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Romanian Scientific Activities proposed for Cooperation within Larsemann Hills ASMA 6 in East Antarctica – Plan for 2013-2014

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1. International cooperation within the Antarctic Treaty

Within the spirit of the Antarctic Treaty, Article 3, for promoting scientific cooperation of Parties in the Antarctic, and of the Article 6 of the Madrid Protocol, Romania makes efforts to promote such collaborations with other states operating in the same research areas and fields.

Romania conducted specific polar activities in Antarctica since 1998, after a series of expeditions and research in the Arctic. Romanian activities of scientific exploration and research in Antarctica have been performed within several expeditions in cooperation with Russia and China. Since June 15, 2005, as a consequence of the *Memorandum of Understanding* concluded and signed between Australia and Romania for a period of ten years (that could be extended, if so agreed by the two Parties), Romanian researchers benefit from the access to the *Law* Base in Larsemann Hills, East Antarctica. Thus this Base named in honour of the Australian scientist *Phillip Law* - the first researcher that explored Larsemann Hills area (1958) also received the name of the Romanian scientist *Emil Racovita* - the first biologist in the world that studied life in Antarctica, within the *Belgica* Expedition (1897-1899).

This Base was denominated, starting with December 9, 2011, *Law-Racovita-Negoita*, in recognition of the contribution of the Romanian explorer and researcher Dr. Eng. Teodor Gheorghe Negoita (1946-2011) to the progress of Antarctic sciences.

The new representative scientific organism of Romania in the Antarctic Treaty System is, starting with this year, the National Commission for Antarctic Research (NCAR) within the Romanian Academy. NCAR delegates were previously involved in activities of scientific research in Larsemann Hills and environmental activities related to the Management Group of Larsemann Hills ASMA 6, along with Australia, China, India and Russia. NCAR is developing the National Antarctic Program according to the Romanian Antarctic Science Strategic Plan 2013-2020 (*Annex 1*) in correlation with the strategic plan of the Romanian Ministry of Environmental Protection and Climate Change. In this context, NCAR intends to continue the cooperation of Romania with the Parties in ASMA 6 in the scientific and Antarctic environmental protection fields.

2. Plan for Romanian Antarctic Scientific Activities in Larsemann Hills ASMA 6 in 2013-2014

- To organize the Romanian National Antarctic Research Expedition in Larsemann Hills, East Antarctica, in summer 2013-2014, in compliance with the Protocol on Environment Protection to Antarctic Treaty.

Description of the proposed activity:

- Title: The 3rd Romanian National Antarctic Research Expedition (RONARE) in cooperation with the 30th Chinese National Antarctic Research Expedition (CHINARE).
- Location: East Antarctica, Stations *Law-Racovita-Negoita* and *Zhong Shan* in Larsemann Hills, and possibly *Davis* in Vestfold Hills.
- Number of Romanian expeditioners: 2 - 4 researchers.
- Main field activities: hydrological, biological, geological, astronomical and medical researches.
- Sampling: ice, lake water, soil, sand and vegetation (a few grams/sample).
- Organizer: National Commission for Antarctic Research (NCAR) of Romanian Academy.

- To develop the *Protocol for the activities in the field of Larsemann Hills*, including the exploration and identification of ecological niches, the criteria for the selection of biological points of interest on view of consecutive studies, as well as the techniques of the preliminary processing of the aquatic samples on icebreaker and in Antarctic station laboratories, and the conditions for sample preservation in the Antarctic continent, Australian customs and during the transport on the ocean, in the airplanes and in national laboratories.

- To endow a small laboratory of biology in the workstation and to install a CDD camera for astronomical recordings.

- To make available the up-to-date information on the location of depositories of samples and collections resulting from Romanian scientific research in Antarctica according to Recommendation ATCM XIII-1 paragraph 5 (a).

- To ensure free exchanges of information between researchers regarding the biological prospecting and aquatic ecosystems in ASMA no. 6 managed by Australia, China, India, Russia and Romania, and to develop joint projects. Based on IP 84 submitted by Romania at ATCM 2012, an exchange of information took place during 2012 between Romanian NCAR and Chinese Arctic and Antarctic Administration, through the agency of Embassy of the People's Republic of China in Romania, on "The Scientific Cooperation between Romania and China in Antarctica: Past, Present and Future".

Annex 1

Strategic Plan for Antarctic Research 2013-2020

Theme 1. Antarctic ecosystems: biodiversity and vulnerability, preservation and bioprospecting

Goal: Investigating the biodiversity of Antarctic ecosystems and the effects upon them of local and global environmental modifications, in view of preserving these ecosystems by the development of the scientific and technical basis of environmental protection activity management and of analysis of the biotechnological potential of some Antarctic species.

Science streams:

1.1. Biodiversity and evolution in the Antarctic environment;

1.2. Vulnerability to change and life preservation;

1.3. Impact of human activities: prevention, control and remediation;

1.4. Biological prospecting in Antarctica.

Expected outcomes:

- Taxonomic identification of archaic, endemic and regional species in the current Antarctic ecosystems – terrestrial, limnetic, glacial and marine.
- Identification of the signals of species vulnerability and of the changing trends of Antarctic ecosystems to the stressors in the environment and to the human pressures.
- Scientific and technical substantiation of the human activity control and consolidation of the practical steps of identification, remediation and preservation of the biodiversity and geodiversity special values within the system of Antarctic protected areas.
- Achievement of some collections of Antarctic micro- şi macroorganisms, isolation of microbial strains with increased biological activity, obtainment of extremolithes with biotechnological potential.
- Reconstitution, based on these data, of some spatial models of Antarctic species and ecosystem diversity in the geological hystory, their structural and functional characterization in relation to the climate change, and sketching a scenario of a possible biodiversity model in the short- and long term future.

Proposed by Life Sciences Section, in correlation with SCAR Programs:

- AnT-ERA (Antarctic Thresholds - Ecosystem Resilience and Adaptation)
- AntEco (State of the Antarctic Ecosystem)

Coordinators: Prof. *Dumitru Murariu* - National Museum of Natural History „Grigore Antipa", Bucharest, and Acad. *Octavian Popescu* - Institute of Biology, Romanian Academy.

Theme 2. Cryo-geo-climatic Processes in the Antarctic Sysyem

Goal: Understanding the Antarctic ice system history and current evolution and the associated effects; establishing the state and evolution of Antarctic permafrost; complex characterization of aquatic habitates in protected areas; understanding the relationship between the cryospheric components and climate variability.

Science streams:

2.1. Antarctic ice system;

2.2. Geology of Antarctic habitates;

2.3. Antarctic paleoclimate;

2.4. Environment protection in Antarctica.

Expected outcomes:

- Determining the glacial balance, the glacier retreat/advancement rithm and the associated geomorphical effects.
- Establishing the thermal state and evolution of the Antarctic permafrost and the associated geomorphical effects.
- Complex characterization (geomorphological, hydrological, geochemical) of aquatic habitates in the protected areas.
- Study of the fluctuations of cryospheric components coupled with low-frequency climate variability.
- Integration of the *in-situ* data with satellite observations for the environment characteristic analysis.
- Development of contamination-free scientific approaches / techniques suitable for Antarctic environments.

Proposed by Geonomical Sciences Section, in correlation with SCAR Programs:

- SERCE (Solid Earth Response and Cryospheric Evolution)
- PAIS (Past Antarctic Ice Sheet Dynamics)

Coordinators: Prof. *Nicolae Panin* - National Institute of Marine Geology and Geo-Ecology (Geo-Eco-Mar) Bucharest-Constantza, and *Roxana Bojariu*, Ph.D - National Administration of Meteorology, Bucharest.

Theme 3. Antarctica as a platform of astronomical, astrophysical and climate observations

Goals: In-situ observations for satellite data validation and numerical modeling applied in astronomic, atmospheric and climate studies.

Science streams:

3.1. Climate response to coupled ocean/fast-ice/land/atmosphere system;

3.2. Atmospheric chemistry in Antarctica and at global scale;

3.3. Site testing for robotic astronomical observations;

3.4. Physical geodesy.

Expected outcomes:

- Enhanced monitoring, understanding, and modeling capacity for the assessment of climate variability and change in Antarctica and at global level.
- Use of robotic facilities in our research to reduce logistic requirements and minimize the environmental impact, and to extend the site testing results in Arctic sites, as logical extension of activities in Antarctica.
- Better knowledge regarding Earth gravity, crustal movement, improvement of the International Terrestrial Reference Frame (ITRF) and integration into the International Geodetic System (IGS).
- Better knowledge to serve international negotiations under UNFCC and monitoring under Montreal Protocol.

Proposed by Physical Sciences Section, in correlation with the SCAR Programs:

- AAA (Astronomy and Astrophysics in Antarctica)
- AntClim[21] (Antarctic Climate Change in the 21st Century)

Coordinators: *Petre Popescu*, Ph.D - Astronomical Institute, Romanian Academy, and *Roxana Bojariu*, Ph.D - National Administration of Meteorology, Bucharest.

Theme 4. Frontier Science: Antarctica as analoguous space

Goal: Investigating the Antarctic environment as a space analoguous for the possible life in extreme conditions on Earth and in extraterrestrial environment.

Science streams:

4.1 Antarctica - medical research environment unique in the Earth;

4.2 Antarctica - natural laboratory of exobiology;

4.3 Crystal structures under various magnetic fields.

Expected outcomes:

- Identification of the adaptation responses of human organism to the aggregate of extreme conditions in Antarctica.
- Development of knowledge on small group psychology isolated under extreme conditions.
- Turning to good account of psychological and medical results obtained on Antarctic expeditioners for the development of strategies of team training for human activities under extreme conditions on Earth (sub-terrain, marine platforms, aviation, natural calamities) and in Space.
- Obtainment of data: biogeographical, proteomic, genomic, microbiological, and assessment of survival limits and adaptation mechanisms under extreme environments.
- Constructing models of some possible environments with implications on the future, robotic or human, Space missions.
- Identification of a structural pattern in various coloidal substances in the fresh water in Antarctic lakes in correlation with the area magnetic field.
- Achievement of a data base on: the self-structuring of substances under the magnetic field of the area in correlation with the temperature variation; and the dependence of Antarctic microorganism size upon the variation of magnetic field intensity.

Proposed by Life Sciences Section, including the Group of Experts in Biology and Human Medicine.

Coordinators: *Florica Topârceanu*, Ph.D - Institute of Virology, Romanian Academy, *Sergiu Fendrihan* Ph.D - Romanian Bioresource Center and Advanced Research Association, Bucharest, and *Zoltan Marosy* Ph.D - Ecological University, Bucharest.