Understanding the Transformations of Nitrate in the Turkey Creek Basin of Colorado

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Abstract. The process of bacterially mediated denitrification results in the conversion of nitrate into nitrogen gas and small quantities of nitrous oxide. Although nitrous oxide is a greenhouse gas, this overall process is favorable for the health of aquatic organisms due to the fact that high levels of nitrate in surface waters are associated with eutrophication. In the Turkey Creek watershed, located southwest of Denver in the mountains, chemical evidence suggests that microbial denitrification may be an important mechanism in removing nitrate from ground water before it enters streams. Our data indicate that the concentrations of nitrate in surface waters are anomalously low relative to those levels encountered in ground water. Because this trend is observed when nitrate is normalized to chloride and other conservative ions, the phenomenon of lower nitrate concentrations in surface waters is not the result of dilution.

In order to understand the extent to which denitrification is responsible for the removal of nitrate in the Turkey Creek basin, $\delta^{18}O$ and $\delta^{15}N$ values in nitrate collected from various domestic well and surface water samples will be measured using isotope ratio mass spectrometry (IRMS). Enriched values for $\delta^{18}O$ and $\delta^{15}N$ above +20‰ are indicative of microbial denitrification. A further goal of our study involves understanding the specific mechanisms by which denitrification may be proceeding. Previous research on denitrification has indicated that this process tends to occur within the upper meter of soil and in association with riparian zones, where higher levels of organic carbon are found. However, several other studies have suggested that pyrite in the ground may act as an electron donor for the process of denitrification deep in the ground. Correlations of stable isotope values in nitrate with depth and lateral distance from the stream will yield a greater understanding of the processes that are responsible for denitrification in the Turkey Creek basin.