

MEMBER COUNTRY: CHINA

National Report to SCAR for year: 2013/14

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NATIONAL ANTARCTIC DATA CENTRE

National Arctic and Antarctic Data Center of China

SCAR DATABASE

insert name of database for which your country has responsibility

National Arctic and Antarctic Data Center of China

A BRIEF SUMMARY OF SCIENTIFIC HIGHLIGHTS*:**National SCAR Committee****Title** Chinese Advisory Committee for Polar Research**Address** No.1, Fuxingmenwai Ave., Beijing, 100860, China**Telephone** 86-10-6803 6469**Fax** 86-10-6801 2776**E-mail** chinare@263.net.cn**Chairman/President Convener:** Chen Lianzeng**Representatives: to SCAR**

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Permanent Secretary	Delegate/SCAR Prof. Yang Huigen	451 Jinqiao Road, Shanghai 200129

National Operating Agency**Title:** Chinese Arctic and Antarctic Administration**Address:** No.1, Fuxingmenwai Ave., Beijing, 100860, China**Tel:** 0086 10 68036469**Fax:** 0086 10 68012776**E-mail:** chinare@263.net.cn**Chief Executive:** Qu Tanzhou**SCIENTIFIC HIGHLIGHTS**

1. Introduction

The 30th Chinese National Antarctic Research Expedition (CHINARE-30, 2013/2014) was composed of 257 personnel, including 83 Chinese scientists. In the early of NOV. 2013, some of the team member flew to Antarctica, and others went there by Chinese vessel "Xuelong". The over-wintering team of CHINARE-29 and the summer team of CHINARE-30 returned to China on April 11th, 2014.

	Great Wall Station		Zhongshan Station		Grove Mountains
	Summer Season	Overwintering	Summer Season	Overwintering	Summer Season
Scientists	22	3	3	7	6
Logistic Personnel	25	11	11	11	3
Others	155				
TOTAL	257				

2. Stations in Antarctica

Wintering Station

Name	Location	Coordinates
<i>Great Wall</i>	King George Island	62°12'59" S 58°57'52" W
<i>Zhongshan</i>	Larsemann Hills	69°22'24" S 76°22'40" E

Summering Station

Name	Location	Coordinates
<i>Kun Lun</i>	Dome A	80°25'01" S 77°06'58" E
<i>Taishan Camp</i>	Princess Elizabeth Land	73°51'S 76°58'E

3. Main scientific activities

The People's Republic of China

National Programs/Projects by Working Group 2013/2014

Geodesy and Geographic Information

Subject	Investigation	Locality	Duration	Principal Investigator	Add
Surveying	2013 International Epoch GPS Campaign	Great Wall	2012/2013		1

Physics and Chemistry of the Atmosphere

Subject	Investigation	Locality	Duration	Principal Investigator	Add
Meteorology	Observation	Great Wall	2012/2013	Ding Zhuoming	2
AVHRR	Receiving	Great Wall	2012/2013	Ding Zhuoming	2
Meteorology	Observation	Zhongshan	2012/2013	Zhao Wenjie	2
AVHRR	Receiving	Zhongshan	2012/2013	Zhao Wenjie	2
Ozone	Observation	Zhongshan	2012/2013	Zhao Biao	2
UAP	Recording	Zhongshan	2012/2013	Hu Zejun	3

Geomagnetism

Subject	Investigation	Locality	Duration	Principal Investigator	Add
Geomagnetism	Recording	Zhongshan	2012/2013	Xie Haiyong	4

Other Programs/Projects

Subject	Investigation	Locality	Duration	Principal Investigator	Add
Traverse	Sampling	Grove Mountains	2013/2014	Miao Bingkui	5

(S)= Summer project only

The list of principal investigators & responsible authorities 2013/2014

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3.Mr. Hu Hongqiao Polar Research Institute of China No.451, Jingqiao Rd. Shanghai City	4.Mr. Ning Baiqi Institute of Geology and Geophysics, CAS No.11, Datunlujia Rd. Chaoyang District, Beijing 100101
5.Mr. Sun Bo Polar Research Institute of China No.451, Jingqiao Rd. Shanghai City	

Major Progress and Results of Polar Scientific Projects 2013/14

Earth Science

(1) Deep ice detecting and changing research of the Antarctic ice sheet

Multiple sets of ice radar systems, including both a deep ice penetrating radar system and a shallow FMCW (Frequency-Modulated Continuous-Wave) radar system developed independently by China, were used in inland ice sheet surveying during the 29th Chinese National Antarctic Research Expedition. The high quality resulting radar data in the field season make China the second country after the United States has this deep ice detecting technology. With the further survey in central region around Kunlun Station and key areas along the Chinese inland traverse using ice radars, the maximum resolution three-dimensional deep ice structure and subglacial topography was found until now. The important discoveries, such as the evidence of the fast growth of the ice sheet from the bottom in three dimensional radargram, will provide new insight to the research of the ice sheet instability and global sea level changing.

(2) The structure and origin of domed-shape sedimentary bodies in the uplift zones of Prydz bay

By collecting the reflection seismic data, the tectonic evolution was divided into four episodes: pre-rift, breakup, post-breakup pre-glacial and post-breakup glacial. The age and relationship in different stratigraphic units were constrained with drilling data. The submarine fans were found under the bottom boundary of glacial sediment, which maybe relate to the initial rifting of Gondwana. Six domed-shape sedimentary bodies were identified in the uplifted zone. Submarine canyons and channels may play a great role on the stripline shape sedimentary bodies.

(3) Study on Geochemistry and geochronology of Mesoproterozoic basement rocks from the eastern Amery Ice Shelf and southwestern Prydz Bay, East Antarctica

The high-grade metamorphic rocks from the eastern Amery Ice Shelf and southwestern Prydz Bay of East Antarctica represent reworked Rayner Complex during the Pan-African metamorphism. These Mesoproterozoic basement rocks can provide important information for the earlier tectonic evolution of the Rayner orogen. Based on a combined geochemical and geochronological study of the rocks, a new tectonic model was proposed for the Rayner orogen, involving the collision of several island arcs with East Antarctica (the Lambert Terrane or the Ruker craton) followed by the closure of ocean and final collision of the Indian craton with the newly accreted Antarctic margin during the Grenvillian time.

Life Science

(1) An Antarctic fungus from which red pigment can be extracted has been found

With Multiphase Classification Methods, taxonomic studies were carried on a fungus isolated from deposits of intertidal zone close to the shore of China Antarctic Great Wall Station. This fungus has been found to be aerobic, moderately salt tolerant and cold-resistant, and its cells exuded pigment into the fermentation broth. This pigment is similar in function to Carmines.

(2) Impacts of fresh water input on nutrients distributions in the Great Wall Bay and Ardley Bay and its ecological effects

In summer, the salinity of water column increased with the depth in the Great Wall Bay and Ardley Bay. The distribution of salinity increased gradually from the inner to the mouth of Great Wall Bay and Ardley Bay. Nutrient concentrations of the runoff which flow into the Great Wall Bay and Ardley Bay were generally very low, suggesting that the rivers water, snowmelt water, and glacier melt water played diluting effect for nutrients in the bays. The only land-source of phosphate and nitrate was runoff from the southeast of the Ardley Island, where numerous penguins habituated and bird dung enriched phosphorus and nitrogen. The average concentrations of Chl a in two bays were 1.34 $\mu\text{g/L}$ and 1.09 $\mu\text{g/L}$, respectively. High value occurred in surface water of station G4 near the mouth of the Great Wall Bay (3.08 $\mu\text{g/L}$), and surface water of station A2 and A3 located at the center of Ardley Bay (1.49 $\mu\text{g/L}$), while low value appeared in the bottom water of mouths of both bays. The vertical distribution of Chl a in the Great Wall Bay was completely different between the mouth of bay and inner bay, which display increase with depth in the inner bay, however high in surface and low in bottom at bay mouth.

(3) Review of fossil, sub-fossil, archaeological, and biogeochemical remains of marine vertebrates in polar sediments: A study on biological responses to climate and environmental changes in remote Polar Regions

Biological responses to climate and environmental changes in remote Polar Regions are of increasing interest in global change research. Terrestrial and marine polar ecosystems have suffered from impacts of both rapid climate change and intense human activities, and large fluctuations in the population sizes of seabirds, seals, and Antarctic krill have been observed in the past decades. To understand the mechanisms driving these regime shifts in polar ecosystems, it is important to first distinguish the influences of natural forcing from anthropogenic activities. Therefore, investigations of past changes of polar ecosystems prior to human contact are relevant for placing recent human-induced changes within a long-term historical context. The study focused the review on the fossil, sub-fossil, archaeological, and biogeochemical remains of marine vertebrates in polar sediments. These remains included well-preserved tissues such as bones, hairs and feathers, and biogeochemical markers and other proxy indicators, including deposits of guano and excrement, which can accumulate in lake and terrestrial sediments over thousands of years. Analyses of these remains have provided insight into both natural and anthropogenic impacts on marine vertebrates over millennia and have helped identify the causal agents for these impacts. Furthermore, land-based seabirds and marine mammals have been shown to play an important role as bio-vectors in polar environments as they transport significant amounts of nutrients and anthropogenic contaminants between ocean and terrestrial ecosystems.

Physical Science

(1) Statistical characteristics of ionospheric backscatter observed by SuperDARN Zhongshan radar in Antarctica

The diurnal variation of SuperDARN Zhongshan radar echoes and the influence of geomagnetic activity on it have been analyzed from 241 days of Zhongshan HF radar data from April, 2010 to February, 2011. The result showed that the diurnal variation was very obvious and the influence of geomagnetic activity was significant. The peak echo occurrence occurred at dayside during geomagnetic quiet times, and shifted toward night side and exhibits an obvious decrease with the increasing geomagnetic level. The result also indicated that the average I-o-s velocity had obvious diurnal variation. At nightside, the velocity was mainly positive and toward the radar, but negative and away from the radar at dayside. The average power and the I-o-s velocity were apparently higher in geomagnetic active times than that during quiet times. In contrast, the echo occurrence and Doppler spectral width were lower.

(2) Process and Research of Antarctic Survey Telescope data

The first Antarctic Survey Telescope (AST3-1) was equipped with the largest single-piece 10K×10K CCD ever used in astronomy. In this year, 29th Antarctic expedition team has acquired 20 thousand image frames from AST3-1, which added up to 1.6 TB data. A semi-automatic pipeline was developed to process the raw data, and extract photometric information and built catalog of point sources. Using the data, researches on supernova, exoplanets, blazars and quasars were carried out and primary results have been achieved. As an example, the AST3 image of quasar PKS0558-504 is shown in the left panel of the following figure, while the light curve of the same object is shown in the right panel.

(3) Study on water contents and hydrogen isotope of melt inclusion and apatite of Antarctic Martian meteorite GRV 020090

The water contents and hydrogen isotope of melt inclusion and apatite of Antarctic Martian meteorite GRV 020090 recovered by CHINARE were determined by nanoSIMS. The melt inclusions showed a logarithmical correlation between the water contents and the hydrogen isotopes, indicative of interchange between rock and Mars atmosphere. The calculated hydrogen isotope of Mars atmosphere was 5860 ± 150 ‰, consistent with that of Curiosity rover. Furthermore, the melt inclusions showed significant hydration profile, indicative of interaction between the parent rock and liquid underground water. The hydration profiles were likely produced by post-crystallization diffusion of Martian underground water, a robust line of evidence for past-presence of liquid water on Mars. Diffusion simulation of the hydration profiles of both water contents and δD values constrained the duration of liquid water up to 130,000-250,000 years at 0 °C or 700-1,500 years at 40 °C. The apatite showed a positive correlation between the water contents (0.10-0.65 wt%) and the δD values (737-4239 ‰), which can be explained by addition of water due to assimilation of D-enriched Martian crustal materials and enhancement of water via fractional crystallization. Our estimation based on the least contaminated apatite from GRV 020090 turned out a low water content of the primordial parent magma (380-750 ppm), which should have been derived from a relatively dry Martian mantle reservoir (~38-75 ppm H₂O).