Methylmercury Formed in Groundwater

Methylmercury (MeHg) is one of the most toxic and persistent substances in the environment. Research has focused on how MeHg forms from inorganic mercury deposited from atmospheric sources such as coal combustion. A UW study conducted at the Allequash Creek watershed in northern Wisconsin determined that anoxic zones in shallow groundwater are an important site of MeHg formation (Stoor, et al., 2002).

Further study showed that MeHg concentrations in these hyporheic (shallow zone) pore waters co-vary with the mercury methylation rate at depth (Meyer, et al., 2005). This suggests that the measured MeHg concentrations are likely produced in situ, and are not from legacy sources. Methylation rates in the hyporheic zone of the peat bog are generally higher than those of the headwater springs – which is consistent with previous observations of increased wetland export of MeHg (Armstrong, et al., 2006).

Additional work also showed that methylation rates were not controlled by the total mercury concentration in pore waters (Creswell, et al., 2008). Instead, high concentrations of strong mercury- binding ligands have been observed and are believed to influence methylation rates by one of several possible mechanisms (Creswell, et al., 2010). Research examines the leading mechanism by determining the role of neutral sulfide complexes on methylation in Allequash groundwater (Shafer 2011).

This information advances our understanding of mercury transport and methylation in groundwater, and will help us interpret the watershed response to changing conditions in the hyporheic zone. For example, due to the lack of correlation between total mercury and the methylation rate in pore water, the mitigation of atmospheric mercury inputs to the watershed, may not immediately affect MeHg export.

In addition, any variation in groundwater levels, whether due to climate change or conjunctive use of groundwater and surface waters, will likely influence MeHg production in both natural and engineered wetlands.

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