—シンポジウム / 会合報告—
Symposium/Meeting Report

Report on workshop on the future Australian-Japanease Antarctic research cooperation

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将来の日豪南極研究協力体制に関するワークショップ

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（Received September 8, 2008; Accepted September 24, 2008）

要旨： 日豪両国間における南極研究の情報交換ならびに将来への協力関係の更なる発展と強化に資する目的で日豪南極研究協力体制に関するワークショップが2008年6月12日、オーストラリア南極局から4名、国立極地研究所から10数名の研究者の参加のもと開催された。研究協力、プロジェクトの検討及びその合意に向けて、さらにそれを両国の研究計画に反映させるためには、さらなる実務レベルでの話し合いが必要であるとの認識で一致した。本ワークショップは2009年前半までに日豪南極研究合同セミナーを開催する必要がある旨合意した。

Abstract: A workshop on future Australian-Japanese Antarctic cooperation was held on 12 June 2008 to exchange scientific information and to initiate a dialog to explore the way forward to further enhance and strengthen collaboration in Antarctic science between the two nations. The workshop was attended by four Australian Antarctic Division (AAD) scientists and more than ten National Institute of Polar Research (NIPR) scientists. Through a series of presentations detailing both countries' projects, and the following discussion, the workshop agreed that there are compelling reasons for holding a joint seminar between Australia and Japan by early next year to prioritize and agree to areas of collaboration, and outline the sorts of projects to be reflected in research plans of both countries.

1. Background

Collaboration in Antarctic science between Australia and Japan has a long history.

As early as 1911 a hand of friendship and support was held out to Lieutenat Nobu Shirase, the first Antarctic explorer in Japan, by a professor of geology at Sydney University, Professor Tennant William Edgeworth David, at a time when Japanese were regarded with suspicion in Australia. Lt. Shirase had failed to reach Antarctica on his first voyage south and

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南極資料, Vol. 52, No. 3, 527–538, 2008
Nankyoku Shiryô (Antarctic Record), Vol. 52, No. 3, 527–538, 2008

had not met with much support from Australia or New Zealand, or indeed from Japan, for his endeavours. Professor Edgeworth David expressed moral and intellectual support for Shirase's scientific objectives, in a letter written to Lt. Shirase on the latter's departure for his second attempt to reach Antarctica, currently held in the Mitchell Library, Sydney.

Since the 1960s, numerous intellectual exchanges and visits by scientists from both countries have been made, leading to a number of research collaborations at various levels, from individual to organization level *i.e*. Southern Ocean Continuous Plankton Recorder (SO-CPR) Survey, 2001/02 time serial four-ship survey, Collaborative East Antarctic Marine Census (CEAMRC), Collaborative geological investigations in Mawson Station, Enderby Land and the Pritz Bay region.

In 1985, when the *Nella Dan* (Australian research and resupply vessel) was locked in heavy ice and failed to be freed by the *Icebird*, it was the Japanese icebreaker RV *Shirase* which finally rescued her out of ice on 15 Dec. 1985. In 1998, the RV *Shirase* rescued the RSV *Aurora Australis* in Pritz Bay.

Strong links with the National Institute of Polar Research (NIPR) in Tokyo have built up over many years and not only in the field of scientific research. In 2009 Australia will arrange its research and re-supply vessel, the RSV *Aurora Australis*, to Japan for the supply of Syowa Station in Antarctica and for the conduct of joint scientific research. Joint collaborative studies on Antarctic oceanic plankton, sea-ice and the status of marine biodiversity have been conducted in recent years and there are plans to continue cooperative research into the future.

The Australian Prime Minister Mr. Kevin Rudd made a visit to Japan in early June, 2008. Quoting from his speech in Kyoto while visiting Japan (http://www.pm.gov.au/media/Speech/2008/speech_0294.cfm) he said:

Australia and Japan have a long history of working together on climate change. In fact, it is the focus of our Antarctic research cooperation. Because the Antarctic and the Southern Ocean play a major role in the global climate system. Later this week in Tokyo, our Antarctic scientists will get together to further strengthen our cooperation in Antarctic climate science. This work is a critical part of the puzzle to help us understand the pace, shape and trajectory of climate change. Their work provides the evidence in support of the call for more action on climate change, not less – and I look forward to taking forward our cooperation with Japan on Antarctic research when I meet Prime Minister Fukuda later in the week.

Further in the joint statement by the Prime Ministers of both Australia and Japan after both met in Tokyo (http://www.pm.gov.au/media/release/2008/media_release_0309.cfm; Japanese translation http://www.mofa.go.jp/mofaj/area/australia/visit/0806_ks.html), it states:

"*The two Prime Ministers recognized the important role of continued cooperation in scientific research in the Antarctic to support the understanding of the global impacts of climate change and confirmed their commitment to further enhanced cooperation in this area.*"

To coincide with Mr. Rudd's visit, as indicated in his Kyoto speech, a function was held in Tokyo jointly by the Australian Embassy in Japan and the Australian Antarctic Division (AAD) on 11 June 2008 to celebrate Australia – Japan cooperation in the Antarctic. The function brought together the leaders of both nations' Antarctic research programs to

acknowledge and celebrate a long and continuing history of scientific collaboration in Antarctica and in the Southern Ocean.

2. The workshop

A workshop was held on the day after the Embassy function to further exchange scientific information and to initiate a dialog to explore the way forward to further enhance and strengthen collaboration in Antarctic science between the two nations.

Four presentations by AAD scientists were given in the morning session and six presentations were made by the NIPR scientists in the afternoon, followed by an overall discussion co-chaired by Prof. K. Shiraishi (NIPR) and Dr. S. Kawaguchi (AAD).

The four Australian scientists presented reports on air transport developments, krill biology, plankton studies, and ice science. Six NIPR scientists gave presentations on the new era of JARE (Japanese Antarctic Reseach Expedition) starting with the 51st JARE, Dome Fuji ice core studies, microbial terrestrial biology, the carbon cycle, evolution of Gondwana, and upper atmospheric physics in Antarctica.

The abstracts including recommendations for future collaboration from each presenter are attached to the end of this report as appendices.

Through all the presentations, the group recognised the diversity of topics in the collaboration currently running at individual levels and also saw further potential in many different discipline areas.

Both countries have strengths and weaknesses in their Antarctic programs. It was noted that sharing of scientific expertise, resources, including flexible shipping opportunities, effective use of air-links, research facilities on the continent and back ashore are needed to further enhance efficiency and strengthen science in Antarctica.

Antarctic research in both countries is not limited to AAD and NIPR scientists. Inclusion of such Antarctic scientists is thought to be important to extend and maintain our scientific horizon.

The workshop recognised that in order to maintain and build on our current collaboration we need to encourage and mentor young scientists as the next generation of collaborators.

Organisational structures and the conduct of Antarctic research are different between the two countries. It is important to specify the time frame as well as the collaboration content itself to be practical and be structured to fit the situations of both countries.

Australia is currently in the process of revising its science strategy (to start in 2009/10) which will likely emphasize the need for enhanced climate change research. It was noted to be beyond the capacity of a single country and therefore needs international collaboration.

NIPR is scheduled to be soon renewing its mid-range plan (6 years) starting from 2010 (fiscal year).

The workshop agreed that there are compelling reasons for holding a 2-day joint seminar between Australia and Japan later this year or early next year (perhaps in March 2009?) to prioritize and agree on areas of collaboration, and outline the sorts of projects to be pursued.

The workshop further agreed on the importance of close communication between the nominated liaisons of the AAD (Dr. S. Kawaguchi) and NIPR (Prof. K. Shiraishi) as well as firm commitments by the relevant scientists to make sure both organizations form common understandings as the plan proceeds.

Examples of issues to be dealt with in the period leading up to the seminar are (not inclusive):

- Approval for holding such seminar by both directors (ASAP)
- Timing of the seminar/tentative venue (by Sept. 2008)
- Consideration for funding (as soon as practical)
- Terms of reference (by Aug. 2008)
- Decision on format of the seminar (by Dec. 2008)
- Themes to be dealt with (by Oct. 2008)
- Sounding of governmental agencies and universities to be involved (by Nov. 2008)
- Nomination of the attendees (by Dec. 2008)
- Pre-seminar communications between the attendees within each theme (Dec. 2008 onwards)
- Logistics of the seminar (at appropriate timing)

Due to absence of both directors at the workshop, the workshop unanimously agreed to recommend to both directors that such a seminar be held*.

APPENDIX: Summary of the presentations on 12th June 2008

Morning session:

Australia's program of scientific research in Antarctic and the Southern Ocean
—On the occassion of a celebration of scientific cooperation between Japan and Australia—

1) Australian Antarctic aviation

Michael Stoddart (Chief Scientist, AAD)

In the 2007/08 Antarctic season Australia inaugurated the Hobart-Casey air link. Using an Airbus A319 aircraft fitted with long-range fuel tanks, the journey from Hobart to Antarctica takes 4.5 hours. The A319 has sufficient fuel capacity to be able to return to Hobart without needing to refuel. Wilkins runway in Antarctica is situated about 70 km from Casey Station and land transfer is accomplished using a tracked passenger vehicle. The runway is situated on blue ice capped with compressed snow which acts to insulate the ice surface against summer melting. A summer camp at Wilkins houses the staff necessary to prepare the runway before each landing, and to undertake runway maintenance duties.

The air service is fully operational from the start of the 2008/09 Antarctic season when it is expected there will be weekly flights, subject to weather conditions. The flying season in 2008/09 will be from November until February. A high throughput of scientists and other staff is expected and the amount of scientific work which can be achieved is expected to rise.

2) Japan-Australia collaboration in marine biology

Graham Hosie

(Environmental Protection & Change Program, AAD)

There have been numerous exchanges of scientists between our countries over the last 25 years. These have been for individual research projects or to participate in various symposiums and workshops. Exchanges have been between laboratories and also between

*Footnote: This was approved by the both directors by the time of this workshop report preparation in August 2008.

Japanese and Australian research ships. Within the last decade, Australia and Japan have developed much more substantial collaborative projects that have involved the exchange of personnel, the sharing of resources, such as ships and equipment, and joint sharing and ownership of data.

The SO-CPR Survey commenced in 1991 for the purpose of mapping the biodiversity of plankton in the Southern Ocean and then to use the sensitivity of plankton to environmental change as early warning indicators of the health of the Southern Ocean. The SO-CPR Survey was initiated by the AAD and only involved Australia until Japan joined the survey in 1999 and commenced towing CPRs regularly on *Shirase*, and later on *Umitaka Maru* from 2003 with the Tokyo University of Marine Science and Technology. Other Japanese oceanographic vessels have been used opportunistically. Japan saw value in participating in the survey to understand climate change effects and to augment the existing JARE Norpac net plankton survey collected annually since 1972 (JARE-14). Japan and Australia are the major partners in the survey collecting 88% of the data. Our success has led to Germany, New Zealand, Great Britain, USA and Russia joining the survey, with France and South American countries seeking involvement. SCAR (Scientific Committee on Antractic Reseach) has given official recognition to the survey as an international program, and created the Action Group on CPR Research (CPR-AG) co-chaired by Dr. Graham Hosie (AAD) and Prof. Mitsuo Fukuchi (NIPR). The survey has produced a massive data set on plankton covering >70% of the Southern Ocean, with more than 27000 samples for >200 species coupled with environmental data. The survey contributes to the Census of Antarctic Marine Life (CAML), it is used by the Commission for the Conservation of Marine Living Resource, and is a foundation component of the Southern Ocean Observing System. It is the largest data set in the SCAR Marine Biodiversity Information Network (SCAR-MarBIN). Analysis by Australia and Japan has shown a significant change in species composition in the sea ice zone around year 2000 with very small zooplankton now dominant instead of krill. Post-doctoral fellow Dr. Kunio Takahashi identified another major change with pelagic foraminiferans increasing in abundance in both the permanent open ocean and sea-ice zones in 2004/05 from a long term average of 2% dominance to >50%. These events could have a significant impact on the rest of the ecosystem.

In 2001/02 Prof. Mitsuo Fukuchi coordinated a multi-ship multidisciplinary survey along 140ºE to look at seasonal changes in the sea-ice zone. This involved four ships from Australia (*Aurora Australis*) and three Japanese vessels (*Hakuho Maru*, *Shirase* and *Tangaroa* – on charter from New Zealand). The study produced a comprehensive understanding of the ecology sea-ice zone, especially seasonal changes in distribution and grazing of krill, salps and other plankton, in relation to physical-chemical oceanography. The results confirmed that it was an area requiring further study and this laid the foundation for the CEAMARC Survey in 2007/08 IPY (International Polar Year).

CEAMARC was the Australian-French-Belgian-Japanese contribution to CAML and was the flag project for CAML. Three ships from Australia (*Aurora Australis*), France (*Astrolabe*) and Japan (*Umitaka Maru*) worked together in the region between Dumont d' Urville and the Mertz Glacier conducting a comprehensive study of the pelagic and mesobathy-pelagic plankton and fish, demersal fish and benthos, physical and chemical oceanography and geomorphology. Video and still images of the benthic and pelagic communities were also collected. The three ships conducted 45 days of sampling, collecting

about 1000 samples from more than 130 sites. Nearly 200 personnel were involved from several countries. 22 key papers have been identified already. As with the SO-CPR and 2001/02 surveys, numerous students were involved and 15 PhD and MSc thesis are likely to be produced, the majority are Japanese. This project has been a great success for Japan and Australia. Further, it has brought France and Belgium into the collaboration group and likely to lead to future monitoring of the CEAMARC area by all four countries.

The next major collaboration is the joint JARE-50 resupply of Syowa and marine science program on *Aurora Australis*. There is no doubt that this will be another success based on our past collaboration. We should continue to develop new collaborative projects of mutual benefit, and for the wider Antarctic community, and encourage other nations to join us.

3) Overview of Australian glaciology research: past, present, future

Tas van Ommen

(Glaciology Research Coordinator, AAD)

This presentation is intended as a general overview of the structure and major activities of Australian glaciological research with some emphasis on links with Japanese Antarctic research and a look toward future potential directions of joint interest.

Glaciological research within the Australian Antarctic program is a component of the ice, ocean, atmosphere and climate theme. This theme studies the physical components of the cryosphere with a specific focus on understanding the climate system. Some of the work involves partners outside of AAD, with major contributions by CSIRO (Commonwealth Scientific and Industrial Research Organization), Bureau of Meteorology and University of Tasmania. These partners and AAD are jointly members of the Antarctic Climate and Ecosystems Cooperative Research Centre (ACE-CRC).

Glaciology research is organized into three main components which study sea-ice, the continental ice-sheet, and ice core climate records.

Sea-ice research is the aspect of the glaciology which has enjoyed the closest connection between Australian and Japanese researchers, mostly from Institute of Low Temperature Science, Hokkaido Univ. This work includes multidisciplinary sea-ice cruises: ARISE (Antarctic Remote Ice Sensing Experiment) in 2003 and SIPEX (Sea Ice Physics and Ecosystem Experiment) in 2007. Some examples of this work are also given in the presentation. Joint studies are also being undertaken to study fast-ice, and polynyas, using remote sensing and in support of Japanese IPY activities in the Cape Darnley Polynya. This includes a JAXA (Japan Aerospace Exploration Agency) sponsored project which provides access to Japanese SAR (synthetic aperture radar) imagery and also includes a coastal monitoring network for studying fast-ice.

Ice-sheet research has limited links with Japanese research in this area, although joint work in the past has centred on ice mechanics, studying ice flow relationships with crystal fabrics. Common links also exist in computer modelling which could provide a basis for greater collaboration in future. The main areas of ice sheet research within the Australian program are ice-sheet modelling, observational mass-balance, ice-shelf/ocean interaction and remote sensing. The program also supports a network of automatic weather stations. Highlights of recent research include the AMISOR (Amery Ice Shelf Oceanographic Research) program which has penetrated the Amery ice shelf with four boreholes, providing

insight into the sub-shelf environment. The work also integrates with the older Lambert Glacier Traverse and remote sensing to provide measurements of mass balance through this major drainage basin.

Ice core research has centred on the high resolution climate history from the Law Dome ice cores—extending back to around 90 thousand years. Key results from this work include high resolution synchronization of Antarctic deglacial changes with those from Greenland, detailed record of greenhouse gas changes over the past 2000 years, and reconstructions of sea-ice extent from methanesulphonic acid. Links with Japanese research have been principally through overlapping interests in the SCAR-ITASE (International Trans Antarctic Scientific Expedition) project and the new IPICS (International Partnerships in Ice Core Sciences) initiative.

In the future, IPICS proposes the recovery of the oldest ice from Antarctica by drilling two or more deep ice cores. Japan and Australia are among the nations who have expressed interest in such drilling, and this could provide the basis of a major new collaboration in the coming decade.

4) AAD's live krill research program and its link to Japan

So Kawaguchi

(Southern Ocean Ecosystems Program, AAD)

There is a unique twenty five year tradition of experimental investigations into the biology of Antarctic krill at AAD and at sea as part of the Australian Antarctic research program.

Australia's krill research program was first founded by Dr. Tsutomu Ikeda in the early 1980s when he joined AAD. The current leader of the krill program is Dr. So Kawaguchi. The experimental krill aquarium in Hobart has many Japanese research visitors who join the program for study periods.

The current krill program covers a wide range of research topics using various approaches including field surveys to understand biomass, ecology and distribution of krill in the Southern Ocean, experimental approaches into krill biology, and analysis of krill fishery and fishery dynamics.

The Antarctic Division is currently the only research institution outside Antarctica that maintains a stock of live Antarctic krill for experimental purposes. This experimental research program has operated continuously since 1981 and has provided information about krill that has fundamentally altered our understanding of krill life history. Currently, the experimental krill research program mainly focuses on obtaining information that can be of use in managing the krill fishery, which is the largest Antarctic fishery and has the potential to be one of the world's largest fisheries. In particular, the program concentrates on studies into growth, aging and reproduction of krill.

Underlying these studies is research that leads to optimizing the collection and maintenance conditions of krill so that a wider range of studies can be tackled. Our recent success in inducing natural behaviour such as schooling and reproduction in the aquarium further enables us to obtain experimental results of high quality, and relate these to observations from the field in confidence. It also greatly advances our knowledge of realistic energetics of this species, and contributes to the development of growth, life history and distribution models.

Further, in recent years global warming and resulting climate changes have received considerable global attention, and this is of course within the scope of our collaboration with Japan. Research into the relation between krill feeding of ecology and its impact on dimethylsulfide (the global warming regulatory compounds) from phytoplankton with NIPR, and study on impacts of rising CO_2 on krill biology with Nagasaki University, are currently running.

Australia values the past and current krill research collaborations with Japan, and is looking forward to further strengthen and extend our fruitful collaboration into the future.

Afternoon session:

Workshop on future Australian-Japanese Antarctic research cooperation

Topic 1) New era of JARE: Operations with new Japanese icebreaker and air links

Kazuyuki Shiraishi (Deputy Director (Polar Programs), NIPR)

JARE celebrated the 50th anniversary in the year of the IPY 2007–2008. At the same time, we are going to have a powerful new research vessel. On this occasion, NIPR considered the future of the Japanese Antarctic programs and their logistics support, viewing the forthcoming 10 years.

Our strategy consists of the following 5 basic visions:

- Open and sophisticated planning system
- Innovation in science and technology
- Safe and efficient operation
- Promotion of international collaboration
- Provision of information and promotion of outreach activity

The new six-year program will start in the fiscal year of 2010 and the main programs will be planned by the second half of 2009 on the basis of the above visions. We look forward to cooperating with Australian scientists in various fields of science.

Japan is one of eleven members of the DROMLAN (Dronning Maud Land Air Networks) consortium. We are planning to perform efficient Antarctic operation in terms of combination of the sea and air transportation in the future. Therefore, in addition to scientific collaboration, we would like to propose international collaboration in logistics support in the Antarctic.

Topic 2) Recent glaciological activities by JARE: Deep ice core drilling at Dome Fuji and other glaciological research

Hideaki Motoyama (Meteorology and Glaciology Group, NIPR)

JARE succeeded in drilling a deep ice core down to 3035.22 m in depth at Dome Fuji Station (77 º19’S, 39 º42’E, 3810 m a.s.l.) in January 26, 2007. The oxygen isotope profile of the Dome Fuji ice core suggests that the deeper part of the ice goes back 720000 years.

We have been conducting the following ice sheet surface observations in East Dronning Maud Land.

<Snow accumulation>

- Snow stake measurement

<Environmental observation>

- Surface snow sampling
- Pit observations

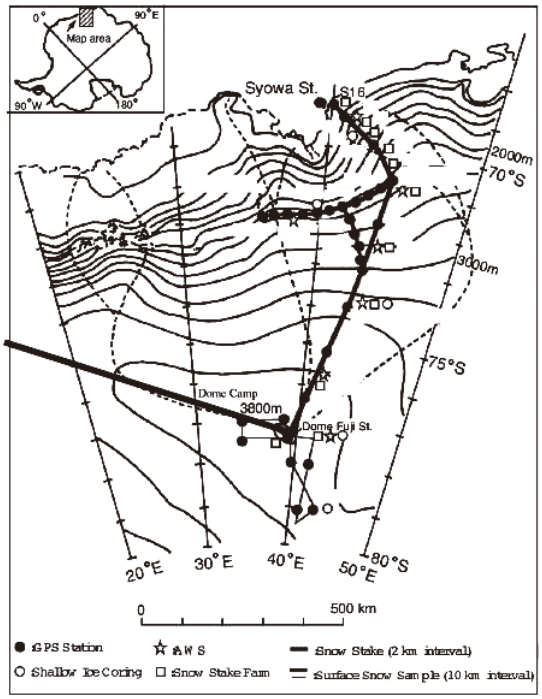

Fig. 1. Traverse routes for glaciological observations in Eastern Dronning Maud Land.

- Shallow ice coring
- Meteorological observation
- Automatic weather station

<Ice sheet dynamics>

- GPS observations
- Radar echo soundings
- GPR

Topic 3) Research on ecology and geohistory of Antarctic lakes

Satoshi Imura (Biology Group, NIPR)

Many researchers in AAD and NIPR have been working together on terrestrial biology in Antarctica under SCAR projects, such as BIOTAS (Biological Investigations of Terrestrial Antarctic System), RiSCC (Regional Sensitivity to Climate Change), EBA (Evolution and Biodiversity in the Antarctic) and Aliens. Now, the terrestrial biology group in NIPR is seeking an opportunity to visit Australian Antarctic territories.

REGAL (Research on Ecology and Geohistory of Antarctic Lakes) has been conducted from 1994 as a consortium project in NIPR, aiming to understand the structure and history of the ecosystem of Antarctic lakes and its catchment. This project covers a wide range of limnological science, from water quality, biodiversity, and photosynthetic activity, to paleoenvironmental study of sediment cores. In this stage, we are almost close to finishing clarifying the ecosystem of lakes in the Syowa Station area.

Now we are planning to extend our framework in the REGAL project to other lakes in the Antarctic coastal area (*e.g*., Bunger Hills or Vestfold Hills), and also to lakes in a more moderate climate (Sub-Antarctic Islands, *e.g*., Head Islands or Macquarie Island), as well as harsher environments ("deep freeze" inland ice free area, *e.g*., Prince Charles Mountains). As shown above, Australian Antarctic territories include all of the temporary candidate fields of our plan.

In the near future, we hope to collaborate with AAD, exchange scientists. The comparative study of the Antarctic lake system should be quite fruitful.

Topic 4) Long-term variation of oceanic CO_2 and possible acidification in the Indian sector of the Southern Ocean

Gen Hashida (Meteorology and Glaciology Group, NIPR)

Long-term monitoring of the partial pressure of CO_2 in the surface seawater (pCO_2) on-board the Japanese icebreaker *Shirase* has been carried out in the Indian sector of the Southern Ocean since 1987 as part of JARE. Meridional distributions of pCO_2 along 110 ºE in early December and along 150 ºE in late March clearly show steep changes at fronts including the Subtropical Front, Subantarctic Front, and Polar Front. pCO_2 of each zone divided by the fronts can be distinguished from the others by the difference of averaged pCO_2 in the zone. Although pCO_2 of each zone shows inter-annual variation, a secular trend is detectable. For example, the estimated rate of increase of pCO_2 in the permanent open ocean zone between the polar front (around 53ºS) and the northern edge of winter ice cover (63ºS) is about 1.5 atm/y, which is almost the same as the rate of increase of atmospheric CO_2 concentration. Oceanic acidification corresponding to pCO_2 increase is one of the most direct effects of increasing atmospheric carbon dioxide. Preliminary analysis of *p*H which has been observed on board *Shirase* and her predecessor *Fuji* shows gradual decrease from 1980 to 2005.

Topic 5) Geologic evolution of East Antarctica & Gondwana: connection from Prydz Bay through Enderby Land to Lützow-Holm Bay: collaboration between ANARE (Australian National Antarctic Reseach Expedition) & JARE—past & future

Tomokazu Hokada (Earth Science Group, NIPR)

Since 1966, Australian and Japanese geologists have carried out a collaborative geologic field survey under both Australian and Japanese Antarctic programs. Based on the intensive exchange of geologists between the two programs and also laboratory analytical collaboration, our understanding of the geologic history of the area from Prydz Bay (PB) through Enderby Land to Lützow-Holm Bay (LHB) has progressed. PB and LHB share the similar tectonic signature (the high-grade metamorphic terranes) and ages (～500 million years ago), but it is still not clear how these two terranes were connected to each other. Further geological field study in these areas is needed, and we would like to promote much more collaborative field operations with Australian geologists joining JARE programs and Japanese geologists participating in Australian Antarctic programs.

Enderby Land (noted as the Napier Complex) located between PB and LHB, possesses unique geologic features, such as the Earth's oldest crust (>4.0–3.8 billion years ago) and the Earth's hottest crust (>1100–1150ºC). This area has attracted great interest from geologists worldwide, but very few geologists can reach this area because of its remoteness. Also

important for this area is the conjugate position of Archaean-Proterozoic-Cambrian tectonic provinces in East Antarctica. From these view points, geological field operation in this area has been desired by many geologists. The Japanese Antarctic program is now conducting a 3-year Sør Rondane Mountains geology program between 2007 and 2010. After this program, we are planning to go back to the geology field operation at Enderby Land. We expect Australian geologists to have a chance to participate in our field program in this area.

Enderby Land is almost the easternmost end of the DROMLAN operation area, and is also the westernmost end of the Australian CASA (Civil Aviation Safety Authority) air operation area. This area can be a key for the connection of these two air networks, and we are seeking potential co-operation between ANARE and JARE in this area, *e.g*., preparation of a fuel depot and/or survey of a potential airstrip.

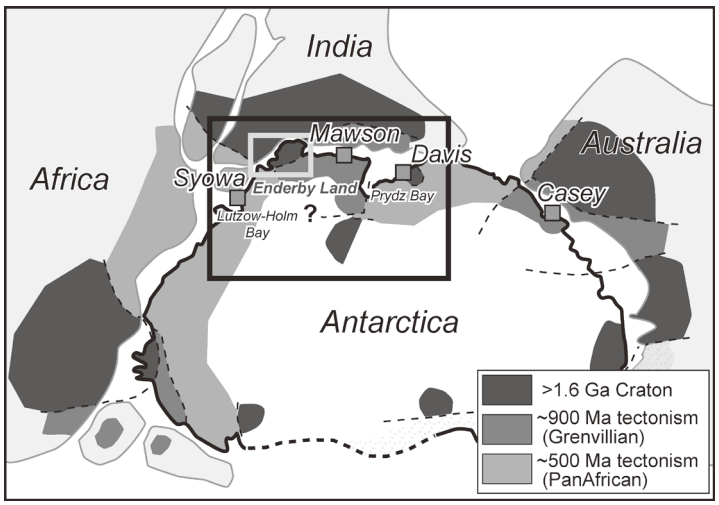

Fig. 2. Reconstruction and geological sketch map of Gondwana supercontinent 500 million years ago. The rectangle shows the potential target area for collaboration.

Topic 6) Australia-Japan collaboration in upper atmosphere physics: present and future

Hisao Yamagishi (Space and Upper Atmospheric Sciences Group, NIPR)

The Space and Upper Atmospheric Sciences Group has collaborated with Australian researchers in the following observations in Antarctica.

1. MF radar at Mawson and Davis (network observation with Syowa MF radar)
2. Imaging riometer at Davis (stereo-scopic observation with Zhongshan riometer)
3. Tigar HF radar (SuperDARN network observation with Syowa HF radars)

In addition to these past and on-going collaborations, we have possibilities of the following future collaborations.

1. Unmanned magnetometer network observation

We have been deploying unmanned magnetometers in east Dronning Maud Land ~ west Enderby Land since 2003 (Fig. 3), which forms a part of the Antarctic magnetometer network proposed in the IPY ICESTAR (Interhemispheric Conjugacy Effects in Solar-Terrestrial and Aeronomy Research) program. Magnetometers at Mawson and Davis stations will increase

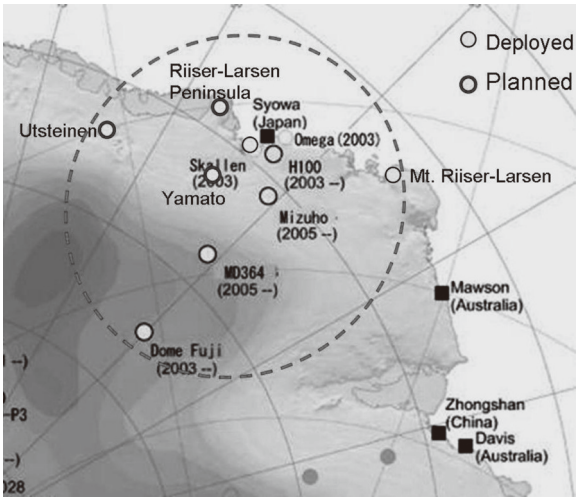

Fig. 3. Unmanned magnetometers deployed, or to be deployed, by the Japanese Antarctic Reserach Expedition.

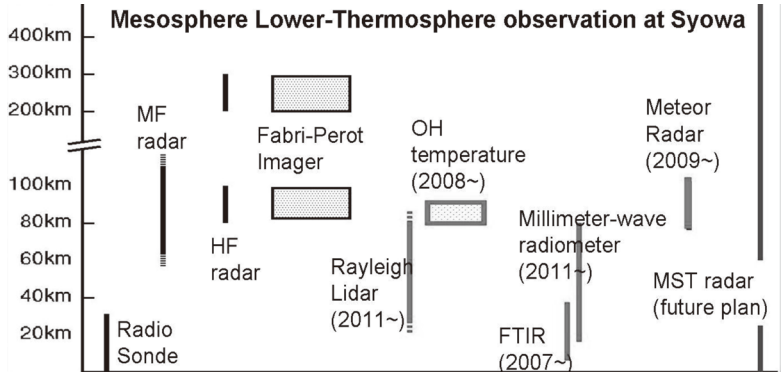

Fig. 4. Instruments for optical and radio-wave remote sensing of the mesosphere and lower-thermosphere installed, or to be installed, at Syowa Station.

the coverage of this network in MLT and MLAT.

2. Mesosphere, Lower-thermosphere remote sensing from the ground

We have a plan to install various advanced instruments at Syowa Station for optical and radio-wave remote sensing of the mesosphere and lower-thermosphere.

Fig. 4 shows the name of instruments, planned year of deployment, and altitude range of observation. Similar instruments are already working at Mawson and Davis Stations, and we are interested in comparing the data obtained at different local times.