Conversion of nitrate to dissolved organic nitrogen in stream water through serpentinite bedrock in a forested watershed

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The concentration of NO$_3^-$ in stream water has been elevated in forested watersheds due to chronic atmospheric nitrogen (N) deposition over the last few decades. N saturation in forested ecosystems, defined as an excess of N deposition supply over biotic demand, results in significant N leaching from forested watersheds. Recent studies, however, indicated that chronic high N deposition has had variable effects on stream water NO$_3^-$ concentrations across the northeastern United States. This is because many factors affect NO$_3^-$ leaching from forested watershed.

In this study, to test the hypothesis that passing groundwater through different bedrock causes a marked difference in the nitrate (NO$_3^-$) concentration in baseflow stream water, two nearly adjacent watersheds, site O (serpentinite and chlorite schist: NO$_3^-$ 55 micro mol L$^{-1}$) and site S (amphibolite: NO$_3^-$ 113 micro mol L$^{-1}$), were investigated and the underlying mechanism affecting NO$_3^-$ concentration as groundwater passes through bedrock was identified. The conversion of NO$_3^-$ to dissolved organic nitrogen (DON) in groundwater as it passes through bedrock could be the primary reason for the lowered NO$_3^-$ concentration at site O. Plausible mechanisms could be NO$_3^-$ reduction to nitrite (NO$_2^-$) by reduced metals, such as iron, chromium, and nickel found in serpentinite bedrock and the subsequent reaction of NO$_2^-$ with dissolved organic matter to produce DON. The results from this initial study showed that certain bedrocks can reduce NO$_3^-$ concentrations in stream water by converting groundwater NO$_3^-$ to DON.

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