International Polar Year 2007-2008
Symposium

IPY Junior Summit
Polar Research in 50 Years

National Science Museum, Tokyo, 1st March 2009

IPY National Committee Japan
and
National Institute of Polar Research

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Foreword

On the first of March 2009, International Polar Year 2007-2008, which started on the first of March 2007, came to the end. On this memorable day the IPY National Committee Japan celebrated the successful completion of IPY2007-2008, and held the symposium "IPY Junior Summit" in Tokyo, together with the National Institute of Polar Research.

It is a common perception worldwide, that polar research does not terminate on that day. It will continue on an extended scale indefinitely. This is the starting day of preparation for the next IPY, which shall be planned for 2057-58.

Since those who are involved in IPY2007-2008 may not be fully active in 50 years, younger people have to take over.

Teenagers were called to give a talk on the theme, "Future Polar Research" at the IPY Junior Summit. Two young scientists, born in 1969 and 1979 respectively, who have just returned from IPY fieldwork in the Antarctic, presented their activities before the children gave their talks. The audience also learned a bit about the Present Polar Research.

The third part of the Symposium took the form of a Panel Discussion. In addition to the teenagers and young scientists, two school teachers and a senior scientist joined the panelists group. The last named wintered in the Antarctic for IGY observation. The time span represented is one hundred years, from 1957 to 2057.

The symposium was quite interesting, and the committee is pleased to conclude that polar research will definitely be continued by future generations in a proper manner. The committee wishes to share this positive conclusion with colleagues worldwide.

The symposium was conducted exclusively in Japanese. The talks and discussions were translated into English afterwards and are contained in this booklet.

Those who are not particularly familiar with Japanese culture might want to read the Glossary first.

Congratulations upon a successful IPY2007-2008.

Prof. Natsuo Sato
Chair, IPY2007-2008 National Committee Japan

Symposium

IPY Junior Summit -Polar Research in 50 Years

Editorial Note

The presentations in Part One were made orally using a large number of slides. The presenters were requested to present in this manner in order that the audience would come to appreciate the polar region, although perhaps at the expense of some scientific details. The Articles in the booklet were rewritten by the presenters, compressing the 45 minute talk into a couple of pages.

The presentations in Part Two were also made using projectors. All the talks were recorded and translated. The presentations were put onto hardcopy as is. Limited editorial work was done. Slides were not reproduced, as most of them contained descriptions in Japanese, only without pictures.

Part Three relied fully on recording. The machine did not fulfill expectations; the sound of the audience was barely picked up. The missing part was partially reconstructed from human memory.

Part I

Snapshot of Present Polar Observation

The Japanese-Swedish Antarctic Expedition 2007-2008
— 2800 km inland traverse from Syowa to Wasa Station in East Antarctica —

Shin SUGIYAMA
Institute of Low Temperature Science, Hokkaido University

Watching the Antarctic sea from a Penguin's eye

Nobuo KOKUBUN
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The Japanese-Swedish Antarctic Expedition 2007-2008
— 2800 km inland traverse from Syowa to Wasa Station in East Antarctica —

Shin SUGIYAMA
Institute of Low Temperature Science, Hokkaido University

1. Introduction

As a joint contribution from Japan and Sweden to IPY 2007-2009, the Japanese-Swedish Antarctic Expedition (JASE) was carried out in the 2007-2008 austral summer season. The idea of this project is to travel the 2800-km-long inland route between Syowa and Wasa stations using Japanese and Swedish snow vehicles (Figure 1). The Japanese team left S16 (30 km from Syowa station) to travel 1400 km to the meeting point, 26º East, 76º South and 600 km from the coast. In the mean time, the Swedish team traveled the same distance from Wasa station to the meeting point. At the meeting point, the two teams exchanged two researchers and several instruments before they left for their return trip to their own bases, so that the whole 2800 km has been continuously surveyed.

2. Travelling to Antarctica

The journey to Antarctica by JARE (Japanese Antarctic Research Expedition) is normally made by the ice breaker Shirase. However, to enable a nearly 3 month inland traverse expedition in the short summer season, we flew from Japan to our starting point in Antarctica. We flew to Cape Town, South Africa by ordinary airline, and then took a chartered flight to Novolazarevskaya, a Russian station in East Antarctica. This flight is operated by a Russian organization that collaborates with 10 countries including Japan. By boarding a connecting flight in Novolazarevskaya to the one for S16, we were able to arrive at the starting point in just 10 days after leaving Japan. Our colleagues who spent the previous winter in Syowa were waiting for us at S16 with snow vehicles prepared for the traverse expedition. After packing a lot of gear and supplies onto the vehicles and sledges, we set off

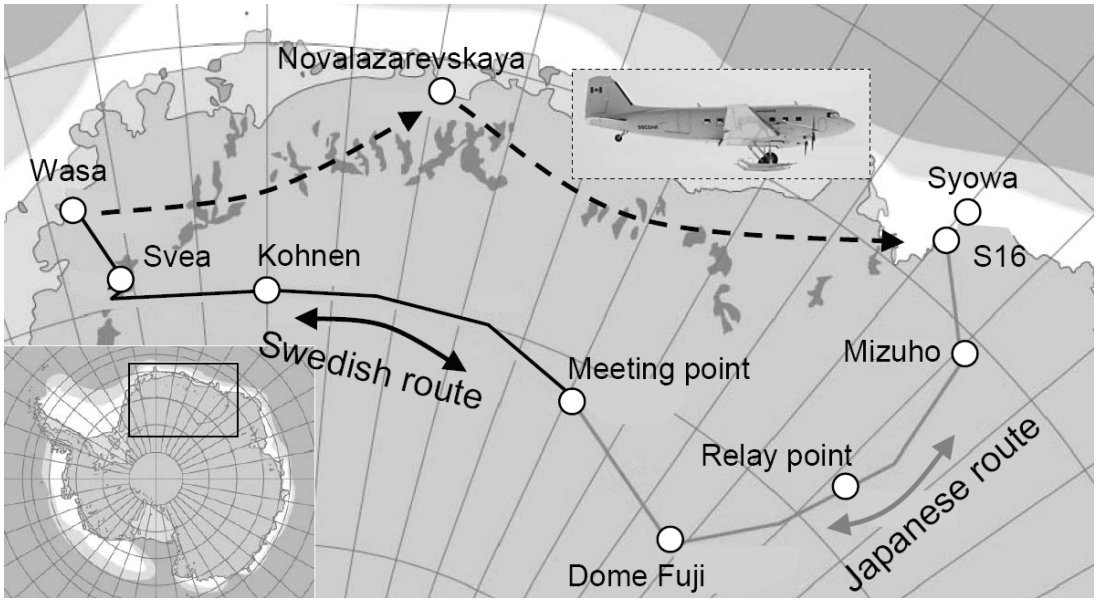

Figure 1: The expedition routes of the Japanese-Swedish Antarctic Expedition 2007/2008.
(Figure 1 is printed in color on the back side of back cover.)

Figure 2: The snow vehicles used by the (a) the Japanese and (b) the Swedish expedition teams.

on the traverse on 14 November, 2007.

3. Japanese Traverse Route S16–Meeting Point

3-1. Japanese snow vehicle SM100

The snow vehicle that we used for the traverse was an SM100 from the Ohara Co. Ltd., the largest vehicle constructed in Japan (Figure 2a). This is a unique vehicle designed for a long distance traverse on Antarctic ice sheets. The 4 m wide and 7 m long vehicle enabled us to do everything; cooking, eating, sleeping, and scientific activities, all inside the cabin. It ensures a safe and easy life during the traverse expedition. Two mechanics also accompanied us to maintain the vehicles throughout the journey.

3-2. The changing snow surface

Immediately after the departure, I realized that the ice sheet surface is not as monotonous as I had previously expected. The snow surface was often very rough because of the wind erosion, which produces a lot of snow ridges (sastrugi) following the wind direction. In some other places, the surface was so flat and hard that no occurrence of snow deposits had happened for several years. As we went up to higher elevations, the surface was sometimes covered with beautiful surface frost. A flat and soft surface was also observed inland. One of the most important research activities during the expedition was to study such non-uniform surface snow properties.

3-3. Scientific activities

Besides the snow survey, we had a lot of activities which aimed to better understand the properties of snow, ice and atmosphere in the Antarctic inland and any changes that might be taking place under the changing climate. Ice radar systems mounted on the vehicles continuously measured the thickness and internal structures of several thousand meters of thick ice. Many snow samples were collected for chemical, biological and physical analyses planned after the expedition. Automatic weather stations were installed and maintained so that the data can be accessed from Japan using a satellite data transmission system. Some of the activities were for the projects proposed by Japanese researchers and the others were for international collaborators.

3-4. Dome Fuji station

After a month, we arrived at Dome Fuji, a Japanese inland station established in 1995 for a deep ice core drilling project. The buildings were buried under snow deposits, but still accessible through purpose built staircases. The air temperature at the station was below -50°C even in summer. The drilling project had been completed in the previous summer season after

drilling to a depth very close to the bedrock. The retrieved ice core has revealed an 800,000 year long climate history. We spent a week at this station for research activities and vehicle maintenance. It was crucial to load fuel drums which had been stored at Dome Fuji for a long period.

3-5. Meeting point

Our arrival at the meeting point was on 24 December, 2007. The Swedish team arrived three days later, so that 8 Japanese and 9 Swedes got together at the middle of nowhere (Figure 3). The Swedish team consists of 2 logistic specialists, 1 vehicle mechanic, 1 doctor, and 5 scientists, while the Japanese team consisted of 2 vehicle mechanics, 1 doctor, and 5 scientists. Two Japanese, including myself, moved to the Swedish team and two Swedes joined the Japanese team in the latter half of the expedition. It was very important to have achieved this meeting and exchange so that some of the measurements conducted by the two teams could be extended to the other side of the traverse route.

4. Swedish Traverse Route, Meeting Point–Wasa station

4-1. Swedish snow vehicle Hägglunds TL4

My journey as a member of the Swedish team began on 1 January, 2008. The Swedish vehicles, Hägglunds TL4, looked very different from our SM100 (Figure 2b). The vehicle was separated into two independently driven tracked vehicles, a driving cabin and a rear platform, which were connected by a flexible driving shaft. This design has the advantage of very smooth driving because the front and rear vehicles can independently adjust themselves to the surface slopes and obstacles. The vehicle towed modules, which were specially furnished for dining, sleeping, and scientific activities. It means that the living space was separated from the driving and travelling space, which made traveling much more comfortable than the SM100. It is difficult to judge which is better, The Japanese SM100 or The Swedish Tl4 for Antarctic expeditions, since each of them have their own unique features designed for a distinctive environment and a different way of travelling.

Figure 3: Japanese and Swedish expedition members at the meeting point on 27 December, 2007.

4-2. Kohnen station

On the way to WASA station, we dropped in at Kohnen, a German base for deep ice core drilling operated under an international collaboration of more than 10 European countries. It contrasted to the similar drilling project in Dome Fuji in that it had been accomplished by only one nation. The buildings of this station were raised several meters above the snow surface to prevent being covered with deposits of drifting snow. Moreover, it is possible to raise the buildings to maintain a distance from the snow surface whenever the snow piles up closer to the floor. This is a technique recently developed for Antarctic stations that are used for extended periods. The newest Japanese station near the coast also employs the same construction.

4-3. Down to the coast

On 16 January, 2008, we drove down a glacier more than 1500m in elevation from the inland plateau to the coast. The air temperature rose up about 10 ºC and clouds increased in the sky, telling us that we were approaching the goal of the traverse. We spent several days at Svea, a small Swedish station at the foot of a 1000m high cliff which separated us from the inland plateau. Cliffs and mountains projecting above the ice sheet surface are called nunataks. Many interesting snow and ice features were created by the nunataks near the Svea station, e.g. bare ice fields, wind scoops and ice falls. These natural features were very interesting and surprising for those of us who had up to that point been traveling a world made up of only white snow and blue sky.

4-4. Wasa station

The Swedish traverse team arrived at their home at Wasa station, the final destination of a 2800-km long journey, on 24 January. The station accommodates about 10 people in a four bed room building, which is considerably smaller than our Syowa station. This is because the station was designed neither for wintering nor running continuous scientific observations. However, the building was cozy and well designed to be operated with the least amount of energy consumption. On the day before the flight back to Novolazarevskaya, the sun touched the horizon, indicating the last day of the midnight sun. We heard that the Japanese team had already arrived at Syowa station and was waiting for their flight. The traverse expedition was completed as it was planned.

5. Concluding remarks

As this was my first experience doing research activity in Antarctica, it was very interesting to see its difference from the activities compared to other regions on the earth. First, it is necessary to collaborate internationally to study this huge continent which belongs to no country. Since we collaborated with the Swedish team, more and more joint projects are now being carried out and being planned in the future. It is also important to work with many countries as a team, like the ice core drilling in Kohnen station. Secondly, the means of transportation to Antarctica are getting more diverse. The Japanese expedition has been using an ice breaker for 50 years, but now it is also possible to reach Syowa station by air. It saves time for traveling and also provides the possibility of working in regions which used to be inaccessible. However, it is not possible to conduct a demanding expedition without material support transport by ship. We have to carefully consider the best use of all these options. International collaboration is also crucial for efficient operation of transportation, as the cooperation of many countries for the flight from Cape Town to Novolazarevskaya is required. Finally, even though the traveling time has been shortened and the equipment has become more sophisticated, the natural environment in Antarctica remains as it was when Shackleton and Amundsen were

exploring the continent a hundred years ago. Antarctica is the harshest, but also the most beautiful continent on the earth. I hope to work and study more on this attractive continent by making the best use of international collaboration and new technologies.

Questions and Answers

(Q1) How did you find each other at the meeting point?

(A) We had fixed the coordinates (longitude and latitude) of the point and used GPS (Global Positioning System) to be there. GPS is accurate enough to find a position within 10-20 m of error.

(Q2) What did you do with the waste and garbage?

(A) We took them back to Syowa and Wasa stations. There is an international rule to be followed in Antarctica.

(Q3) What was the impression of the Swedish researchers who spent a month with the Japanese team?

(A) They had a very positive impression of us and provided many interesting observations about the Japanese expedition team. What impressed them the most was: "We were surprised at the fact that the Japanese eat so much rice".

Watching the Antarctic sea from a Penguin's eye

Nobuo KOKUBUN
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Seabirds: connecting the Antarctic and Arctic seas

Our common image of the "Antarctic sea" perhaps seems a little unreal: very far from Japan, very cold and icy, etc. But there is something that makes us familiar with the Antarctic sea. A good example of that is one species of seabird, called the "short-tailed shearwater". They breed on islands off of southern Australia, and sometimes go to the Antarctic sea to feed on nutrient-rich prey, during the austral summer season. After that, they begin to migrate to the northern hemisphere to areas such as the Sea of Okhotsk and the Bering Sea over the winter. We can observe millions of short-tailed shearwater passing along south-eastern coast of Japan, especially during the spring season. Through them, we can begin to appreciate the connection between the Antarctic sea and the northern hemisphere.

Seabirds in the Southern Ocean

The marine environment surrounding Antarctica varies according to latitude. If we go south by ship, we can experience it as a decline in air and water temperature. At the same time, we will find that seabird species vary with latitude. The reason for the variation in seabird species is that they are distributed in a species-specific marine habitat surrounding Antarctica. From north to south, many species of seabirds such as large albatrosses, medium or small-sized shearwaters and petrels show a circumpolar distribution. Some species of penguins also show circumpolar distribution from subtropical (north) to Antarctic (south) marine environment. In this presentation, I will talk about penguins, which are distributed in the southernmost cold marine environment, near Antarctica.

Antarctic marine ecosystem: sea ice, phytoplankton and Antarctic krill

Main topics concerning the physical processes and production in the Antarctic marine ecosystem are sea ice, phytoplankton and Antarctic krill. During winter, the Antarctic sea is covered with sea ice. On the undersurface or under the sea ice, is inhabited by phytoplankton called "ice algae", such as some types of diatoms and phytoflagellates. Size of ice algae ranges from 1 to 100s μm. In spring, after the melting of sea ice, the phytoplankton "bloom" dramatically. The bloom phytoplankton is the main food for Antarctic krill during the summer season. Antarctic krill are large (5 cm) shrimp-like zooplankton, and live 4 to 5 years. They are a rich source of nutrients for whales for example and are abundant (10s million of tons) in the Antarctic sea. Thus, Antarctic krill is one of the main food resources for top predators, such as seabirds and marine mammals, in the Antarctic sea.

Top predators in the Antarctic marine ecosystem: penguins and others

Antarctica is inhabited by 5 species of penguins. The largest and southernmost species is the emperor penguin. Among Antarctic penguins, the emperor is the only species that breeds during austral winter. The Adelie penguin also inhabits southern icy conditions, and shows circumpolar distribution around the Antarctic continent. The remaining three species, chinstrap, gentoo and macaroni penguins inhabit around the northern

part of Antarctica. Their main food is Antarctic krill. In this presentation, I will show examples of our study on three congeneric species, Adelie, chinstrap and gentoo penguins. Other than penguins, various top predators such as whales, seals and fur seals inhabit the Antarctic sea, and mostly feed on Antarctic krill.

Methods to study penguins on land

We have studied the ecology of penguins, as one of the top predators in the Antarctic marine ecosystem for a long period. We monitor some basic breeding and foraging information about penguins on land. For example, we count breeding pairs in colonies to quantify annual population, measure body size to quantify growth rate or body condition, observe foraging trip duration, and sample stomach contents etc. Most of our fieldwork is conducted during the austral summer season, in which several species such as chinstrap and gentoo penguins raise their chicks. During the summer season (2-3 months), we can observe that the parent penguins incubate eggs, the eggs hatch, parents guard and feed the chicks, and the chicks fledge. From hatching to fledging (during one month), the chicks rapidly grow from about 100 g to 3 kg.

Methods to study penguins in the sea

It is difficult to study penguins in the sea compared to studying them on land. We can observe them swimming in the sea from ships if we cruise along the Antarctic coast, but they spent most of their time under water especially when they are actively foraging. That is to say, their underwater diving or foraging behavior is almost invisible to the human eye. Thinking from a different angle, we can study underwater behavior of animals, if we make diving animals record their behavior themselves. The new method, attaching small instruments called “data loggers” to animals to record their behavior, has developed over the last 30 years. At first data loggers were large, and were driven by clockwork timers, and data recording was analog. Nowadays they have become smaller and are powered by batteries, and data recording is digital.

Diving record of animals

Diving depth and duration is one aspect of the basic information concerning the underwater behavior of diving animals. By using data loggers (Time-depth recorders), diving depth and duration were recorded from several species of Antarctic diving animals. For example, maximum depth record of an Adelie penguin is 175 m which takes 5 minutes, and that of emperor penguin is 534 m, which takes 20 minutes. For marine mammals, the diving depth is deeper and diving duration is longer than penguins. At maximum, Weddell seals dive to 741 m which takes 80 minutes, and southern elephant seals dive to 1926 m, which takes more than120 minutes. For comparison, the maximum diving depth record of a human is 102 m, and maximum diving duration of that is 9 minutes.

Various kind of data loggers

Not only depth but also various parameters reveal the detailed behavior of animals, as various small sensors developed for data loggers. For example, temperature sensor record temperature profiles surrounding the animals, propeller sensor reveal the swimming speed, acceleration sensors reveal the body angle and stroke events, 3-dimensional magnetic sensors reveal the 3-D track under the water, heartbeat sensors reveal body conditions or energy consumption, GPS sensors reveal the location of the animals, and small cameras take pictures under the water, etc. Thus nowadays we can study underwater behavior of diving animals at a fine scale, from the animal’s point of view, by using recently developed data loggers. With those specifically, I will show examples of studies on penguins by using GPS and camera loggers.

Studying penguins in the sea: GPS loggers

GPS loggers can measure the diving location of penguins every second (only when they are out of the water), at a 10-100 m scale. The logger also can record diving depths. We attached the loggers on the back of penguins. Fig. 1 shows an example of the foraging track of a penguin. The individual departed from the colony, then followed the track on the sea and then returned to the colony (Fig. 1 A). Appending simultaneously recorded dive depth to the track, such 3-dimensional track can be obtained (Fig 1 B).

Study site

We conducted fieldwork to study the foraging ecology of penguins in the 2006-2007 austral summer season. Our study site was Barton Peninsula, King George Island, the South Shetland Islands, and the Antarctic Peninsula region. This is the northernmost region of Antarctica. Both chinstrap and gentoo penguins breed at the study site. We compared foraging locations of the two species, by using a GPS logger.

Foraging location of chinstrap and gentoo penguins

Fig. 2 shows the distribution of diving locations with the density of the diving locations. The left and right panels represent chinstrap (Fig. 2 A) and gentoo (Fig. 2 B) penguins, respectively. Diving locations were distributed within 40 km from the colony, for both species.

Diving depth in relation to sea bottom depth

Subsequently, we compared diving depth with water depth for both species. Fig. 3 shows typical examples of dive profiles with sea-bottom profiles along the tracks of chinstrap (Fig.3 A) and gentoo penguins (Fig. 3 B). Diving depth did not differ between the species itself, but chinstrap penguins tended to dive to the pelagic layer in deep regions, while gentoo penguins tended to dive to the benthic layer at shallow regions. Here, if we regard dives of maximum dive depth reached within 80 % of water depth as benthic dives, the proportion of benthic dives was larger for gentoo penguins than chinstrap penguins.

Segreation between chinstrap and gentoo penguins in foraging hotspots

As the results, sympatric chinstrap and gentoo penguins used a similar foraging range, but they segregated their foraging hotspots: chinstrap penguins tended to use the surface layer at deep regions, while gentoo penguins tended to use the benthic layer at shallow regions. The overlapping area in foraging hotspots was only a small portion for both species. That is to say, we highlighted the difference in foraging locations between chinstrap and gentoo penguins in detail using GPS loggers.

Studying penguins in the sea: camera loggers

Next I will show the results of studies on penguins using a camera logger. Camera loggers can take color pictures underwater every 4-15 seconds. Capacity of memory is 10000 pictures per deployment. The logger also can record diving depths. We attached the loggers on the back of penguins, like other types of data loggers. Fig. 4 shows examples of underwater pictures from the penguin's point of view. Several pictures show underwater group behavior (Fig. 4 A to D), penguins swimming on the sea surface (Fig. 4 E, F), and penguins feeding on a school of Antarctic krill (Fig. 4 G to L: Fig. 4 K, L shows gentoo penguins feeding on a school of krill on the sea bottom). These pictures show some clues about foraging conditions in detail: vertical distribution of Antarctic krill, diving depth, and existence/ absence of sea ice, etc. Using this information, we can analyze how sea ice condition affects Antarctic krill distribution and foraging behavior of penguins.

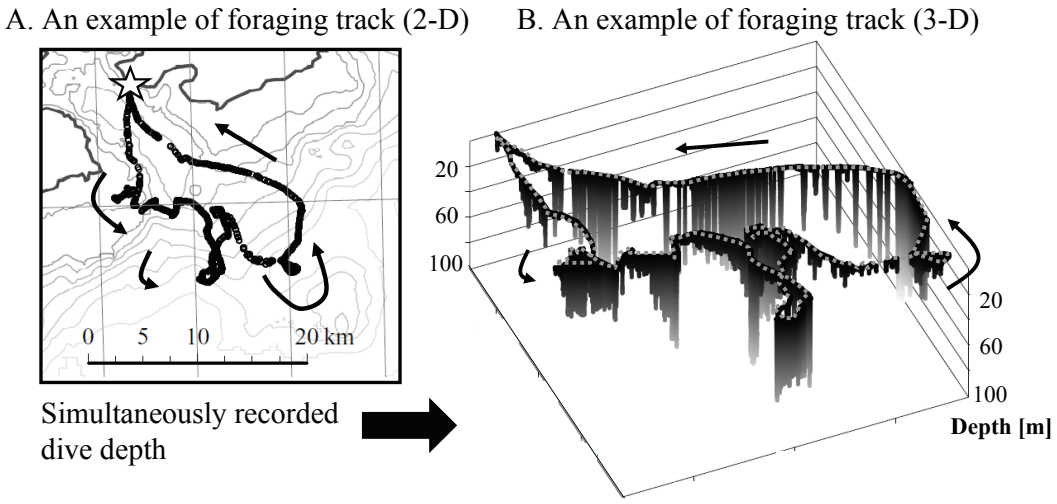


Fig. 1. Examples of 2-dimensional (A) and 3-dimensional (B) foraging tracks of a chinstrap penguin.

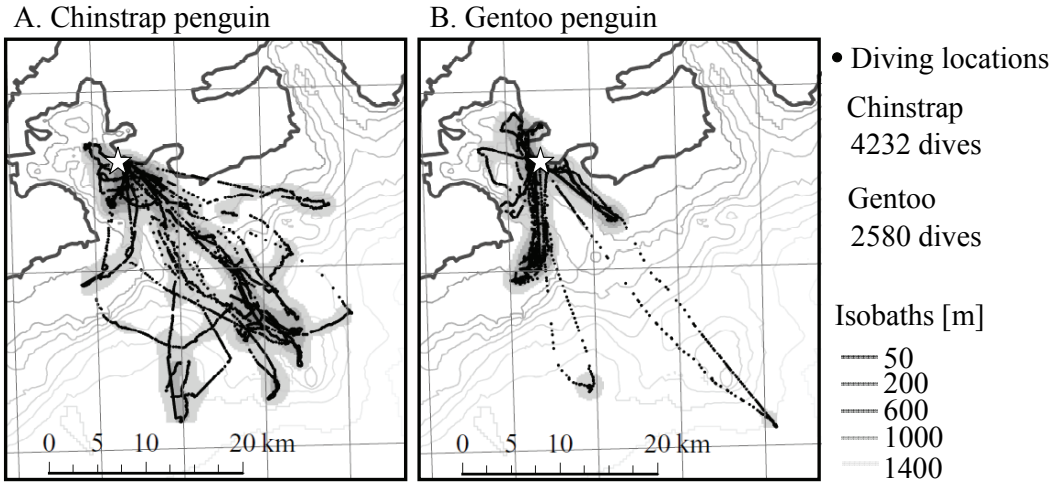


Fig. 2. Diving locations with kernel density of the locations for chinstrap (A) and gentoo penguins (B). Star represents the location of their colony.

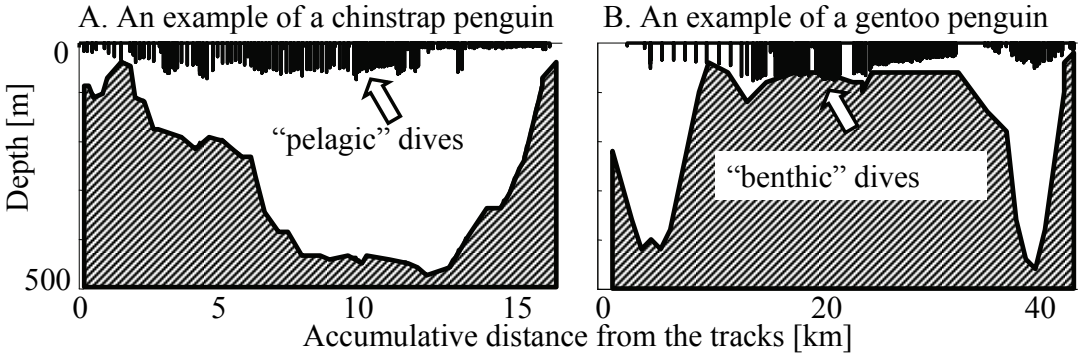


Fig. 3. Examples of diving depth of a chinstrap (A) and a gentoo penguin (B) with profiles of bathymetry (oblique lined zone) along their foraging tracks.

Vertical distribution of krill and dive depth of penguins in relation to sea ice condition

For example, a study on Adelie penguin breeding at Signy Island, South Orkney Islands in the 2007-2008 austral summer season revealed that both vertical distribution of Antarctic krill and diving depth of penguins became deeper when the sea ice did not appear in the pictures. Penguins needed to more energy to dive deeper under the light sea ice condition. The result suggests that sea ice conditions affect foraging behavior of Adelie penguins through the vertical distribution of krill.

Changes in the Antarctic marine environment and response of penguins: future works

These fine-scale studies on ecology of penguins together with some information about the marine environment offer a unique opportunity to examine how penguins respond to Antarctic environmental change. For example, population trends of Adelie penguins show a different tendency between western (including Antarctic Peninsula region) and eastern (including around Japanese Syowa station) Antarctica. In the last 30 years, most of the western population is abruptly decreasing, while the eastern population is increasing. The reason for the contrasting population trend is not clear, but differences in environmental change between western and eastern Antarctica is considered to be important. In western Antarctica, mainly in the Antarctic Peninsula region, abrupt warming with marine ecological changes has been reported in recent years: air temperature elevated 1.2 ^{o}C in the last 40 years, the latitude of sea ice edge moved south / sea ice extent reduced, and Antarctic krill stock decreased by more than half in the last 80 years,

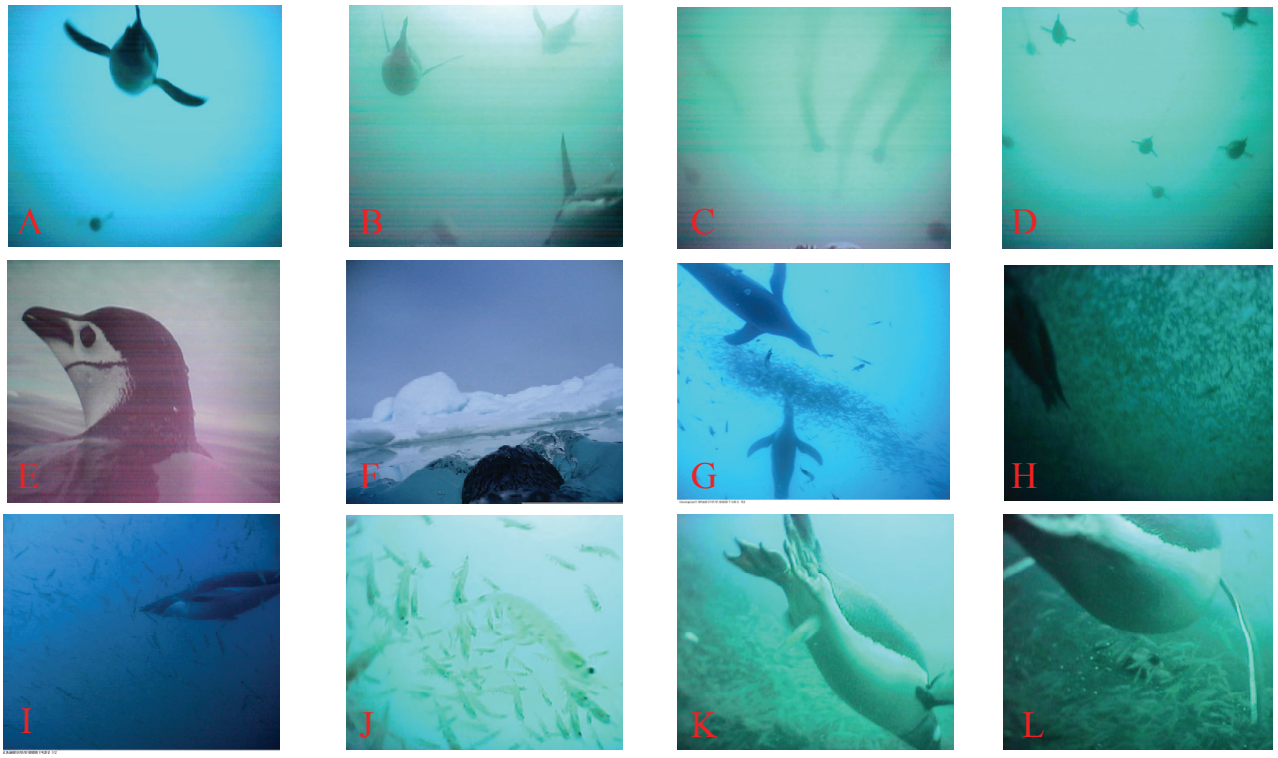


Fig. 4. Underwater pictures taken by camera loggers attached on the back of penguins. Each panel shows underwater group behavior (A to D), penguins on the sea surface (E, F), penguins feeding school of Antarctic krill (G to I), and school of Antarctic krill (J) and gentoo penguins feeding school of krill on the sea bottom (K, L).

(Fig. 4 is printed in color on the back side of back cover.)

etc. Thus the environmental changes may have negative effects on foraging and breeding of Adelie penguin in western Antarctica. On the other hand, in eastern Antarctica, the warming is not as clear as it is in western Antarctica. But some study reported a frequent breakup of fast ice in recent years. In eastern Antarctica, fixed fast ice was originally limiting the foraging behavior of Adelie penguin. Thus the changing fast ice conditions possibly have positive effects on foraging and breeding of Adelie penguin in eastern Antarctica. The contrasting response of Adelie penguins to environmental change in western and eastern Antarctica may be examined by interannual comparison of fine-scale foraging behavior in relation to sea ice condition in both regions, by using camera loggers and other informational resources such as satellite images.

In addition, in the Antarctic Peninsula region, population trends of penguins are different between species. In recent 30 years, Adelie and chinstrap penguins are decreasing, while gentoo penguins are stable or slightly increasing. The reason for the contrasting population trend is also not clear, but differences in foraging behavior during summer between the species are considered to be important. For example, our study showed that foraging locations were different between chinstrap and gentoo penguins during summer: chinstrap penguins tended to use the surface layer at deep regions, while gentoo penguins tended to use the benthic layer at shallow regions. If this continues for many years, chinstrap and gentoo penguins may be mainly affected by environmental change in surface layer and benthic layer, respectively. The hypothesis may be examined by interannual comparison of fine-scale foraging behaviour of the two species in relation to krill density and distribution, by using GPS loggers and ship-based krill survey.

Conclusion

In conclusion, recently developed small data loggers enable us to study the behavior of penguins in the sea at fine scale, from a penguin's eye point of view. Furthermore, interannual study on foraging and breeding ecology of penguins in relation to regional marine environment may reveal the response of penguins to changes in the Antarctic marine ecosystem.

Questions and Answers

(Q1) I heard that an individual of Adelie penguin tagged in Syowa station has been found around the Australian station, thousands of kms away from the Syowa, several years after the release. Do the penguins have the ability to travel such a long way from the colony? From today's presentation, the home range of the penguins seem to be only 10s km from the colony.

(A) Penguins travel thousands kilometer away from the colony during the non-breeding season. The small home range in today's presentation is observed during the breeding season, when the parent birds need to return the colony frequently to feed their chicks. In contrast, the home range expands to thousands kilometer for parent birds during the winter or young birds, which has no constraints to return to the colony. However, the detailed tracks or foraging behavior during the non-breeding season are almost unknown. That is one of the most interesting future works in studies of the ecology of penguins.

(Q2) How do you attach the data-loggers to the penguins?

(A) We attach the loggers to the back of penguins using tape with good adhesion (tesa-tape®). Using the tape, we roll and attach the loggers with plumage, and fix the tape by quick-drying glue. Then the loggers cannot be left out.

During removal, we only detach the loggers tape. The method minimizes the handling time and effects on behavior of penguins.

(Q3) How long have the GPS loggers been developed?

(A) Large type of GPS loggers, which can be attached to large/non-diving animals such as albatrosses, was developed more than 10 years ago. The key point was minimizing the size and water-resistance. The smaller or water-resistant type of GPS loggers was developed in this few years.

(Q4) How do you capture the penguins for the observation? Is it hard to capture them?

(A) We can capture them by hand easily. Chick-guarding penguins do not run away unexpectedly from their nests, and go for foraging/come back to the nests regularly, thus we take advantage of the characteristics of chick-guarding birds for attaching/detaching the data loggers. The only thing penguins do to protest when they are captured is picking or biting our hands, but it is not serious. To capture and to handle the penguins is much easier than that for flying birds. However, the larger ones such as emperor penguin are a different matter. When they struggle against to capture, several persons are needed to hold them. I heard that a scientist broke a bone in hand and finger hit by an emperor penguin's flipper.

Part II

Prospect of Polar Research in 50 Years

MC:

Now, we will start Part Two of the Symposium. First, Mr. Yuto Izawa, who is a third grade student of Waseda University Senior High School, will present you his opinion. He received the Platinum Prize for the proposal titled "Penguins, the Saver: Research and Applications of the Penguin's Amazing Sense of Hearing" in the Open Forum in 2004. At that time, he was a second grade student in Koganei Junior High School attached to Tokyo Gakugei University.

IZAWA:

I'm Yuto Izawa, a third grade student of Waseda University Senior High School, as just introduced now. It is my great pleasure to meet all of you here.

I confess you that I am a bit nervous now, immediately after wonderful research reports were presented with many beautiful Antarctic pictures in the Part One. I had been considering for a long time how to present my opinion to you in the best manner. I do not have any special knowledge of Antarctica, and I might give you the impression only that I love Antarctica in my 8 minutes speech. If so, please forgive me. The title of my talk is "I hope the Antarctica will be still beautiful 50 years from now".

First, I would like to show you some pictures of the Polar Regions. (Editor's note: Hereinafter, some slides and their explanations will be omitted.) Today, a pamphlet has been distributed to you by the symposium organizer and there are various beautiful pictures of the Polar Regions in it, like these. I believe that the audience today, who decided to participate in this symposium, loves the Polar Regions and is certainly impressed by these pictures. Many valuable landscapes, which we can never see in our everyday lives, are conserved, because they are located in the Polar Regions. Because of this, recently more than twenty thousand people visit Antarctica per year for sightseeing. Of course, not only the number of visitors, but also the number of research stations has increased. The number of stations where researchers stayed over the winter in 2000 was "37" in the Antarctic region and "7" in the remote Arctic region. As you well know, the Polar Regions are a sort of gold mine for researchers. The Polar Regions are key factors in many disciplines; the solar wind energy mechanism can be elucidated based on the research of the aurora, and the research of ice sheets gives us a glimpse of the global environment of the period seven hundred twenty thousand years long. The research challenges to the polar region were started at the end of the 19th century and the first International Polar Year was carried out. The current polar research is based on our predecessors' efforts for the voyage and staying over winters at the risk of their lives.

However, it was unfortunate for the scientists at that time, that the scientific technology had not been developed sufficiently. The scientists contaminated the polar region as the result of their polar research and they were not able to restore it to the clean condition as it had been. Areas of rock without ice (called bear rock or naked rock), for instance, are required for constructing a research station. The areas are valuable not only for the researchers but also for the creatures desperately trying to survive in the severe polar region. In Antarctica where bare rocks are rare, bryophytes, fungi and small invertebrates gather there together. Therefore, the construction of stations and the intrusion of people itself carry the risk of destroying the ecosystem of such creatures. Also, the construction of a station creates a garbage disposal problem. Chemical substances discharged from ships that were unfortunately shipwrecked during their cruise observation, contaminate the habitat of creatures in the Polar

Regions. The penguins in the slide shown you before, suffer serious PCB contamination. PCB stands for polychlorinated biphenyl and is an endocrine-disrupting chemical for which production was prohibited globally in 1970s. This chemical has a very strong hepatic toxicity. These contaminants were carried in the air and dropped on the Polar Regions, and then spread through the food chain from phytoplankton, zooplankton and Antarctic krill to penguins. Of course, it must be very difficult to perform any work without contamination in such places with severe environmental conditions like the polar region. I believe that there should be some sort of compensation.

Now, I would like to introduce to you an archaeological work I was very much impressed. This slide shows the picture of an unexplored ruin located in Angkor Wat. A king's mummy and accessories might lie in the ruins. When holes are made into this ruin, they might be found and taken out. However, archeologists would never do such a stupid action, as the ruin as a whole is considered a historical treasure, and cannot be damaged. The Antarctic scientists shall learn something from this, as a similar way of thinking is applicable for the Polar Regions. There are many essences packed into the Polar Regions, which are quite attractive for scientists and useful for them to elucidate truths. However, I believe that we should not contaminate Antarctica by digging them out, i.e. by performing researches without rules or procedures to preserve it. Scientists are requested to continuously advance science. However, we should not destroy nature, which is the source of science, using only scientific advancement as prior justification.

I feel that recent science has run away a bit. People assume that science should advance all the time. And so, scientists frantically accelerate their research to fulfill the general requirement. The order is reversed, I am afraid. I believe that scientists should perform their researches to find the truth for their own interest. Scientific technology advances, together with the progress of the research. However, people today believe that the advance of scientific technology is made independently to that of the science. I feel that scientists busily perform their research, in order to keep the pace with the maximum advancing speed of scientific technology. When they earnestly see the future only in such a way, they have no time to stop and look back the past. The Polar Regions have been rather contaminated due to their polar research. Recently, environmental preservation methods have been enhanced thanks to advanced scientific technology. Nevertheless, PCBs are being accumulated in the bodies of penguins and their ecosystem has been disturbed due to past over hunting. Because the environments in the Polar Regions should be preserved at any cost, I would like to propose that we proceed with the polar research, keeping a keen eye also on the past.

The end purpose of polar research is the understanding of our natural environment, and the environmental preservation based on the understanding. Furthermore, the contaminants made by past human activities are also to be removed using newly obtained knowledge. I believe this is the ultimate purpose of the research of the polar region, which is highly sensitive to environmental contamination. Field observation is only a part of Polar research. Equipments shall be developed, which do not contaminate the environment in the Polar Regions. Techniques shall be developed to restore the environment, utilizing the newly obtained knowledge in various fields. It is important for us to realize all above are components of the polar research.

What I wish for is only one thing. I wish that the

Polar Regions in 50 years remain as beautiful as they are now. If this is achieved, only if this is achieved, we will finally conclude that the polar research in coming 50 years is successful, that is, the work made for the International Polar Year 2057-2058 is successful.
That is all my opinion. Thank you very much for listening.

MC:
Thank you very much, Mr. Izawa. In Part Two, we do not have question time. If you have any questions or opinions you would like to express, please deliver them in the panel discussion in Part Three.

Next, I would like to introduce you Mr. Takashi Shibanuma, a first grade student in Saitama Prefectural Honjo High School. Mr. Shibanuma won the Gold Prize in the Open Forum in 2006. The award winning proposal was "Investigation of Microorganisms and Unpleasant Noxious Insects at Syowa Station". At that time, Mr. Shibanuma was a second grade student in Honjo-Nishi Junior High School.

SHIBANUMA:
I am Shibanuma, a first grade student in Saitama Prefectural Honjo High School. Today, I am going to present my opinion on the future Antarctic research. However, I had a hard time to find what I focus on in my presentation. Frankly speaking, I was very much embarrassed. I am still anxious that my opinion can be accepted by you, but I will do my best.

When I gave thought to the future Antarctic research, and looked for an adequate title of my presentation, my thinking always went back to the experiment we proposed in the Open Forum. Therefore, I will mention you about our proposal in the Open Forum, in some places during my talk.

My presentation consists of four parts; (1) The reason why I was interested in Antarctic research, (2) The proposal for which I won the Gold Prize in the 3rd Open Forum, and experiment results, (3) The future way of Antarctic research and station management, (4) Sending junior and senior high school students to Antarctica.

I asked myself why I am standing here today. In July 2006 when the summer vacation had started, I visited the "Mysterious Continent Antarctica 2006" exhibition held in this National Science Museum. I knew about Antarctica, but only to the extent that I have seen some TV programs, read some books on occasion, and from my textbook in school. For me, the exhibition "Mysterious Continent Antarctica" was very interesting and I learned that we, as human beings, are closely connected to Antarctica in the global environment. I felt Antarctica is now close to us, which for me had been a far and unknown land before.

Around the time when the summer holidays were going to end, some classmates who wanted to submit proposal jointly to the Open Forum, gathered together and discussed, what theme we should focus. In the discussion, exotic species in Japan became the topic. We found that most of the exotic species in Japan were imported aboard cargo ships. Then, we thought that such species might have been included in cargo and carried into the Syowa Station in the past 50 years. We decided to investigate if there are any such species at the station.

The theme we decided was to investigate microorganisms and unpleasant noxious insects in Syowa Station. We asked expedition members to perform an experiment of mold growth under the same conditions as those in our Honjo-Nishi Junior High School in Saitama Prefecture to compare them. Also, we asked them to investigate if there are any mites, cockroaches, flies, etc. The

mold growth in Syowa Station was very much different from that in our school as we expected. Also, we found mites in the dust found at the corners of the Science Room in Honjo-Nishi Junior High School, but no unpleasant noxious insects such as mites, were found at Syowa Station.

Now, I would like to talk about what I hope for in the future Antarctic research. First, I would like to mention the way of Antarctic research and station management, which is related to our opinions as expressed in the Open Forum. When any human being sets foot in a region as yet unexplored, a variety of things are carried into the region. Mold in Syowa Station was carried in like that. In the National Institute of Polar Research News No. 187 issued in September last year, Dr. Imura, Moderator of the panel discussion in this Symposium, reported "Watch aliens on the Antarctic Continent". I heard that they have already taken measures not to take pollen and seeds, etc., into Antarctica. However, I believe that it is necessary to establish a quarantine system immediately before we enter the Antarctic Zone, as well as before departing from Japan to preserve the everlasting environment of Antarctica. Recently, tourism to Antarctica has grown drastically and more than 20,000 people per year visit our sensitive Antarctica. When so many people visit Antarctica, the possibility of foreign species to enter the zone, becomes quite high.

There is one more thing I am concerned about. It is the waste accumulated in 50 years and has been left at the station for long periods. The expedition has a very hard time in last years carrying such waste back to Japan. We request the expedition to prepare an action plan to carry 100% of their waste on the Syowa Station back to Japan. All the waste at other stations is also to be removed. The intention of our proposal in the Open Forum is that the Syowa Station becomes world No. 1 both in research and environmental preservation. I expect the Syowa Station to become a good model to all stations of other countries, and Japan to become the leading country that enlivens international activities.

We move on to the second item, the possibility to send junior high school and high school students to Antarctica. There are extra apace in addition to that for expedition members on board the newly build icebreaker "Shirase". The possibility is certainly raised by the news. The purpose of sending students are that the students not only think, but also take an action for the future of Antarctic research and environment, and that young researchers are fostered in order to perform high quality research in 50 years from now. However, it would be difficult for the students to go to and come back from Antarctica with the expedition members on "Shirase", because it takes a long time. The use of an airplane to shorten the time for the transportation from Japan to Antarctica and vice versa would solve this problem. I believe that the fostering of young researchers is essential for active Antarctic observation and research in the future.

I told you I had the opportunity to become interested in Antarctica in the National Science Museum. I am very glad of the good fortune to spend nice time on the last day of the "International Polar Year" at the memorial place. I would like to express my gratitude to the people in Syowa Station, who performed the mold experiment at the same time with us, and to people in the National Institute of Polar Research, who gave me the chance of presenting my opinion this time, and to my teachers who cooperated with me. I have obtained valuable experience now. Also, I would like to say thanks to my classmates at the time of Honjo-Nishi Junior High School, who managed to come to this venue today with me while they are very busy.

Now, I am pleased to see the people in the world take action for environmental preservation and to settle environmental issues also in the polar region. I would like to expand my dream, utilizing the knowledge and experience learned through the participation to the Open Forum, and will keep my interest in the Antarctic research. Thank you very much for listening to my presentation.

MC:
The third speaker is Mr. Yu Ono, who is our only university student today. He is a university student now, but when he received the Platinum Prize, he was a second grade student in the Tennoji High School attached to Osaka Kyoiku University. The winning proposal theme was "Global Observation using the Ecology of Arctic Terns". Please start your presentation.

ONO:
Nice to meet you, I am Yu Ono and a first grade student of College of Geoscience, School of Life and Environmental Sciences, University of Tsukuba. Today, I would like to present my opinion titled "linkage between the Antarctica and us". I participated three times in the Open Forum: In 2004, with the title of "300 Miles in Search of Frost", in 2005, with the title of "Global Warming examined using Ossicles of Whales/Dolphins", and in 2005, with the title of "Global Observation using the Ecology of Arctic Terns" as introduced. In addition, I also submitted another proposal in this year with the title of "Earthquake: At that time, what happen to ice?"
As I was introduced by the MC, when I applied my proposal for the first time, I was still a third grade student of junior high school. Now, I am a university student. Time flies like an arrow. People around me now are all high school students. Therefore, I feel I am an old man.
The first opportunity for me to become interested in the Polar Regions including Antarctica, was the Open Forum. I was very much interested in, and got to know the greatness of Antarctica through the Open Forum. Now, I am studying the earth science in the University of Tsukuba because I would like to have a job connected with Antarctica in the future. If I did not participate in the Open Forum, I might not have become as I am now.

The overall theme of the symposium is the Antarctic/Arctic Research for 50 years from now. There are many different approaches to the theme. I take somewhat different approach from those of other speakers. I would like to start with a question, to what extent the general public are familiar to the Antarctica. I decided to send a questionnaire to obtain data, how many people are interested in the Polar Regions. Based on the results of the questionnaire, I would like to investigate this issue.

The questionnaire was given to the students of the Global Environmental Science III course, on February 20, 2009, which was given in the College of Geoscience, where the students study earth science as a major, of the University of Tsukuba. It was natural to assume that the students, who were taking this course, should be interested in every topic of the the earth science to some extent. I sent the questionnaire to 92 students. In the questionnaire, there are six question items.

The contents of the questionnaire are shown here (Table 1) [Editor's Note: The editor compiled many slides and made one Table.] Before the first question, I asked; what image pops up in your mind when you hear the word "Antarctica". Then, in the first question, you are asked if you are interested in Antarctica:" Yes" or "No". Then in Question 2, the reason is asked to the person who answered "No" in Question 1. Then, Question 3 asks the person who answered "Yes" in Question 1 to select specific items in the Antarctica they are interested in. In Question 4, the person who

Table 1: Questionnaire Results

Subjects: 92 (first grade) university students of "Earth Environmental Science III" course in the School of Geoscience, University of Tsukuba. In some questions multiple answers are permitted.

Pre-question: what image pops up in your mind when you hear the word "Antarctica"?

Question 1: Are you interested in Antarctica?
Yes: 63.0% (Go to Questions 3, 4 and 5).
No: 36.9% (Go to Questions 2 and 5).

Question 2: Please tell us the reason why you are not interested in Antarctica.
I do not know much about Antarctica. 12 persons
Antarctica doesn't seem real to me. 22 persons
Others: 3 persons

Question 3: For Antarctica, what are you specifically interested in?
Antarctic Environmental Change: 3 persons
Antarctic Creatures: 20 persons
Snow/Ice on Antarctica: 22 persons
Antarctic Research: 21 persons
Antarctic Physical Phenomena: 12 persons
Others: 9 persons

Question 4: Do you want to actually have a job related to Antarctica?
Yes: 37.9%
No: 62.0%

Question 5: Do you know about the "International Polar Year 2007-2008"?
Yes: 1.1%
No: 98.8%

[Editor's Note: The editor compiled many slides and made one Table.]

answered "Yes" in Question 1 is asked if he/she actually wants to work in the polar region: "Yes" or "No". Then, the last question is whether they know about the "International Polar Year". The questionnaire asked a total of six questions as above.

First, I would like to show the results of the Pre-question about the image of the Antarctica. The answer of "Penguin" was ranked on top and the second is "Ice". I will introduce their answers from the top. In the Weather/Marine Section, the answers include "Oceanic General Circulation", "Atmosphere General Circulation", "Rossby Wave", "Antarctic Oscillation", "Ozone Layer" and "Ultraviolet Rays". In the Creatures Section, the

answers includes “Penguin”, “Seal” and “Creatures peculiar to Antarctica”, which perhaps means “bryophyte” or something like that. Also, there is an answer that human beings have deprived polar bears of their habitable environment. There are no polar bears in the Antarctica, but only in the Arctic Region. Therefore, this answer is a mistake. However, I found many mistakes of this kind. It indicates the poor knowledge about the Polar Regions. For the Antarctic research, there are the “Syowa Station”, the “Vostok Station” and the ice breaker “Shirase”. Also, sledge dogs “Taro” and “Jiro” and the film “Nankyoku Monogatari” (Antarctica Story) were found in the answers. In addition, in the Snow and Ice Section, “Ice”, “Ice Sheet”, “Melting Ice due to Global Warming”, “Boring Investigation”, “Snowfield/Snow Mountains”, “Snow/Ice Core Age Determination” were given .

For "others", people have an image of “Cold” for Antarctica. Therefore, many people answered “Cold” for the image of Antarctica. Also, there are answers of “Continent”, “Unknown/Deserted Continent” and “Key for obtaining information about the Past Global Environment”. There is one strange answer, which is “Evangelion” (TV animation title).

The answer to the Question 1 indicates the percentage of people that are interested in Antarctica, “Yes” was 63% and “No” was 36%. The majority of subjects answered “Yes”. Therefore I got the impression that their interest in Antarctica was quite high.

Then, in Question 2, the subjects who answered “No” in Question 1 were asked the reasons for their negative answer. There were three options to choose; “I do not know about Antarctica well”, “Antarctica does not seem real to me”, and “Others”. The greatest number of subjects answered “Antarctica does not seem real to me”, as somehow I expected. The subjects answered “Others” were asked to write down their individual reasons freely and openly. They answered “Antarctica is not interesting”, “The Antarctic environment issue is doubtful” and “Antarctica has nothing to do with me”, which was not my expectation. The above responses seemed to relate to the answer “Antarctica does not seem real to me”. I think these can be put together with “Antarctica does not seem real to me” group making a total of 25 persons. This high figure can be explained by the fact, that the Antarctica is not so well known as we wish. However I suspect some more unknown factors exist which create the figure so high.

For Question 3, the subjects who answered “Yes” in Question 1 were asked to specify what in the Antarctica are specifically interesting. There were 6 options. The most numerous answers were about environmental issues and changes. I had the impression that these answers were far and away the most common. I think repeated Newspaper Articles on environmental issues in Antarctica or TV programs influenced the subjects. Second most was “Snow/Ice”, then “Research”, “Creatures”, “Physical Phenomena” and “Others” in this order. For the “Others”, “Measurement of Past Carbon Dioxide Concentration”, “Antarctic Weather”, “Ozone Hole”, “Geological Features” and amazingly “Territorial Issues” were found.

For Question 4, the subjects who answered “Yes” in Question 1 were asked if they would like to have a job related to the Antarctica. The resultant rate of “Yes” was 38% and “No" was 62%. The majority of the subjects, who answered that they were interested in Antarctica, answered “No” in this question. This is a big problem. We heard about the problems in fostering researchers in the early part of this Symposium. The answer above indeed confirms the problem is a real one. I feel

very sorry about this result.

Then, regarding the result of Question 5, where the subjects were asked if they knew about the "International Polar Year", the resultant rate of "Yes" was 1.1% and "No" was 98.8%. This must be a shocking result for an audience attending this symposium; however, these are indeed the real and honest results. This means that the number of subjects who answered "Yes" was only one out of 92 subjects. It was a shocking result also for me that most of them answered "No". I felt that the promotion and publicity was not adequate. If you do not usually think about Antarctica, you will not be interested in such event as IPY. People have expressed their interest in Antarctica in the answer to Question 1. They surely have obtained the information about the "International Polar Year" that was held this year. The problem is the result of the fact that they are interested in Antarctica, but only superficially. This would be a high hurdle to clear. I found a comment from a subject written on the questionnaire sheet, "What did they do for the 'International Polar Year'? They should have promoted this event much more". It means that we received the message loud and clear that the IPY should have been promoted much more.

Based on the questionnaire results, there are not few, but a significant percentage of people who are interested in Antarctica. However, the number of people who want to have a job related to Antarctica is not as many as those who are interested in it. The majority of people answered that Antarctica did not seem 'real' to them as their reason. Those who are interested in Antarctica pay attention to the environmental changes in Antarctica. Unfortunately, the recognition rate of the "International Polar Year" was very low. The above were the results of the questionnaire at this time.

In conclusion, there are many people, more people than I expected, who do not know about Antarctica particularly well. I feel very sorry that there are many people who do not know the attraction, the beauty and the current critical situation of Antarctica. It might be no bad, if we ask us anew, what image we have for the Antarctica. It may be the time, not let the people think deeply about Antarctica, but we ourselves do that sincerely. I close my talk with the words I love, "Polar Regions are a mirror of the global environment". Thank you very much.

MC:
Now, I would like to introduce Ms. Ayako Yamasaki, who won the Platinum Prize in 2006. The winning proposal was "Investigation of the Stress Degree in the Polar Region using Medullas". At that time, she was a third grade student in Shimabara City Junior High School. Now, she is a second grade student of Nagasaki Prefectural Shimabara High School. Please start your presentation.

YAMASAKI:
I am Yamasaki, a second grade student of Nagasaki Prefectural Shimabara High School. I would like to introduce my co-presenter Ms Mitsuko Taniguchi, who operates the power-point. She is a second grade student of Nagasaki Nihon University Senior High School.

We would like to talk about the following two topics in this International Polar Year Junior Summit. One is the "Observation of Isostasy Change" and the other is "What we expect in the Antarctic Research in 50 years time"

First topic is Isostasy. The earth's crust with a relatively low density floats over the fluid mantle with a density higher than that of the crust. The gravity that works from the crust to the mantle is balanced with the vertical upward reaction from

the mantle to the crust, so the crust continues to float over the mantle. This phenomenon is called "Isostasy". Because of this, under the mountains where the crust is thicker, the pressure from the crust to the mantle becomes greater, so the upper surface of the mantle becomes dented. On the contrary, when the gravity from the crust is lowered, the reaction from the mantle becomes larger than the gravity. In such cases, the crust is lifted.

This figure shows a model of a sectional view of current Antarctica. The average thickness of the ice sheet on the Antarctica is 2,400 meters. It is said that the thickest part is about 4,000 meters. On such locations, strong gravity works downward from the crust to the mantle. On the upper surface of the mantle, the reaction against gravity works against the crust. So, the crust floats over the mantle, but the mantle surface must be dented a little. Based on this theory, it is said that the average height of the bedrock on Antarctica is about sea level.

Now, the media reports that due to currently progressing global warming, mountain glaciers in the world, such as in the Himalayas, are decreasing and ice on the Arctic region including the Greenland is also decreasing. In Antarctica, when the ice sheet on the Antarctic continent decreases due to global warming, the gravity of the crust working against the mantle will decrease. In such a case, the reaction from the mantle to the crust will become greater than the weight of crust, so the bedrock of Antarctica will be uplifted. If so, it is a perfect opportunity for us to elucidate the isostasy, now. For this purpose, we need to continue to observe accurately the hardness of the Antarctic bedrock.

Based on the results of the quantitative observation of the decrease of gravity accompanied with the ice sheet disappearance on the Antarctic bedrock and the rise of such bedrock, the quantitative relation in the isostasy could be elucidated precisely.

Although the time period of 50 years is quite short in the long history of the earth, it is a good opportunity for us to do research about isostasy.
You might argue me that the isostasy is an established theory and no more work is required. It is in fact mere a hypothesis to explain the rise of the Scandinavian Peninsula; The hypothesis says that the Scandinavian Peninsula was covered with an ice sheet with a thickness of 2,000 meters during a glacial age. The glacial age passed and the ice sheet disappeared. Since then, the Peninsula has been rising 1 to 2cm per year to keep balance between gravity and reaction.
Although the hypothesis may be correct, we have not proved it. We have no measurement right after the disappearance of the Scandinavian ice sheet. In the Antarctica we have an opportunity to start the observation immediately after the ice sheet disappears

Now, we will present our opinion on "What we expect in the Antarctic Research in 50 years time". First, we expect them to develop a large airplane with a short landing or takeoff run. The current operation of the Antarctic research, the supply of goods and replacement of the research members only once a year, presents a serious inconvenience. Antarctica also need to function as a civilized sphere in the future. For this purpose, it is required to develop an airplane that should be large and can take off or land with short running distance, and be capable of enduring severe natural conditions in Antarctica to some extent, by means of bringing together the essence of the latest technologies.

Then, we expect them to install beacons dedicated to aircraft in Antarctica. The installation of beacons can guide airplanes during dark nights

and even under whiteout conditions to some extent. Using beacons secures the safe takeoff and landing of airplanes, so safer transportation of goods becomes available. In November 1979, a McDonnell Douglas DC-10 that was operated for the Antarctic tours by Air New Zealand, crashed into Mount Erebus on Antarctica due to a whiteout, and the lives of all the passengers and crews were lost. To avoid such accidents, we would like to expect them to install beacons. When safe navigation over the Antarctic continent becomes available the souls of the victims will be sure to attain eternal rest.

Also, we expect them to construct runways on Antarctica. Is it possible to construct a runway close to a research station on Antarctica, where large airplanes can land or take off. As for the runway length, as I mentioned before, when the airplane with a short takeoff or landing run is developed, the runway length can be shorter. When this is realized data and research result exchanges can be made, directly among the stations of various countries in Antarctica. Also, the transportation of goods from various countries that have constructed and maintain their stations in Antarctica can be performed more than once a year. When the current scientific technology developed in Japan is utilized, the construction of runways in Antarctica would be possible. Thus, when safe airplane transportation to the stations in Antarctica is assured, the Antarctic Continent joins in a civilized world.

In this connection I may add a story. My grandfather used to visit Nepal for trekking. He showed me some pictures from the tour. I was very surprised, when the picture of the Lukla Airport was shown: an extremely short runway was constructed on the slope of a mountain.

Then, I would like to tell you about the necessity of the investigation of the changes in marine species in the Antarctic Ocean due to global warming. Sometimes, we hear or see the news about a slump in fisheries on TV programs or newspapers. Shimabara City where I live is located along the Ariake Sea. In the Ariake Sea, pen shells used to be popular catch, but nowadays they can not mature so pen shell hunting has been discontinued. On the other hand, I heard from one of the fishermen in the Ariake Sea that recently they started to catch skipjack tunas, which were regarded southern fish. Also, I saw the news that around Genkai-nada, tropical fishes have been increasing and total fish catches have decreased sharply. I suppose that the marine species might change also in the Antarctic Ocean because of the rise of seawater temperatures. Therefore, I believe that it must be important to investigate the changes in marine species in the Antarctic Ocean. In the future, apart from Antarctic krill, seafood from the Antarctic Ocean might be served on our tables. I definitely expect this.

Finally, I would like to propose the fostering of Antarctic researchers for a 50-year period in the future. In the science courses in our junior high school, we studied about the changes of the earth including volcanoes, earthquakes, strata and crustal movements in the single subject course, when we were first grade students. When we became second grade students, we studied about weather and its changes including weather surveys, weather changes, and water changes in the air, fronts and changes of weather. When we became third grade students, we studied about the earth and the universe including planetary movements and the movement of the earth, star groups in each season and seasonal change, and the solar system. These subjects are all included in the earth science field, and all given in a single course of science.

Now, I am a second grade student of the high

school. In our high school, we have no possibility to study Earth Science. Among other high schools in the vicinity, only few schools provide Earth Science course. Under such educational conditions, we can not foster students who are interested in Earth Science and have an ambition to be researchers. I wish Earth Science courses would be provided to high school students all over Japan. Through Earth Science education, the number of students who are interested in geology, weather and the universe will be increased. They will play a lively part as researchers in Antarctic research for the next 50 years. Thank you very much for listening to us. Now, our presentation has been completed.

MC:

The last speaker in Part two is Mr. Tomoyuki Oshima. He received the Gold Prize in 2007 for the proposal titled "Attention Paid to Static Electricity – Are Snow Grains charged in a Blizzard?" At that time, he was a third grade student of Maebashi City, the Forth Junior High School.

OSHIMA:

I am Oshima as introduced and a student of Gunma Prefectural Maebashi High School. I would like to present our opinion. The title is "Act Polar, Act Global, and Think Cosmic". [editorial note: the expression "Act Polar, Act Global, and Think Cosmic" was given in English words by the speaker.]

We would like to think about what we could do for Antarctica and the Arctic Region for the future of the earth.

At first, please look at this world globe. This world globe with a diameter of 1.59 meters was a present of the Belgian Government before World War II. It is exhibited in the University Museum, Koishikawa Annex, the University of Tokyo. When we visited Tokyo for the Open Forum, we made an excursion to the museum and found the globe. I remember that we were very much surprised because Antarctica was not printed on this world globe at all. It indicates the history of Antarctic research is quite short. Today, we can see the precise and live images of the Antarctica while we are in Japan. We realize the great progress of technology.

Antarctica was discovered in 1820. Since then, great scientific attention has been paid to Antarctica and many explorers have gone on Antarctic expeditions. This period is called the "Antarctic Exploration Era". After that, as you know well, the Norwegian team conducted by Amundsen, reached the South Pole in 1911 for the first time.

This activity was as much as they could do at the time. Then, the "International Polar Year" (IPY) was performed for the international research plan to obtain physical data of the earth with international joint efforts, aiming at the observation of the polar region's terrestrial magnetism and a world weather survey in the years 1882 and 1883. The Second IPY was performed in 1932 and 1933, and the Third IPY in 1957 and 1958. This time, we are in the Fourth IPY and it is completed today.

One of the recent great changes in Antarctica would be the Ozone Layer Depletion. This was discovered in the research at the Syowa Station and now everybody believes that worldwide regulations are required to stop it. This article was in the newspaper dated April 14, 2008. The article describes about the Gentoo Penguin suffering warm weather. Through the internet, we can see the images of these penguins that gather in the shade to escape from the heat of 25.3 ° C in the same location as that in the article. Also, we heard that polar bears in the Arctic region are seriously affected by the disappearance of ice due

to global warming. Many scientists predict that the ice on the Arctic Ocean will melt away and disappear in summers by the end of this century. If this turns out to be true, polar bears will disappear from the earth within 100 years from now.

Currently, global warming is at the center of topics concerning environmental problems. As shown in the above two examples, the animals in the Polar Regions can be regarded as canaries in a coal mine.

We are also concerned that the research in the Polar Regions might cause environmental problems. This picture shows waste left in Antarctica.

The video shows the sonic-velocity in situ experiment of the proposal submitted to the Open Forum 2004.

(Video Replay)
"Hello, everybody in Maebashi City Forth Junior High School. My name is Hirosaki. I am a member of the 46th Japan Antarctic Research Expedition. Today, I would like to perform the sonic-velocity measurement under extremely cold temperatures as was proposed by you. Here is the fourth Japan Antarctic Station, "Dome Fuji". It is located 3,810 meters above the sea level. Currently, deep layered ice sheet drilling is performed 3,000 meters underground……"

What I want you to look at is not the experiment, but the snow mobile. We were very shocked to see the dark smoke in otherwise pure white world. The snow mobile used in the experiment produces a large amount of exhaust gas. This situation needs to be improved so that the research can be performed without a load on the environment. Considering the exhaust gas and noise problems in the operation of snow mobiles, a snow mobile driven by a fuel cell may be one of the solutions.

We have to give a thought, also to generate power consumed at the station without disturbing the environment. We may consider employing wind power generator? I mention in this relation, there was a proposal of blizzard power generation by the students of St.Viator Rakusei Senior High School in the Open Forum. Also other power generation methods are to be considered; the availability of geothermal power generation using volcanoes, power generation using temperature differences in the ocean and so on. Another possibility is human power generation using exercise bicycles. If vegetable cultivation is made with the LEDs as light source, which is powered by the human-generator, the problem of a shortage of fresh vegetables in winter period could be solved. At the same time, it would be a solution to the problem of insufficient exercise or stress for the expedition members.

An energy-saving structure developed for the prefabricated houses in the Syowa Station, has been employed to design houses in Japan, which save energy as much as possible. Some more industrial materials or techniques developed for Antarctic cold temperatures may find application at home in Japan. Even the harmful strong ultraviolet rays due to the enlargement of the ozone hole may be utilized for some purpose, and the skin cancer can be investigated in situ. Medicine using wild animals or plants of the polar region may be developed.
This worksheet for population and food issues was used in our school class. On the worksheet, it is calculated; the increase of the world's total population is expected to reach 9 billion by 2050 and 10 billion in 2100. It is necessary to somehow find food for all of them. One of the solutions would be to use the rich resources in the Arctic Ocean and Antarctic Ocean.

On the earth there is a phenomena called the “Grasshopper Effect”, where substances such as pollutants on the earth, are concentrated and drawn to the Polar Regions. Is it possible to make the earth clean, by concentrating the pollutants in the polar region purposely and make treatment there?

The Antarctic research has indeed a broad range and application is unlimited.

We would like to consider that the theme of the Fifth IPY from 2057 to 2058 would be “Act Polar, Act Global, and Think Cosmic”. We have been practicing to work in the polar region thinking the entire globe: "Act Polar, Think Global". Similarly, we will find the way in future to work on the earth thinking the entire cosmos.
The theme of the Sixth IPY from 2107 to 2108 would be “Act Polar, Act Global, and Act Cosmic”.
Of course, we would not forget to continue the experiments for the school children of the time, like the static electricity experiment proposed by us last year. Not only the application researches like environment and ecosystem, but also basic scientific experiments shall be contained in the future IPY program.
I apologize for making so long presentation. Now, I have finished it. Thank you very much for listening to my presentation.

MC:
Thank you very much my presenters. I expect that audience have their own opinions. Please express your opinion in the panel discussion in the Part Three. We would like to finish Part Two now.

Part III

Panel Discussion

Antarctic and Arctic Research 50 Years Ago, Present and 50 Years from Now

Panelists :

Yuto IZAWA (Waseda University Senior High School)

Takashi SHIBANUMA (Saitama Prefectural Honjo High School)

Yu ONO (University of Tsukuba)

Ayako YAMASAKI (Nagasaki Prefectural Shimabara High School)

Tomoyuki OSHIMA (Gunma Prefectural Maebashi High School)

Shin SUGIYAMA (Institute of Low Temperature Science, Hokkaido University)

Nobuo KOKUBUN (The Graduate University for Advanced Studies)

Naomichi TOMITA (Teacher, Maebashi City Fourth Junior High School)

Masami SUZUKI (Teacher, Honjo City Honjo-Nishi Junior High School)

Taiichi KITAMURA (Prof. Emeritus, Kyushu University)

Chair : Satoshi IMURA (National Institute of Polar Research)

IMURA:
Hello, everybody. My name is Imura. I work for the "National Institute of Polar Research". I would like to start the discussion with the theme of "Antarctic and Arctic Research 50 Years Ago, Present and 50 Years from Now". I will serve as MC for this discussion.

I would like to introduce you the panelists seated in the row on the stage. First Mr. Kokubun and Mr. Sugiyama, the young scientists who gave presentations in Part One. They are in charge of the current Antarctic research. Then, the young people who gave presentations in Part two and whom we expect to take part in Antarctic Research over the next 50 years.

Also, I would like to introduce three additional panelists. First, Professor Kitamura. He is an honorary professor of Kyushu University. He took part in the First Japanese Antarctic Research Expedition in 1957 and was deeply touched by the survival story of the two sledge dogs, "Taro and Jiro". Professor Kitamura, thank you very much for participating in this panel discussion.

Then, Mr. Tomita. He is a teacher in the Maebashi City Fourth Junior High School. He has taught many students and instructed them on the proposal applied to the Open Forum.

Next, Mr. Suzuki. He is a teacher in the Honjo City Honjo-Nishi Junior High School. He also has sent many students who gave presentations at the Open Forum.

I have introduced these panelists seated in a row. As you well understand, the people from three generations connected to Antarctic Research are seated in this row in front of you. Professor Kitamura, who took charge of the Antarctic Research 50 years ago, and two young researches who are now working at the forefront of the Antarctic Research. Then, young people whom we expect to participate in future Antarctic Research during the next 50 years, and their teachers. The people from three generations have gathered together here and are going to discuss and exchange their opinions.

I will ask not only the people on the stage to express their opinions, but also the audience to raise your hands and actively express your opinions. The time is limited, I am afraid, but we expect your active participation.

Well, we did not allocate any time for questions after the presentations in Part Two. We would like to start with that. Do you have any opinions or comments in reference to their presentations?

NAKAYAMA:
My name is Ms. Nakayama. I'm a journalist with The Asahi Newspaper. I felt that I, and also the Antarctic researchers here are shocked by the results of Mr. Ono's questionnaire that the numbers of people, who knew about the International Polar Year, were so few. I discovered that the effort of journalists to publicize the event was insufficient. What should we do to give the greatest impact to appeal to people about the International Polar Year, and make the Antarctic Research more familiar to the general public, in addition to ordinary efforts as writing reports or holding events? Do you have any epoch-making idea different from the existing ones?

IMURA:
Mr. Ono, please answer her question.

ONO:
I am Ono. I presented the results of the questionnaire in Part Two. I was also very surprised to see the results. There were other questions and most of them were answered as we expected. However, the answer to the last question was a great shock to me. We did not expect at all that there would be only one person who knew about the IPY. I was taken aback in the course of the analyzing results. Maybe it is

because of insufficient PR. As the recognition of the IPY is low, public relations activities are important. I became interested in the IPY through the Open Forum. However, I also had opportunities to become familiar with Antarctica through TV programs, etc. For example, they invited some children into the studio and asked the viewers to send a facsimile message to the Antarctic station through TV studio. I enjoyed sending my own facsimile message. For children, it might be important to touch on information about Antarctica when they are small kids.

IMURA:
In the presentations of the students, there are many opinions about Antarctic environmental issues. I suppose that one of the reasons is the recent growing concern for the global environment. Also, I was interested in the opinion not only about global environmental issues, but also about environmental improvement in Antarctica, and the proposal with this purpose. I think it is a very important point. Is there anyone on the stage who has a comment on it? Yes? Please, Mr. Sugiyama.

SUGIYAMA:
I was very pleased with the presentation by the high school students. The most interesting talk for me was Mr. Izawa's. He showed us pictures of an ancient ruin and Antarctica. At that time, I was very impressed by his comment that it was not necessary to go so far as to do research in Antarctica that destroys its environment, just as researchers would not destroy ruins to find buried items. After that, I also felt that the talk of perhaps Ms. Yamasaki was great. Her proposal was to make much more use of Antarctica. She suggested that it would be better if we could use airplanes to travel to Antarctica and to make use of many more marine products.

I would like to ask both of you. First, I would like to ask Mr. Izawa. I felt that the proposal by Miss Yamasaki to actively make much more use of Antarctica seems go against your proposal. What do you think?

IZAWA:
I am Yuto Izawa. I think that it is nonsense to place two opinions opposed to each other in such a way. What I wanted to say in my presentation is that we should not contaminate Antarctica. I feel very strongly about this. That's why I presented my opinion. Therefore, if research could be performed without contaminating Antarctica due to the progress of scientific technology, it would be no problem to actively conduct any kind of research. If runways can be constructed without destroying the global environment, it would be OK. I hope that the technology is developed based on this aspect, to realize the research without destroying the environment over the next 50 years.

YAMASAKI:
The Antarctic research is now being performed, so I would like them to use the Antarctic in a good way. The general public also wants to be involved in the activities in Antarctica, as well as the expedition members. I do not mean to make a counter-argument to the opinion of Mr. Izawa, but I gave the presentation of my opinion as to what the general public might expect from Antarctic Research.

INABA, journalist:
(Editor's Note: The record is missing. Question/Comment related to International Cooperation System)

IMURA:
As for the international cooperation system, here is Mr. Sugiyama, who has just returned from cooperative research with the Swedish team in Antarctica. What do you think of this, Mr. Sugiyama?

SUGIYAMA:
I totally agree with them. The reason why I just asked the questions to the students is based on this. When I am staying in the community of researchers, Antarctica is just a subject for research. Therefore, we feel we are in an atmosphere where we could do anything we want, as long as we find something new there. However, when I saw the picture of the ruin presented by Mr. Izawa, my heart stood still because I thought that his opinion was right.

Why do such things happen? Perhaps the reason is that in the case that there are some items on which agreement has been reached in a small community, it would be difficult for them to think flexibly beyond their stipulations. For example, the discussion of the people working for an air line who has the aim to fly their airplanes to Antarctica would be led to the conclusion that the airport is to be constructed in Antarctica, if the discussion is performed only by them. However, there are people in various positions, who have various opinions in the world. For example, the people who face starvation would think that they should catch much more fish in the Antarctic Ocean. However, the people who are not having trouble getting enough food would insist that they should preserve the Antarctic environment. Which is right? It is a very difficult question. For international cooperation, people with different standpoints should determine what they should do in close communication each other. What we lacked in the past is this point.

After my talk, I was asked about waste treatment. I would like to add one point. There was only one thing we did which was different from what the Swedish team did. It was about how to deal with human waste. The Swedish team said that they would remove their waste and carry it with them to South Africa. The Japanese team collected it on a sledge and when a certain amount was collected, they disposed of it in Antarctica. Both the Swedish team and the Japanese team conducted their disposal according to the international rule. However, there are different ways of solving this problem and they are different depending on the way of each country. There is no definite answer to this question. When we decide what we should do in such a situation where there is no definite answer to the question, in particular, about Antarctica, we need to have many more opportunities to discuss with people in other countries.

YOSHIDA:
(Editor's Note: The old professor remembers his young age, when he joined the training of sledge dogs in Hokkaido, northern Japan, fifty years ago. The very interesting story he told us was unfortunately not recorded.)

HATANAKA:
I am Ms. Hatanaka, a student of Suwa-Seiryo High School. If there is an environmental destruction problem caused by constructing a runway, how about using an airplane which can land on or take off on water?

IMURA:
Professor Kitamura, you had a water plane at the early stage, didn't you? I remember that the Antarctic research ship "Soya" was equipped with such a plane for scouting.

KITAMURA:
Yes, at the early stage, we discussed whether it would be better for us to carry an airplane with us or not. It was such an era. There were some who strongly insisted that we should carry an airplane. However, the majority of people were opposed to it. Therefore, we did not carry an airplane in the IGY. It was some time after that when we started carrying an airplane with us. We need an airplane nowadays. Airplanes have been used since 1927 when they were used by the Watkins' Antarctic

research team. That was 80 years ago. Sorry, I got sidetracked with a general story about airplanes. What did you ask me?

HATANAKA:
I asked you whether an airplane that can land on and take off from the surface of the water could be utilized or not. I mean an airplane that uses floats rather than tires. Using a water airplane that does not need a runway, I thought, would not do any damage to the Antarctic environment.

KITAMURA:
Unfortunately it would not be useful at all. Even in summer, there is no stable water surface close to the Syowa Station. Not to mention in winter, the distance to the open sea is about 100 km to 200 km from the station. Therefore, a water airplane is not practical. The research ship, not the station, had a water airplane before. However, open water opens and closes repeatedly. The open water might close due to wind after an airplane takes off. Also, when the concentration of drift ice becomes high, the airplane can not land on it. Even when the airplane can take off sometimes it can not land when it returns because of rapidly changing conditions. Therefore, unless landing gear integrated with the sledges, the wheels and floats is developed, a water airplane can not be used on a frozen sea. I am sorry that I can not help with your idea.

IMURA:
In the case that the water surface can not be used for an airplane landing, we need to construct a runway on the ground. Actually, there has been a request for a permanent runway close to the Syowa Station for a long time. However, the construction work creates a considerable load on the environment. Therefore, no new construction has been performed. Do you have any other opinions? Yes?

Name Unknown:
How about using a helicopter? An airplane needs a runway, but a helicopter does not need the construction of a runway. The function is limited to short distance transportation, but it can transport men and things in a safe manner. How about it?

IMURA:
I will explain. We already use a helicopter. In Antarctica, a helicopter is the best transportation method during summer. When we transport something from the station to a vessel or vice versa, we basically use a helicopter in summer and a snow mobile in winter.

SHIGETA, student:
(Editor's Note: Record missing. Opinion something like cultivation or proliferation of useful plants or animals)

IMURA:
Cultivation of food in a perfectly sealed environment is theoretically possible. However, it is strictly prohibited to bring any alien species into Antarctica. Therefore, it is very difficult to make this happen. Actually, the introduction of alien species into Antarctica has already become a big problem. Currently, the investigation on the impact of exotic species in Antarctica is underway.

SHIBANUMA:
Certainly, I think that the idea of cultivating something in Antarctica is great. However, it is difficult because bringing anything for cultivation into Antarctica is prohibited.

IMURA:
Do you have any other opinions or questions?

ABE:
I was engaged in the Japanese Antarctic Research Expedition as the member in charge of

construction. Researchers have to stay and live in Antarctica. Our job was to support them. The main job of our research team was field investigation and we camped out for the entire research period. There were some individuals in the investigation team who had little or almost no experience of fieldwork. Such persons had hard times themselves, but we also were concerned about them for safety purposes. I would like to ask Mr. Suzuki and Mr. Tomita. I believe that only the researchers who can manage to camp out, stay and perform activities in such area, could perform the research in Polar Regions such as Antarctica or the Arctic region. Recently, young people in Japan do not have the experience of being out in the natural world. Even though they study hard in school, with that alone, they can not become researchers in a polar region. How much time do recent junior high school students spend experiencing the natural world, such as walking in mountains or fishing in rivers? What sort of outdoor activities are undertaken recently by junior high school students? What do they learn or experience in school? I would like to ask these two junior high school teachers.

IMURA:
OK, we would like to ask these teachers. Mr. Suzuki, please.

SUZUKI:
Frankly speaking, the opportunity for the students to come into contact with nature has diminished recently as you have suggested. I myself grew up in a town in the mountains in the northern area of Saitama Prefecture. Therefore, I had rich experiences of contact with nature, for example going into the mountains, cutting trees and constructing a hut or playing in a river, etc. Recently, neighboring children seem to have no experience of such activities. They spend a long time playing games at home and go to private study centers after school. The purpose of their study is to enter a higher level school. It is rather a pity. In junior high schools, the school curriculum will be completely renewed in 2012. As for students' direct contact with nature through courses or events, restrictions will be increased in the new regulation. I wonder to what extent we can help students come into contact with nature during the course of their school education. Our conditions do not allow us to have open-air schools and other out-of-school activities easily. I feel that we need to start by considering how to move our curriculum forward. Then, I would ask Mr. Tomita to answer the question.

TOMITA:
I was born in 1957 when the first Antarctic research was conducted by a Japanese team. Looking back at my childhood, I have no memory of playing outside. I grew up in Maebashi, Gunma Prefecture, which is a small city. In Maebashi, there were some paddy fields and streams. However, until now, I have just had the experience of walking in the mountains a little bit when I had time in my university days or after I secured a job. Children at the present time go to school in the morning and come home late in the afternoon, so they spend most of their time in towns or cities.

For open-air classes in school education, as mentioned before, "Oze" school will be started next year in Gunma Prefecture. However, such activities can be performed only in quite limited places. These days, we will have the instruction that any activity that is considered even to contain the slightest risk is not permitted. Also, it is possible that under the current atmosphere, the purpose of open-air schools is mainly considered to be for training of group activities. I feel that situations where children come into contact with real nature and become interested in natural phenomenon are becoming fewer and fewer.

IMURA:
Certainly, considering the future of Antarctic research, I believe that societal conditions in Japan are heading in this direction. For example, I heard that information about Antarctica is not presented in Science textbooks in junior high schools. How many paragraphs related to Antarctica are there actually in the textbook?

SUZUKI:
About three years ago, I thoroughly checked all the Science textbooks issued by 5 publishing companies, as to whether or not there was anything about Antarctica. This investigation was requested by the National Institute of Polar Research, in connection with the "50th Anniversary of Japan's Antarctic Research". I remember that there was no word about Antarctica in any of the text books.
However, science is just one of the nine subjects for the students. It would be wise for us to expect the children to naturally become interested in Antarctica during the time when they are learning not only science, but a broad spectrum of eight other subjects as well. Anyway, we need to establish a system where children can obtain a broad knowledge base. It is the most important thing.

IMURA:
(Editor's Note: Record missing. A question about what you think looking back on the Open Forum)

OSHIMA:
My name is Oshima and I participated in the Second, Third and Fourth Open Forum over the last three years. Frankly speaking, I did not know about this project until my teacher told me about it. The participating schools are listed in the web site. I remember that the number of schools is less than 100. I feel that the PR was not enough. Once I participated in it, I received the Gold Prize and the experiment was actually held in Antarctica. I am thankful to you all for giving me a good chance and I feel sorry for the insufficient PR all the more.

IMURA:
Thank you very much. Each of you must have a different opinion about the contents of the Open Forum. Mr. Oshima, thank you very much.

TOMITA:
I am just a mere teacher of a junior high school, so I was very lucky that conditions allowed me to participate, otherwise, I could not have been involved in the Open Forum. In our school, there are some optional subjects which are relatively freely organized. Science course if one of such subjects. Also, I am an advisor to the Science club in the school. Therefore, the reason why I could be involved in the Open Forum was that I could prepare for the Open Forum as an official duty. Looking back on the past situation, if I were not the advisor to the Science club, nor took charge of a science course, I could not have taken time to examine our participation in the Open Forum with my students even though I knew about the Open Forum.

IMURA:
Thank you very much. Does anyone in the seats have any opinion?

SHINDO, teacher:
(Editor's Note: Record missing. Question about how they attract young people to Antarctic research or about information dispatch and public relations)

IMURA:
Do any of you have an answer to this question?

SUGIYAMA:
I don't have an answer to that question; however I would like to talk about what I was impressed

with the most. Ms. Yamasaki mentioned about the Geo-Science education in her proposal. Last week, I supervised the entry examination of my university. There were 60 students who took the examination in the room. Everybody needed to select two subjects in the Science. The number of students who took Geo-Science was only one individual. It means that only one out of 120 students (1/120) selected the Geo-Science course. It has been a subject of discussion for a long time. In this situation, as it takes time to prepare the questions for the entrance examination, I became concerned that Geo-Science might be removed from the optional subjects. In such case, high school students would not be able to study Geo-Science at all. I considered what we should do. It is true we have to ensure Geo-Science is kept as a scientific subject. However, the other solution might be to include geo-scientific elements in the Physics or Chemistry disciplines as an application of Physics or Chemistry.

I agree with the opinion mentioned in the latter part, that the information such as research results should be dispatched to young students and children. In our research center, we attempt to dispatch such information and increase the seminars for the general public. For the scale of whole country, the academic society for snow and ice which I am involved in, focuses not only on the arguments for specialists, but also holding events for children. I believe that it is a very important thing now.

IMURA:
Certainly, I have the impression that education and public relations are falling behind. However, in this symposium, I felt that we could stimulate the young people a little and bring out a lot of their opinions, so I believe that this symposium is very useful and I was impressed by the above results.

Soon our time is going to be up. Mr. Kokubun, what do you think about the proposals presented by the young people this time, as a member of the Antarctic Research Team who currently takes charge of leading-edge scientific research in Antarctica?

KOKUBUN:
My comment is not for each of their individual opinions, but I felt that when the young people are not interested in Antarctica, it is because their interest does not turn to nature. I do not know what we should do about this exactly. Looking back on my past, I believe that they need the experience of direct contact with nature. Certainly, what they learn in school is important. Fortunately, I was able to take various science discipline courses. When I looked at birds using binoculars and went into mountains, I could experience for myself what was taught in the school course. Then, I fully understood about it and how it was linked to the other things to be learnt. In such a way, when they learn and experience, their interest will finally be led to Antarctica or the Arctic. It might be somewhat forward of me to say so, but I would say that students should not only listen to the teacher's words in the classroom, but go out from school and visit many places for fun. In such places, they could remember what they are taught in the school. Through the internet, they can collect data. However, going to actual mountains or playing in a river, would provide necessary experiences for their future.

IMURA:
Thank you very much. We heard many opinions. I felt that the level of awareness and the quality of the student's ideas here is very high. In the future, when we continue the research over the next 50 years it will be very helpful. Then, I would like Prof. Kitamura who has been actively working over the last 50 years, to give us words of

encouragement to the children.

KITAMURA:
The education of Geo-Science was mentioned before. I would like to tell you many things, but our time is going to be up soon. Therefore, I picked up one important thing only. As Mr. Abe told us before, a scientist wants to do something, but she can not do for herself without support at the site. As Mr. Abe did, somebody took her to the site, and then the geologist can do the research. It is wrong. It is no good. I am sure that people here want to go to Antarctica. When such a person performs her own research, she should do it for herself without needing any support from other people. It is the essence of a field scientist. Laboratory scientists can not do any such thing. They can not go to the place 1000 kilometers away unless somebody takes them. You should arrange for yourself to do what you want to do. It is the very code of a field scientist. The polar research itself is field science. Therefore, any of you who want to go to Antarctica in the future should start outdoor training as soon as you get home today. Start a wood fire in the rain. Sleep in a cold place. Then the next generation of Antarctic research will be wonderfully secured.

IMURA:
Prof. Kitamura has heartily cheered us on. Thank you very much. The end of the forum has finally come. I am sorry for my unskillful handling of the proceedings. To the panelists on the stage and the audience, thank you very much.

Appendix I

Glossary

1) Education System

[School Year]

Schools start their term on the first of April and end on the 31st of March every year. Wherever the ages of children are referred to below, it is from the first of April.

[Obligatory Education]

Every Child receives a minimum education of nine years. When the children are six years old, they begin Primary School, where they are taken care of for six years. The second part of the obligatory education is provided at the Junior High School.

[Further Education]

After 9 years of basic education, a variety of schools are available to be chosen from, if one wishes to learn more. The most popular choice is the High School, where children study for three years.

Universities accept students who have completed the three-year course at the High School. The minimum age for the application is 18 years old. The university students graduate after four years of study. Fresh graduates are 22 years old, unless a detour is made on the way.

A two-year master course and a three-year PhD course, or a five-year combined PhD course, are offered in many universities for graduate studies.

(Some high schools call themselves Senior High Schools, distinguishing them from the junior high schools. Since they are the names, the word Senior is respected and is left in the position in this booklet.)

[Operator]

Primary schools, junior high schools and some senior high schools are owned and operated by cities/towns, whilst most high schools are owned by prefectures. There are also private schools, and a limited number of national schools.

The universities are national, prefectural, municipal or private.

[Entrance examination]

The applicants to high schools and universities have to pass an entry examination, i.e. the graduation of junior high school or high school alone is not sufficient. Private schools and national schools also perform an examination for the younger applicants.

[Science Class]

At the primary school and junior high school, a Science Class is given, which covers every aspect of science. At the high school, science is divided into four disciplines: Physics, Chemistry, Biology and Geo-Science. The children need not attend all four classes; only two classes of their choice. Geo-science seems to be the least popular. Some high schools do not open all four classes, often omitting the geo-science class.

2) Open Forum

[Junior Contest on Polar Research]

The IPY National Committee Japan and the NIPR organize an annual contest for the children of high schools and junior high schools.

Theme: If you were allowed to visit a polar region, what would you like to investigate?

This is an IPY outreach activity, which began in 2004, i.e. three years before the IPY itself starts. Proposals of 25 to 115 in number are submitted every year.

Gold prize, platinum prize, silver prize and bronze prize are given to excellent proposals (cf. Appendix II). The investigation proposed by the gold medalist is executed in the Antarctic by the expedition members.

[Open Forum]

Prize winners are invited to a forum, where they present their proposals and receive their prizes. Together with the tour in the NIPR, the forum became a great day. The word "open forum" was the name of the event on the day, but has been often misused: now the people understand that the entire contest is called "open forum". In the talks and discussion the word is used in this sense.

[Speakers at Junior Summit]

Winners of Gold and Platinum prizes at the Open Forum in five years are asked to give a talk at the Junior Summit.

3) Antarctic Expedition

[Syowa Station]

The Syowa Station is the largest of four Japanese research stations in the Antarctic. It was established in 1957. Year round research activities have been made almost continuously since then, with interruptions only in 1958 and from 1962-65.

[Sledge dogs]

In 1958 the Syowa Station had to be hurriedly evacuated due to a sudden change of ice conditions. There was no time to fetch the sledge dogs or to kill them. 15 dogs were left at the station with nobody to feed them, tied to a chain as usual. When the expedition came back the next year, two of them were found alive. It is still unknown, how they survived through the Antarctic winter. Taro and Jiro, so the dogs were named, became heroes in Japan.

4) Address

First names are seldom used in the conversations in Japan, except for the chat within a family, where everybody has an identical last name, and with very young children, who have not learned what their last names are yet. The last name is commonly used also in the conversation with school children, and among them.

There is a single super-gender word "san" in Japanese for Miss, Mrs., Ms. and Mr. Both traditions combined, it is not easy to distinguish whether a boy is speaking or a girl, when a talk is transformed to a written sentence.

Appendix II

Prize Winners at the Open Forum: Junior Contest on Polar Research I

The First Open Forum on 18 December 2004

Gold Prize= The Detection and Analysis of Organic Contaminants Contained in the Fat and Dung of Penguins Living in the Antarctic

by Masahiro Umetsu (male, 17 years old) and 13 colleagues

of Tochigi Prefectural Utsunomiya Technical High School

Gold Prize= Snow and Ice in the Polar Region

by Megumi Imai (female, 17 years old) and six colleagues

of Gifu Prefectural Gizan High School

Gold Prize= Examination of Basic Scientific Phenomena in the Polar Region: Focusing on the Sound Velocity, Gravity and Earth's Rotation

by Hiromi Haruyama (female, 14 years old) and 23 colleagues

of Maebashi City the Fourth Junior High School (Gunma)

Platinum Prize= Penguins, the Saver: Research and Applications of the Penguins' Amazing Sense of Hearing

by Yuto Izawa (male, 14 years old)

of Koganei Junior High School attached to Tokyo Gakugei University

Silver Prize= Research on the Oxygen Consumption of Fish Living in the Polar Ocean

by Mihoko Nishimori (female, 16 years old) and three colleagues

of Yamaguchi Prefectural Asa High School

Silver Prize= Simultaneous Meteor Observation at Plural Sites Including those in the Polar Regions

by Junki Ichikawa (male, 17 years old) and four colleagues

of Gifu Prefectural Gizan High School

Silver Prize= Proposal to Treat Sewage at Syowa Station Using the Sunlight Catalytic Activity

by Kenji Hamada (male, 13 years old)

of Gakushuin Junior High School (Tokyo)

Silver Prize= Observation of Floating and Falling Dusts in the Antarctic and Arctic

by Kanako Narita (female, 13 years old) and two colleagues

of Mizuho Town Mizuho Junior High School (Nagasaki)

Silver Prize= Power Generation Utilizing Blizard

by Toru Kuriyama (male, 13 years old)

of St.Viator Rakusei Junior High School (Kyoto)

Prize Winners at the Open Forum: Junior Contest on Polar Research II

The Second Open Forum on 17 December 2005

Gold Prize= Measurement of contamination degree of Polar Air Using Soap Bubbles

by Yuki Murata (female, 13 years old) and Tatsuya Imai(male, 13 years old)

of Oizumi Junior High School attached to Tokyo Gakugei University

Gold Prize= Examination of Basic Scientific Phenomena in the Polar Region, Part II: Focusing on the Terrestrial Magnetism, Power Generation Experiment by Cutting the Terrestrial Magnetic Field, Increased Power Generated in the Polar Region? Magnetic Field Detectable?

by Kohei Tsukada (male, 14 years old) and four colleagues

of Maebashi City the Fourth Junior High School (Gunma)

Platinum Prize= Research on the DNA and Evolution Process Through the Analysis of Organism Conserved in the Ice Sheet

by Korefumi Nakano (male, 16 years old)

of Eimeikan Senior High School (Tokyo)

Silver Prize= Observation of Air Contamination in the Antarctic and Arctic

by Maya Maeda (female, 14 years old) and three colleagues

of Unzen City Mizuho Junior High School (Nagasaki)

Silver Prize= Global Warming examined using Ossicles of Whales/Dolphins

by Yu Ono (male, 16 years old)

of Tennoji High School attached to Osaka Kyoiku University

Silver Prize= How Do the Ice Algae underneath the Sea Ice Survive at Low Temperature and under Poor Lighting

by Keigo Nagasakiya (male, 16 years old) and 37 colleagues

of Nagasaki Prefectural Yuukoukan High School

Silver Prize= Relation between the Brightness of Stars and the Air Conditions

by Ryutaro Sakai (male, 17 years old) and three colleagues

of Nagano Prefectural Suwa Seiryo High School

Silver Prize= Research on the Gravitational Acceleration and Coriolis in the Polar Region through the experiment of Pendlum

by Tomoyuki Inoue (male, 17 years old) and five colleagues

of Nara Prefectural Nara High School

Prize Winners at the Open Forum: Junior Contest on Polar Research III

The Third Open Forum on 17 December 2006

Gold Prize= Investigation of Microorganisms and Unpleasant Noxious Insects at Syowa Station

by Takashi Shibanuma (male, 14 years old) and six colleagues

of Honjo City Honjo-Nishi Junior High School (Saitama)

Platinum Prize= Global Observation Using the Ecology of Arctic Terns

by Yu Ono (male, 17 years old)

of Tennoji High School attached to Osaka Kyoiku University

Platinum Prize= Investigation of the Stress Degree in the Polar Region Using Medullas

by Remi Sato (female, 15 years old) and Ayako Yamasaki

of Shimabara City the Second Junior High School (Nagasaki)

Silver Prize= Research on the pH change in the Polar Hydrosphere and CO2 Absorption

by Naohiro Fujimura (male, 16 years old) and two colleagues

of Yamaguchi Prefectural Asa High School

Silver Prize= Research on the Behavior Rhythm of the Polar Bears and Fat Deposition

by Taku Kuroishi (male, 16 years old) and three colleagues

of Yamaguchi Prefectural Asa High School

Silver Prize= Aurora Observation and the Earth Environment

by Nozomi Yoshizawa(male, 17 years old) and three colleagues

of Nagano Prefectural Suwa Seiryo High School

Prize Winners at the Open Forum: Junior Contest on Polar Research IV

The Fourth Open Forum on 16 December 2007

Gold Prize= Examination of Basic Scientific Phenomena in the Polar Region, Part IV: Focusing on the Static Electricity, Are Snow Grains Charged in a Blizzard?

by Tomoyuki Oshima (male, 15 years old) and 14 colleagues

of Maebashi City the Fourth Junior High School (Gunma)

Platinum Prize= Light Emission at very high altitude and its relation to various phenomena observed in the Polar Region

by Toshihiko Takematsu (male, 17 years old)

of Nagano Prefectural Suwa Seiryo High School

Platinum Prize= How do the Emperor Penguin Parents Conserve the Food in the Body?

by Yuki Kawamoto (male, 17 years old) and four colleagues

of Yamaguchi Prefectural Asa High School

Silver Prize= Power Generation Utilizing Blizard, IV

by Toru Kuriyama (male, 16 years old)

of St.Viator Rakusei Senior High School (Kyoto)

Silver Prize= Sampling Foraminifera at Ocean Floor around the Antarctic and in the Arctic

by Shoichi Sano (male, 17 years old) and 19 colleagues

of Shizuoka Prefectural Shizuoka Chuo High School

Silver Prize= Observation of Snow Crystals and Vapor in the Antarctic

by Maiko Kokubo (female, 15 years old)

of Honjo City Honjo-Nishi Junior High School (Saitama)

Silver Prize= Research on the Genes of Penguins

by Hironobu Ueta (male, 16 years old) and three colleagues

of Yamaguchi Prefectural Asa High School

Prize Winners at the Open Forum: Junior Contest on Polar Research　V

The Fifth Open Forum on 14 December 2008

Gold Prize= Is the Freeze Dried Tofu Especially Tasty, if they are produced in the Antarctic ?

by　Miho Hatanaka (female, 16 years old) and three colleagues

of　Nagano Prefectural Suwa Seiryo High School

Silver Prize= Effective Temperature under Strong Wind

by　Toru Kuriyama (male, 17 years old)

of　St.Viator Rakusei Senior High School　(Kyoto)

Silver Prize= Development of Antarctic Yogurt Using Domestic Lactobacilli

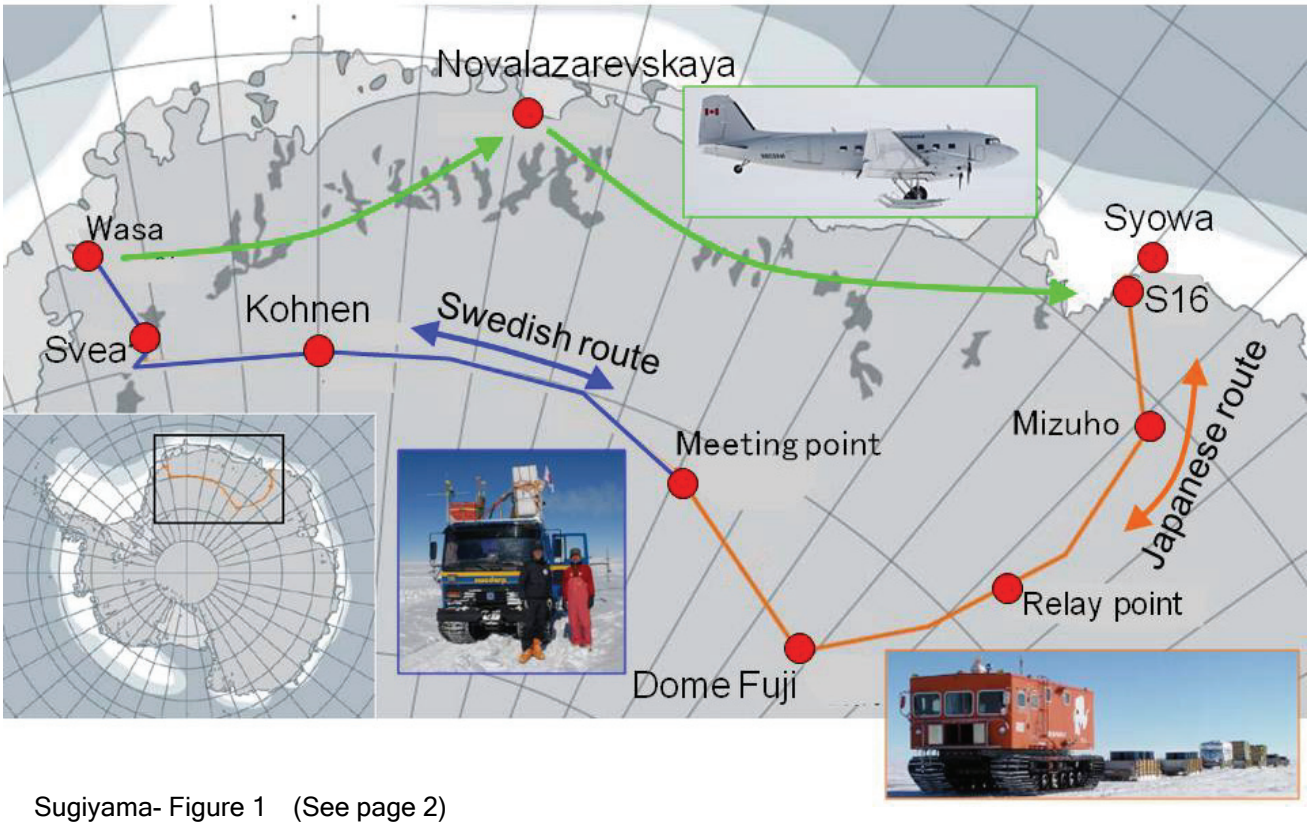
by　Keisuke Takanashi (male, 16 years old)

of　Edogawa Gakuen Toride High School　(Ibaraki)

Silver Prize= Improvement of the Power Generation Utilizing Peltier Device

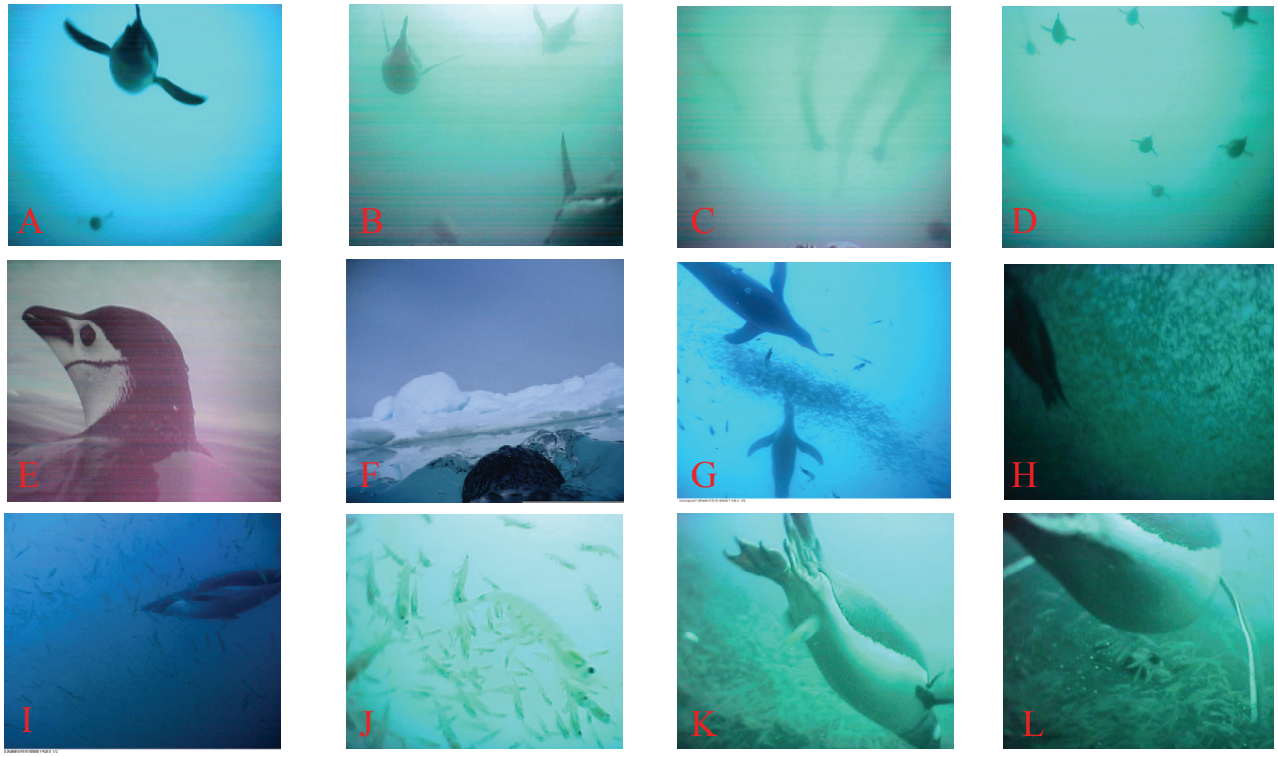
by　Reo Inomoto (male, 17 years old)

of　Nagasaki Prefectural Yuukoukan High School



Sugiyama- Figure 1 (See page 2)

The expedition routes of the Japanese-Swedish Antarctic Expedition 2007/2008.



Kokubun- Fig. 4. (See page 11)

Underwater pictures taken by camera loggers attached on the back of penguins. Each panel shows underwater group behavior (A to D), penguins on the sea surface (E, F), penguins feeding school of Antarctic krill (G to I), and school of Antarctic krill (J) and gentoo penguins feeding school of krill on the sea bottom (K, L)

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