

Highlights of Analytical Chemistry in Switzerland

Division of Analytical Chemistry

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POPs – A Haunting Legacy

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Industrial chemicals such as polychlorinated biphenyls (PCB) and dichlorodiphenyltrichloroethane (DDT) have been produced and used in large quantities more than 50 years ago. During the phase of application they were released to the environment and mainly distributed by atmospheric transport. Today, due to their hazardous properties these chemicals are apostrophized as persistent organic pollutants (POPs) and are banned worldwide by the Stockholm Convention. However, they are still circulating in the environment. Actual and historical atmospheric input of chemicals can be calculated from investigations of dated lake sediments. Trace analyses of POPs in sediments from Swiss plateau lakes using gas chromatography-high resolution mass spectrometry show decreasing input in the last 40 years. In strong contrast, we observed increasing input in proglacial lakes. This surprising phenomenon led us to the ‘glacier hypothesis’ claiming that POPs deposited in the past on glaciers are now released from the melting ice. This hypothesis has been corroborated by findings from sediment analyses of several mountain lakes. In these investigations we observed that not only the long-term behavior of glacier movement and ablation but also short-term based growth and decline are reflected in the sediment input of a proglacial lake.



Stein glacier and Lake Stein in the Bernese Alps. (Photo: Ruedi Keller 2009)

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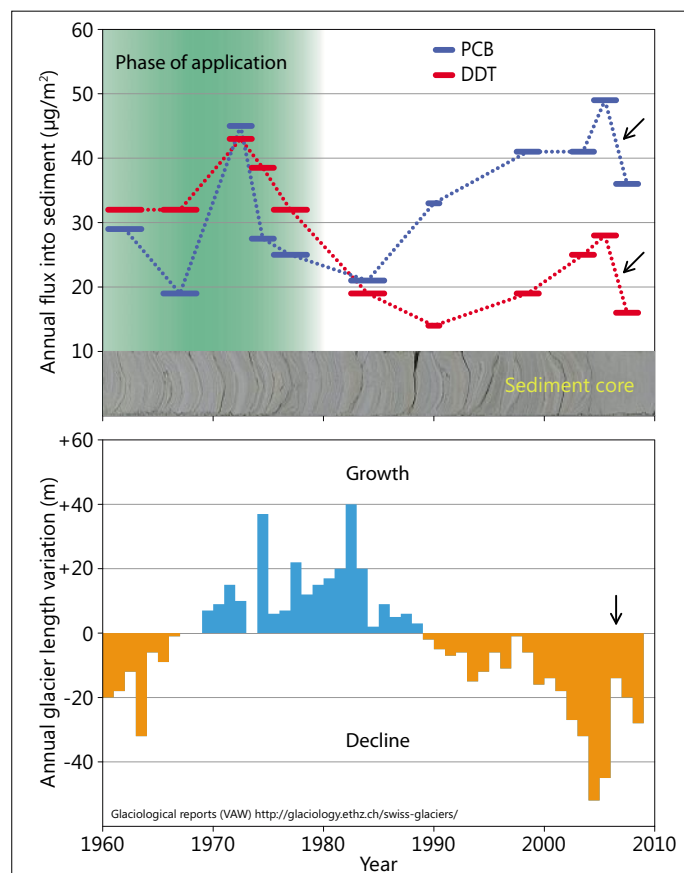
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Comparison of length variations of Stein glacier and annual fluxes of DDT and PCB into the same-named lake show that fluxes increased during the application phase of these POPs (highlighted in green). Thus, input into the lake in the 1970s is assigned mainly to direct atmospheric input, which decreased rapidly due to phase-out of these chemicals later on. After 1990, fluxes increased again due to release from the glacier by melting of ice in which the chemicals had been stored for more than two decades. The renewed decrease observed in the last sediment layer (*ca.* 2007, arrows) is attributed to an intermediate stagnation of the accelerated decline of the glacier after 2005 (arrow). **The findings are a piece of jigsaw to the knowledge how POPs are still circulating in the environment, even if phased out decades ago. Thus, the haunting legacy of POPs calls for the development of more sustainable chemical products and a careful assessment of their properties prior to widespread use.**

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Annual fluxes of PCB and DDT into the sediment of Lake Stein and annual length variation of Stein glacier.