THE EVOLUTION OF ANSMET: HOW IDEAS ABOUT THE RECOVERY, CONCENTRATION AND SIGNIFICANCE OF ANTARCTIC METEORITES HAVE CHANGED OVER FOUR DECADES.

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Introduction: The US Antarctic Search for Meteorites (ANSMET) program recently completed its 40th field season. While ANSMET can claim neither the first serendipitous nor the first systematic recoveries of Antarctic meteorites, the incredible continuity of ANSMET recoveries has provided the opportunity for steady improvement in recovery techniques, exploration of new sites in new glaciological settings, and the development new paradigms in the field of meteoritics.

Recovery: There were two goals for ANSMET's earliest field seasons: meteorite recovery (to prove the concept) and discovery of localized concentrations (to prove the long-term value of creating a program). Both benefitted from early partnership with Japan's NIPR [1]. Utilization of the US Antarctic Program's (USAP) advanced logistical led to the discovery of concentrations throughout the Transantarctic Mountains and encouraged rapid, mechanized search techniques, while partnerships with world-class characterization and curation institutions and a system designed to encourage scientific discoveries by others maintained a high demand for specimens. Recognition of the value of increasingly rare specimens in concert with careful surveying of meteorite find locations (first optically and then by GPS) encouraged a transition toward more intense searches and more "complete" levels of recovery, including foot searching at firn edges and moraines. More recently, access to high-resolution satellite imagery has further promoted a focus on completeness and supported reconnaissance to promising sites that might have remained unexplored in previous eras [2]. One thing that hasn't changed in 4 decades- ANSMET still relies on the astounding abilities of the human visual system as its primary meteorite detector.

Concentration Mechanisms: Early attempts to explain why Antarctic meteorite concentrations exist rightly understood the importance of the geographical setting (typically sites where seaward flow of the East Antarctic ice-sheet is retarded by mountains) but often focused on individual processes such as ice motion, long-term deflation or direct infall [3]. As of this writing ANSMET has explored meteorite concentrations on nearly 200 different icefields at locations along 2600 km of the Transantarctic Mountains, and the overwhelming consensus is that meteorite concentrations result from a mixture of all three of these supply mechanisms in varying proportions, with highly-localized microclimate, long-term stability and minimization of superimposed loss mechanisms all playing roles [2]. In spite of this improved understanding of the processes involved, there are still places that defy all explanation; where meteorites are concentrated in spite of the absence of stability or appropriate mechanisms, or meteorites are completely absent when all other conditions are clearly present. The best approach to improving our understanding of meteorite concentration mechanisms would be dedicated multi-disciplinary studies, and growing recognition that blue ice areas may preserve ice that is millions of years old has gained growing interest within the glaciology community.

Significance: High rates of recovery meant that the number of recovered Antarctic meteorites quickly reached parity with non-Antarctic specimens, and then exceeded it. It also resulted in a high rate of discovery of new classifications of meteorites, some corresponding to entirely new families of materials from previously unrecognized parent bodies. Meta-analytical comparisons of the statistics, taxonomy and geochemistry of various meteorite collections (including growing numbers from systematic recoveries outside Antarctica, observed falls and even ancient falls from the rock record) suggest basic similarities between all of them but with superimposed distinctions due to differing mechanisms of delivery, concentration, loss and recovery, and (perhaps most importantly) the period of time each represents within the flux of meteorites arriving at Earth [4]. We recognized that the continued significance of the Antarctic meteorites recovered by ANSMET require a persistent commitment to systematic recovery techniques, minimal sorting and limited contamination that together promote future discoveries illuminating the range of planetary materials making up our solar system.

References: [1] Marvin U. (2015) in *35 seasons of US Antarctic Meteorites (Righter et al., eds.)* 1-22. [2] Harvey R.P. et al., (2015) in *35 seasons of US Antarctic Meteorites (Righter et al., eds.)* 23-42. [3] Harvey R.P. (2003) *Chemie der Erde* 63:93-147. [4] Corrigan et al., (2015) in *35 seasons of US Antarctic Meteorites (Righter et al., eds.)* 173-188.