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Microbial geochemical and tracer transport studies of ocean basement using ODP CORK observatories

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The sediment-buried ocean basement environment represents a vast, but largely unexplored chemosynthetic environment. Circulation Obviation Retrofit Kit (CORK) observatories affixed to Integrated Ocean Drilling Program (IODP) boreholes offer an unprecedented opportunity to study the biogeochemical properties, microbial diversity, and particle/solute transport in the circulating fluids within this deep environment. Recent developments in CORK designs have been implemented and recently tested; these include: 1) Dedicated microbiologicial/geochemical fluid delivery lines (FDL) using chemically inert PVDF to minimize chemical contamination and surface biofouling; 2) Development of a seafloor instrument sled for coupling to the CORK's bio-fluid delivery system for acquisition of real-time, *in situ* electrochemical (voltammetry) redox chemistry data on basement fluids, in addition to *in situ* particle filtration of basement fluids for molecular genetics, culturing and biogeochemical studies. Results of the first deployment of this instrument sled to a CORK observatory in Cascadia Basin, on the flanks of the Juan de Fuca Ridge, will be described.

Additionally, planning is underway for a (funded) three-dimensional, subseafloor cross-hole tracer transport study which will utilize a group of borehole CORK observatories (Cascadia Basin). The transport of injected dissolved and particulate tracers will be observed at spatial scales of meters to several kilometers and temporal scales of hours to years. The particulate tracers, fluorescent microbeads and stained deep ocean microorganisms, are intended as proxies for subseafloor microbes. The overall

hydrological, geochemical and microbiological context of the experiment, as well as the design and testing of optimal protocols for preparing fluorescent particles, will be described.