Czech research activity in Petuniabukta, Billefjorden, central Svalbard

report from 2011 season fieldwork

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Centre for Polar Ecology
Faculty of Science
University of South Bohemia
Czech Republic

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1. Introduction

The 2011 research programme is a logical consequence of the previous project of the Ministry of Education, Sports and Youth of the Czech Republic - INGO LA341 (Biological and climatic diversity of the central part of the Svalbard archipelago) which has finished in 2010. The majority of research topics including field experiments/observations were prolonged for another years. These have been funded by new research project of the Ministry of Education, Sports and Youth of the Czech Republic – LM2010009 CzechPolar (Czech polar stations: Construction and logistic expenses). However, selected individual research projects were funded also from other sources (Masaryk University, Palacký University, University of Defence etc.).

As in the previous seasons, we have occupied the old Russian hunting hut in Petuniabukta, together with our two containers on the landing wharf in Pyramiden, that serve for storing material and emergency overnight stay (see figs. 1 and 2).

Figure 1. Containers in Pyramiden.

Figure 2. Old Russian hunting hut in Petuniabukta.

2. 2011 season programme

The fieldwork was carried out from July 4th till October 2nd , 2011 on the Czech research base in Petuniabukta, Billefjorden. Total number of 50 persons have worked on the base, from which half of them (24) were participants of the Polar ecology course. The following institutions had their representatives in the field:

University of South Bohemia – Faculty of Sciences, Centre for Polar Ecology	(CPE)
Masaryk University in Brno – Department of Geography	(DG)
Masaryk University in Brno – Department of Botany and Zoology	(DBZ)
Academy of Sciences of the Czech Republic – Institute of Botany	(IB)
Academy of Sciences of the Czech Republic – Institute of Parasitology	(IP)
Academy of Sciences of the Czech Republic – Institute of Animal Physiology and Genetics	(IAPG)
Academy of Sciences of the Czech Republic – Institute of Soil Biology	(ISB)
Charles University in Prague – Department of Physical Geography and Geoecology	(DPGG)
Charles University in Prague – Department of Ecology	(DE)
Czech Geological Survey	(CGS)
University of Defense - Department of Military Geography and Meteorology	(DMGM)
Palacký University in Olomouc - Laboratory of Ornithology	(LO)
Charles University in Prague – Department of Botany	(DB)

List of expedition participants with their affiliation and period of stay:

1	Josef Elster	CPE, IB	04/07-03/08 and 08/09-26/09
2	Oleg Ditrich	CPE, IP	04/07-10/08
3	Jitka Klimešová	IB, CPE	21/07-04/08
4	Jiří Komárek	IB, CPE	21/07-04/08
5	Pavel Prošek	DG, CPE	07/07-20/07
6	Alexandra Bernardová	CPE	21/07-15/08
7	Jan Kavan	CPE	04/07-02/10
8	Tomáš Hájek	IB, CPE	15/08-08/09
9	Jana Kvíderová	IB, CPE	21/07-15/08
10	Tomáš Tyml	IP, CPE	04/07-10/08
11	Daniel Nývlt	CGS, CPE	07/07-20/07
12	Kamil Láska	DG, CPE	07/07-20/07
13	Daria Tashyreva	CPE, IB	04/07-21/07 and 09/09-26/09
14	Miloslav Devetter	ISB, CPE	21/07-10/08
15	Zbyněk Engel	DPGG, CPE	07/07-20/07
16	Linda Nedbalová	DE, CPE	07/07-20/07
17	Karel Janko	IAPG, CPE	21/07-15/08
18	Otakar Strunecký	IB, CPE	10/07-15/08
19	Marek Křížek	DPGG	01/08-15/08
20	Petr Bureš	DBZ	15/08-31/08
21	Petr Šmarda	DBZ	15/08-31/08
22	Václav Pavel	LO	21/07-10/08
23	Martina Pichrtová	DB	15/08-31/08
24	Karel Dejmal	UO	15/08-08/09
25	Miloslav Dvořáček	photographer	15/07-28/07
26	Alois Suchánek	civil engineer	08/09-15/09

3. Fieldwork projects reports

Significant number of research projectc covering wide spectrum of scientific topics has been carried out during the 2011 season. Some of the projects were rather taken as a first recognition of terrain conditions, the others have already started in previous seasons and more people have participated on them. A brief description of each of the performed research project is described in further text. The project are listed in according their topics from geoscinces projects to the biological ones.

3,1 Geomorphology *(Marek Křížek)*

Geomorphological research was devoted to periglacial and glacial landforms.

Geomorphological field reconnaissance works were performed in front of Longyerbreen on its wash plain and in the vicinity of field station near Pyramiden (area delimited by the glaciers from Bertilbreen - Svenbreen to wash plains of Hørbyebreen and Ebbabreen glaciers). The research was focused on analysis of patterned ground and sampling of glacial and fluvioglacial sediments.

Patterned ground were classified according to their genesis (fig.3) and they were studied from morphometric and granulometric point of view. Futhermore, cryoturbation and frost sorting and heaving were studied and analyzed in bodies of patterned ground. Dataloggers with continuous recording of temperatures were installed into selected patterned ground (fig. 4).

Field thermal mapping using thermocamera allowed to find a dead-ice in moraines (figs. 5,6) and allowed to select suitable patterned ground for installation of thermal dataloggers.

Glacigenous and glacifluvial sediments were collected for exoscopic analyses to determine differences in micromorphology of grains (figs. 7,8) depending on transport characteristic of equivalent sediments.

Figure 3. Sorted polygons near Bertilbreen.

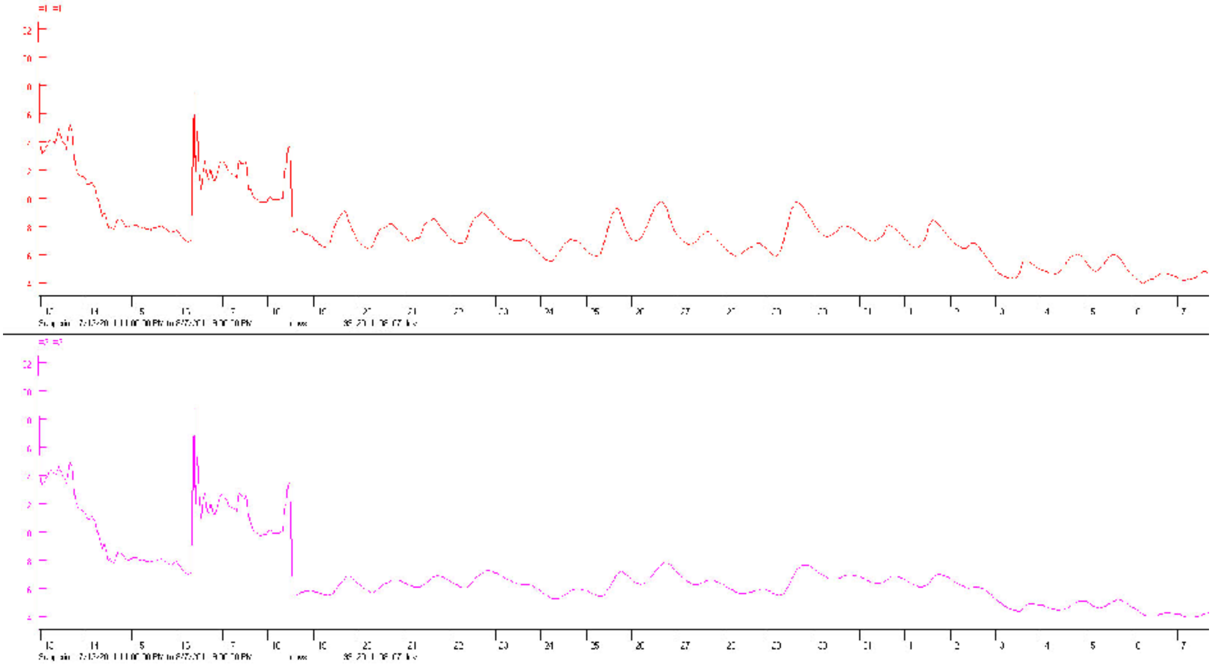

Figure 4. An example of temperature data taken by thermal dataloggers from 19.7. to 7.8. 2011 in solifluction lobe at the highest marine terrace near coast of Petunia Bay (red line: profile depth 15 cm, violet line: profile depth 30cm).

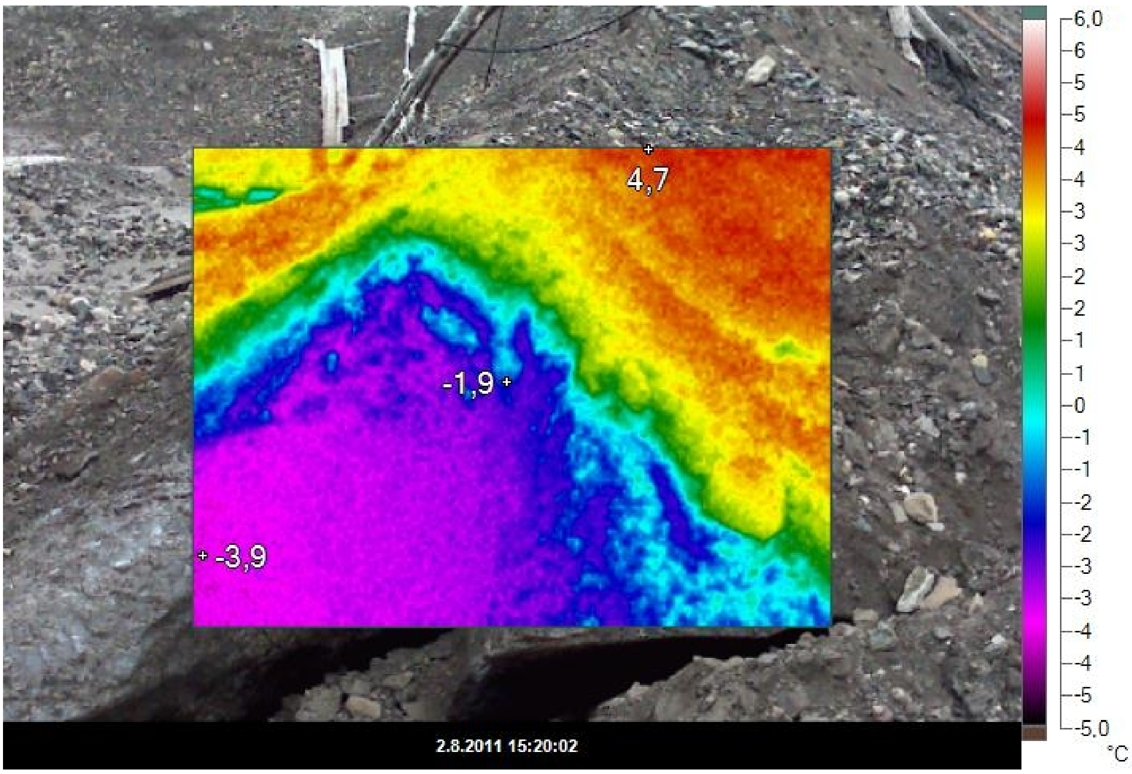

Figure 5. Detail of found hill with dead ice core in wash plain of Bertilbreen.

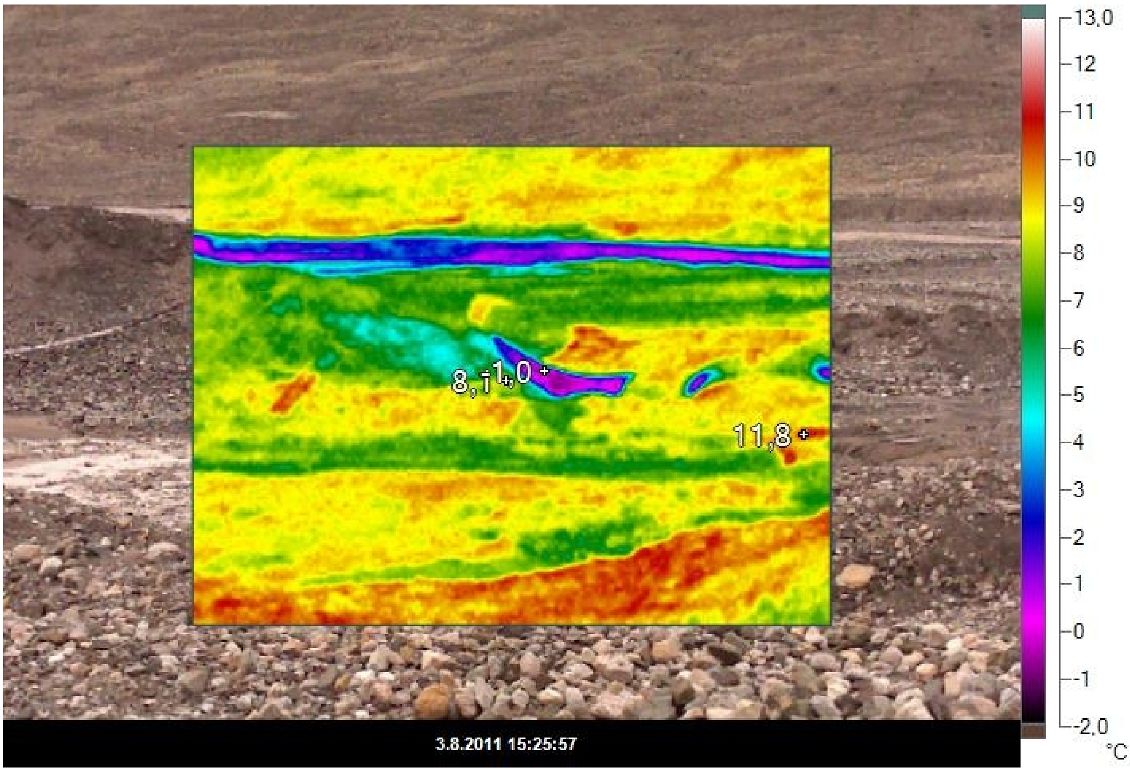

Figure 6. Thermal analysis of wash plaion in front of Bertilbreen (purple spots in the central part of image indicate the presence of dead ice.

Figure 7. Sampling of sediments from lateral moraine for exoscopy analysis.

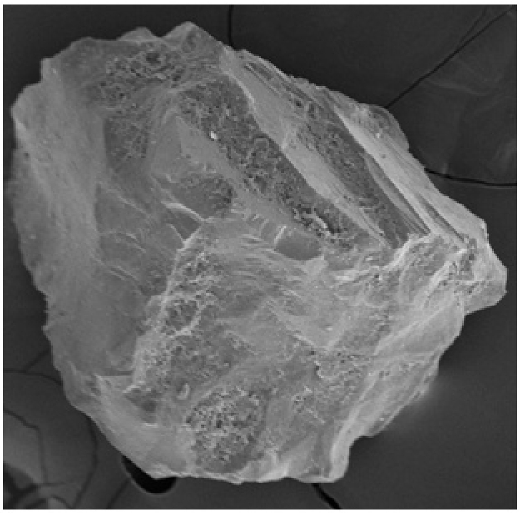

Figure 8. A qaurtz grain with charateristic features of glacial transport.

3,2 Climatology *(Kamil Láska, Pavel Prošek)*

The meteorological measurements and climate research were performed in the coastal ice-free zone of Petuniabukta, northern branch of Billefjorden in the period 8 July–22 September 2011. The main goal of the fieldwork activities was maintenance service and calibration of the meteorological instruments installed on the seven automatic weather stations (fig. 9). Yearly data (August 2010-July 2011) on the climate variability were downloaded from the automatic weather stations at all sites. Moreover, network of the automatic weather stations was enlarged by new measuring point located on the upper part of the Bertil Glacier (Bertilbreen). Each automatic weather station was equipped with an identical set of sensors to measure air temperature and relative humidity at a height of 200 cm and several other probes (soil thermometers, soil water content sensors, pyranometers, anemometers) depending on the study site. Additionally, short-term measurement of surface energy balance on the permanent tundra vegetation plot was done by micrometeorological station supplied by external photovoltaic panels. In the September 2011, micrometeorological station was winterized; part of high sensitivity instruments was dismounted and transported to the Czech Republic (Masaryk University, Brno) for calibration and technical service.

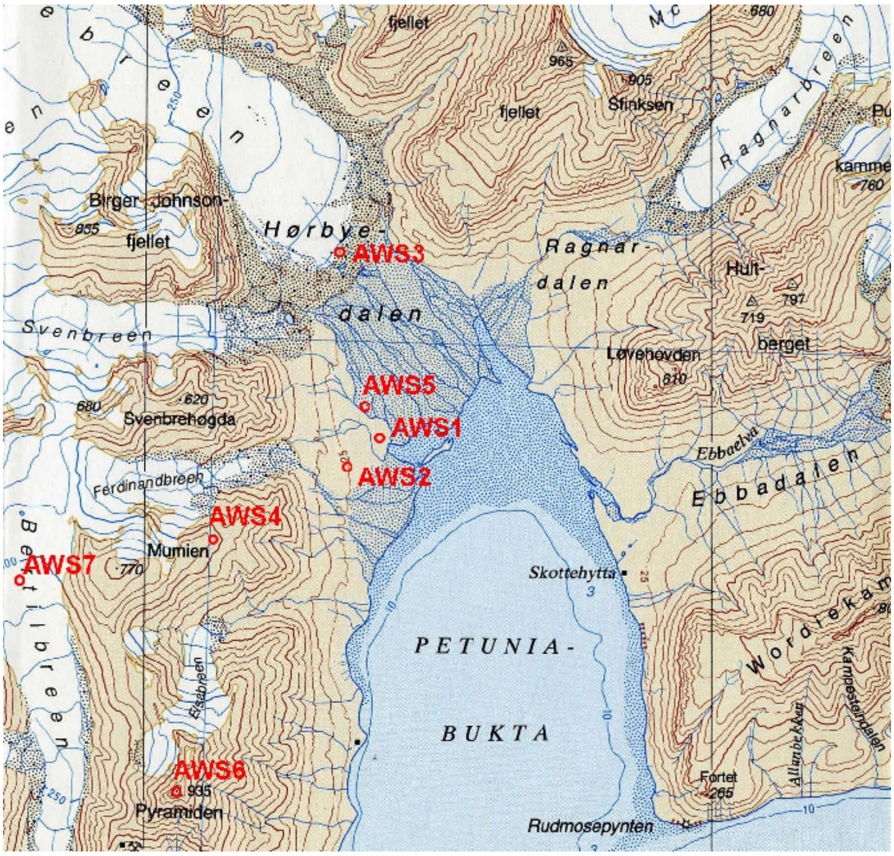

Figure 9. Location of the automatic weather stations in the northern coast of Petuniabukta.

Recently, seven automatic weather stations (AWS) are operated along the north-western coast of Petuniabukta in the following locations:

- AWS1 – old marine terrace at an altitude of 15 m a.s.l. (operated from 2008)
- AWS2 – old marine terrace at an altitude 25 m a.s.l. (operated from 2008)
- AWS3 – head of Hørbye Glacier at 67 m a.s.l (operated from 2008)
- AWS4 – mountain ridge of Mumien Peak at 475 m a.s.l. (operated from 2008)
- AWS5 – hummock tundra – thufur field at an altitude 8 m a.s.l. (operated from 2009)
- AWS6 – the Pyramiden Peak at 935 m a.s.l. (operated from 2009)
- AWS7 – the Bertil Glacier at 464 m a.s.l. (operated from 2011)

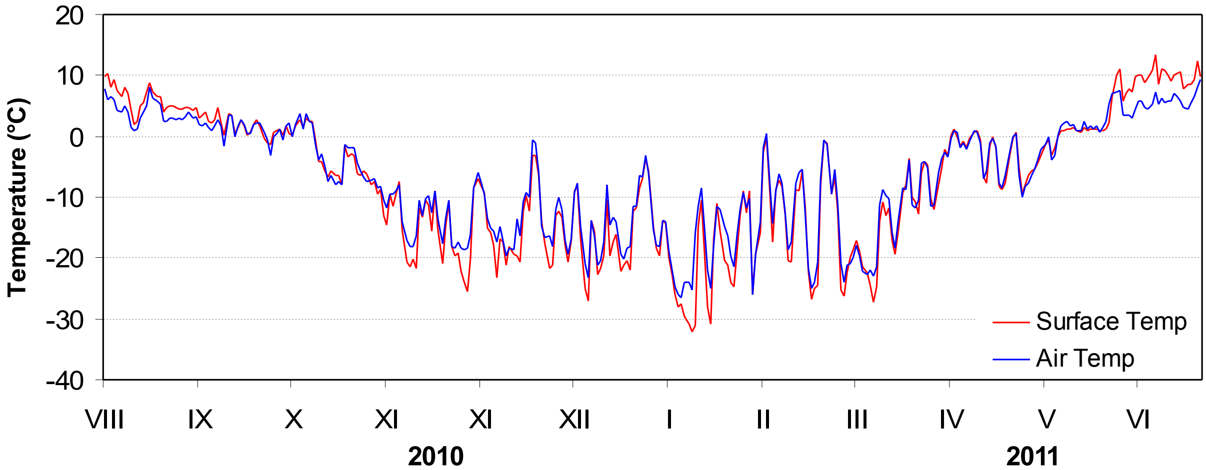

Fig.10 Variation of daily mean surface and air temperatures in Petuniabukta (AWS1) in the period from August 2010 to July 2011.

A variation of daily mean surface temperature and air temperature at 2 m above ground in the period 7 August 2010 to 10 July 2011 is shown in fig. 10. In the study period, the mean surface temperature at the AWS1 dropped to -7.2°C, while air temperature was -6.8 °C. The coldest month was January with monthly air temperature of -15.3 °C, while the warmest one was July with temperature of 7.0 °C. The absolute minimum and maximum air temperatures varied between -32.3 °C and 11.0 °C. However, the maximum surface temperature of tundra vegetation (*Silene acaulis*, *Saxifraga*, *Dryas octopelata*) reached up to 20.8 °C during clear sky days around summer solstice (see fig. 10). In the study period, the predominant wind was from the south and mean wind speed was estimated at 4.2 $m.s^{-1}$.

3,3 **Hydrology and limnology** *(Jan Kavan, Linda Nedbalová)*

Czech research activity in the region has been focused mainly on biosciences in the past, therefore this first season of hydrological monitoring could be considered as starting point for further more detailed studies in upcoming seasons.

Discharge measurement in several water streams has been carried out during the summer season and finally four of them has been chosen for longterm monitoring. Water level sensors were installed to monitor these four experimental catchments on the western shore of Petuniabukta, Billefjorden. The purpose of these measurements is to describe hydrological regime and response to climatic forcings in catchments with different level of glaciation. Measuring profile downstream of the Bertil glacier serves also for mass balance study held on this glacier. Ferdinand and Elsa glacier catchments are an example of fast retreating glaciers and last catchment has no permanent icecover anymore.

Figure 11. Discharge measurement in the Bertil glacier catchment.

Different types of lakes have been identyfied in the area with predominance of recent lakes on recently deglaciated moraines. Some older lakes with high amount of organic matter sedimentation were found as well. About 20 lakes in total has been mapped in the area. Detailed bathymetry mapping has been made on 6 of them. Physical and chemical parameters were measured on the beggining and at the end of the season. Temperature sensors have been installed in 6 lakes of different types and on different localities to cover their spatial heterogeneity, age and origin of lake ecosystems.

Very basic study on the sea environment has been done as well. Water level sensor was installed to monitor tidal movements and temperature regime near the shore. Physical and chemical parametres were measured on several spots in the axis of the Petunia bay in the depth profile down to 10 metres.

Figure 12. Working on the locality in Mathiesendalen.

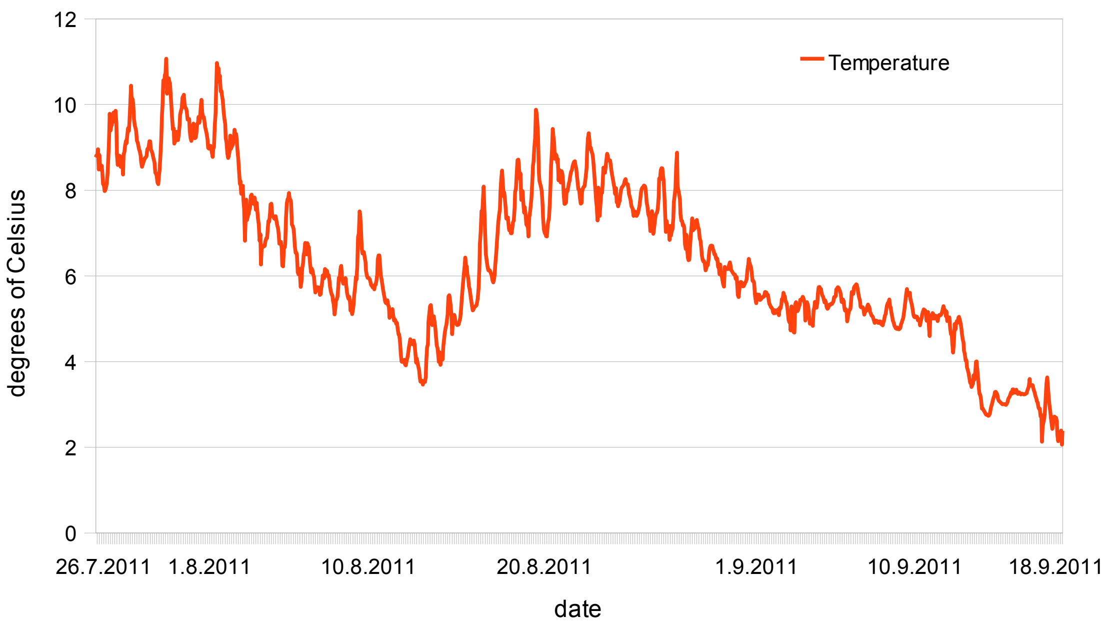

Figure 13. Temperature record from lake in Garmaksla locality.

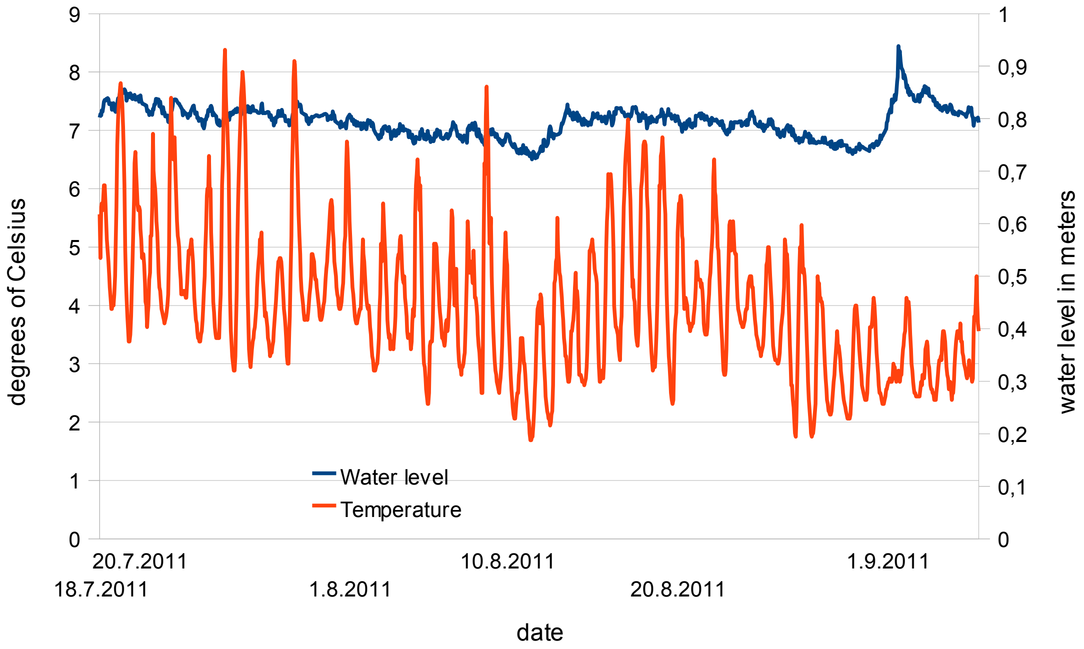

Figure 14. Temperature and water level record from measuring site in Elsabreen catchment.

Samples of biological material (such as algae, diatoms etc.) have been taken from all above mentioned environments and are now further analysed. Special emphasis has been put on diatom assemblages sampling. More than 200 species of diatoms has been identyfied with probably some new species, that must be further described.

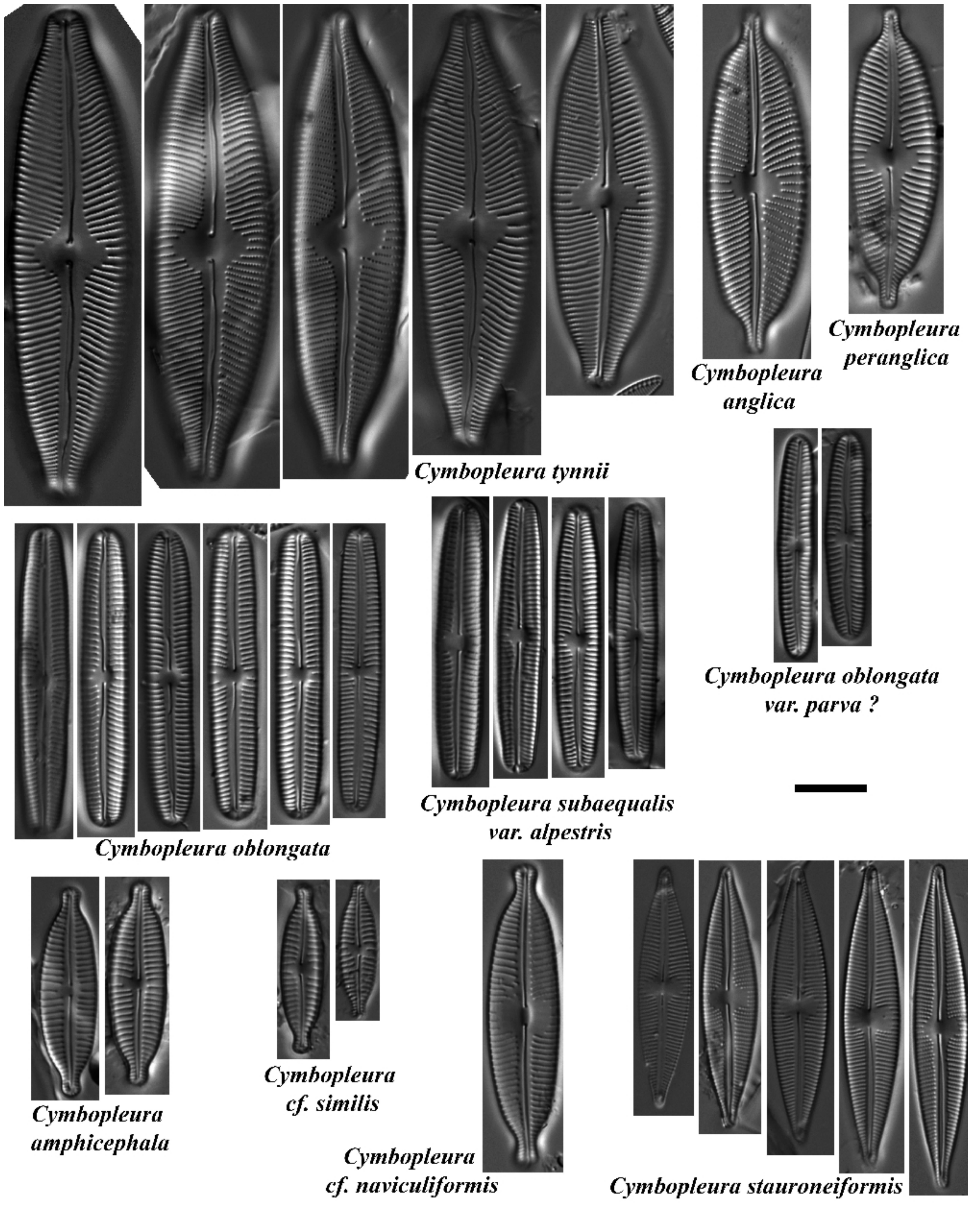

Figure 15. *Cymbopleura sp.* - one of the most common species in Billefjorden lake samples.

3,4 Physics of atmosphere *(Karel Dejmal)*

The work was focused on visibility and optical resolution of objects. The visibility is mostly reduced by condensation product in clear areas such as Svalbard and the role of aerosols does not have to be considered.

The visibility was very good in the second part of August and in the beginning of September - mostly visibility above 50 km, visibility below 1 km was observed only one time. Worse visibility was due to drizzle, precipitation and/or low cloudiness.

The object resolution was studied with the help of digital photos. Prepared figures and other objects were photographed in different meteorological and light conditions. For example the Polish containers in a distance of 4 km were used (see figure below). Firstly, the camera detector characteristics were found (see example in figure 2). Results of resolution are not available yet and the evaluation is still in progress.

Figure 16. Containers of AMU reserach station in Ebbadalen as seen from the hut in Petunia (4km).

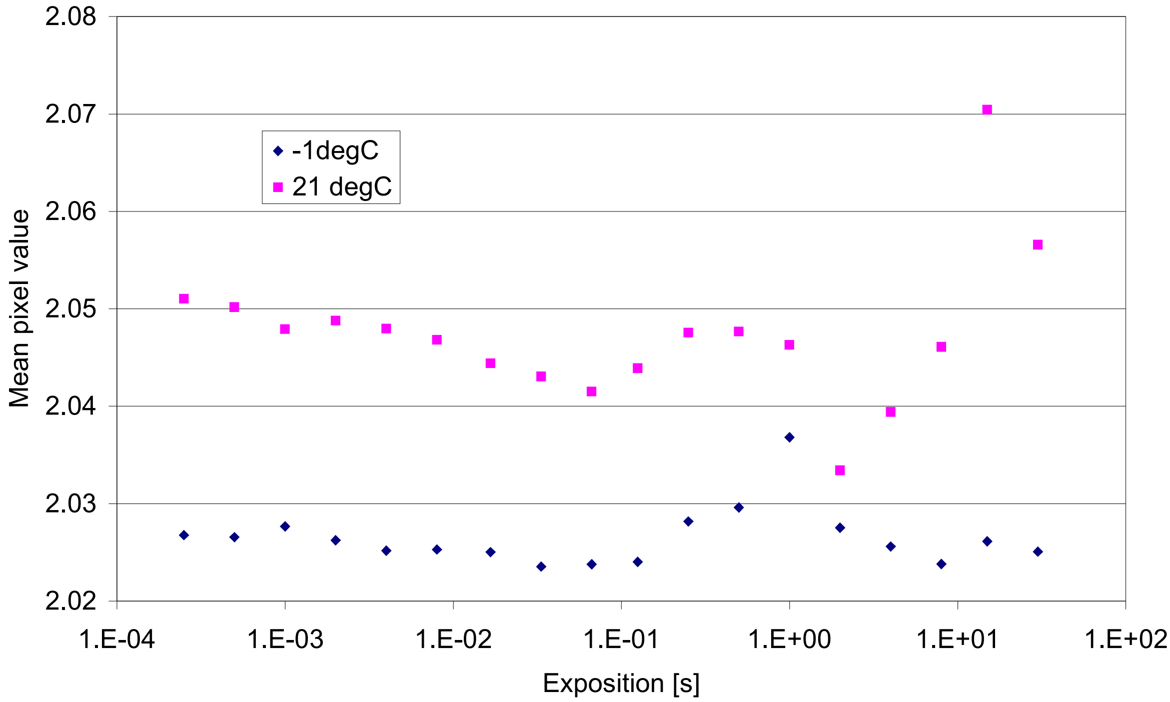

Figure 17. Dependence of mean red pixel value on exposition for “black figure” (ASA = 100).

The second goal was mapping of mostly hydrological objects, such as creeks, lakes and glacier. The GPS was used for this purpose. The example is shown below.

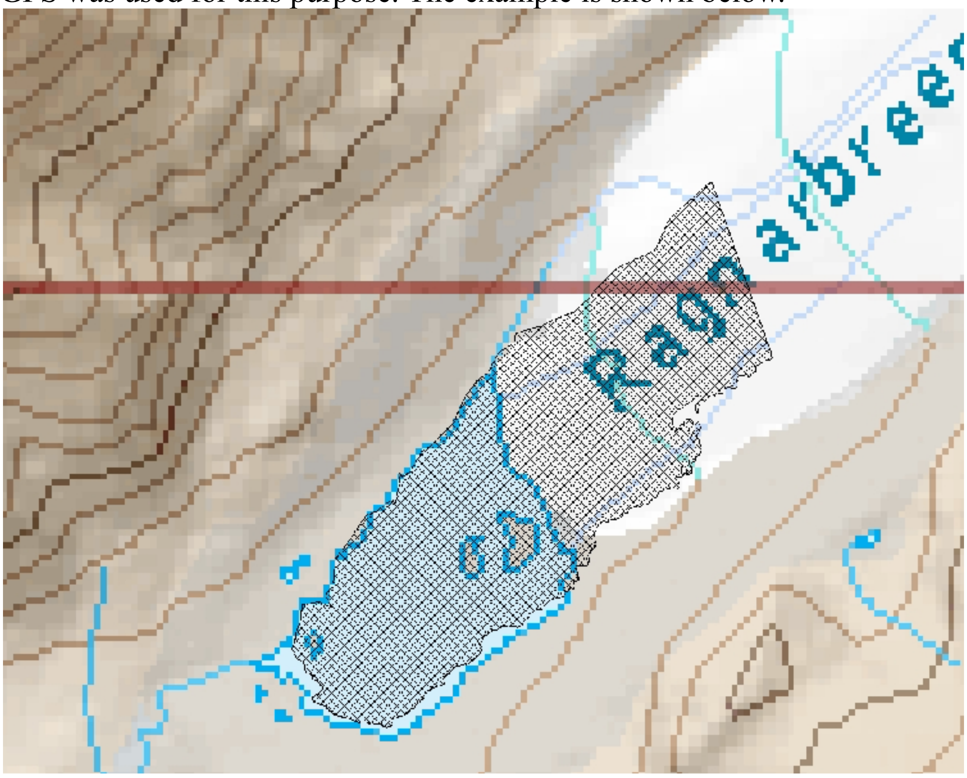

Figure 18. Lake below Ragnar glacier (comparison with older map).

3,5 **Palaeoecology** *(Alexandra Bernardová)*

Palaeocological research is intended for reconstructing past ecological conditions. This year it was focused on taking samples from lacustrine sediments - small lakes, pools or limans. Proper sediments that were obtained were found at two localities - the first was small pool in Petuniabukta, at the ca. 15m terrace and second cores were taken from liman in Adolfbukta, close to the houses of Brucebyen settlement. The cores were obtained undisturbed, by multisampler. The cores will be subsampled precisely for fine analysis of fossil pigments, chemical composition, for pollen, macrofossills and other proxies.

The second project was focused on the seed dispersal possibilities in the Arctic. Seed fallout was collected at the edge of morraine dammed lake at the Ragnar glacier and will be analysed under binocular for species determination. Species composition in the lake will be compared with the phytocenological samples from the moraines of the Ragnar glacier.

Next study will try to estimate reindeers potential to serve as seed distributors via their faeces and thus enhancing the colonisation of deglaciated, disturbed or newly emerged areas. The faeces were collected in the area of Petuniabukta in various distances from the glacier. Now are the samples going to be evaluated by the mean of analysis of macrofossils.

Figure 19. Reindeer faeces just before sampling.

Figure 20. Reindeer on a river terrace with almost no vegetation. Will he help to make succesion faster?

3,6 Plant Ecology *(Tomáš Hájek)*

Example of change in vascular plant cover before (2009, July) and after (2011, September) covering the hummock tundra by open top chambers (OTC) and cages (Control). The green wire mesh served as indicator of exact location and new biomass growth. The cage protected vegetation from herbivores, namely geese and reindeers.

There is clear increase in biomass cover (*Salix polaris*, *Equisetum variegatum, Bistorta vivipara*) in the cage indicating intensive pressure of herbivores. Elimination of herbivory, however, partly obscured the positive effect of elevated temperature on plant production in OTC. Nevertheless, the conditions in OTC prolonged vegetation season as indicated by green leaves of *S. polaris*, in contrast to senescent yellow leaves in the control cage.

Figure 21. Change in vegetation cover between 2009 and 2011

Flat and wide riverbed, adjacent to the northern shoreline of Petuniabukta, is sparsely covered by vegetated hummocks which provide refuges for numerous moss and vascular plants species. These hummocks are not built exclusively from peat as in the case of wet hummock tundra site but they have clearly distinguished mineral base consisting mostly of fine silt (as shown on cross-sectioned hummocks in the lower photographs). The elevated central parts of the mineral bases indicate that the vegetation was heaved by the action of freeze–thaw cycles in the underlying silt. Such hummocks are called thúfur.

Thúfur that are developing in earlier successional stages are usually large, solitary and sparse (photographs on the left). They must cope with more or less regular spring flood burying the vegetation by deposited silt (see the organic and mineral layers on the bottom left photographs). Abundant but smaller thúfur of later successional stages (photographs on the right) are already not disturbed by high flood and silt deposition. The growth of these hummocks thus results from synergy between biotic (plant production and biomass decomposition) and abiotic (silt deposition and frost heave) processes. It can be expected that further succession will result in merging the thúfur into a "meadow-like" habitat.

Figure 22. Earth hummock (thúfur) tundra on the northern shore of Petunibukta

3,7 Desiccation tolerance and osmotic potential of *Zygnema* *(Martina Pichrtová)*

Zygnema is a filamentous green alga belonging to the class Zygnematophyceae (Streptophyta). It has a cosmopolitan distribution and has been very often reported from both the Arctic and Antarctic. It typically occurs in shallow pools or on the surface of wet soil and therefore it is subjected to a range of environmental stresses, including desiccation and high irradiation. In spite of that, *Zygnema* is quite abundant and easy to find on Svalbard, especially in meltwater streams and pools, which shows its high tolerance and resistance to the extreme ambient conditions.

During the 2010's expedition we investigated the seasonal development of selected populations on Svalbard. This year we picked up the threads of that work and concentrated on desiccation tolerance of *Zygnema*. During the summer season, most of the shallow pools start to desiccate when snow fields are melted and no longer provide them with the water. Then, the *Zygnema* biomass, often forming dense mats, can be found on the wet soil in various stages of desiccation, being rewetted again from time to time by rare rainfalls.

The aim of our study was to investigate the desiccation tolerance of *Zygnema* in the field conditions. We selected 6 populations around Billefjorden in different stages of desiccation – from wet biomass floating in water to dried paper-like films. We observed the morphology and viability of the cells with light and epifluorescence microscopy using the fluorescent dye SYTOX. Moreover, osmotic potential (Ψ_s) of the cells at the turgor loss ($\Psi_{t=0}$), was estimated as the osmotic potential of sorbitol solution in which plasmolysis occurs for the first time (fig. 23). Furthermore, the algae were stressed with 2M sorbitol and then their recovery in water was studied.

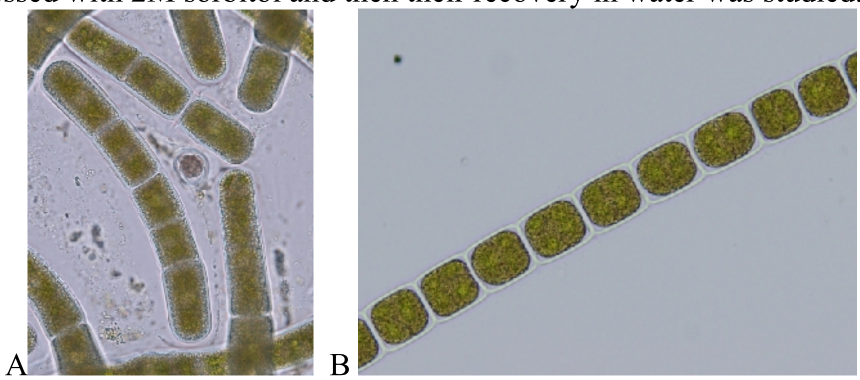

Figure 23. Resting cells of *Zygnema*. A: before experiment – in water, B: plasmolysis in 2M sorbitol

We found out that during the summer season, the vegetative cells of *Zygnema* change their appearance towards so called resting cells. Interestingly, this occurs in both „wet" and „dry" locations showing that slow desiccation is not the key factor controlling the resting stage production. However, a considerable difference in stress resistance of cells from those types of habitats was still present. The 2M sorbitol (Ψ_s=−5.87 MPa) represented rather high osmotic stress. The „wet" populations showed high mortality after this treatment (fig. 24) and also the recovery of fluorescence parameters was slower (fig. 25). They also plasmolysed sooner (at 450 mM sorbitol) than populations in various stage of desiccation (750 mM or more). On the other hand, 750 mM sorbitol does not represent strong stress for the photosynthesis in naturally dried cells – as shown in fig. 26, the decline in the steady-state PSII quantum yield in light with increasing sorbitol concentration was significant only in wet and half-desiccated samples.

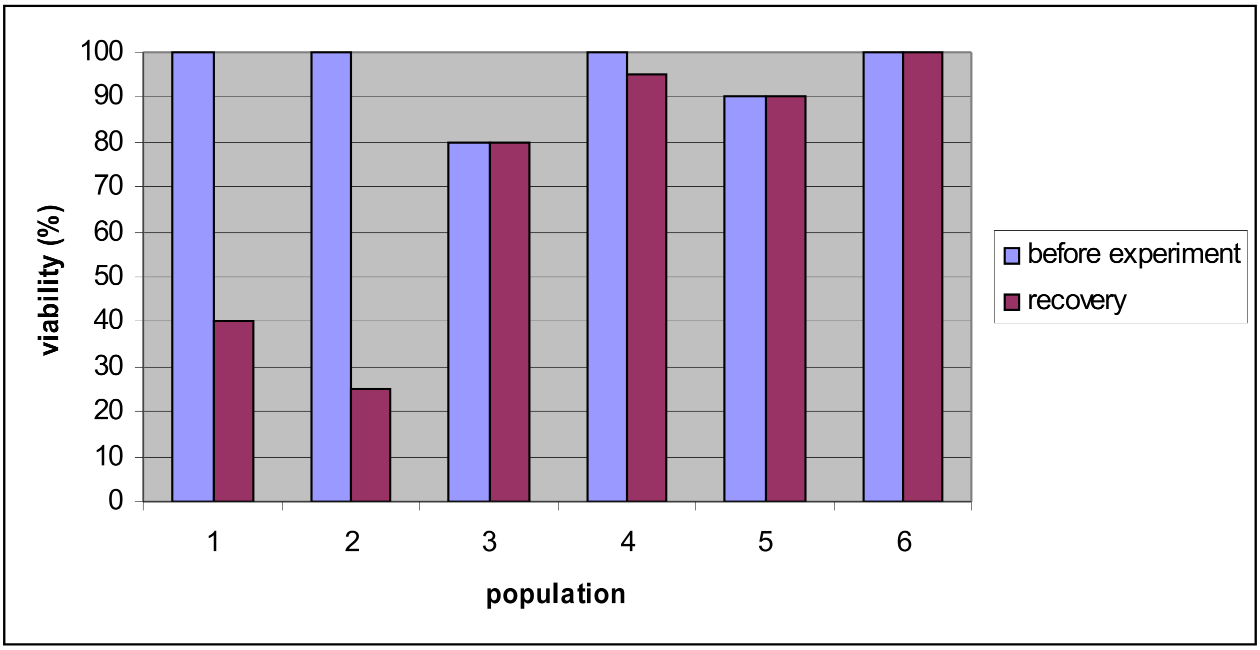

Figure 24. Viability of individual populations before and after the treatment with 2M sorbitol.

Our results show that *Zygnema* is well adapted to the field desiccation during the season. As the cells are subjected to reduced water potential during slow desiccation, they are becoming more resistant (hardened) to severe desiccation stress. Nevertheless, also the wet biomass contained resting cells with quite negative osmotic potential for plasmolysis (in comparison to freshwater species) showing that this alga is well adapted to life in a hydroterrestrial environment.

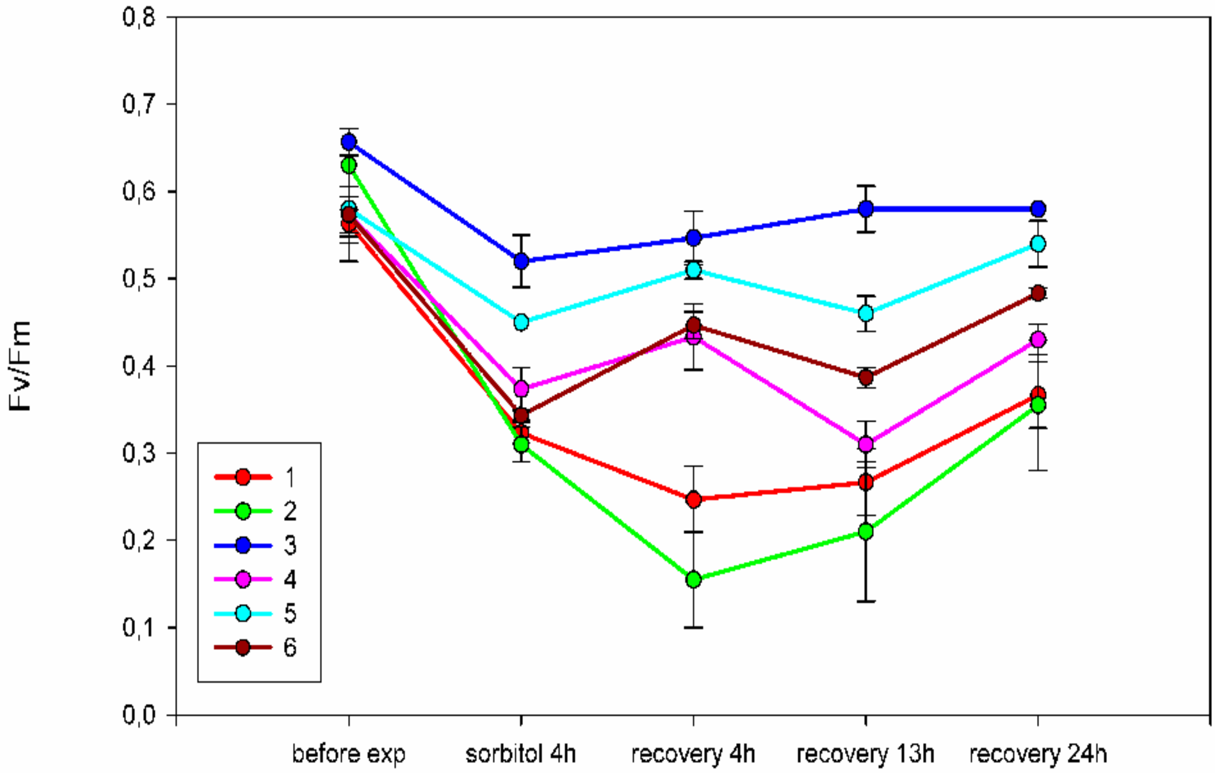

Figure 25. Maximum quantum yield of PS II during the experiment with 2M sorbitol. 1 and 2 are wet populations, 4 half dried, 3, 5 and 6 dry biomass.

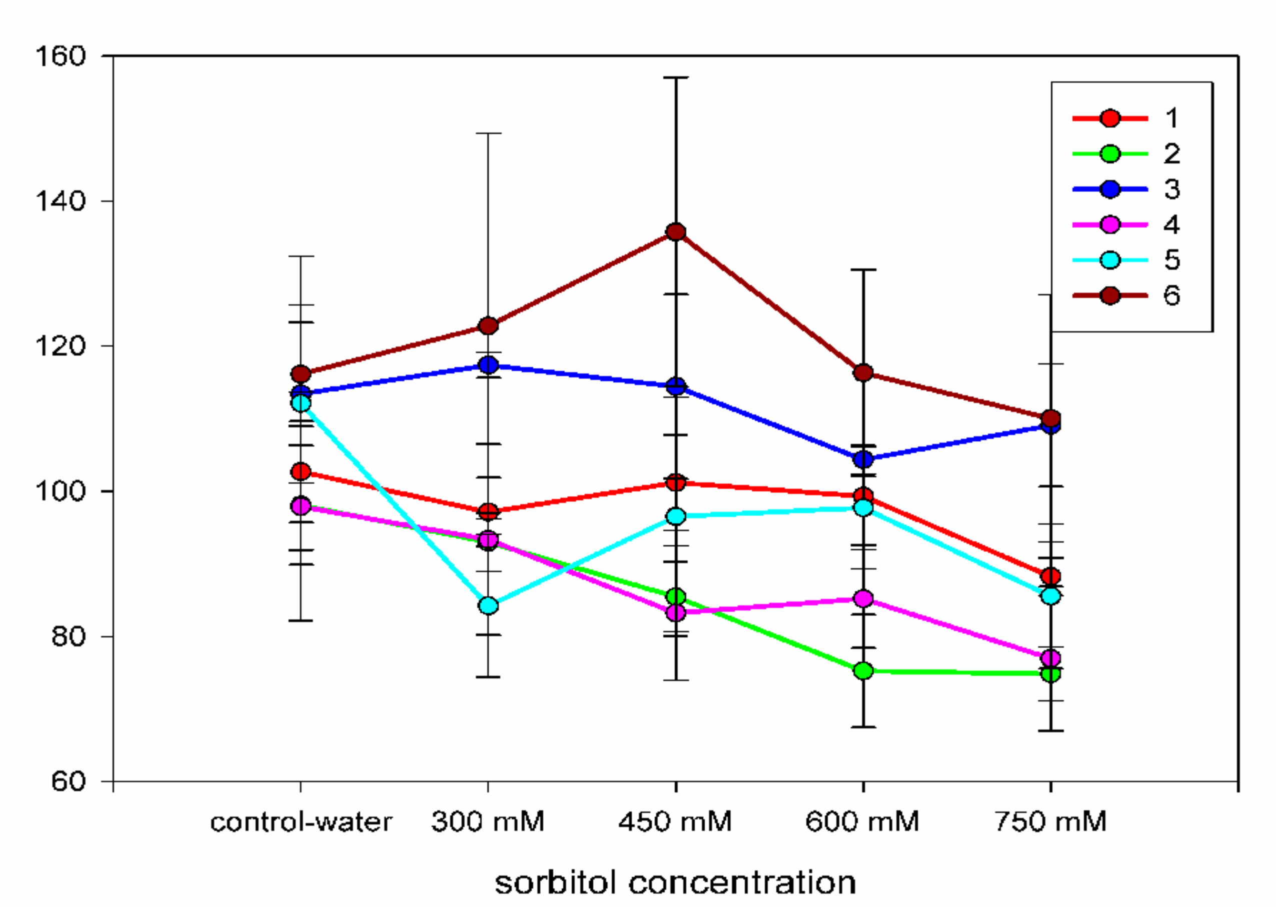

Figure 26. Steady-state PSII quantum yield in light of all populations in different sorbitol concentrations.Y axis shows the percentage of QY Lss values when compared to controls. 1 and 2 are wet populations, 4 half dried, 3, 5 and 6 dry biomass.

3,8 Phycology - Open Top Chambers manipulation in wet meadow thufur tundra

(Josef Elster, Jana Kvíderová,)

In summer season 2011, we continued in the open-top chamber (OTC) experiment established in 2009 by regular measurements of weight, photochemistry and nitrogenase activity in selected *Nostoc* colonies in Petri dishes and Exposition chambers. Since both types of exposition did not provide full contact between the colony and the water, a new type of exposition was introduced. The colonies were enclosed in a small cage which was pinned tightly to the ground fig. 27.

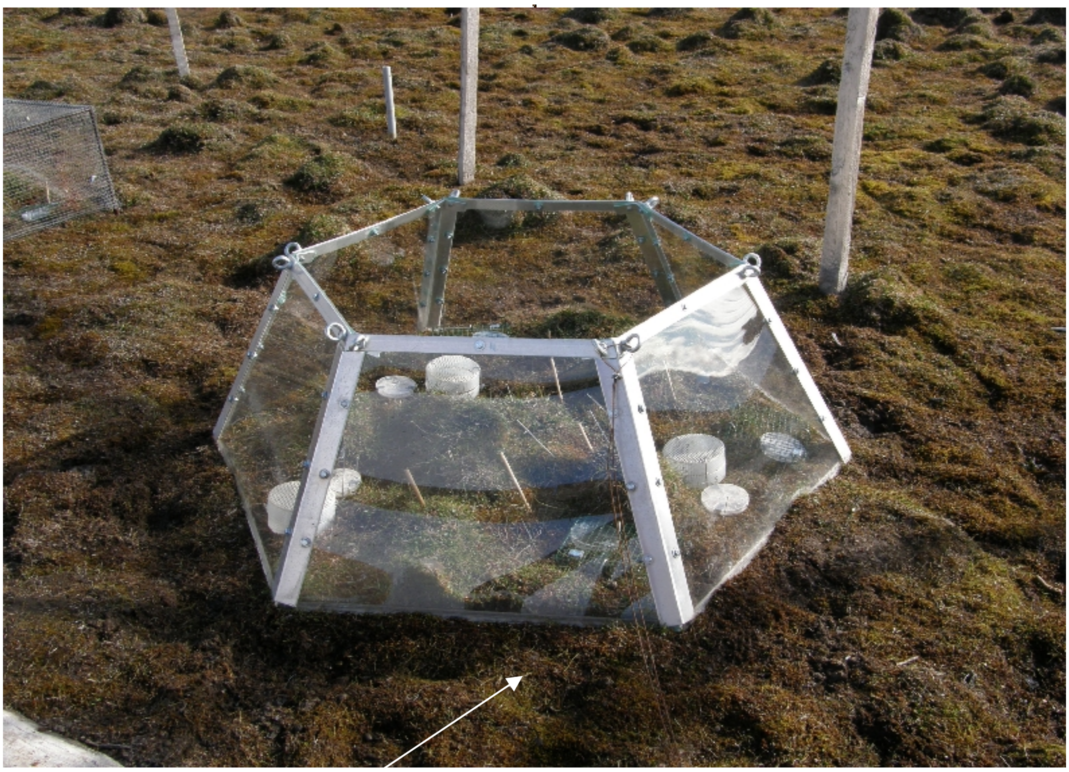

Figure. 27 Example of one of the installed Open Top Chambers (OTCs).

The 2-year period of microclimate monitoring indicated that the effect of OTCs was dependent on microtopography. During winter, two short-term snow-thaw episodes occurred, so that liquid water could have been available for *Nostoc* communities. Because of the warming, the OTC thufur bases remained unfrozen three weeks longer in comparison to the control boxes (CBs) and, in spring, the OTC thufur tops and bases exceeded 0°C several days earlier than CB ones. Mean summer temperature differences were 1.6°C in OTC and CB thufur tops, and only 0.3°C in OTC and CB thufur bases. The thufur tops were drier than their bases; however the volumetric water content difference between the OTCs and CBs was negligible. Due to the only minor differences in the microclimate of OTC and CB thufur bases, where the *Nostoc* colonies were located, no differences in ecophysiological characteristics of *Nostoc* colonies expressed as photochemistry parameters and nitrogenase activities were detected. In order to increase the differences between the OTC and CB, the OTCs were covered by a Perspex lids with holes enabling gas exchange (fig. 28). The lids were installed in August 2011.

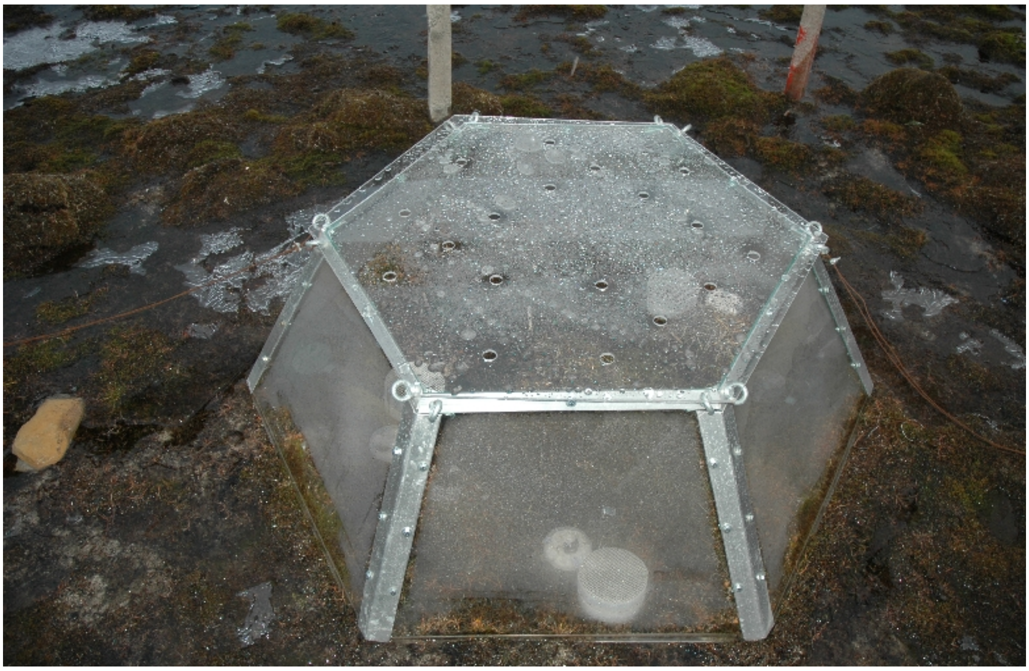

Figure 28. New cover of the OTC.

3,9 Phycology – Zoology - Warming effect (OTC) on soil microbial and invertebrate communities *(Josef Elster, Jan Kavan, Miloslav Deveter, Karel Janko, Jana Kvíderová)*

To study of warming effects on soil microbial and invertebrate community along temperature and water availability gradient, new OTCs were constructed at three different localities; a) on the top of the Mumien Peak (fig. 29), b) near the main weather station (fig. 30), and finally c) in front of Horbybreen glacier on deglaciated moraine. OTCs are followed by microclimatic automatic stations where temperature and water content of upper soil layer is continually monitored.

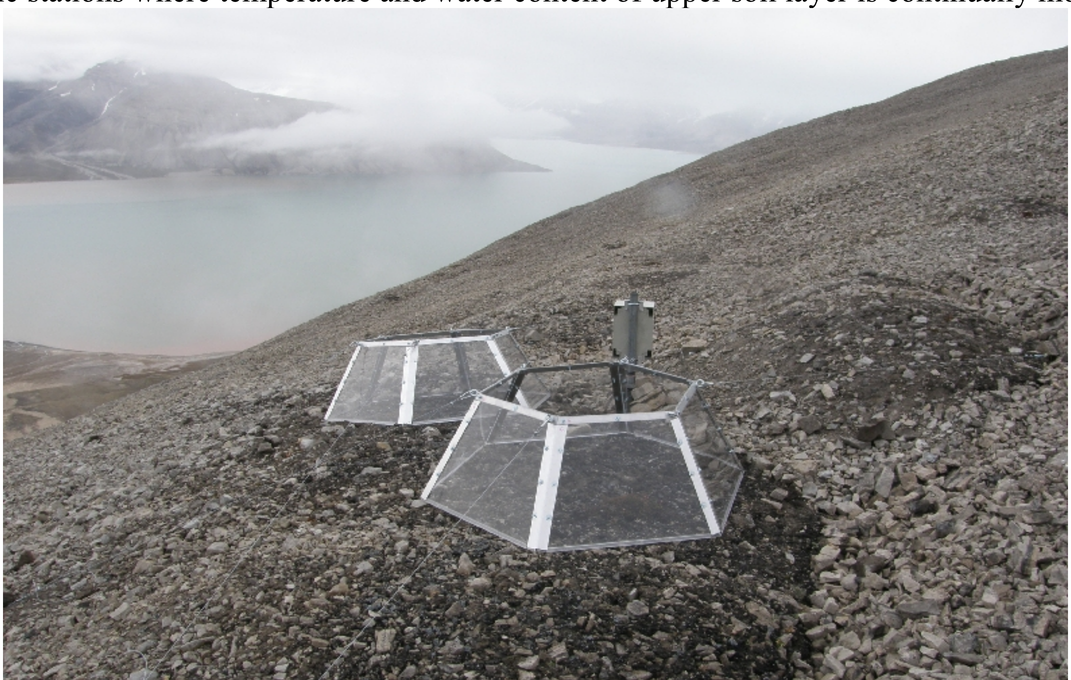

Figure 29. OTC experimental site on the crest of Mumien peak.

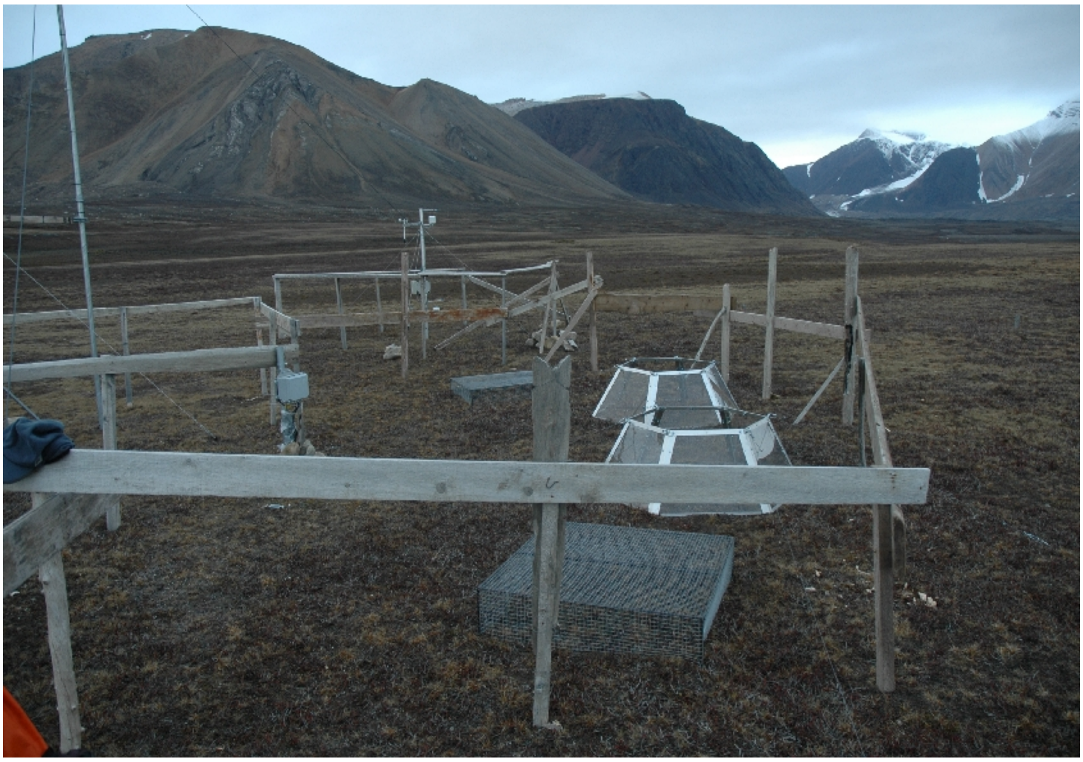

Figure 30. OTC experimental site on the tundra vegetation of the sea terrace.

3,10 Phycology - In situ monitoring of physiological state of cells in Phormidium populations employing fluorescent staining *(Daria Tashyreva)*

Aim: investigate the survival strategy of *Phormidium* populations in the Arctic with particular attention to cells responsible for survival during winter periods.

Current task: monitor the seasonal changes in the structure of the communities, morphology of the cells and filaments, and physiological state of the cells based on fluorescence microscopy observations.

Timeline: study consists of two parts, that is early July (spring), and late September (autumn) observations.

Methods: the comprehensive study on subcellular integrities and metabolic activity of cells was performed *in situ* by staining with fluorescence dyes that indicate the plasma membrane integrity (SYTOX Green), nucleoid localization/presence (DAPI), respiration activity (CTC/INT), and presence of photosynthetic pigments by means of autofluorescence observation. This reveals the state of cells in mixed populations.

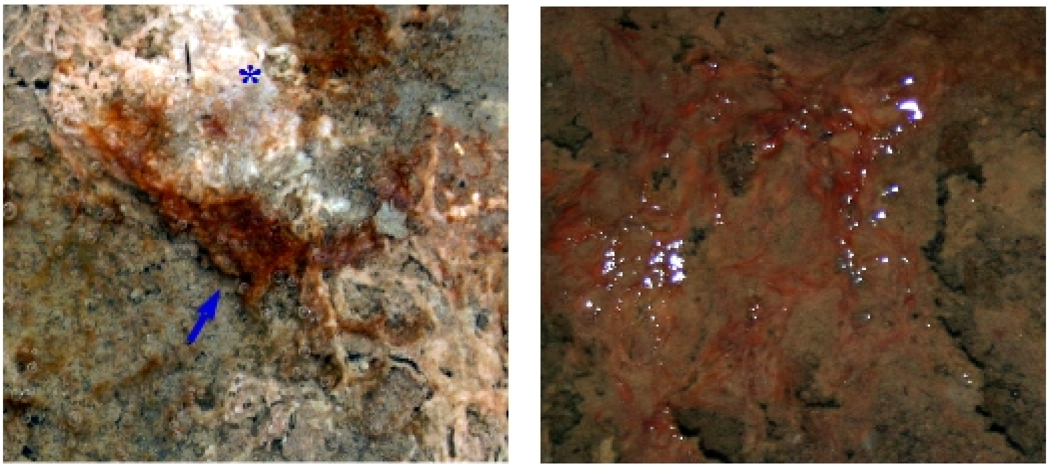

Figure 31. *Phormidium* community in July and September.

Spring communities appeared as white crust (mostly composed of empty sheaths and debris, fig. 31, asterisk) with the red patches of newly grown *Phormidium* biomass (fig. 31, arrow) made of cells quite uniform in morphology and physiological state: long filaments lacking sheath, having high respiration activity, compact nucleoid, non-compromised membranes, and significant content of photosynthetic pigments (fig. 32)

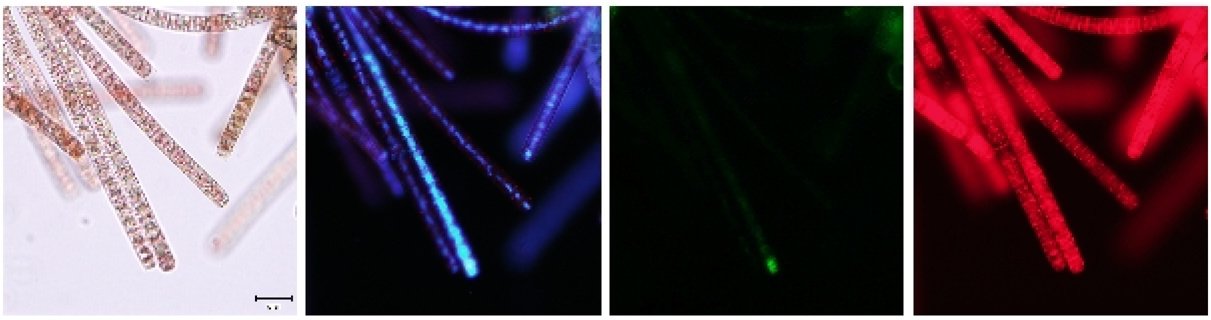

Figure 32. Left to right are brightfield CTC image, signals of DAPI, SYTOX, pigment fluorescence

Autumn communities were represented as tight red-pink crusts (fig. 31); nearly all filaments were enclosed into extremely thick sheaths, frequently formed hormogonia that escaped from the sheaths. The general trend in physiological state was a significant overall decrease of respiration and visible decrease in phycobiliprotein fluorescence; SYTOX-positive cells with compromised membranes were mostly represented by necridic cells that are responsible for hormogonia formation.

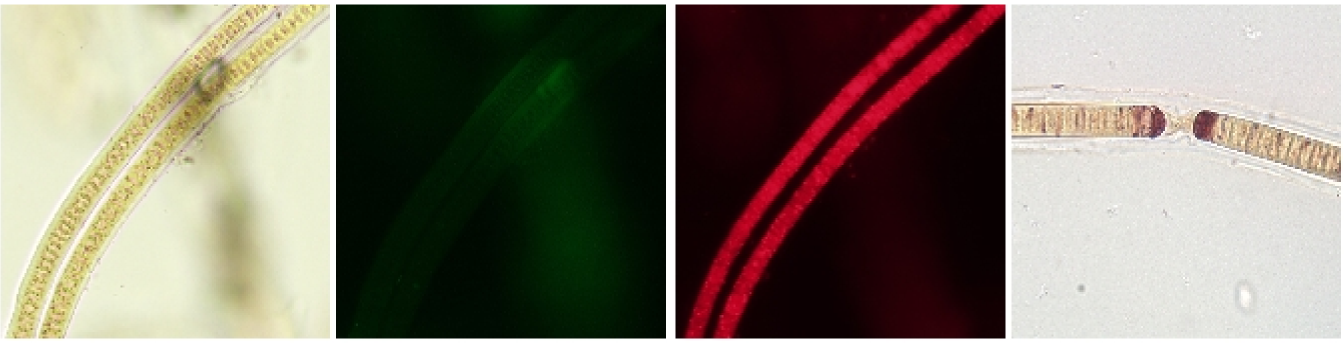

Figure 33. Left to right are brightfield CTC image, signal of SYTOX, pigment fluorescence, hormogonia formation

3,11 Phycology *(Otakar Strunecký, Jiří Komárek)*

Otakar Strunecký under the guidance of prof. Jiří Komárek collected and taxonomically determined natural samples of various types. The main focus of field and laboratory work was aimed to the order Oscillatoriales on genera *Shizothrix*, *Microcoleus*, *Pseudanabaena* and *Leptolyngbya*. Also the order Nostocales with genera *Rivularia*, *Nostoc*, *Anabaena* and *Nodularia* were studied.
The natural samples underwent the initial cultivation in Svalbard.

Figure 34. Otakar Strunecký during sampling from the Petuniabukta sea environment.

Figure 35. Sampling from the terestric ecosystems in the vicinity of research base.

3,12 **Ornithology** *(Václav Pavel)*

The year 2011 was the first year of the Czech ornithology activities in Svalbard. During the first year of study was performed basic reconnaissance of the area close to Petunia bukta, were monitored breeding bird species and were estimated possible research activities.

Although there are only small bird cliffs close to the Petunia bukta and there are no large seabird collonies, several bird species breeds in considerable numbers in the area, from which the most abundant is arctic tern (*Sterna paradissea*). There is an interesting breeding population of this species including several hundred pairs, situated in the rocky hump in front of the Nordenskioldbreen glacier, accessible only from the air or water. There are no arctic foxes (*Vulpes lagopus*) or other mammalian predators in this locality and terns breed in dense colony defending collectively the nests against aerial predators (Arctic skua *Stercorarius parasiticus*). This population is suitable to study breeding behaviour and breeding success of this species, and the results would be comparable to similar study on the Antarctic tern (*Sterna vittata*).

Figure 36. Arctic tern (*Sterna paradissea*).

3,13 **Parasitology** (Oleg Ditrich, Tomáš Tyml)

Parasitological group continued with examination of fish for unicelullar and multicellular parasites.

Fish dissected	
Myoxocephalus scorpius	98 ex.
Clupea harengus	33 ex.
Gymnocanthus tricuspis	22 ex.
Boreogadus saida	14 ex.
Mallotus villosus	16 ex.
Hippoglossoides platessoides	9 ex.
Lumpenus lampretaeformis	8 ex.
Salmo salar	1 ex.

Examination of invertebrate hosts was aimed to obtaining of developmental stages of trematodes, cestodes and myxozoans.

Molluscs dissected	
Hiatella arctica	63 ex.
Buccinum undatum	35 ex.
Mya truncata	29 ex.
Chlamys islandica	5 ex.
Chlamys minima	8 ex.
Serripes groenlandicus	10 ex.
Margarites olivaceus	9 ex.
Tonicella marmorea	6 ex.
Tonicella rubra	5 ex.
Euspira pallida	9 ex.
Coleus kroeyeri	3 ex.
Ciliocardium ciliatum	5 ex.
Astarte rugosa	5 ex.

Polychaetes dissected	
Spirorbis spp.	100 ex.

Crustacens dissected	
Gamarus spp.	100 ex.

New advanced microscopic equipment enabled us to document the findings of myxosporeans reported in results from 2009 expedition. Based on our previous results, we focused series of examination to myxosporea-positive organs of selected fish species. Squash preparations were examined from bile, urine and various kidney segments.

Positive hosts and myxosporeans (figs. 37–40) found in some cases with high prevalence are listed in Tab. 1. Spores and plasmodial stages were fixed for further morphological characterization using transmission and scanning electron microscopy. Samples of myxosporeans were taken for DNA isolation. Multigene phylogenetic analyses are scheduled for near future.

Table 1. Myxosporean species collected in Petunia expedition 2011.

Species	**Host/site of infection**	**Prevalence**
Ceratomyxa longispina	*M. scorpius*/gall bladder	2% (2/98)
Myxidium gadi	*M. scorpius*/gall bladder	14% (14/98)
Sinuolinea sp.	*M. scorpius*/urinary bladder	3% (3/98)
Latyspora sp.	*C. harengus*/kidney	12% (8/66)
Parvicapsula sp.	*G. tricuspis*/kidney, urinary bladder	9% (2/22)
Zschokkella hildae	*B. saida*/kidney	43% (6/14)
Parvicapsula sp.	*H. platessoides*/kidney, urinary bladder	56% (5/9)
Schulmania aenigmatosa	*H. platessoides*/ urinary bladder	44% (4/9)

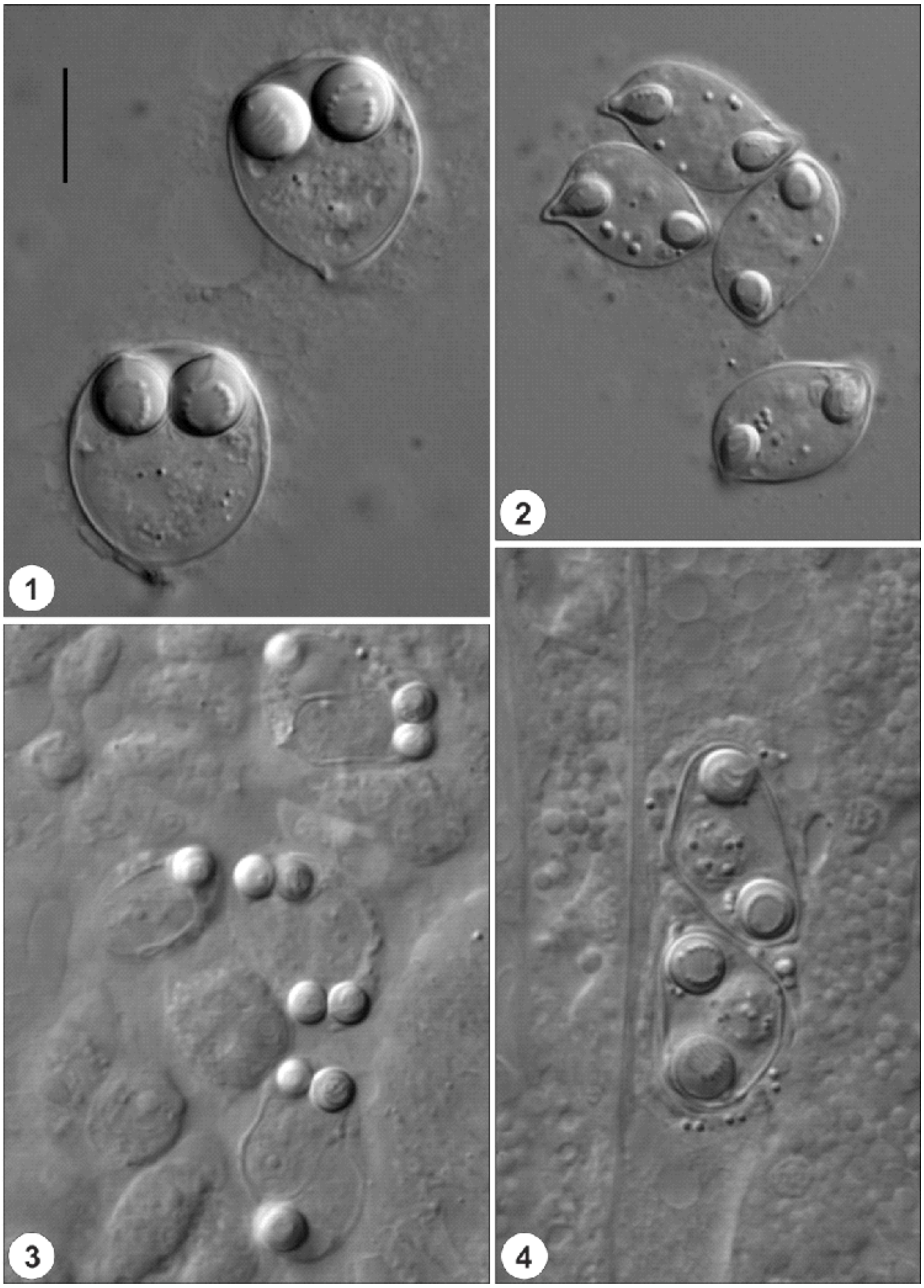

Figure 37−40. Myxospores as seen in Nomarski DIC. **Part. 1.** Mature spores of *Schulmania aenigmatosa* in fresh urine. **Part. 2.** Mature spores of *Myxidium gadi* in fresh bile. **Part. 3.** Mature spores of *Parvicapsula* sp. as observed in the kidney tissue of American plaice, *Hippoglossoides platessoides*. **Part. 4.** Plasmodium of *Zschokkella hildae* with mature spores located in renal tubules of Polar cod, *Boreogadus saida*. Scale bar = 10 µm.

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