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Context

Problem

Dredging operations generate large amounts of sediments that they become **waste** for their land management.

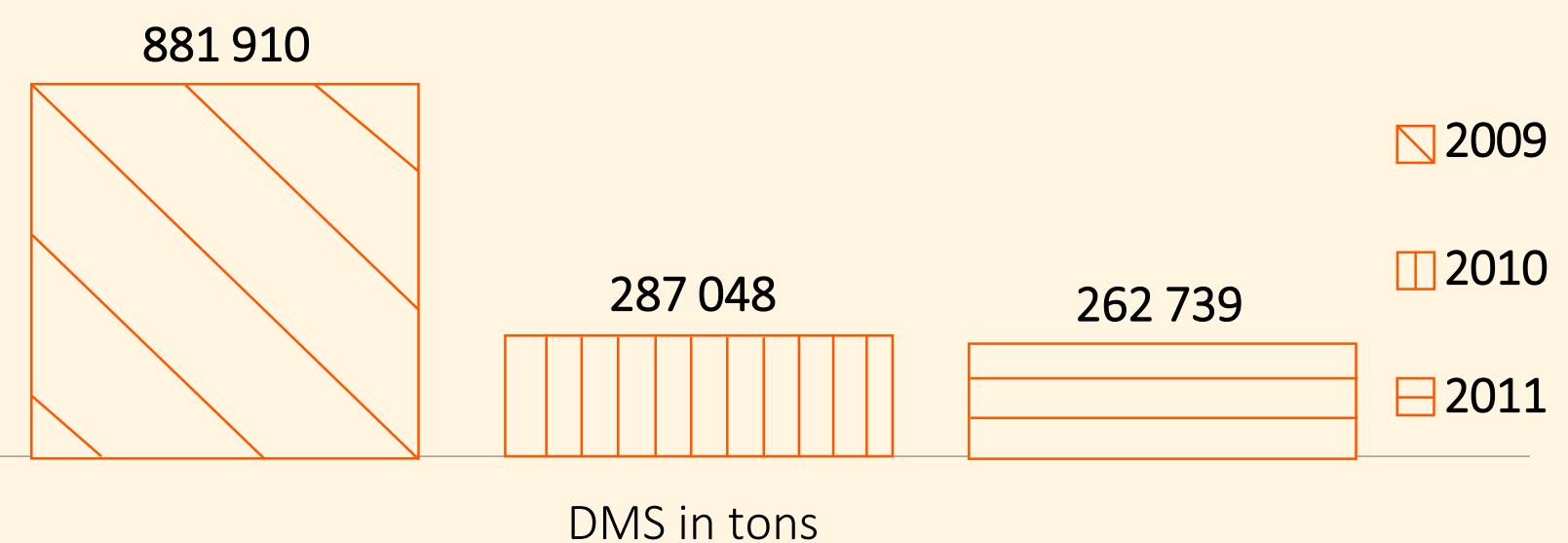
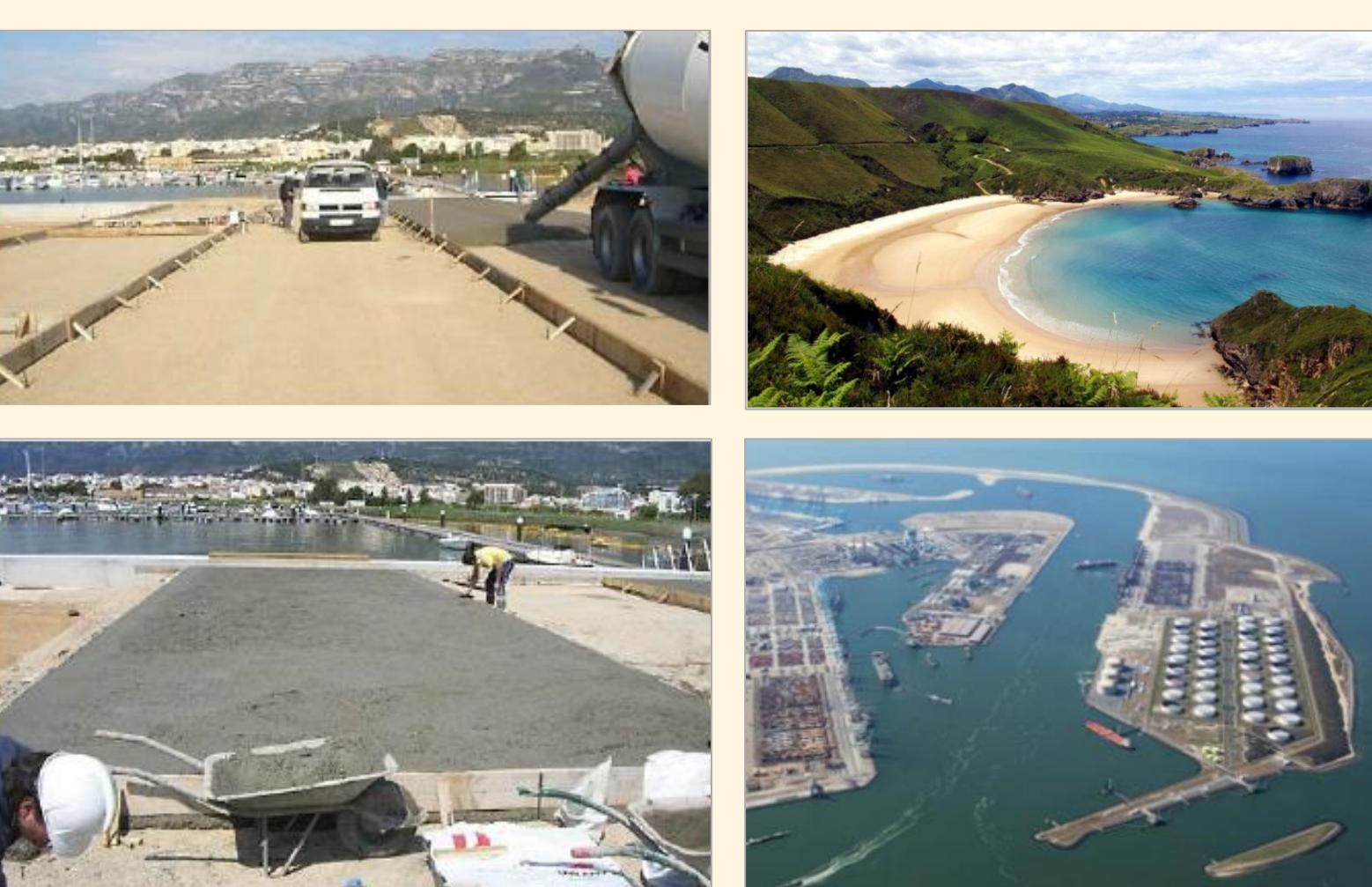


Fig. 1. Evolution of dry matter of sediments dredged - DMS - in France 2009-2011 [3]

Solution: reuse



Preparation: How to eliminate water?

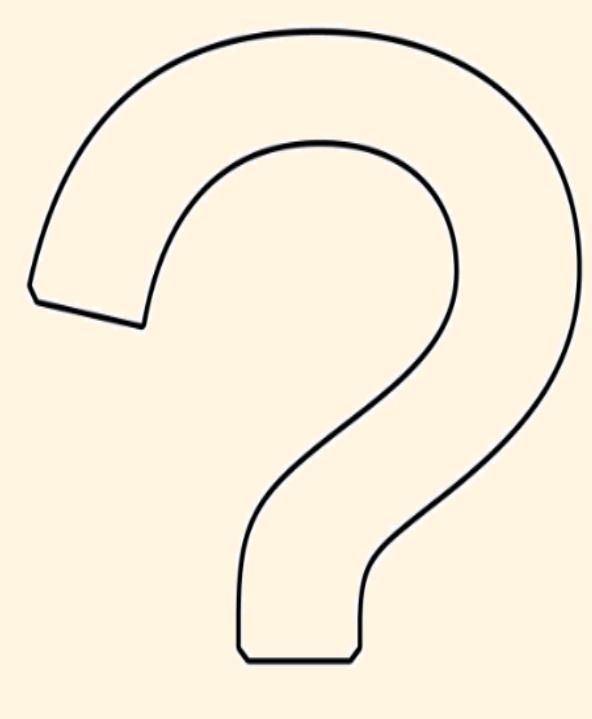
Dehydration

Evaporation
+ Drainage
Natural dehydration

Tests
Natural dehydration tests (NDT)

Drainage tests [1], [2]

Shrinkage tests [4], [5]



Materials

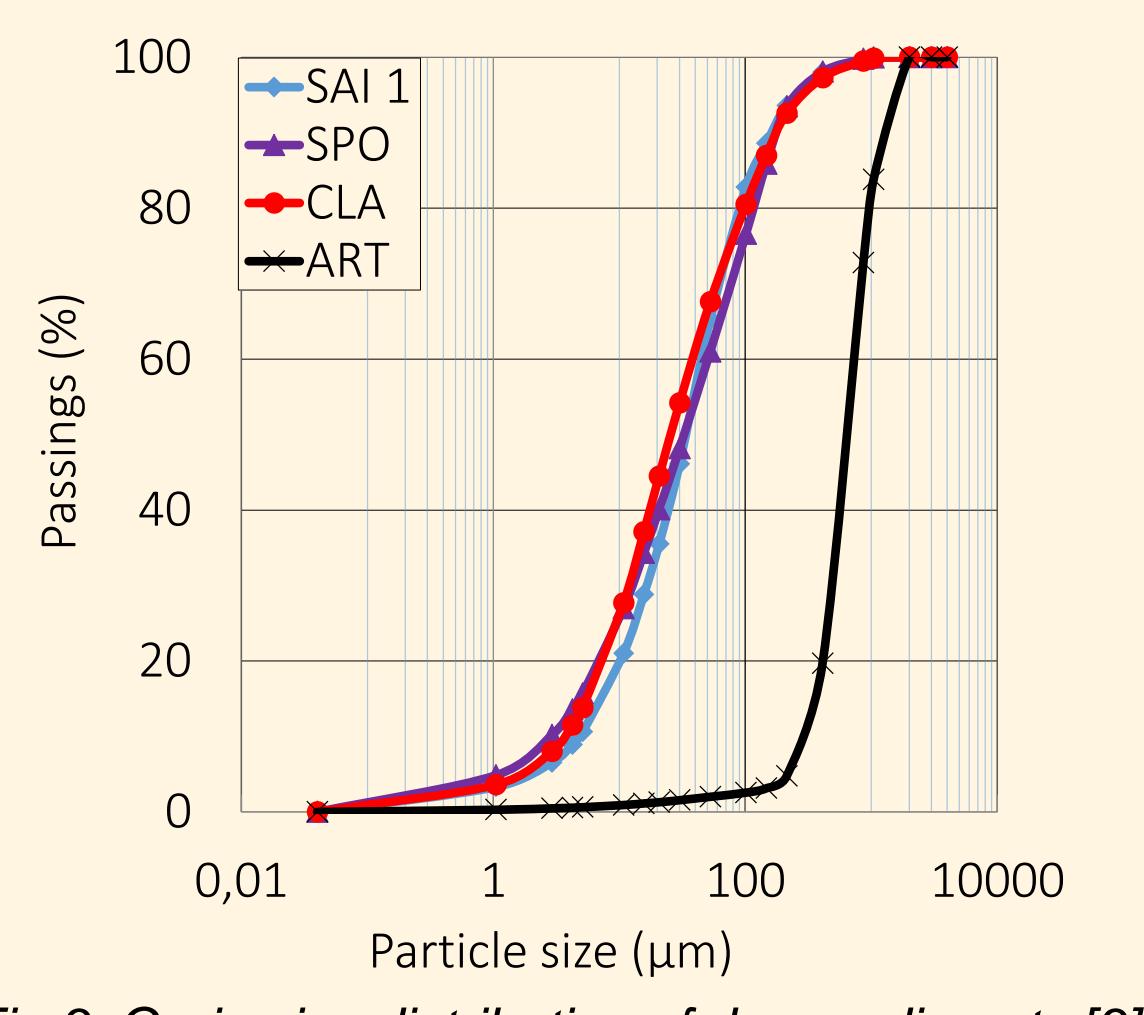
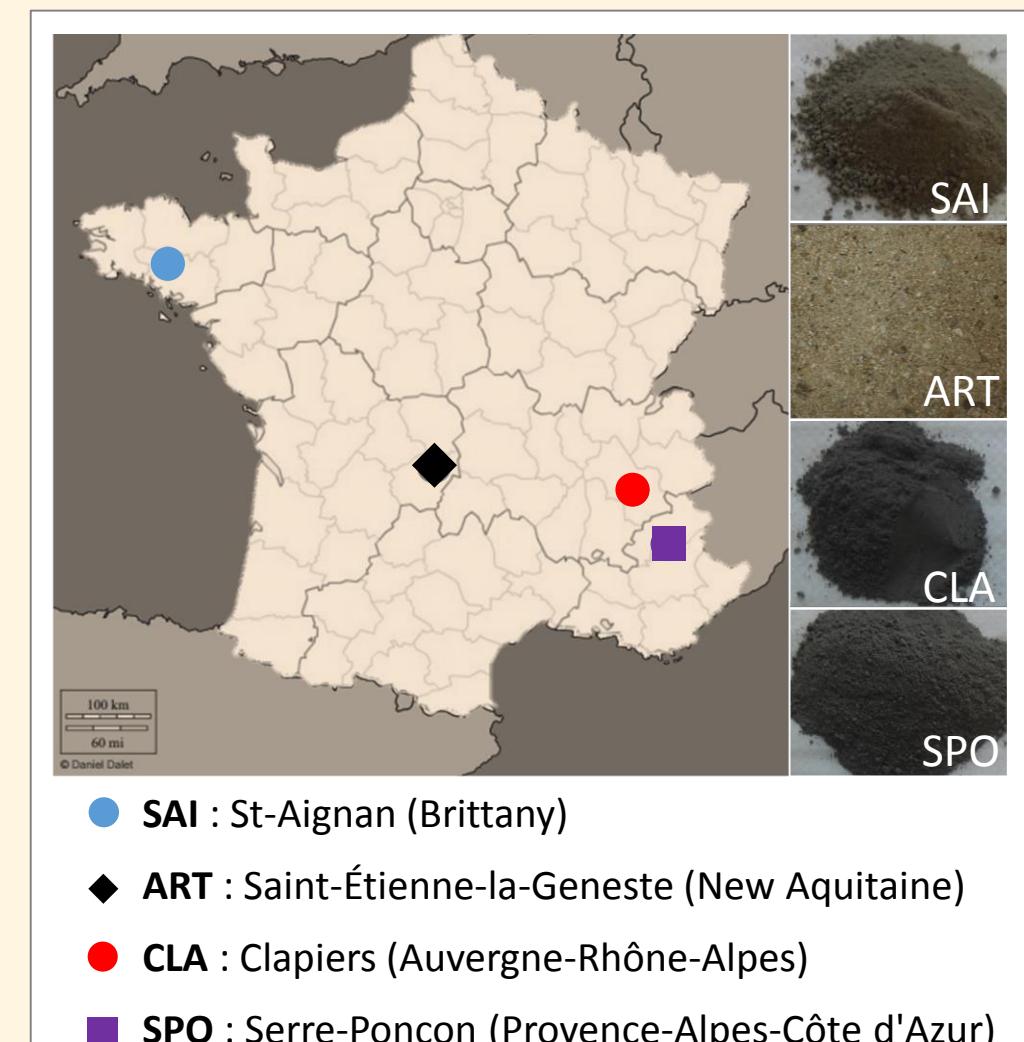


Fig. 3. Grain size distribution of dam sediments [3]

Fig. 2. Origin of dam sediments [1], [2]

Table 1 Chemo-physical characteristics of sediments

Parameters	SAI	ART	CLA	SPO
LL (%)	64.66	22.33	34.41	31.57
CaCO ₃ (%)	0.69	0.41	23.34	11.68
Organic matter(%)	6.61	0.80	1.26	1.51
Activity	2.08	-	1.84	0.45



Fig. 4. Experimental set-up [3]

Methods

Drainage tests

Objective

1. Water content in sediments samples $E1$
2. Drained water $E2$
3. Quantity of evaporated water $E3$
4. Velocity of water content decreasing

Description

Weighing measurements of sediment during drying process

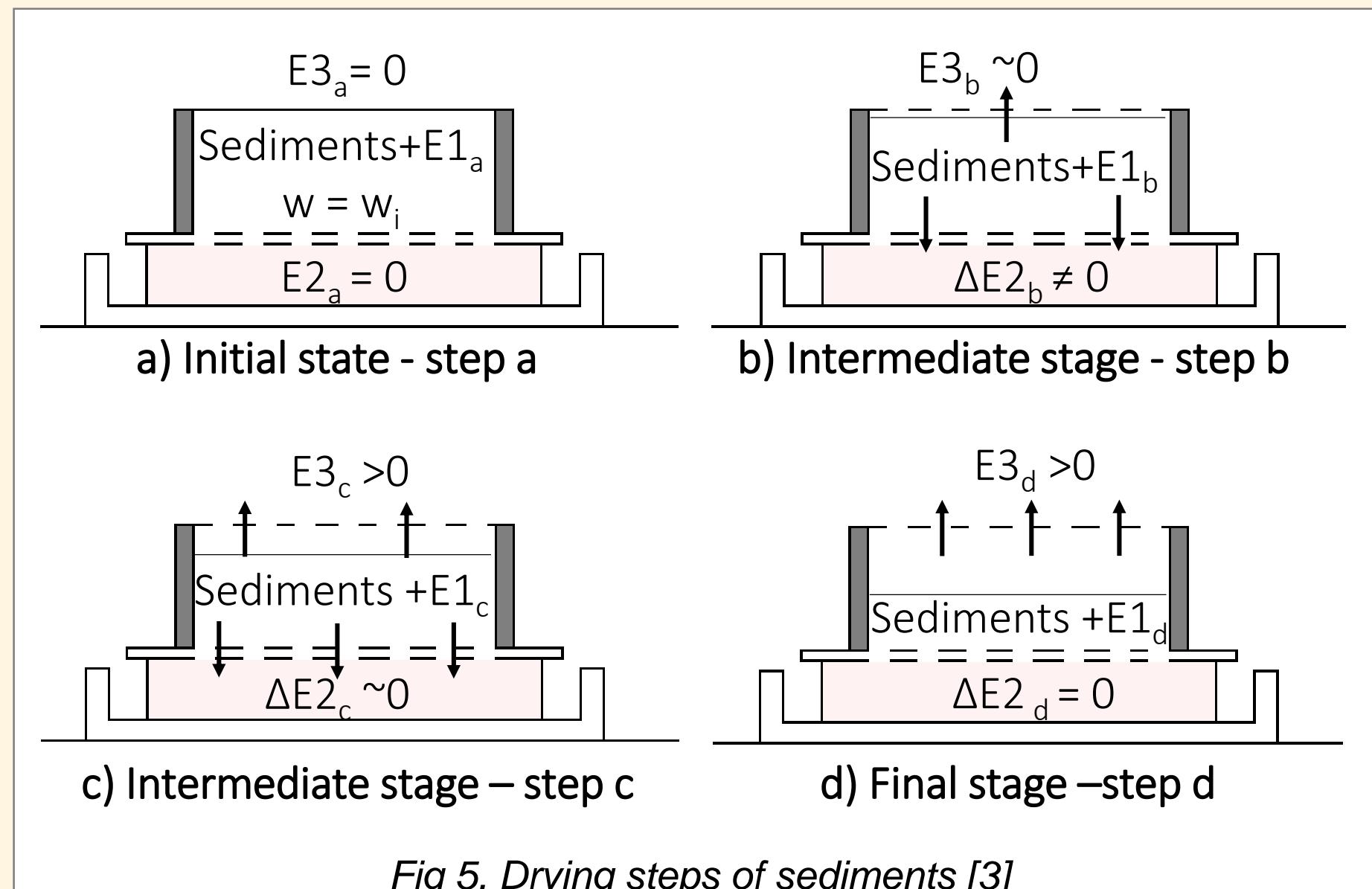


Fig. 5. Drying steps of sediments [3]

Procedure

1. Weighting materials of the sample
2. Preparing the mixture (sediments with the initial high water content w_0 (1.5 LL, 2LL and 2.5LL))
3. Filling oedometer ring with this mixture
4. Weight is stabilized) Total masse geotextile and ring filled masse
Porous stone and solid base masse
5. Placing samples in an oven at 60 °C for 48 hours → Dry mass of solid particles M_d [4], [5]

Shrinkage tests

Objective

Study of the shrinkage of samples

Definition of state parameters during NDT period → ϵ_a, w, e, S_r

Procedure

1. Measurements of sample dimensions from initial state to the end of experiments
2. Determination of variation of volume

Results

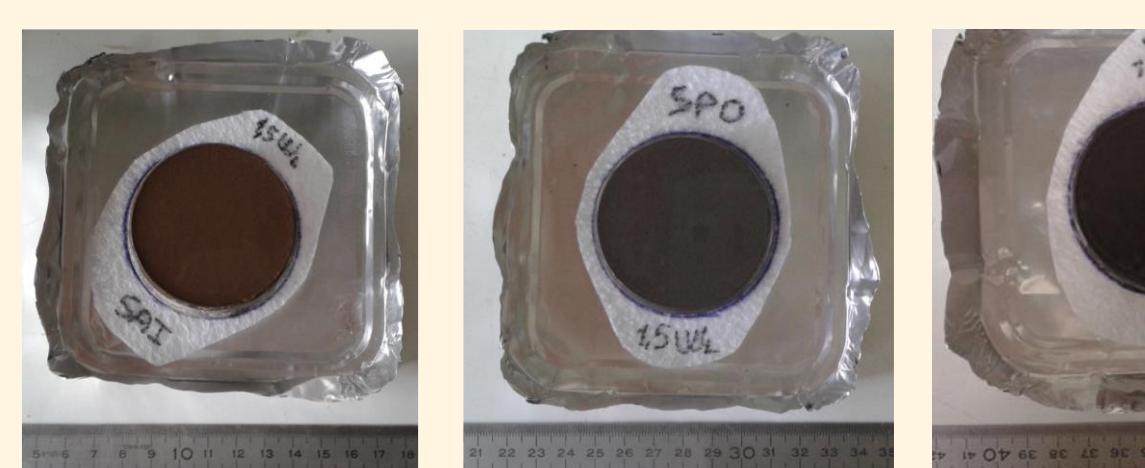


Fig. 7. Initial state

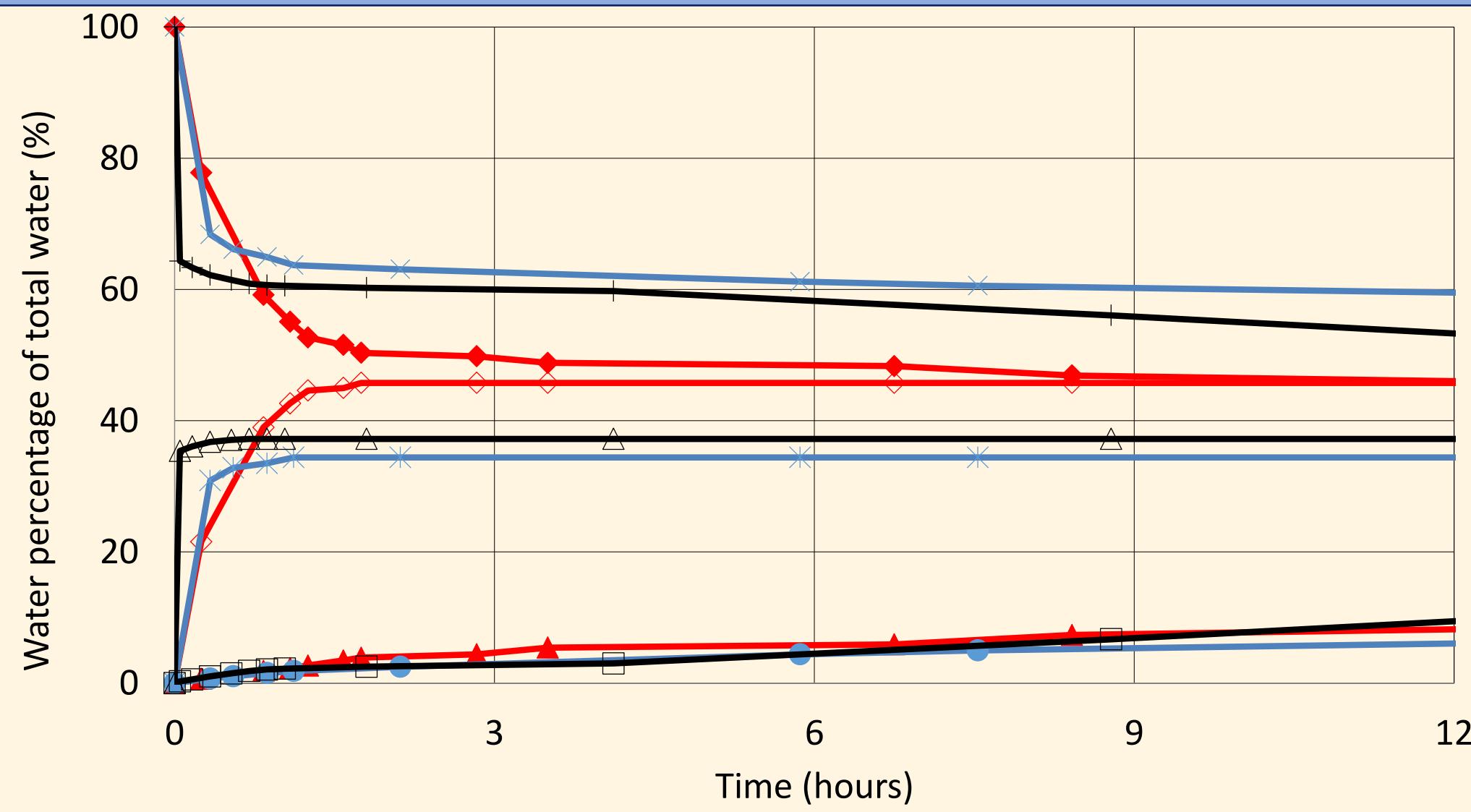


Fig. 8. Intermediate state

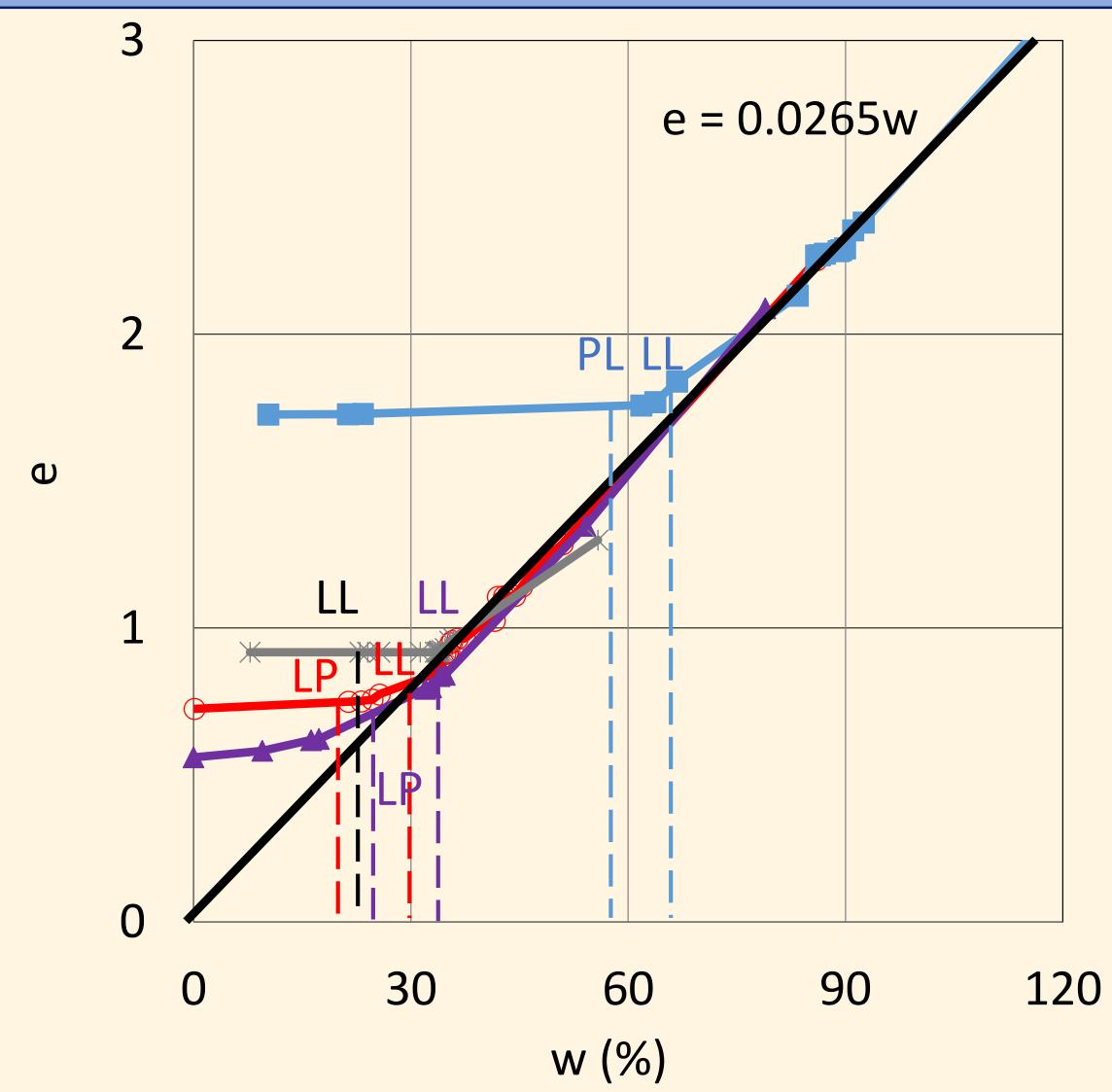


Fig. 9. Final state

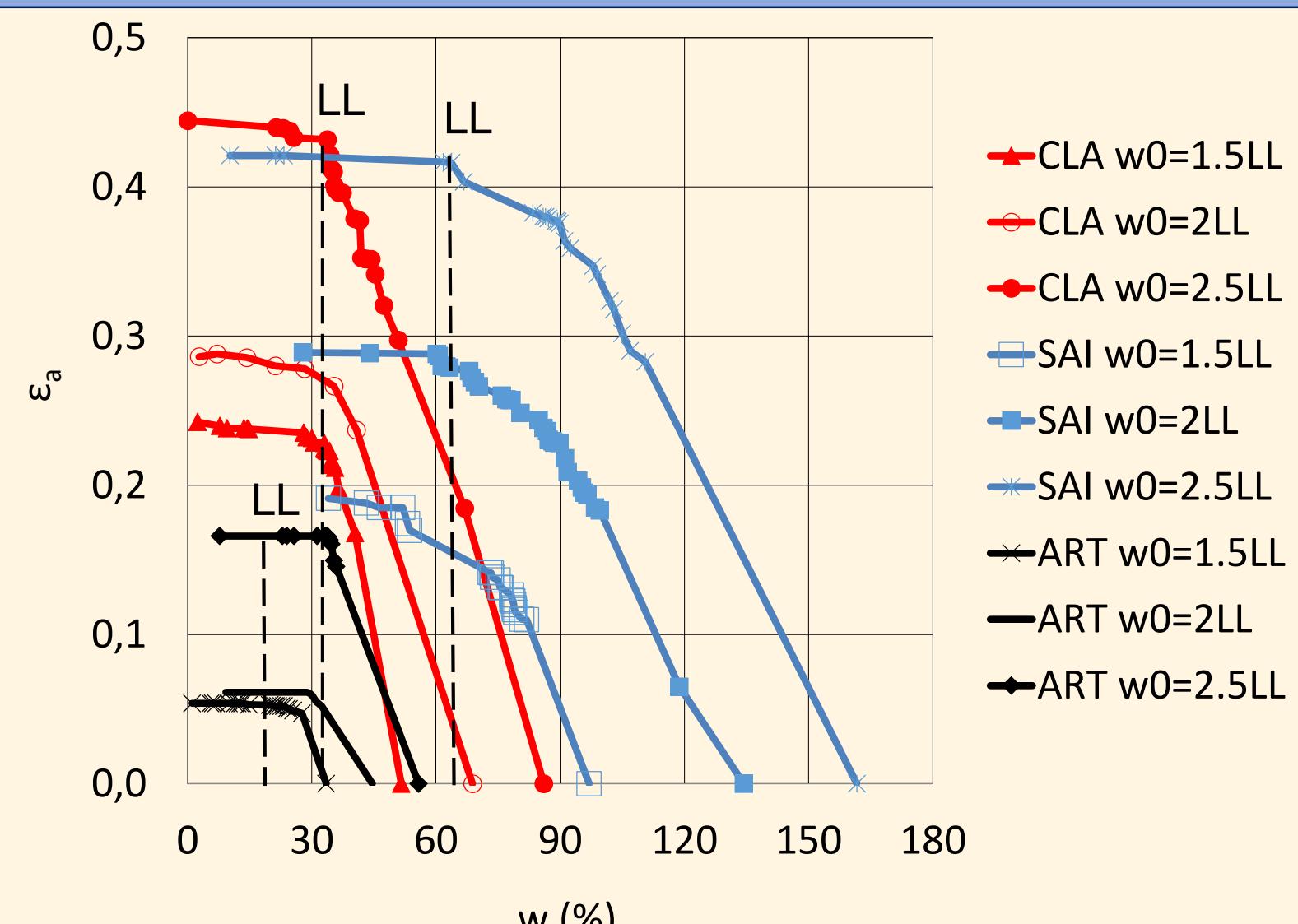
Water quantities evolution versus drying time. $w_0=2.5LL$



Water content w versus void ratio e . $w_0=2.5LL$



Axial deformation ϵ_a versus water content w



Conclusions and perspectives

- Points of inflection of $e-w$ curve correspond exactly to LL and LP values.
- Evaporation becomes more effective when drainage is stopped.
- Evaporation needs more time to dehydrate sediments due to capillary and adsorbed water.
- Different physical sediments properties → Not the same ability to dehydration → What are the main factors?
- Perspectives: Definitions of a natural dehydration ability criterion for sediments
What is the adequate moment to remove sediments for accelerating the dehydration?

References

- [1] Boullosa Allariz B. (2016). Caractérisation et déshydratation naturelle des sédiments. Report, N° 2, réf. N° M2C-COVASED-EDF-02. University of Normandy, Unicaen, 63 p.
- [2] Boullosa Allariz B. (2017). Sédiments de barrage en cours de séchage naturel. Étude phénoménologique. Suivi des paramètres d'état. M2C report, University of Normandy.37p.
- [3] El Fadili M., & Messager M. (2013). Enquête dragage 2011. Synthèse des données. Cerema – Cetme, 39p.
- [4] Serratrice J-F., (1995). Comportement d'une argile compactée. Bulletin LPC. Laboratoire Régional des Ponts et Chaussées d'Aix-en-Provence – 200-nov-déc 1995 Réf.4006, 13-23.
- [5] Serratrice J-F., (2015). Une représentation des courbes de retrait des sols argileux. SEC 2015 International Symposium 179-186.