Using Geochemical Indicators to Distinguish High Biogeochemical Activity in Sediments

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Abstract. The relationship between subterranean microbial communities and the physical and chemical heterogeneity of the subsurface needs to be better quantified to understand and model biogeochemical reactions. This study develops a methodology to link microbial activity to subsurface physical and geochemical parameters including total organic carbon (TOC), iron and manganese, and bulk microbial DNA quantity. These characteristics are statistically clustered to identify consistent geochemical indicators which can be used to predict biological hot spots. Operationally defined hot spots can have an inordinate influence on the behavior of the entire system. The first use of this methodology was on an inactive floodplain in the anthropogenically-influenced Rifle, Colorado study site where thirty-three sediment samples were collected from eight drill cores. The second phase of the project tested the methodology in a headwater basin for the Colorado River, an actively meandering floodplain in the relatively undisturbed East River region of Colorado near Crested Butte. Soil and sediment samples were collected in transects across and down four meanders in the East River study site. Using results from both sites, the terminal electron acceptors displayed site-specific influence on microbial communities whereas TOC had a consistent relationship with microbial DNA. A quantitative study of the microbial communities at each site helped explain the discrepancy of metal influence. Applying the methodology to both an inactive, anthropogenically-influenced floodplain and an active meandering headwater basin demonstrates the broad applicability of a geochemical indicator based approach.