Acidic Bog Drainage and Limestone Dissolution, Mammoth Cave National Park

Jeff Timmons
Chris Groves
Center for Cave and Karst Studies
Department of Geography and Geology
Western Kentucky University
Bowling Green Kentucky

Joe Meiman
Division of Science and Resource Management
Mammoth Cave National Park
Mammoth Cave, Kentucky

Abstract

Stagnant ponds or bogs produce abundant amounts of humic material and organic acids. Organic acids are also produced on forest floors and by simpler organisms such as bacteria or lichens, thus accumulating in the upper horizon of the soil. The potential impact of these species on karst landscape development has received relatively little study. Organic acids have been found to promote mineral dissolution via two mechanisms, acidification and metal complex formation. In most natural settings, carbonic acid will be the predominant proton donor. The ability to form multifunctional complexes with cations, in addition to their acidic properties alone, allows these compounds to be effective at mineral dissolution.

Two small catchments in similar geologic settings within Mammoth Cave National Park are being examined to study the phenomenon. One of these drainage areas contains a large bog with abundant organic matter and a pH of that has been measured below four. The control stream does not contain bog vegetation and typically has more circumneutral pH levels. An approach combining geochemical modeling with limestone tablet weight loss methods is underway to determine the effect of these organic acids on limestone dissolution and thus potentially on landscape development. Preliminary results indicate significant differences in the geochemistry of the two streams. Conductivity measurements in the bog stream (often microSiemens) are as low as any surface or groundwaters that we know of recorded in the Mammoth Cave area.