SEARCH FOR METEORITES AT MARTIN HILLS AND PIRRIT HILLS, ANTARCTICA. P. Lee[1], W. A. Cassidy[2], D. Apostolopoulos[3], D. Bassi[4], L. Bravo[5], H. Cifuentes[5], M. Deans[3], A. Foessel[3], S. Moorehead[3], M. Parris[3], C. Puebla[5], L. Pedersen[3], M. Sibenac[3], F. Valdés[6], N. Vandapel[7], and W. L. Whittaker[3]. [1]NASA Ames Research Center, MS 245-3, Moffett Field, CA 94035-1000, USA, pclee@mail.arc.nasa.gov, [2]Dept. of Geology and Planetary Science, Univ. of Pittsburgh, Pittsburgh, PA 15260, USA, [3]The Robotics Institute, Carnegie Mellon Univ., Pittsburgh, PA 15213, USA, [4]Universidad de Santiago, Santiago, Chile, [5]Fuerza Aerea de Chile, Chile, [6]Empresa Nacional Aeronaútica (ENAER), Chile, [7]Laboratoire d'Analyses et d'Architectures des Systèmes, France.

Introduction: Between 4 and 8 Nov., 1998, a foot search for meteorites was conducted at Martin Hills (82°00'S, 88°00'W) and Pirrit Hills (81°09'S, 85°05'W), Antarctica. This search was made in the context of a test site survey for the NASA-funded Robotic Antarctic Meteorite Search (RAMS) Program of the Robotics Institute of Carnegie Mellon University, Pittsburgh, PA, USA. The goal of the RAMS Program is to develop a robotic vehicle capable of searching for meteorites in Antarctica autonomously. The Martin Hills and Pirrit Hills areas were chosen mainly because of their proximity to Patriot Hills (80°20'S, 81°20'W), a site where logistical support is readily available and where the 1998-1999 field season tests of the Nomad rover, the present robotic testbed, would be conducted. No meteorites are found at Patriot Hills, possibly because of the site's low altitude (800 - 1000 m) which results in relatively warm summer peak temperatures and hence significant surficial ice melting [1]. Both Martin Hills and Pirrit Hills are at higher elevations, ~1600 m and ~1400 m respectively, and are associated with blue ice fields as evident in aerial photographs. We report here on our search for meteorites at Martin Hills and Pirrit Hills, the first meteorite searches conducted at these sites.

Martin Hills: On 4 Nov., 1998, a 7-person search was conducted on foot at Martin Hills during a brief 2-hour stop at the site's northern blue ice field. Both the eastern and western strips of this ice field were walked. The total distance traversed was approximately 10 person-kilometers, covering an estimated 1% of the total blue ice area available **(Fig. 1)**.

One meteorite was found, on blue ice near the western end of the eastern ice strip, at 82°03.1'S, 87°59.5'W. The meteorite, ~ 3.5 x 1.5 x 1.5 cm in size and 70% fusion-crusted, was assessed upon collection as probably an ordinary chondrite **(Fig. 2)**.

Numerous terrestrial rock debris fragments in a variety of sizes were also present on the ice, mostly fragments of dark basalt evidently derived from the Martin Hills. A few *regelation portholes* (windows of clear refrozen ice through which sunken rocks or finer sediments can be seen) were noted on the ice, but not nearly as abundantly as at Patriot Hills **(Fig. 3)**.

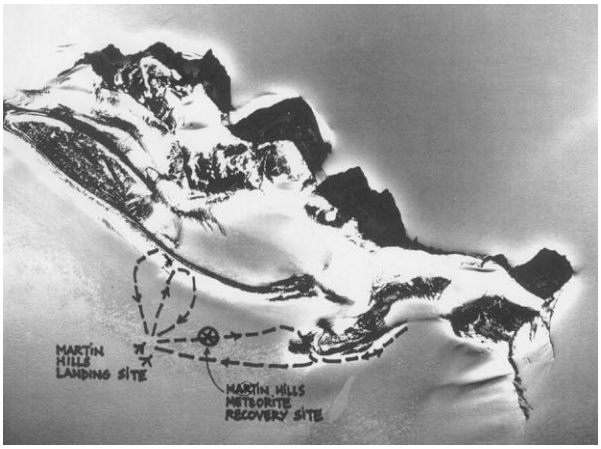

Fig.1. Aerial photograph of Martin Hills showing the foot-search traverses and the meteorite find site.

Fig.2. The single meteorite recovered at Martin Hills. The 11cm-long tool is shown for scale.

Pirrit Hills: Between 4 and 8 Nov., 1998, several foot searches by groups of 2 to 5 persons were conducted across the eastern blue ice fields of the Pirrit Hills. Blue ice areas within a radial distance of ~3 km from a temporary campsite established at 81°08.9'S, 85°05.4'W were searched. Traverses reached as far south as 81°09.9'S, 85°23.0'W, 5.3 km from camp, and as far west as 81°08.2'S, 85°21.1'W, 4.7 km from camp. The total distance walked was approximately 60 person-kilometers **(Fig. 4).**

Fig.3. Regelation porthole shown with tip of boot.

Fig.4. Aerial photograph of Pirrit Hills showing the area searched on foot.

Fig.5. The single meteorite recovered at Pirrit Hills was identified as a meteorite only once cut in the field with an experimental field petrography kit.

One meteorite was found. The object is 2.5 x 2.5 x 2 cm in size and was only conclusively identified as a meteorite on 30 Nov, 98, when it was saw-cut at the Patriot Hills camp using an experimental field petrography kit developed by NASA Ames, The Mars Society, and the Robotics Institute of Carnegie Mellon University. The meteorite appears to be an H-chondrite **(Fig.5)**.Numerous terrestrial rock debris fragments in a variety of sizes are present on the ice at Pirrit Hills, mostly leucocratic fragments of granitic rocks, but also dark fragments of biotite, hornblende and magnetite. A typical surface density of macroscopic debris encountered on bare blue ice is 25 m^{-2}, while snow cover on the blue ice fields was about 50%. Many regelation portholes were noted, in lesser abundance than at Patriot Hills and perhaps more commonly than at Martin Hills [2]. Many rocks or sediments seen in the regelation portholes at Pirrit Hills are of relatively low visual albedo (e.g., granodiorites).

Discussion and Conclusions: One meteorite was found at Martin Hills, and one at Pirrit Hills. Signs of ice melting at both sites, mostly in the form of regelation portholes, are fewer than at Patriot Hills but are nevertheless present. Two explanations for the general dearth of meteorites at Martin Hills and at Pirrit Hills are possible: (a) The ice may experience significant melting due to summer peak temperatures above freezing, especially around rocks of low albedo. A meteorite about to emerge from the ice would tend to remain below the ice surface by radiatively melting its surroundings, or if somehow exposed at the surface, would likely experience rapid weathering; (b) The history and sources of ice in the Martin Hills and Pirrit Hills areas are unknown and might have been inadequate for concentrating meteorites. The blue ice fields traversed might have been exposed as potential meteorite stranding surfaces only recently, or the upstream gathering areas might not be extensive. The Martin Hills and Pirrit Hills blue ice fields are clearly not meteorite stranding sites of high yield. Our results support the general observation that only those blue ice fields experiencing very little surficial melting may be productive meteorite stranding surfaces [2]. Combined with our meteorite search experience in the Patriot Hills area [1], a threshold altitude in the Ellsworth Land region of Antarctica below which meteorite searches are likely to be unproductive appears to be ~1500 m. We do not recommend robotic meteorite searches at either Martin Hills or Pirrit Hills.

References: [1] Lee, P. *et al*. (1998). *Meteorit. & Planet. Sci*. 33, A92-A93. [2] Cassidy, W. A. (1991). In *The Geology of Antarctica*, Oxford Univ. Press, 652-666.

Additional Information: Additional information is available at www.frc.ri.cmu.edu/projects/meteorobot/

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