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Experimental Investigation of Illite Clay in Norwegian Quick Clay for Sustainable Ground Stabilization

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Quick clay is a young geological clay formation and has been formed during the last glacial ice age. Due to the isomorphic substitutions in these phyllo-silicates, their flat surfaces are net negatively charged (1). The Na+ cations which come from the main salt in the marine environment (35g/L) is attracted by the negatively charged surface and neutralizes it. As a result, the particles have a thin diffuse double layer (DDL), leading to flocculation in a "House- of-cards"structure (2,3,4). Due to the isostatic rebound above sea level, fresh water can infuse into the marine deposits, causing salts to leach out. With the loss of cations, the Coulomb forces between the clay platelets increase and overcome the attractive van der Waals forces, and the structure becomes extremely sensitive (5,4). When this structure is disturbed, the clay formation turns into a low-viscosity fluid, and a catastrophic landslide occurs.

To stabilize quick clay, a deep mixing technology with lime and cement is used. Although this technology has been improved over the past decades, it still has a high carbon footprint.
To provide a more sustainable stabilization, our project "Sustainable Stable Ground"investigates the quick clay formation from an atomic scale and upscale to geological scale.

Here, our focus lies in examining the interaction between clay particles through experimental investigation of illite suspensions under different conditions, such as different ionic strength and adding various additives. For our experiments we are using the Tiller-Flotten quick clay from the area around Trondheim, Norway.
Our process involves purifying the clay from the natural ground and characterize the physical- chemical properties using diverse methods such as Scanning Electron Microscopy (SEM) and Elemental Analysis (EDS). With the objective of identifying potentially sustainable stabilizers, we create different suspensions with diverse (sustainable) additives, allowing for a long-term observation of the clay-rich ground.

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References

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