Volcanic, solar activity, and atmospheric circulation influences on cosmogenic 10Be fallout at Vostok and Concordia (Antarctica) over the last 60 years

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The cosmogenic nuclide beryllium 10 (10Be), recovered from ice cores, is often used to study solar activity on long timescales. However, the 10Be signal is also influenced by factors other than the Sun. In order to identify and quantify various contributions to the 10Be signal, two Antarctic snow records from the Vostok and Concordia sites spanning the last 60 years were studied at a sub-annual resolution. Three factors that contribute to the 10Be signal were identified. First, in both records, a significant period of approximately 11 years, that can be associated with the modulation of 10Be production by solar activity, was detected. Then, peaks in 10Be concentrations during the time of the stratospheric volcanic eruptions of the Agung (in 1963) and the Pinatubo (in 1991), respectively, were observed. The data indicate that stratospheric volcanic eruptions can impact 10Be transport and deposition. Also, an interannual variability of ~4yrs was determined in both 10Be records. As with species of marine origin, this 4yrs variability is interpreted as a tropospheric signal that could be associated with atmospheric circulation inherited from the coupled Southern Ocean ocean-atmosphere system. The results presented, here, from sites within the high Antarctic plateau open perspectives for ice cores dating over the last few centuries, as well as for the reconstruction of past solar activity in relation to climate.

Characterization of Anaerobic Methane Oxidation in Lake Kinneret (Israel)

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In this study we show biogeochemical evidence for anaerobic oxidation of methane (AOM) in deep lake sediments and demonstrate that this AOM is likely driven by iron reduction. This is by producing porewater chemical and isotope profiles from Lake Kinneret (Sea of Galilee, Israel), together with incubation experiments, lipid analysis and molecular microbiology methods, including PCR, cloning and sequencing of archaea and bacteria.

Porewater profiles of methane and the stable carbon isotopes of the total lipid and methane indicate a sink for methane below the depths at which nitrate and sulfate are completely exhausted and the zone of methanogenesis. At that depths Fe(II) showed an increase, and iron isotopes decrease, suggesting that Fe(III) is the probable terminal electron acceptor. Based on these results incubation experiments of sediment cores and slurries were conducted to verify and quantify the rate of this process and its key parameters. This is by using amorphic ferric oxide and labelled methane. The results strengthened the iron dependent AOM hypothesis, and the obtained AOM rates were about 10% of the production rates. Analyses of the community structure and diversity of bacteria and archaea along the sediment gradients showed indeed the appearance of involved bacterial methanogens and methanotrophs in the deep sediment.