



FIVE DECADES OF COOPERATION AND COMMITMENT TO SCIENCE AND ENVIRONMENTAL PROTECTION

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Scientific & Science-related Collaborations with Other Parties During 2010-2011

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Conscious of the importance of the collaborations and the spirit of the Antarctic Treaty, and in accordance with Article 6 of the Protocol, the Republic of Korea cooperated with other parties during 2010-2011 in conducting polar scientific research and related activities. (Contact Point: Mr. Dongmin JIN, KOPRI, dmjin@kopri.re.kr)

1. KOPRI-Rutgers University Joint Research Expedition

The Korea Polar Research Institute (KOPRI) and Rutgers University (U.S.) had a first joint research expedition using the Republic of Korea's Ice Breaking Research Vessel *Araon* in the frozen Southern Ocean, the Amundsen Sea, during 21 December 2010 ~ 23 January 2011.

This Joint Amundsen project took place to assess the rapid changes of polar sea-ice dynamics and related physical, chemical, and biological processes influenced by the current trend of climate change, by implementing an earth observation system from space down to the deep sea. The study looks into the physical mechanisms associated with the opening and closing of the Amundsen polynya and its impacts on the biology and biogeochemistry in the region; the behavior of gas exchange in and out of the polynya, and the role of gases in ecological processes; and the spatial and temporal variability of the physical properties of sea ice, which are important to air-sea interaction and to biological processes in the sea-ice zone. We wanted to examine the links between biogeochemical processes and food web structure, and to identify key functional groups, their roles and interactions, etc.

The first year we implemented: 1) hydrographic survey; 2) a long duration mooring for the observation of ocean currents and sediments on the continental shelf; 3) observation of dissolved gases; 4) atmospheric monitoring; and 5) biological & microbiological investigations, etc.

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2. Joint Expedition for the Search of Antarctic Meteorites between KOPRI and Italian PNRA

KOPRI and PNRA (the Nazionale delle Ricerche in Antartide) carried out a joint expedition for the search of meteorites in Victoria Land, Antarctica, within the logistic framework of the XXVI PNRA Antarctic Campaign in January 2011.

The search was conducted at the Frontier Mountain blue ice field, operating from a remote camp installed in the area, and supported by the Italian Mario Zucchelli station at Terra Nova Bay. A number of helicopter-supported reconnaissance trips from the station were carried out to several blue ice fields in Victoria Land to evaluate their potential in yielding high concentrations of meteorites. These areas are potential targets for future joint meteorite search campaigns. During the expedition, both parties successfully recovered 113 meteorites ranging from >500 g to < 1 g, and are currently classifying the specimens at the

laboratories to register them for the Meteoritic Society. This first joint expedition between KOPRI and PNRA will be extended to various scientific activities and logistics for further collaboration.

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3. International Collaborative Marine and Quaternary Geoscience Research on Abrupt Environmental Change in the Larsen Ice Shelf System

For the International Polar Year (IPY), two KOPRI scientists participated in an international, multi-disciplinary field program (USAP LARISSA program) driven by Professor Eugene W. Domack at Hamilton College, New York, to address the rapid changes occurring in the Antarctic Peninsula region as a consequence of the abrupt collapse of the Larsen Ice Shelf. The overarching goal of this project is to describe and to understand the basic physical and geological processes active in the Larsen embayment that: **a)** contributed to the present phase of massive, rapid environmental change; **b)** are participating in that change as part of the coupled climate-ocean-ice system; and **c)** are fundamentally altered by these changes. The collaboration between KOPRI and its US partners will be extended for further accomplishment. This collaborative project will make use of the USAP *RV Palmer* in 2012 (as part of the IPY: LARISSA project) with Korean participation. In the following season, the Republic of Korea's icebreaker *Araon* will deploy to the NW Weddell Sea in the area of the Larsen Ice Shelf.

An international workshop for Weddell Sea Ice Shelf research was held in Incheon, the Republic of Korea, during September 7-8, 2010. Research on the Larsen Ice Shelf system has been accepted as a new challenge in Antarctic sciences; many scientists are collaborating to illustrate the affects of the shelf collapse on the marine ecosystem as well as on glacial dynamics and interactions between ocean, ice, geology and biology. The purpose of the workshop was to provide a forum to all participants (LARISSA parties and Korean scientists) to discuss current ongoing challenges and share their ideas and opinions with special attention given to the expedition of *RV Araon*. Six LARISSA participants (Eugene Domack, Amy Leventer, Ted Scambos, Maria Vernet, Bruce Huber, and Ronald Ross) were invited to visit KOPRI during this workshop.

We contracted an agreement with Ted Scambos to build and assemble 2 AMIGOS (Automated Meteorology-Ice-Geophysics Observing Stations). The existing US-installed and new KOPRI-installed AMIGOS & seismometer installation will create an observing network for the Crane-Flask-Leppard-Scar Inlet glacier system in the Larsen shelf area. We also extracted slab sediments from the cores collected from a vessel-based expedition (*NB Palmer*) in 2010. Gray scale analysis of the slab X-radiographs is to be undertaken to unravel the dynamics of grounding line zone stability and sub-glacial melt water efflux under the influence of long period waves (tsunami, storm surge, and unusual tidal alignments). In addition, for paleoenvironmental interpretation, the ongoing work is diatom assemblage analysis to reconstruct a long record of climate and oceanographic change from the section of the Antarctic margin. The cores collected from outer Barilari Bay, the western Antarctic Peninsula, are most proximal to the ice site (Site Beta), providing the closest link between the marine and ice core records.

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4. Expedition to the Antarctic Ridge

In early 2011, KOPRI conducted a short survey of two segments of AAR (the Australian-Antarctic Ridge), the largest unexplored expanse of the global mid-ocean ridge system, using the icebreaker *Araon*. Dr.

Charles Langmuir of Harvard University and Dr. Jian Lin of Woods Hole Oceanographic Institution (from United States) participated in the cruise as research scientists. They will keep collaborating for the interpretation of the data and participate in further cruises. As a result of the cruise, we have a multi-beam map and 16 rock core samples from the two ridge segments at 160°E (K1) and 152.5°E (K2). Also, we found strong signals of hydrothermal venting using MAPR (Miniature Autonomous Plume Recorder) profiles from the ridge. It appears that hydrothermal vents are distributed in the central part of the K1 segment. In the K2 segment, hydrothermal vent signals were mainly found in the western part of the segment. This first discovery of hot vents may be of interest to CCAMLR.

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5. International Collaboration on the Study of Magnetism in the King George Islands

NIPR (National Institute of Polar Research: Japan) proposed a magnetic study over King George Island and Bransfield Strait. Proposed study methods were aeromagnetic survey using an unmanned aerial vehicle (UAV), and rock magnetism. The Republic of Korea supported transportation of equipment from the Republic of Korea to Antarctica and provided accommodation for 3 scientists of NIPR at King Sejong station from 1 Feb. to 28 Feb. 2011. NIPR and KOPRI also agreed on collaboration in the magnetic study of the study area.

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6. International Visiting Research Program between Collaboration on the study of magnetism in King George Islands

KOPRI and OGS (Istituto Nazionale di Oceanografia e Geofisica Sperimentale: Italy) conducted a collaborative study on Antarctic gas hydrates as a visiting research program between the Republic of Korea and Italy during 2007-2009. The two institutes have shared multichannel seismic data and swath bathymetry data. KOPRI invited Italian scientists to the Republic of Korea and conducted the collaborative Antarctic survey during the period.

As an extension of the program, Dr. Umberta Tinivella of OGS joined KOPRI's geophysical survey conducted on the South Shetland continental margin with *Araon* in Dec. 2010.

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