Vietnam’s tropical karst is a sink for atmospheric methane greenhouse gas

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The atmospheric concentration of the potent greenhouse gas methane (CH₄) is globally rising mainly due to anthropogenic activities. Forecasting of global climate change by models requires knowledge of sources and sinks of greenhouse gas species. A mostly overlooked sink of CH₄ is the microbial oxidation in subterranean environments following air exchange with the atmosphere. Northern Vietnam’s vast carbonate province with deeply incised tower karst valleys offers exposure of abundant air-filled voids (i.e. caves and other porosity). Air exchange is enhanced by steep topography (hence large surface area of carbonate exposure) and limited soil cover. Our international team used portable methane detectors (SARAD® RTM 2200, SARAD® GmbH, Germany, with Axetris methane module; Gasmet DX-4030 FTIR, Gasmet Technologies Oy, Finland) and mesocosm experiments in caves to confirm strong methanotrophic depletion of CH₄ over 12 hours in contact with moist cave rocks. The warm and moist climate should maintain strong methanotrophic activity throughout the year. The methanotrophic capacity of a cave depends on its air exchange rate and the abundance of suitable microbial habitats. The exchange of cave air with outside air is enhanced by thermal gradients and outside wind. ‘Warm season’ measurements along transects in numerous caves in May 2012 produced distinct CH₄ concentration profiles. Complementary ‘cold season’ measurements in November/December 2015 will complete the basis to estimate the year-round methanotrophic activities in surveyed caves, and by extrapolation will arrive at a regional estimate of the rate of methanotrophy in northern Vietnamese karst.

Biography

Arndt Schimmelmann completed his PhD in Geochemistry in 1985 at the University of California at Los Angeles, was a Post-doctoral researcher at Scripps Institution of Oceanography in California, USA, and is now a Senior Scientist in the Department of Geological Sciences at Indiana University in Indiana, USA. He has published more than 100 peer-reviewed papers.

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