Scientific Yield of Meteorites Recovered from the Dominion Range, Transantarctic Mountains

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Introduction: The US Antarctic Meteorite Program has visited the Dominion Range in the Transantarctic Mountains during several different seasons, including the 1985, 2003, 2008, 2010, and 2014 seasons. Total recovered meteorites from this region is over 2000 [1]. The 1985 (11 samples), 2003 (141 samples), 2008 (521) and 2010 (901 samples) seasons have been fully classified, and the 2014 samples (562) are in the process of being classified and characterized. Given that close to 1500 samples have been classified so far, it seems like a good opportunity to summarize the state of the collection. Here we describe the significant samples documented from this area, as well as a large meteorite shower that dominates the statistics of the region.

Significant samples: The Dominion Range has yielded some very important and interesting samples, including: (a) DOM 08006 and DOM 08004 two CO3 chondrites that have provided interesting results on organic compounds [2,3], pre-solar grains [4], and refractory inclusions [5]; (b) DOM 14021 a large EH3 chondrite, (c) DOM 10077 and paired CR2 chondrites, (d) DOM 08001 a large brecciated eucrite (Figure 1) and DOM 10100, a large howardite, (e) DOM 03183 and paired masses that are CM2 material with unique inventories of volatiles [6,7,8], (f) the small and rare CM1 chondrite DOM 14239, recording highly aqueously altered lithologies [9], (g) DOM 14170, a spectacularly oriented ungrouped iron meteorite specimen (Figure 2), (h) DOM 10848, DOM 10302, and DOM 08002 - H, L and LL chondritic impact melts, respectively, (i) DOM 10490, an LL3.2 chondrite, (j) DOM 10122, a metal-rich mesosiderite, and (k) DOM 10662 - a rare highly shocked (mosaicised olivine and pyroxene) ureilite.

This great diversity of samples suggests more interesting samples will come from Dominion Range. Contributions have been to understanding differentiated bodies, volatile-rich asteroids, and complicated impact histories of ordinary chondrites.

Figure 1 (left): The DOM 08001 brecciated eucrite – a 1.3 kg meteorite.
Figure 2 (right): DOM 14170, a flight oriented iron meteorite; length of sample is approximately 7 cm.

Presence of a large L chondrite shower: During characterization of the larger 2008 and 2010 season sample suites it became clear that a large shower dominates the DOM dense collection area. Although initially this was identified as an LL shower, additional samples and analysis revealed that it is in fact an L chondrite shower with the olivine content predominantly $Fa_{25\text{-}26}$ [10]. This shower comprises ~60% of all samples recovered in those two seasons. Nearly 500 equilibrated ordinary chondrites (EOC) from the Dominion Range have been measured for magnetic susceptibility, and many classified by SEM and/or electron microprobe. Magnetic susceptibility measurements utilized the pocket contact probe SM30 (ZH Instruments). Efforts are currently underway to re-classify samples from earlier seasons (2003 and 2008) which have been transferred to the Smithsonian Institution. Once all the samples have been re-assessed, more accurate and meaningful comparisons may be drawn between

this pairing group and some other Antarctic EOC pairing groups such as from the Queen Alexandra Range (QUE), and Lewis Cliffs Ice Tongue (LEW) [11,12].

The QUE shower characterized by [8] consisted of ~ 2000 specimens with a total mass near 60-70 kg, <1% of the estiamted pre-atmospheric size and mass of 150 cm and 50,000 kg respectively. The Dominion Range shower may be of comparable size – even the 15 samples studied in [10] comprise a total mass of ~ 15 kg. There are at least 1000 additional samples that have been collected of smaller size, but the total mass could easily approach the QUE shower.

Conclusions: The Dominion Range hosts a diversity of meteorite types that provide information about early solar system differentiation, volatile inventories, pre-solar processes, aqueous alteration, and regolith and impact breccia formation (chondrites and polymict HEDs). In addition, the large L chondrite shower may provide an opportunity to document the nature of a near Earth asteroid (NEA) impactor. Further characterization of this shower could yield insights into its pre-atmospheric size and mass, and add to the number of large showers represented in the US Antarctic meteorite collection.

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