

An investigation of 330 km glaciological profile from Zhongshan Station to inland of Antarctica^{*}

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After several years preparation, the 13th Chinese Antarctic Research Expedition (CHINARE) successfully carried out an investigation of Ice Sheet in a range of 330 km from Zhongshan Station to inland of Antarctica in 1996 – 1997. In this investigation, surveys were made of the mass balance features, meteorological characteristics and snow pit strata, and samples from the surface, snow pit and ice core were collected. This investigation attaches emphasis on the mass balance of ice sheet, the environment evolution in the last 200 a and the exchange process of ice-snow with atmosphere.

1 Background and scientific problem

About 98% area of Antarctic Continent is covered by ice sheet, whose thickness is about 2450 m. The existence of ice sheet makes Antarctica become a cold source of earth climatic change, greatly affecting the atmospheric change and oceanic circulation. The mass balance of ice sheet causes the fluctuation of sea level. Climatic and environmental records contained in snow and ice have high resolution, continuity, and more information, recording the background characteristics of climate and environment of earth and the change of magnificent environment because of the characteristics of snow and ice. The research of geology and geophysics in Antarctica is very important to reveal the history of split and drift of ancient Gondwana continent. This research help us to known the ice sheet characteristics of Antarctica. So the inland ice sheet become the important problem of Antarctic research.

The sector area from Zhongshan Station to the highest point of Dome A is little known in Antarctica research. The plateau area of Antarctic inland ice sheet is named “inaccessible area”. It is one of the most crude areas on the earth, and is also an uninvestigated area in Antarctic research. The glaciological and geological profile extending from Zhongshan Station to Dome A and even to South Pole is very important to understand this area. The investigation will be greatly contributive to International-

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al Trans-Antarctic Scientific Expedition(ITASE) and Global Change and the Antarctic(GLOCHANT) Programmes.

With a view to clarify the relationship between Antarctic ice sheet and globe change and their mutual influence, according to the core problems of GLOCHANT and ITASE, the following research and observation will be performed in the Trans-Antarctic Scientific Expedition Project from Zhongshan Station to Dome A: (1) Accurate observation of the mass balance on the surface of ice sheet; (2) Research on snow and ice record in the environmental change since last 200 a; (3) Research on the interface between ice, snow/atmosphere.

2 Performance and preliminary result of the first CHINARE Antarctic inland expedition

The first Chinese Antarctic inland expedition consisted of 8 members, they come from Polar Administration of SOA, Polar Research Institute of China, Lanzhou Institute of Glaciology and Geocryology, Chinese Academy of Sciences, Wuhan Technical University of Surveying and Mapping, and Glaciology Division of Antarctic Bureau, Australia respectively.

Research route is from Zhongshan Station at Larsemann Hills to Dome A, acrossing hypsographic curve along longitude line. The expedition started from Jan. 18, 1997 to Feb. 1, 1997, took a period of 15 d, penetrated into inland of ice sheet as far as 330 km. During the expedition, the members kept working while travel with a speed of about 5 km/h, every day they travelled about 30 – 45 km. The farthest place is at 71°52'59"S, 77°57'E, altitude is 2350 m(Fig. 1).

From the edge of ice sheet, the expedition had performed GPS positioning, mass balance measurement and landform observation of ice sheet at an interval of 2 km along the research route, collected surface snow sample and shallow snow pit sample at an interval of 4 km, dug four 1.5 – 2.6 m snow pits at the altitude of 1030 m(69°55'16"S, 76°29'35"E), 1850 m(70°49'59"S, 77°31'1"E), 2080 m(71°11'11"S, 77°21'5"E) and 2320 m(71°52'59"S, 77°57'E) respectively, observed the physical characteristics of snow layer, drew the strata sketch map of 1:1 ratio, collected samples from top to bottom of snow pit at interval of 3 cm and by drilling 2 m snow cores were taken at bottom of snow pit. Two 50 m ice cores were taken by drilling at the altitude of 2320 m, aerosol samples have been collected and meteorological observation was made in the travels. The inland expedition have collected several 2 m snow cores and about 1000 samples to be used in heavy metal, chemistry, microparticle, stable isotope analyses, etc. . Through the research at work spot, the synthesis of existing data and the comparison of data with those from other area, we can obtain the preliminary knowledge as follows: (1)The researched area is shallow and concave in topography, facing to the Indian Ocean. Excepting that the precipitation came from the sub-Antarctica cyclones, the warm and humid air flow caused by low pressure nearby the sea surface intruded into this region which resulted in a peak center of air temperature in winter. According to the data analysis from auto-meteorological station, the

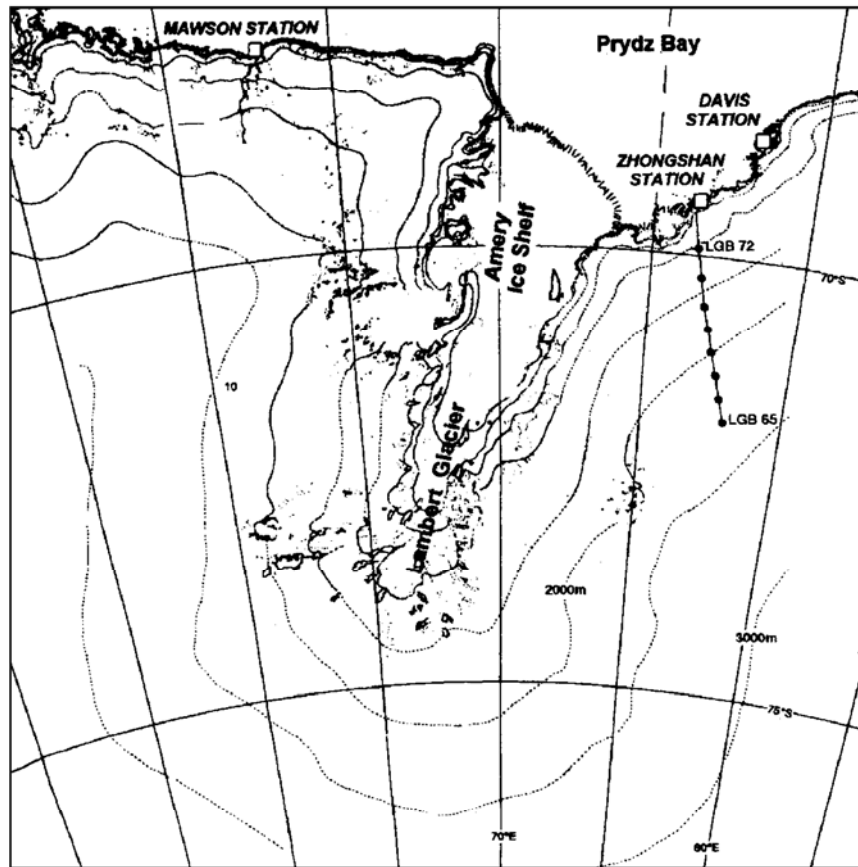


Fig. 1. The route of 330 km glaciological expedition in inland of Antarctica.

warm and humid air flow could intrude into ice sheet above 500 km, this can form a concentrated period of snow falling in winter; (2) According to the observation of mass balance sticks, the mass balance in this area is strongly affected by landform; (3) The observation of snow pit at this area in comparison with Law Dome ice cap, the ice formation zones shift toward inland in this area.

Samples collected in inland expedition are being analyzed, with the purpose to relieve the problems including stable isotope, microparticle, chemical composition, organic composition, H_2O_2 , heavy metal, β activate, stratigraphy, and physical observation of snow and ice.

Because of the success of the first Antarctic Inland Research Expedition, Polar Administration of SOA will continue Antarctic Inland Research Expedition, elongate the research profile from 330 km to 500 km, and setup relay station.

In additional, some international cooperations are carrying on for field work and sample analysis.