

**CZECH REPUBLIC**

**Exchange of Information  
in Accordance  
with Article III and VII (5) of the Antarctic Treaty  
and  
ATCM Resolution 6 (2001)**

# **Annual Report for Australian Summer Season 2007 – 2008**

## **1. Scientific information**

### **Czech activities on James Ross Island in the austral summer of 2007 – 2008**

The field research performed in the area of the Czech Antarctic Station of Johann Gregor Mendel (CAS JGM) in the summer of 2007/08 was in accordance with the concept of Czech research focused on climatology, botany and geology. The notification duty for these activities was fulfilled and permit for the project was issued by the Czech Ministry of the Environment separately for geology and for climatology together with botany (Resolution No. 82556/ENV/07).

In the summer of 2007/2008, 6 scientists from (a) the Faculty of Science of Masaryk University Brno, (b) the Faculty of Science, South Bohemia University, (c) Charles University in Prague and (d) the Institute of Botany of the Academy of Sciences of the Czech Republic participated in climatological and botanical investigations related to the following projects: KONTAKT ME 945 - Multidisciplinary research of Antarctic terrestrial vegetation within IPY (authorized by the Czech Ministry of Education, Youth and Sports), and grant of the Czech Science Foundation 205/07/1377 - Impacts of atmospheric factors on the UV radiation regime in the territory of the Antarctic Peninsula (Czech Science Foundation). The area and the locations of the field campaign that was commenced on January 17 and ended on March 9, 2008 are depicted on a schematic map of the area of interest (see the graphic supplement). The field operations consisted of 6 main subject areas.

#### **(I) Local climate and microclimate of the Ulu Peninsula**

In the framework of climatological research, data downloading and maintenance were performed for 7 automatic weather stations (AWS) located in the area of scientific interest. The main purpose of this work consisted in continuation of the long-term monitoring of various abiotic factors and investigation of the spatiotemporal variability of the climatic conditions of the Ulu Peninsula. Another objective lay in explanation of the processes leading to regional atmospheric warming and determination of the influence of the relief on transformation of air masses and boundary layer processes. The data files were stored and briefly checked. However, final processing of the data sets and their verification will be carried out in the CR.

The second task consisted in maintenance, checking and repair of damaged meteorological instruments, ventilation units, their holders and auxiliary structures. Meteorological sensors were replaced to enable their annual calibration in certificated laboratories according to the WMO regulations, e.g. the Solar and Ozone Observatory of the Czech Hydrometeorological Institute in Hradec Králove and Kipp-Zonen BV. Special attention was devoted to servicing the solar radiation sensors and devices (pyranometers, PAR radiometers, UV radiometer and UVB-Biometer), which are located at the J. G. Mendel station. Prediction of the erythemally effective UVB radiation and evaluation of the effects of atmospheric factors (ozone concentration, optical air mass, spm, etc.) will be studied using the nonlinear modelling approach.

In addition, the open-top chamber experiments described below were performed, including setting and operation of the meteorological instruments for microclimate and soil climate

monitoring. Several topographical surveys were carried out in Brandy Bay, Whisky Bay and Santa Martha Cove. Glaciological observations were carried out on the ice cap of Davis Dome.

## **(II) The effects of global warming on Antarctic vegetation – field experiments in a manipulated environment**

In the 2007/2008 summer season, the plant stress physiology team (Masaryk University, Brno) continued work on the installation of open-top chambers (OTC) in the northern part of James Ross Island. Altogether, 5 new OTCs, including data loggers and several temperature sensors, were installed at three different locations:

seashore – moss-dominated ecosystem close to CAS JGM – 6 m a.s.l. (see the Fig., referred to as A),

de-glaciated table mountain (Berry Hill Mesa, *Usnea* sp., and *Umbilicaria decussata*) - 350 m a.s.l. (see the Fig., referred to as B),

table mountain, close to the ice cap (Davis Dome) - 410 m. a.s.l., no moss and lichen vegetation (referred to as C in the Fig.).

Recently, three OTC have been located at site A, three at site B, and one at site C. A typical set up of instruments and sensors collecting environmental data outside (control plot) and inside each OTC consisted of (a) a 13-channel data logger, (b) 3 soil thermometers (Pt-100) placed at a depth of 5, 10 and 15 cm, (c) 2 Cu-Co thermocouple thermometers monitoring the surface temperature of typical components of the vegetation cover, (d) 1 Cu-Co thermometer placed 30 cm above the surface, (e) 1 hygrometer measuring the relative humidity close to the ground. Annual microclimatological data from the control plots and OTC downloaded in January 2008 from sites A and B showed that, in 2007, the OTC-induced shift in the air, vegetation cover, and soil temperatures was strongly dependent particularly on the character of the prevailing weather, the light and the wind speed (for analysis, ref: and MS submitted). High-resolution photos of the vegetation cover were taken from a constant height above the control plots and OTCs, so that long-term changes in the lichen/moss growth rate and biodiversity could be determined.

## **(III) Stress physiology of Antarctic autotrophs**

A combined field- and laboratory-based approach was employed to study moss and lichen responses to hydration/dehydration. In the field, a portable fluorometric system was installed inside an OTC at site A. The system measured the primary photosynthetic processes of moss thalli (effective quantum yield of the photochemical processes in photosystem II -  $\Phi_{II}$ ) at 15 minute intervals for 28 days. Preliminary analysis of the collected data showed that, specifically for February 2008, hydration was the environmental factor that was most limiting for photosynthetic photochemical processes. Simultaneously, laboratory-based experiments were performed at the J.G. Mendel station using a water potential meter and a modulated fluorometer. These experiments consisted in measurement of the dependence of  $\Phi_{II}$  on the water potential (WP) of lichen/moss thalli. The measurements showed inter-specific differences of the studied representatives of moss and lichen vegetation occurring on James Ross Island. They differed in the WP critical for primary photosynthetic processes. In addition, water stress in desiccating lichen and moss species was studied using a fast chlorophyll induction curve (OJIP).

## **(IV) Soil biota evaluation**

In January-February 2008, soil and substrate samples were collected from several typical (and contrasting) de-glaciated ecosystems in the northern part of James Ross Island and were transferred to laboratories in Brno, Czech Republic. After isolation, soil microorganisms were cultivated on agar so that the biodiversity of bacteria and other soil microorganisms could be evaluated.

#### **(V) Study of lake ecosystems**

Fundamental limnological and hydrobiological investigations were performed on 16 small lakes in the areas of Cape Lachman, Halozetes Valley, Brandy Bay and Solorina Valley. The relatively broad genetic and ecological spectrum is typical for these lakes (flat-bottomed lakes on coastal terraces, thermokarst lakes and corrie lakes - some of them are frozen with surface and bottom ice in the summer season).

Profile bathymetric measurements were performed on all the lakes to estimate their greatest depth. The physicochemical properties of water at the extreme points (temperature, pH, conductivity, intensity of PhAR, oxygen content) were measured by probes and 1 to 3 samples were taken for further chemical analysis (alkalinity, total dissolved inorganic carbon, TC, CO<sub>2</sub>, HCO<sub>3</sub><sup>-</sup>, CO<sub>3</sub><sup>2-</sup>, NO<sub>3</sub><sup>-</sup>-N, NO<sub>2</sub><sup>-</sup>-N, NH<sub>4</sub><sup>+</sup>-N, total N, PO<sub>4</sub><sup>3-</sup>-P, total P, Ca, Mg, K, Na, Si) in the vertical water profile using a 50 cm step. The samples for content evaluation of bacteria and for determination of phytoplankton and zooplankton were taken at the same time. The phytobenthos was sampled in relatively deep lakes.

Preliminary analysis of the samples showed that the lakes of James Ross Island are far richer in macroscopic fauna than reported in previous studies (Björck et al. 1996) and that this fauna resembles that of maritime Antarctica (i.e. the South Shetlands and the west coast of the Antarctic Peninsula) (Toro et al. 2007).

#### **(VI) Ecology of lichen communities on hilltops of mesas (Bibby Point, Berry Hill and Lachman Crags)**

A similar approach as in (II) was used to evaluate the potential effect of climate warming on the diversity of lichen communities and especially on changes in their biomass, density and thalli height. For this purpose, several open-top chambers (OTC) were installed in a high-altitude location (see the enclosed graphic supplement). The installations were begun at the mesa of Bibby Point in the previous summer season. The first OTC equipped with temperature and humidity sensors and data-loggers to measure the basic characteristics of the internal and external microclimates were installed in 2007. In the summer of 2008, another OTC couple and snow catch were installed in order to adjust snow cover. The species diversity and biomass of lichen communities were observed in dependence on the distance from ice caps in 4 longitudinal profiles on the Lachman Crags and Berry Hill mesas. Altogether, 75 open Petri dishes were installed in each profile to collect wind-transported lichen spores. The quantity of spores will be analyzed after a year of exposure.

#### **(VII) Geological study of James Ross Island, Antarctic Peninsula, and Seymour Island**

From January to mid-March 2008, geological work took place in three parts of Antarctica, namely at James Ross and Seymour Islands, and in the northern part of the Antarctic Peninsula (Graham Land, Trinity Peninsula).

At James Ross Island, geological mapping was performed in order to complete the geological map of the northern, de-glaciated part of the Ulu Peninsula with the Cretaceous

marine sediments of the back-arc James Ross basin, with Neogene up to Quaternary volcanic rocks of the James Ross Group and terrestrial and marine sediments. The relation of volcanism to the glaciation of the island from Neogene to the present time was studied, together with the youngest de-glaciation, and the subsequent evolution of the present landscape. Samples were collected within research for further petrological, geochemical, and geochronological studies. Detailed topographical GPS mapping was carried out for the purpose of creation of a topographical map of the northern de-glaciated part of James Ross Island, in addition to basic geological mapping and further detailed geological studies.

The youngest Cretaceous and Paleogene marine sediments of the back-arc James Ross basin were studied at Seymour Island from the points of view of paleontology, biostratigraphy, paleoecology and mineralogical composition, and post-sedimentary changes in marine organisms shells. The greatest attention concentrated on the Cretaceous/Paleogene boundary in the Lopéz de Bertodáno member.

Structural geological and petrological research of low metamorphosed and highly deformed Permian-Triassic sediments of the Trinity Peninsula Group, and of Mesozoic-Cainozoic granitoids of the Antarctic batholith, and of mutual relations of individual rock types was performed in several regions of the northern part of the Antarctic Peninsula (Camp Hill, Church Point, Crystal Hill, Pitt Point, Mt. Reece).

#### **(VIII) Avifauna study at James Ross Island**

The shore around Johann Gregor Mendel, the Czech Antarctic station, was monitored in a 21 km long section Brandy Bay, Lachman Peninsula, and Santa Martha Bay. Ten bird species were registered here; the frequency of these species was estimated. According to the estimates, the numbers of identified specimens were sub-normal, due to the sub-normal course of the winter season.

The following species occurred regularly of the avifauna species: South Polar Skua (*Catharacta maccormicki*), Antarctic Tern (*Sterna vittata*), Kelp Gull (*Larus dominicanus*), Adelie Penguin (*Pygoscelis adeliae*), Gentoo Penguin (*Pygosceli papua*), Wilson's Storm-petrel (*Oceanites oceanicus*), Imperial Shag (*Phalacrocorax atriceps*).

All observations were made during January and February 2008.

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- **Masaryk University, Brno**  
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- **Czech Geological Survey, Praha**  
contact: [www.geology.cz](http://www.geology.cz)

Members of the Czech Antarctic expedition at the Czech Antarctic Station of Johann Gregor Mendel – 2007-2008

Name and surname	Profession	Institution
<b>Doc. Ing. Josef Elster, CSc.</b>	Biologist	Institute of Botany of AS CR at Třeboň
<b>Doc. Ing. Miloš Barták, CSc.</b>	Botanist, head of expedition	Institute of Experimental Biology, Faculty of Science, Masaryk University Brno
<b>Mgr. Olga Bohuslavová</b>	Bio-geographer	Institute of Geography, Faculty of Science, Masaryk University Brno
<b>Mgr. Linda Nedbalová</b>	Botanist	Institute of Botany of AS CR at Třeboň
<b>Mgr. Kamil Láška, Ph.D</b>	Climatologist	Institute of Geography, Faculty of Science, Masaryk University Brno
<b>Mgr. Peter Vázci, Ph.D.</b>	Plant physiologist	Institute of Experimental Biology, Faculty of Science, Masaryk University Brno
<b>RNDr. Václav Pavel, Ph.D</b>	Ornithologist	Palacký University, Olomouc
<b>Nick Halls</b>	Geologist	Czech Geological Survey
<b>RNDr. Bedřich Mlčoch</b>	Geologist	Czech Geological Survey
<b>Mgr. Daniel Nývlt</b>	Geologist	Czech Geological Survey
<b>Mgr. Jiří Žák, Ph.D.</b>	Geologist	Czech Geological Survey
<b>Mgr. Radek Vodrážka</b>	Geologist	Czech Geological Survey
<b>RNDr. Ondřej Lexa, Ph.D.</b>	Geologist	Czech Geological Survey
<b>Mgr. Vojtěch Janoušek, Ph.D.</b>	Geologist	Czech Geological Survey
<b>Mgr. Zdeněk Venera, Ph.D.</b>	Geologist, head of the geological expedition	Czech Geological Survey

In 2007, the Ministry of the Environment of the Czech Republic issued, at request of a group of 10 citizens of the Czech Republic, a Permit for visit of Antarctica for the period of

21 days. This was a planned visit to the Eco-Nelson station at Nelson Island. This island belongs to the group of South Shetland Islands. During the visit, this non-governmental expedition generally concentrated on the “Man in Extreme Conditions” program and monitored the “Waste on Shore” program under the auspices of the Greenpeace movement. The Ministry of the Environment was informed of the results of the visit in a written report.

## **2 Environmental Information**

### **2.1 Compliance with the Protocol**

Act No. 276/2003 Coll., on Antarctica and on amendment to some laws, entered into effect on March 31, 2005. The Protocol on Environmental Protection to the Antarctic Treaty (Madrid Protocol) was published in the Collection of International Treaties under No. 42/2005 Coll. Int. Tr. on March 31, 2005. The Geology Department of the Ministry of Environment issued three Permits in total, two of which allowed for entry to Antarctica by Czech research expeditions for the period from December 2007 to March 2008. One permit was issued for a group of Czech citizens for the period of December 2 – 22, 2007.

### **2.2 Waste Management Plans**

The waste management plan of the Czech Antarctic base, Johann Gregor Mendel, was generally formulated in the Comprehensive Environmental Evaluation for the Czech base (Czech Scientific Station in Antarctica- Construction and Operation. Czech Republic January 2004). Waste management was performed according to the prepared plan from December 2007 to March 2008. All combustible waste was disposed of in the Norwegian incinerator, GOLAR, at temperatures exceeding 1000 °C. Non-combustible waste (metal and glass) was collected in barrels with a volume of 200 l and is prepared for transportation.

## **3 Other information**

### **3.1. Inspection report**

No case.

### **3.2 Notice of Activities Undertaken in Case of Emergencies**

No case.

## **4. Permanent Information**

### **4.1. Operational Information**

#### **Czech Antarctic Station of Johann Gregor Mendel**

James Ross Island, location: 63°48'5.6''S a 57°53'5.6''W

**Operating period : Antarctic summer**

**Maximum population : 15 persons**

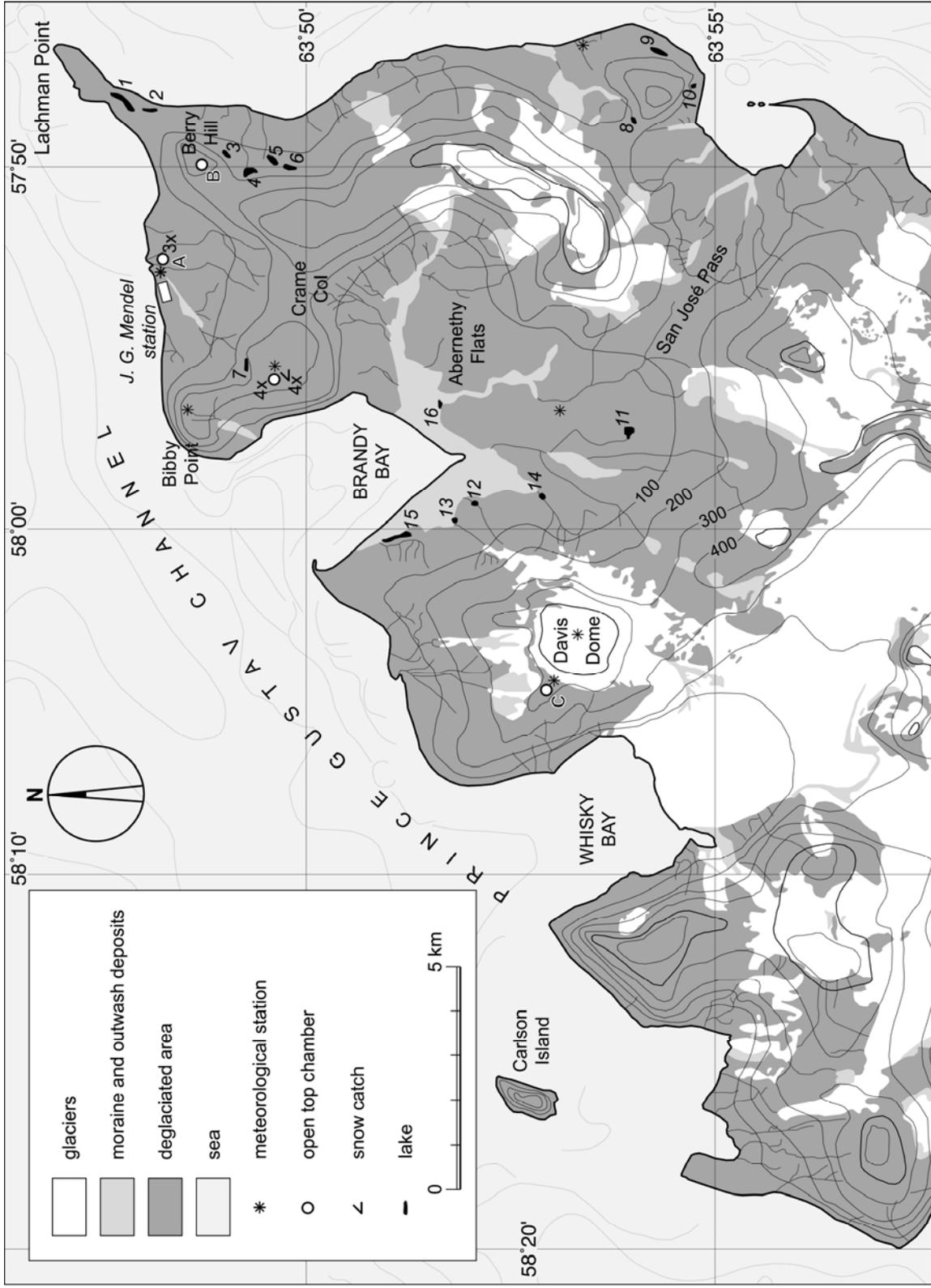
Specialized medical assistance: Marambio station in Argentina

#### **4.2 Relevant National Legislation**

Following the entry into effect of Czech Act No. 276/2003 Coll., on Antarctica and on amendment to some laws, the Geology Department of the Ministry of the Environment issued, in 2007, in administrative proceedings:

- Joint permit for visit and research at the Czech Antarctic base for the Institute of Geography of the Masaryk University Brno and for the Institute of Botany AS CR, for the period from December 26, 2007 to March 15, 2008.
- Permit for the Czech Geological Survey for visit at James Ross Island and the Antarctic Peninsula for geological research, for the period from December 26, 2007 to March 15, 2008.
- Permit for a group of Czech citizens for visit at the Eco-Nelson base at the Nelson Island.

Contact: [www.env.cz](http://www.env.cz)



Distribution of Czech fields research on the Ulu Peninsula (north part of James Ross Island) in the austral summer 2007/08.

Source of cartographic content: British Antarctic Survey, Mapping and Geographic Information Centre, Series BAS 100, Sheet 2, Edition 1, 1995