SEARCH AND COLLECTION OF YAMATO METEORITES IN THE 1982–83 FIELD SEASON, ANTARCTICA

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Abstract: Search and collection of Antarctic meteorites were carried out by the inland traverse party of the 23rd Japanese Antarctic Research Expedition (JARE-23) in the Meteorite Ice Field near the Yamato Mountains in 1982–83. Collected meteorites (named Yamato-82 meteorites) are 211 specimens, and their total weight is over 35 kg. A preliminary study revealed that the Yamato-82 meteorites included 10 carbonaceous chondrites, 5 diogenites, 13 eucrites, 3 unclassified achondrites and a large number of chondrites. Among them, more than 50 specimens were found in the limited area within 1 km in diameter, 25 km south from Kuwagata Nunatak of the Minami-Yamato Nunataks. Such a meteorite-concentrated area as this one suggests that the sub-ice mountains may exist in the bare ice area and the ice flow carrying meteorites forms a horizontal convergence.

1. Introduction

Large numbers of the Antarctic meteorites in the Meteorite Ice Field near the Yamato Mountains (Fig. 1), named Yamato meteorites, have been collected by the Japanese field parties since 1969, which was reviewed by YANAI (1981). In particular, the 20th Japanese Antarctic Research Expedition (JARE-20) collected over 3500 meteorites as the result of systematic search in 1979–80. JARE-22 also conducted the search for Yamato meteorites and found 133 meteorite specimens in 1981 (YOSHIDA and SASAKI, 1983).

The JARE-23 inland traverse party visited the Yamato Mountains region in the 1982–83 austral summer. The party left Mizuho Station on October 12 and arrived at the Meteorite Ice Field east of Motoi Nunatak on December 14, 1982. From that date to January 21, 1983, search and collection of meteorites were carried out along with the glaciological and geological investigations in the Yamato Mountains region. Search for meteorites was conducted by all members of the traverse party which consisted of one geologist, three glaciologists and four field assistants. The operation routes are shown in Fig. 2. Meteorite search was not systematic but conducted by careful observations of the surface of bare ice with the naked eye mainly from the moving snow vehicles or snowmobiles at all times in the bare ice areas. Collected specimens

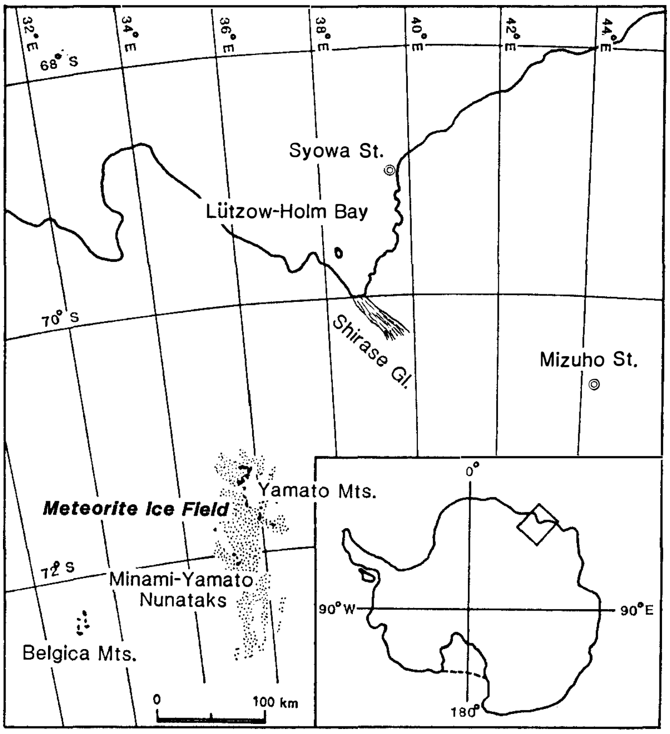

Fig. 1. Location map of the Meteorite Ice Field near the Yamato Mountains.

were carefully packed, kept frozen and shipped to the National Institute of Polar Research, Tokyo.

The present paper briefly describes the occurrences of meteorites and features of the bare ice areas as sampling sites.

2. Occurrences of Meteorites and Features of the Bare Ice Areas

The modes of occurrence of the meteorites collected in this season are almost the same as those of the previous findings. Collected meteorites (Yamato-82 meteorites) are 211 in number, and their total weight exceeds 35 kg. They included 10 carbonaceous chondrites, 5 diogenites, 13 eucrites, 3 unclassified achondrites and a large number of chondrites, according to the preliminary study. They were scattered all over the searching area, a part of the Meteorite Ice Field, although the degree of their concentration was variable as shown in Fig. 3. The area where the Yamato-82 meteorites were collected can be divided into the four sub-areas as follows: (1) Area between Motoi Nunatak and Massif A, (2) Area between Massif A and the Minami-Yamato Nunataks, (3) Area around the Minami-Yamato Nunataks, (4) Area of southern bare ice of the Minami-Yamato Nunataks. Table 1 shows the number of specimens by each kind of meteorites in each area.

2.1. *Area between Motoi Nunatak and Massif A*

The bare ice area near Motoi Nunatak is one of the most fruitful sites of meteorites. Seven parties had visited this area and collected a large number of meteorites since the first find of them by JARE-10, 1969. Especially, JARE-15, -16, -20 and -22 conducted

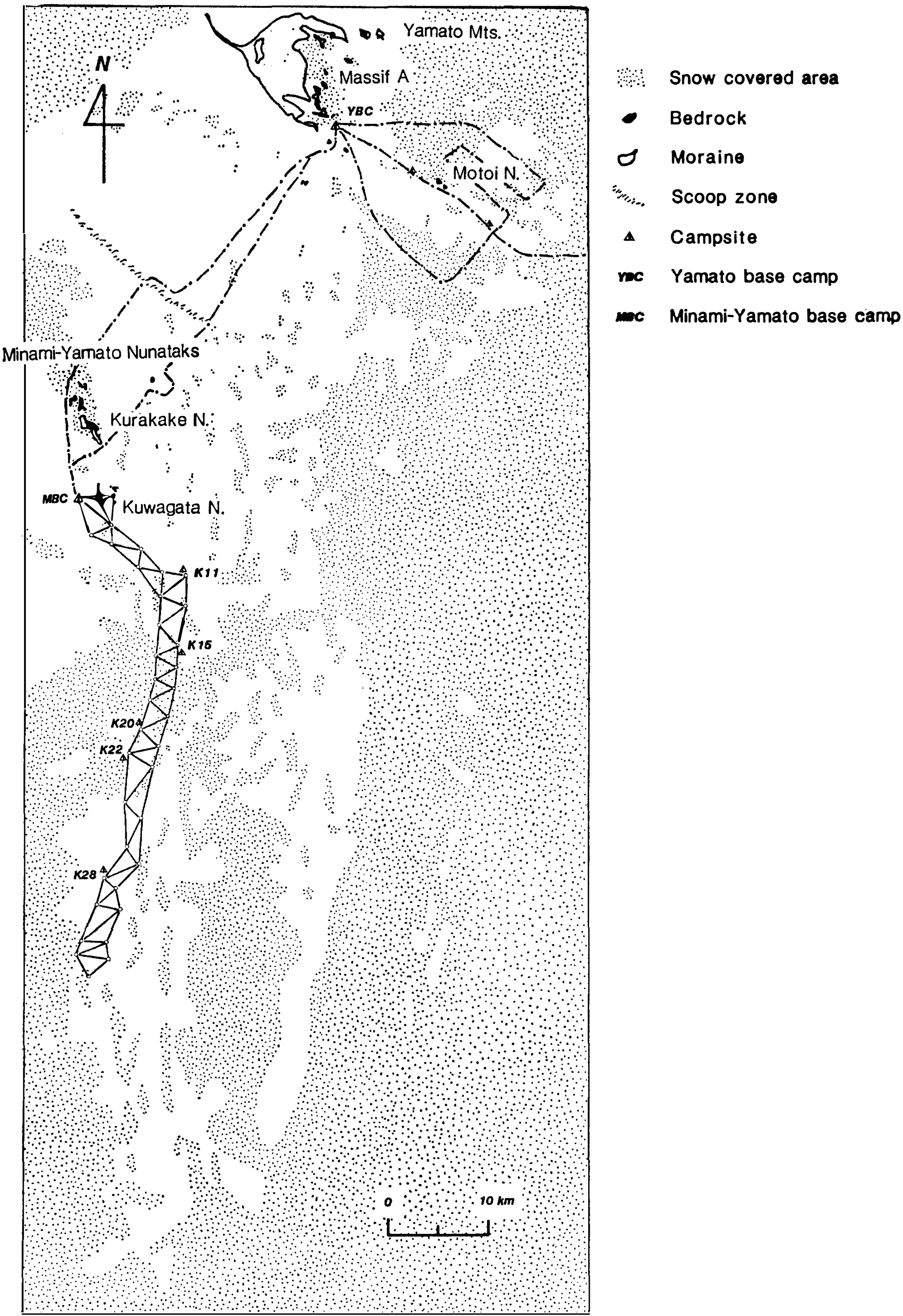

Fig. 2. Search routes of the JARE-23 inland traverse party. Chain line: the route of the survey by radio echo sounding; solid line: triangular chain.

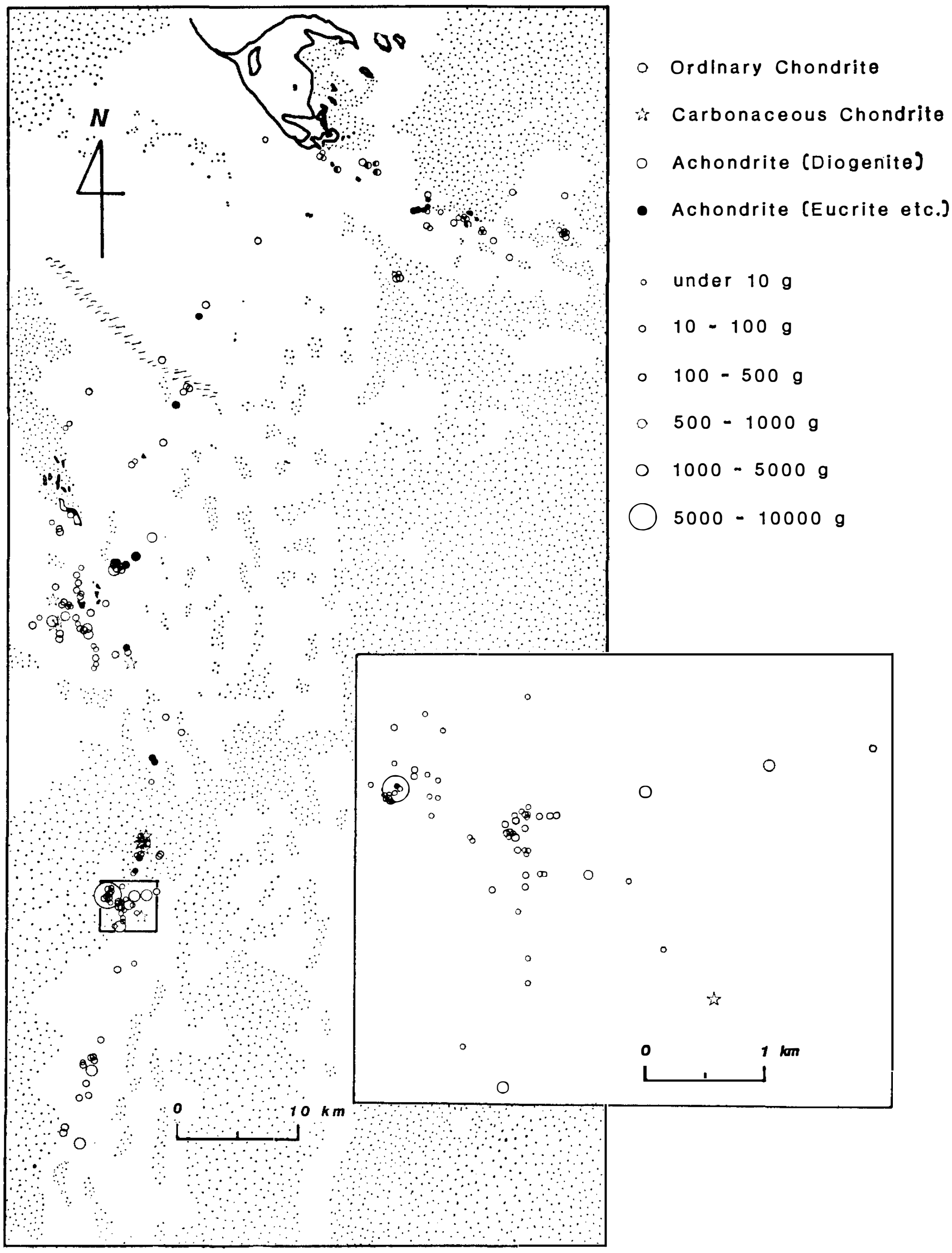

Fig. 3. Sampling sites of Yamato-82 meteorites. The meteorite-concentrated area near station K22 is also shown by the close-up figure.

detailed and systematic search for meteorite in the grids. Although the present party traced the routes by the previous parties, only several meteorites were found there and most of them were small, less than 100 g. Diogenites and eucrites in addition to ordinary chondrites were collected there. Diogenites, in particular, were not found in other areas.

2.2. *Area between Massif A and the Minami-Yamato Nunataks*

This area situated southwest of the Yamato Mountains is the most extensive bare ice area in the Meteorite Ice Field. The bare ice surface shows gentle undulation. Crevasses are rarely observed except the crevasse zone in the southernmost part. The

Table 1. Preliminary classification of Yamato-82 meteorites.

Area	A	B	C	D	Total
Ordinary chondrite	31	13	37	98 (65)*	179
Carbonaceous chondrite	—	—	3	7 (1)	10
Achondrite, diogenite	5	—	—	—	5
eucrite	5	2	4	2	13
others	—	—	—	3	3
Unidentified	—	—	—	1	1
Total	41	15	44	111 (66)	211

Area A: Area between Motoi Nunatak and Massif A
B : Area between Massif A and the Minami-Yamato Nunataks
C : Area around the Minami-Yamato Nunataks
D: Area of southern bare ice of the Minami-Yamato Nunataks
*Figures in parentheses indicate the specimens collected in the limited area about 1 km around near station K22.

scoop zone with ice mounds runs in the NW-SE direction in the center of the area.

Many meteorites had already been collected by the previous parties in this area as well as in the above-mentioned area. The present party collected only a small number of meteorites. The search was conducted roughly and in a short time, but it seemed that meteorites occurring in this area are few.

2.3. *Area around the Minami-Yamato Nunataks*

The present party set up the base camp 2 km west of Kuwagata Nunatak and stayed for a week. The search for meteorites on the bare ice surface around the Minami-Yamato Nunataks was carried out then. Meteorites in this area were collected mainly near Kuwagata Nunatak and were generally larger in size than those from the above areas. The present collection suggests that the area around the Minami-Yamato Nunataks is one of the meteorite-concentrated places as already pointed out by YANAI (1981) and YOSHIDA and SASAKI (1983).

2.4. *Area of southern bare ice of the Minami-Yamato Nunataks*

The bare ice area extending to the south of the Minami-Yamato Nunataks had not been explored until the present party visited there. The bare ice surface is gently elevated southward. The eastern part of the area has a dangerous slope with crevasses. The present party established a triangular chain with 37 stations from Kuwagata Nunatak as a datum point to about 50 km southward. The bare ice area stretches further south from the surveyed area, which corresponds to almost half of the bare ice in the Yamato Mountains region.

Although the search for meteorites was conducted only along the triangulation chain, more than half of the Yamato-82 meteorites were collected in this area. They included many chondrites and a small number of achondrites (Table 1), and were found mostly on the bare ice surface as the cases of the other areas. Figures 4 and 5 show the general figures of the modes of their occurrence. It must be noted that more than 50 specimens including the largest one (Figs. 6, 7), over 9 kg, were found in the limited area about 1 km around near station K22. The distribution of these specimens is shown

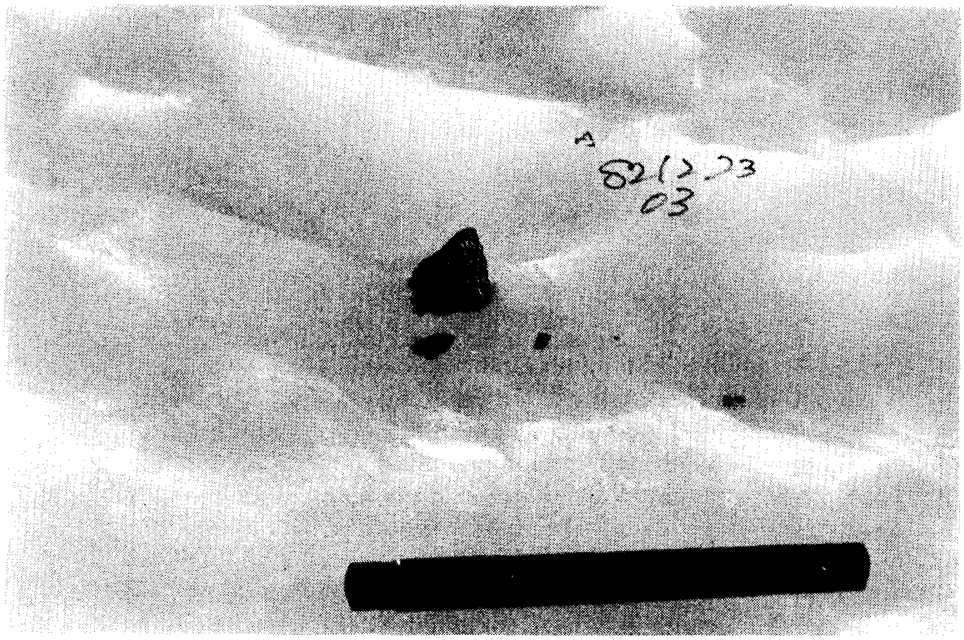

Fig. 4. Yamato-82037, eucrite, located on the rough surface of bare ice.

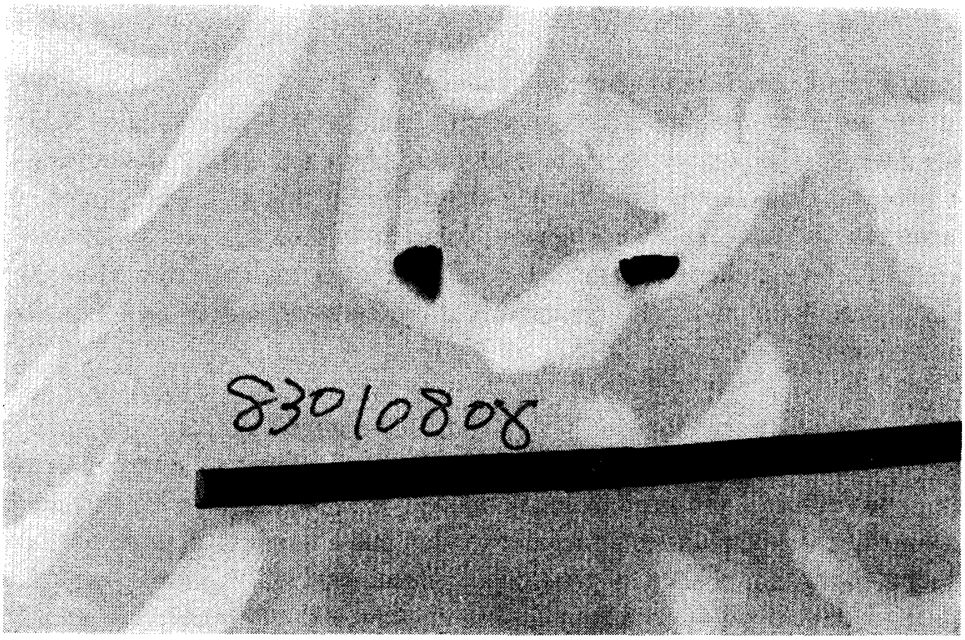

Fig. 5. Yamato-82120 and -82121, chondrites, located in the snow-covered part of the hollow of bare ice.

in the close-up figure in Fig. 3. It seems to be one of the meteorite-concentrated areas such as those near Motoi Nunatak and the Minami-Yamato Nunataks. The relation between meteorite concentration and surface morphology in this area has not been clarified. However, the result of the radio echo sounding measurements indicates that the sub-ice mountains may exist under the meteorite-concentrated area.

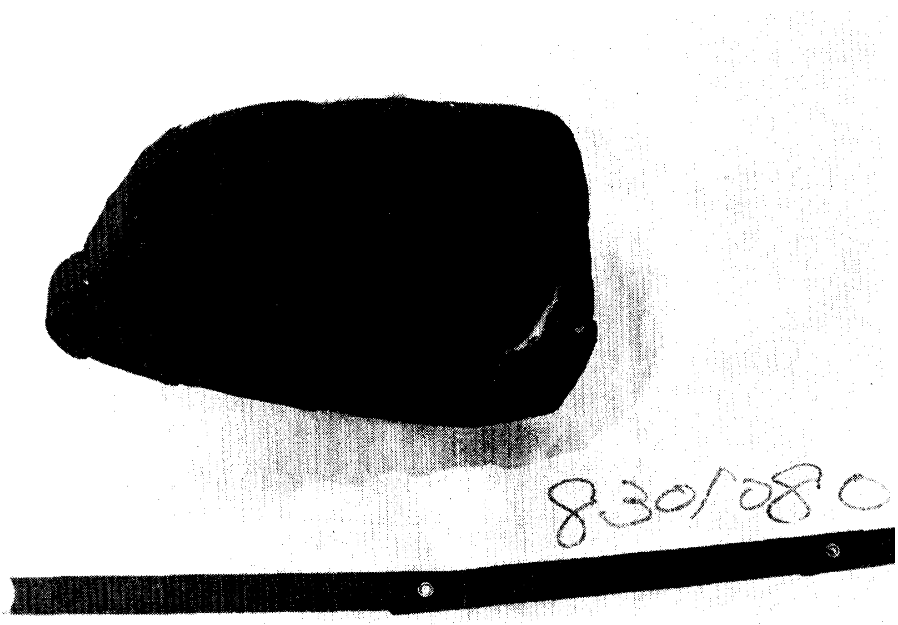

Fig. 6. Yamato-82111, chondrite. The largest specimen in the present collection.

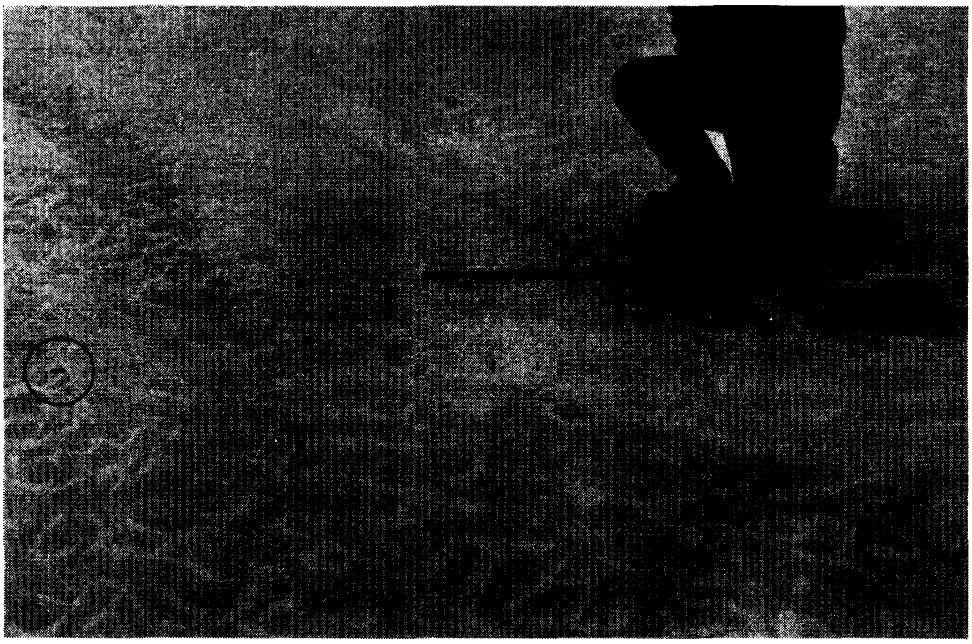

Fig. 7. Yamato-82111 chondrite and two small chondrites: the center one (Yamato-82112) located in the snow on bare ice, the left one (Yamato-82113) on the rough surface of bare ice.

3. Concluding Remarks

The inland traverse party of JARE-23 has collected 211 specimens of the Yamato meteorites, which consist mainly of ordinary chondrites with several to ten carbonaceous chondrites, achondrites (diogenite, eucrite, etc.) as revealed by the preliminary study. More than half of the Yamato-82 meteorites were found on the bare ice surface along the triangulation chain from the Minami-Yamato Nunataks to 50 km southward. Within this area, there was a meteorite-concentrated area, but no nunataks were recognized in the vicinity of the area. On the basis of radio echo sounding, it is strongly suggested that the sub-ice mountains may exist in this area and the ice flow carrying the meteorite specimens forms a horizontal convergence to result in stagnant areas and then makes an upward motion due to some barriers in the front like the sub-ice mountains. Therefore, if the ice flow is favorable for accumulation of meteorites, there might have existed a meteorite-concentrated area on the bare ice surface even though nunataks are not recognized.

Moreover, a bare ice area widely extends southward from the trianguration chain, and it is a large possibility that many meteorites might be discovered in the unexplored bare ice areas. In concluding this report, it will be worthwhile to insist that more systematic studies on the distribution of the Yamato meteorites within the bare ice area far from the Minami-Yamato Nunataks should be carried out in the future on the basis of the present survey.

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