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Meteorite search by JARE-39 in 1998–99 season

Hideyasu Kojima[1], Hiroshi Kaiden[2] and Toru Yada[3]

[1]*National Institute of Polar Research, Kaga 1-chome, Itabashi-ku, Tokyo 173–8515*
[2]*Tohoku University, Aoba-ku, Sendai 980–8577*
[3]*Department of Earth and Planetary Sciences, Kyushu University 33, Hakozaki, Fukuoka 812–8581*

Abstract: A meteorite search party composed of eight men of the 39th Japanese Antarctic Research Expedition (JARE) collected 4136 meteorites on bare ice areas around the Yamato Mountains and the Belgica Mountains in 1998–99 field season. Approximately 4100 meteorites have been collected around the Yamato Mountains. They include many kinds of rare meteorites. By classification in the field, 2 lunar meteorites, 3 irons, 4 stony irons, 15 ureilites, 37 diogenites, 63 eucrites, 29 unclassified achondrites and 160 carbonaceous chondrites are distinguished. The number of irons is very small for such a great number of the meteorites.

We also searched for meteorites around the Belgica Mountains. Twenty-one meteorites have been collected. All of them are ordinary chondrites.

1. Introduction

Prior to the 1998–99 field season, 6000 meteorites had been collected by 13 expeditions on bare ice fields around the Yamato Mountains (*e.g.* Yanai, 1978, 1981; Katsushima *et al.*, 1984). Two parties of JARE-15 and JARE-20 have performed the meteorite searches as the main project. Although the aims of other parties were such as glaciological survey, geological survey and geographic survey, all the parties reaching the Yamato Mountains have collected meteorites in greater or lessor amounts (Table 1). However, we expected to collect many additional meteorites for the following two reasons. The area of bare ice areas around the Yamato Mountains is estimated about 4000 km^2 (Yanai, 1978). One third of the area has been already searched by prior expeditions. So the other 2/3 of the area is remained for meteorite search. The parties of JARE-15 and -16 have collected several hundred meteorites around the Motoi Nunatak (Yanai, 1978; Matsumoto, 1978). The party of JARE-20 has collected more than 1000 meteorites in each of both the bare ice fields; around the Minami-Yamato Nunataks and the JARE IV Nunataks (Yanai, 1981). These three ice fields are the most meteorite concentrated areas at the Yamato Mountains region. Meteorite searches have not been done for the last twelve years on these three ice fields. Naruse (1975) reported that 4 to 7 cm of ice sheet near the Yamato Mountains were ablated for one year. As approximately 1 m of ice sheet is

Table 1. Meteorite collections of the Yamato and Belgica Mountains until 1997.

Meteorite name	Year	Expedition	Iron	Stony-iron	Achondrite	Carbonaceous-chondrite	Chondrite	Total
Yamato-69	1969	JARE-10			1	1	7	9
Yamato-73	1973	JARE-14			1		11	12
Yamato-74	1974	JARE-15		2	28	4	629	663
Yamato-75	1975	JARE-16	2	1	12	3	290	308
Yamato-79	1979	JARE-20	5	3	83	41	3565	3697
Belgica-79	1979	JARE-20				1	4	5
Yamato-80	1980	JARE-21		1	1		11	13
Yamato-81	1981	JARE-22			2	10	121	133
Yamato-82	1982	JARE-23	1		21	14	175	211
Yamato-83	1983	JARE-24				1	41	42
Yamato-84	1984	JARE-25		1	2	4	52	59
Yamato-86	1986	JARE-27			6	28	783	817
Yamato-92	1992	JARE-33			1		2	3
Yamato-94	1994	JARE-35					16	16
Total			8	8	158	107	5707	5988

JARE: Japanese Antarctic Research Expedition.

estimated to have been ablated over this period, some meteorites are expected to have newly appeared to the surface.

We have planned to search for meteorites in three known meteorite concentration areas and other areas in which any parties have not tried meteorite search.

We also tried to collect micrometeorites by melting ice at the meteorite field. The result of this project is reported separately (Yada and Kojima, 2000).

2. Plans

As mentioned before, 2/3 of the bare ice fields around the Yamato Mountains are unsearched. We planned to search for meteorites for the first time on the bare ice fields around the Higasi-Yamato Nunataks and far southern area of the Minami-Yamato Nunataks. We also planned to search for meteorites again in three previously searched meteorite concentration areas; the ice field around the Motoi Nunatak, the ice field around the Minami-Yamato Nunataks, and the ice field around the JARE IV Nunataks. We also planned to visit the Belgica Mountains to search for meteorites. We estimated 114 days for the traverse including 80 days for meteorite searching. The traverse route to the Yamato Mountains and the Belgica Mountains is shown in Fig. 1. The party prepared four large oversnow vehicles (three SM100 types and one SM50 type) and six snowmobiles (Yamaha CS340E). The party also prepared 33000 litters of fuels for oversnow vehicles and 5800 litters of fuels for the snowmobiles.

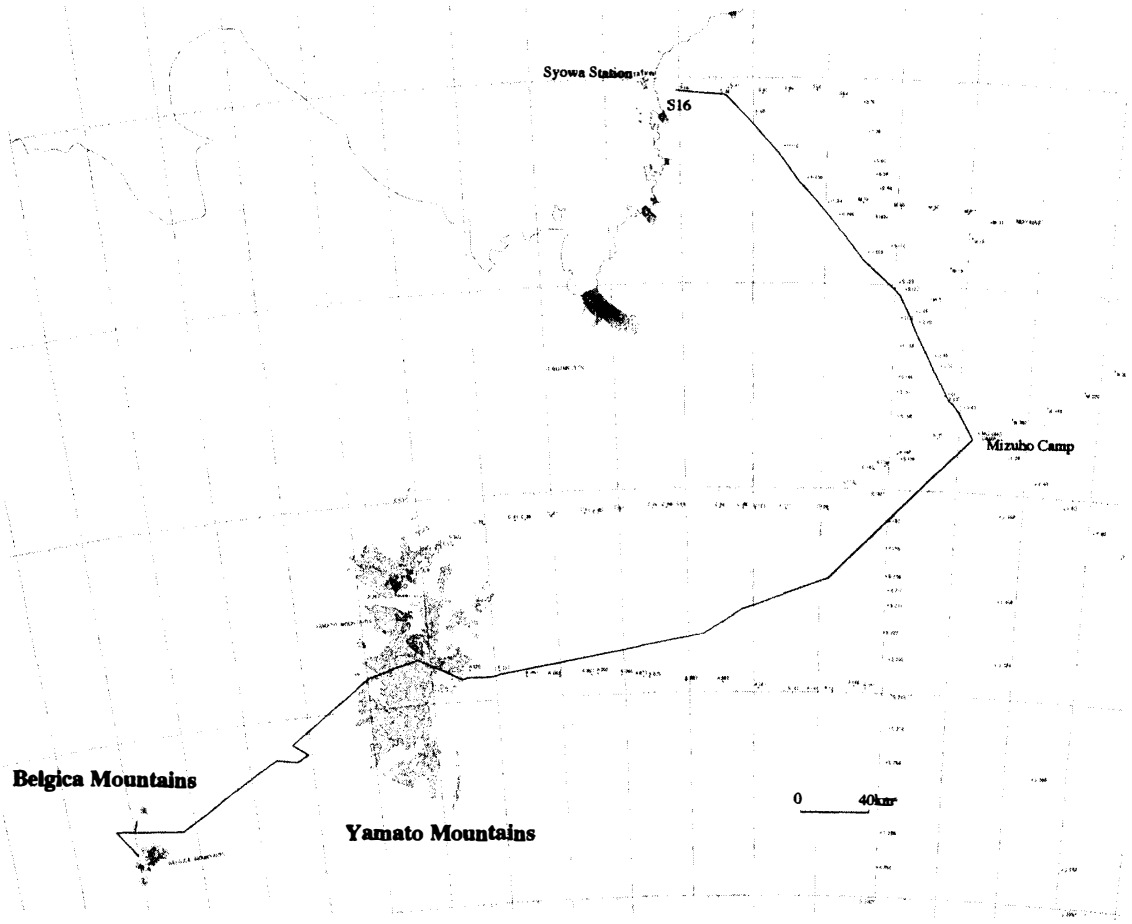

Fig. 1. Expedition route to the Yamato and Belgica Mountains through the Mizuho Camp of the JARE-39 Meteorite Search Party.

3. Meteorite search

The party left Syowa Station with 4 large oversnow vehicles on 16th of October, 1998 and reached the Yamato Mountains on 2nd of November after 600 km traveling. We had to lay aside one SM100 for differential trouble at YM135 point, 90 km far from the Yamato Mountains. We also deposited 2 snowmobiles and 6 large sledges at the same point. We used 3 large oversnow vehicles and 4 snowmobiles for meteorite searching. The weather was bad through the searching period including several times of blizzard with winds stronger than 15 m/s. Collection positions of all meteorites were recorded by a global positioning system (GPS).

We tried to search for meteorite on the ice field far south of the Minami-Yamato Nunataks at first. We found and collected about 100 meteorites along a traverse route from C1 to C3, on the way to the far southern ice field (Fig. 2). We found approximately 200 meteorites in the far southern area during a 9 day search. Contrary to our expectation, the distribution density of meteorites of this area is

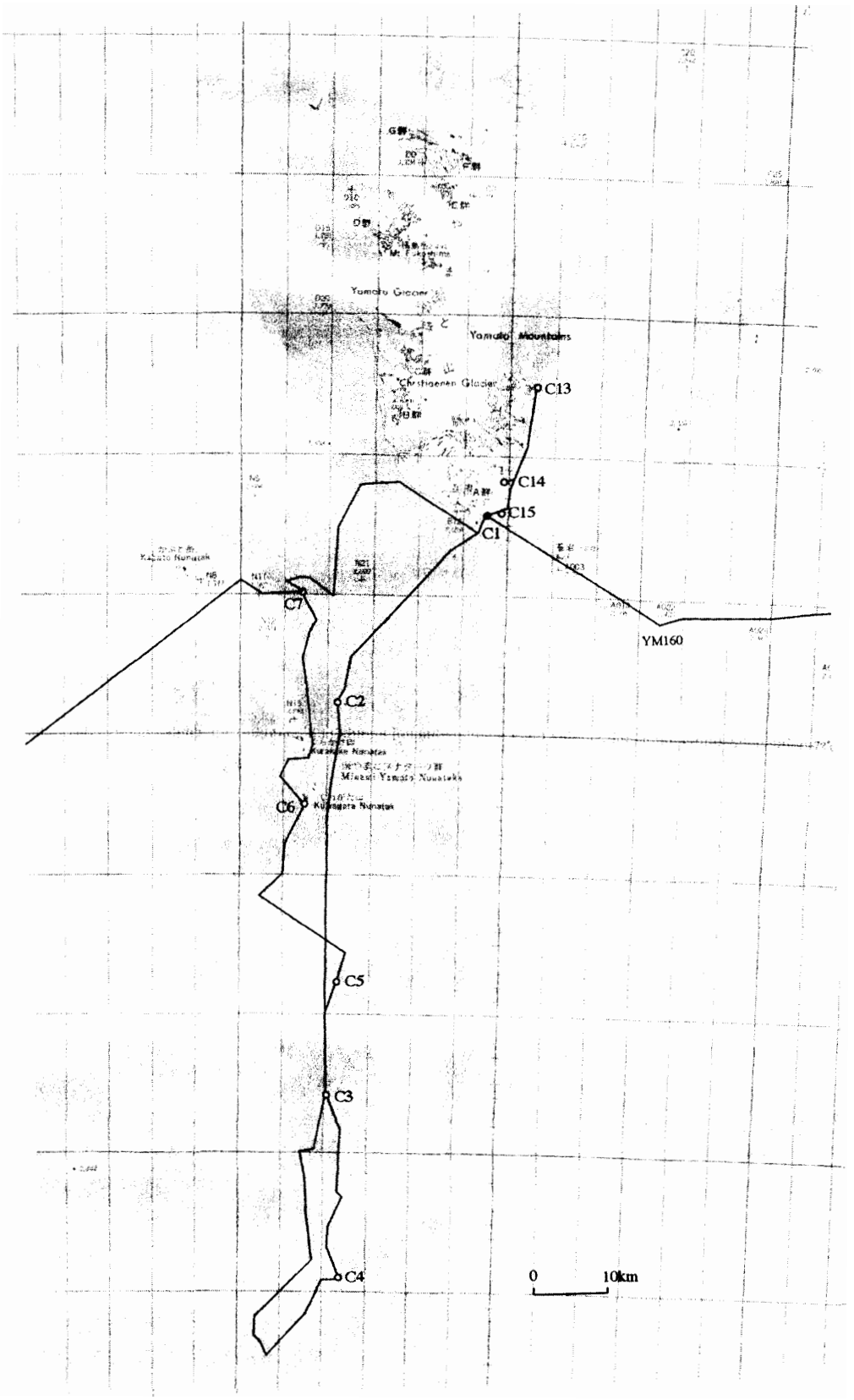

Fig. 2. Traverse routes of JARE-39. C1–C7 and C13–C15: Camp site.

very low. We searched continuously for meteorites around the Minami-Yamato Nunataks. The party of JARE-20 found approximately 1000 meteorites in the area, so we expected to find many meteorites again. Approximately 2000 meteorites were collected at the region during 7 days. We collected 450 meteorites on the most successful day. We collected 370 meteorites along the route from C6 to C7 during one day. Approximately 1000 meteorites were collected around JARE IV Nunataks.

We could not visit the Higasi-Yamato Nunataks, because there are so many hidden crevasses between the JARE IV Nunataks and the Higasi-Yamato Nunataks.

Over 4100 meteorites have been collected around the Yamato Mountains.

We have also searched meteorites around the Belgica Mountains, 200 km far west from the Yamato Mountains. 21 Meteorites have been collected. All of them are ordinary chondrites.

4. Result and remarks

Approximately 4100 meteorites have been collected around the Yamato Mountains (Kojima *et al.,* 1999). They include many kinds of rare meteorites. By the classification in the field, 2 lunar meteorites, 3 irons, 4 stony irons, 15 ureilites, 37 diogenites, 63 eucrites, 29 unclassified achondrites and 160 carbonaceous chondrites were distinguished (Table 2). The largest meteorite is an ordinary chondrite approximately 10 kg in weight (Fig. 3).

One lunar meteorite was found several km west of the Kurakake Nunatak of the Minami-Yamato Nunataks. This rock has thin, yellow-green fusion crust and consists of dark gray matrix with light-colored clasts and mineral fragments (Fig. 4). This feature indicates that the rock is an anorthositic breccia derived from the lunar highland. Yamato-793274 had been classified as an anorthositic breccia, and as this lunar meteorite was found near the Kurakake Nunatak, these two meteorites are possibly paired. Another lunar meteorite was found near of northern end nunatak of the JARE IV Nunataks, about 50 km northeast of the other lunar meteorite. This rock also has thin, yellow-green fusion crust. The rock consists

Table 2. Classification of Yamato-98 and Belgica-98 meteorite at the fields.

Iron	Stony Iron	Achondrite		Carbonaceous chondrite		Chondrite	Total
	Lodranite 3	Ureilite	15	CI	54		
		Diogenite (A)	14	CM2	71		
		Diogenite (B)	8	CV3	13		
		Diogenite	15	unclassified	22		
		Eucrite*	28				
		Eucritic	35				
		Lunar	2				
		unclassified	29				
3	3		146		160	3824	4136

* May include howardite.

Fig. 3. Field occurrence of the largest meteorite in this meteorite search. About 10 kg in weight.

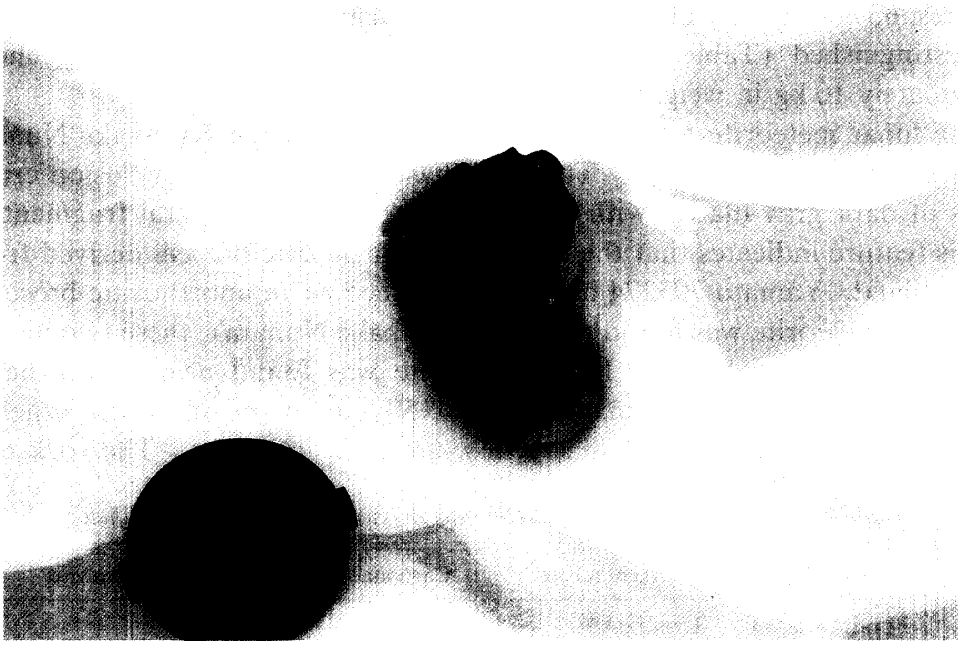

Fig. 4. Field occurrence of a lunar meteorite (anorthositic breccia of lunar highland) near the Kurakake Nunatak.

mainly of dark gray matrix with some light-colored lithic fragments, which may indicate that the rock of lunar highland origin.

Thirty-five complete stones and fragments of coarse-grained eucritic meteorites (Fig. 5) were found in about 100 km^2 of southwest of Kuwagata Nunatak. These meteorites are probably paired.

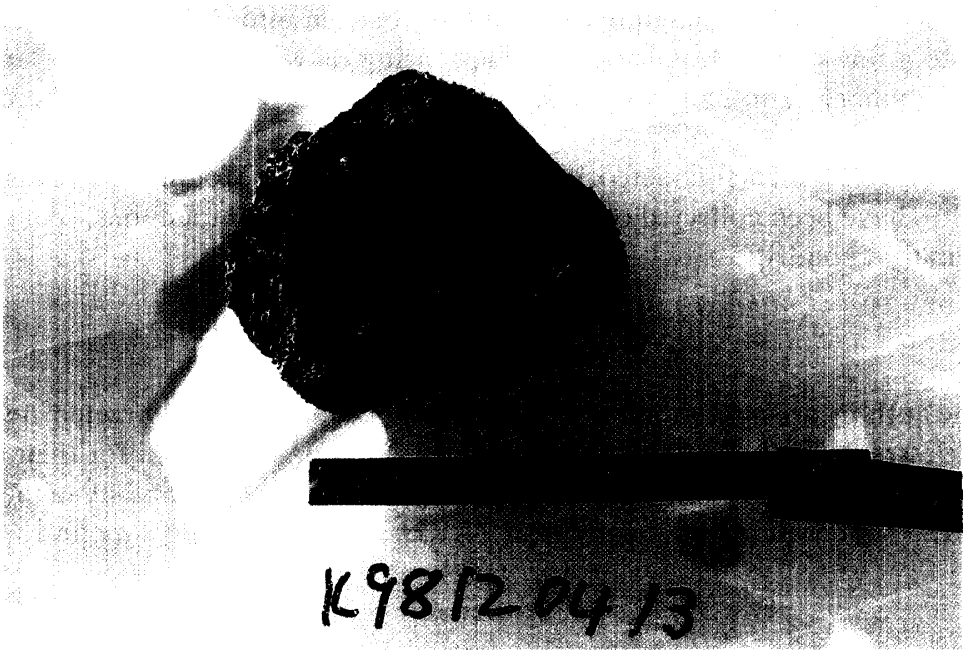

Fig. 5. Field occurrence of coarse-grained eucritic rock near the Kuwagata Nunatak.

Fig. 6. Field occurrence of C1 chondrite fragments near C7. This occurrence may show that a complete stone has broken into several fragments after appearing on the surface of the bare ice.

Three concentrations totaling 54 fragments of carbonaceous chondrites (Fig. 6) were found in 1 square km near of Camp 7 (C7, Fig. 2). These fragments consist of black matrix. No chondrules and inclusions are observed. One of the authors classified these meteorites into C1 from the features at the field. The occurrence

possibly shows that three complete stones have broken into three concentrations of several to a few tens of fragments after appearing on the surface of the bare ice.

The number of irons is very small for such a great number of total recovered meteorites.

We also searched for meteorites around the Belgica Mountains. Twenty-one meteorites have been collected on bare ice northwest of the mountains. All of them are ordinary chondrites.

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