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20 - 22 April 2015 • Brno, Czech Republic

Jakub Ondruch, Filip Hrbáček , Daniel Nývlt, Kamil Láska (eds.)

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CPE CENTRE FOR POLAR ECOLOGY CZECH REPUBLIC
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Students in Polar Research Conference 2015 - Preface

Jakub Ondruch, Filip Hrbáček

Dear young polar scientists,
we are really happy to welcome you to the first polar conference dedicated to researches in the beginning of their scientific career, which is organised on the ground of Department of Geography at Masaryk University in Brno, Czech Republic.
Our aim is to establish a platform, where young researcher can meet and discuss various topics related to range of disciplines throughout Polar science. We believe, establishing such network will help the comunication on national as well as international level and thus many common efforts, projects would arise as an outcome.
In order to make the network as dense as possible, our conference is open to all young scientists, whose research focuses on any geoscience and bioscience topics located in Polar regions.
Our conference offers standard concept with most of time given to participants to present themselves. Furthermore, we are pleased our invitation accepted four young well established Czech researchers, who will share the experience with us from their work in both the Arctic and Antarctica. After two intensive days, we invited participants to spend great time with us in Palava region and explore the natural and cultural beauty of one part of Southern Moravia Region.
We hope you will have a great time with us in Brno and will leave enriched with new knowledge and inspiration helpful for your further - not only academic - efforts and we together lay the base for annual meeting for many years to come.

In Brno 20 April 2015
Jakub Ondruch and Filip Hrbáček

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Editors
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Diatoms from the Maritime Antarctic Region; Extreme endemism in Antarctica (keynote)

Kateřina Kopalová[1,2]

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The terrestrial and freshwater aquatic habitats of the Antarctic region include Sub-Antarctic Islands, Maritime Antarctica and Continental Antarctica (Chown and Convey, 2007) (Fig.1). These ideas separated terrestrial habitats on the Antarctic Peninsula and the high latitude Southern Ocean islands from the main part of the Antarctic Continent, where biogeographical zones differ significantly in climatic parameters and type of ecosystems (Walton, 1984). In the past, Continental Antarctica has been described as biologically barren, a cold desert with only a few, usually not very unique (animal) species (Convey, 2010). For some groups that statement may well still be true. However, for other groups, a variety of methods including morphological and molecular techniques, have started to highlight that the Antarctic region is more diverse that has been assumed in the past.

Figure 1: Map of the Antarctic Continent and surrounding Southern Ocean, indicating the three commonly recognised terrestrial biogeographical zones within the region. Picture taken from Convey (2010).

(Bio-)geographically interesting location such as Maritime Antarctic region currently receives considerable attention with growing interest towards global climate changes. Diatoms (*Bacillariophyta*) are one of the principal algal groups in the freshwater and terrestrial ecosystems of the Antarctic Region and their communities are often used as perfect indicators of environmental changes and also as excellent tool for paleo-ecological and biogeographical studies. Until recently, most of the fresh-water diatom species were believed to have a cosmopolitan nature although recent studies show that a highly specific flora could be found in Maritime Antarctic Region. The diverse diatom flora was observed and the results from the similarity and diversity analysis suggest that the diatom flora taxa from the Maritime Antarctic Region present a unique situation in the entire Antarctic Region.

In the last 10 years, applying LM and SEM tools, and a fine-grained taxonomic approach, a large number of new Luticola taxa have been described from Antarctic region (Esposito et al., 2008; Kopalová et al., 2009, 2011; Van de Vijver and Mataloni, 2008; Van de Vijver et al., 2006, 2001, 2012b; Zidarova et al., 2014; Kohler et al., 2015), making the genus one of the most species-rich in the area. Images of endemic *Luticola* species described from the Maritime Antarctic region can be seen in figure 2.

The diversity and levels of endemism seen in the genus Luticola are unmatched by any other known group of organism across a wide range of biodiversity in the Antarctic region. The pristine nature of Antarctica and its freshwater diatom flora will allow us to further explore what appears to be one of, if not the most, extreme cases of endemism ever described for life in Antarctica. Not only is the flora of *Luticola* species high in endemics in the sub-Antarctica region (44 of the 45 species currently described from the region are endemic to the, but of the total number of species in the genus (ca. 200; Levkov et al., 2012), 20% of them are endemic to Antarctica. There is only one cosmopolitan species known, further suggesting the pristine nature of the region, and avoiding the

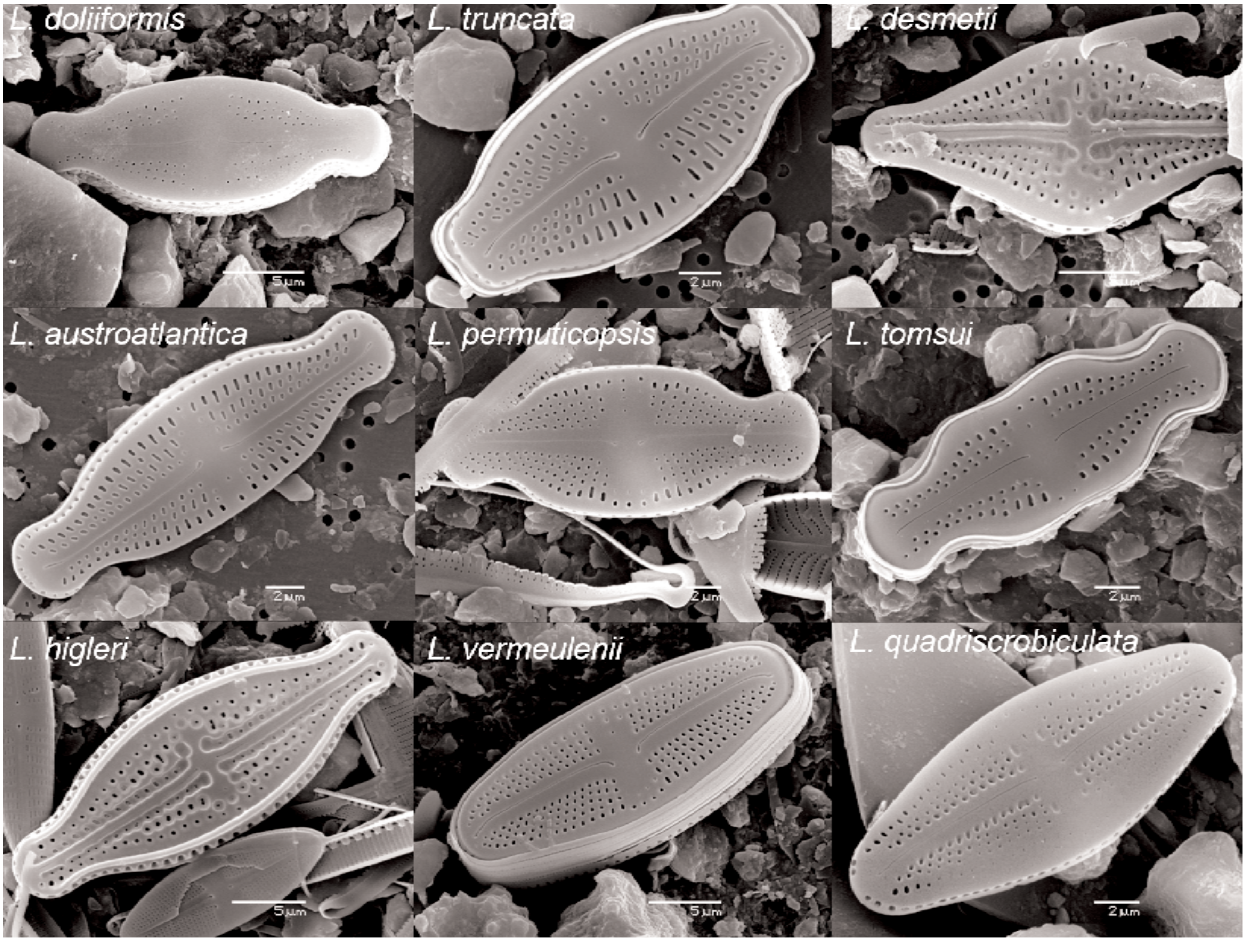

Figure 2: Species from the genus Luticola found in the Maritime Antarctic region showing their morphological variability.

intermixing of cosmopolitan and endemic taxa.

Studies on the genus *Luticola* from Antarctica show high levels of endemism in general and interesting biogeographic patterns. In total, 45 *Luticola* species have been found in the Antarctica region, of which 9 of the species are found in the sub-Antarctic region, and 7 of them are endemic to this region. In Maritime Antarctica, a total of 29 *Luticola* species have been found, and 24 of them are found only in that region (some of them presented in figure 2). Of the 14 species found on continental Antarctica, 9 are endemic. Of the total number of taxa encountered (45), only 1 is found outside the Antarctica region (*L. cohnii*), 1 is found in all three regions (*L. muticopsis*), and 3 are found in Maritime + Continental Antarctica (*L. austraoatlantica*, *L. gaussii* and *L. permuticopsis*); no species are found with the distribution of sub-Antarctic islands and Continental Antarctica to the exclusion of Maritime Antarctica. Thus for the entire region the level of endemism is 98%, and lower but still substantial levels of endemism occur in the three regions. For the genus as a whole, nearly 20% of all species are endemic to Antarctica. *This represents the highest degree of endemism at the level of genus in the Antarctic region for any other group of organisms on earth*.

Can we consider Maritime Antarctic region as a biogeographical hotspot or is it just a taxonomical artefact?

The present lecture discusses the diatom communities living in various freshwater habitats such as lakes, streams and seepage areas and mosses in relation to ecological factors determining their composition and discussing the high endemism found in the genus *Luticola*.

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Glacial changes of marginal parts of Antarctica since the Last Glacial Maximum: The James Ross Island case study (keynote)

Daniel Nývlt[1]

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Antarctic Ice Sheet has changed significantly in its marginal parts over the Quaternary glacial-interglacial cycles. James Ross Island (JRI) located at the north-eastern tip of the Antarctic Peninsula (AP) represents an excellent place to study glacial changes since the Last Glacial Maximum, i.e. from the full glacial to present interglacial conditions.

Deglaciation of the Weddell Sea outer shelf began around 18.3 cal. ka BP (recalibrated age of Heroy and Anderson, 2007). It is very probable, that the most important retreat from outer to middle shelf occurred during Meltwater pulse 1A, i.e. ~14.5–14.0 ka (Weaver et al., 2003; Clark et al., 2009). In spite of the subsequent climatic deterioration during the Antarctic Cold Reversal (~14.1–12.4 ka; Stenni et al., 2001), which interrupted the Antarctic Late Glacial warming, individual ice streams of the north-eastern part of the AP continued to retreat as was shown for the Southern Prince Gustav Ice Stream by Evans et al. (2005) and Pudsey et al. (2006). The retreat of ice streams even during unfavourable climatic conditions of the Antarctic Cold Reversal was induced by rising sea level due to continuing thawing of Northern Hemisphere ice sheets and by an earlier warming in peripheral areas of Antarctica (such as the JRI area) as has been shown by deuterium excess calculated temperature anomalies from the JRI Ice Cap (Mulvaney et al., 2012). It could be shown from their data, that the most prominent warming in the area of JRI occurred between 13 and 12 ka (Mulvaney et al., 2012). This was connected with the change of grounded glaciers to floating ice shelves and the grounding zone retreat. The debuttressing effect from the break-up of ice shelf edges accelerate retreat and affected coastal lower-lying land areas, which have ceased to be supplied by ice from ice streams and deglaciated rapidly, as is the case with the neck of Cape Lachman, northern JRI (Nývlt et al., 2014).

Due to the thinning and retreating Northern Prince Gustav Ice Stream split from the remaining ice cover left on the surface of northern JRI approximately at 12.9 ka and since that both ice masses evolved separately (Nývlt et al., 2014). This age represents the minimum age of deglaciation of JRI's low-lying areas, the remaining ice cover located at higher elevations retreated during the early Holocene due to gradual decay of terrestrial ice. The Cape Lachman elevated promontory with an altitude of 100–116 m deglaciated by ~8.0 ka (Johnson et al., 2011) and higher-lying volcanic mesas, such as Johnson Mesa (with an altitude of 260–323 m) became ice free by ~6.6 ka (Johnson et al., 2011). This is a different deglaciation model compared to exposure data from a more proximal part of northern AP ice streams in the southern Prince Gustav Channel and former Larsen A ice shelf, where AP ice streams thinned gradually with time and thus higher-lying elevations deglaciated first and low-lying areas became ice-free more recently (Balco et al., 2013).

Advances of local land-terminating valley glaciers have been reported at different scales for the Mid-Holocene (Hjort et al., 1997) and Late-Holocene (or Little Ice Age, LIA) times (Carrivick et al., 2012). During this time the local equilibrium line altitude was significantly lower than at present (Nývlt et al., 2010; Engel et al., 2012) even though other parameters, such as precipitation and snow drift became more important for small glaciers mass balance changes, than temperature (Carrivick et al., 2012). This is well supported by other independent data inferred from diverse proxy records originating from lake sediments (Ingólfsson et al., 1992; Björck et al., 1996). We do not have enough data to reconstruct the deglaciation of northern Ulu Peninsula during the mid- and late-Holocene period, especially for higher elevations. The present front of a small ice dome on the Lachman Crags lies at ~510 m (CGS, 2009). The generally low-lying landscape has thus remained ice-free for most of the Holocene due to the absence of higher-located accumulation areas for local glaciers (Nývlt et al., 2014). However, the remaining ice-cover on higher-lying volcanic mesas has most probably persisted since at least the Pleistocene, as was demonstrated by Johnson et al. (2009) for Patalamon Mesa on the western coast of JRI.

Prominent moraine ridges (originating from LIA advance) immediately in front of all studied glaciers have crests that are typically 20–40 m higher in elevation than the present glacier surface. All of the moraines are ice-cored. Multiple crests are evident at most of the glaciers, particularly in the re-

gion of the glacier snout, i.e. at lowermost elevations (Carrivick et al., 2012). The magnitude of retreat of the glacier snout positions since this last advance is remarkably similar between small land-terminating glaciers of northern JRI and varies from 75 m at Triangular Glacier to 130 m at San José Glacier. The glacier surfaces have lowered by (9–23) ± 1.6 m on average since the LIA. Surface lowering at each glacier declines in magnitude with increasing altitude up to the maximum elevation of the moraine crest. Overall, glacier attritions amount to 0.16–0.44 km^2, which equates to 12–46% of their LIA surface area (Carrivick et al., 2012). The LIA glaciers were more extensive, thicker and with a convex long profile, which clearly demonstrates that they had a positive mass balance. In contrast, the present asymmetric surface morphology and linear-slope long profile, the absence of contemporary surface crevasses or moraines could be taken to imply modern negative mass balance of these glaciers. This is supported by remote data and field observations (Engel et al., 2012). The ongoing glacier changes are reflected also in changing glacier thermal regime. The Late Holocene ice-marginal retreat and surface lowering has caused a transition from polythermal glaciers to cold-based glaciers (Carrivick et al., 2012). Land-terminating glaciers on the northern JRI are now apparently cooler despite a warmer climate.

Since that time local glaciers retreated significantly, however remote sensing data shows that most of the retreat took place during the last four decades (Engel et al., 2012). This has been supported with field and remote sensing data from Davies Dome and Whisky Glacier. The changes in elevation, area and geometry of these two glaciers between 1979 and 2006 were derived from digital elevation models and aerial photographs. Ice thickness was measured using ground-penetrating radar for glacier volume and glacier bed elevations calculations. Maximum measured ice thicknesses of Davies Dome and Whisky Glacier are 83 ± 2 and 157 ± 2 m, respectively. The mean ice thickness of Davies Dome and Whisky Glacier is 32.4 ± 1.2 and 99.6 ± 1.8 m, respectively (Engel et al., 2012). Between 1979 and 2006, the volume of Davies Dome and Whisky Glacier reduced from 0.23 ± 0.03 km^3 to 0.16 ± 0.02 km^3 (–30.4%) and from 0.27 ± 0.02 km^3 to 0.24 ± 0.01 km^3 (–10.6%), respectively. The mean elevations of Davies Dome and Whisky Glacier decreased by 0.32 ± 0.10 and 0.37 ± 0.10 m a^{-1}, respectively (Engel et al., 2012). These values correspond well with the mean surface lowering of the Glaciar del Diablo located on the northern coast of Vega Island ~30 km northeast of our studied glaciers published by Skvarca et al. (2004). The annual mean surface lowering of this glacier was –0.32 m w.e. over the period of 1999–2003, which is higher than mean values of –0.20 m w.e. over the period of 2001–2011 published for the same glacier by Marinsek and Ermolin (2015).

A comparison of our spatial data with earlier glaciological observations suggests that Davies Dome and Whisky Glacier were subject to greater retreat, surface lowering and ice volume loss than other island ice domes and valley glaciers in the Antarctic Peninsula region. If the recent rate of volume loss continues, they could disappear within 62 ± 52 and 227 ± 220 years, respectively. This approximated timing corresponds well with the value based on mean rate of areal loss for Whisky Glacier (228 ± 22 years to extinction), but the volumetric change of Davies Dome is more rapid than its areal change (104 ± 5 years). However, we assume that area rather than volume is a more important factor in the future evolution of both glaciers (Engel et al., 2012). However, field glacier mass balance data for small glaciers on JRI show large inter-annual variability with unprecedented ice gains in 2007, 2009, 2010 and 2012, which might show on a slightly changing climate conditions at this part of AP in the last decade (Láska et al., 2012, 2015).

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Algae as a significant factor for albedo feedback on the Greenland ice sheet (keynote)

Marek Stibal[1,3,4], Jason E. Box[2], Karen A. Cameron[1,3], Marian L. Yallop[5], Nathan A. M. Chrismas[5,6], Alia L. Khan[7], Filippo Calì Quaglia[2,8]

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Microbial activity is a significant yet little known factor responsible for the darkening of glacier ice worldwide. For example, the Greenland ice sheet has been darkening since the year 2000 and, without this darkening, the increase in its surface melt rate would be half as large. Light-absorbing impurities found in Greenland snow and ice include mineral dust, black carbon, and, importantly, microbial cells; however, no quantitative relationship between cell abundance and solar absorbance has been established to date.

It has been demonstrated that some species of microalgae from the group Zygnematophyceae are abundant on the surface of the Greenland ice sheet as well as other land ice masses. These algae produce a dark-coloured pigment as a screening mechanism to down-regulate photosynthesis when exposed to high intensities of visible and ultraviolet radiation typical for glacier surfaces. Intact cells of ice algae absorb light with characteristic spectral profiles across ultraviolet and visible wavelengths, where a sinorganic dust particles typical for these areas display little absorption. Further, humic byproducts of microbial metabolism are absorptive and may contribute to the darkening of glacier surfaces.

A dark region appears each ablation season along the Greenland ice sheet periphery. This region contains dust deposited in the late Holocene, which is now melting out and is considered the principal factor responsible for the observed albedo reduction. High abundance of ice algae has also been observed in this region. We chose a site at the edge of the dark region to measure surface albedo and evaluate the role of outcropping dust and algal presence in its change, and collected algal abundance and surface albedo data over 57 days in summer 2014. We also collected samples of surface ice in other locations on the Greenland ice sheet to show the presence of ice algae outside the dark region and to identify the environmental factors controlling the growth and abundance of the algae. We show that the effect of algae on surface albedo is more important than that of mineral dust, and that the algae may be responsible for a significant part of surface melting on the ice sheet.

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Palaeontology of Cenozoic and Mesozoic sedimentary environments in James Ross Basin, Antarctic Peninsula (keynote)

Radek Vodrážka[1]

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The James Ross Basin, at the northern tip of the Antarctic Peninsula, provides the thickest and best-exposed onshore Cretaceous and Early Tertiary sedimentary succession in Antarctica.

The sedimentary record exposed within the basin also provides an unrivalled opportunity to unlock the record of climate change and biotic response within a high-palaeolatitude setting.

The James Ross Basin initially formed as a back-arc basin, next to the intermittently active volcanic arc. It was continuously subsiding, providing the accommodation space for the deposition of in excess of 5 km of marine sedimentary rocks for over 115 million years, through the Late Jurassic to the Late Eocene.

The result of years of geological research now confirms the James Ross Basin fill as one of the most important Early Cretaceous-early Palaeogene sedimentary sequences in the Southern Hemisphere. It has prolific marine invertebrate faunas, an important vertebrate record, the highest latitude section in the Southern Hemisphere across the Cretaceous-Tertiary boundary, and fossil floras that are key to understanding past climate change and biogeographic evolution. In addition, exceptional fossil preservation has enabled the use of various isotopes (Sr, O, C) to provide a more robust chronostratigraphic framework for palaeoclimatic and evolutionary histories, and has highlighted the importance of the basin within a global context.

The first palaeontology studies are derived from the material collected by Swedish geologist Otto Nordenskjöld in 1901-1903 during the heroic age of polar exploration of Antarctica. Since the 1940s, the rocks and fossils of the James Ross region have been the target of serious scientific investigations by scientists from many nations, most notably from United Kingdom, Argentina and USA. Since 2008 Czech scientists provide the palaeontological studies from the James Ross Island region, joining international effort in scientific exploration of this key-reference section.

The talk will focus on results of palaeontological expeditions to James Ross Basin by Czech scientists between 2008-2013. Tens of important fossil finds from Cenozoic and Mesozoic strata of Antarctic Peninsula and Seymour, Vega and James Ross islands will be presented. Moreover, the importance of these fossils for understanding biostratigraphy, palaeogeography and palaeoecology of studied sedimentary rocks will be discussed. A special emphasis will be put on description of palaeontological techniques employed in field studies in Antarctica, comparing and contrasting them with those used in temperate climate regions. Laboratory methods for extraction of micro- and meso-fossils will be briefly introduced as well.

The Influence of Atmospheric Circulation on Summer Free-air, Near-surface and Reanalysis Temperature Lapse Rates from Ny-Ålesund (Svalbard)

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The air temperature stratification is an important factor affecting various environmental processes in the Arctic. In regions with sparse data, such as Svalbard archipelago, the free-air temperature lapse rates (frequently obtained from radiosounding observations) might be substituted by temperature lapse rates (LR) derived from near-surface measurements or reanalysis data. Nevertheless, the interchangeability of those LR in Norwegian Arctic has not been assessed yet.

In this contribution, the air temperature stratification in Ny-Ålesund (Spitsbergen Island) in July 2009 is determined based on three different datasets: the radiosounding in Ny-Ålesund, performed by Alfred Wegener Institute at 12 UTC every day, the ERA-Interim Reanalysis (ECMWF) from the grid point nearest to Ny-Ålesund (at the distance of 5.4 km) and near-surface temperature LR. The last mentioned dataset was derived using 2-m air temperatures from a measuring site at 8 m a. s. l. and from the Zeppelin Mountain (475 m a. s. l.), which are 2 km apart. Therefore, the free air and reanalysis temperatures were interpolated to the levels of 8 and 475 m and the corresponding LR were calculated. The influence of atmospheric circulation was examined using 850 hPa geopotential height, the meridional component of geostrophic wind and other parameters from the ERA-Interim Reanalysis above the study site.

In the study period, the LR derived from reanalysis data differed significantly from the other two LR. The differences between free-air and near-surface LR ranged from -0.4 to 0.6 °C/100 m, however, the absolute value of the difference was less than 0.1 °C/100 m in 29% of the days. The reanalysis LR indicated the occurrence of air temperature inversion up to four times more often than free-air or near-surface temperature LR. All the LR were negatively correlated to 850 hPa geopotential height and the 850- to 1000-hPa thickness. The differences between free-air and near-surface temperature LR correlated positively to wind speed and negatively to meridional component of the wind.

Acknowledgement

The authors thank Alfred Wegener Institute for the coastal air temperature and the radio sounding data. We acknowledge the EBAS database (http://ebas.nilu.no/), from which air temperature data for the Zeppelin Mountain were used. ERA-Interim Reanalysis datasets are available on the ECMWF website (http://apps.ecmwf.int/datasets/data/interim-full-daily/). The research was supported by the project LM2010009 CzechPolar (MSMT CR) and project of Masaryk University MUNI/A/0952/2013 „Analysis, evaluation, and visualization of global environmental changes in the landscape sphere (AVIGLEZ)".

New Antarctic gregarine from littoral amphipod from James Ross Island

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Antarctica is an exceptional continent of the Earth with very extreme environment. Not many species can survive there, however, the marine fauna is enormously rich, especially in plankton, nekton and benthos. Many reviews concern climatology, geology, palaeontology, and fauna of vertebrates (fish, birds and mammals) of Antarctica (Eastman, 2005; Barbosa and Palacios, 2009). A number of investigations were dedicated to apicomplexans parasitizing fish, birds, and plankton krill (Barber and Mills Westermann, 1988; Takahashi et al., 2009; Golemansky, 2011). Only few studies, however, dealt with gregarines – one of the basal groups of the phylum *Apicomplexa* occurring in littoral or benthic invertebrates, especially amphipods.

Gregarines are extracellular endoparasites of a broad range of invertebrates. Most of them inhabit host intestinal lumen and possess heteropolar elongated, cylindrical body with the anterior end attached to the host cells. Usually, the feeding stages of parasite (=trophozoites) are subdivided into three parts: epimerite (function of attachment), and protomerite followed by a deutomerite with large nucleus. The last two are separated by a fibrillar septum. Gregarines with such organisation represent the "tricystid" form of gregarines. On the other hand, the gregarines, which are not subdivided, represent the "monocystid" form. It should be also mentioned that, generally, trophozoites exhibit gliding motility and possess a unique organisation of cell cortex. The pellicle forms longitudinal epicytic folds with special sets of fibrils on the top. Before gametogenesis, the gamonts form a sexual association called syzygy. Later on, they round and form a common envelop (gametocyst), under which further process, including gametogenesis, fertilisation and formation of invasive stages (sporogenesis), take place (Desportes and Schrével, 2013).

Amphipods *Gondogeneia* sp. were collected on littoral of Cape Lachman, James Ross Island. Animals were dissected and gregarines were collected from their intestine with thin glass pipets. Parasites were measured, documented under light microscope, and fixed for electron microscopy.

In the amphipod intestine we observed mostly syzygies, in which the partners contacted to each other in head-to-tail manner (Figure 1). The prevalence and abundance of parasite were very low: about 10% and 1-2 syzygy, correspondingly. Only few trophozoites were found. All found para-

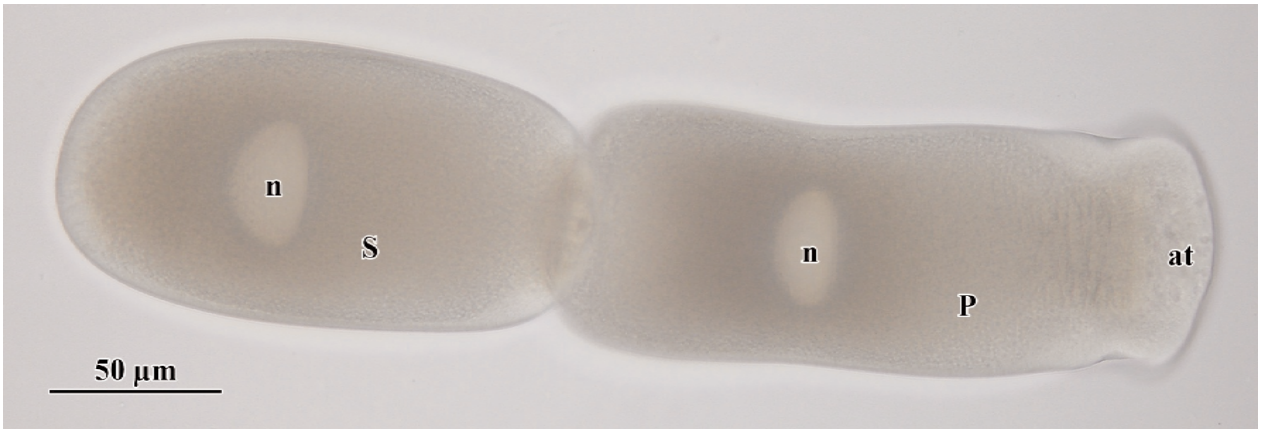

Figure 1: Syzygy of Antarctic gregarine from littoral amphipod Gondogeneia sp. (at – attachment point, n – nucleus, P – primite, S – satellite). Light microscopy.

sites showed similar morphology. Anterior gamont of syzygy (primite) was longer than posterior one (satellite). Both partners were of monocystid appearance and possessed oval or lentil-shaped nucleus, situated in the second half of the cell. The syzygies exhibited gliding motility. As other gregarines with this type of movement, the surface of observed gamonts was covered with longitudinal epicytic folds. The attachment site of the primite was convex with a crumpled surface, and epicytic folds extended from it towards the posterior end of the cell. The posterior end formed concave depression with a collar into which the anterior end of satellite plugged in. The cytoplasm of both gamonts was packed with amylopectin grains, which are the marker of gamont stage.

So far, only two species of gregarines were reported from Antarctic region, from planktonic krill *Euphasia superba* and littoral amphipod *Paramoera walkerii.* Both of them belong to the family Cephaloidophoridae, which possess tricystid form of trophozoites and gamonts (Lipa and Rakusa-Suszczewski, 1980, Takahashi et al., 2009). There are numerous gregarines described from different crustaceans. Among them, the representatives of the family Ganymedidae are monocystid, parasitize in crustaceans, and in amphipods as well. They form a cup-like interface between the primite and satellite. We assume that newly found gregarine from *Gondogeneia* sp. belongs to this family (genus *Ganymedes*), but further investigations are needed.

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Supplemental UV-B treatment leads to different responses in *Nostoc commune* and *Xanthoria elegans*. Activation of photoprotective mechanisms

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Antarctic terrestrial autotrophs are capable to survive extremes in physical factors of polar environment. Their resistance to individual stress factors, however, is species-specific and dependent on capacity of protective mechanisms of particular species. Antarctic lichens, thanks to synthesis and presence of photoprotective compounds (see e.g. Vráblíková et al., 2005), exhibit a high degree of resistance to high doses of photosynthetically active radiation (PAR). Resistence against photoinhibition is reported for several Antarctic species, e.g. *Umbilicaria aprina* (Kappen et al., 1998), *U. decussata* (Barták et al., 2003), *U. antarctica* (Barták et al., 2004), and *Usnea antarctica* (Balarinová et al., 2014). Sensitivity of Antarctic lichens to UV-B radiation is much less studied. Moreover, only fragmentary knowledge exists on physiological processes in such organisms under UV-B stress. In our study, we therefore focused on the responses of an Antarctic cyanobacterium (*Nostoc commune*) and algal lichen (*Xanthoria elegans*) to supplemental UV-B to evaluate an extent of photoprotective mechanisms.

Thalli of *X. elegans* and *N. commune* colonies were hydrated for 48 h at 5 °C and then exposed to low light (10 ≒mol m^{-2} s^{-1}, PAR) supplemented with low (0.7 W m^{-2}), medium (1.5 W m^{-2}), and high (3.0 W m^{-2}) dose of UV-B radiation for 6 days at 24 °C. On days 0, 1, 2, and 6, chlorophyll (Chl) fluorescence parameters were measured and samples for pigment analyses taken. To evaluate UV-B treatment-related effects on primary photosynthetic processes, Kautsky kinetics supplemented with quenching analysis were measured by a HFC-10 fluorometer (PSI, Czech Republic). To evaluate pigment content (Chla, Chlb, carotenoids) and UV-B screening compounds according to Buffoni-Hall et al. (2002), ethanol extracts from the samples collected before and during treatment(s) were measured by UV-VIS spectrophotometer (Spekord 205, Analytik, Germany) within the wavelength range of 190-700 nm.

Fluorometric data revealed interspecific differences. Changes in primary photochemical processes of photosynthesis (Fv/Fm, Phi PSII) in response to treatments were less pronounced in *N. commune* than *X. elegans*. Interspecific differences were demonstrated in the shape of Kautsky curves. Generally, variable Chl fluorescence (Fv) recorded during actinic light period showed polyphasic course in *X. elegans*, while it was found close to steady-state fluorescence (Fs) in *N. commune* colonies. High resistance of *N. commune* against supplemental UV-B is attributed to effective energy quenching of absorbed light in antennae and involvement of hundreds of proteins into acclimation responses to UV-B stress (Ehling-Schulz et al., 2002). Our data support the conclusion of Singh et al. (2011) that majority of Antarctic higher plants and autotrophic organisms have a high capacity to synthetize photoprotective secondary compound when exposed to increased levels of UV-B. Similarly to field evidence (Lud et al., 2001, study done on *Turgidosculum complicatulum)*, an increase in UV-B dose led to enhanced synthesis of UV-B absorbing compounds, parietin in particular, in *X. elegans*. Comparably to our study, UV-B induced synthesis of UV-screening secondary compounds was found by Nybakken et al. (2004) in the

species. Further analysis of the data will address an involvement of non-photochemical quenching (NPQ) into the protection of photosynthetic apparatus of the two species when exposed to supplemental UV-B doses.

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Sediments from the Pleistocene-Holocene transition in Mimerdalen, Spitsbergen – first research results

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Relics of glacial and glaciomarine sediments of local Last Glacial Maximum and subsequent Late Glacial to Early Holocene deglaciation are preserved on the sides of Mimerdalen valley. Large relic of these sediments could be found at the western margin of the Pyramiden town in the southern mouth of the Bertilbreen valley. The accumulation has been studied using sedimentological, geophysical and palaeontological methods.

Lodgement till with 50–65% of striated clasts rests on the basement. Supraglacial melt-out till with only 24–37% of striated clasts and common subvertically aligned clasts continues in vertical succession (Fig. 1). These tills could be attributed to the Late Pleistocene Bertilbreen advance basing on the topographical position and petrological composition. The facies composition of supraglacial tills resembles the Little Ice Age supraglacial tills of this glacier.

Glaciomarine gravely to less commonly sandy sediments with well-evolved foreset and topset rest on the tills. Ground penetrating radar survey has shown the coupling of facies evolution and the preglacial basement topography. Foresets and topsets are well-developed in a place of gentle depression. On the other hands, all units continue horizontally, or slightly inclined on elevated flat topography.

Shells of three bivalve species have been preserved in living positions in sandy gravel set: *Mya truncata* (60%), *Macoma calcaera* (30%) and *Hiatella arctica* (10%), see also Fig. 2. AMS radiocarbon dating of the shells shows ages of ~11,000 cal. years BP. Sea urchins

Figure 1: Studied tills and glacimarine sediments near the western margin of the Pyramiden Town lies at ~50 m a.s.l. The scale at the left bottom is 40 cm long.

Strongylocentrotus droebachiensis are also common species preserved here. Algae remains concentrations could be found in some layers, some of the cover larger clasts.

The whole accumulation has been deposited in deltaic and littoral settings. Coarse-grained delta distributary channels prograded through the depressions. Gravely sand sheets developed on flat sea floor between the deltaic distributary channels.

Species composition, as well as the age of bivalves show the earliest deglaciation phase after the local Last Glacial Maximum (Feyling-Hanssen, 1955; Mangerud et al., 1992). The main glacier outlet of Billefjorden originating from Adolfbukta decayed by calving and basal melting as an ice shelf. Lateral outlets from Mimerbukta have generally been in hanging position comparing to the main outlet and retreated at the same time as land-terminating glaciers depositing subglacial and supraglacial tills. The abrupt early Holocene glacioeustatic sea-level rise led to the sea transgression to the Mimerdalen area. Proglacial stream from Bertilbreen entered the sea by coarse-grained delta with sediment redistribution between deltaic tributary channels by long shore currents.

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Monogenetic ectoparasites (Plathelminthes, Monogenea) from the Antarctic fishes collected in Prince Gustav Channel, Weddell Sea

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Gyrodactylidea Bychowsky, 1937 (Monogenea) includes species that parasitize predominantly on the gills or the fins of fish. To date, only nine species of the genus *Gyrodactylus* Nordmann, 1832 (Gyrodactylidae Cobbold, 1864) and five species of the three genera of Tetraonchoididae (*Allotetraonchoides* Dillon and Hargis, 1968, *Neopavlovskioides* Dillon and Hargis, 1968 and *Pavlovskioides* Bychowsky et al., 1965) have been described from fishes living in Antarctic waters (Gusev, 1967; Hargis and Dilon, 1968; Dilon and Hargis, 1968; Rokicka et al., 2009). The fish were sampled in Prince Gustav Channel, Weddell Sea during the Antarctic summers of 2013 and 2014. Parasitic examination was performed at the Johann Gregor Mendel Station on the James Ross Island and parasite identification was carried out in the lab at the Department of Zoology and Botany, MU, Brno. Examined fish belong to genera *Notothenia* Richardson, 1844 and *Trematomus* Boulenger, 1902 (both *Nototheniidae* Günther, 1861) and *Parachaenichthys* Boulenger, 1902 (Bathydraconidae Regan, 1914). A prevalence of 38% (44/115) was recorded for monogeneans. Species identification based on morphometric analysis of hard parts of attachment organ shown the presence of seven species from genera *Gyrodactylus* and *Pavlovskioides*. From *Notothenia coriceps* two *Gyrodactylus* species were identified, *Gyrodactylus coriicepsi* and *Gyrodactylus* sp. 1. From the fish of *Trematomus* (*T. newnesi, T. bernacchi, T. eulepidotus and T. hansoni*) four *Gyrodactylus* species and two *Pavlovskioides* species were recognized, namely *Gyrodactylus australis*, *Gyrodactylus* sp. 1, *Gyrodactylus* sp. 2, *Gyrodactylus* sp. 3,

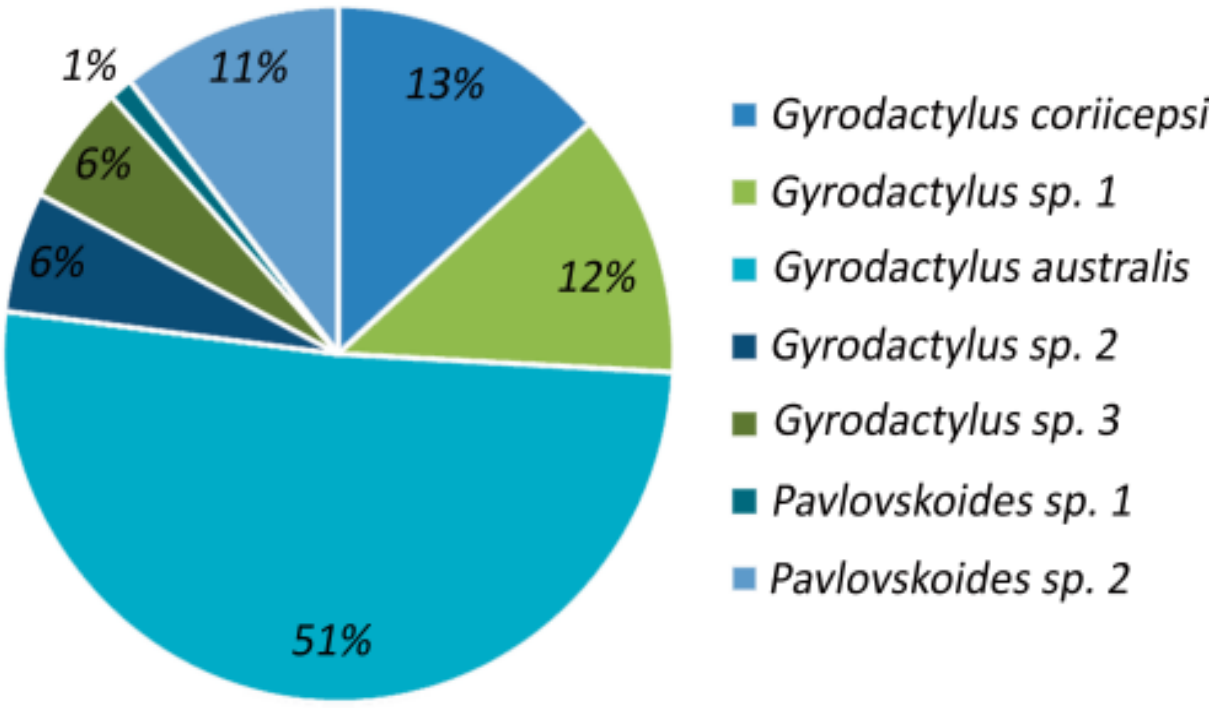

Figure 1: The percentage of parasites .

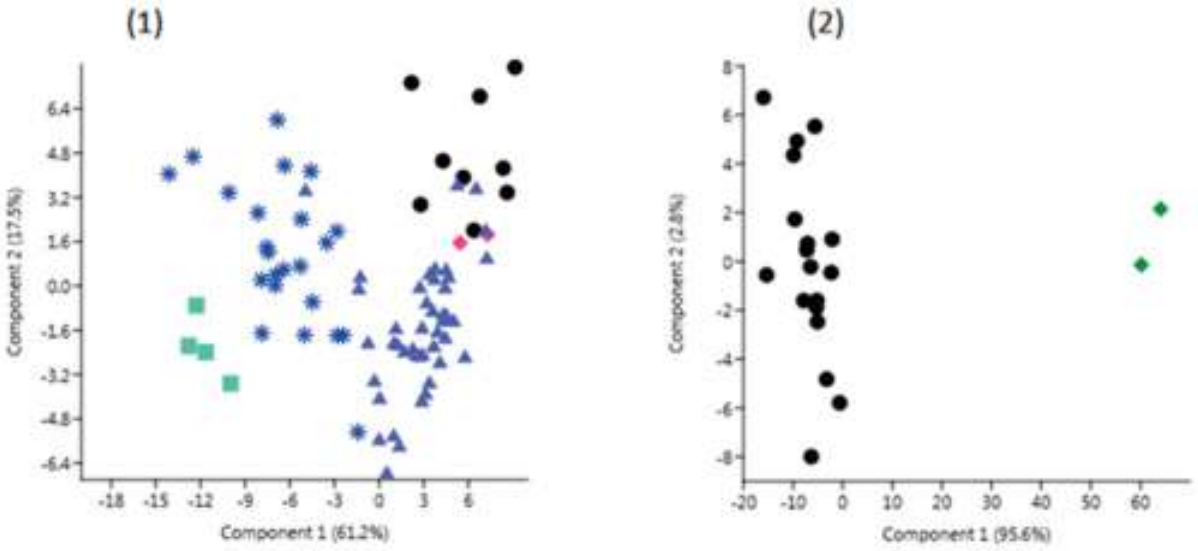

Figure 2: Scatterplot of principal component analyses on haptoral hard parts measurements of *Gyrodactylus* spp. (1) and *Pavlovskioides* spp. (2): *G. australis* (▲), *G. coriicepsi*(∗), *Gyrodactylus* sp. 1 (•), *Gyrodactylus* sp. 2 (■) and *Gyrodactylus* sp. 3 (♦); *Pavlovskioides* sp. 1 (•) and *Pavlovskioides* sp. 2 (♦).

Table 1: Species of monogeneans per fish.

Fish	Gyrodactylidea
Notothenia coriceps	*G. coriicepsi*, *Gyrodactylus* sp.1
Trematomus newnesi	*Gyrodactylus* sp. 1, *Gyrodactylus* sp. 2, *Gyrodactylus* sp. 3, *G. australis*
Trematomus bernacchi	*Gyrodactylus* sp. 1, *Gyrodactylus* sp. 3, *G. australis*, *Pavlovskioides* sp. 1, *Pavlovskioides* sp. 2
Trematomus eulepidotus	*Gyrodactylus* sp. 1, *Pavlovskioides* sp. 2
Trematomus hansoni	*Pavlovskioides* sp. 2
Parachaenichthys charcoti	–

and *Pavlovskioides* sp. 2. No monogeneans were observed from fish of the genus *Parachaenichthys*. The highest species richness, 3 species of *Gyrodactylus* and 2 species of *Pavlovskioides*, was observed on *T. bernacchi.* The highest prevalence of 51% was observed for *G. australis* on *T. newnesi*. This study significantly extends the knowledge about monogeneans in the Antarctic region.

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Long term monitoring of active layer thermal properties on James Ross Island, Eastern Antarctic Peninsula

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Active layer and permafrost are considered a very important component of the Cryosphere, which is very sensitive to climate change. Antarctic Peninsula region is one of the most rapidly warming part of the Earth in last few decades (Turner et al., 2002). These changes strongly affect state and thermal regime of active layer and permafrost. Unfortunately there is still lack of information about active layer properties in Antarctica although the number of studies especially from South Shetland region have increased in last several years (Guglielmin, 2012). This study brings information about state of the uppermost part of the active layer on Johnson Mesa (James Ross Island, Antarctica) in period 2007 to 2014.

Johnson Mesa (340 m a. s. l.) is about 2 km^2 large volcanic mesa in the northern part of James Ross Island (Figure 1). The monitoring site is located in the centre of sorted polygon composed of frost shattered basalts typical for the Johnson Mesa surface. The active layer thermal regime at 5, 10 and 20 cm depths and meteorological condition were measured since January 2007 using resistance thermometers Pt100/8.

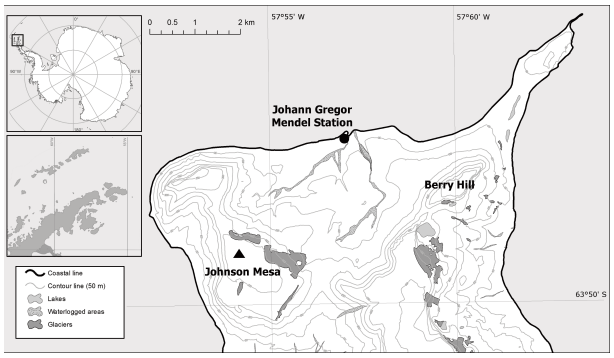

Figure 1: Location of the study site in the northern part of James Ross Island.

The mean annual air temperature varied between -6.5 and -10.4 °C while the mean annual ground temperature at 5 cm varied between -5.1 and -9.2 °C during period 2007 to 2014. Strong correlation relationships (Figure 2a) were found between mean annual air temperature and mean annual ground

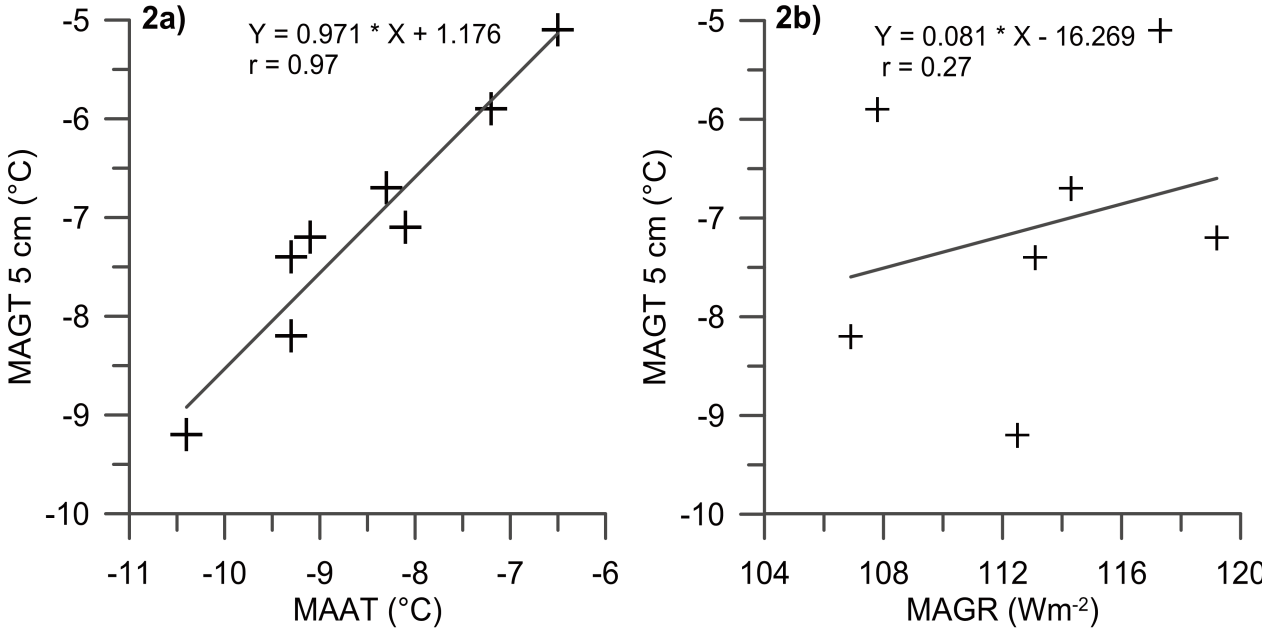

Figure 2: Relationship (2a) between mean annual air temperature (MAAT) and mean annual ground temperature at 5 cm (MAGT) and (2b) between mean annual global radiation (MAGR) and MAAT during years 2007 and 2014.

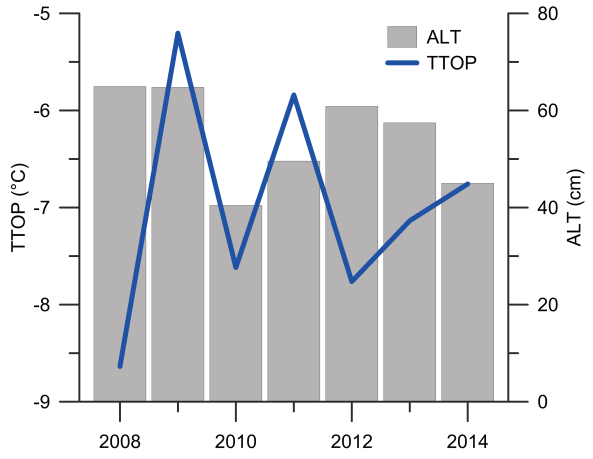

Figure 3: Variability of active layer thickness (ALT) and temperature on the top of permafrost table (TTOP) in period 2008-2014.

temperature at 5 cm (r = 0.97) while the effect of mean annual global radiation (Figure 2b) on mean annual ground temperature was found as poor (r = 0.27). Finally, the T-TOP model and Stefan model (Figure 3) were used for calculation of the mean annual temperature on the top of permafrost table and the annual active layer thickness in the profile respectively (Riseborough et al., 2008).

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Algal Stream dynamics, James Ross Island, Antarctica

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Ulu Peninsula on James Ross Island (JRI) is one of the largest unglaciated areas in Antarctica (Ingólfsson et al., 1998), also an important area with freshwater ecosystems - running water in particular. Only a few studies on hydrology of Antarctic water streams are available usually dealing with technical issues or estimating freshwater budget on the basis of indirect methods (i.e. Affleck et al., 2014, Rückamp et al., 2011). Dynamics of Algal Stream (Fig. 1) behaviour has been studied during the 2015 expedition. Emphasis has been put to study runoff, thermal regime and suspended sediment transport. 6 weeks of continuous automatic hydrological monitoring together with manual discharge measurements and suspended sediment samplings has been carried out in the vicinity of the J. G. Mendel research station. A more detailed study has been done on the thermal regime on the longitudinal profile of Algal Stream during 10 days in February.

Algal Stream is a typical small water stream characteristic for this part of JRI with the river basin covering the area of about 5 km^2 (Fig. 2). It is mostly covered by Cretaceous sediments with some volcanic clasts in the uppermost part of the basin (Davies et al., 2013, Nývlt et al., 2014). The upper part of the basin is formed as a flat valley surrounded by high volcanic cliffs, the downstream part is formed rather as a deep eroded canyon usually covered by seasonal snow patches. This features are very well represented later in the thermal regime of the stream, where the temperature is rather low directly below the snowpatch, the highest temperatures are recorded at profile C directly at the end of the flat upper part of the basin. The low velocity of the current enables the water to heat up whereas downstream it is cooled down again due to flow through snow patches (Fig. 3).

Average discharge (10/01/2015-18/02/2015) was 0.065 m^3/s with the highest discharge 0.35 m^3/s during the high air temperature events and the minimum (no dis-

Figure 1: Algal Stream – photography taken near the discharge measurement and sediment sampling profile (February 5, 2015).

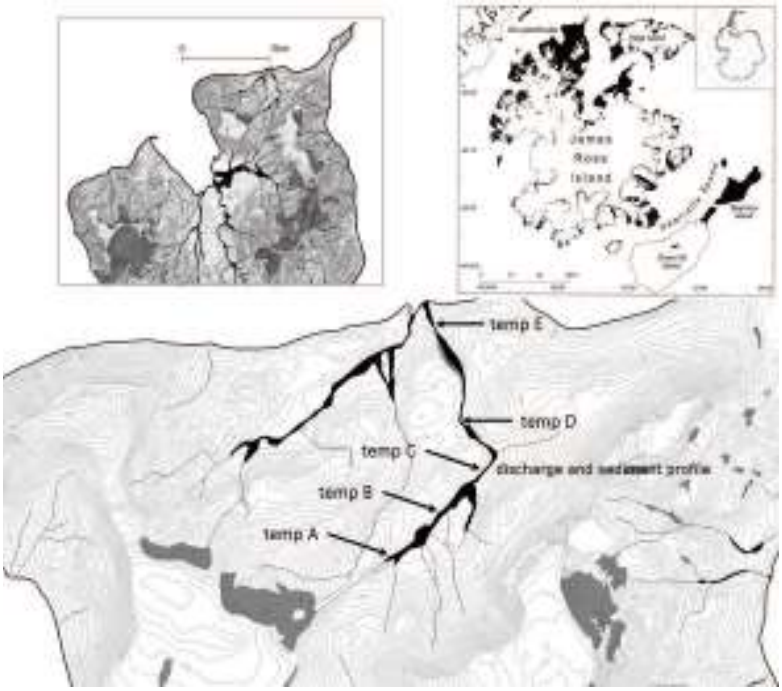

Figure 2: Study area with marked locations of measuring points (James Ross Island, Ulu Peninsula).

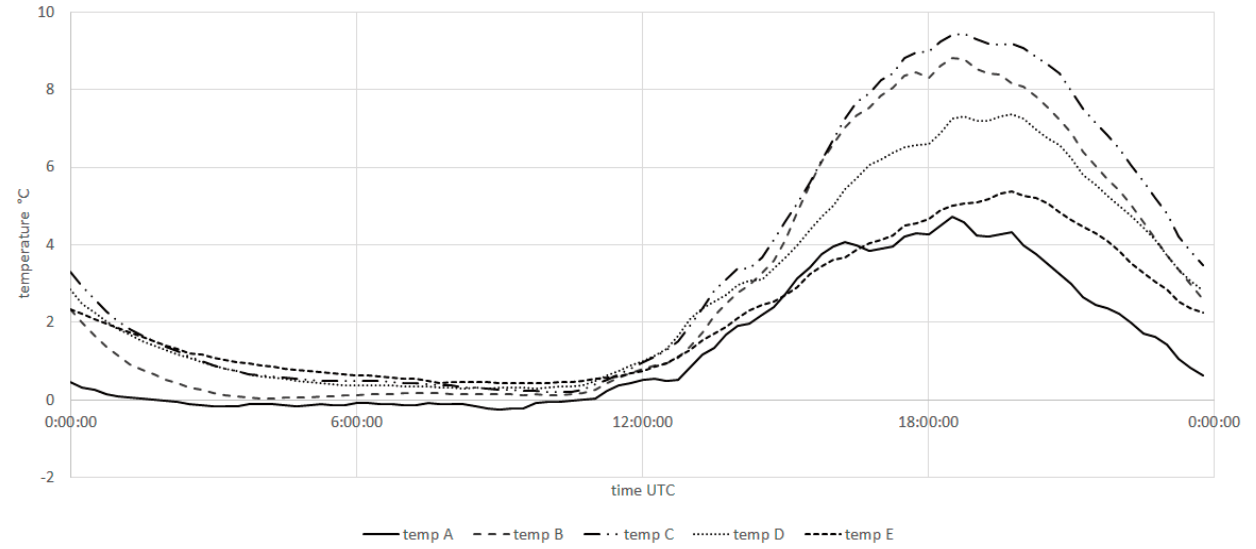

Figure 3: Thermal regime on longitudinal profile of Algal Stream.

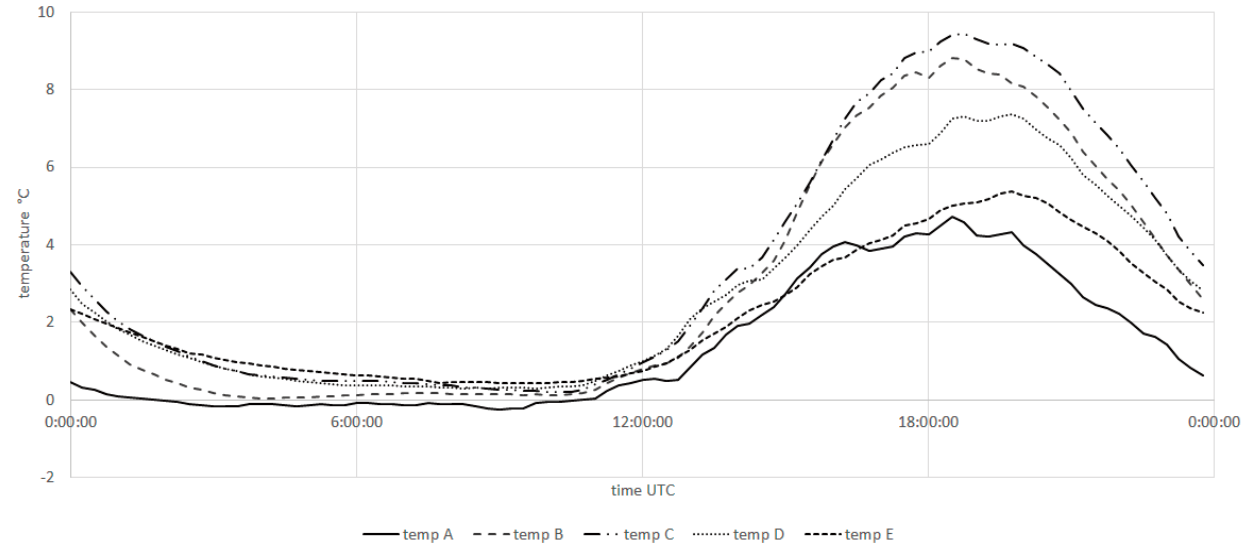

Figure 4: Discharge and suspended sediment concentration on Algal Stream.

charge) during the low temperature events when all water has been frozen. Average temperature is 4.0 °C (maximum 18 °C and minimum -2.3 °C).

Suspended sediment concentration and load have been estimated on the basis of manual sampling later on calibrated on the actual discharge (Fig. 4). Average suspended sediment concentration during the study period was 545 mg/l (with sampled maximum 2194.35 mg/l and estimated maximum approximately 6000 mg/l). This corresponds to total sediment material transport of 246.8 tons (10/01/2015-18/02/2015) and estimated whole summer season about 500 tons. This corresponds to surface loss of about 0.1 mm.

A time-lapse camera was set up to monitor fluvial activity of the outwash plain in the upper flat part of the river basin. This however didn't reveal any significant changes in the river network during the study period despite the presence of significantly high discharges. This indicates that possible fluvial activity triggering channel shifting occur probably on the very beginning of the summer season when more meltwater and especially sedimentary material is available.

Acknowledgement

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Seasonal and interannual variability of a small proglacial stream as a control variable of bedload transport: Case study from Bertilbreen, Svalbard

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Svalbard as a high Arctic location is a vulnerable area affected by recent chmate change with an important enviromnental consequences. New landscape with new dynamic river network appeared after retreat of the glaciers (Rachlewicz et al., 2007). Therefore it is essential to study such processess influencing local ecosystems. Monitoring of the dynamics of the fluvial system on Bertil glacier outwash plain has been carried out since 2011 with regular monitoring since 2012. Main goal of the complex study is to bring new information about this environment. It is clear that local morphological changes in the outwash plain are strongly connected to local atmospheric and hydrologic conditions triggering the fluvial procesess. Thus an analysis of meteorological conditions and runoff characteristics has been done to clarify these environmental interconnections.

Bertil glacier is situated near the Pyramiden settlement in Petunia bay, central Spitsbergen. Outwash plain is located 500 m downstream of the glacier front. Automatic hydrostatic pressure sensor was installed downstream the outwash plain in 2011 and has been since that in operation with measurement interval of 15 minutes. Manual discharge measurement is done according to local conditions throughout the season with handheld Flowtracker device on the ADCP principle. Time lapse shooting by the cameras (5 and 10 minutes interval) started also in season 2011. There are time series for analysis and correlations with meteorological characteristics and fluvial activity (Fig. 1).

Fluvial gemorphological research in this catchment started in 2013 season. Braided channels, moving channel bars, differentiation of bedload

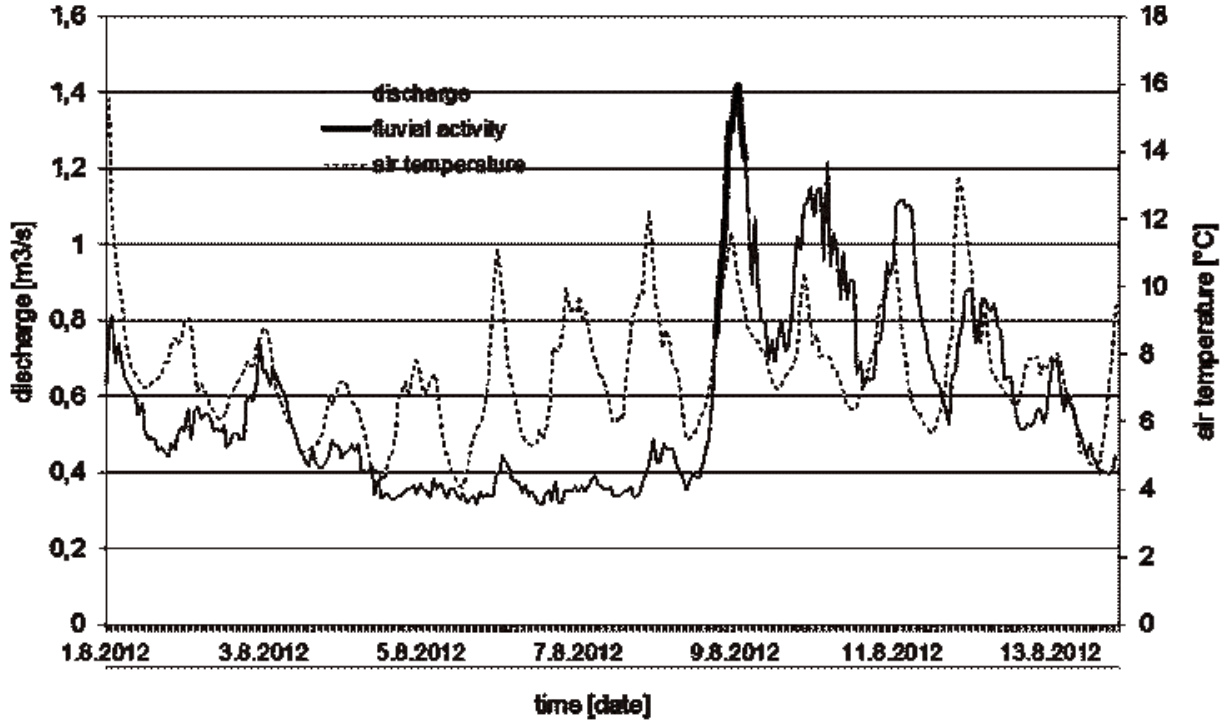

Figure 1: Discharge, air temperature and fluvial activity in August 2012, Bertil glacier outwash plain, Svalbard.

ment is usually connected with the highest flow rates in the summer season. Bedload sediments were collected by the modified sediment samplers. Grain size analysis and weighting (wet and dry sample) was done on these samples. Further analysis were carried out in connection with the discharge and meteorological measurements. For example during the discharge, 1.93 $m^3.s^{-1}$ were transported fractions bigger than 128 mm (maximum size of boulder was 300 mm) and total amount of bedload material was 234 kg. After the primary testing of the methodology for sediment sampling it is necessary to go back and continue in this type of research.

The aim is to identify the discharge treshold level leading to changes in channel dynamics and trying to quantify the amount of material (bedload and suspension) being removed from the outwash plain. For a more complex analysis we will need larger dataset and longer series of observations, so it is necessary to continue the study in the future seasons. Comparison of the time lapse shooting with discharge records to identify the treshold discharge level. Digital elevation model was performed by laser scanning technices using terrestrial laser scanner ILRIS 3D, where mean interval of reflection was 2.5 cm/100 m distance. Laser scanning is able to quantify amount of material transported from and to the outwash plain. Change in fraction composition with increasing discharge is very intensive and dynamic. Channel bed dynamics was monitored by the change in cross-sections in many profiles on the outwash plain.

Acknowledgement

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Scandinavian types of beaded streams

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System of small pools connected by short straight channels, which were subjected to occasional research for several decades, is situated in alpine summit parts of the Krkonoše Mountains. In year 2002 (Kociánová and Štursová, 2002) was first noticed its shape similarity (not origin similarity) with "beaded stream" sensu Brown and Kupsch (1992) - relief form bound to permafrost, more precisely to tundra polygons and ice wedges in Alaska. Intensive and multidisciplinary research in the course of last years concluded to description of this phenomenon as "mountain beaded stream" ecosystem (Štursa et al., 2012). The term "mountain" distinguished it from the form bound with permafrost. However, literature information (Svenson, 1963) and tentative findings gained from comparative studies of Krkonoše Mountains, Scandinavian and Scotland tundra proved occurrence of similar forms also in Subarctic (Kociánová et al., 2004; Kociánová and Štursová, 2010; Málková and Kociánová, 2012). Therefore, detailed focus on these forms was the primary goal of students field work in Finland – in area of Kilpisjärvi (69°03' N, 20°50' E) and Pallas Yllas Tunturi (67°55´ N, 24°07´ E) in 2014. Localities were selected on base of former experiences and Google Earth's satellite images.

Four types of beaded streams were recognised in terrain: two correspond partly with description of Svenson (1963) and Brown and Kupsch (1992) open zigzagged fissures of tundra or stony polygon furrows connecting small pools. These types are frequent in climatic harsh conditions of Kilpisjärvi area (MAAT -2.2 °C) nearby lakes (connection with tundra polygons) and on stony bedrocks of snow fields (connection with stony polygons) respectively. Next ones comprise more or less straight lines in the deeper peat/soil profile on mildly inclined slopes. These types were found both in Kilpisjärvi and Pallas-Yllas area (MAAT +0.8 °C), and are more approximate to mountain beaded stream in less harsh climate of Krkonoše Mountains (MAAT +1.6 °C) and Cairngorm Mts. (MAAT +5.1 °C).

Authors of new complete ecological study concerning of beaded streams in Arctic (Arp et al., 2014) point out their high biological functions and the broader role of this thermokarst fluvial system with respect to climate and land use changes. Likewise, mountain beaded streams in Hercynian range (Štursa et al., 2012) represent special tundra ecosystem of Central Europe. That kind of studies is missing for Scandinavian Subarctic situated within Arctic and boreal/temperate zone. It should be a call for next research of our students.

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Description of *Pseudomonas gregormendelii* sp. nov., a Novel Psychrotrophic Bacterium from James Ross Island, Antarctica

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During the microbiological research performed within the scope of activities of Czech expeditions based at the Johann Gregor Mendel Station at James Ross Island, Antarctica, two psychrotrophic Gram-stain negative non-fluorescent strains CCM 8506T and CCM 8507 from soil were extensively characterized using genotypic and phenotypic methods. Initial characterization using ribotyping with HindIII restriction endonuclease and phenotyping imply that both isolates belong into a single Pseudomonas species. Sequencing of rrs, rpoB and rpoD genes of strain CCM 8506T confirmed affiliation of investigated strains within the genus Pseudomonas. Further investigation using automated ribotyping with EcoRI (RiboPrinter® Microbial Characterisation System), whole-cell protein profiling using the Agilent 2100 Bioanalyzer system, extensive biochemical testing and DNA-DNA hybridization experiments confirmed that both investigated strains are members of a single taxon, which is clearly separated from all hitherto described Pseudomonas spp. Based on all findings we describe a novel species *Pseudomonas gregormendelii* sp. nov. with the type strain CCM 8506^T (= LMG 28632^T).

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Motility of archigregarine *Selenidium* sp. parasitizing polychaete *Pygospio elegans* from White Sea

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Phylum Apicomplexa belongs to the most monitored group of protists, comprising exclusively arasites of vertebrates and invertebrates. Beside important pathogens of human (e.g. *Plasmodium* spp., *Toxoplasma gondii*) and agricultural animals (*Eimeria* spp.), the phylum also includes gregarines – relatively large parasites inhabiting intestine, body cavity or different tissue of invertebrates. It is known that marine gregarines (mainly archigregarines) possess specific characteristics inferred to be ancestral for the phylum. Among theories on apicomplexan motility, the 'glideosome' concept, first announced for *Toxoplasma gondii* (Keeley and Soldati, 2004), takes the principal place. This concept describes a unique mechanism of substrate dependent gliding motility of apicomplexan zoites, facilitated by a conserved form of actomyosin motor, and based on the locomotion of myosin along actin filaments together with the transport of adhesins from the anterior end to posterior one of the parasite. This machinery is also limited by fixation of actin filaments to the inner membrane complex, underlying the plasma membrane, and requires a stable subpellicular network of microtubules. Nevertheless, the exact mechanism of motility still remains unknown in early emerging groups of *Apicomplexa*, comprising lower coccidia and gregarines. Movement in these organisms usually differs from the typical substrate dependent gliding observed in other apicomplexans. These different modes of motility seem to correlate with various modifications of their cell cortex and could represent specific adaptations to a parasitism in different environments. Here, we present our preliminary data on the motility of an archigregarine *Selenidium* sp. parasitizing the intestine of marine arctic polychaete *Pygospio elegans* (*Spionidae*). Samples were collected from sand-silt littoral zone close to the White Sea Biological Station of M. V. Lomonosov Moscow State University situated in the Kandalaksha Bay of the White Sea, near to the Arctic Circle. In general, gregarines of genus *Selenidium* exhibit pendular or rolling movement. Their cell surface displays broad longitudinal folds separated by grooves. Beneath each fold, sets of parallel longitudinal subpellicular microtubules are present (Desportes and Schrével, 2013). In this study, we performed experiments on living parasites treated with cytoskeletal drugs, to determine the role of actin filaments and subpellicular microtubules in their motility. For monitoring the actin filaments, two probes were used: jasplakinolide (induces actin polymerisation) and cytochalasine D (inhibits actin polymerisation and depolymerises pre-existing filaments). To verify the role of subpellicular microtubules in parasite movement, oryzalin and colchicine (both probes destroy existing microtubules and inhibit tubulin polymerization) were used. The changes of gregarine motility induced by drugs were monitored under light microscopy (photo and video documentation), and processed for further immunofluorescent and electron microscopic analyses. Expected results of this study should verify that cytoskeletal proteins, actin and tubulin, have fundamental role in archigregarines motility, and the principle of movement mechanism is comparable to that described in apicomplexan zoites. Comprehension of cell motility, especially in ancestral lineages of apicomplexans, appears important for controlling diseases caused by these unicellular parasites and for developing a more effective treatment.

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Coal deposits on the Faroe Islands: preliminary geological and compositional characteristics

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The Faroe Islands belong to the large North Atlantic Igneous Province that extends from Arctic Greenland in the west to the Vøring Plateau (Norway) in the east and to the British Isles (western Scotland and northern Ireland) in the south (Jolley and Bell, 2002). The Faroe Islands were formed by huge effusions and minor dyke intrusions of tholeiitic plateau basalts of Paleogene age (Storey et al., 2007). Passey and Jolley (2009) defined seven lithostratigraphic formations with a total thickness of 6.6 km – Lopra Fm. (reached only in the Lopra-1 borehole), Beinisvørð Fm., Prestfjall Fm., Hvannhagi Fm., Malinstindur Fm., Sneiss Fm. and Enni Fm. The occurrence of a coal-bearing sequence (3–15 m thick sedimentary facies of claystone, schist, sandstone, conglomerate variably accompanied by coal seams) is mainly connected with the Prestfjall Fm. (Ellis et al., 2002). In addition to the Prestfjall Fm., sporadic coal-bearing strata were also recognized in the upper part of the Beinisvørð Fm. (Rasmussen and Noe-Nygaard, 1970). Coal from both formations was formed within local limnic basins (Passey 2014).

The coal mining in the Faroe Islands continued throughout the whole 20th century. Mining was realized in local adits at sites where coal-bearing sequences of the Prestfjall Formation are exposed close to the surface. Currently, only one mine (New Prestfjall Mine; Suðuroy Island) is still active. Coal from this mine is locally of high quality, similar to anthracite, due to contact metamorphism of coal beds by basalt lava flows. The coal sequence with the highest thickness (0.5 m) is located in the working face of the 120 m long adit (Fig. 1). Coalified wood or bark fragments are frequently present in surrounding claystone.

The majority of abandoned coal mines lies on the Suðuroy Island, where coal beds are exposed in steep cliffs as well (Fig. 2). Old adits and other mine workings are typically buried beneath basalt block slides and overgrown by vegetation. Several adits are still accessible, though relatively unstable (Fig. 3). The extent of mining operations in the past is indicated by the size of coal waste dumps and by remains of mining equipment. Some abandoned mines, including the one still in operation, have problems with groundwater drainage. In contrast to the New Prestfjall mine, coal from the other investigated sites shows a more xylitic character.

In addition to the Suðuroy Island, coal seams and lenses can be found in sedimentary sequences near the coastline on the islands of Vágar, Tindhólmur and Mykines. They were not systematically

Figure 1: Working face of the active coal mine called "New Prestfjall mine" with notable thickness and luster of the coal bed.

Figure 2: Coal-bearing sequence (reddish thin layer) at the Prestfjall Fm. boundary in the NW part of the Suðuroy Island.

Figure 3: Abandoned mine of "Rókhagi" – a large slide of basalt blocks around the adit portal.

atically mined due to their small thickness, lower quality and poor access.

Coal samples were collected from most of the sites of the Faroe Islands and analysed for their chemical composition using X-ray fluorescence (XRF). Additionally, mercury contents were measured by a single-purpose atomic absorption spectrometer (AAS). The obtained preliminary data suggest various compositions of samples from the older Beinisvørð Fm. and the Prestfjall Fm. They differ in total trace-element contents measured by XRF, while the ranges of mercury contents determined by AAS broadly overlap.

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Nitrous oxide emissions from intertidal macrofauna

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Nitrous oxide (N_2O) is a potent greenhouse gas and is chiefly responsible for ozone depletion(Ravishankara et al., 2009). It is produced biologically through the microbial mediated transformations of fixed nitrogen. Nitrification and denitrification are the two pathways responsible for most of the N_2O production. N_2O production from both pathways is highly dependent on oxygen (O_2) availability (Schreiber et al., 2012). An excess of anthropogenically fixed nitrogen in the environment has stimulated nitrifying and denitrifying microbes so that atmospheric N_2O concentrations continue to rise at a steady rate. Recent efforts to understand the sources of N_2O emissions have found temperate zone marine invertebrates to be hot spots for nitrification and denitrification through fauna stimulated local nitrogen cycling and O_2 dynamics (Stief, 2013 and references therein).

The Arctic covers 25% of the world's coastline, where productivity can be high and marine invertebrate biomass abundant. An overlooked marine invertebrate N_2O emission rate here could be significant enough to impact the current global N_2O budget. If significant, N_2O emissions would be a nutrient sink from the ecosystem.

The purpose of this study was to quantify and compare N_2O emissions from the blue mussel *Mytilus edulis* and the rough periwinkle *Littorina saxatilis* in Nuuk, Greenland and Kerteminde, Denmark.

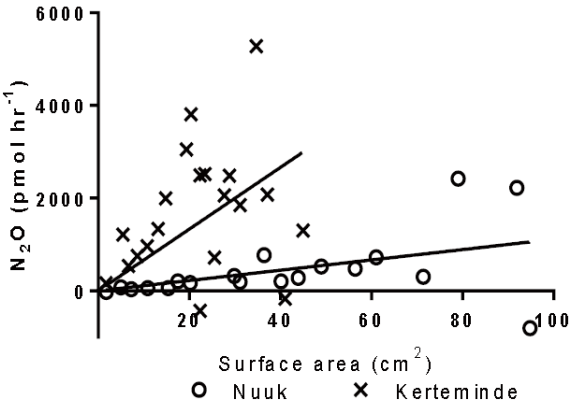

Figure 3: The size dependence of N_2O turnover associated with emerged *M. edulis* in Nuuk and Kerteminde. N_2O turnover is a function of mussel shell surface area. Size was chosen as a proxy for microbial abundance. Lines show the linear regression when forced through origin. The air temperature during experiments was 0.5 °C in Nuuk and 17 °C in Kerteminde.

N_2O emissions from *Mytilus edulis* and *Littorina saxatilis* at ambient air temperatures are respectively 40 and 30 times higher in temperate Kerteminde compared to sub-arctic Nuuk (Figure 2). N_2O emissions from species in Nuuk was close to zero. Species N_2O emissions were generally positively affected by temperature (Figure 2), fauna size (Figure 1) and air exposure (data not shown).

These results show, particularly from species in Nuuk, that N_2O emissions

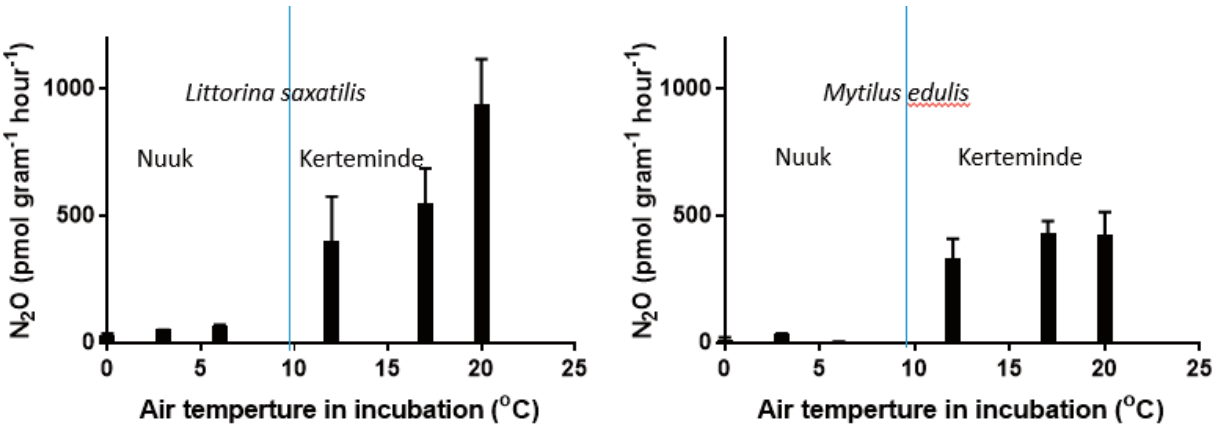

Figure 2: Temperature dependence of N_2O emissions (mean±SE) from emerged *L. saxatilis* (left) and emerged *M. edulis* (right) in Nuuk and Kerteminde. Nuuk and Kerteminde experiments are separated by a blue line.

Table 2: Comparing the rates of N_2O emissions during this study with other aquatic/polar habitats.

N_2O emission rate (µmol m^{-2} h^{-1})	Habitat	Reference
0.007 this study	*M. edulis* Kobbefjord GL	Biomass from Blitcher unpublished
0.001 this study	*L. saxatilis* Kobbefjord GL	Biomass from Blitcher unpublished
0.03 this study	*M. edulis* Baltic SW	Biomass from Kautsky and Evans (1987)
0.02 this study	*L. saxatilis* Baltic SW	Biomass from Johanesson et al. (1995)
28	Zebra mussel beds	Svenningsen et al. (2012)
0.5	Lake sediments	Poulsen et al. (2014)
0-23.2	Rocky Biofilm	Magalhaes et al. (2005)
-6.7	Intertidal mudflat	Vieillard and Fulweiler (2014)
0-5	Aquatic ecosystems	Seitzinger (1988)
0.1-7.8	Mangrove	Corredor et al. (1999)
8.9	Penguin colony (tundra)	Zhu et al. (2013)

from *M. edulis* and *L. saxatilis* are of little global significance (Table 1). In Kerteminde, emissions vary depending on the shifting local conditions reflective of the intertidal zone. This highlights the importance of considering emissions from species of different climatic regimes. As well as the importance of the effect of short-term disturbance on N_2O emissions brought on by tidal pulsing.

Acknowledgement

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First Report on Anisakid Nematodes from South Polar Skua (*Catharacta maccormicki*) in James Ross Island, Antarctica

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The aim of this study is to report new locality and morphological study of anisakid nematode parasites collected from the South Polar Skua [*Catharacta maccormicki* (Saunders, 1893), *Stercorariidae*] in James Ross Island, February 2014. We examined one skua's regurgitated pellet. Among others parasite, 53 adults and larvae of genus *Contracaecum* Railliet et Henry, 1912 were found. Nematodes from family Anisakidae are cosmopolitan parasites of fish-eating avifauna. It may be associated with erosion and ulceration leading to haemorrhage (Duignan, 2001) however the impact of endoparasites on the health of Antarctic seabirds populations is as yet unknown (Woods et al., 2009). Host can be infected by ingestion of intermediate or paratenic host (aquatic invertebrates, fishes).

Our material was washed in physiological saline and preserved in 80% ethanol. For light microscopical (LM) examination, nematodes were cleared with glycerine and examined using an Olympus BX 50 microscope equipped with differential interference c ontrast optics and a digital image analysis system. For scanning electron microscopy (SEM), one male and two female were used (sample preparation according Mašová and Baruš, 2013). LM and SEM revealed the detailed structure of the head region and tail, the number of caudal papillae and size and shape of spicules in males, presence of the ventricular appendix and intestinal caecum. Also measurements of morphological structures were obtained.

Further molecular analyses were performed to elucidate the exact species determination. Genomic DNA was extracted from parasites´ tissues and applied as template for PCR reactions. To amplify specific region of exploitable DNA markers, we used (1) universal primer combination and nested PCR according methodology by Plaisance et al. (2005) for 18S gene in Platyhelminthes and (2) specific primer combinations to amplify rDNA markers (ITS2, 18S) and partial region of mitochondrial gene CO1 in relative families of nematodes of the same order (according Foitová et al., 2014). The PCR amplicons of our samples were subsequently purified and analyzed by Sanger sequencing (ABI 3130 Genetic Analyzer). After finishing these analyses, the obtained sequences will be compared and potential variability between samples will be inferred. In the case of informative and conclusive results for the species identification in final data set, the evolutionary distances between relative nematode species

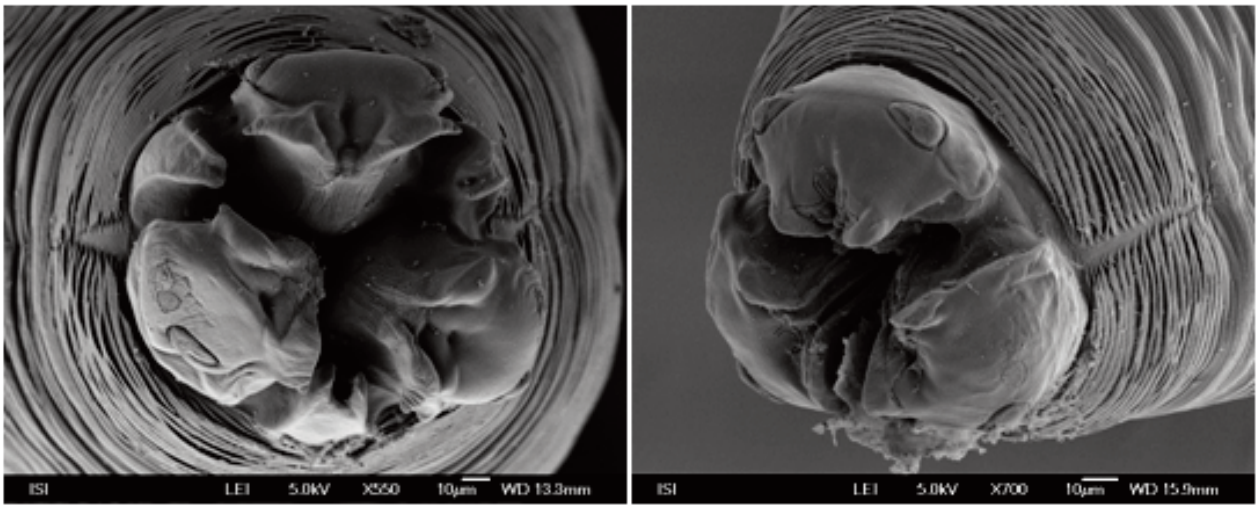

Figure 2: Scanning electron micrographs of head regions of two different females of *Contracaecum* spp. collected from a regurgitated pellet of the South Polar Skua (*Catharacta maccormicki*).

will be computed and phylogeny reconstruction may be performed by common statistical methods.

Acknowledgement

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Monogenea parasitizing gills of the capelin, *Mallotus villosus*, in Petuniabukta, Svalbard

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During the Polar Ecology Course in July 2014 a field research was carried out to study monogenean parasites of arctic fish from Petuniabukta (Billefjorden, central Svalbard). The capelin, *Mallotus villosus* (Müller, 1776) (Osmeridae), is a small forage fish distributed in the Atlantic and Arctic oceans and it frequently occurs in Petuniabukta. In total 17 individuals of fish were caught with gill nets (benthic and pelagic) and transferred to laboratory for parasitological examination, focused on gill parasites. A subsample of 57 alive individuals of Monogenea was collected. Based on morphological characteristics, three species determined. *Gyrodactyloides andriashewi* was the most common species (39 individuals). Another two species, *Gyrodactyloides petrushewskii* (6 individuals) and *Laminiscus gussevi* (12 individuals), were found less frequently. A high number of monogenean parasites were found dead because most of the fish died shortly after catching in gill nets and their gills were in bad condition. The gill nets, therefore, seem to be unsuitable method to capture the capelin for parasitological examination because the fish appear to be too fragile to survive. Examination of fish gills for monogenean parasites requires fresh material, so I recommend alternative fish sampling methods for further study of gill parasites of capelin.

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Chlorophyll fluorescence parameters used in analysis of photoinhibition in Antarctic lichens: A deeper insight into photoprotective mechanisms

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Our experiments deal with sensitivity of Antarctic lichen to photoinhibition, i.e. high light-induced decrease in photosynthetic rate. For our experiments, thalli of *Usnea antarctica* were collected at the James Ross Island, Antarctica (57°52´57´´W, 63°48´02´´S) in 2012 and transferred in dry state to the Czech Republic. After rewetting in a laboratory, we used two types of high light treatments in order to induce moderate and heavy photoinhibition of photosynthesis: (1) short-term (30 min), and long-term (6 h). In the first treatment, we used two different doses of photosynthetically active radiation (PAR): 1000 and 2000 $\mu mol.m^{-2}.s^{-1}$ PAR. In the second treatment (long-term), we used three doses of photosynthetically active radiation (PAR): 300, 600 and 1000 $\mu mol.m^{-2}.s^{-1}$. These three types of radiation are typical in the Antarctic region (Barták et al., 2003, 2004, 2005).

In response to light dose and duration of high light exposition, several chlorophyll fluorescence parameters (see Table 1) were measured so that responses of chloroplastic apparatus of symbiotis alga *Trebouxia* sp. as well as primary photochemical processes of photosynthesis could be evaluated (Heber et al., 2000).

Analysis of time courses of chlorophyll fluorescence parameters showed that photosynthetic apparatus of *Trebouxia* sp. is quite resistant to high light treatment even if lichen thallus is exposed in hydtared state. The lichen symbiotic alga also showed a great potential to recover after the termination of photoinhibitory treatment(s). The rate of recovery, however, differed according to the PAR dose and duration of the treatment. The results are comparable to the evidence gathered within similarly-oriented experiments published recently (Balarinová et al., 2014).

Table 1: Chlorophyll fluorescence parameters deducted from Kautsky kinetics.

	Title
Rfd	fluorescence decrease ratio (Roháček et al., 2008)
$\mathbf{q_{F0}}$	quenching of basic fluorescence (van Wijk and van Hasselt, 1990)
$\mathbf{F_M/F_{M'}}$	maximum fluorescence yield in dark-adapted state/maximum fluorescence yield in light-adapted state
$\mathbf{F_{0'}/F_{0''}}$	Minimum fluorescence yield in light-adapted state/minimum fluorescence yield in dark-relaxation state

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Seasonal dynamics of proglacial braidplain: Case study from Untersulzbachkees, High Tauern, Austria – preliminary results

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Climate change causes rapid glaciers retreat in many regions all around the globe and thus, in turn, affects local ecosystems. In many deglaciated areas, fluvial processes represent massive agents that determine the evolution of landscape (Carrivick and Rushmer, 2009). Glacier in the Alps has undergone substantial retreat since the Little Ice Age (Baewert and Morche, 2013), which is even accelerated in past decades. In past years, an intensive research has been conducted on glacier-fed rivers in the Alps that focused on three key questions to tackle: (1) Understanding the spatio-temporal hydrological behaviour of glacier-fed streams (e.g. Conovitz et al., 1998), source areas (e.g. Blaen et al., 2013), and controls of independent factors (e.g. Conovitz et al., 1998), (2) Evolution of braided rivers and braidplains (Bertoldi et al., 2010), (3) and soluted (e.g. Szpikowski et al., 2014), suspended (e.g. Hodson et al., 1999), and bed load sediment transport (e.g. Kociuba and Janicki, 2014). These studies are mostly located into one small catchment or proglacial zone. All key questions aim to unravel general findings applicable to all braided rivers. Nonetheless, specifics of environmental conditions play very substantial role in a spatio-temporal evolution of glacier-fed rivers and thus it is crucial to comprehend as many locations as possible in order to satisfyingly evaluate the complex consequences of climate change.

This study is located into proglacial zone of Untersulzbachkees in High Tauern. During the ablation season in 2014, air temperature, discharge, suspended sediment concentrations (SSC) and bed load were measured. Meteorological station was installed on the glacier approximately 200 m from the snout and was in operation during July and August. Due to massive flood that occurred in the studied area on turn of July and August discharge, SSC and bed load data were lost for most of the season. After the flood terrestrial laser scanning (TLS) and Structure-from-Motion (SfM) were applied in order to evaluate morphological activity within studied braidplain. Applicability of different procedure of photo acquisition for SfM were tested and compared with conventional method of TLS. Based on topographical data and information from two photo traps that captured extent of the flood, hydrodynamical 3D modelling aims to be applied in order to estimate peak discharge. SSC were been obtained for three profiles in late August – beginning of September. Results show that profile located at downstream end of braidplain documents lower SSC in comparison with upstream end of the braidplain profile as well as with one that is located immediately downstream the glacier snout, suggesting that studied braidplain acts as a sink during common discharges.

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Palaeolimnology of high-altitude Arctic lake Garmaksla, central Svalbard

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The Arctic is one of the fastest changing regions of the Earth and environmental changes are of great magnitude (Miller et al., 2010). Our aim is to investigate the lacustrine sediments that are natural archives of past changes, among which we are interested mainly in the evolution of the climate, the lake basin and the lake itself including its biota. For this purpose, three sediment cores were retrieved from the high-altitude lake Garmaksla, located in the northern Billefjorden, Svalbard archipelago. A multi-proxy approach was applied to study deposited material. The first analyses were non-destructive, above all magnetic susceptibility or XRF spectrophotometry. Magnetic characteristics of the sediments were measured and used for mutual correlation of the three cores (Fig. 1) and to infer the past conditions in the lake basins, such as the erosional rate (which is influenced by the vegetation density and climatic parameters). XRF spectrophotometry enabled to detect the elemental composition of the samples, so that trends of the major elements and their ratios (Fig. 2) will complement the other proxy data, such as particle size.

The age of the sediments was determined by AMS ^{14}C dating (Fig. 3). So far five dates through-

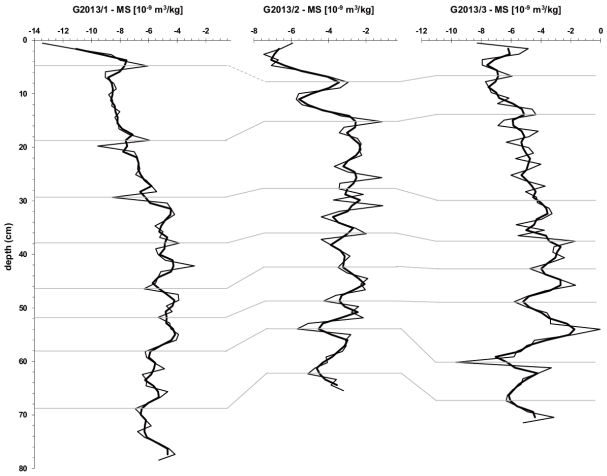

Figure 1: Correlations of the sediment cores based on magnetic susceptibility trends.

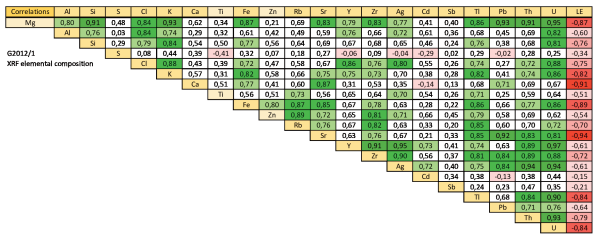

Figure 2: XRF elements correlation table.

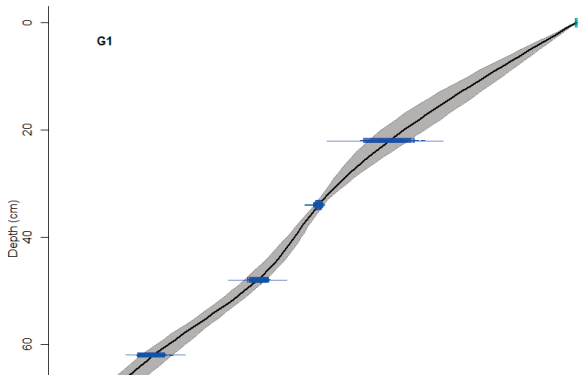

Figure 3: Depth-age model of the master core based on calibrated ^{14}C ages.

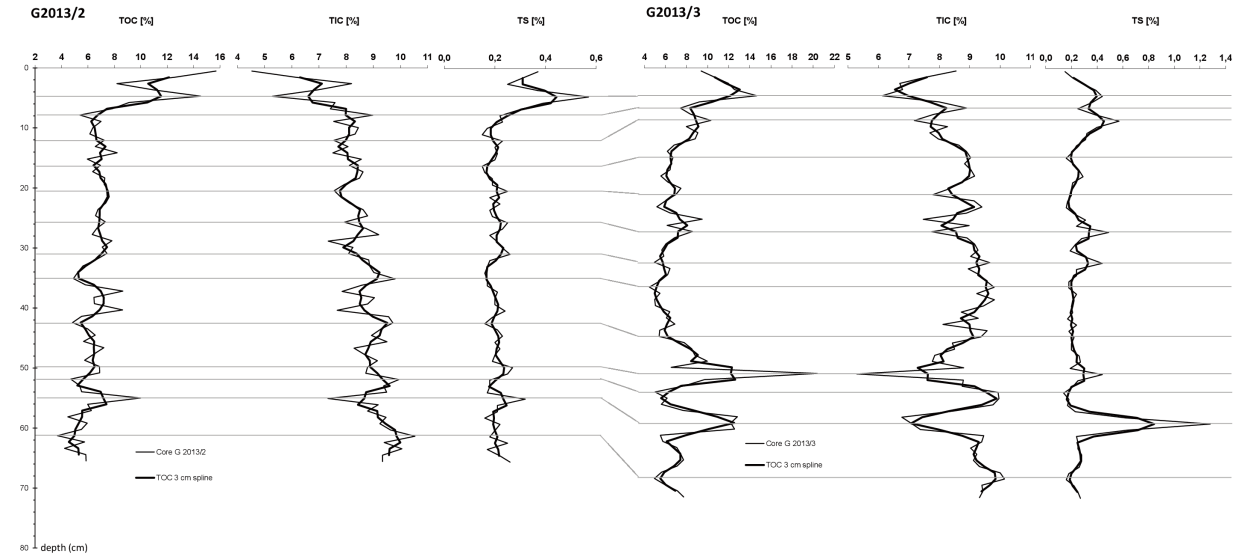

Figure 4: TOC/TIC/TS relative content diagram.

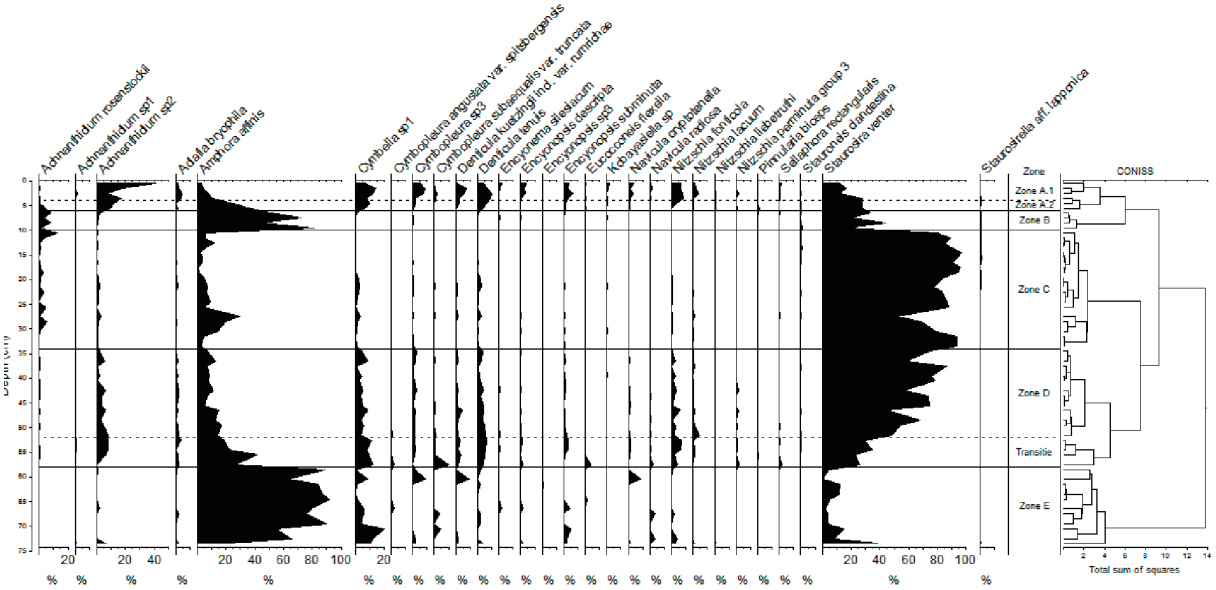

Figure 5: Diagram of diatom assemblages.

out the core were obtained and calibrated using IntCal13 calibration set (Reimer et al., 2013) from which we can infer the age of the base is ~6 ka old, i.e. the mid-Holocene. The terrestrial organic material (mainly mosses) were used for AMS dating to avoid the error of hard water effect of the carbonate bedrock (and thus the risk of overestimating the age). Additional dating of short-lived isotopes ^{210}Pb and ^{137}Cs will determine the age of the upper part of the core. Furthermore, the sediment chronostratigraphy will be improved by additional ^{14}C ages.

The sediments were investigated for the content of the total organic and inorganic carbon and total sulphur, allowing an insight into the past productivity of the lake (Fig. 4). A sudden increase in the

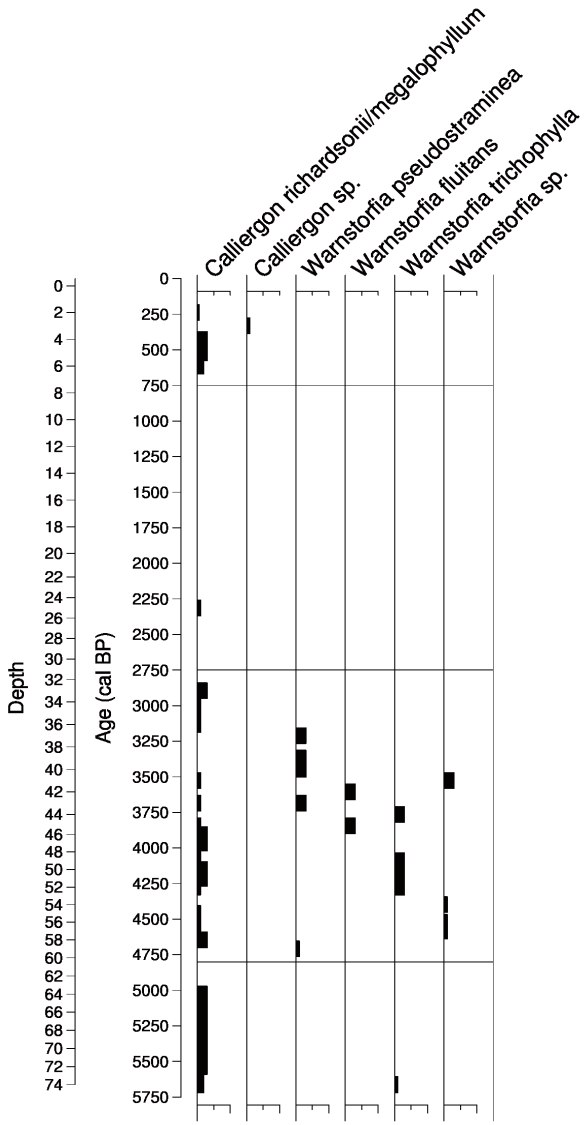

Figure 6: Diagram of moss assemblages.

content of the organic material occurs in the topmost units of the sediment cores. Afterwards, the first biological analyses of diatom, bryophyte and chironomid assemblages were performed. The relative abundances of specific taxa in given units were determined, which allows to infer past environmental conditions from their ecological preferences. The diatom stratigraphy of the master core G13/1 (Fig. 5) is dominated by two Arctic diatom species, *Staurosira venter* (indicating colder climate in the middle part of the core) and *Amphora affinis* (relatively warmer-loving taxon of the lower part of the core), but both these species mostly disappear in the upper part, probably as a consequence of great warming unprecedented throughout the remaining part of the lake evolution and attributed to the end of the Little Ice Age (~100–150 years ago). The stratigraphy of chironomids and both terrestrial and aquatic mosses reflects a pattern similar to diatoms (albeit less detailed; Fig. 6), that is a gradual cooling throughout most of the core and a sudden warming in the topmost units (deduced from the dominant taxa: moss *Calliergon* and chironomid species – stenotermic *Micropsectra radialis* and more diverse assemblages with *Orthocladius* and *Procladius*). In addition, a change in the bryophyte taxa in the middle part of the core suggests lake level fluctuations and possibly changes in nutrient availability (supported by the peaks in C and S, possibly indicating lake eutrophication). Multiple proxy data (magnetic susceptibility, ecological assemblages) indicate the occurrence of Holocene Thermal Optimum ~6–5 ka BP, then a gradual stepwise cooling culminating in the Little Ice Age and the 20th century rapid warming (D'Andrea et al., 2012).

The final synthesis of the data will follow the accomplishment of last analyses that are on the schedule for this year. This study should shed a new light into the evolution of high-altitude Arctic ecosystems and mid to late Holocene climate changes.

Acknowledgement

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Desiccation-induced changes in photochemical processes of photosynthesis and spectral reflectance in *Nostoc* sp. colonies from Antarctica

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Nostoc commune is a cyanobacterial species occurring worldwide including both Polar Regions. Since the species frequently grows on the soil surface, it copes well with frequent air. The mechanisms responsible for surviving frequent desiccation has been investigated in many studies focused on exopolysaccharidic envelope, stability of membranes, antioxidants, and pigments (Potts, 1994). In this study, we investigated changes in photochemical processes of photosynthesis and spectral reflectance during controlled desiccation. The colonies of *Nostoc commune* used in this experiment were collected in James Ross Island, Antarctica and transported to Brno, Czech Republic, in dry state, in February 2015. Before the experiment, the colonies were rewetted by demineralized water for 3 days. During the experiment, the fully-hydrated colonies were let to follow natural dehydration in open dishes at laboratory temperature (20 °C). Every 30 min, the weight, water potential (WP), spectral reflectance indices PRI and NDVI, potential (Fv/Fm) and effective quantum yield of photosynthesis (ΦII) were measured.

The preliminary results showed that the potential and effective quantum yield decreased during desiccation, although some parts of thalli were still able to photosynthetize during severe desiccation. That is in a good agreement with results obtained from the same species from Svalbard, Arctic (Trnková, unpublished data). After proper analysis, the data from measurements of spectral indices and chlorophyll fluorescence will be compared with those obtained from the same species in field conditions in Antarctica (Barták, unpublished data) and in Arctic (Kvíderová et al., 2011), and also with the data obtained from polar lichens (Barták et al., 2015; Jupa et al., 2012)

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Diatoms observed in cryoconite holes on Nordenskiöld glacier and nearby freshwater habitats (Spitsbergen, high Arctic)

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Diatoms (Bacillariophyta) are one of the most abundant and diverse algal group in polar ecosystems and play a dominant role in all freshwater and terrestrial ecosystems. As species of diatoms are quite selective based on their significant response to the physico-chemical characteristic of their habitats, they proved to be excellent bio-indicators in applied science as well as in paleoecological and biogeographical studies.

In the presented study we focused on diatoms found in cryoconites holes, supraglacial microhabitats of proved biological activity. Although diatoms are usually very abundant in polar lakes and streams, they are mostly only seldom reported from cryoconites. Yallop and Anesio (2010) cultured debris from Svalbard and Greenland cryoconites to promote the growth of diatoms, as the direct observations were unfeasible. They recorded between 12 and 15 live genera in Svalbard's cryoconites and 27 in total, which revealed significantly higher diversity than was previously reported elsewhere and is comparable with common polar habitats. We therefore present comparisons between diatom communities obtained from cryoconites samples from Nordenskiöld glacier and in nearby moraine freshwater habitats. Our difficulties with the direct observation of the material sampled, together with the former taxonomic force-fitting and incorrect identification of polar diatom taxa, forced us to make comparisons at the generic richness level only.

In total about 85 taxa belonging to 43 genera have been observed. Our results suggests that cryoconites may support higher diversity than is generally presumed, probably mainly due to a difficult observation of the material and its under-sampling. Considerably, number of the diatom frustule could not be identified to the species level using currently available literature. For the identification we therefore used a list of diatom species found in lakes in Petunia Bay (Pinseel et al., 2014). Additionally, we observed only 8 genera different from this list, however, the high number of unidentified taxa indicates that the diatom diversity of Spitsbergen is clearly underestimated at the moment and more sampling is required to achieve a comprehensive knowledge of diatom flora from this region.

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Marine Mercury and Other Heavy Metals in Some Sea Urchin Species And Lichen in Antarctica

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Antarctica is generally seen as a symbol of the great wilderness untouched by human disturbance. Despite of its environment it is not like other remote regions on Earth anymore, it is exposed to the effect of global and local anthropogenic activities (Bargagli et. al., 2005 ; Bargagli, 2008). Besides, the global sources reach this area through the atmospheric transport of elements coming from lower latidudes, with Antarctica acting as a sink for gaseous and particulate trace materials (Lambert et. al., 1990).

Increasing atmospheric carbon dioxide concentration changes the chemistry of the oceans into more acidic conditions. Polar oceans are particularly affected because of their low temperature and carbonate content and mixing patterns, for instance upwellings. Calcifying organisms are expected to be highly affected by the decrease in the oceans' pH and carbonate ions concentration. In particular, sea urchins as *Sterechinus neumayeri*, members of the Echinoid, are hypothesized to be at risk due to their high-magnesium calcite skeleton. However, tolerance to ocean acidification in metazoans is first linked to acid–base regulation capacities of the extracellular fluids. No information on this is available to date for Antarctic echinoderms and inference from temperate and tropical studies needs support.

Toxicity of littoral species to aquatic organisms and their potential for bioaccumulation, several marine species has been studied to determine the concentration of trace metals. Lichens as *Usnea antarctica*, *Usnea barbata*, *Usnea aurantioca* are significant aspects of Antarctic vegetation. Their growth is controlled through environmental influences such as water availability and temperature. As these environmental factors are predicted to change drastically in response to climate change, the impact on lichen growth needs to be assessed accordingly. Lichens could then be used as bioindicators of climate change in Antarctica. Among the organisms that are used as indicators of environmental conditions, lichens and mosses have been found to be particularly convenient “sensors” because they are highly sensitive to anthropogenic changes in the environment, especially to air pollution (e.g. Seaward, 1992; Lippo et al., 1995; Bargagli et al., 1998; Van Dobben et al., 2001; Wolterbeek et al.; 2003). Unlike higher plants, lichens and mosses lack a root system and are largely dependent on elements, which are deposit from the atmosphere for their nutrient supply. These organisms have no protective waxy cuticles or filtration mechanisms therefore, they absorb the available ions dissolved in the air along with melting water and snow through their body surface. Slow rate of lichens’ growth causes a constant absorbtion of atmospheric pollutants to the level considerably higher than those of air deposition (Bargagli et al., 1998; Olech et al., 1998; Bargagli, 2001).

It is a fact that a bioaccumulation process of Hg depends upon food chain and high trophic animals contain higher content of Hg than that in lower trophic animals. Such bioaccumulation process was found both in the western North Pacific and Antarctic marine ecosystems. But when compared to the western North Pacific, the Antarctic ecosystem is relatively simple in the food web and short in the length of food chain with krill as key species. This accounts for the lower bioaccumulation factor of Hg in the Antarctic organisms compared with those in the western North Pacific. Also, low absolute values of Hg in the Antarctic organisms stem from a low concentration of Hg (5.8k2.5 ng/L) in the Antarctic seawater than those (17.7k5.5 ng/L) in the western North Pacific.

Mercury is an atmospheric pollutant of global concern. Its biogeochemical cycle includes various physical, chemical and photochemical interactions, both wet and dry deposition, and reemission from environmental surfaces (Schroeder and Munthe, 1998; Wängberg et al., 2001). Mercury occurs mainly as HgO (elemental mercury vapour) in the atmosphere, along with reactive gaseous mercury ((RGM)—Hg^{2+} divalent mercury compounds) and mercury associated with particulate matter. Lichens are capable of capturing and accumulating gaseous atmospheric pollutants and are commonly used as biomonitors of airborne metals including Hg (Bargagli and Barghigiani, 1991; Loppi and Bonini, 2000; Conti and Cecchetti, 2001; Pisani et al. 2011; Mlakar et al,. 2011;

Lodenius, 2013; Mão de Ferro et al., 2014). There are five processes which both nutrients and contaminants are deposited onto lichens are described. These include wet deposition (including snowfall), occult precipitation (fog, dew and mist), sedimentation (particles >1–4 mm), impaction (particles <1–4 mm carried by wind) and direct uptake (particularly when wetted) (Knops et al., 1991).

The study was designed to investigate the content and distribution of selected heavy metals (Hg, Cd, Cu, Zn, Fe, Pb) in samples of sea urchin *Sterechinus neumayeri* and fruticose macrolichen *Usnea antarctica*, *Usnea barbata*, *Usnea aurantioca.* It will be the first scientific expedition by Turkish scientists Hg and heavy metal concentrations of lichens and littoral species from Antarctica will be compared to those from Canakkale Strait Sea urchin species as *Paracentratus lividus*, *Arbacia lixula* and lichen species as *Usnea articulata*, *U. filipendula*.

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Preliminary reports of microorganisms of Antarctic cryoconite holes (King George Island)

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According to current literature, glaciers and ice sheets are treated as a new biome. Cryoconite holes are water filled reservoirs on the glacier surface and they constitute independent freshwater ecosystems with the most abundant and diverse biota (Wharton et al., 1985; Anesio and Laybourn-Parry, 2012). Despite the fact that studies on the glaciers have started at the beginning of 20th century, the knowledge on invertebrates and bacteria in cryoconite holes is still poor. Up to date, few papers focused on the biota in Antarctic cryoconite holes have been published and data on the Antarctic cryoconite holes invertebrates (tardigrades and rotifers) have been presented in one paper only (Porazinska et al., 2004). The aim of this study was to investigate the diversity of faunal communities and determine culturable bacteria in cryoconite holes located on two glaciers: Ecology and Baranowski (King George Island, Antarctica). Eleven samples of cryoconites were collected during Antarctic summer in 2008 and 2011. Tardigrade *Acutuncus antarcticus* (Richters, 1904) and bdelloid rotifers were found in the samples. Tardigrada and Rotifera have been previously found in Himalayan, Alpine, Arctic and Antarctic (McMurdo Dry Valley) cryoconite holes (Zawierucha et al., 2015). The enumeration of culturable bacteria was carried out by using spread plate method on brain heart infusion agar and on selective media for detection and enumeration of diverse groups of bacteria. Bacteria of the genus *Pseudomonas* closely related to *P. fluorescens* were detected. Owing to generally poor knowledge on the fauna of cryoconite holes, there could be more faunistic, taxonomic and microbiological discoveries and only comprehensive and integrative methods can reveal true biodiversity of these extreme habitats.

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Snow as the entrance to the glacial ecosystem

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Glaciers and their contribution to biogechemical cycling became recently a vital topic in ecology. Since the glaciers are basically accumulated snow, the seasonally developing snow cover comprises the main input for new ice mass production (Benn and Evans, 2010). The fate of the snow is not everywhere the same. In the accumulation zones it can be exposed to melt and later - when overlaid by following layers - to percolation of meltwater from the surface until the crystalls re-form to firn and become subsequently compacted to ice. In the ablation zones the snowpack melts completely releasing all its content to the surface of bare ice and cryoconite - fine sediment on the ice suraface (Zarsky et al., 2013). Depending on the thermal regime of the glacier a substantial proportion of the meltwater contributes to subglacial water storage or drainage (Irvine-Fynn et al., 2011). Dissolved substances including nutrients and toxines are released in the early phase of the melt characterised by ionic pulse, as it is called (Telling et al., 2014). The suspended matter involves organic matter including living bacterial cells. In contrast to e.g. the dissolved ions they show retention effect (they elute from the snowpack at lower rate than melt water) with cell proliferation as a significant component of the observed effect (Björkman et al., 2014). This retention effect leads to the development of cryoseston in the advanced stage of the snowmelt. Understanding the interplay of both processess - the high elution rate of ions and low elution rate of cells - is crucial for the assessment of the significance of the melting snow pack as a biogeochemical reactor. Here I present a study, which has the variability in leucine incorporation rates (close proxy to proteosynthesis rate) in microbial communities harbored in the snow as the main focus. The study was carried out in two in situ measurement sets on a small High Arctic glacier (Svalbards Middle West) with special emphasis on the "slush layer" of the melting snow pack, which typically develops on the interface between snow and ice in shallow slopes of the ablation zone. Our data show patterns of variability, which support higher proteosynthesis (growth) rate in the slush zone. This data support the findings of the previous study focused on the retention of cells in snow and their pronounced increase in abundances within the snowpack in general (Björkman et al., 2014). The overall ecological significance of microbial metabolism in such habitat is close to none if related to the magnitude of microbial metabolism in cryoconite. The biogeochemical relevance thus concerns principally substances with biological effect even in extremely low concentrations (e.g. mercury in Larose et al., 2013). Our study however demonstrates a dynamic interaction of microbes and their abiotic environment in an extreme aquatic habitat, which represent ecological start-up for the interactions typical in the downstream cryoconite microbial communities.

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