A Natural Solution to Sinkholes

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Sinkholes are a persistent problem throughout the world. Biomineralization is a large step forward in science and has been applied to restore cement structures, statues, etc. but has never been utilized to rehabilitate sinkholes, which are primarily composed of calcium carbonate. In this experiment, Bacillus subtilis, Bacillus megaterium, and Bacillus cereus were used for their ability to precipitate calcium carbonate crystals; these biomineralized crystals represent the reformation of limestone in the subsurface of land susceptible to sinkholes. Three counties, Marion, Lake, and Sumter, were sampled for sand depths of one foot, one and a half feet, and two feet. These sand samples were sprinkled in petri dishes with agar, cultured over a four week time period, and observed weekly to recognize any changes or growth in the sediment and crystals. Extensive soil testing was performed to understand the composition of each sand sample. The amount of air and calcium carbonate levels were determined and analyzed, in addition to the silt to clay to sand ratio in each sample using the soil triangle, as well as a twenty-step measurement and calculation process. Then, the petri dishes were plated with the bacteria and maintained in an incubator. In each sand sample and for each bacteria, all abnormalities or growths were recorded per week by the end of the experimentation. Through a slurry pump system application, Bacillus subtilis, Bacillus megaterium, and Bacillus cereus can be implemented into the ground in either susceptible land areas as a preventative method, or in pre-existing sinkholes to strengthen and stabilize them. This experiment provides a foundation for future research on biomineralization and its application to sinkhole reformation and prevention.

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