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SCAR Delegates Report 2021

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Application of the Czech Republic for Full Membership

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Summary
This paper is an application by the Czech Republic for Full Membership of SCAR as an Initial Stage Program. The letter of application and an annex on scientific work undertaken and to be continued by the Czech Republic are provided. The Czech Republic adopted the Protocol on Environmental Protection to the Antarctic Treaty in 2004, and became a consultative party to the Antarctic Treaty in 2014 (acknowledging the prior status of Czechoslovakia since 1962).

Recommendations

The Delegates consider the application of the Czech Republic for Full Membership of SCAR.

Budget Implications

Initial Stage Membership fees are $12,400, which would represent an additional annual positive contribution to SCAR's budget, above the Associate Member Fees currently contributed by the Czech Republic.

Prof. Steven Chown
President
Scientific Committee on Antarctic Research

Brno, February 5, 2021

Application of the Czech Republic to SCAR Full Membership

Dear Prof. Chown,
hereby, the Czech Republic applies to the SCAR Full Membership as an initial-stage programme. The Czech Republic has a continuous Antarctic research programme since the beginning of the new millennium. The Czech Republic adopted the Protocol on Environmental Protection to the Antarctic Treaty in 2004 and became a consultative party to the Antarctic Treaty in 2014. However, it should be noted that the former Czechoslovakia acceded to the Antarctic Treaty already in 1962. For further details about the procedure, please refer to Decision 1 (2013) - ATCM XXXVI - CEP XVI, Brussels. The Czech Antarctic Research Programme (CARP) hosted by the Masaryk University Brno, Czech Republic has been a member of the Council of Managers of National Antarctic Programmes (COMNAP) since 2013 and associate member of SCAR since 2014, for which a detailed description of the Czech national research achievements in Antarctica was presented (please refer to WP05a - XXXIII SCAR Delegates Meeting, Auckland, New Zealand).
After the construction of the Johann Gregor Mendel Czech Antarctic Station (JGM Station) on James Ross Island in 2005–2006, the area of the north-eastern Antarctic Peninsula became the focus of Czech scientists. The JGM Station is owned and operated by the CARP, hosted by the Masaryk University. The Masaryk University was appointed in 2013 by the Academy of Sciences of the Czech Republic, as the Czech member of the International Council for Science (now International Science Council), to implement the obligations of the Czech Republic within the Scientific Committee on Antarctic Research (SCAR) (please see the scanned letter in an annex 1). The CARP at the Masaryk University serves as the National Committee for the Czech Republic, and its Head, Prof. Daniel Nývlt (daniel.nyvlt@sci.muni.cz) is appointed as the Delegate for Czech Republic to SCAR. Prof. Miloš Barták (mbartak@sci.muni.cz) is an alternate delegate.
The CARP focuses on long-term research regarding the marginal part of Antarctica on the north-eastern part of Antarctic Peninsula and is fully in accordance with the SCAR Horizon Scan and SCAR Strategic Plan 2017–2022. The leading direction is the study of the response of Antarctic geo- and ecosystems and their components to past, present and future environmental changes.

This could not be achieved without detailed mapping of Antarctic environment, from geology through topography, geomorphology, biota to wildlife. Numerous studies have described hundreds of new Antarctic species, mainly diatoms, bacteria, and/or cyanobacteria, which significantly widen the general knowledge about Antarctic life. More than 60 individual scientific disciplines have been involved in the CARP since its establishment and >110 scientific papers listed in Web of Science have been published by Czech scientists over the last five years (2016–2020). Last, but not least, collaboration on Antarctic research with scientists from other countries is very wide, which is well visible in published outputs and in collaboration within SCAR's standing committees and action and expert groups. The main achievements of Czech scientists in individual scientific disciplines of Antarctic Research are described in brief in an annex 2 to this application. Research in these and related areas will continue as a central core of CARP's work.

We do hope that the application of the Czech Republic for Full Membership of SCAR will be positively accepted by the voting members at the Delegates Meeting in 2021.

Yours sincerely,

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Czech Antarctic Research Programme Head

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Annex 1

ACADEMY OF SCIENCES OF THE CZECH REPUBLIC

PRESIDENT

Dr Mike Sparrow, SCAR Executive Director
Scientific Committee on Antarctic Research
Scott Polar Research Institute
Lensfield Road
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Prague, November 12, 2013
Ref. No. KAV-3341/P/2013

Recommendation of the Masaryk University as the Czech National Lead Agency to the SCAR

This is to certify that

the Academy of Sciences of the Czech Republic, as the member of the International Council for Science (ICSU), declares that the Masaryk University is eligible body to act as The Czech National Lead Agency to the Scientific Committee on Antarctic Research - SCAR (the Charity) as an Associate Member.

The Academy of Sciences of the Czech Republic hereby nominates and recommends Masaryk University, as the owner and operator of the Johann Gregor Mendel Czech Antarctic Station, James Ross Island (i.e. the only Czech scientific base in the Antarctica), to be accepted as an Associate Member of the Charity on behalf of the Czech Republic's National Antarctic Scientific Research Program.

The Masaryk University is fully responsible to cover all costs related to its membership in the Charity. There will not be any financial commitments on the side of the Academy of Sciences of the Czech Republic.

Sincerely yours

Professor Jiří Drahoš

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Annex 2

Brief overview of the main scientific achievements of the Czech Antarctic Research Programme

Geospatial mapping including UAV applications

The topographic mapping using remote sensing imagery and D-GNSS was essential not only for the production of printed topographic map of Ulu Peninsula, James Ross Island (Nývlt and Šerák, 2009), but served as the basis for the safety of navigation in the field and for all subsequent geospatial activities. These cover the geological (Mlčoch et al., 2020), geomorphological (Davies et al., 2013; Jennings et al., in review) and numerous scientific studies. Furthermore, the main areas of algal and moss dominated areas of the northern ice-free part of Ulu Peninsula were geospatially mapped (Barták et al., 2015). Currently, additional methods of UAV remote sensing are applied to define the distribution and changes of basic geo-/ecosystems elements. The high-resolution aerial mapping showed important data to explain the contribution of prevalent snow accumulation and meltwater streams to processes of landscape shaping within the ice-free environment (Kňažková et al., 2021). UAV-captured high-resolution spectral imagery and derived indices were applied to analyse the vegetation types forming patchy spots (Váczi et al., 2020).

Geology and palaeontology

Subglacial volcanism of James Ross Archipelago and associated clastic deposits were investigated from the viewpoint of their chemical and isotopic composition (Košler et al., 2009; Altunkaynak et al., 2019), through the reconstruction of their depositional environment (e.g.; Nehyba and Nývlt, 2015) towards the interpretation of an interplay of volcanism with glacial and marine processes (Nývlt et al., 2011). Magnetic fabric and tectonic setting of the Early to Middle Jurassic felsic dykes were studied at Pitt Point and Mount Reece, eastern Antarctic Peninsula by Žák et al. (2012). The first fossil sponges from Antarctica were described from James Ross Island by Vodrážka and Crame (2011). Biostratigraphy and palaeoecological implication of Late Cretaceous flora of volcaniclastic Hidden Lake Formation cropping out close to the JGM Station was studied by Kvaček and Vodrážka (2016) and the description of a new species of *Antarctoxylon* by Sakala and Vodrážka (2014) increased general knowledge about the early angiosperm plants of Antarctica. Besides, fish scale assemblages (Přikryl and Vodrážka, 2012) and a novel intertidal balanomorph (Kočí et al., 2019) were described from Eocene strata of Seymour Island.

Paleoclimatology and palaeoecology

Past climate and environmental changes were studied on numerous occasions in the north-eastern Antarctic Peninsula area. The pattern and timing of deglaciation of the area after the last Ice Age was presented in Nývlt et al. (2014). Recently, a review of changes in ice cover of the entire continent, with the emphasis on the last deglaciation and its termination, was presented in Nývlt et al. (2020). Besides the palaeoglaciological studies, the CARP team has also been involved in palaeolimnological investigations of lake sediments in order to reconstruct Holocene climates. Two lakes on Vega Island, located in close proximity to JRI, have yielded palaeoreconstructions on timescales of a few hundreds to thousands of years: Píšková et al. (2019) have established the formation of lacustrine varves, i.e. annual increments of sediment settling on the lake bottom, discovered for the first time in the Antarctic. The other recent palaeolimnological studies investigated the onset of the Late Holocene Neoglacial period in north-eastern Antarctic Peninsula (Čejka et al., 2020), or changes in past diatoms communities in respect to climate changes (Bulínová et al., 2020).

Atmospheric sciences

Long-term studies of solar UV radiation and ozone content above James Ross Island (e.g.; Láska et al., 2009, 2011; Petkov et al., 2016) and Seymour Island (Čížková et al., 2019; Aun et al., 2020) contributed to the topic of Antarctic high-atmosphere physics. Air temperature and lapse rate variation in the ice-free and glaciated areas of James Ross Island by Ambrožová et al. (2019), as well as assessment of local and long-range aerosol transport (Kavan et al., 2018) are baselines for future atmospheric research, which is enabled by a dense net of automatic weather stations located on ice-free and glaciated surfaces of north-eastern Antarctic Peninsula and adjoining islands.

Permafrost and soil science

The primary area of interest of permafrost and soil science research activities is James Ross Island, where continuous monitoring of selected ground characteristic has been carried out since 2006. Datasets of high spatio-temporal resolution have been collected. The first results have been published in several well-cited papers (Hrbáček et al., 2016, 2017a, 2017b). Soil element speciation (Prietzel et al., 2019), and heavy metal soil contamination (Zvěřina et al., 2017) are other direction of soil science research. Our research activities have significant complementarity with work in other regions, mostly in the Antarctic Peninsula. We collaborate closely with researchers within the framework of SCAR ANTPAS (Antarctic permafrost, periglacial environment and soil), which has resulted in papers assessing Antarctic permafrost and the active layer at continental-scale (Hrbáček et al., 2018; Obu et al., 2020). Further, we contribute to several global databases SoilTemp (Lembrechts et al., 2020), Global Cryosphere Watch and Ground Terrestrial Network - Permafrost. Importantly, research of ground thermal regime under different climate and vegetation conditions was the main topic of SCAR Fellowship received by Dr. Hrbáček in 2017.

Glaciology and climate change impact on Antarctic cryosphere

Centennial to decadal changes of local glaciers (Carrivick et al., 2012; Engel et al., 2012, 2019) show accelerated down-wasting and retreat of local land-terminating glaciers on James Ross Island. The surface mass balance of three local glaciers is continually monitored using the field-dGNSS methods, which have shown a slight positive mass balance of local glaciers between 2009 and 2015 (Engel et al., 2018). Besides, local and long-range aerosol and mineral material transport and its deposition on local glaciers (Kavan et al., 2020) accelerate their surface melting. Regional study of the impact of long-range atmospheric temperature changes showed a statistically significant cooling trend between 1999 and 2015 and its prominent effect on the cryosphere mostly on the northern and north-eastern Antarctic Peninsula (Oliva et al., 2017). However, we have also reconstructed past paraglacial response of ice-free landscape and associated biota within the entire Antarctic Peninsula (Ruiz-Fernández et al., 2019). The summer surface energy budget of the ice free area of James Ross Island and its impact on the ground thermal regime and underlying permafrost was assessed by Ambrožová et al. (2020).

Lake and stream physics and ecology

Lakes are also a focus of continuous monitoring and cataloguing, since their physico-chemical characteristics and biota are affected by current imminent environmental changes and represent thus sensitive bellwethers of past, ongoing and forthcoming changes in the Antarctic. Lentic freshwater habitats of northern JRI were described in well-cited paper by Nedbalová et al. (2013). The Czech team participated also in discovering and studying of a limnologically diverse system of more than 50 lakes on Clearwater Mesa, JRI (Roman et al. 2019, Kopalová et al., 2019), and Devil's Bay, Vega Island (Kavan et al., 2020), which are important hotspots of biodiversity on the boundary between the Maritime and Continental Antarctica, and react quickly to ice retreat, weather variability, and climate changes. The

geochemical dynamics of the JRI lakes were presented in Lecomte et al. (2020), noting the pristine nature of these habitats. Suspended sediment and bedload transport in proglacial streams (Kavan et al., 2017; Ondráčková et al., 2020) were the pilot studies for future larger ice-free areas and more dominant fluvial processes. Our data have also contributed to the study of global patterns and drivers of ecosystem functioning in rivers and riparian zones (Tiegs et al., 2019), or for the estimation of iron transfer by surface runoff to maritime Antarctic ecosystems (Hodson et al., 2017).

Microbial diversity

Czech Antarctic microbiological research began in 2008 when the first abiotic samples for microbiological analysis we investigated. The James Ross Island area provides a unique environment for the study of extremotolerant microorganisms and their survival (Brat et al., 2016). The main aims of the microbiological work in James Ross Island are continuous monitoring of diversity, taxonomy and phylogenetic relationships among heterotrophic bacteria and microscopic fungi from various sources as rock, regoliths, permafrost, cryoconites, lakes, lake sediments and streams and results have been published in numerous well-cited papers (e.g.; Kosina et al., 2013; Sedláček et al., 2017, 2019; Pantůček et al., 2018; Králová et al., 2019). In the last years the microbiological research was extended by the study of bacterial diversity of the gastrointestinal tract from different Antarctic animals, especially penguins, skuas, elephant seals and seals (Nováková et al., 2020; Vrbovská et al., 2020).

Algal diversity and ecology

As they represent the key primary producers, algae and cyanobacteria have been intensely studied in the area since the establishment of the JGM Station. The research on their diversity, ecology and ecophysiology was focused on freshwater and terrestrial habitats on the Ulu Peninsula and Clearwater Mesa. The thorough sampling of the area resulted in the description of many new species of cyanobacteria, diatoms and green algae (e.g.; Kopalová et al., 2011; Nedbalová et al., 2017) contributing to our knowledge of biodiversity in the region. Selected cold adapted strains were tested as candidates for the production of valuable compounds (Řezanka et al., 2017). The assessment of diversity in the different habitat types was accompanied by the identification of key factors driving species composition (Komárek et al., 2008; Kopalová et al., 2013). Unusual biogenic calcite structures were described from two shallow lakes of James Ross Island (Elster et al., 2016) and molecular clock evidenced survival of Antarctic cyanobacteria from Paleozoic times (Strunecký et al., 2012). The dataset from James Ross Island was included in the complex study of diatoms distribution patterns, which defined a novel freshwater biogeography of the Antarctic and emphasised high level of endemism within this group (Verleyen et al., 2021).

Plants and plant physiology

Plant science has been performed in the field (mainly James Ross Island) and in lab-based experiments since 2006. Recently it has developed into a wide array of topics ranging from the studies focused on the responses of mosses and lichens to manipulated warming using an Open-top chamber approach, towards ecophysiology of Antarctic lichens in response to stress factors. Other topics are photoinhibition of photosynthesis by photosynthetically-active and UV-B radiation, and species-specific spectral reflectance signatures. Laboratory experiments investigate physiological background and underlying biochemical/biophysical mechanisms activated in Antarctic autotrophs under stress, low and subzero temperature in particular. Fruitful international co-operation has been established with Chilean scientist in the field of Antarctic lichen ecophysiology. The scientific outputs of major importance comprise different aspects of desiccation stress (Barták et al., 2018a; Bednaříková et al., 2020; Mishra et al., 2020), freezing stress (Marečková et al., 2019), UV-B effects (Barták et al., 2018b), and cryoresistance of Antarctic autotrophs (Hájek et al., 2016; Orekhova et al., 2018).

Animal science

While fish play an important ecological role in the Antarctic marine ecosystem, there is relatively little information available on fish assemblages in pristine shallow coastal waters. To address this, marine biota research has focused on the assemblage structure and diet of fish in the relatively pristine and previously unstudied coastal zone off James Ross Island (Jurajda et al., 2016). The data gathered provides new insights into fish behaviour in a largely unstudied Antarctic habitat. In addition, fish scale samples were used to assess bioaccumulation of 14 trace metals, including Uranium, previously unstudied in Antarctic waters (Roche et al., 2018, 2019). The resultant baseline data will be essential for assessing the impacts of increased metal deposition (esp. Uranium) and increasing temperatures and meltwater runoff associated with climate change on the Antarctic food web. Besides, Czech scientists described new species of marine crustaceans (Diakin et al., 2017), studied their behaviour (Tomanová and Vácha 2016), or diversity of soil microfauna (Smykla et al., 2018). Abundance and breeding of Antarctic tern and its interaction with Polar skua on James Ross Island was investigated by Weidinger and Pavel (2013a, b).

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