Abstract ID : **274**

Svalbard ice core reveals levels and distribution profiles of fluorinated contaminants in the High Arctic

Content

Several Svalbard ice cores have been used to investigate the long-range atmospheric transport of contaminants to the Arctic. We drilled, dated, and analysed an ice core from Lomonosovfonna, the highest elevation ice cap on Svalbard (1198 m.a.s.l.), to investigate the atmospheric deposition of poly- and perfluoroalkyl substances (PFAS). High levels of these anthropogenic organic contaminants are known to be present in Arctic apex predators, such as polar bears (*Ursus maritimus*). PFAS are also known to be persistent, toxic and bioaccumulative, but their transport mechanism to the Arctic is less understood.

The 12.3 m ice core was dated using annual layer counting of the seasonally varying δ18O and Na+/Cl- ratios, in addition to a peak in non-sea-salt sulfate assigned to be the 2011 Grímsvötn volcanic eruption in Iceland. This revealed the ice core to cover 2006 – 2019 (±2 years).

Hydrofluorocarbons (HFCs) were thought to be responsible for the high levels of trifluoroacetic acid (TFA) observed in the ice core (4.2 – 16.5 ng/L). HFCs and associated compounds were introduced in the 1990s after the Montreal protocol banned ozone depleting chlorofluorocarbons (CFCs). However, HFCs are also known to undergo a radical mediated atmospheric degradation to TFA and other short-chain PFAS.

Of the 45 PFAS compounds targeted by this study, 26 were detected in at least one core section. Distribution profiles of some PFAS matched the known degradation products from laboratory simulated atmospheric degradations. This suggests that PFAS contamination is widespread in the Arctic and that the atmosphere plays an important role in the transport, degradation, and deposition of PFAS in the remote Arctic environment. TFA was found to correlate with two melt proxies, indicating that seasonal snow melt and glacier run off could be a significant source of TFA to Arctic fjord ecosystems.

In this ice core, an atmospheric record was still preserved, despite the numerous melt features observed. However, increasing summer temperatures and a rising firn aquifer may limit the possibility for future ice core records from Lomonosovfonna, and other drilling sites on Svalbard, in the coming decades.

Primary author: HARTZ, William (University of Oxford / University Centre in Svalbard)

Co-authors: BJÖRNSDOTTER, Maria (Institute of Environmental Assessment and Water Research / Örebro University); YEUNG, Leo (Örebro University); HODSON, Andrew (University Centre in Svalbard); THOMAS, Liz (British Antarctic Survey); HUMBY, Jack (British Antarctic Survey); DAY, Christopher (University of Oxford); ERICSON JOGSTEN, Ingrid (Örebro University); KÄRRMAN, Anna (Örebro University); KALLENBORN, Roland (Norwegian University of Life Sciences / University Centre in Svalbard)

Presenter: HARTZ, William (University of Oxford / University Centre in Svalbard)

Track Classification: Pollution records