

## Research Activities of the Overwintering Parties of the Korea Antarctic Research Programs carried out between 1988 and 1997

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**ABSTRACT.** The research activities of 10 Overwintering Parties (OPs) since the inauguration of the King Sejong Station at King George Island in the South Shetland Islands on February 1988 to December 1997 were briefly reviewed. The research team of OP is principally composed of a couple of scientists majoring biological and/or geological sciences, one meteorologist from the Korea Meteorological Agency, and the officer-in-charge (OIC) with the personal background of natural science. Most of the subjects of the research team comprise description of the natural environmental changes around the King Sejong Station and basic analysis of the samples gathered in the vicinity of the station. Biological and geological and/or geophysical activities, and meteorological data gathering were their major research topics. Technical reports and some research papers were issued by the scientists after overwintering. Several books related to the overwintering or major field were also published by them. A couple of English written books were translated into Korean during the overwintering period. Several suggestions were proposed for developing the research activities of hereafter OPs.

*Key Words:* King Sejong Station, overwintering party, research activities, suggestions

### Introduction

The King Sejong Station, the Korea Antarctic research station, was inaugurated on February 17, 1988 in the western tip of Barton Peninsula of King George Island in the South Shetland Islands. Since then, Overwintering Parties (OPs) carried out their research activities in every year. Approximately 12 to 15 people participated in each OP. It generally included three different fields of research scientists; usually one meteorologist and a couple of geoscientists and/or biologists. Additionally, one cook, five or six mechanics, one physician, and one radio officer give support to the research scientists, and maintain the research station all through the year. They

arrived in the station in November and left in December next year. Most of OIC were scientists having a Ph.D. degree in geology or biology or oceanography and working in the Korea Ocean Research and Development Institute (KORDI), the main organizer of the Korea Antarctic Research Program (KARP) (Table 1).

The aim of this paper is to delineate the research activities of OPs since the inauguration of the station to the 10th OP overwintered in the 1997 austral winter according to the KARP. This paper will be a useful guide for research activities of hereafter OPs.

### Study Materials

All OPs but the 6th OP issued their overwintering report after returning to Korea (Ministry of Science

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**Table 1.** Date of arrival and departure from the King Sejong Station and OIC and research team of OPs from the 1st to 10th OPs of KARP.

	arrival departure	Officer-In-Charge (degree, major, polar experience)	Research Team (degree, major)	No. of OP members
1st	Feb. 10, 1988 Feb. 8, 1989	S.-K. Chang (Ph.D., geology, Korea Antarctic Expedition, reconnaissance party for Korean Antarctic Station)	D.Y. Kim (Ph.D., marine biology) B.Y. Lee (M.Sc., meteorology) H. Chung (M.Sc., biology, diver) D.H. Lee (field assistant, diver)	13
2nd	Jan. 19, 1989. Jan. 17, 1990.	Y.D. Kim (Ph.D., geophysics, stayed at McMurdo Station for collection of materials for Ph.D. degree)	D.H. Kim (M.Sc., meteorology) Y.C. Kang (M.Sc., marine biology, diver) J.W. Kim (M.Sc., geophysics)	14
3rd	Jan. 6, 1990 Dec. 17, 1990	J.S. Yang (Ph.D., marine chemistry, summer party)	S.H. Nam (M.Sc., geophysics) D.S. Chun (M.Sc., marine biology) J.C. Nam (B.Sc., meteorology)	15
4th	Dec. 14, 1990 Jan. 12, 1992	S.-K. Chang (Ph.D., OIC of the 1st OP)	M.Y. Choe (Ph.D., sedimentary petrology) M.B. Shim (M.Sc., marine biology) C.K. Kim (marine chemical assistant) I.S. Chang (meteorologist)	15
5th	Dec. 19, 1991 Dec. 30, 1992	S. Kim (Ph.D., fishery, summer party)	H.I. Yoon (M.Sc., marine geology) Y.K. Jin (M.Sc., geophysics) H.C. Shin (M.Sc., marine biology) B.H. Noh (field assistant) J.H. Koh (meteorologist)	14
6th	Dec. 25, 1992. Dec. 21, 1993.	D.Y. Kim (Ph.D., marine biology, 1st OP)	S.J. Bae (M.Sc., marine biology) Y.M. Nam (meteorologist)	12
7th	Dec. 16, 1993 Dec.14, 1994.	K.S. Nam (Ph.D., physics)	Y.M. Park (M.Sc., marine biology) H.C. Kim (M.Sc., marine biology) Y.J. Yoon (field assistant) H.S. Chang (meteorologist)	15
8th	Nov. 25, 1994 Dec. 13, 1995	S.-K. Chang (Ph.D., OIC of the 1st and 4th OPs)	J.K. So (M.Sc., physical oceanography) K.J. Kim (M.Sc., geophysics) D.H. Kang (M.Sc., marine biology) I.H. Lee (M.Sc., marine geology) H.S. Chang (meteorologist)	15
9th	Dec. 5, 1995 Dec. 12, 1996	Y.D. Kim (Ph.D., OIC of the 2nd OP)	S.H. Kang (Ph.D., marine biology) W.C. Lee (Ph.D., marine biology) Y.J. Yoon (field assistant, 7th O.P.) Y.J. Kim (meteorologist)	15
10th	Nov. 25, 1996 Dec. 16, 1997	H.B. Cho (administrator)	J.I. Lee (Ph.D., igneous petrology) D.H. Kim (M.Sc., marine biology) J.K. Chung (M.Sc., space science) M.J. Kim (meteorologist)	15

**Table 2.** Relative activities related with various fields of research.

	1st	2nd	3rd	4th	5th	7th	8th	9th	10th
meteorology	+++	++	+++	++++	++	++++	++	+++	+++
upper atmospheric science		+++	+		+				++++
general oceanography	+			+++		++++	++++		
marine biology	+	++		+++		+	++++	++++	++++
under sea ice study	++						+++		
diving	+++	+++							
penguins	+			+++	++++	+	++++		
fish		++++		++++	++++	+++	++++		
fresh water				++					
general environment	+		++	+++			++++		
tide				+			+++		
gravity		++++						++++	
electric resistivity								++++	
seismic recording		++	+		+++	+	+++	+++	
geomagnetism		+++	+		+		+	++	
field geology	+			+					++++
domestic animal collection	++			++++	+		+		
foreign animal collection	++			++					
seal rookery							++		
Total pages of research section	52	87	52	101	91	280	176	167	99
Total pages of overwintering report	313	418	328	664	737	898	533	490	344

and Technology, 1990, 1992, 1993, 1995; Korea Ocean Research and Development Institute, 1991a, 1991b, 1998; Ministry of Ocean and Fishery, 1997a, 1997b). All reports of OPs were scrutinized for this review.

## Research Activities of Overwintering Parties

The main research activity of OPs is to observe and record natural environmental changes around the station. The main core of the research team is limited to the major of the scientists as well as OIC participated in the overwintering.

All the main activities of every OPs were shown in Table 2. The number of the cross shows the relative amount of the topics. It should be noted that the number of pages of the reports are generally due to the routine sheets of meteorological informations.

More detailed topics of the reports are summarized below.

### Atmospheric Sciences

Routine meteorological data, equipments, and other topics related to meteorology. Establishment and operation of the Fabry-Perot interferometer and the multi-colored Photometer in the Upper Atmospheric Sciences

### Biological Sciences

*Fish.* Measurement of the Antarctic fish, major part Antarctic cod (*Notothenia neglecta*) collected in the vicinity of the station including length, weight, collection of scales and otoliths. Results were reported.

*Ave Fauna.* Observation of the penguin rookery situated 2 km south of the station.

The observation of the gentoo penguin (*Pygoscelis*

*papua*) and chinstrap penguin (*P. antarctica*) from arrival of the penguins and nest, egg, hatch, and growth pattern.

*Diving.* Divers recorded their activities with the collection of marine invertebrates and algae.

*Visit to the rookery of Weddell Seals.* The Weddell Seal rookery located in the vicinity of the Czeck Vaclav Vojtech Station in Nelson Island was visited by skidoos when Maxwell Bay was frozen with the approximate thickness of 60 cm.

### **Geological Sciences**

Geological field survey was carried out in the vicinity of the station and nunataks located in the southwestern part of King George Island. The change of the land surface was observed and recorded.

*Geophysical Survey.* Seismic activities and geomagnetism were recorded in the station. Gravity and Electric resistivity were also measured in the vicinity of the station. They kept the notes about the geophysical equipments newly equipped in the station.

*Marine Geology.* Bottom sediments were collected when the sea was frozen.

### **General Oceanography**

Sea water samples were collected and measured in the view point of general oceanography from the several points and around the station. When the sea was frozen, the water samples were collected through the holes made in the sea ice. Tidal characteristics were also reported.

### **Other studies**

Fresh water samples were collected around the station.

Foreign animals were captured and reported. Antarctic animals were collected for their display in domestic museums.

## **Other Research Results related with Overwintering Parties**

Lots of M.S. thesis, Ph.D. dissertations, and scientific research papers and books were published using the

materials collected during overwintering.

Mr. Kim, member of the 7th OP obtained his degree of Master of Science from the Graduate School of Seoul National University with the materials collected during his overwintering participation (Kim, 1996). Medical doctor Lee of the 10th OP, the only Korean woman participating overwintering, obtained her degree of Master of Hygienics from the Graduate School of the Yonsei University (Lee, 1998a) with the research on the physical examination results of OP's of KARP. Mr. Chung obtained his degree of Ph.D. from the Graduate School of Seoul National University in 1997 with the materials collected during his participation in the 1st OP in 1988 and summer parties (Chung, 1997). Mr. Kim, member of the 10th OP, collected his study materials for his degree of Ph.D. in the Alfred-Wegener Institute in Kiel. Mr. Lee is also preparing his degree of Ph.D. in the Graduate School of Yonsei University with the meteorological data collected during the 1st overwintering in 1988.

Many papers are also published in several scientific journals by OP's members using the material gathered during overwintering (Kim *et al.*, 1990; Yang and Jeon, 1990; Lee *et al.*, 1990; Kim *et al.*, 1991; Kim and Lee, 1991; Nam and Lee, 1991a, b; Lee and Nam, 1991; Chang, 1991, 1993c, 1997b; Lee and Chang, 1992; Cho *et al.*, 1993; Chang and Yoon, 1995; Kang *et al.*, 1997; Lee 1997a, b; Lee *et al.*, 1997, 1998; Lee *et al.*, 1998; Chung *et al.*, 1998). The igneous petrologist, Dr. Lee, member of the 10th OP, co-worked with Chinese scientists and published his results in the Chinese Journal of Polar Research (Zheng *et al.*, 1998). Two results were presented in the Scientific Assemblies held in Korea (Chae *et al.*, 1994; Kim and Shin, 1994).

Most of the overwintering members, especially OICs wrote a book by himself or in conjunction with other people, or translated English written books into Korean (Park and Yang, 1992; Chang, 1993a, b, 1997a; Kim, 1994a, b; Nam, 1997; Kim and Kang, 1997). Medical doctor, Dr. Lee, published a book about her experiences during the overwintering participation (Lee, 1998b).

Fig. 1 shows the results made or made with the

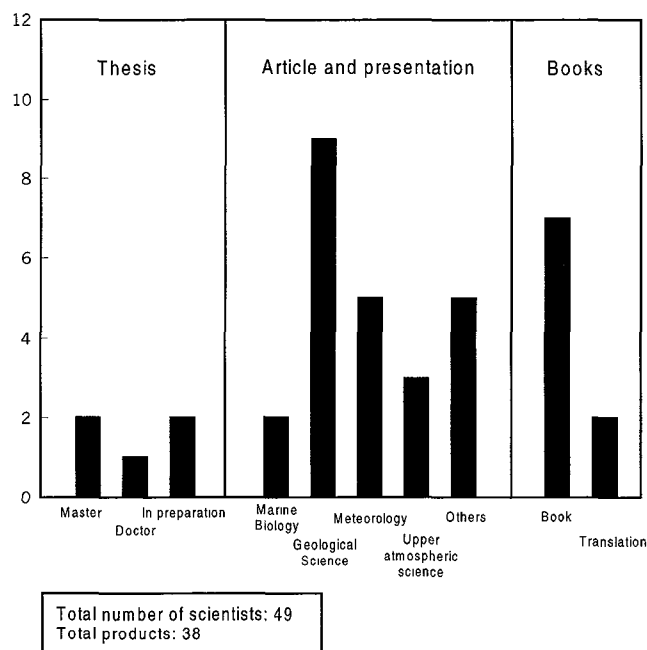


Fig. 1. Schematic presentation of the research results of OPs between 1988 and 1997 of KARP.

materials collected during overwintering. Totally, 49 peoples made 38 results such as papers, thesis, and books.

## Discussion

The natural environments around the Korean Antarctic station is composed of two realms; one realm is marine environment and the other is terrestrial-atmospheric environments. Marine environment comprises general oceanography and marine ecology including planktons, fishes, ave faunas, and seals.

It is natural that these environments should be observed without cessation. This statement particularly applied to the fields with the changing characteristics in temporal as well as spatial terms such as the marine environments associated with biological and physical aspects and atmospheric fields and some aspects in geophysics. It also applied to the terrestrial fauna and flora.

It seems that the focus of KARP is concentrated on the general oceanography and biological sciences due to the main goals of KORDI, the main organizer of KARP. This situation made most of OPs carry out

works related to general oceanography as one of their main goals during overwintering. However this situation is also a limiting factor not to pay much attention to the ecological aspects of the terrestrial fauna and flora in the vicinity of the station. The penguin rookery 2 km south of the station, was observed in relatively regularly by the 1st, 4th, 5th, and 8th OPs compared to other OPs. The 7th OP observed the rookery, but no result was recorded in its report (Ministry of Science and Technology, 1995, p. 480-483). Fish became a focus of study by the 1st, 4th, 7th, 8th OPs. Research activities unique to certain OPs such as gravity measurement of the 2nd OP, tidal research of the 8th OP, research of phytoplankton and meiofauna of the 9th OP, and field geology of the 10th OP were also carried out. These activities were done due to specialists of that field participated in OP.

It is also a limiting factor that the change of OPs in austral summer hampers continuous activities of the pertinent scientists. Or the cessation of observation occurred by the participation of overwintering scientists for oceanographic survey in the summer campaign.

## Conclusions

Several conclusions were made for the development of the research activities of the OPs of KARP.

It should be kept in mind that the positive mentality of the research team as well as the support team is indispensable for the fruitful results of its research and for successful overwintering.

The activities related with biological researches including terrestrial fauna and fish should be continued. In this regard, OIC of OP should understand and accept the continuation of the activities related to biology, as the personal philosophy of OIC has a great influence on the activities of OP.

It should be understood that overwintering scientists were evaluated not by their simple presence but by their scientific results made during the overwintering. So they should not be contend with the

overwintering report. They should extend the data and informations gathered during overwintering into research papers. It should be added that the research papers should be completed before overwintering is finished, because it seems impossible or very difficult to make papers after returning to Korea.

It is strongly recommended that the medical doctor should also carry out a certain kind of research activity, because he or she is highly educated, and he or she has ample time to carry out own research. His or her topic may be medical surveys related to psychology or other fields according to personal interests.

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## (Annex) Summaries of Reseach Parts of Overwintering Reports.

### *The 1st Overwintering Party*

Research activities were reported from page 125 to 176 (Ministry of Science and Technology, 1990).

1. Description of general environment around the station: general geomorphology, meteorological data, sea ice, land surface and weathering, fresh water lakes around the station.

2. Research topics: meteorological analysis, bottom

sediments, ice-transported sediments, algae, general oceanography and diving under sea ice, census of penguins.

3. Collection of Antarctic animals for museums and foreign animals imported to the station in the inner space of the boxes.

4. Bathymetry in the vicinity of the pier.

### *The 2nd Overwintering Party*

Research activities were reported from page 19 to 103 (Korea Ocean Research and Development Institute, 1991a).

1. Meteorological activity; Routine activity with daily data.
2. Gravity measurement from 83 points around the station.
3. Upper Atmospheric sciences: Establishment and operation of Fabry-Perot interferometer in January, 1989.
4. Seismic recording: Seismograph established in February 1989.
5. Marine biology: Description and measurement of marine animals collected with diving and netting.

#### *The 3rd Overwintering Party*

Research activities were reported from page 65 to 106 and in the Annex V from page 317 to 328 (Korea Ocean Research and Development Institute, 1991b)

1. Meteorological activity; Routine activity with daily data
2. Upper Atmospheric Science: Repair of the interferometer and the establishment of the multi-colored photometer.
3. Geophysics: Magnetometer established in March 1990.
4. Environment: General description of the environments around the station in Korean as well as in English.

#### *The 4th Overwintering Party*

Research activities were reported from page 279 to 379 (Ministry of Science and Technology, 1992)

1. Meteorological activity; Routine activity with daily data in addition to monthly and yearly analyses from page 41 to 81.
2. Biological Sciences: Observation of fauna and banding of penguins, marine ecological survey, fish, collection of Antarctic and foreign animals, and whale bones.
3. Geological Sciences: Field survey in the vicinity of Admiralty Bay, Field survey around the station in the view of Quaternary geology.
4. General oceanography: Results of the analyses of the fresh and marine water around the station. Tidal gauge moored in front of the pier.
5. Research paper: Human Elements for Successful Overwintering.

6. Upper Atmospheric Science: Maintenance of the equipments.

#### *The 5th Overwintering Party*

Research activities were reported from page 95 to 185 (Ministry of Science and Technology, 1993)

1. Measurements of basic characteristics and sampling of key parts of *Notothenia neglecta* collected in the vicinity of the station in 14 times from February 1991 to December 1992.
2. Basic survey of two species of penguins related to breeding and growth with banding of several specimens.
3. Geophysics: Routine check and recording.
4. Meteorological activity; Routine activity with daily data.

#### *The 7th Overwintering Party*

Research activities were reported from page 289 to 569 composed of Chapter 3, 4, and 5 (Ministry of Science and Technology, 1995)

- Chapter 3 Meteorological activity: Routine activity with daily data in combination of detailed analyses.
- Chapter 4 Marine biology: General oceanographic survey related to biology in conjunction with the morphological and anatomical study of fish and the discovery of parasites from the Antarctic cods.
- Chapter 5 Geophysics: Routine check and recording.

#### *The 8th Overwintering Party*

Research activities were reported from page 69 to 184 (Ministry of Ocean and Fishery, 1997a)

1. Physical oceanography: Tidal prediction and modelling of Maxwell Bay.
2. Geophysics: Analyses of several seismic records and description of the change of the sensors of the magnetometer.
3. General oceanography: Results of 4 points and 1 point measured monthly and weekly respectively, and 5 points measured only during the freezing of the Maxwell Bay.
4. Marine biology: Monitoring of penguin rookery, basic study of Antarctic cods in combination with the visits to the breeding place of Weddell Seals



located in Nelson Island.

5. Description of phenomena related to Earth sciences: Erosion of land surface and exceptional flooding with high sea water in April 1995 due to strong wind in conjunction with high tide.

6. Meteorological activity; Routine activity.

The Chapter 2 of the report of this O. P. was devoted to the description of the environmental changes including ave fauna and seals observed in the station (Ministry of Ocean and Fishery, 1997a, p. 9-68).

#### ***The 9th Overwintering Party***

Research activities were reported from page 23 to 189 (Ministry of Ocean and Fishery, 1997b)

1. Marine biology: Two topics were studied; one with the seasonal change of microalgae, and the other meiofauna collected from Maxwell Bay in 1996. They were written to the style of research arti-

cle.

2. Geophysics: Electric resistivity and absolute value of gravity of the station were described.

3. Meteorological activity; Routine activity.

#### ***The 10th Overwintering Party***

Research activities were reported from page 15 to 113 (Korea Ocean Research and Development Institute, 1998)

1. Field geology in the southwestern area of King George Island in combination with the sampling in Weaver Peninsula, nunatak in the southwestern area, and geological survey of the Barton Peninsula.

2. Upper atmospheric sciences: display of the values measured with the interferometer.

3. Meteorological activity; Routine activity.

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