COLLECTION OF YAMATO METEORITES IN THE 1979–1980 FIELD SEASON, ANTARCTICA

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Abstract: An 8-man oversnow traverse party of the 20th Japanese Antarctic Research Expedition (JARE-20) visited the Yamato Mountains in the 1979–1980 field season to search for Antarctic meteorites. After 991 meteorite specimens were collected by previous searches in the bare ice field near the Yamato Mountains in the eastern Queen Maud Land, existence of over 7000 meteorites was expected in the entire bare ice field. The party of the JARE-20 planned to collect about 1000 meteorites of them in one field season. In less than one month of actual activities, over 3300 meteorite specimens were collected on the bare ice between October 1979 and January 1980. About 2000 meteorites were concentrated in very small areas of the bare ice around massif A and JARE IV Nunataks, and over 1000 meteorites were also concentrated around the Minami-Yamato Nunataks. But in the bare ice areas northwest of the Yamato Mountains meteorites were not numerous.

The collected specimens are chondritic metorites for the most part, and the finds included less than ten iron, over twenty carbonaceous chondrites (type 2 in majority), about one hundred achondrites (eucrites and diogenite in majority), and also included possibly many unique specimens. This collection was officially named Yamato-79 meteorites and each specimen was designated as Yamato-790001 to Yamato-79XXXX respectively in order of finding.

1. Introduction

Prior to the 1978–79 field season, over 1600 Antarctic meteorites were discovered at 12 localities on the continent (No. 1 to No. 12 of Fig. 1) (YANAI, 1978b; SHIRAISHI, 1979). Until 1973 the collections were due to accidental discoveries (BAYLY and STILLWELL, 1923; HEY, 1966, FORD and TABOR, 1971; YOSHIDA *et al.*, 1971; KUSUNOKI, 1975; SHIRAISHI *et al.*, 1976), but after 1974, each collection was a result of the systematic search by the parties mainly of Japan and U.S.A. (YANAI, 1976, 1978a, b, 1979b; CASSIDY *et al.*, 1977; MATSUMOTO, 1978; SHIRAISHI, 1979).

Between December 1969 and January 1976, the Japanese Antarctic Research Expedition (JARE) found 991 meteorite specimens in the bare ice field near the Yamato Mountains at the east end of the Queen Maud Land, Antarctica (YOSHIDA *et al.*, 1971; SHIRAISHI *et al.*, 1976; YANAI, 1976, 1978a; MATSUMOTO, 1978). Existence of more meteorites was expected in this bare ice field, since the previous parties had searched only small areas of the bare ice field. The author estimated that meteorites will exist

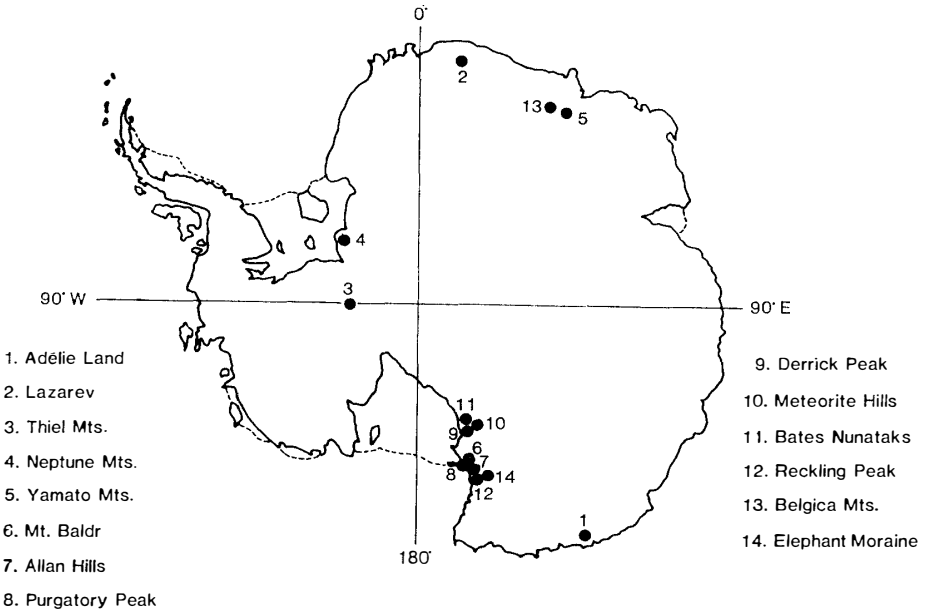

Fig. 1. The location of meteorites collected in Antarctica, 1912–1980 (modified from YANAI, 1979a).

throughout the bare ice field surrounding the Yamato Mountains. The estimation is based on the finding of over 200 specimens in the limited area of 10 kilometers square in the bare ice field near the Motoi Nunatak, south of the Yamato Mountains. Over eight thousand meteorites were expected to occur in the total bare ice of about 4000 km^2, so that a search for those meteorites was planned as one of the projects of the 20th Japanese Antarctic Research Expedition (1978–1980). An 8-man party of the 20th Japanese Antarctic Research Expedition (JARE-20) visited the bare ice field in the 1979–1980 austral summer and found over three thousands meteorite specimens. The finds included complete individuals with fusion crust, but most of the specimens were fragments with or without fusion crust like the previous collections.

2. Estimation and Potential Finding of Yamato Meteorites

In the bare ice field surrounding the Yamato Mountains roughly eight thousand meteorite specimens had been estimated by the author (YANAI, 1978c). In this paper the estimation of the total Yamato meteorites is described in more detail, and the author points out a high potentiality of meteorite finding. According to the Landsat images taken by U.S. Geological Survey, the total area of bare ice exposed around the Yamato Mountains is of the order of 4000 km^2 which is one of the most extensive bare ice in the Antarctic Continent (Fig. 2).

Over 200 meteorites were found by JARE parties before the 1978–1979 field season in the grid of 10 km square in the bare ice field near the Motoi Nunatak, south of the

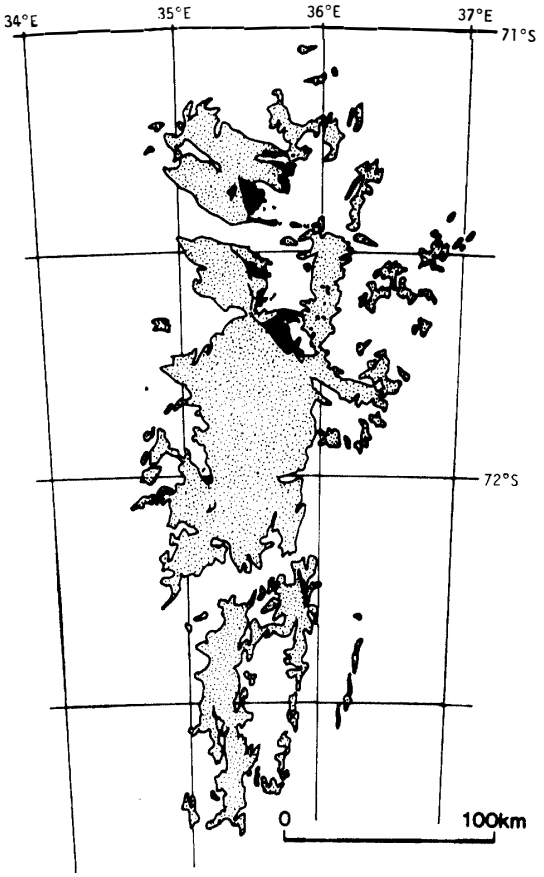

Fig. 2. Large bare ice field surrounding the Yamato Mountains, Antarctica. Black area: mountains and nunataks; dotted area: bare ice (modified from Landsat image dated December 16, 1973).

Yamato Mountains. The potentiality of meteorite finding in the bare ice field is shown by the ratio of one specimen to about 0.5 km^2, so that about 8000 meteorites are expected to exist in the entire bare ice field. Since 991 specimens were collected during the period from 1969 to 1976, if the same distribution density applies to the entire bare ice field it is possible to collect about 7000 specimens more.

3. Object and Plans

There is a high potentiality of meteorite existence in the bare ice field surrounding the Yamato Mountains, but the distribution of meteorites may be very irregular as was shown by YANAI (1979a, Fig. 2). Also it is impossible to search over the large bare ice in one field season. So the search party of the JARE-20 planned to cover one-fifth or one-tenth of the entire bare ice field and anticipated to collect about one thousand specimens. As the high potential areas of meteorites finding, the party chose a few bare ice areas surrounding the JARE IV Nunataks and the south of the massif A (Fig. 3) where the ice flow was stagnant due to the damming up by several mountains or nunataks (NISHIO and ANNEXSTAD, 1980). The party prepared two each

of large and small oversnow vehicles, three snowmobiles (YAMAHA ET-250) and 4200 liters of fuel for 30 days field activity.

4. Meteorites Search

The party left Syowa Station on October 13, 1979, and arrived at C1 (Camp No. 1, Fig. 3) near the Motoi Nunatak, on October 30, via Mizuho Station. The searching was begun in the bare ice area around C1. The weather was very bad in November, two-thirds of the month was under blizzard with strong wind and low temperatures. Meteorite search was carried out on several days of good weather at C2, C3, C4 and C5 in the bare ice area around JARE IV Nunataks located north of massif A. In the area the party collected about 2000 specimens which included a few irons, many achondrites and carbonaceous chondrites. These meteorites were concentrated in several very small areas of the bare ice near C2–C5. The party searched around C6

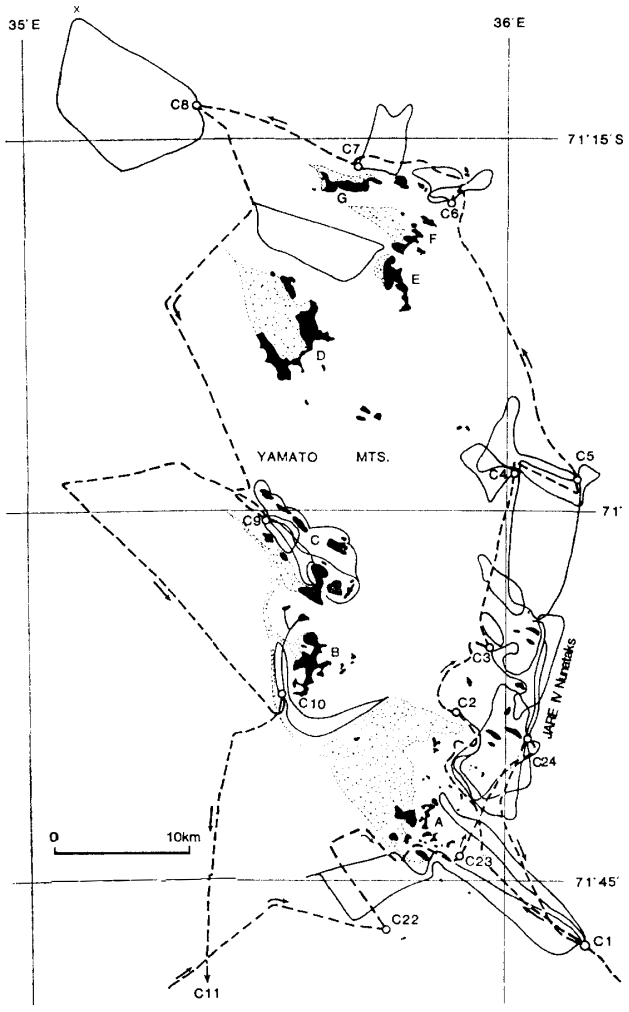

Fig. 3. Routes of meteorite search around the Yamato Mountains in the 1979–1980 season. Traverse routes are shown with dotted lines, and meteorite search routes using two small snow vehicles and three snowmobiles are shown with solid lines. C1–C11 and C22–C24: Camp, A–G: Main massif of the Yamato Mountains, Dotted area: Moraines.

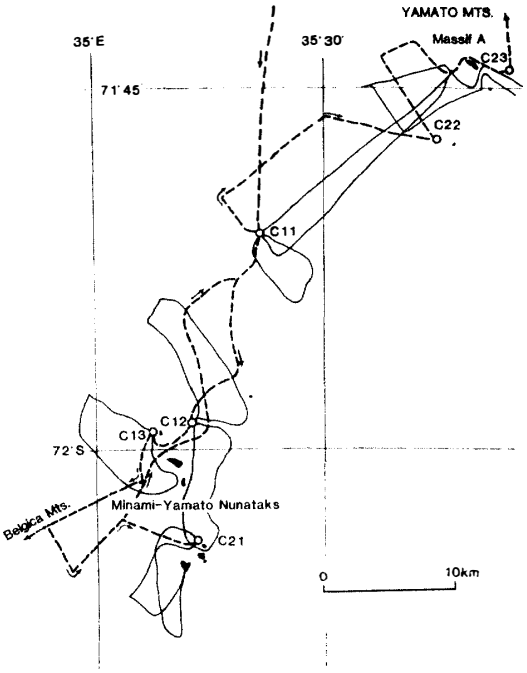

Fig. 4. Routes of meteorite search around the Minami-Yamato Nunataks, and in the area between massif A and Minami-Yamato Nunataks. Symbles are the same as Fig. 3.

and C7 near massifs F and G of the northern Yamato Mountains, and collected about one hundred specimens, mostly low grade chondrites, and one small iron.

The largest chondrite specimen, weighing more than 25 kg, was found at the northern end of the bare ice area (marked × in Fig. 3) northwest of C8. About twenty specimens were found along the route of C7 through C11 in the western and southern parts of the bare ice of the Yamato Mountains.

Larger specimens were recovered from the bare ice around C12, C13, C21, and the Minami-Yamato Nunataks (Fig. 4). They were mostly chondrites but included some achondrites amounting to several kilograms, and a few carbonaceous chondrites. C14 to C20 are in the Belgica Mountains located about 200 km southwest of the Yamato Mountains.

5. Occurrences

Most of the finds in this season were from the bare ice field as the case of the previous finds of Antarctic meteorites. None of them was recovered on the snow or under the ice surface, but some specimens were found in the moraine which is composed of thin layers of rock fragments.

Most of the Yamato-79 meteorites were sitting on the bare ice surface (Fig. 5); it looks like that they were left on the bare ice surface due to ablation, but some may have fallen directly onto the bare ice field.

Fig. 5. Typical occurrence of Yamato meteorite. Yamato-790724, 2166 g, iron. Widmanstatten pattern is very clear on the corroded surface.

6. Result and Remarks

About 3300 meteorites were discovered and collected in the bare ice area around the Yamato Mountains in the 1979–1980 field season. As was expected the meteorites were concentrated in the bare ice area, particularly in the southeastern part of the bare ice area where flowing ice was dammed up by uplifted basement rocks, several nunataks and the Yamato Mountains. There are four meteorite-rich areas, such as the southern bare ice area of massif A, around the JARE IV Nunataks (around C2 to C5 and C24), the northwest side of massif G (around C6 to C7), and around the Minami-Yamato Nunataks (around C12, C13 and C21). Concentration of meteorites was not recognized in other areas in this season, but large specimens weighing over a few kilograms were often recovered there.

In the 1979–1980 season the party searched several areas along the routes shown in Figs. 3 and 4, so over 2500 km^2 of bare ice remained unsearched. The potentiality of meteorite existence in these areas may be similar to that in unconcentrated areas in view of the author's experience, but it cannot be denied that there may exist very precious specimens including hitherto unknown or very rare ones.

The present collection consists of chondritic meteorites for the most part, possibly including many unique specimens. The number of irons, carbonaceous chondrites and achondrites was larger than those in the previous collections. The collection of the 1979–1980 season was officially named the Yamato-79 meteorites by the Japanese Committee on Antarctic Meteorites in the National Institute of Polar Research on December 4, 1980 and each specimen was designated as Yamato-790001 to Yamato-79XXXX in order of discovery. The Yamato-79 meteorites together with the specimens

Table 1. Antarctic meteorites collected till January 1980.

Meteorite name	Date of find	Irons	Stony-irons	Chondrites	Achondrites	C.C.*	**	Total	Search party
1. Adélie Land	Dec. 1912	—	—	1	—	—	—	1	Australia
2. Lazarev	Jan. 1961	2	—	—	—	—	—	2	U.S.S.R.
3. Thiel Mts.	Dec. 1961	—	2	—	—	—	—	2	U.S.A.
4. Neptune Mts.	Feb. 1964	1	—	—	—	—	—	1	U.S.A.
5. Yamato	Dec. 1969	—	—	7	1	1	—	9	Japan
〃	Dec. 1973	—	—	11	1	—	—	12	Japan
〃	Nov. to Dec. 1974	—	1	631	28	3	—	663	Japan
〃	1975–76	2	—	290	12	3	—	307	Japan
6. Mt. Baldr	Dec. 1976	—	—	2	—	—	—	2	Japan—U.S.A.
7. Allan Hills	Jan. 1977	1	—	8	—	—	—	9	Japan—U.S.A.
〃	1977–78	6	1	293	4	2	4	310	Japan—U.S.A.
8. Purgatory Peak	Jan. 1978	1	—	—	—	—	—	1	U.S.A.
9. Derrick Peak	Dec. 1978	6	—	—	—	—	—	6	New Zealand
9. Derrick Peak	1978–79	10	—	—	—	—	—	10	Japan—U.S.A.
10. Meteorite Hills	〃	—	—	28	—	—	—	28	Japan—U.S.A.
11. Bates Nunataks	〃	—	—	6	—	—	—	6	Japan—U.S.A.
7. Allan Hills	〃	2	—	249	7	2	2	262	Japan—U.S.A.
12. Reckling Peak	〃	—	—	5	—	—	—	5	Japan—U.S.A.
7. Allan Hills	1979–80	—	—	52	1	—	2	55	Japan—U.S.A.
12. Reckling Peak	〃	1	—	14	—	—	—	15	Japan—U.S.A.
14. Elephant Moraine	〃	—	—	7	5	—	—	12	Japan—U.S.A.
13. Belgica	Dec. 1979	—	—	>3	—	—	—	3	Japan
5. Yamato	1979–80	<10	?	>3200	<100	>20	<20	>3300	Japan

* Carbonaceous chondrites. ** Dubious specimens.

collected between 1912 and the 1979–1980 field season were classified into several types as shown in Table 1 in order of finding (SHIRAISHI, 1979; YANAI, 1979b).

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