Time series of elemental carbon concentrations at Alert, Canada

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Introduction

There is significant interest in the concentration of elemental carbon in the Arctic ambient aerosol because of its potential climatic effect in reducing the albedo of the snow cap. Ambient particulate matter samples have been collected at Alert, Nanuvut, Canada (latitude 82.3" N, longitude 62.5" W) since 1980 by Environment Canada. In 1989, they began making hourly black carbon mearusrements using an aethalometer [1] and the time series of these data are presented in Figure 1.

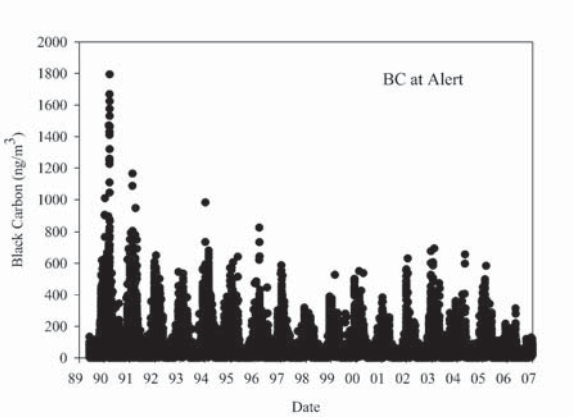

Figure 1. Environment Canada data for light absorbing carbon measured at Alert with an Aethalometer.

Methods

High volume samples have been collected on 20 x 25 cm Whatman 41 filters for 7 day periods. These filters were then cut into strips and we are analyzing one of these strips. The analysis follows the procedures developed by Husain et al.[2]. The filter material is dissolved in a concentrated $ZnCl_2$ solution. The elemental carbon particles are then collected on a baked quartz filter and the carbon determined using a Sunset carbon analyzer implementing the NIOSH protocol for organic and elemental carbon [3]).

Results and Conclusions

We will report the EC concentrations in almost 400 samples begiing with 1980 that we have analyzed. Thus, we will present the results in terms of the trends observed over the full 30 years spanned by these samples as well as fill in some of the gaps when the aethalometer was not functioning.

[1] Data from http://www.ec.gc.ca/donneesnatchem-natchemdata/default.asp?lang=En&n=22F5B2D4-1

[2] Husain, L., Khan, A.J., Ahmed, T., Swami, K., Bari, A. and Li, J, (2008) J. Geophysical Research., **113**, D13102, doi:10.1029/2007JD009398

[3] Birch, M.E., Cary, R.A., 1996. Aerosol Science and Technology, **25**, 221–241

Archaeal and bacterial tetraether lipids in carbonate chimneys of the Lost City Hydrothermal Field

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The Lost City Hydrothermal Field is a peridotite-hosted hydrothermal system near the mid-Atlantic ridge [1] with a rich microbial ecosystem. Microbes inhabiting carbonate chimneys are sustained by reducing fluids that contan methane and H_2 derived from serpentinization reactions. Extensive tag sequencing of archaeal communities in Lost City revealed diversity to be low: biofilms composed almost exclusively of *Methanosarcinales* are common in active chimneys, inactive chimneys contain ANME-1, and a phylotype similar to Marine Group I *Crenarchaeota* was detected in the active chimneys with the hightest fluid temperatures. Less abundant phylotypes include groups similar to the order *Thermoplasmatales* and Marine Benthic Groups 1-2 [2].

Organic geochemical investigations provide a time-integrated record, offering insight complementary to nucleic acid-based studies. Previous work focusing on diether membrane lipids common to *Methanosarcinales* found evidence for methanogenesis and carbon limitation at Lost City [3]. Here, we present data on membrane-spanning glycerol dialkyl glycerol tetraether (GDGT) lipids from six active and five inactive chimneys. Although the distribution of individual GDGTs is similar across sites, concentrations are higher in inactive chimneys where biomarkers record the cumulative history of microbial history over years of active venting and dormancy.

We detected three GDGTs not commonly reported in marine systems: an H-shaped isoprenoidal GDGT found in thermophilic archaea isolated from hydrothermal systems and two branched, non-isoprenoidal GDGTs. Branched GDGTs, attributed to bacteria and abundant in many soils, have been used as a proxy for the input of terrestrial organic matter to marine sediments (BIT index, [4]). Their presence at Lost City, together with that of other GDGTs, suggests that input of hydrothermal sediments may complicate paleoproxies based on tetraether lipid distributions. Large, non-systematic variations in both the BIT index and the sea surface temperature proxy TEX_{86} [5] were observed in Lost City samples.

Finally, we discuss the likely archaeal and bacterial source organisms of GDGTs at Lost City.

[1] Kelley *et al.* (2005) *Science* **307**, 1428–1434. [2] Brazelton *et al.* (2010) *P Natl Acad Sci USA* **107,** 1612-1617. [3] Bradley *et al.* (2009) *Geochim Cosmochim Ac* **73,** 102-118. [4] Hopmans *et al.* (2004) *Earth Planet Sc Lett* **224,** 107-116. [5] Schouten *et al.* (2002) *Earth Planet Sc Lett* **204,** 265-274.