Plant impoundments as habitats for methanogenesis in tropical rainforest canopies

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Tropical epiphytes within the family Bromeliaceae possess foliage arranged in compact rosettes capable of retaining water. This creates an unusual environment suspended in the rainforest canopy; acidic and anaerobic, with decomposition of impounded material. Archaeal communities within the tanks were dominated by methanogens (~90% of archaeal ribotypes) and community structure, although variable, was generally dominated by the hydrogenotropic *Methanoregula*, with *Methanocella*, a specific clade of the acetoclastic *Methanosaeta*, rice cluster II, and *Methanosarcina* also present. Close relatives were recovered previously from peat bog, acidic fens, and anoxic rice fields, all areas of similarly high organic content and low pH. All tanks (n = 63, comprised of 6 plant species, sampled over a two year period) showed presence of methanogens, as long as they exceeded ~22 cm in plant height or ~7 cm tank depth. Soil was negative for methanogens (n=8), except in one case, in which the dominant methanogen, related to *Methanosarcina*, was different from nearby bromeliads. Archaeal methyl coenzyme M reductase A copy numbers correlated with both plant height and light levels, suggesting that these environmental parameters affect conditions for methanogenesis. Methane-specific isotopes ranged from -45 to -63‰, and direct methane production rates, comparable to emissions measured for pasture and peat bogs, were measured in microcosm experiments. These results suggest that bromeliad-associated archaeal communities may play an important role in the cycling of carbon in tropical forests.

Osmium isotopic tracing of atmospheric emissions from an aluminum smelter

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In this study, we use osmium (Os) isotopes as a tracer of the environmental footprint of an aluminum smelter in Saguenay (Canada). This prebaked technology smelter transforms alumina (extracted from bauxite) in primary aluminum via carbon anodes. These latter are almost entirely consumed during the electrolytic process and are emitted as CO2 when reducing Al_2O_3 to Al(l). Such large gas emissions entrain inevitably some particulate matter (dust) at the stacks, despite gas and dust scrubbers demonstrate a more than 99.5% efficiency.

Heavy metals found in atmospheric emissions from this type of industry may have an isotopic composition significantly different from the local natural environment. The results of isotopic analysis of a sample of anode have revealed the presence of very radiogenic Os ($^{187}Os/^{188}Os = 2.393 \pm 0.005$) compared to typical eroding continental crust (~1.2) and to usual anthropogenic sources (0.1-0.2). This suggested that Os might be a good candidate to follow a smelter's environmental impact. The main objective of this study is to determine the isotopic composition of real emissions from an aluminum smelter for metals of geochemical interest (variable isotopic composition) and compare them with the natural surrounding environment.

During this meeting, we present Os results for a wide range of analyzed samples: carbonaceous material (anode); filters of emissions from the plant; samples of soils and sediment collected in the surrounding environment of the plant; and sedimentary sequence including pre-anthropogenic levels to characterize the natural background.