A one-day **post-conference** field trip on **June 27**, 2009

Geobiology in the Jöri glacial lake area, upper Vereina valley / GR / Switzerland

for participants of the Goldschmidt Conference 2009 in Davos, Switzerland

HIGH MOUNTAIN GEO-MICROBIOLOGY

Microbial life strategies and
geochemical nutrient scavenging in nutrient-poor high mountain aquatic ecosystems

***Contents**:*
Landscape changes during events of glacial retreat, alpine water resources and climate change, prevention of acidification, relations to alpine geology, geo-hydrology in recently formed lakes, nutrient scavenging and transport in remote areas, sources and sinks for nutrients, role of erosion nanoparticles, ice and cold water ecosystems, microbial colonization and alpine habitat evolution, low-nutrient life strategies, cold-adapted microorganisms, microbially mediated geochemical cycling of P, Fe, Mn

High mountain lakes are ideal for studying the adaptations of organisms to a variety of environmental extremes: nutrients are scarce, water temperatures are often near freezing, darkness under snow and ice lasts for many months and UV radiation is strong during the summer months. We wonder how life has adapted to these challenges over time and yet are constantly amazed at the strategies microbes have developed to cope with these extreme conditions. The water in the 22 Jöri Lakes originates exclusively from rain, snow and ice-melt, which makes them interesting aquatic ecosystems for studying the role of erosion particles as nutrient scavengers and in soil formation, and the quantitative contribution of airborne natural components and pollutants to the chemical composition of the water.

We are studying how microorganisms respond and adapt physiologically to the complex interactions between chemical, geological and atmospheric determinants in the lakes of the Jöri catchment, thereby contributing to efforts aimed at understanding evolutionary processes in earth history and the microbial diversity in extreme environments.



Jöri catchment

Objectives and Topics

- How „new“ lakes form during glacial retreats and become habitable ecosystems (Glacier border lakes)
- Limits to habitability in surface environments and in oxic-anoxic redox interfaces
- Biosphere responses to atmosphere-geosphere interactions (weathering)
- Role of microorganisms and erosion particles for soil formation in glacial flood plains (lakes I and XIV)
- Regulation of nutrient balances in oligotrophic environments by biogeochemical Fe-cycling (lake XIII)
- Colonization of remote mountain lakes (lake XVII)
- Lifestyles under extremes of temperature, radiation and the lack of nutrients (all lakes and melting snow)
- Molecular analysis of cold-water microbial communities
- Modeling the regulation of selection, adaption and extinction in high mountain ecosystems

Research sites (visits might change depending on weather and time)

The terrestrial hydrological cycle, which begins in the central European Alps distributes water by 4 major river systems across much of continental Europe. Millions of people in Europe depend on water originating in these alpine regions for drinking water, power generation, transport, industrial purposes and recreation.

High altitude research: Researchers at the High Mountain Research Station, located at lake XIII are studying how microorganisms respond and adapt physiologically to the complex interactions between extreme and extremely variable chemical and atmospheric determinants in the Jöri lakes, in snow and on ice. The studies here are aimed at understanding evolutionary processes in ecosystem research and the microbial diversity in cold-extreme environments.



Quaternary geology



lakes with and without glacial melt water



enormous glacier retreat in 50 years

Discussion topics (depending on interest):

- Geology of the Joeri catchment
- How nutrients are cycled in cryosphere ecosystems
- What is the role of the geochemical iron cycle for nutrient accumulation?
- How nutrients are scavenged in oligotrophic high-mountain lakes
- Is self-trophication a phenomenon of specialized low nutrient environments?
- How organisms adapt to low temperatures, intensive solar radiation and long periods of darkness: lifestyles
- How community diversity is regulated by changing habitat conditions
- How microbial mats and biofilms are formed in nutrient poor flowing and stagnant mountain waters
- How sedimentary bio-laminations are built in glacial fluvial deposits

Field trip program

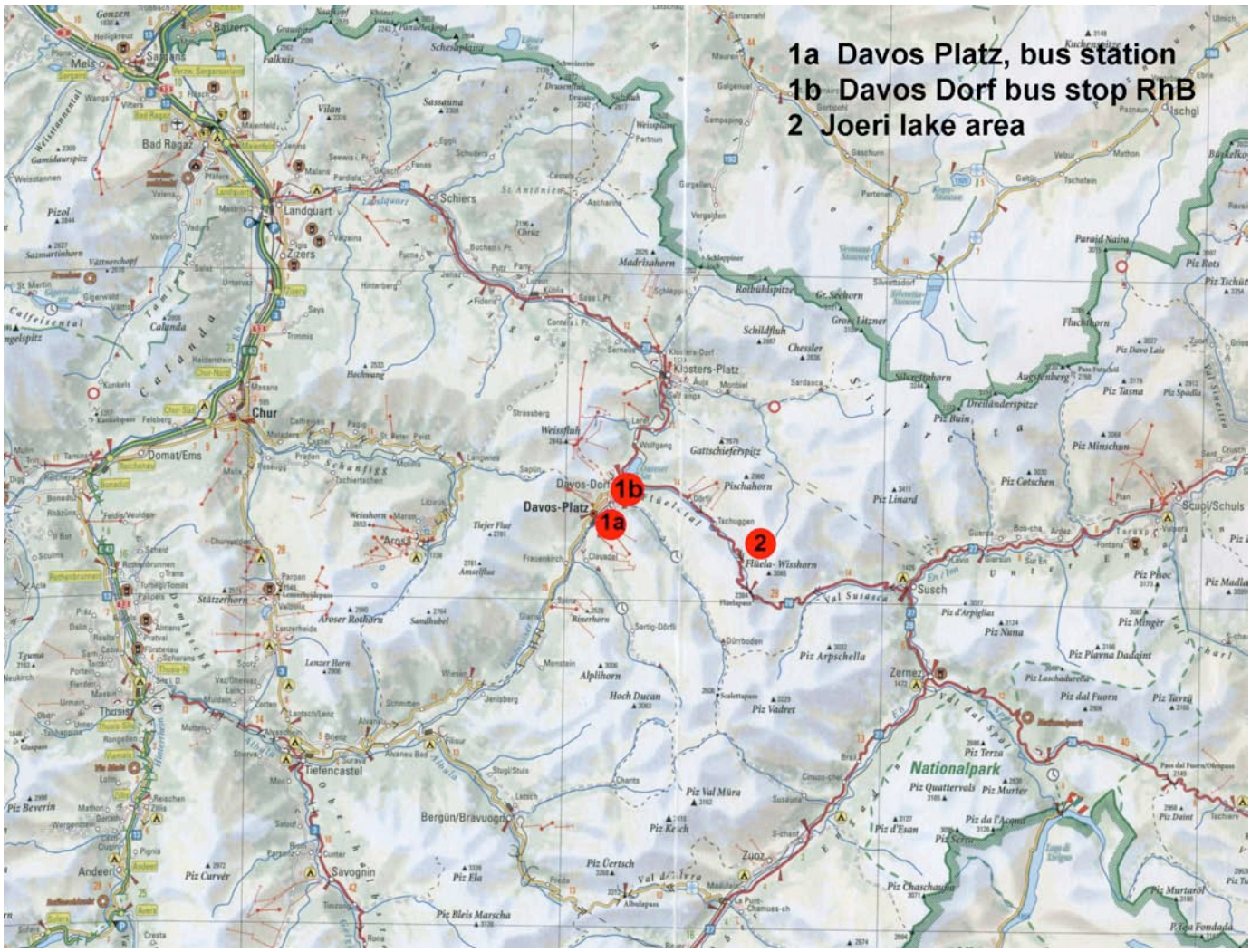
June 26 (Friday) 5pm – 6 pm

Preparation: Lecture on field trip topics and sites
Location: lecture room of the Swiss Alpine Gymnasium, Guggerbachstrasse 2, Davos-Platz

June 27 (Saturday)

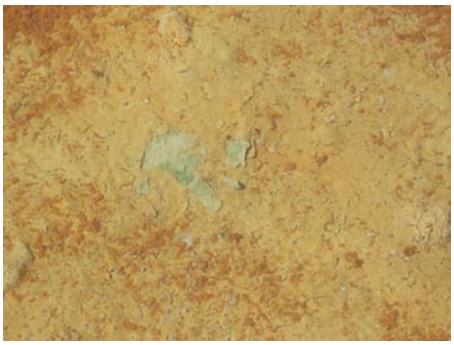
07.40	Assemble at Davos-Platz, Bus Terminal PTT
07.45	Depart from Davos-Platz, Bus Terminal PTT to Wägerhus via Davos-Dorf
08.12	Arrival at Wägerhus, begin ascent
10.00	Arrival at Research Station lake XIII: geochemical Fe-, Mn-, P-cycling
12.00	Lake I: highly turbid lake, role of suspended nanoparticles
13.00	Lake II: iron rich swamp and moraine spring with *Hydrurus sp.*
14.30	Lake XIV: Glacial sedimentation field, fractionation of erosion particles, soil formation
15.30	Glacial lakes XVI – XXII and cryoconite holes on Jöri glacier (depends on snow cover)
16.30	Winterlücke, begin descent
17.41	Bus departs from Wägerhus to Davos
18.10	Arrival Davos-Platz, end of field trip

Locations



Clothing The excursion will take place as planned if most of the snow has melted. We might decide on the spot to change the program if the conditions demand it. The weather can change abruptly in the mountains; please be equipped with a hat and rain gear as well as sun glasses and UV protective lotion.

Sturdy, waterproof walking shoes are a must since we will traverse rough montainous terraine, rock fields and possibly snow and ice. A small backpack will be necessary for provisions, drinks, lunch and sample collection.
If the weather allows, we will have opportunities to enjoy the beautiful landscapes with great views of the Alps. Don't forget your camera!



Cyanobacteria in iron mats



Differential oxidation of De and Mn



Diatom mats on top of glacial varves

Fitness We will be in the field for about 8 hours, walking on well marked paths and stopping frequently. The walks will not be strenuous. However, the highest elevation that we will reach is 2800 m, the maximum altitude difference is 600 m.

Travel We will travel as a group by public transportation (bus) from Davos-Platz and return to Davos-Platz in the evening. This requires that you are aware of the schedule and do not miss connections. As a group we will have to take the reserved buses.

Special train-bus tickets: If you plan to travel further before or after the conference you might consider buying a Swiss travel pass, valid for 3, 4 or more days of travel by public transportation to anywhere within Switzerland. Such a ticket would cover your travel from the airport to Davos and back, the transportation on pre- and post-conference field trip days and any other traveling by train or bus within Switzerland for the chosen number of days within 4 weeks. There are additional discount tickets if you always travel with a second person. Some of the special tickets are only available at Swiss border stations, e.g. at the airport. Please look up details at
http://www.swisstravelsystem.ch/en/content/offer/tickets/swiss-card/

Costs 50 € (Students 35 €). Please pay fee to Goldschmidt directly. The costs for transportation by bus are included. Backpack lunches are the particpants' responsibility and must be purchased in Davos; there are no stores or restaurants along the way.

Insurance is the responsibility of the participant. The tour guides cannot be held liable for damages or lost items. You may not leave the group on the walks since you might get lost or get yourself into danger. Please make sure that your accident insurance is valid outside your country of origin.

Signing up There are 35 places available. Please sign up before June 10. Once you have signed up and if you are prevented from participating, please let us know as soon as possible, so we can offer your place to a person on the waiting list. Cancellation remains without financial consequences until June 21. For cancellations between June 21 and June 25 the costs amount to 50% of the total price of the arrangement; for later cancellations 100%.

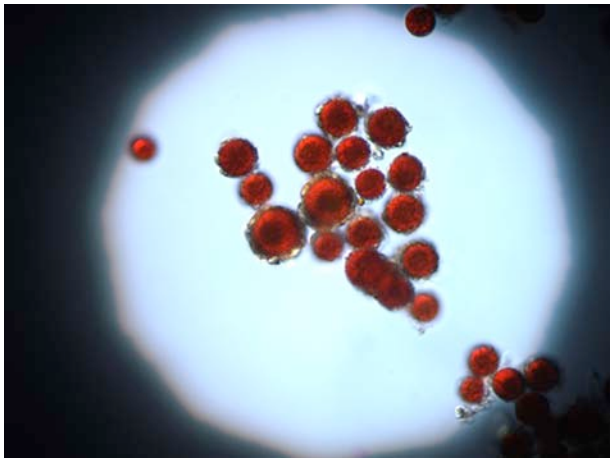
Information Kurt Hanselmann, swiss | i-research & training, kurt.hanselmann@hispeed.ch





High mountain research station at Joeri lake XIII

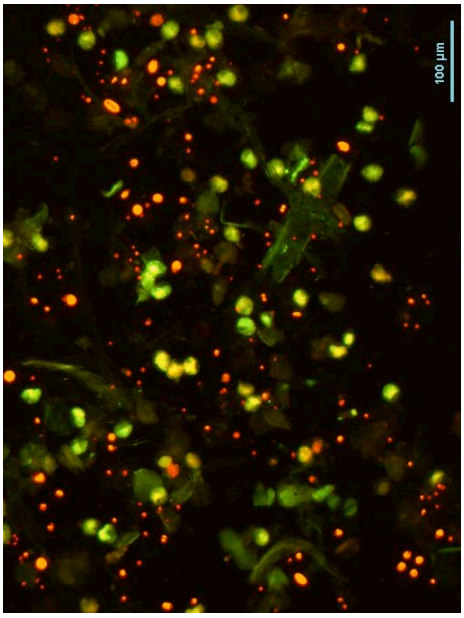




Aplanospores of Chlamydomonas spp. green, unicellular algae as primary producers in microbial snow communities







Algal blooms in "nutrient-poor", remote mountain lakes are induced by tunrover after summer snow fall