

Imaging seafloor instabilities using high-resolution seismic and sedimentological data in the Gulf of Lions (NW Mediterranean)

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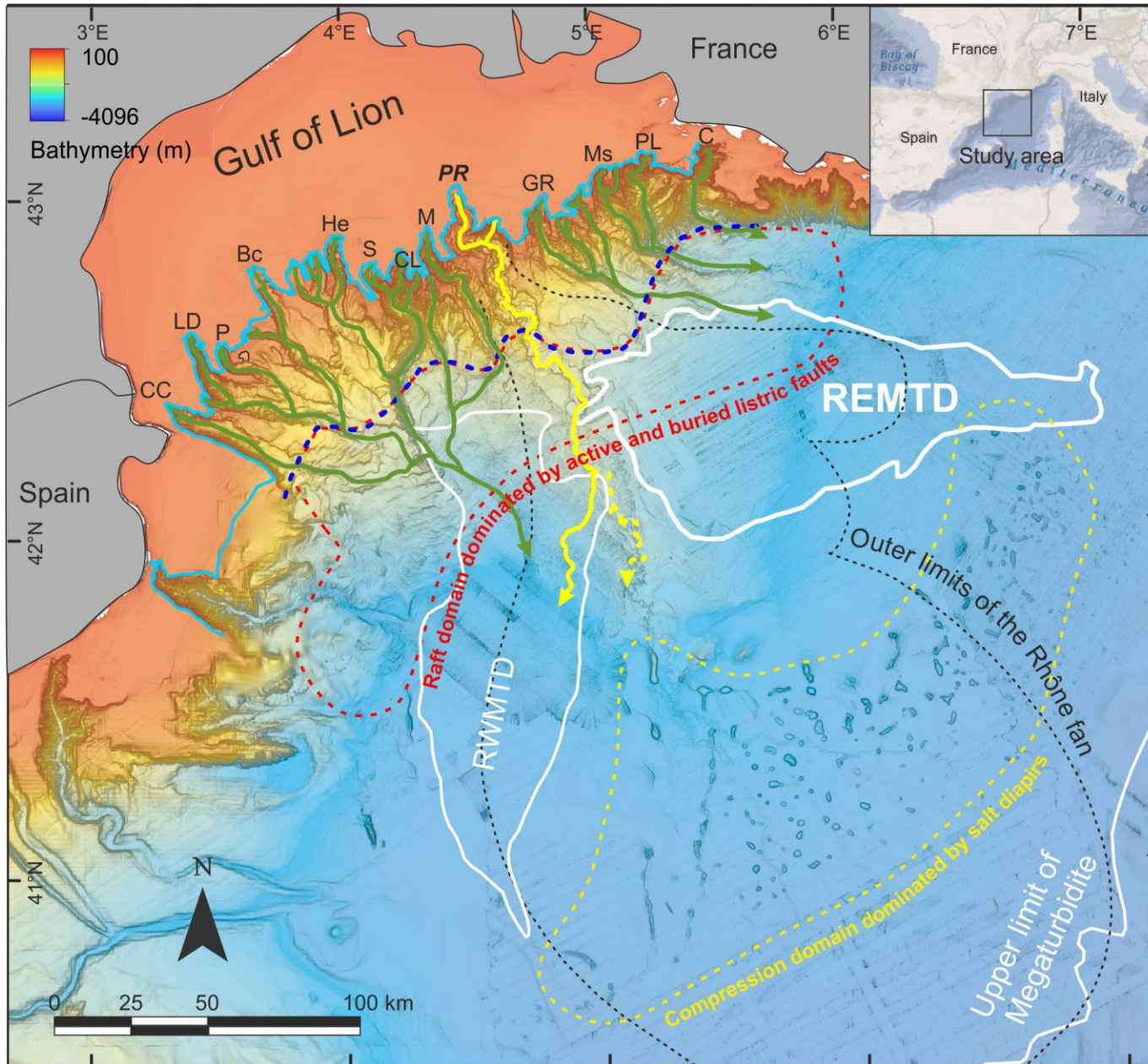
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Motivation and objectives

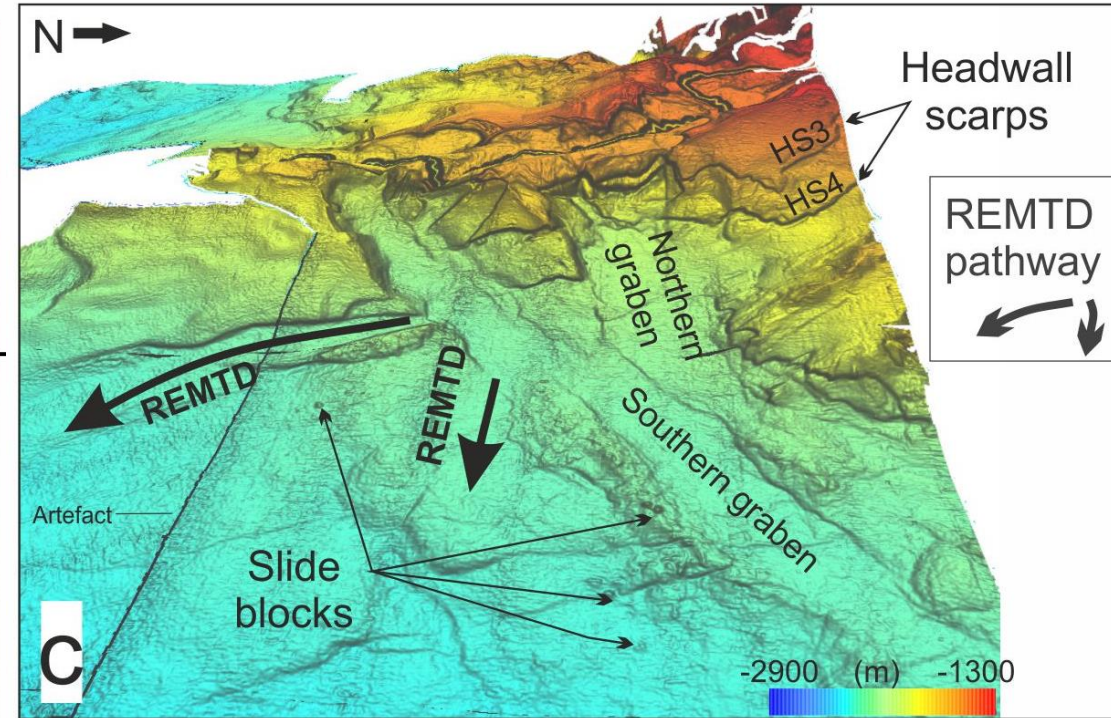
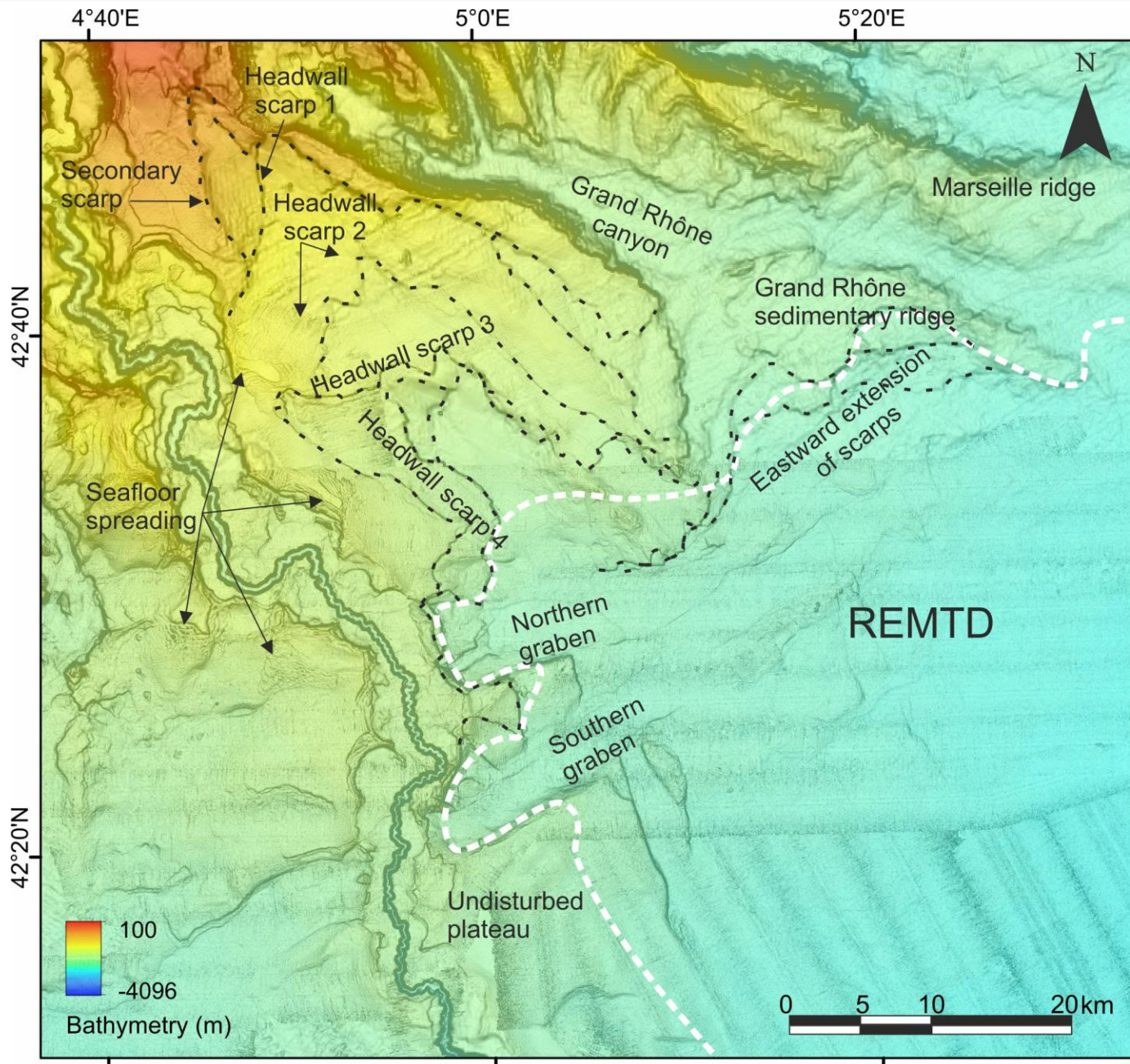


- The Gulf of Lions presents widespread Mass Transport Deposits (MTD) affecting the levees of the turbiditic Rhône system in the lower slope (700 - 2000 m water depth)
- Two major deposits are the Rhône Western Mass Transport Deposit (**RWMTD**) and the Rhône Eastern Mass Transport Deposit (**REMTD**)
- The RWMTD and REMTD cover **surface areas >6500 km²**. They represent **volumes >150 km³** that have **run-out distances >200 km**

Objectives

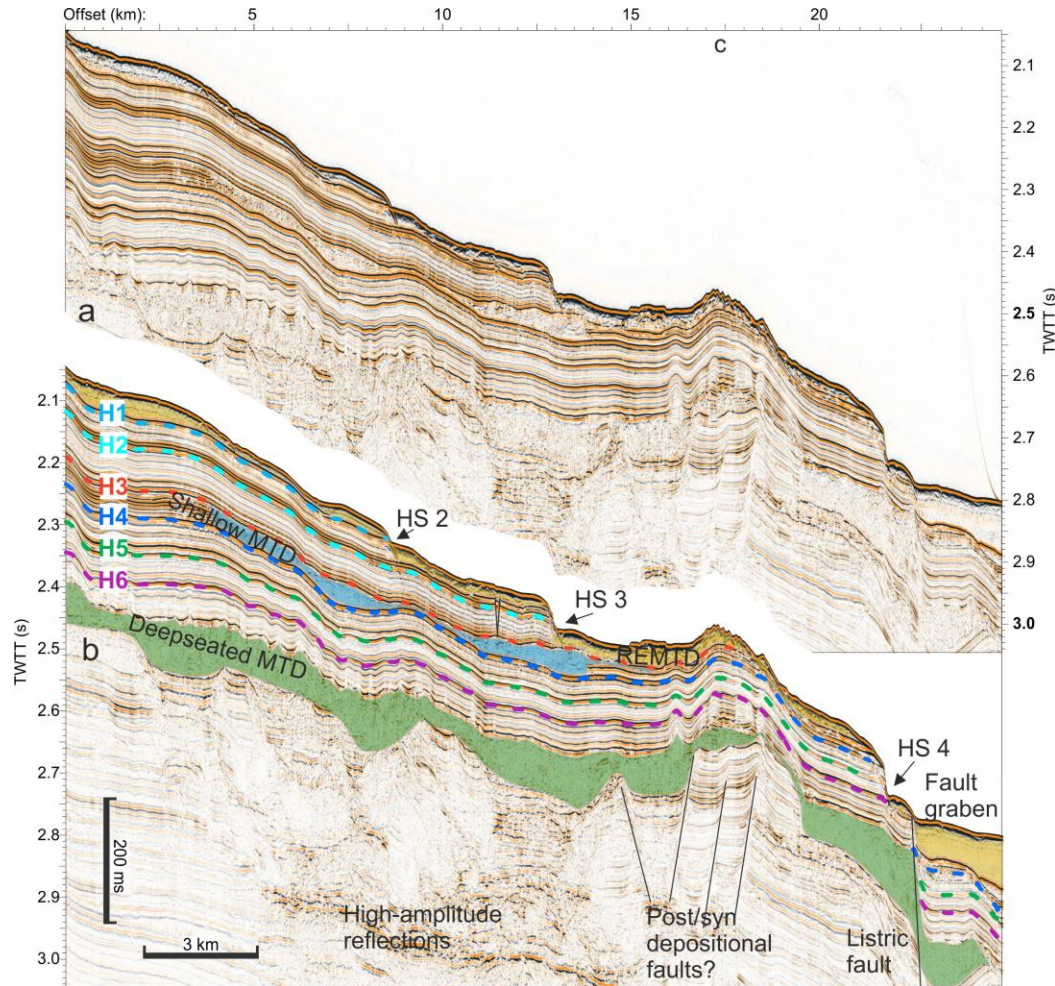
- Assess seafloor instabilities in the Gulf of Lions
- Identify potential role of climatic forcing in facilitating slope failures

The Eastern Rhône Interfluve Slide



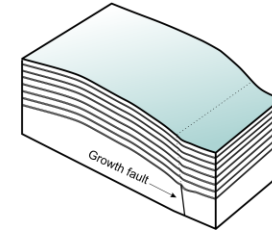
- At least five headwall scarps are identified
- Headwall scarps are aligned in a staircase style
- Two large (active) fault grabens cross the toe area of the slide

Evolution of the ERIS

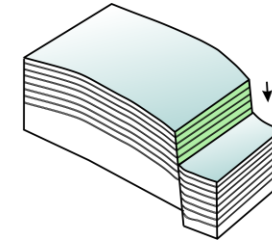


- The basal surface of slide coincide with high-amplitude reflectors
- Retrogressive style of failures is identified, which propagated from the base of the slope to the shelf

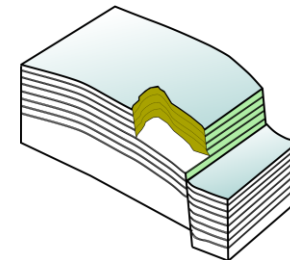
1. Initial slope before failure



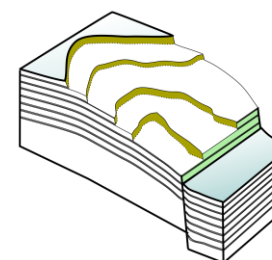
2. Growth fault slip (~21ky)



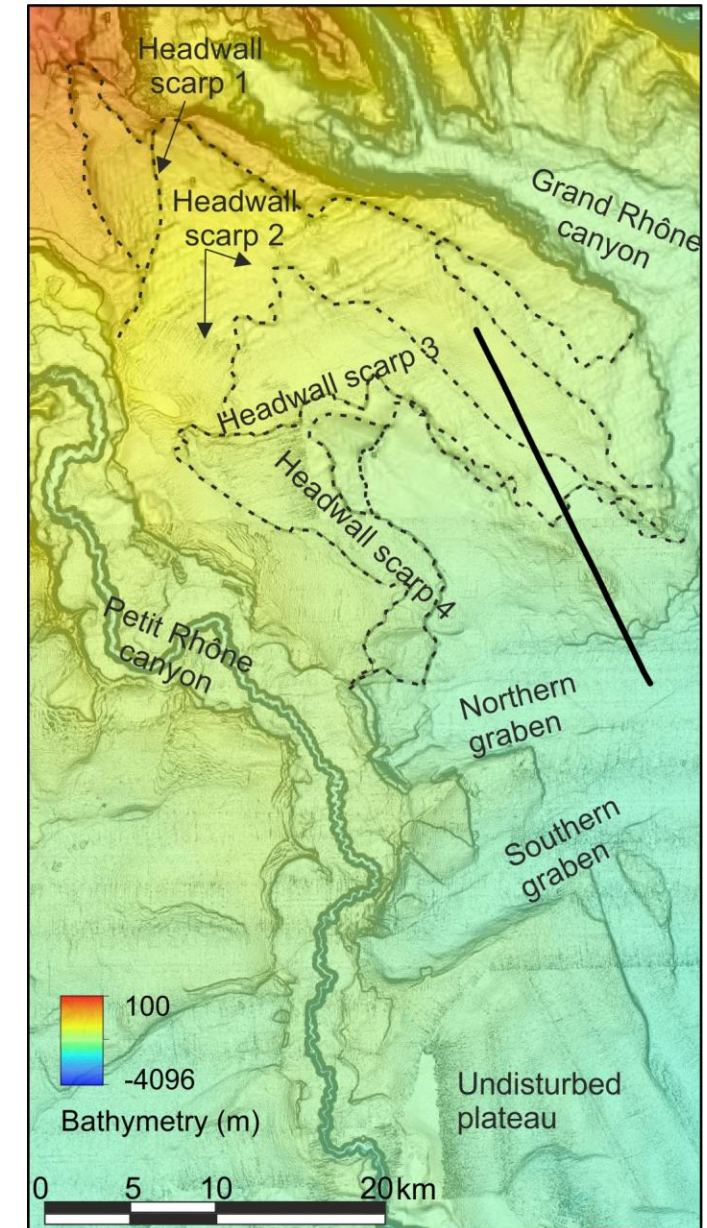
3. Slide initiation



4. Present day slope geometry

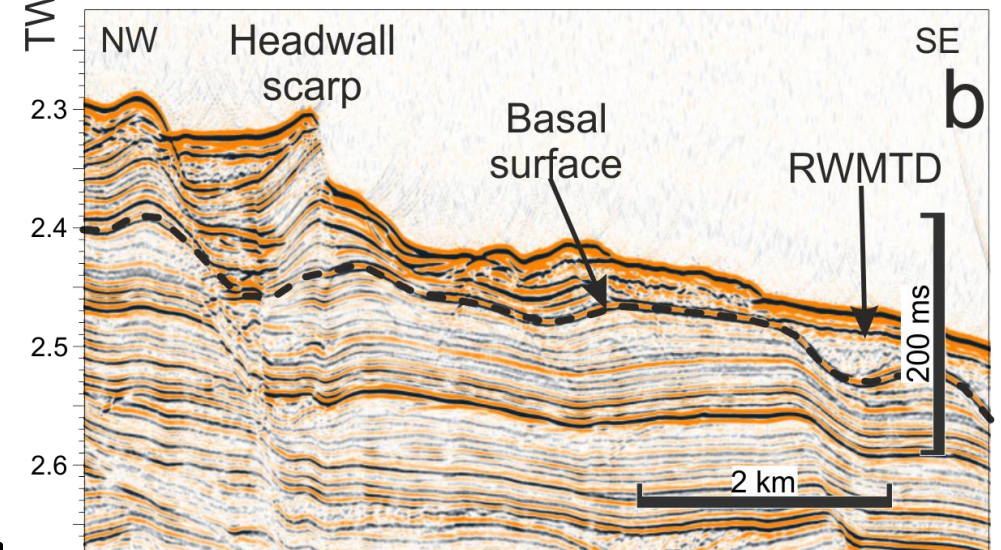
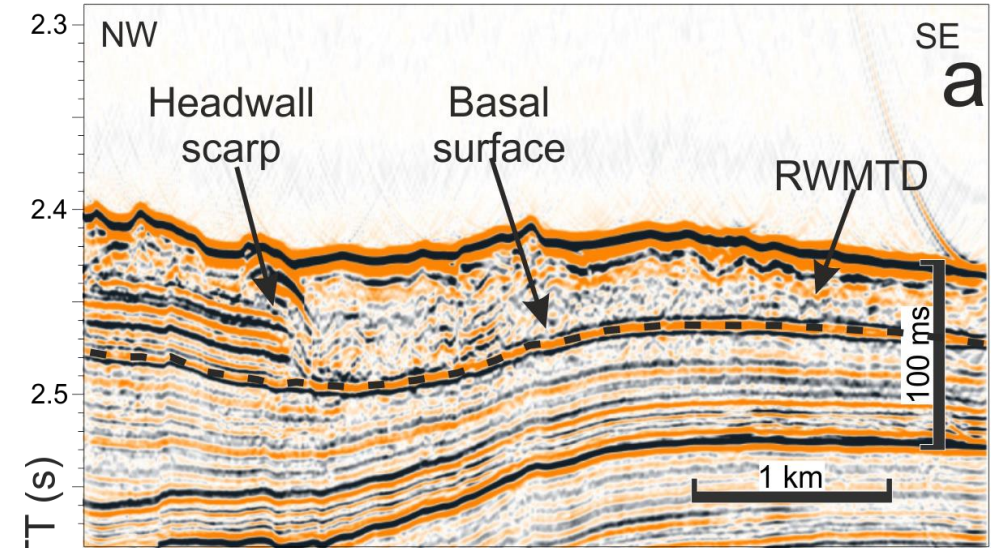
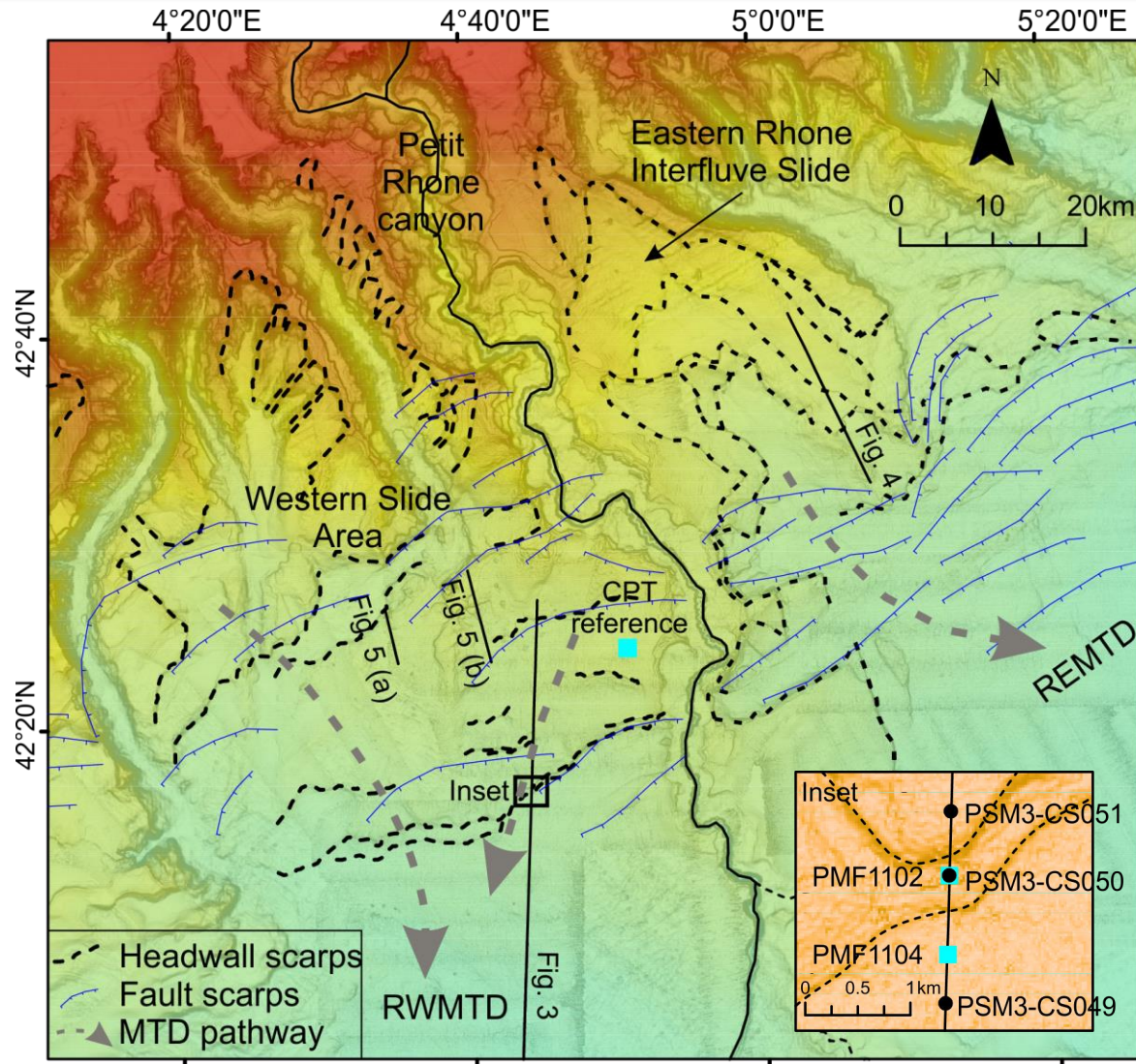


not to scale



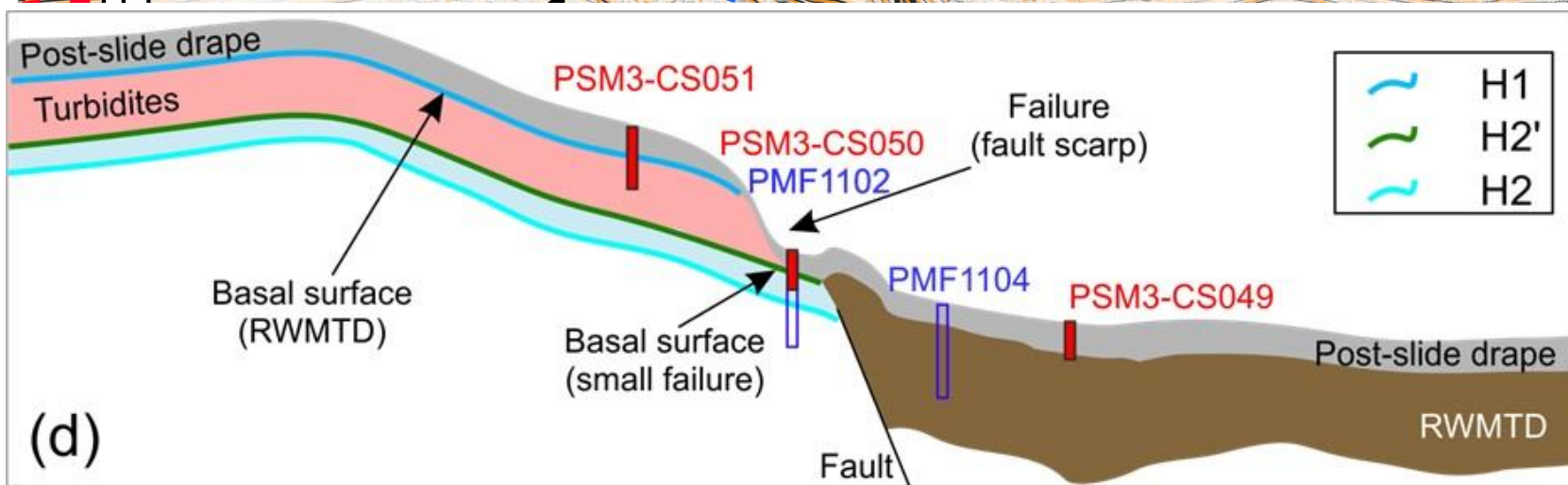
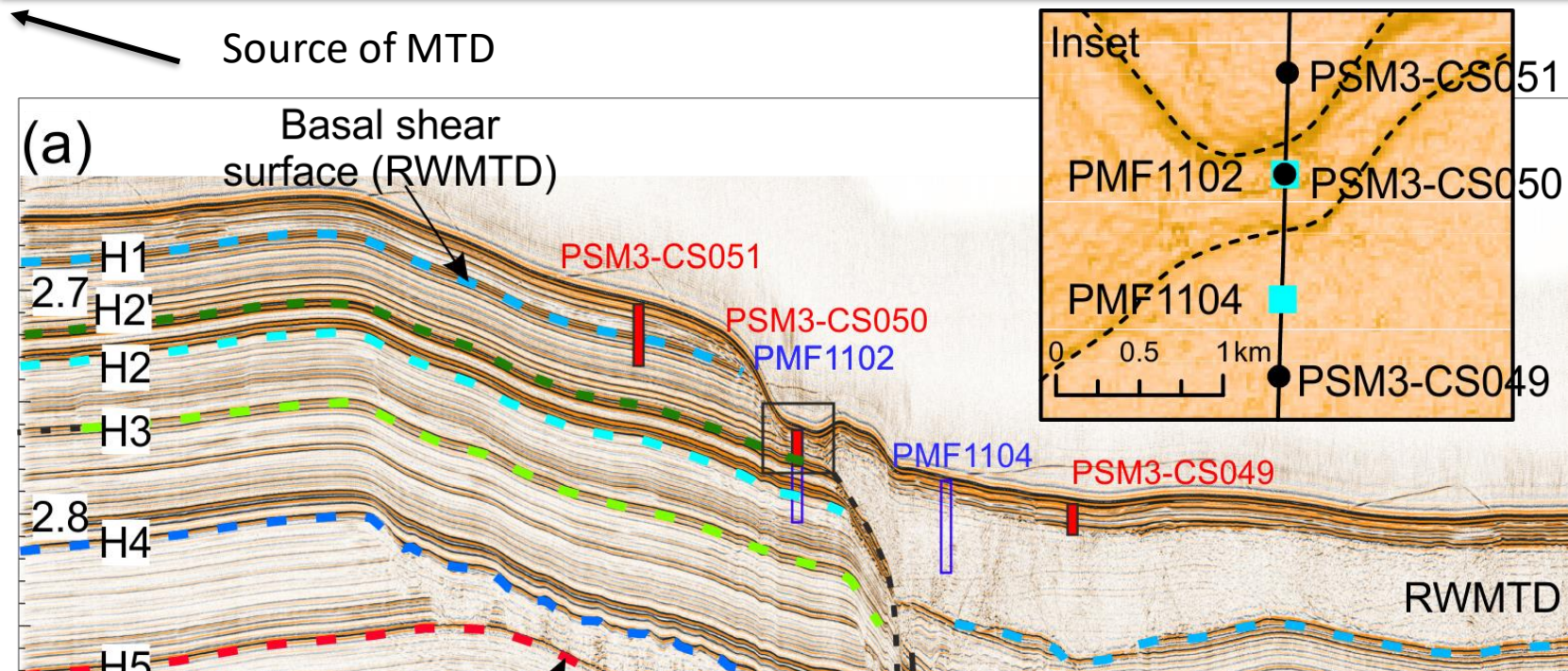
Badhani et al., 2020a

Western slide area



Bedding parallel failure mechanism in the entire Gulf of Lions suggests strong control of sedimentation in preconditioning the failure

Badhani et al., 2020b



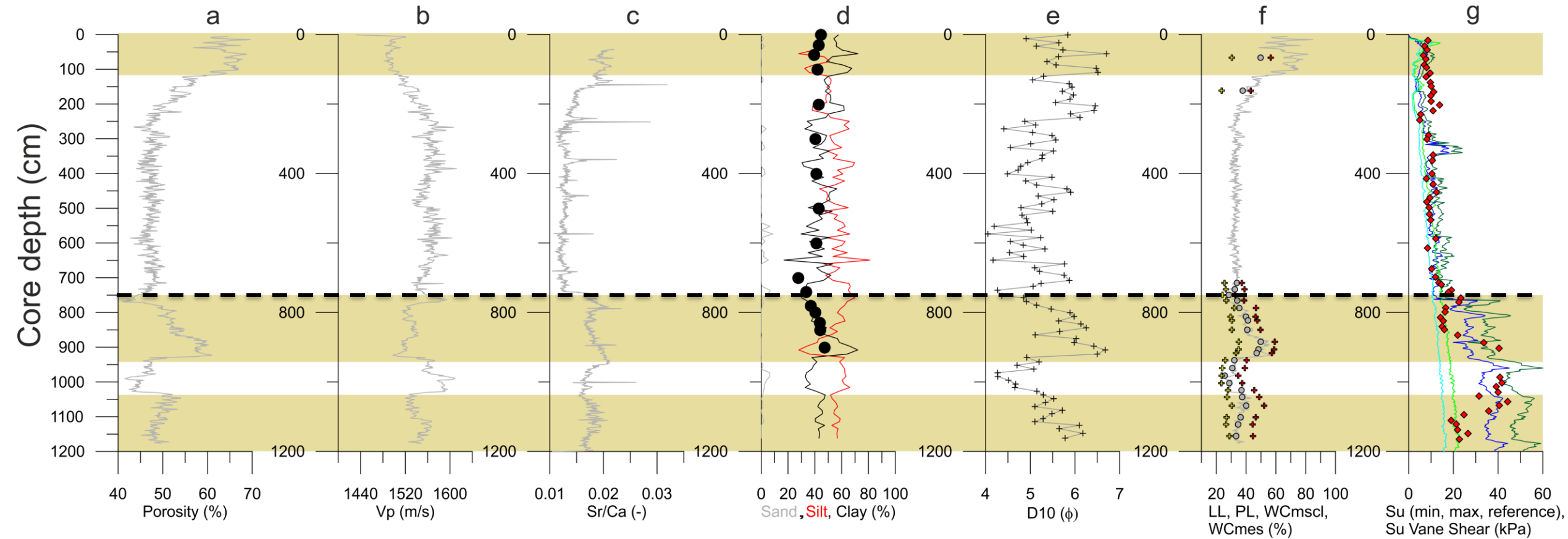
- High-resolution internal architecture of the study area shows cyclicity of high-low amplitude seismic reflections
- Two sediment cores penetrated the high-amplitude reflectors at two different stratigraphic levels – H1 and H2' These two key horizons have acted as basal surfaces of landslides in the study area
- A multidisciplinary analysis was performed on cores PSM3-CS051 and PSM3-CS050, which penetrated horizon H1 and H2', respectively (see next slides for details)

Basal surface multidisciplinary analysis

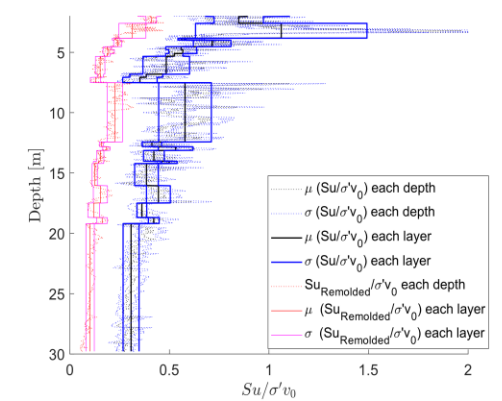
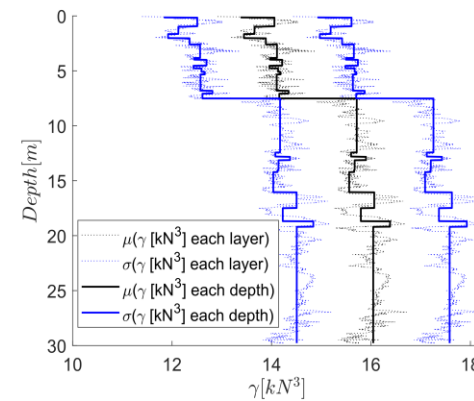
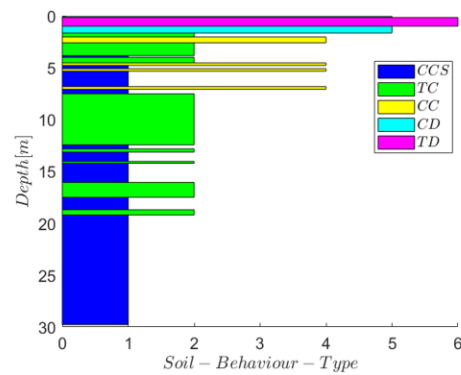
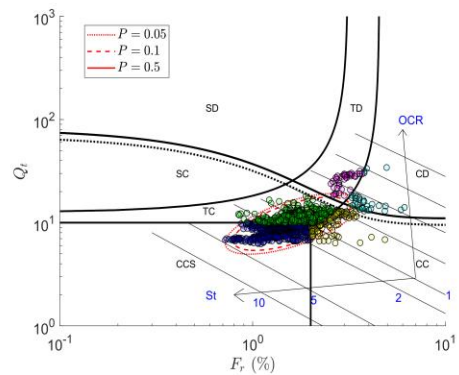
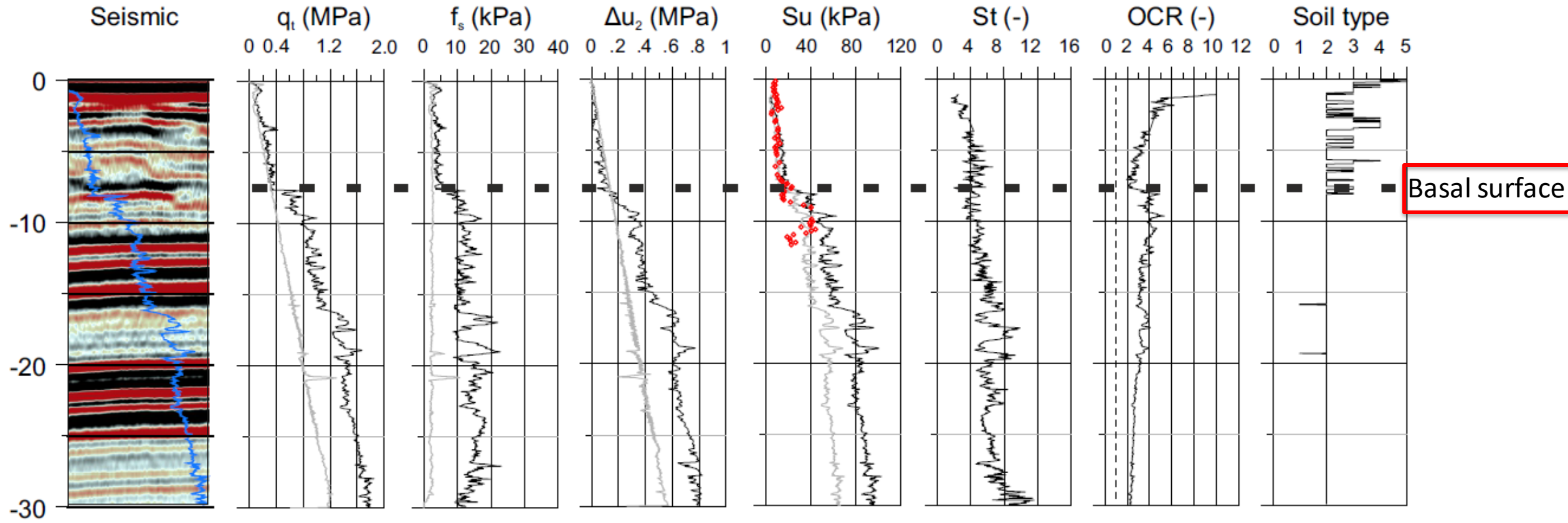


PSM3CS050

--- Basal surface (horizon H2')



Multiple anomalies below the basal surface: high porosity (presence of forams), high clay content, high water content, liquid and plastic limits and higher shear strength. This suggest a lithological control on slope failures in the study area.



- Combination of deep-towed seismic, sedimentological data and in-situ measurements allowed us to analyse the basal surface of the slope failures in greater detail.
- We showed that the basal surfaces of the recurring slope failures consist of clay-rich sediments as compared to turbiditic deposits that dominate the GoL margin.
- It is evident that greater degree of lithological heterogeneity promotes slope failure in the GoL most likely related to higher liquefaction potential of coarser-grained material, excess pore pressure and maybe resulting variation in sediment strength.
- This suggests that climatically controlled deposition of different sediment type is an important preconditioning factor that determines the failure potential

Thank you for reading

References:

- Badhani Shray, Antonio Cattaneo, Stefano Collico, Roger Urgeles, Bernard Dennielou, Estelle Leroux, Florent Colin, Sebastien Garziglia, Marina Rabineau, and Laurence Droz. "Integrated geophysical, sedimentological and geotechnical investigation of submarine landslides in the Gulf of Lions (Western Mediterranean)." *Geological Society, London, Special Publications* 500 (2020b).
<https://doi.org/10.1144/SP500-2019-175>
- Badhani Shray, Antonio Cattaneo, Bernard Dennielou, Estelle Leroux, Florent Colin, Yannick Thomas, Gwenael Jouet, Marina Rabineau, and Laurence Droz. "Morphology of retrogressive failures in the Eastern Rhone interfluvium during the last glacial maximum (Gulf of Lions, Western Mediterranean)." *Geomorphology* 351 (2020a): 106894.
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