Evaluation of the wall friction angle of dry volcanic materials from laboratory experiments

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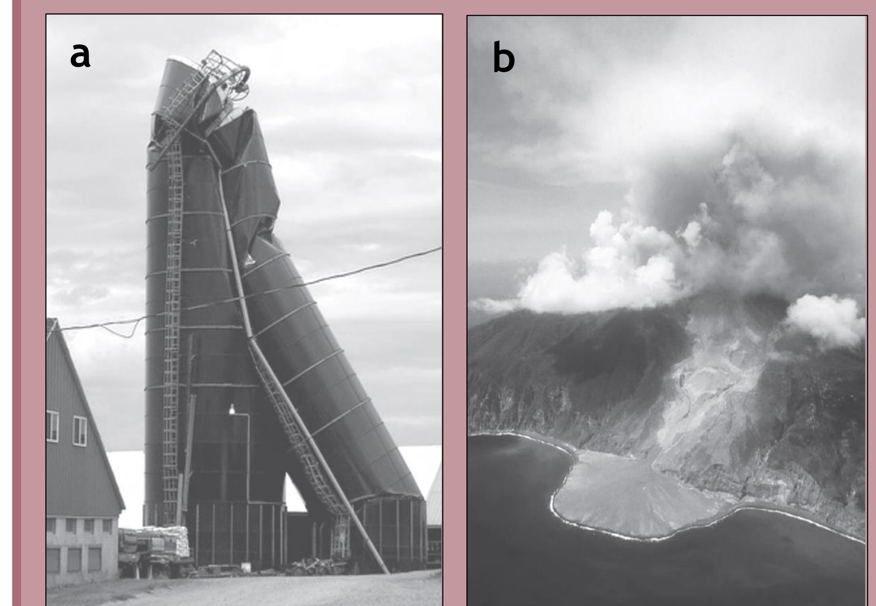
BGS British Geological Survey

1 - Background

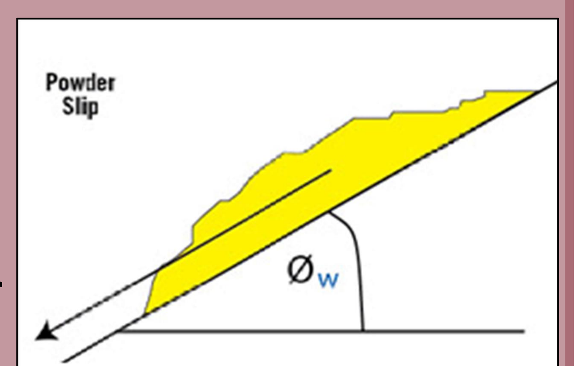
Granular materials are widely involved in industry, but also and in natural phenomena, like pyroclastic density currents and debris flows.



a) The collapse of a silo.

b) Pyroclastic flow at La Soufrière Hills Volcano, Montserrat Island (from Andreotti et al., 2013).

A challenging topic is the quantification of the frictional forces that develop between the granular flow and the wall surface in contact with it, like the substrate.



From: www.brookfieldengineering.com

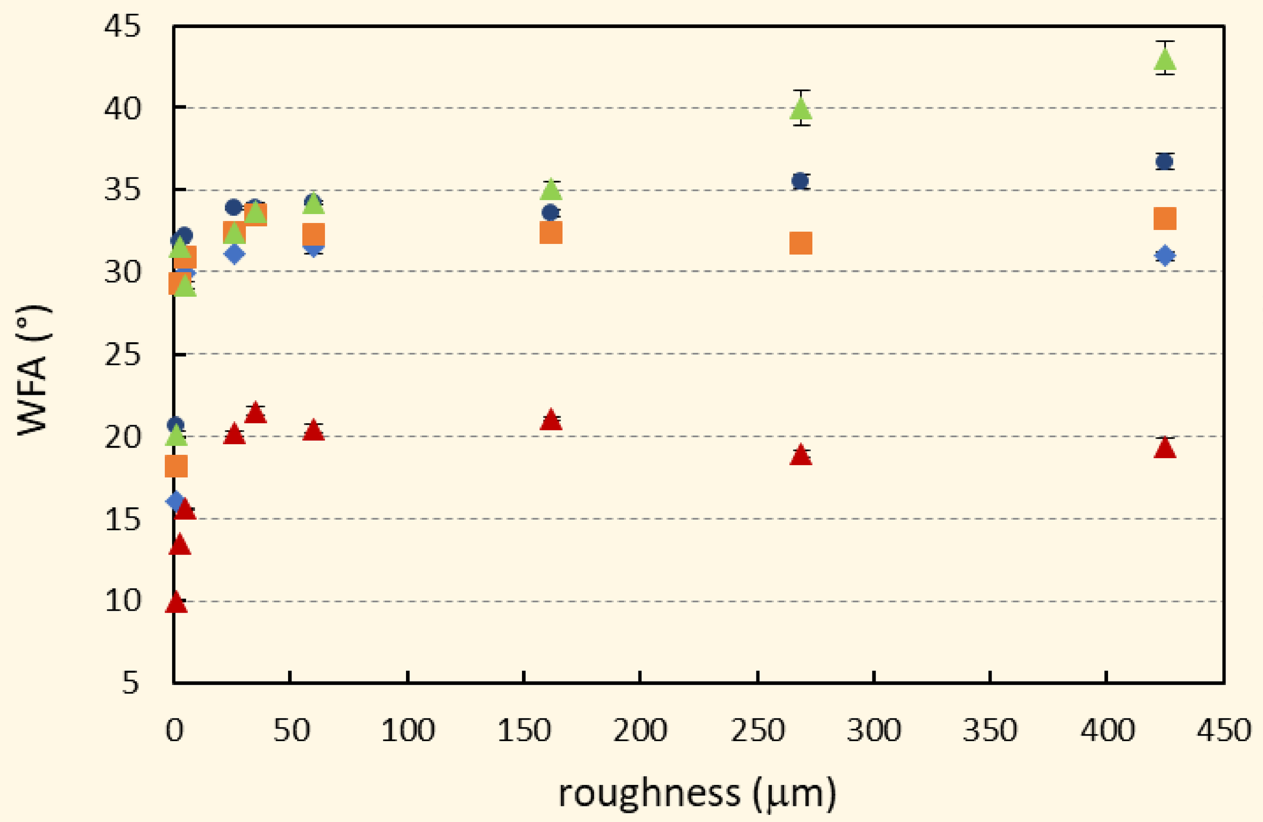
2 - Research challenges

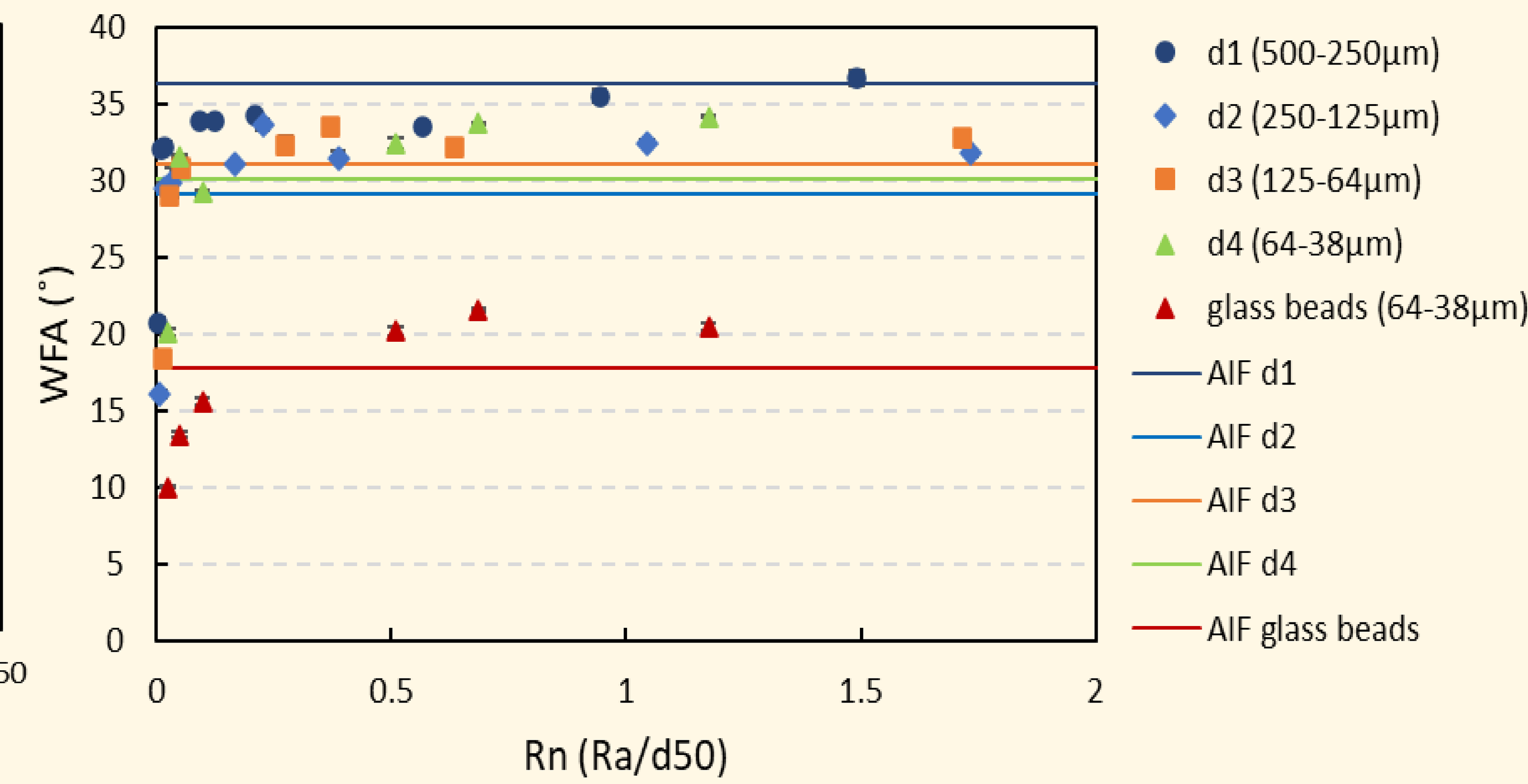
- Study the flow behaviour of volcanic particles on a rough surface.
- Use the generated experimental data to assess the effect of relative roughness on the shear strength.
- Characterise the bulk behaviour of volcanic material and eventually compare the results with the ones obtained with large-scale experiments.

4 - Results

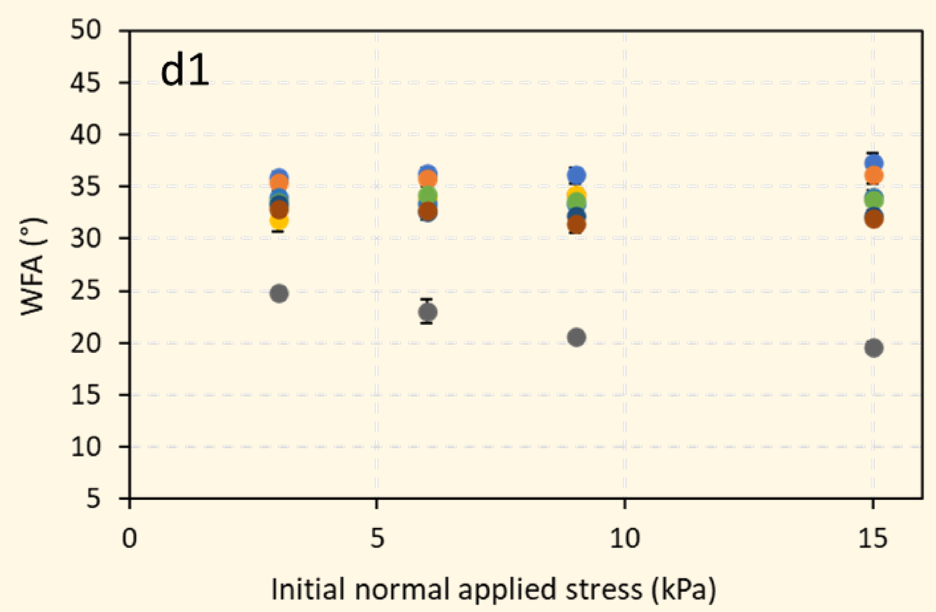
Left: relationship between wall friction angle and roughness.

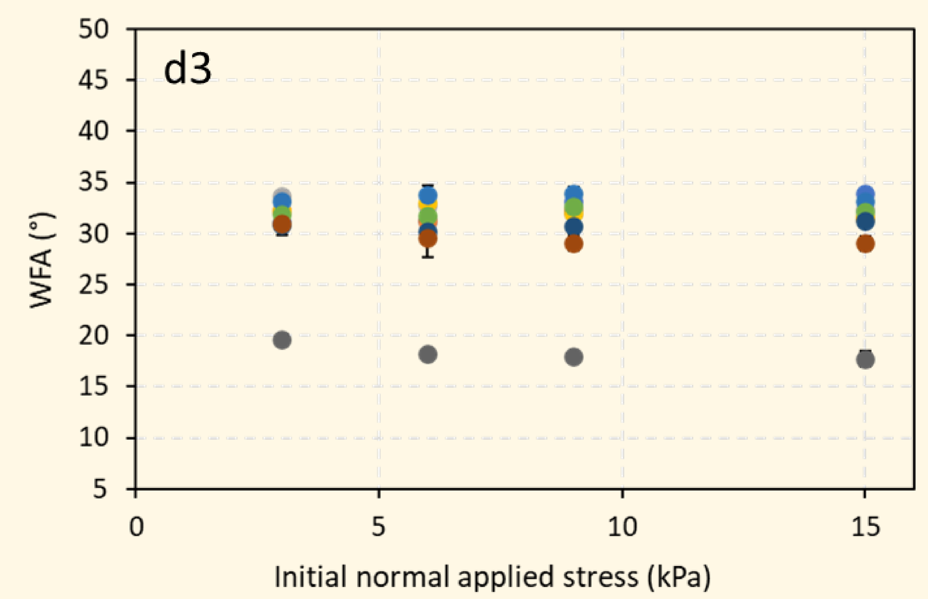
Right: relationship between wall friction angle and relative roughness Rn=Ra/d50.

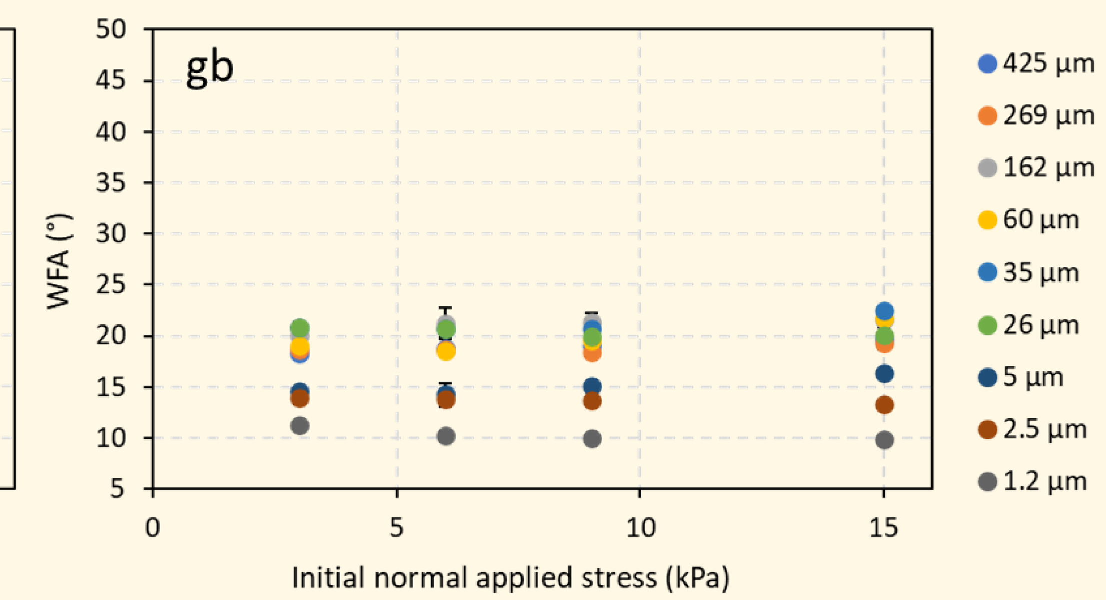


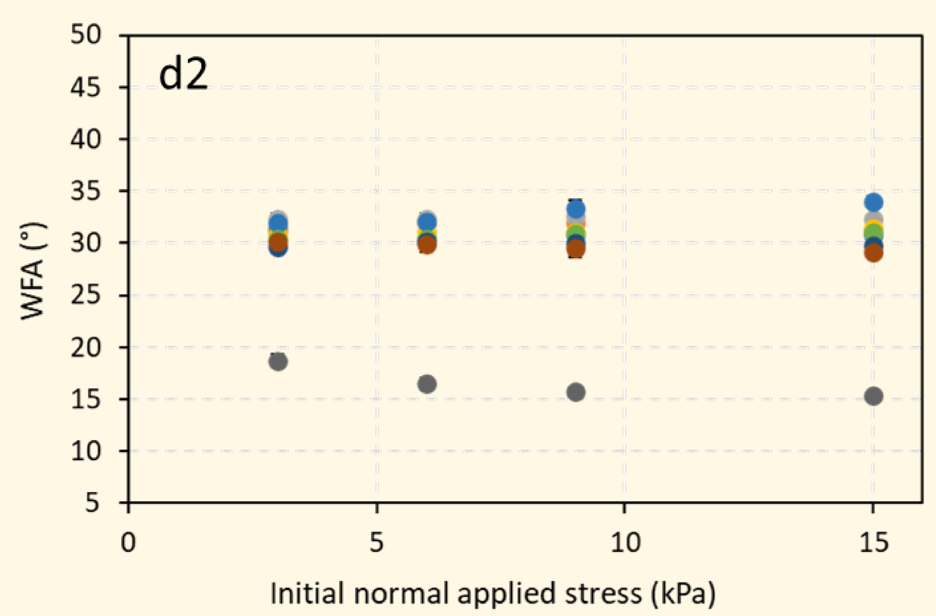


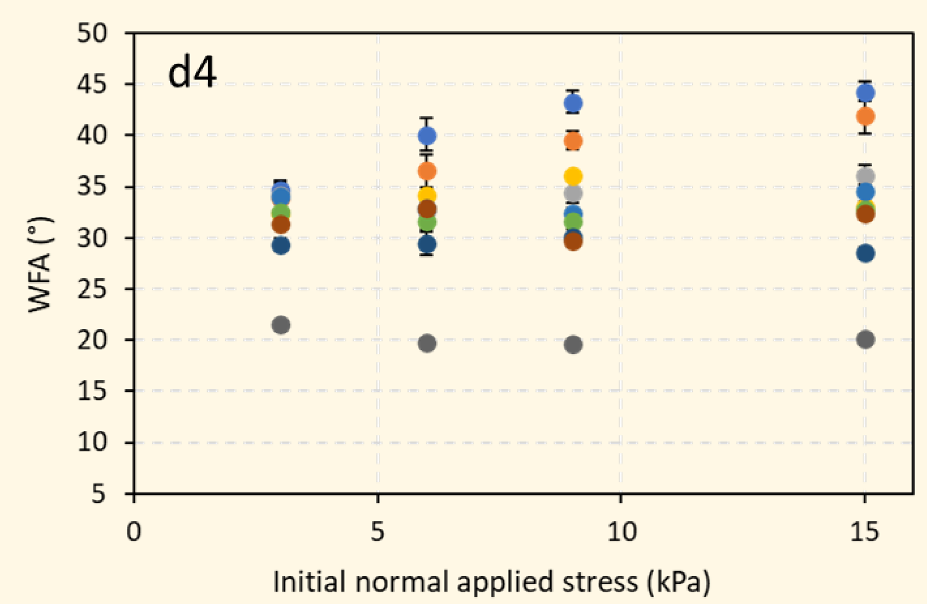
Relationship between wall friction angle, normal applied stress and roughness:



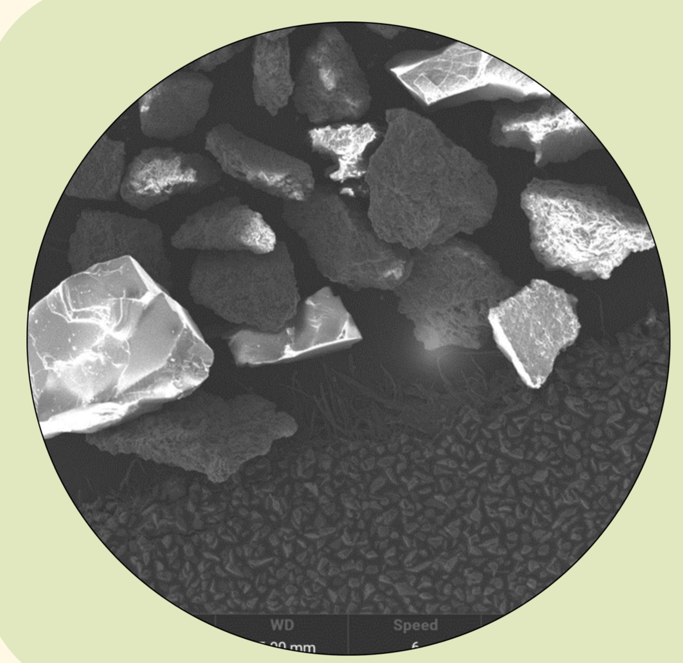






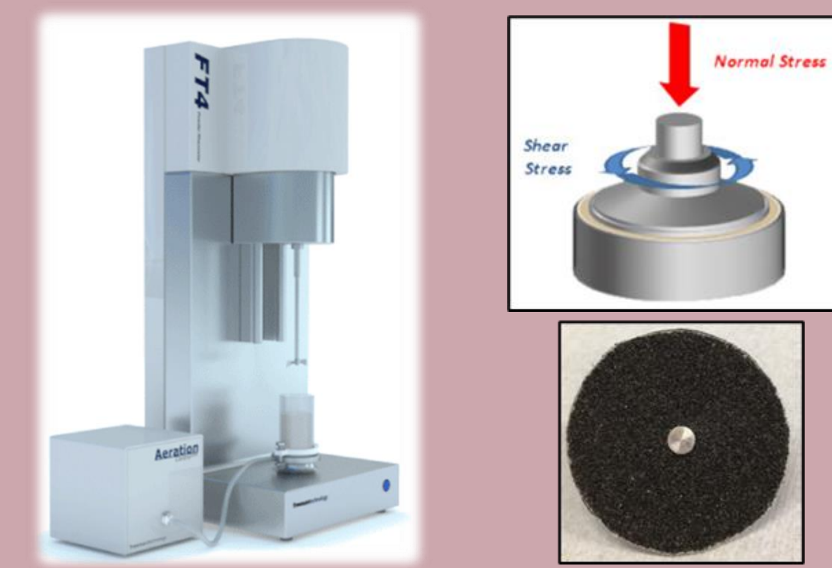


5 - Next steps

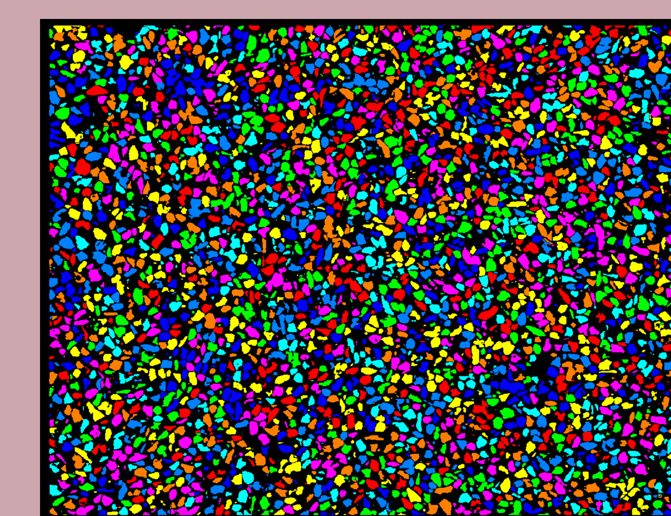


- Run numerical simulations using these values of wall friction angles.
- Define a critical value of wall friction angle based on the relative roughness.

3 - Methodology



The **FT4 Powder Rheometer** is used to measure the sliding friction between the samples of dacite and sandpaper of different roughness (as wall material).



Micro-CT scan: To quantify the grain size distribution and the shape of the particles.

Acknowledgements

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EGU Sharing is encouraged