

Influence of soil geochemistry on microbial community structure in a Northern California watershed

JOANN M. HOLLOWAY^{1*}, KATE. M. SCOW² AND MARTIN B. GOLDHABER¹

¹U.S. Geological Survey, Denver, CO 80225, USA

(*correspondence: jholloway@usgs.gov)

²University of California, Davis, CA 95616, USA

In this study, the relationship between soil parent lithology, microbial biomass and community structure was explored in soils from a small watershed impacted by historic mercury mining. Stream sediment entering the Davis Creek reservoir is derived from serpentinite, siltstone, volcanic rocks and mineralized serpentine that includes cinnabar, metacinnabar and other Hg minerals. Upland soils and riparian alluvial soils were collected and analyzed for major and trace elements, methyl-Hg, and PLFAs. Soils from different parent materials have distinct PLFA biomass and community structures that are related soil chemistry, including Ca/Mg ratios, toxicity effects of Ni and Cr from serpentinite and nutrient (e.g., organic C, N, S) concentrations. Serpentine soils in this catchment have a greater PLFA biomass (7-42 nmol) than do siltstone soils (2-21 nmol), and PLFA biomarkers (e.g., 18:2w6c, 18:1w9c) for fungi that are absent in the siltstone soils are present in the B-horizon of the serpentine soils. Regional PLFA data suggest that these PLFA biomasses are anomalously low, and that the absence of fungi from the siltstone soil is unusual. Methylation of Hg is closely tied to sulfate-reducing bacteria, including *Desulfobacter*. The greatest concentrations of methyl-Hg (>0.5 ng g⁻¹) were found in association with alluvial soils and a volcanic parent soil (9-37 ug Hg g⁻¹). Although mineralized serpentine soils had much greater Hg concentrations (>50 ug g⁻¹), methyl-Hg concentrations were <0.3 ng g⁻¹. Biomass and PLFA biomarkers for *Desulfobacter* (10Me16:0) were greater in the alluvial and volcanic soils relative to the mineralized serpentine, thus the greater methyl-Hg concentrations. The combination of geochemical, microbial and soils perspectives enhances the understanding of processes such as methylation within a watershed.

Phosphorylation underneath the ocean floor?

NILS G. HOLM

Department of Geology and Geochemistry, Stockholm University, Stockholm, Sweden

The formose reaction has been outdated for abiotic synthesis of carbohydrates for a while. However, it is still possible that it is responsible for prebiotic formation of ribose in natural environments and that this may occur in close vicinity to purine synthesis and phosphorylation processes in hydrothermal environments of convergent margins. The potential of pyrophosphate formation upon heating of hydrogenated orthophosphates to a few hundred °C in geological environments where the activity of water is low has probably been underestimated. Once pyrophosphate is available, phosphorylation of ribose and/or nucleosides may occur. The ribose molecule may be stabilized by borate that binds to the 2' and 3' positions of ribose. The reason is that boron is an element that has a strong affinity for organic material since it forms trigonal and tetrahedral complexes with oxygen groups. For instance, boric acid and borate readily form complexes with a wide variety of sugars - pentoses such as ribose, in particular - and other compounds containing cis-hydroxyl groups like humic substances. The fact that ribose is stabilized by borate may change our opinion of the formose reaction as a seemingly random and nonselective reaction into a very precise geochemical pre-RNA process.