GEOSPATIAL ANALYSIS OF ANTARCTIC METEORITES

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Introduction: The Antarctic Search for Meteorites (ANSMET) recovery teams have collected over 22,000 non-terrestrial specimens from Antarctica [1]. Though search techniques have been greatly effective, limitations due to the unavailability of high resolution geospatial datasets and the lack of dedicated studies have greatly restricted our understanding of why Antarctic meteorites occur where they do. Recent advancements in Antarctic geospatial data currently allow for a highly precise investigation into the relationship between where meteorite are stranded and the environmental factors affecting their placement. Interpretations have been made yet most relationships between meteorite specimens and the Antarctic environment remain anecdotal [2].

This study focuses on extracting the spatial statistics associated with meteorite parameters and establishing relationships between them and the physical and environmental aspects of the Antarctic terrain. This is essential to understanding the relationship between meteorite locations, their concentration mechanisms, localized features such as ice flow, wind direction, topography and micro-climate. Identifying variables such as clustering, trends and spatial patterns associated with the geographic distribution will likely help recognize any previously unidentified phenomena. This is especially critical for developing and understanding spatial relationships between variables such as petrographic types, mass, dimensions, weathering and pairing.

Methods: The first phase of this study is an investigation of the spatial statistics of meteorites recovered from icefields in the Walcott Névé and Miller Range areas. Both of these regions have been searched multiple times, each has accumulated a sampling size >3000 meteorites, and both have comparable geographic aspects such as altitude and relief. Geographic trends and clustering of meteorite parameters, including meteorite type, mass, terrestrial weathering and paring will be examined with the intent of answering whether meteorite distribution on Antarctic ice surfaces is random. The extracted spatial distributions will then be assimilated with topography, ice flow, wind direction, ablation rates and proximity to glaciological features as derived from DigitalGlobe® high resolution World View satellite imagery and digital terrain models. In order to produce a high resolution view of these relationships.

Preliminary Results and Discussion: Preliminary analysis of the Lewis Cliffs ice tongue in the Walcott Névé region shows a mass stratification mechanism working on the distribution of the meteorites at the surface (Figure 1). This trend exists in the west to east direction nearly perpendicular to ice flow and predominate katabatic wind direction. The dominate wind flow direction in this ice tongue is N-S trending. A second trend shows a high concentration of meteorites in the western portion of the icefield versus the eastern portion of the icefield. Due to the N-S trend of wind direction, it has been previously suggested that meteorite concentration in the western portion is not due to wind-driven movements [3]. Our results reinforce this idea because sorting grades finer as you move to the east of the ice tongue. In general, these initial results of our study suggest ice driven meteorite distribution in the Lewis Cliff icefield is not random.

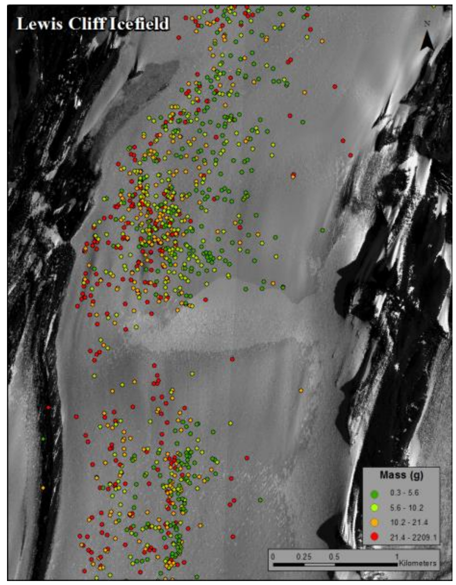

Figure 1. Map of the central portion of the Lewis Cliff icefield. Meteorites are plotted by mass in a quantile classification scheme. The largest concentration of on meteroites occurs in the western portion of the ice field. Here a distict linear treand is desplayed, where meteroites occur as a mass stratified deposit from west to east in the ice field.

Future Work: Once a thorough analysis of Walcott Névé and the Miller Range is accomplished, our future goals are 1) a comparative analysis of the statistics and relationships between these two areas and 2) a comparison of our conclusions, mainly focusing on meteorite type ratios, to data from additional Antarctic meteorite collections, recent falls and dry desert collections. This should help us determine if the ANSMET collection reflects Earth's complete meteorite distribution and if our interpretations are valid both within and outside of the Antarctic continent.

[1] Corrigan C. et al. (2017) this volume. [2] R. Harvey (2017) this volume. [3] Harvey R. P. (2003) *Chemie der Erde* 63:94–184.