

Name of research institute or organization:

**Laboratory of Radiochemistry and Environmental Chemistry,
Paul Scherrer Institut**

Title of project:

Accelerated release of persistent organic pollutants (POPs) from Alpine glaciers.
Snow chemistry, reconstruction of palaeo atmosphere and climate from high-altitude ice cores.

Project leader and team:

Prof. Margit Schwikowski, project leader
Pavlina Pavlova, Isabella Mariani, Isabel Schuck, Alexander Zapf, Beat Rufibach
Dieter Stampfli, Felix Stampfli (FS INVENTOR)

Project description:

Persistent Organic Pollutants (POPs) are regulated by international conventions due to their particularly hazardous properties to persist in the environment, accumulate along food chains, and exhibit serious toxic effects. Recent studies indicated that melting Alpine glaciers represent a secondary source of legacy POPs, which were previously deposited to and incorporated into glaciers and are now released to the environment due to the rapid melting induced by climate warming. In order to assess the relevance of this secondary source for the alpine environment a better understanding of the behavior of POPs in cold and temperate glaciers is needed. In cold glaciers most of the ice has a temperature below the pressure melting point. In temperate glaciers, liquid water is present within the ice matrix in lenses between ice grains, in veins at triple grain intersections, and in nodes where veins intersect. Bulk water content of temperate ice ranges from 0% to 9%. The majority of Alpine glaciers is temperate.

In the frame of a new SNF project „Accelerated release of persistent organic pollutants (POPs) from Alpine glaciers“, a collaborative effort, involving scientists from PSI, University of Bern, ETH Zurich, EAWAG, and EMPA, the distribution and transport of POPs through temperate glaciers is examined.

The strategy of our contribution is determining inventories of POPs in three ice cores from different types of glaciers: i) to establish the undisturbed input function of POPs from a cold Alpine glacier, ii) to investigate the transport of POPs in a temperate glacier having an intact water-saturated firn layer, and iii) to determine the remaining signal of POPs in a temperate ablation area. For the first purpose the well-dated Fiescherhorn ice core is available, obtained in 2001. For the second goal we selected the Ewigschneefeld near Jungfrauoch in the Bernese Alps (46°33'N, 08°01'E) for ice core drilling. Ewigschneefeld is a temperate glacier, containing a water table in depths between 14 and 32 m below surface. For the third purpose Silvretta glacier was chosen, a glacier in the Grisons, with temperate ablation area connected to proglacial lakes.

Ice coring in temperate ice is a special challenge. Commonly used electromechanical drills have problems with freezing and transport of drilling chips due to the presence of liquid water. Instead we used our new combined electromechanical and thermal drill (TD) [6], which has a modified control unit and power supply, since thermal

drilling consumes more power. The TD itself consists of two barrels. The upper barrel contains two pumps and two containers, for ethanol and for the ethanol/meltwater mix, respectively. The lower one is the core barrel bearing the melting ring and the core catchers. In September 2010 we obtained a 57 m ice core from 3462 m a.s.l. on Ewigschneefeld near Jungfrauoch (Fig. 1). The upper 31 m were drilled electromechanically and for the deeper part the TD was used. At about 21 m depth the water table was reached. The new drill produced ice cores of excellent quality even in the water-filled borehole.

The next steps include method development for determination of POPs in ice samples, analysis of POPs in the ice cores from Fiescherhorn glacier and Ewigschneefeld, and ice core drilling on Silvretta glacier.



Fig. 1: Ice coring with the thermal drill at Ewigschneefeld.

Key words:

persistent organic pollutants, ice core

Internet data bases:

<http://lch.web.psi.ch/webcontent/research/analytic/>

Collaborating partners/networks:

Dr. Christian Bogdal, Prof. K. Hungerbühler (ETHZ)

Dr. Peter Schmid (EMPA)

Prof. F. Anselmetti (Eawag)

Dr. Martin Lüthi, Prof. Martin Funk (VAW, ETHZ)

Address:

Paul Scherrer Institut

CH-5232 Villigen PSI, Switzerland

Contacts:

Prof. Margit Schwikowski

Tel.: +41 56 310 4110

Fax: +41 56 310 4435

e-mail: margit.schwikowski@psi.ch

<http://lch.web.psi.ch/webcontent/research/analytic/>