

Introductory Summary

Since the International Geophysical Year of 1957–1958 studies on the crustal and upper mantle structure in Antarctica were one of the major contributions to the Antarctic research. Ice sheet thickness and subglacial seismic velocities were obtained from seismic refraction profiles and the structure of Antarctic ice sheet including ice shelves and the upper crustal structure became clear. The results of seismic refraction experiments in Antarctica were compiled by BENTLEY and CLOUGH (1972). It is found out that the sedimental layer with less than 5 km/s of *P*-wave velocity was observed in West Antarctica, but not in East Antarctica.

Many refraction works with small charge size had been done in Antarctica, but only the Soviet Union made two explosion seismic reflection experiments along the 200–400 km long lines near Novolazarevskaya Station in 1968 and in the Enderby Land in 1973 (KOGAN, 1972; KURININ and GRIKUROV, 1982). The crustal thickness in the margin of the East Antarctic shield was firstly obtained by the seismic reflection study, being in the range from 30 to 40 km in the vicinity of Novolazarevskaya Station and the thickness of the granitic layer is about 20 km.

Japanese Antarctic Research Expedition (JARE) has been carried out small-scale explosion seismic experiments mainly for the purpose of obtaining the thickness of ice sheet. In 1979–1981, scientific program of JARE was focussed on earth sciences, in particular, explosion seismic experiment along long survey lines was the major item during these years. In January 1979, experiments were carried out along a profile from Syowa Station to the point 35 km east from Syowa in the Sôya Coast. Two explosions, named Shots 1 and 2 as a serial number of explosions throughout the experiments, were made at the both ends of the profile. Shot 1 was exploded with 560 kg dynamite in a drilled ice hole with the depth of 63 m in ice sheet and Shot 2 was 1 t yield in the Ongul Strait at 100 m in depth. These experiments aimed at the establishment of technique of explosion seismic experiment by JARE. Dr. A. IKAMI, Messrs. Y. ICHINOSE and M. HARADA, members of the JARE-20 summer party (1978–1979) were engaged in the experiments with support of the wintering members led by Prof. Y. YOSHIDA. Mr. Y. ICHINOSE handled the dynamite and Mr. M. HARADA had the responsibility of drilling ice hole for the placement of the dynamite. Field operation and results of experiments were reported by IKAMI *et al.* (1980, 1981).

In the second year 1980, Drs. A. IKAMI and K. SHIBUYA, Messrs. K. ITO, S. KATAOKA, K. SHIRAISHI and R. KATO were engaged in the experiments. Mr. S. KATAOKA handled the dynamite in all the experiments. Mr. K. SHIRAISHI had the responsibility of drilling ice holes for the placement of the dynamite. Mr. R. KATO provided logistic support in the field operation throughout the experiments. Fourteen explosions from Shot 3 to Shot 16 were conducted in the Sôya Coast and around Syowa Station from April to September 1980, using from several hundred grams to few kilograms of dynamite. The experiments revealed shallow crustal structures of Ongul Islands and the outcome is presented in the first and the second papers of this volume.

In November 1980, two large-scale experiments (Shots 17 and 18) were successfully made along a 270 km long profile between Syowa Station and Mizuho Station. The

total charge of 1.4 t of dynamite was exploded in Shot 17 in the 150 m deep ice hole at Mizuho Station and 1-t charge was used at Shot 18 in the 100 m deep ice hole midway between Syowa Station and Mizuho Station.

In January 12, 1981, the members of JARE-21 and -22 carried out the experiment with 3-t dynamite in the sea 20 km northwest from Syowa Station along the Syowa-Mizuho profile. The *P*-wave velocity of 8.0 km/s beneath the Moho and average crustal thickness of 40 km between Syowa and Mizuho Stations became clear from Shots 17, 18 and 19 big explosions. The results were presented in the third paper of this volume. The gravity measurements and the aeromagnetic surveys were also carried out along the seismic profile between Syowa and Mizuho Stations. The obtained crustal structure is believed to be representative of East Antarctica.

Three other papers contained in this volume are the supplemental results of the explosion seismic experiments.

The experiments (Shots 3–18) in 1980 were conducted by the wintering party of JARE-21. The authors (K. KAMINUMA, A. IKAMI, K. ITO and K. SHIBUYA) who present papers in this volume express their sincere thanks to Prof. S. KAWAGUCHI, leader of the wintering party of JARE-21, for his conducting and encouragement during the experiments and field operations. Much of the success of the experiments depended on his kind advice. The authors are grateful to all the members of the wintering party of JARE-21, especially Messrs. S. KATAOKA, K. SHIRAIISHI and R. KATO, for their continuous assistance and cooperation.

The authors also thank Prof. Y. YOSHIDA, leader of JARE-22, and other members of JARE-22 for their cooperation in carrying out the large-scale experiments.

The authors also express their hearty thanks to Prof. T. NAGATA, Director of the National Institute of Polar Research; Dr. T. ASADA, Emeritus Professor of the University of Tokyo; Prof. S. ASANO, the University of Tokyo; Prof. A. TAKAGI, Tohoku University; and Prof. H. AOKI, Nagoya University for their kind guidance and encouragements from the planning to the execution of the experiments.

References

- BENTLEY, C. B. and CLOUGH, J. W. (1972): Antarctic subglacial structure from seismic refraction measurements. *Antarctic Geology and Geophysics*, ed. by R. J. ADIE. Oslo, Universitetsforlaget, 638–691 (Int. Union Geol. Sci., Ser. B, 1).
- IKAMI, A., ICHINOSE, Y., HARADA, M. and KAMINUMA, K. (1980): Nankyoku ni okeru jinkô jishin kansoku no gaiyô (Field operation of explosion seismic experiment in Antarctica). *Nankyoku Shiryô (Antarct. Rec.)*, **70**, 158–182.
- IKAMI, A., KAMINUMA, K. and ICHINOSE, Y. (1981): Upper crustal structure of Sôya Coast, Antarctica, revealed by explosion seismology. *Nankyoku Shiryô (Antarct. Rec.)*, **71**, 58–63.
- KOGAN, A.L. (1972): Results of deep seismic sounding of the earth's crust in East Antarctica. *Antarctic Geology and Geophysics*, ed. by R. J. ADIE. Oslo, Universitetsforlaget, 485–489 (Int. Union Geol. Sci., Ser. B, 1).
- KURININ, R. G. and GRIKUROV, G. E. (1982): Crustal structure of part of East Antarctica from geophysical data. *Antarctic Geoscience*, ed. by C. CRADDOCK. Madison, Univ. Wisconsin Press, 895–901.

Katsutada KAMINUMA
National Institute of Polar Research