40 Years of Processing Pieces of Space

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This year marks the 40th year anniversary for the Antarctic Search for Meteorite (ANSMET) program. In 1976, the ANSMET program led the first expedition to Antarctica. The ANSMET program is a US-led field-based science project that recovers meteorite samples from Antarctica. Once a year from late November to late January, a field team consisting of 8 to 12 people, spends 6-8 weeks camping on the ice and collecting meteorites. Since 1976, more than 22,000 meteorite samples have been recovered. These meteorites come from asteroids, planets and other bodies of the solar system.

Once collected, the Antarctic meteorites are shipped to NASA/Johnson Space Center (JSC) Houston, TX. in a refrigerated truck and are kept frozen to minimize oxidation until they are ready for initial processing. In Antarctica each meteorite is given a field tag which consists of numbers, once in the lab, this is replaced by an official tag, consisting of the Antarctic field location and year collected.

The types and numbers of meteorites that have been classified include 849 carbonaceous chondrites, 135 enstatites, 512 achondrites, 64 stony, 115 irons, 48 others (27 R chondrites, 7 ungrouped), 6,161 H's, 7,668 L's, and 4,589 LL's. Although 80-85% of the collected meteorites fall in the ordinary chondrite group, the other ~15% represent rare types of achondrites and carbonaceous chondrites. These rare meteorites include 25 lunar meteorites, 15 Martian meteorites, scores of various types of carbonaceous chondrites, and unique achondrites.

The Antarctic meteorites that have been collected are processed in the Meteorite Processing Lab at JSC in Houston, TX [1]. Initial processing of the meteorites begins with thawing/drying the meteorites in a nitrogen glove box for 24 to 48 hours. The meteorites are then photographed, measured, weighed and a description of the interior and exterior of each meteorite is written. The meteorite is broken and a representative sample, either a 1-3 g chip or thin section is sent to the Smithsonian Institution for classification. After Antarctic meteorites have been classified and approved by the Nomenclature Committee of the Meteoritical Society, they are announced in the Antarctic Meteorite Newsletter [2-3], which is published twice per year (fall and spring) so that scientists may review which meteorites are available to study. Requests for Antarctic Meteorite samples are welcomed from research scientists, regardless of their current state of funding for meteorite studies. Since its inception over 3,300 requests have been made for pieces of these meteorites and over 400 investigators worldwide are active in the study of meteorites. . Research on these samples has been published in >1500 peer reviewed articles; a listing of papers for any meteorite sample can be generated by accessing http://curator.jsc.nasa.gov/antmet/referencesearch.cfm.

Antarctic meteorite samples requested by scientists are prepared several different ways. Most samples are prepared as chips, either using a rock splitter or using a chisel and chipping bowl. In special situations, a researcher may request a meteorite slab in which case the samples are cut using a diamond-bladed bandsaw inside of a dry nitrogen glove box. The meteorites are always cut in a 100% liquid-free environment. Additionally, thin/thick sections of Antarctic meteorites are also prepared at JSC. The meteorite thin section lab at JSC can prepare standard 30-micron thin sections, thick sections of variable thickness (100 to 200 microns), or demountable sections using superglue, all section are prepared without using water.

Although many of the techniques used back in the '70's are still used today, advances in computers, software, databases, available tools and instrumentation have helped to streamline and shorten the duration of the classification process. In conjunction with present day missions to asteroids and other planets, meteorite studies have not only led to a better understanding of the complex histories of these bodies but have also tied certain meteorite groups to particular asteroid bodies. New meteorite discoveries by the ANSMET program provide a cost effective method for obtaining samples of previously unsampled bodies, allowing scientists to learn more about the origin, composition, and evolution of the solar system. Preservation in our cleanrooms at NASA allows material to be archived for future generations and advances in instrumentation and analysis.

References: [1] http://curator.jsc.nasa.gov/antmet/index.cfm [2] http://curator.jsc.nasa.gov/antmet/classdb.cfm [3]http://curator.jsc.nasa.gov/antmet/amn/amn.cfm