FLUORESCENT MICROSPHERES AS PROXIES FOR MICROORGANISM IN A DEEP SUBSEAFLOOR TRACER TRANSPORT EXPERIMENT

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ABSTRACT

There is growing evidence that the subseafloor biosphere extends throughout the immense volume of aging basement underlying the global system of mid-ocean ridge flanks and ocean basins. The umbrella Tracer Transport experiment will be conducted by injecting fluorescent microspheres into a borehole on the flank of Juan de Fuca Ridge and monitoring their arrival at all of the observation boreholes. Microsphere transport rates obtained from this experiment will provide a basis for evaluating the origin of microbes observed in 3.5 million year old sediment-buried basement. In this experiment, the fluorescent microspheres are used as proxies for microorganism. Colloid tracers such as fluorescent microspheres are used to characterize flow rates and preferred flow paths of groundwater, and to gain information about the subsurface transport of microbial pathogens, or other colloidal contaminants. The objective of my thesis is to study the compatibility of these microspheres to the ocean basement environment for the tracer transport experiment, by defining their detection limits within the context of deep basement environment by the detection methods available, studying the characteristics of the microspheres and studying the behavior of colloid tracers through a basalt core. From the detection limit experiment, the minimum concentration detected for the fluorescence microscopy method is 10 microspheres/ filter and for the flow cytometry method is 40 microspheres/ ml. The two methods yield very similar results. Microspheres also clump significantly at high concentrations. The size and fluorescence of the microspheres remain unaffected by light, salinity, temperature (4 to 60 ºC) or pressure (up to 80 bars).

The basalt core tested in this experiment did not have connectivity in a scale of cm to m, but in the ocean basement, there will be connectivity in a scale of 10s of m to 1000s of m.