CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
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Project Number
J0803

Project Title
Salt and Subsidence

Abstract

Objectives/Goals
Subsidence has cost billions of dollars in structural damage to buildings,roadways, homes and economic loss in land use. Most devastating consequence of subsidence is that it is responsible for having residents relocate due to coastal erosion and flooding. Based on existing research by Ingles & Aitchson that salt is important component of soil mechanics and the petroleum industry's precedent to shore up the Long Beach harbor by injecting salt into oil bearing rocks.This project investigates whether salt's ionic properties will add stability to ground material's equilibrium and retard the effects of subsidence.

Methods/Materials
This project ran 40 trials of subjecting clay and soil to lateral compression to demonstrate the effects of pressure on ground material. Water was utilized as a transport method to introduce the salt to the two materials. The premise is that salt will act as a bonding agent in both clay and salt and exhibit lower compression compared to the trails without salt.

Results
The results of adding salt didn't meet my hypothesis. Clay mixed with salt water had the greatest compression possibly due to salt's lattice energy assisting clay in re-ordering itself and distributing the change in pressure. Adding water did lower the compression rates. Increasing the volume of material in a "dry state" showed the lowest compression. The USGS indicated that minimal water intrusion is necessary in the "dry state" to make the material pliable to counter pressure changes but to limit the water so there will not be a loss cohesion and cause erosion.

Conclusions/Discussion
While my results were unexpected, I was able to make the observation of whether covalent bonding is stronger than the ionic bonding within the salt/clay mixture. Clay with its high porosity/low permeability allowed it to adapt to various shapes for energy distribution.In the future, I would measure salt's ionization, utilize a vacuum apparatus to measure compression in psi and try different water levels that assist in the pressure stability without causing disequilibrium.

Summary Statement
Can salt's ionic bonding assist in stabilizing ground material's equilibrium and retard subsidence?

Help Received
interviews with the Kern Water Agency and USGS Wetland Reseach Center and my father building the sandbox