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THE ASUKA-90 METEORITES COLLECTION FROM ANTARCTICA: SEARCHING, INITIAL PROCESSING AND PRELIMINARY IDENTIFICATION

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Abstract: Over 2400 meteorites have been collected by the Japanese Antarctic Research Expeditions (JARE) on the bare icefield around the Sør Rondane Mountains in Queen Maud Land, East Antarctica, since 1986. The Asuka wintering party of JARE-30 (1989–91) carried out a meteorite search during a geological survey, and collected 48 meteorites on the bare icefield around Mt. Balchen in the eastern part of the mountains on November 1990. During the initial processing, the specimens were officially named the Asuka(A)-9001 to A-9048, in order of discovery. The Asuka-90 meteorites collection was cataloged by the National Institute of Polar Research (NIPR) with details of find, weight, dimensions, brief identification and classification data, and comments.

According to the preliminary identification, the Asuka-90 meteorites include one achondrite and 47 ordinary chondrites, the total weight being 11.48 kg. The largest specimen is an L chondrite of about 3.27 kg. The Asuka-90 meteorites included no irons, no stony-irons and no carbonacous chondrites.

1. Introduction

The search for meteorites on the bare icefield around the Sør Rondane Mountains was conceived and planned at the National Institute of Polar Research (NIPR), beginning in 1987. Starting with the accidental finding of the first Asuka meteorite in November 1986, the systematic search in the Sør Rondane Mountains area was carried out by the Asuka wintering party of the 29th Japanese Antarctic Research Expedition (JARE) in the 1987–88 and 1988–89 field seasons (YANAI and the JARE-29 ASUKA PARTY, 1989; YANAI *et al.*, 1993a). This is a report of the search for the Asuka meteorites during the 1990 field season. It also contains some results of the initial processing and preliminary identification of the newly collected Antarctic meteorites.

The Asuka meteorites collections include Asuka-86, Asuka-87, Asuka-88 and Asuka-90 meteorites. The Asuka-86 meteorites are 3 ordinary chondrites, discovered by chance in November 1986 by the glaciological party of JARE-27 (1985–87) on bare ice near Mt. Balchen, at the eastern end of the Sør Rondane Mountains. This was the first discovery around these mountains (NISHIO *et al.*, 1987).

Only 113 meteorites of the Asuka-87 collection were recovered from the bare icefield around Mt. Balchen in January 1988, by the joint geology and geomorphology party in JARE-29. In February 1988, the Asuka wintering party approached the

Nansenisen (Nansen Icefield) for the first time for a reconnaissance search. The party collected over 200 meteorites of the Asuka-87 collection there. This reconnaissance strongly suggested that the Nansen Icefield had very high potential for meteorite concentration.

A systematic search of the Nansen Icefield was carried out by the Asuka wintering party between October 1988 and January 1989. Over 2000 specimens, the Asuka-88 meteorites, were recovered from the icefield by the systematic search. Both the Asuka-87 and Asuka-88 meteorites are typified by the large number and great variety of types including unique and unusual specimens such as lunar gabbro and angrite specimens (YANAI, 1989; NARAOKA *et al.*, 1990; YANAI, 1991a, b, c, d, 1993a, b; YANAI and KOJIMA, 1992; YANAI *et al.*, 1993a).

Asuka-90 meteorites were collected on the bare icefield around Mt. Balchen by the Asuka party, led by one of the authors (K.S.), of JARE-31 in November 1990. Meteorite searching was carried out as part of a geological survey (YANAI *et al.*, 1993b).

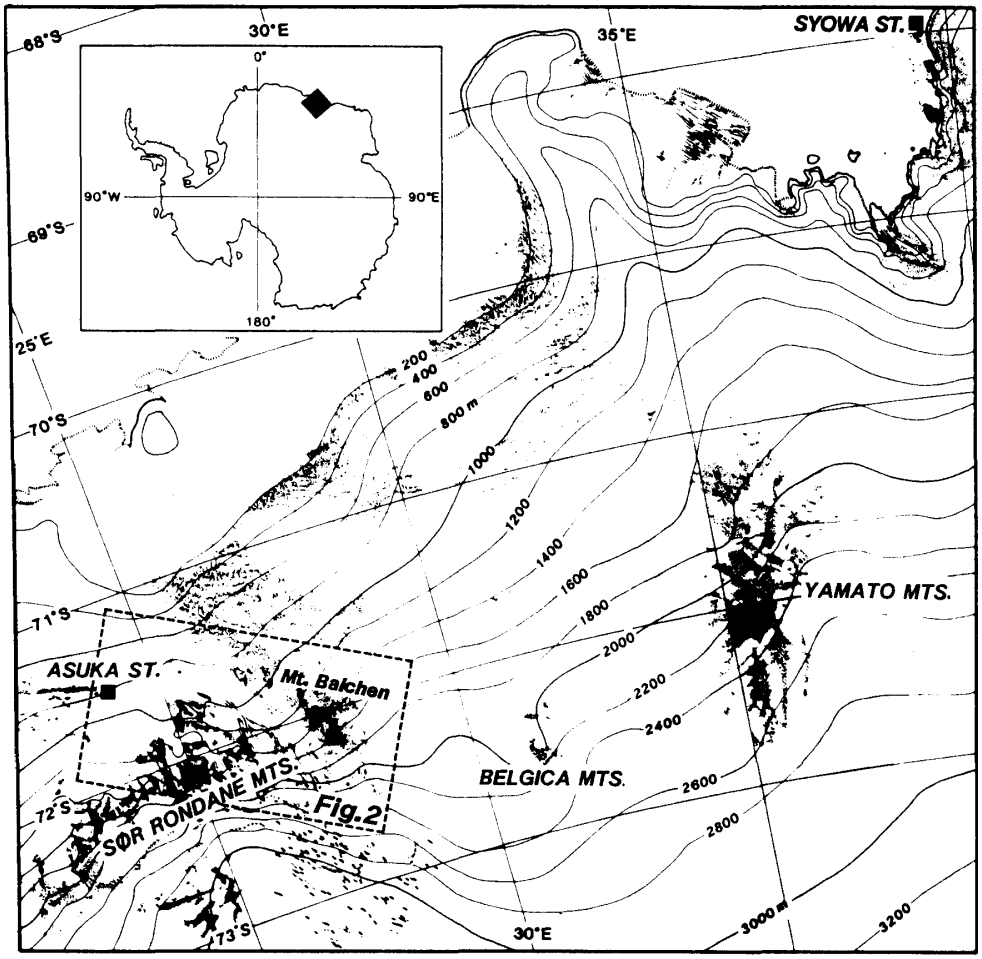

Fig. 1. Location map including the Yamato Mountains, Belgica Mountains and Sør Rondane Mountains in Queen Maud Land, East Antarctica. The locations of the Japanese bases "Syowa Station" and "Asuka Station" are noted.

2. General View of Mt. Balchen (Balchenfjella) and Bare Icefield

Mt. Balchen is 50 km east of the central Sør Rondane Mountains and is isolated by the Byrdbreen (Byrd Glacier) (Figs. 1, 2). Mt. Balchen consists mainly of Gropehela and Berpheta masses with several nunataks. The topography of Mt. Balchen is generally gentle, with slopes distinct from the central masses, steeples, steep walls and isolated high peaks (Fig. 3). The bare icefield is elongated in the north-south direction along Mt. Balchen and is also developed south-east (down-wind) of each of the nunataks. There are several large blue icefields and many smaller ice patches. The icefield gently flows from south to north and descends from an elevation of 1700 m to 1000 m. The bare icefields near Mt. Balchen are covered somewhat by thin moraines or morainal rocks (Fig. 4), but most of the icefields are free of terrestrial materials. Crevasses occur most commonly around the nunatak and at the eastern end of the blue icefield, where they are typically a few meters wide to 10 m wide and are an ever-present danger (Fig. 3).

3. Search and Recovery of the Asuka-90 Meteorites

The geology party of 4 members of the JARE-31 group at Asuka Station carried out the meteorite search around Mt. Balchen on November 12–29, 1990. The party collected 48 pieces of meteorites. The specimens are mostly fragments with or without fusion crust and are brown to dark brown, and may include the

Fig. 2. Satellite photo of central and eastern parts of the Sør Rondane Mountains (from USGS). Darkest areas are bedrock, blue areas are bare icefields. See Fig. 1 for location.

Fig. 3. Field view around Mt. Balchen (center), central Sør Rondane Mountains (back) and Isklakken nunatak with moraines (three nunataks in front) surrounded by blue icefields. Large crevasses are recognized as parallel white patterns in front. View from north to south (photo by M. SANO, NIPR).

Fig. 4. Field occurrences of the bare icefield east of Mt. Balchen. There are many terrestrial rocks mixed with the meteorites. View from south to north (photo by M. SANO, NIPR).

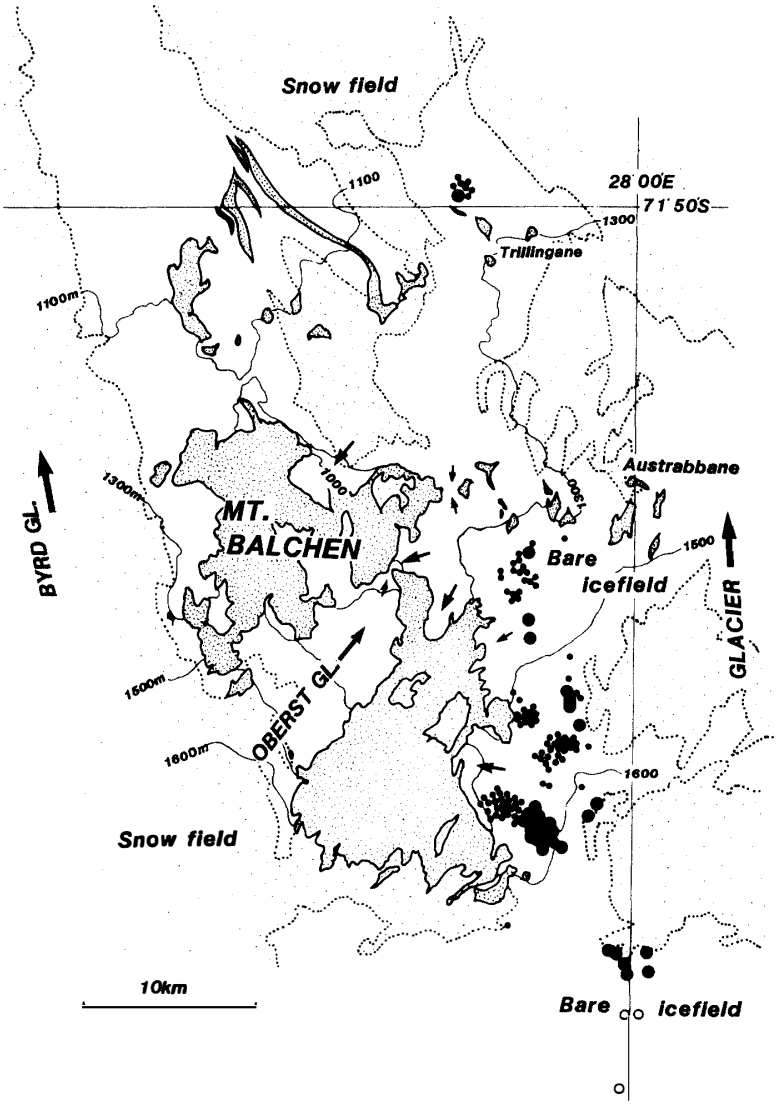

Fig. 5. Distribution map of the Asuka-90 meteorites (large solid circles) with Asuka-86 (open circles) and Asuka-87 (small solid circles).

largest stone, 8 kg. These meteorites are located just on the ice surface in the southern bare icefield, but the largest fusion-crusted specimen, 8.27 kg (Fig. 6b), was found in bare ice below 1300 m (possible almost 1000 m) altitude north of the Trillingane nunatak. The largest specimen was buried in frozen meltwater with tiny fragments and fine grains down to powder size. At the other side of the mountains below 1500 m altitude, there is much meltwater during the summer. Insolation warms the rocks, as well as any meteorites that might be there, and they sink into the ice. It is common to see rocks at the bottom of clear, frozen meltwater holes (cryoconite holes). It is very rare for a meteorite to be found in the bare icefield below 1300 m altitude.

Most of the meteorites in Mt. Balchen were collected on the bare icefield adjacent to the eastern edge of the mountain (Fig. 5). There are many terrestrial

rocks on the bare ice surface mixed with the meteorite pieces (Fig. 4). There was some difficulty in distinguishing terrestrial from extraterrestrial materials because terrestrial rocks include various types that are black, brown, dark brown, gray and white. Heavily oxidized and limonitic stained terrestrial rocks also added difficulty. However, most meteorites have been identified more easily.

Most of the meteorites collected in the Mt. Balchen area are highly weathered, covered by brown-dark brown limonitic stains, and fragmented into tiny pieces. They might have been exposed on the bare ice surface for a long time, compared with other meteorites in the Asuka region.

4. Asuka Meteorites: Initial Processing and Brief Identification

All meteorites are put in clean teflon and/or polyethylene bags in the field. The meteorite collection was kept frozen (below $-20^{\circ}C$) and shipped from the field to Japan. Then the collection was kept in the refrigerator (under $-20^{\circ}C$) at the NIPR. Following the procedures for all Antarctic meteorites, the initial processing was started in 1992, using the meteorite processing facilities of the NIPR. The meteorites were first returned to room temperature in a dry nitrogen-filled cabinet. The authors placed each meteorite on a clean flow bench and labeled it as Asuka-9001 to Asuka-9048 in order of the time when it was found. The meteorite was weighed, its three dimensions measured and briefly described with a brief classification. All the Asuka-90 meteorites have been listed in the meteorite catalogs and stored at the NIPR as source materials for further research, detailed identification and classification after the initial processing.

Together with the previously collected Asuka meteorites collections, the Asuka-90 meteorites were initially processed and briefly classified as shown in Table 1 with numbers, total weights and meteorite type identifications. The Asuka-90 collection consists of one achondrite (brecciated eucrite) and 47 chondritic specimens including one deeply weathered H-group chondrite. The total number in the Asuka-90 collection is 48 meteorites and meteorite fragments, weighing 11.48 kg in total. The largest, an L-group chondrite (Fig. 6b), weighs 8.27 kg. Another specimen is a 65 g

Table 1. Asuka meteorites collections.

Name (year)	Asuka-86 (1986)	Asuka-87 (1988)	Asuka-88 (1988/89)	Asuka-90 (1990)
Total	3	352	2124	48
The largest (kg)	1.5 (L)	46 (LL)	43 (H)	8.27 (L)
Irons	—	1	7	—
Stony-Irons	—	1	5	—
Achondrites	—	9	53	1
C. Chondrites	—	3	31	—
Chondrites	3	325	2028	47
Doubtful	—	13		
Total weight	2.20 kg	120.13 kg	394.08 kg	11.48 kg

Fig. 6a. Photograph of the Asuka-9029 eucrite, 65 g in weight, covered completely by shiny, black fusion crust with gray interior. Scale cube is 1 cm.

Fig. 6b. Photograph of the Asuka-9048 L chondrite, 8.27 kg. This is the largest stone in the Asuka-90 collection. Asuka-9048 is a fragile stone partly coated with evaporated mineral (white) and covered by a dark brown fusion crust (bottom). Scale cube is 1 cm.

eucrite breccia that is an almost perfectly rounded stone covered completely by a shiny-black fusion crust (Fig. 6a).

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References

NARAOKA, H., YANAI, K. and FUJITA, S.(1990): Dai-29-ji Nankyoku Chiiki Kansokutai Sêrurondâne Sanchi shûhen ni okeru inseki tansa hôkoku 1988–1989 (Report on Antarctic meteorites search around the Sør Rondane Mountains, JARE-29 1988–1989). Nankyoku Shiryô (Antarct. Rec.), **34**, 216–224.

NISHIO, F., OHMAE, H., MORI, K., OSADA, K. and URATSUKA, S. (1987): Collection of Yamato and Sør Rondane meteorites in the 1986–87 field season, Antarctica. Papers Presented to the 12th Symposium on Antarctic Meteorites, June 8–10, 1987. Tokyo, Natl Inst. Polar Res., 1–2.

YANAI, K. (1989): Over 2000 new Antarctic meteorites, recovered near the Sør Rondane Mountains, East Antarctica. Meteoritics, **24**, 343.

YANAI, K. (1991a): Asuka-87 meteorites collection: Preliminary report of the initial processing. Papers Presented to the 16th Symposium on Antarctic Meteorites, June 5–7, 1991. Tokyo. Natl Inst. Polar Res., 1–2.

YANAI, K. (1991b): Olivine fassite basalt: An unusual achondrite from Antarctica. Lunar and Planetary Science XXI. Houston, Lunar Planet. Inst., 1539–1540.

YANAI, K. (1991c): Unbrecciated and porphyritic eucrite Asuka-15 composed of silica mineral-plagioclase-pyroxenes. Meteoritics, **26**, 411.

YANAI, K. (1991d): Gabbroic meteorite Asuka-31: Preliminary examination of a new type of lunar meteorite in the Japanese collection of Antarctic meteorites. Proc. Lunar Planet. Sci., **21**, 317–324.

YANAI, K. (1993a): The Asuka-87 and Asuka-88 collections of Antarctic meteorites: Preliminary examination with brief descriptions of some typical and unique-unusual specimens. Proc. NIPR Symp. Antarct. Meteorites, **6**, 148–170.

YANAI, K. (1993b): Angrites LEW87051 and Asuka-881371: Similarities and differences. Meteorites, **28**, 463–464.

YANAI, K. and the JARE-29 ASUKA PARTY (1989): The meteorite concentration on the bare ice surface around the Sør Rondane Mountains, Antarctica. Papers Presented to the 14th Symposium on Antarctic Meteorites, June 6–8, 1989. Tokyo, Natl Inst. Polar Res., 1.

YANAI, K. and KOJIMA, H. (1992): Asuka-88 meteorites collection: Preliminary report of discoveries, initial processing and brief classifications. Papers Presented to the 17th Symposium on Antarctic Meteorites, August 19–21, 1992. Tokyo, Natl Inst. Polar Res., 2–3.

YANAI, K., KOJIMA, H. and NARAOKA, H. (1993a): The Asuka-87 and Asuka-88 collections of Antarctic meteorites: Search, discoveries, initial processing, and preliminary identification and classification. Proc. NIPR Symp. Antarct. Meteorites, **6**, 137–147.

YANAI, K., SHIRAISHI, K. and KOJIMA, H. (1993b): Asuka-90 meteorites collection: Preliminary report of discovery, initial processing and identification. Paper Presented to the 18th Symposium on Antarctic Meteorites, May 31–June 2, 1993. Tokyo, Natl Inst. Polar Res., 1–2.

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