A SECOND COLLECTION OF MICROMETEORITES FROM THE SOUTH POLE WATER WELL

S. Taylor, J. H. Lever, and J. Govoni, CRREL, 72 Lyme Road, Hanover, NH 03755, staylor@crrel.usace.army.mil.

Introduction: In 1995, we successfully collected both melted and unmelted micrometerorites from the bottom of the South Pole drinking water well (SPWW). Particles were obtained from a 30-m^2 area and the age of the ice sampled was approximately 1100-1500 AD. We returned to the well in December 2000 with the goal of collecting all of the material from the bottom before its closure in 2001.

Experimental Methods: We used the same equipment and general methods we described for our 1995 deployment (Fig.1)[1]. Our collector suctioned and internally filtered the particles from the ice surface while traversing the well bottom. We controlled it from the surface via a waterproof electro-mechanical cable and an underwater video system. Based on what we knew about the bottom topography of the well we modified the collector to improve its ability to climb sloped surfaces and to suction particles from cm-deep depressions in the ice. The former was accomplished by using higher torque motors and by lowering the center of gravity of the collector.

Fig. 1. Plastic 0.3 by 1.2 m collector body (white) containing filter fabric. Spiked wheels (top one visible) provide mobility; stainless steel central waterproof housing contains motors and pump.

To suction particles from small deep depressions we reconfigured the collector components (Fig. 2) and attached an intake nozzle directly to the pump and a filter bag to the pump outflow. The filter fabric we used had a 17-µm mesh opening.

Fig. 2. Modified collector. Particles are suctioned by axe-shaped nozzel (right), go through the pump and into filter bag. The spiked wheels are not visible.

Results: The well is now 140 m deep, 35 m below the 1995 level. A depth-to-age relationship obtained from an ice core [2] gives an age of 700-1100 AD for the new interval. The main bottom features we observed in 1995, a central plateau and surrounding pockets, were preserved. This time, however, the central plateau was larger and bowl shaped. Climbing out of the bowl, the collector decended into narrow particle-filled depression (pockets). We had difficulty suctioning these areas in 1995.

In 2000, we were able to suction the central plateau and all the surrounding pockets. The 11 deployments yielded about 40 g of material. Hand sorting of several different samples suggests that about 1% of the collected material is extraterrestrial. Only 1/5 as much sediment was collected this time, indicating that much of the debris from the 1994 water pump failure was removed during the 1995 deployment. We have not yet processed the video record to determine the area suctioned, but we estimate that we sampled about 40 m^2.

As found previously [3], most the micrometeorites appear unweathered. Many of the extraterrestrial particles are cosmic spherules that have been partially to totally melted(Fig. 3). There are some transparent and translucent glass spherules, in addition to a few unmelted micrometeorites.

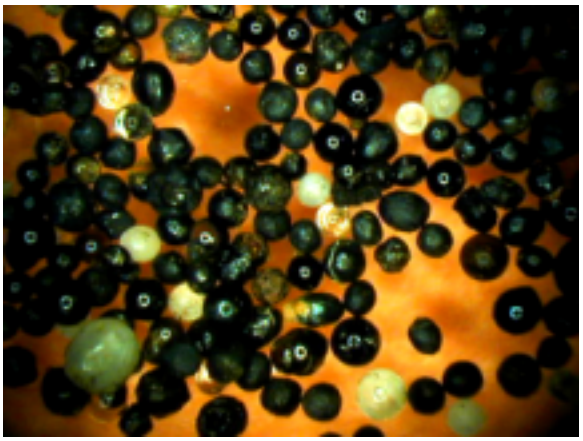

Fig. 3. Assortment of extraterrestrial particles from the 250-425 μm size-fraction (deployment 10). The large, light-colored spherule in the lower left is 650 μm in diameter.

Conclusions: The 1995 South Pole water well plateau sample yielded a precise flux and mass distribution for 50-700 μm cosmic spherules [4], and a complete statistical description of the number, type, and composition of these spherules [3]. These types of measurements require a large, unbiased deposit of particles, little or no weathering, good age constraint, a known area of contribution, and an unbiased collection technique of known efficiency. Because the 2000 collection contains less terrestrial contamination it should beeasier to find unmelted micrometeorites. We, therefore, hope to characterize the 2000 plateau sample for both melted and unmelted nicrometeorites. Knowing the flux, size, and compositional distributions provides important background information that increases the value of individual samples sent to other researchers analyzing subsets of the collection.

References: [1] Taylor S. et al. (1997) *CRREL report 97-1.* [2] Kuivinen K.C. et al. (1982) *Ant. J.of the US***XVII**, 89-91. [3] Taylor S. et al. (2000) *MPS, 35*, 651-666. [4] Taylor S. et al. (1998) *Nature 392*, 899-903.