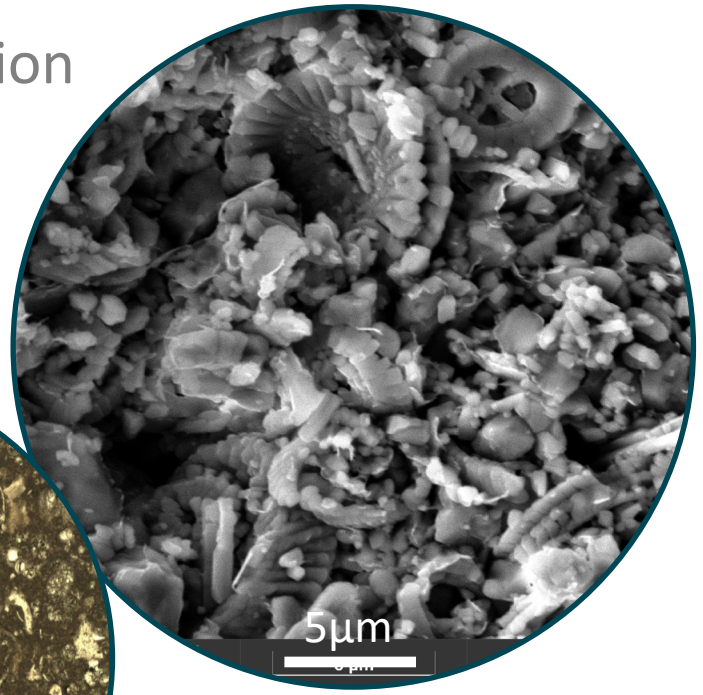
Base of Trivières Chalk



- Glauconitic chalk : 5-10m thick
- Wack- to packstone texture
- Clay flakes from local alteration of glauconite (SEM)







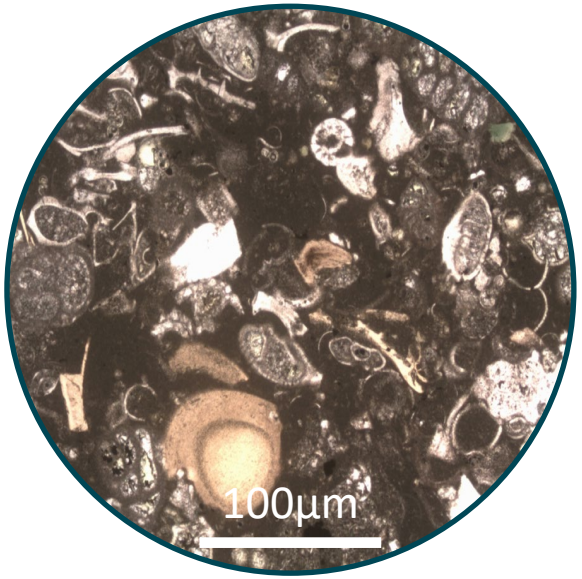
XRD analyses:
Glauconite : up to 8%
Quartz : up to 5%
Apatite : up to 5%

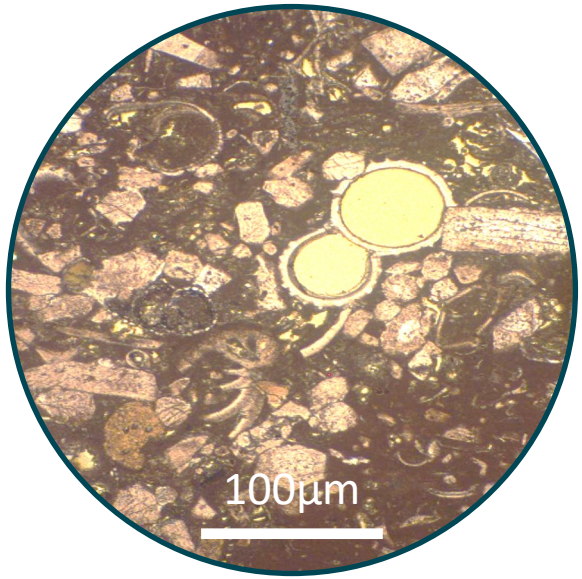
- Decimeter thick conglomerate

Matrix-supported gravelly mud (Pickering et al. 1986)

- Polymictic conglomerate

(bioclasts, fish bones fragments, benthic forams, quartz, chert fragments, chalk intraclasts, glaucony grains)

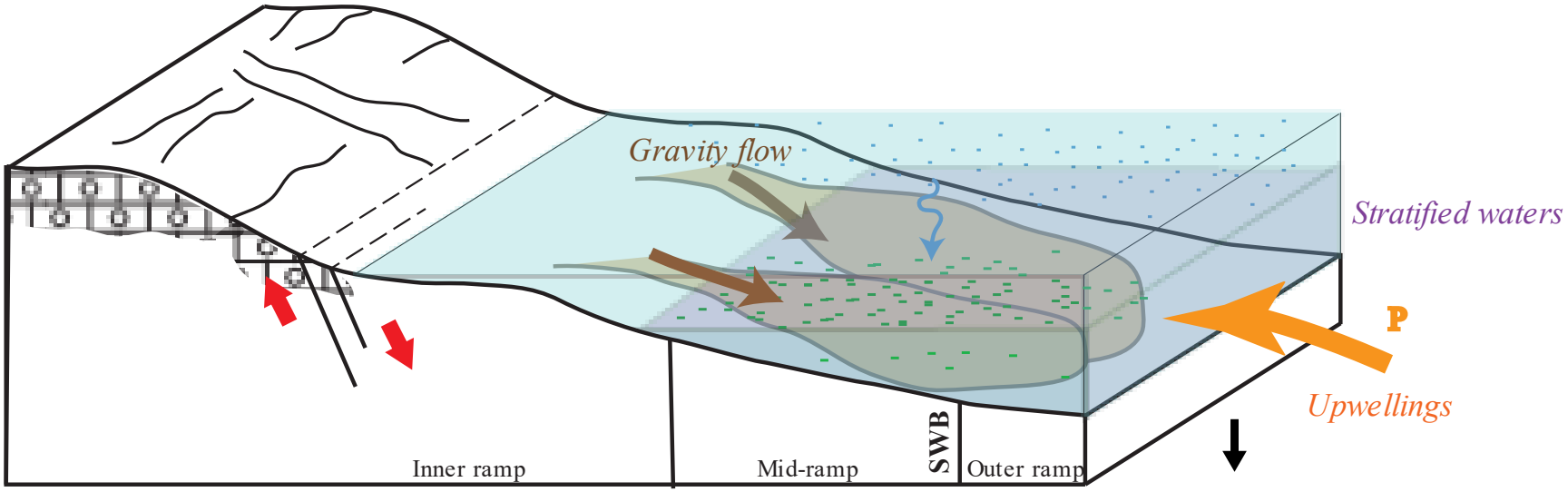




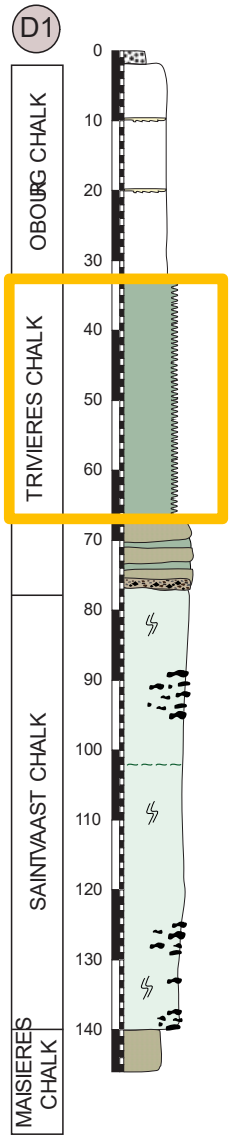
→ Shallow environment : **lower offshore**

Glauconite + phosphorite : Between the upper slope and outer shelf, closely associated with the oxygen minimum zone (Banerjee et al., 2019)

→ **Intrabasinal conglomerate**

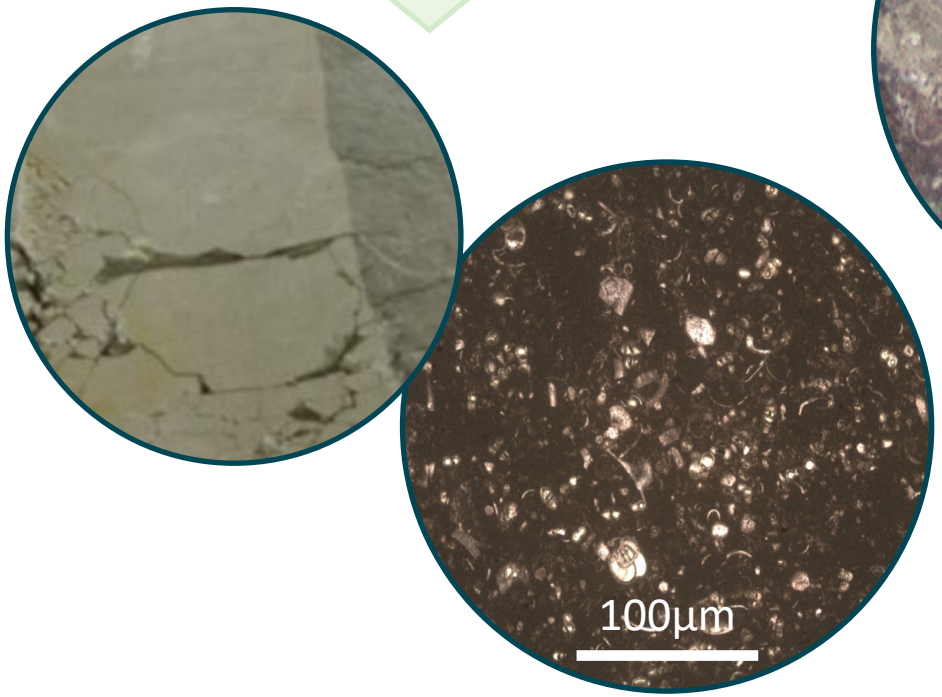


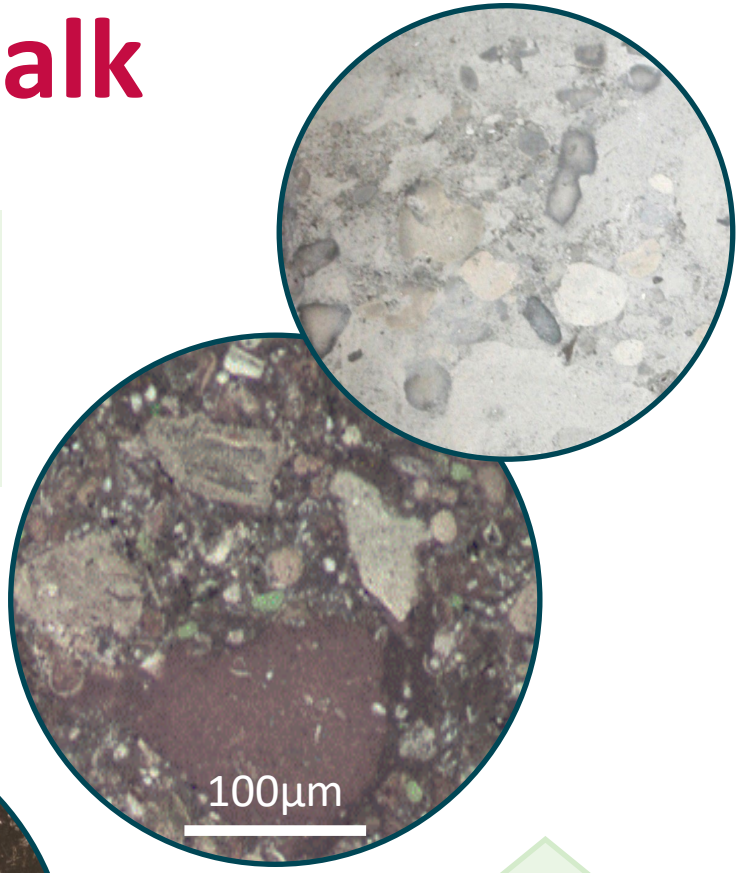
Trivières Chalk



Sedimentary cycles chalk-marl couplets

- Firmgrounds hiatal surfaces
- **Mud-wackestone texture**





Conglomeratic chalk

- Centimeters to decimeter thick layers
- Packstone texture

Deformation bands in Trivières Chalk

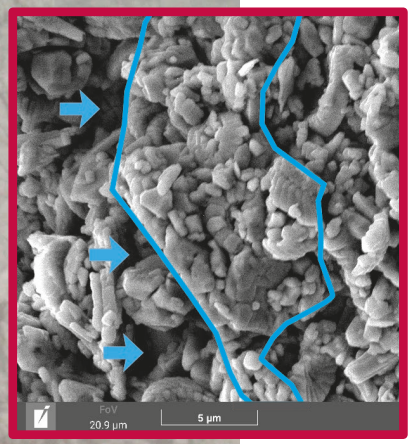
- Formerly called “Hairline fractures” : no fractures but local pore collapse

- Deformation bands (*Wenneberg et al. 2013*)

- *Swanger et al. (2013)* plastic yielding (deformation band) and brittle failure (normal faulting) = two responses to a normal stress

→ Damage zone of a major fault / active in extension at the time of chalk deposition

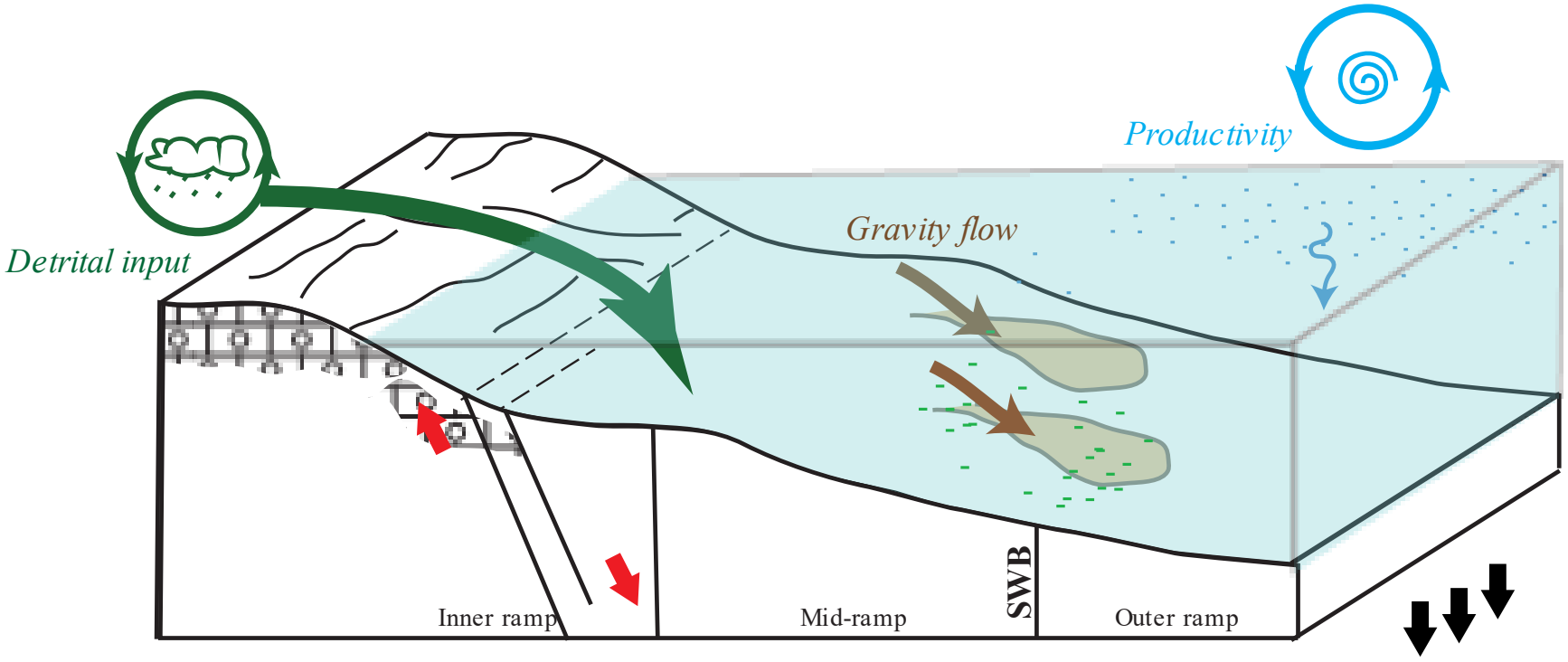
→ Evidence of active syn-sedimentary tectonic during Trivières Chalk deposition



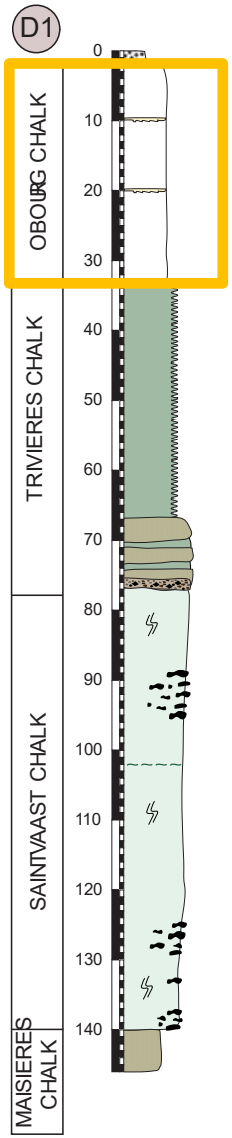
→ Cyclicity of the deposits (detrial input / productivity)

→ **Synsedimentary tectonic activity** (extensive system opening of the Mons basin):

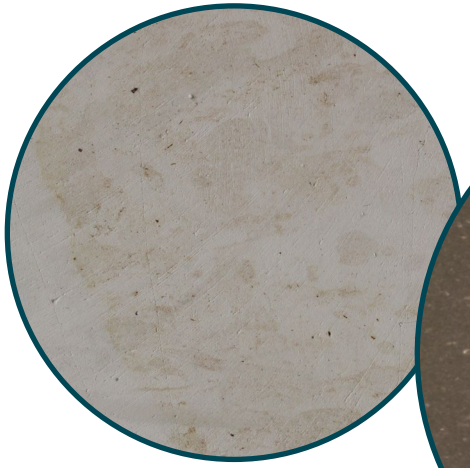
- **deformation bands** along main faults
- **destabilization** of the sea floor leading to **gravity flows**

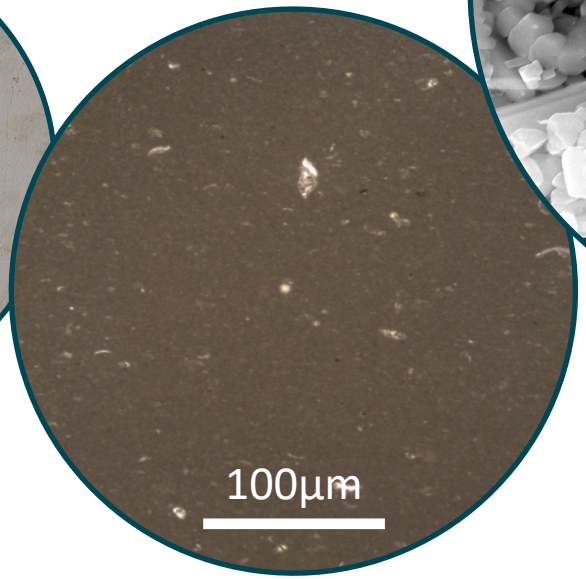


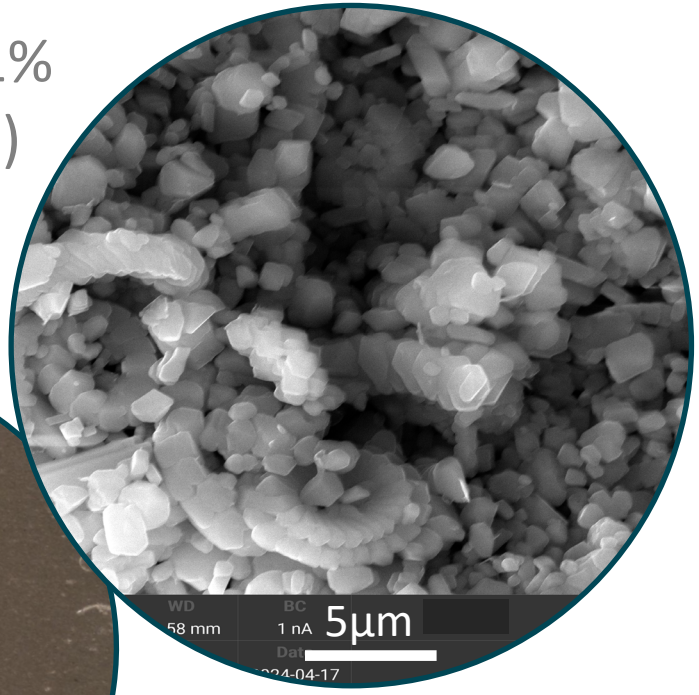
Obourg Chalk



- White Chalk
- Mudstone texture
- Insoluble residue <1%
- Microrhombic (SEM)

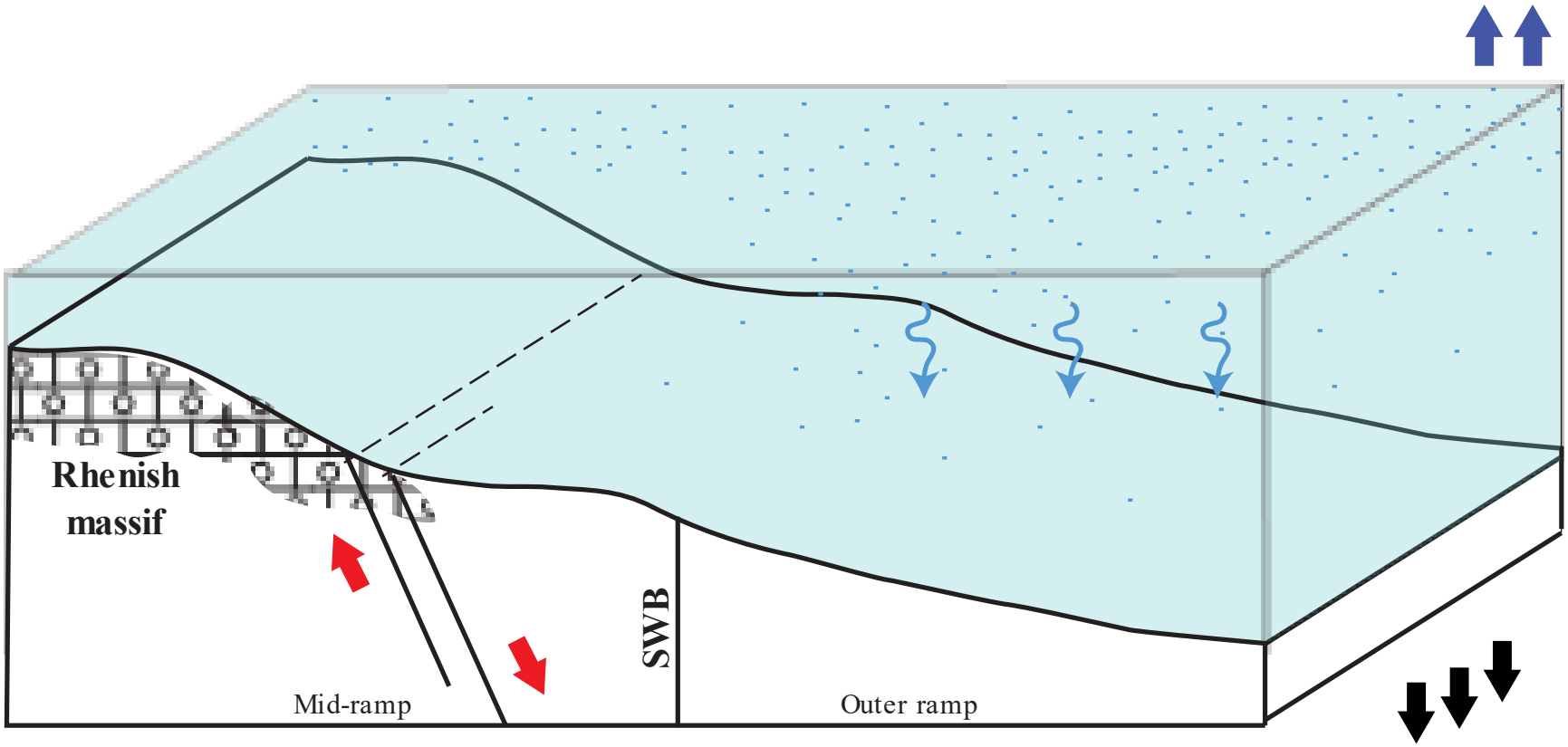




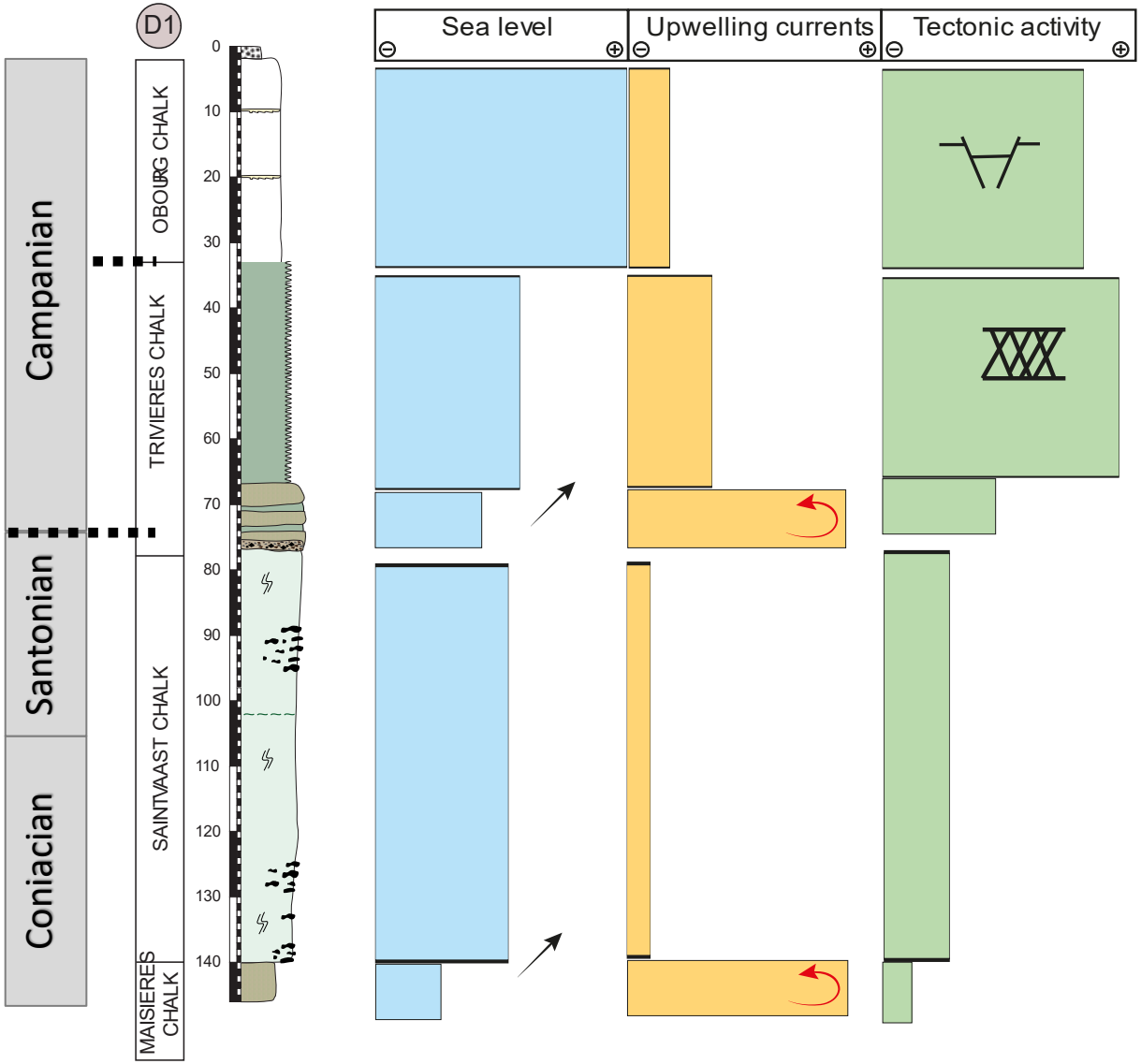


→ **Sea level rise :** The Campanian transgression flooded all the remaining emerged lands in Northwestern Europe (Rhenish massif)

→ Culmination of the Chalk Sea : “white chalk” (as defined sensu stricto) across entire northern Europe



Conclusion


D1
Campanian
Santonian
Coniacian
OBOURG CHALK
TRIVIERES CHALK
SAINT-VAAST CHALK
MAISIERES CHALK
0
10
20
30
40
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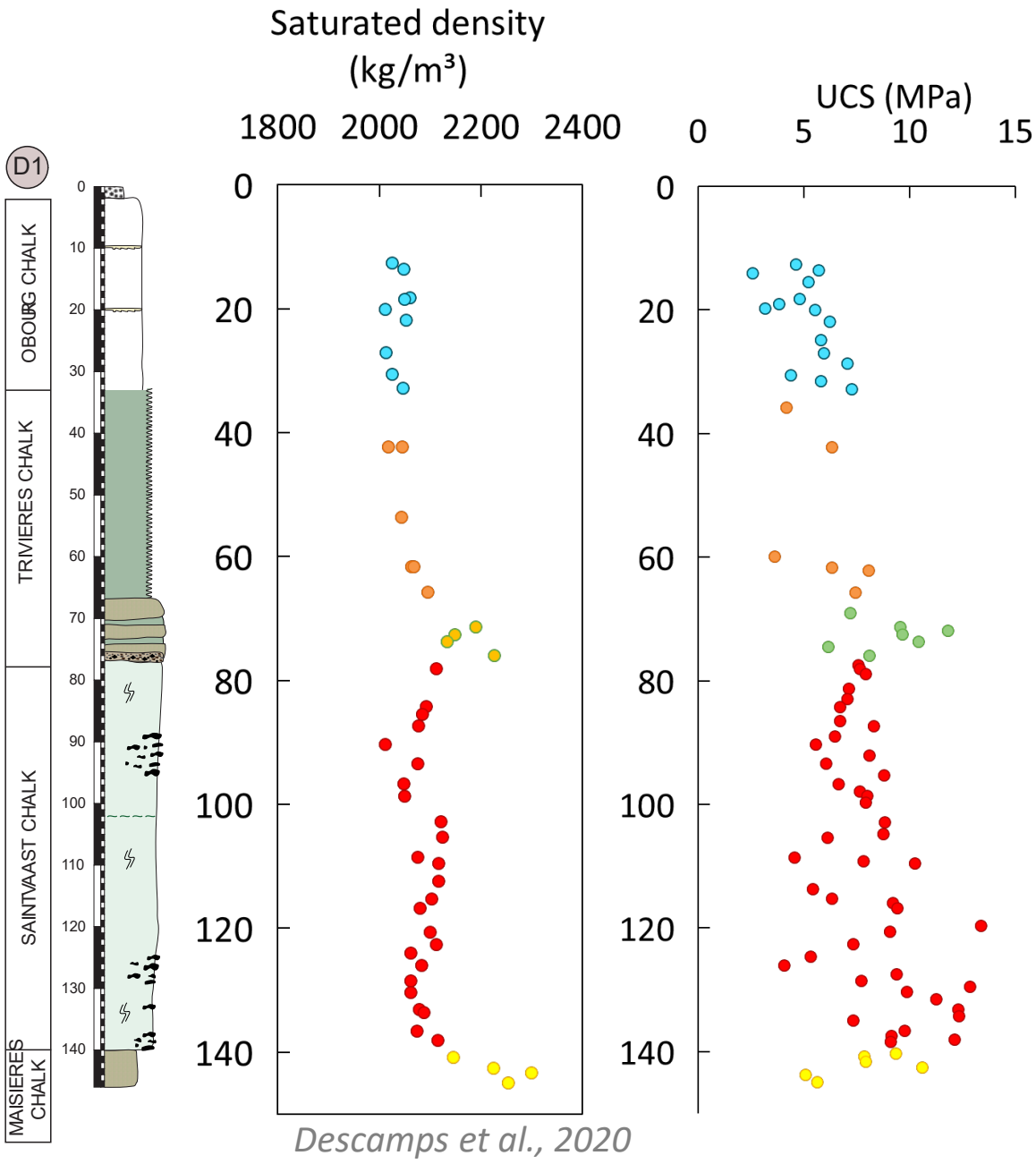
70
80
90
100
110
120
130
140
Sea level
Upwelling currents
Tectonic activity



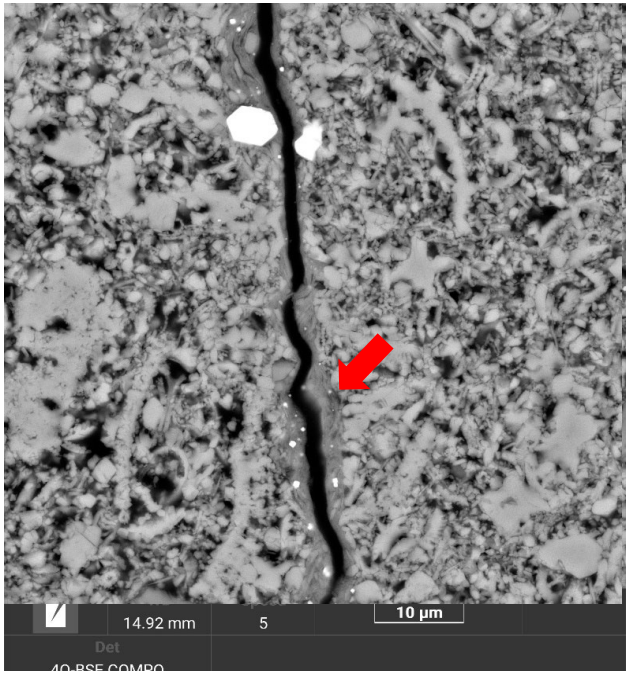
Descamps et al., 2020

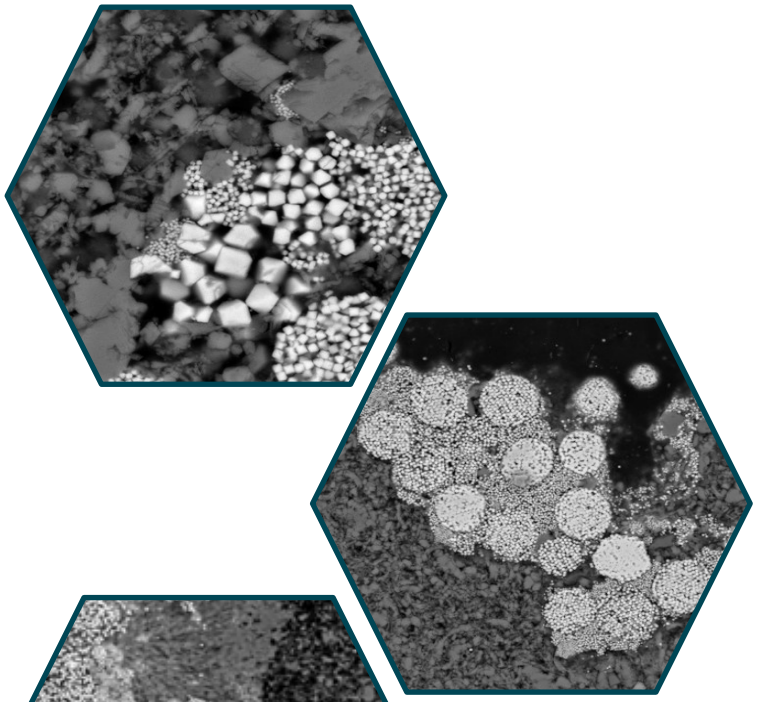
- Impact of the depositional setting on the petrophysical and geomechanical properties

- Higher UCS (Unconfined compressive strength) related to calcite cementation

- Low burial diagenesis BUT **structural diagenesis**.

Evidence of tectonic stylolites in the Mons Basin





Thank you.

Descamps, F., Faÿ-Gomord, O., Vandycke, S., Gonze, N., & Tshibangu, J. P., 2020. Connecting engineering properties of chalk to geological logging. In ISRM International Symposium - EUROCK 2020.