ANTARCTIC SEARCH FOR METEORITE BY U.S.-JAPAN JOINT PARTY, 1978–1979

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Abstract: The third U.S.-Japan joint program entitled "Antarctic search for meteorites" (ANSMET) was carried out during the 1978–1979 field season. Three Japanese and four U.S. scientists collaborated in the search for meteorites and found 311 specimens.

262 meteorites were found around the Allan Hills where 311 specimens were collected during the 1977–1978 season. 44 meteorites were found near the Darwin Glacier, 10 of which are iron meteorites. Six irons were discovered by a New Zealand geological party near Derrick Peak and five chondrites were found by a party of Ohio State University geologists in the vicinity of Reckling Peak.

Preliminary classification in the field shows that the parties collected 11 irons, 5 to 8 achondrites, 2 carbonaceous chondrites and 290 to 292 chondrites. Most specimens were recovered with minimum contamination and were transported frozen in order to retard chemical weathering.

1. Introduction

The third U.S.-Japan search for Antarctic meteorite was conducted from November 1978 to January 1979 in South Victoria Land. The U.S. participants were William A. CASSIDY and Dean A. CLAUTER, Department of Geology and Planetary Science, University of Pittsburgh, John O. ANNEXSTAD, Lunar Curator's Office, NASA/Johnson Space Center, and Ursula B. MARVIN, Smithsonian Astrophysical Observatory. Japanese participants were Fumihiko NISHIO, Minoru FUNAKI and the author from the National Institute of Polar Research.

Since a number of meteorites had been found on the bare ice sheet around the Allan Hills, the first task of the search party this season was to find other localities where meteorites may be concentrated (YANAI, 1978, 1979). The second goal was to conduct a glaciological survey to investigate the mechanism of the concentration of the meteorites. A resurvey in detail around the Allan Hills region was also planned.

In this report, the field occurrences of the meteorites collected during this season are briefly described. The results of the glaciological survey will be reported in another article in this volume.

Method: Method of collection followed that of the previous season when all

Table 1. Preliminary tabulation of specimens found during field season 1978–1979.

	Around Darwin Glacier	Around Allan Hills	Total
Iron meteorites	10	1	11
Achondrites		5	5
Chondrites except carbonaceous chondrites	34	256*	290
Carbonaceous chondrites		2	2
Possible meteorites		3	3
Total	44	267	311

* Including five chondrites which were found by a party of Ohio State University in the vicinity of Reckling Peak.

stony meteorites were carefully packaged in clean teflon bags. Carbonaceous chondrites received special handling in that they were wrapped in aluminum foil and put in tightly sealed stainless steel containers in the field. All meteorites were kept frozen and were shipped to the Johnson Space Center, Houston, Texas, for initial processing and subdivision.

The result of the meteorite search is summarized in Table 1.

2. Meteorite Search in Darwin Glacier Area

Darwin Glacier is located at about 300 km southwest of McMurdo Station. An advance camp, which was constructed for field parties this season, was the base for the reconnaissance meteorite search by helicopter from December 2 to 30, 1978. The blue ice areas searched include Boomerang Range, Warren Range, Finger Ridges, Butcher Ridge, upper Darwin Glacier, Darwin Mountains, Turnstile Ridge, Westhaven Nunatak, Bates Nunataks and Lonewolf Nunataks (Fig. 1).

The first meteorite discovery in these regions was made at Derrick Peak by a geological survey party from the University of Waikato, New Zealand, on December 11, 1978. Following this original find of six iron meteorites, ten more irons were collected by the joint U.S.-Japanese parties around Derrick Peak (Figs. 2 and 6). All of the irons from Derrick Peak were found among rocky debris of the basal Ferrar dolerite and Beacon sandstone. This could be the first discovery of meteorites in that type of situation in Antarctica. The biggest iron meteorite, which might be over a hundred kilograms in weight, was found on a rocky terrace over 600 meters above the Hatherton Glacier. The irons were found distributed from the terrace to the valley with most of the large specimens located at or near the top of the terrace.

There may be two possible causes of the concentration of these iron meteorites

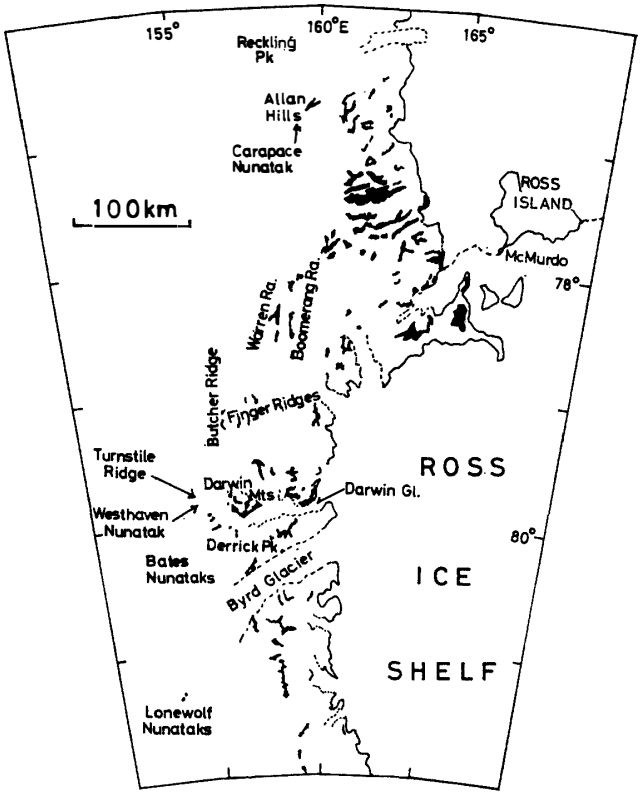

Fig. 1. Index map of place names in South Victoria Land.

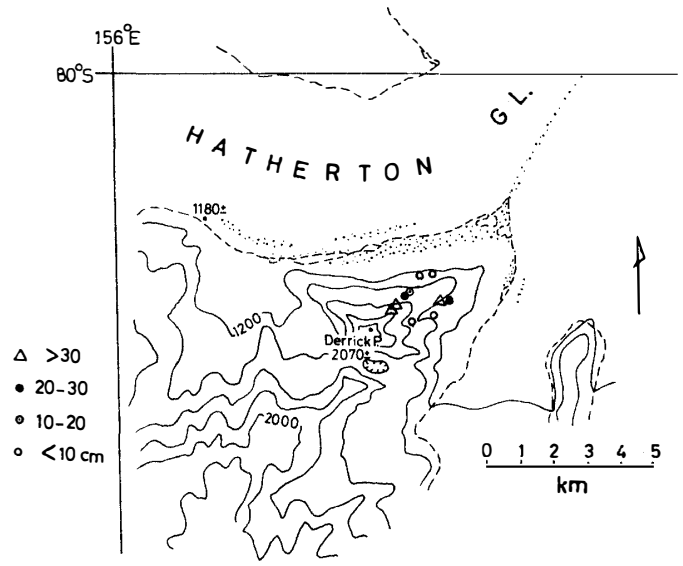

Fig. 2. Distribution map of iron meteorites around Derrick Peak. Symbols indicate the sizes of the meteorites.

in such a narrow region. One is that the parent body fell near the present area. The distribution of size decreasing from the terrace toward the valley suggests the position *in situ* except for a few larger specimens which slipped down later. The other is that these meteorites were transported from the upper ice sheet during the time when ice covered Derrick Peak. Though the latter case seems to be more probable, it is likely that the parent body (or meteorite shower) fell reasonably close to the present find region.

All other find localities are on the bare ice fields near the western end of the Darwin Mountains and Bates Nunataks. Near the Darwin Mountains, where the ice sheet spills down to the glaciers, twenty-three stony meteorites were concentrated (Fig. 3). They ranged in size from 4.5 to 6.5 cm and have almost complete fusion crusts. It was noticed that some were sunk in ice hollows filled with water due to solar heating.

Some larger meteorites, including one about 15 kilograms, were found on the bare ice near the end of a moraine which divided the Darwin and Hatherton

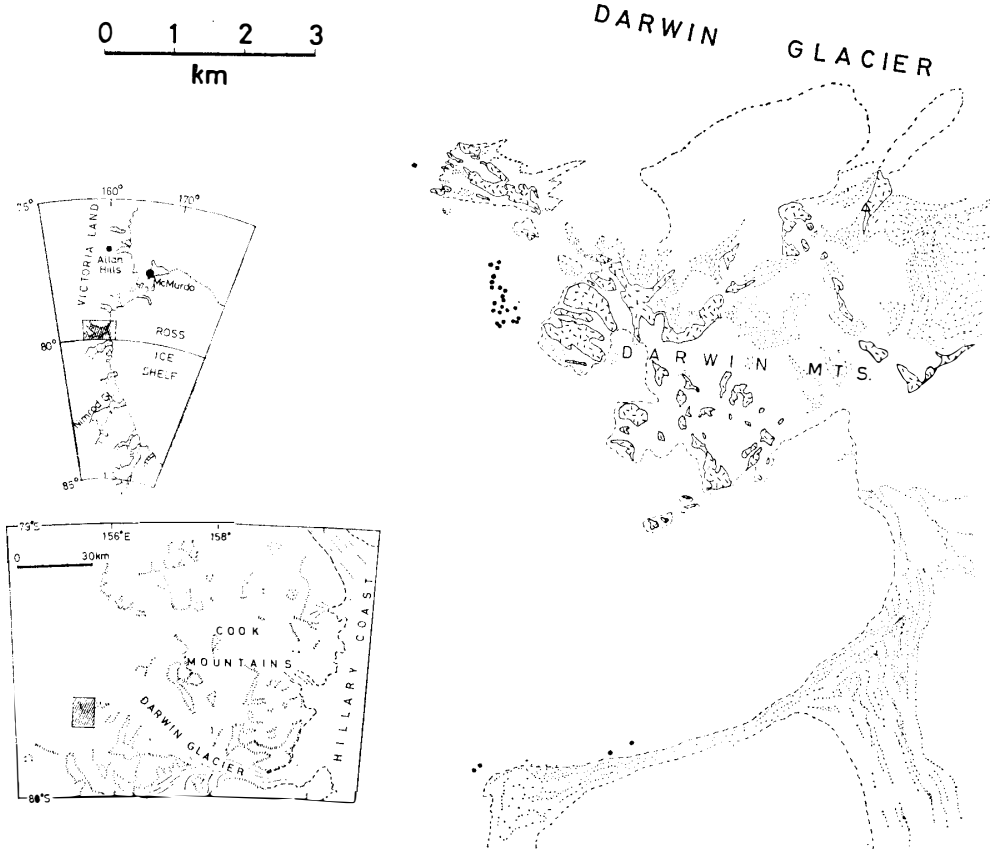

Fig. 3. Map showing the distribution of the meteorites in the Darwin Mountains area. The map was compiled from the airphotographs. Scale is approximate.

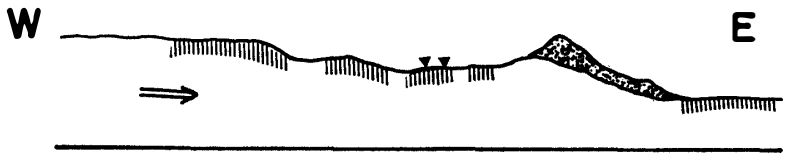

Fig. 4. Schematic cross section around Bates Nunataks. Shaded areas are bare ice patches. Triangles indicate approximate sites of meteorites. Arrow shows the estimated direction of ice flow.

Glaciers (Figs. 3 and 14). In this area, the ice sheet ends at the Darwin Mountains with step-like surface topography similar to the case of Bates Nunataks as shown in Fig. 4. Most of the meteorites were found on the lower step, but one was discovered on the upper step. Therefore, it is probable that more meteorites would be found on the upper step if the area was investigated further.

Bates Nunataks are composed of three isolated nunataks over a rather wide bare ice field. Six stony meteorites were collected in this area. Two of the six were located close to each other and fit on the fractures (Figs. 8 and 9), while three of the other four were found within 100 meters from them. These are considered to have come from the same fall.

3. Meteorite Search in Allan Hills

The meteorite search around the Allan Hills was carried out during two periods, *viz.* from 11th to 26th November 1978, and from 29th December 1978 to 14th January 1979. Meteorites were also found by personnel during the glaciological work between December 7, 1978, and January 2, 1979.

The search was limited to the bare ice area between longitude 159°E of Fig. 5 and the western flank of the Allan Hills. In this same area, about 300 meteorites had been found during the 1977–78 season. One reason why so many meteorites (262) were found by the second search party might be due to the removal of snow cover by the wind and the exposure of greater parts of bare ice. Two sites, about 500 meters in diameter, where many meteorites were concentrated are on the margin of the bare ice and firn area. Many fragmental meteorites were also found on the firn.

Fig. 5a shows the distribution of meteorites collected around the Allan Hills during this season and Fig. 5b the total collection in the past. The distribution of meteorites as shown in these figures indicates that specimens are concentrated at the eastern side of the monocline as described by YANAI (1979). The concentrations this season are in the same areas as past seasons.

Two carbonaceous chondrites were found at area B in Fig. 5a and in the moraine which is located 2 km east of the campsite, respectively. The specimens are only a few centimeters long with subangular shapes, but the fusion crusts are

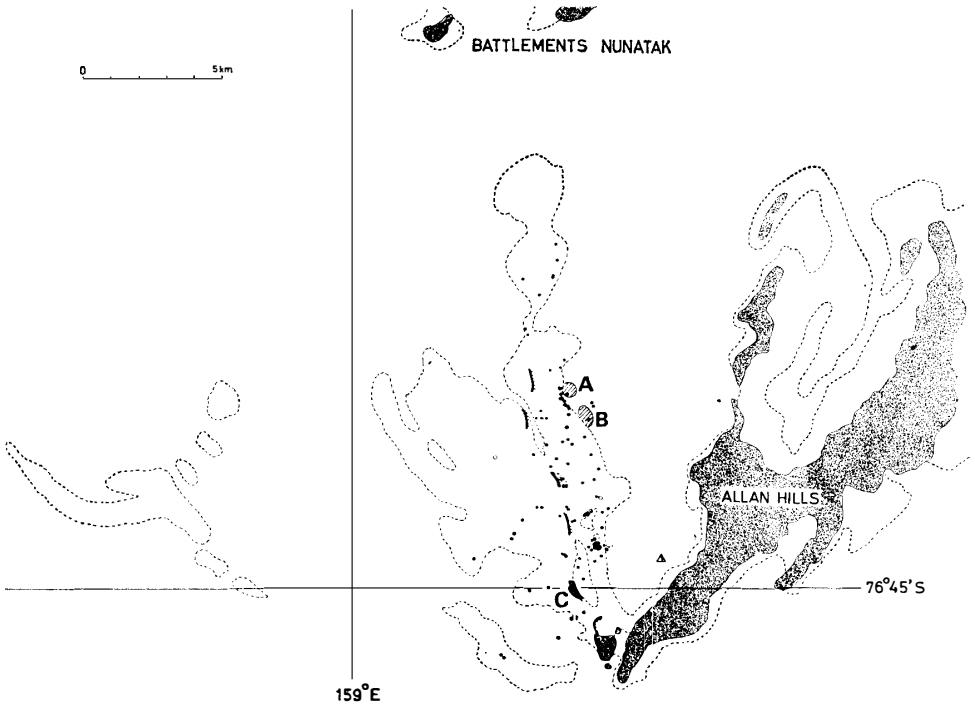

Fig. 5a.

Fig. 5. Map showing the distribution of all the meteorites collected around the Allan Hills during 1978/1979 field season (Fig. 5a) and during the three seasons since 1976 (Fig. 5b). Three hatched areas A, B and C are where 22, 98 and 11 specimens were concentrated respectively. Triangle indicates the campsite this season.

easily recognized (Figs. 12 and 13). One iron meteorite was collected along with 256 to 258 chondrites and 5 to 8 achondrites. Most specimens are fragmental but some of them have a complete fusion crust (Fig. 15).

Two meteorites were partially or entirely buried in the ice. This is a very rare occurrence, although YANAI (1979) also observed it. YANAI noted in his paper that the meteorite might be on the way to the surface as the ablation process continues to wear the ice away. However, careful observation this season denies YANAI's explanation at least for the above two meteorites. The ice surrounding the meteorites is quite clear in contrast to that of the outer ice which has many bubbles. It seems that the clear ice might have crystallized later than the outer ice, suggesting that solar heating has caused the ice to melt around the meteorite. On refreezing, the meteorite is trapped in the clearer or younger ice. This phenomenon has been seen at the Darwin Mountains as meteorites sunk in hollows filled with meltwater.

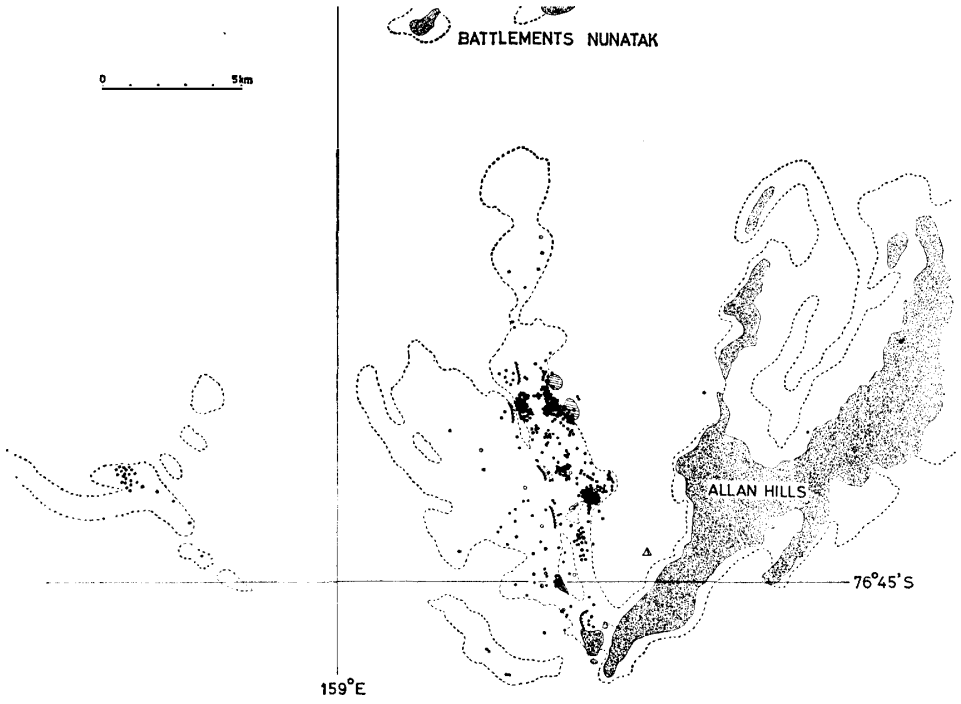

Fig. 5b.

Fig. 5b is referred to YANAI *(1979).*
●: *Chondrite,* ○: *Achondrite,* ◑: *Carbonaceous chondrite,*
⊙: *Iron meteorite.*

Acknowledgments

The author's special thanks are due to the staff of the United States Antarctic Research Programs (USARP). Drs. Craig LAW and Michael SELBY of the University of Waikato were kind enough to co-work for search of iron meteorites at Derrick Peak.

One of the ten iron meteorites at Derrick Peak was presented by Mr. Peter KING, member of the New Zealand Antarctic Research Program. Dr. Phillip KYLE of Ohio State University, who was carrying on geological survey, offered us five chondrites from Reckling Peak.

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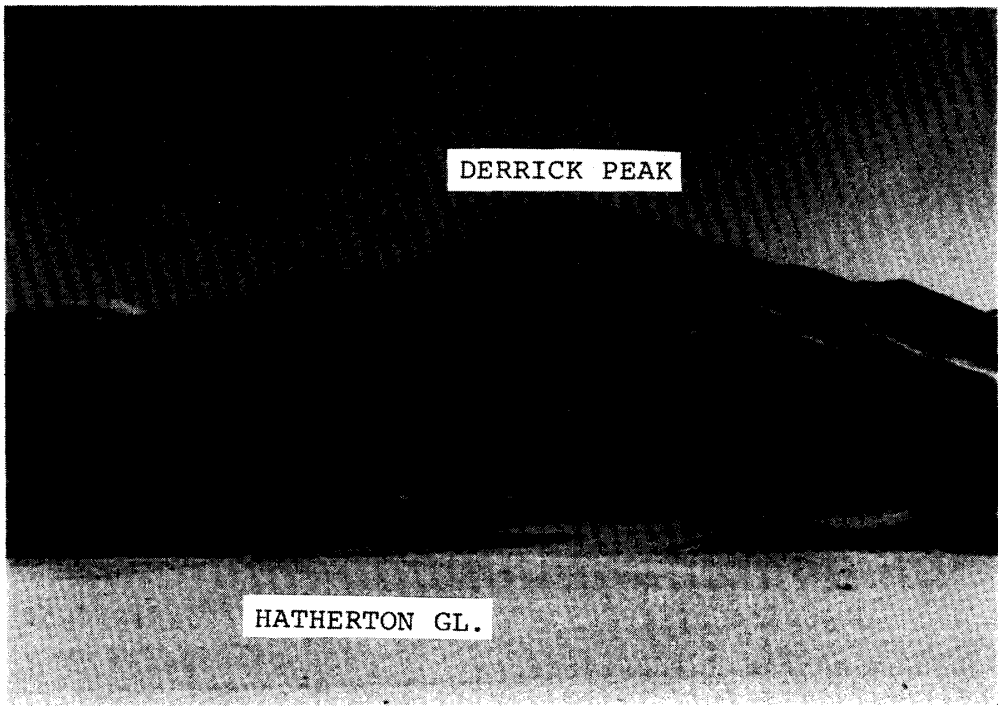

Fig. 6. Derrick Peak viewed from north. Dark band is Ferrar dolerite sill and its debris covering Beacon sandstone.

Fig. 7. The largest iron meteorite from Derrick Peak (field number 302).

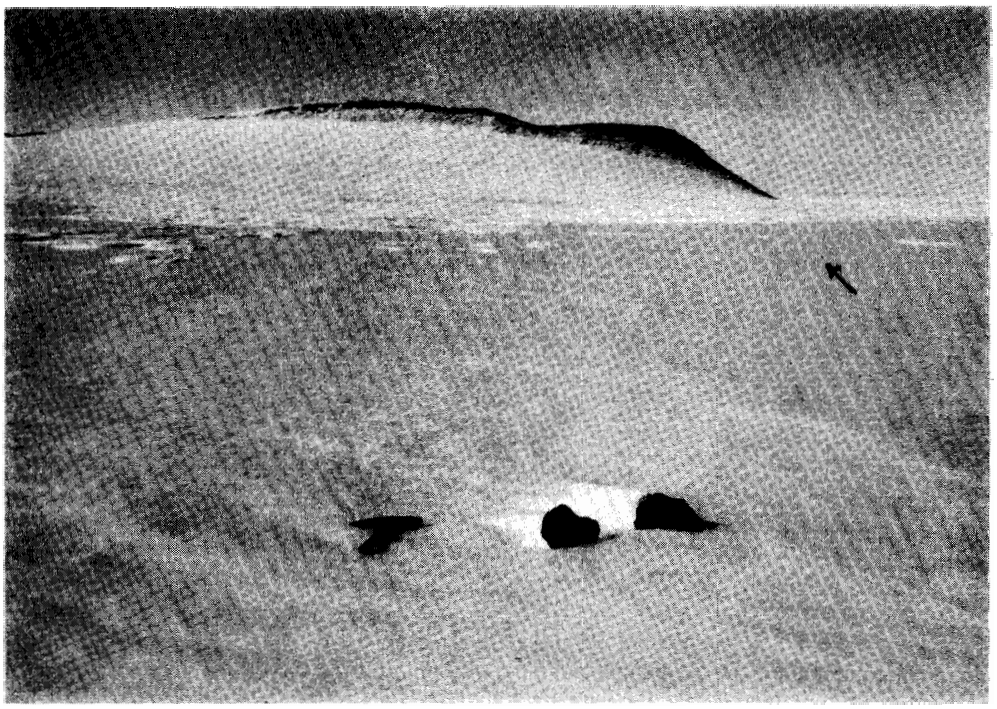

Fig. 8. Stony meteorites located close to each other near Bates Nunataks (field numbers 325 and 326). Arrow indicates another fragment of the same meteorite (field number 327).

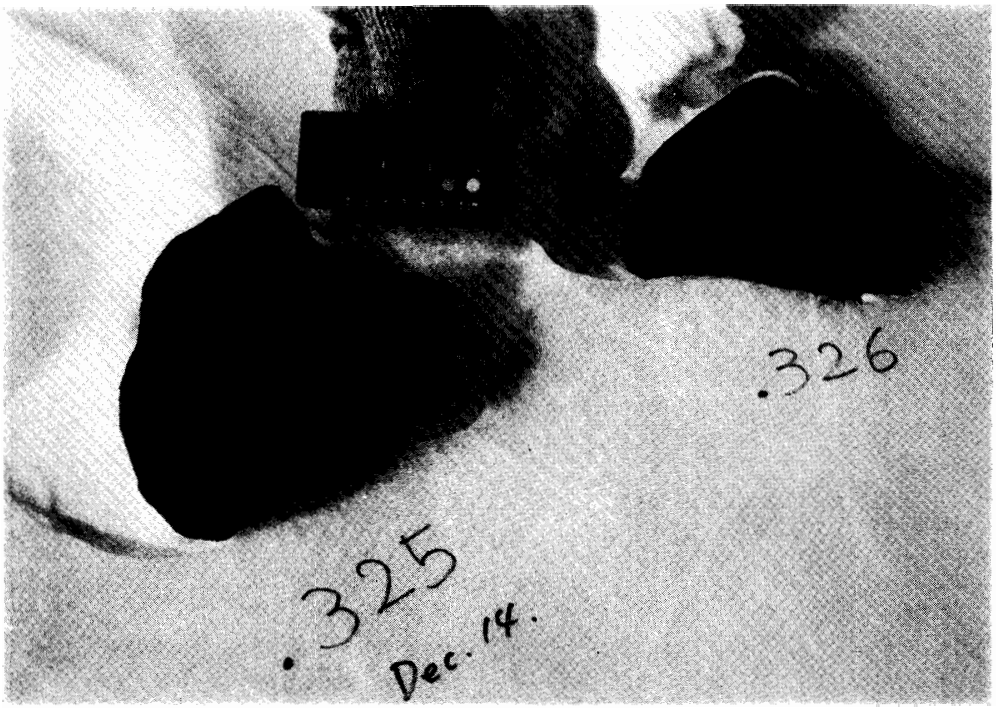

Fig. 9. Close-up photograph of Fig. 8.

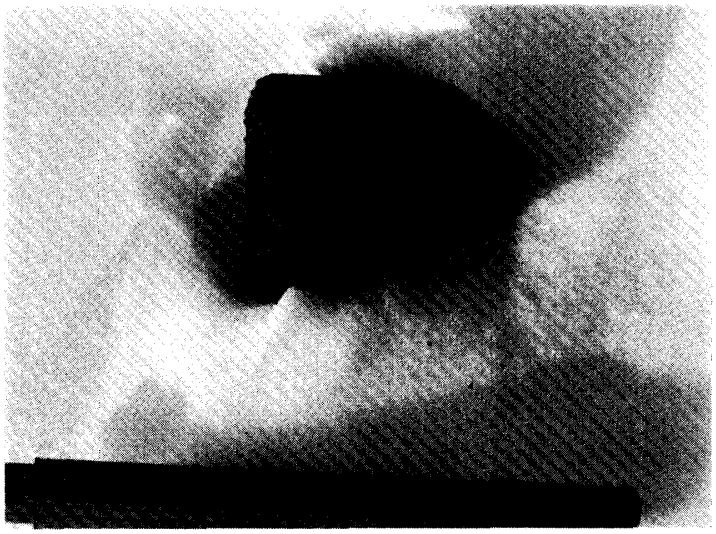

Fig. 10. The largest achondrite from the Allan Hills this season (field number 406). Photograph taken by F. NISHIO.

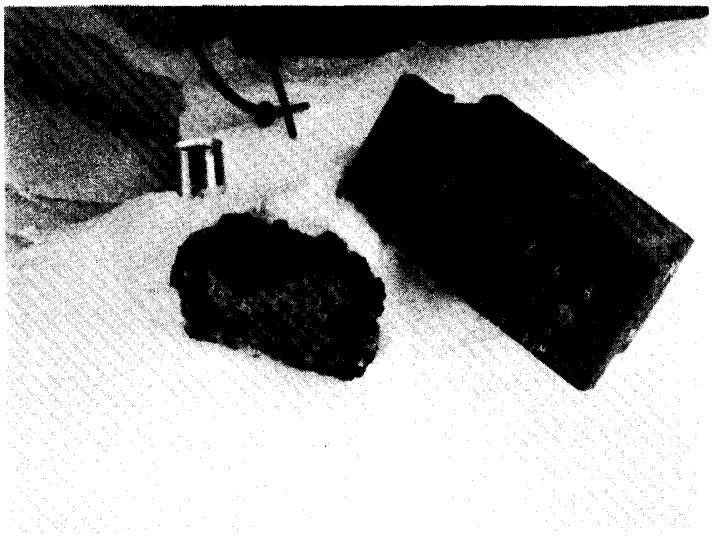

Fig. 11. Probably unequilibrium chondrite from the Allan Hills (field number 248).

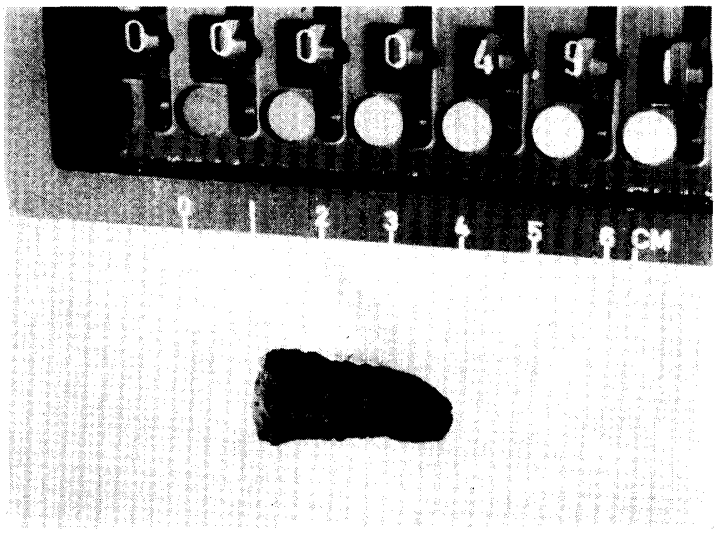

Fig. 12. Carbonaceous chondrite from the Allan Hills (field number 491).

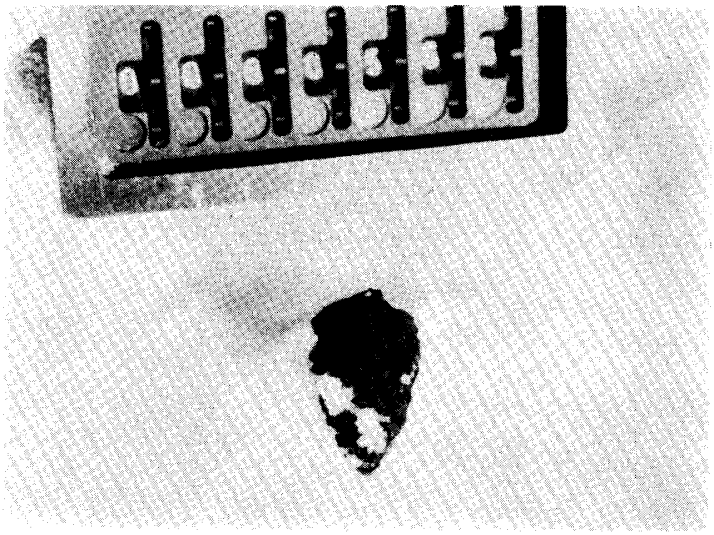

Fig. 13. Carbonaceous chondrite from the Allan Hills (field number 500).

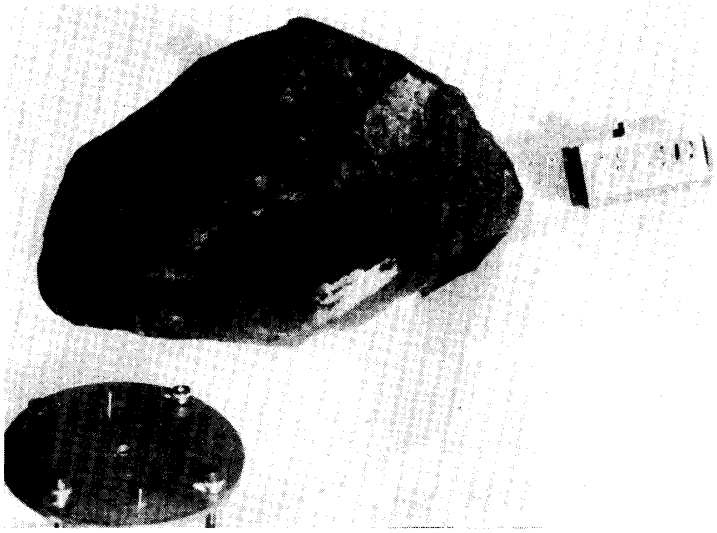

Fig. 14. The largest chondrite from the Darwin Mountains this season (field number 333).

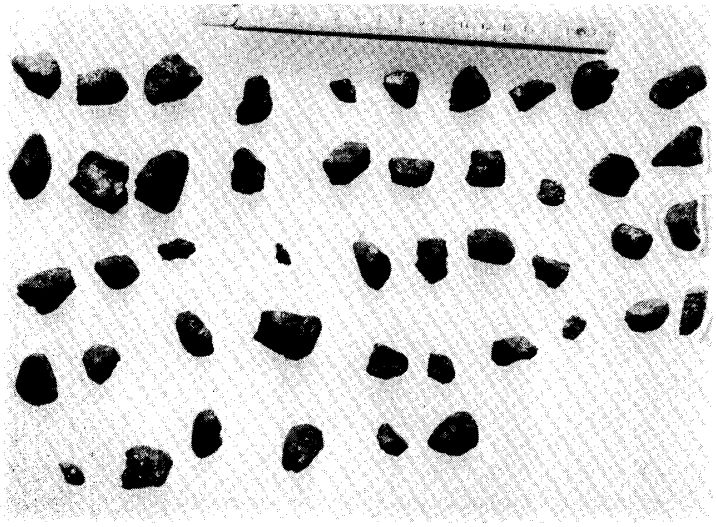

Fig. 15. 46 chondrites of 98 meteorites from area B of Fig. 5a (field number 081–090, 141–150, 171–190 and 391–396). These specimens were collected in one group bag.