A Large Ordinary chondrite shower in the dominion range. C. E. Satterwhite[1], K. Righter[2], R. Harrington[1], K. M. McBride[1], and R. Funk[1], [1]Jacobs Technology, NASA-JSC, Mailcode XI2, Houston, TX 77058; (cecilia.e.satterwhite@nasa.gov). [2]Mailcode XI2, NASA-JSC, 2101 NASA Pkwy., Houston, TX 77058

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. The 2008 and 2010 seasons have been fully classified ([1-2] and [3, 4], respectively) revealing the presence of a large meteorite shower that comprises ~ 60% of all samples recovered in those two seasons. The oil immersion classification suggests that this shower is LL chondrite material, whereas published magnetic susceptibility (MS; log χ) measurements yield L chondrite values [5]. However, usually random sampling of a large collection like this would uncover EOC material for which we have prepared thin sections. In this case, no LL chondrite materials have been found in thin section, suggesting that the shower might instead be an L chondrite. L and LL chondrites are notoriously difficult to distinguish using oil immersion techniques [6]. To better characterize this large group of samples, we have decided to examine some of the large members of this group, using EMPA analysis of the olivines to verify the classifications. With a compositional link between this subset of samples, and the MS measurements, we can more confidently classify the samples making up this pairing group. Subsequently, more accurate and meaningful comparisons may be drawn between this pairing group and some other Antarctic pairing groups such as from the Queen Alexandra Range (QUE), and Lewis Cliffs Ice Tongue (LEW) [7,8].

Samples: A large subset of EOC samples from the Dominion Range have had magnetic susceptibility measured at the time of initial characterization. Nearly 220 samples have been measured [5], but very few of these have chemical data to accompany and help interpret the MS measurements. Therefore we selected 15 large ordinary chondrites, and prepared standard thickness (30 μm) polished thin sections to use in a more detailed study of this group.

Analysis: Olivines were analyzed for major element composition using a Cameca SX100 for electron microprobe analysis (EMPA) at NASA-JSC. A 1 μm beam was used at 20 kV accelerating voltage and 15 nA sample current. A variety of natural and synthetic standards were used to calibrate the major and minor elements.

Magnetic susceptibility (MS) measurements utilized the pocket contact probe SM30 (ZH Instruments). This instrument determines the susceptibility of the infinite half space in front of the sensor with a sensitivity of 10^{-7} SI and an acquisition time of about 10 sec. We measured log χ for all samples using the main mass, an average of 2 or 3 measurements, and the overall approach outlined by [9].

Results: 10 to 15 individual and randomly selected olivine grains were analyzed in each thin section. The averaged results (in Fa content) are summarized in Table 1. All 15 samples yielded olivine compositions of Fa_{24} to Fa_{25}, within the field for L chondrites. In addition, we measured magnetic susceptibility for all samples. Values ranged between 4.4 and 4.8; again these fall in the range for L chondrites (Figure 1). For these 15 samples, then, the bulk of the information indicates these are L chondrites.

Discussion: Inspection of the MS values measured for all Dominion Range ordinary chondrites from the 2008 and 2010 ANSMET seasons [5] reveals ~125 samples classified as LL chondrites, but with MS values between 4.2 and 4.7. Therefore, based on our findings it seems these 125 samples should be re-classified as L chondrites. Because not all samples have been measured for MS, including all of the DOM 03 season, efforts should be made to identify other members of this large pairing group. Complete characterization of the preceding years will nicely complement the ongoing classification of the DOM 14 season samples that is currently underway.

The QUE shower characterized by [8] consisted of ~ 2000 specimens with a total mass near 60-70 kg, <1% of the estimated 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 here 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.

Table 1: Summary for 15 DOM chondrites[1]

sample	mass	Mag. Susc.	New Fa[2]	Orig.[1]/ Re-vised[3]
DOM 08017	1021.1	4.85	25	LL5/L5
DOM 08018	1447.8	4.83	25	LL6/L6
DOM 08019	1434.5	4.63	25	LL5/L5
DOM 08020	1020.6	4.84	25	LL5/L5
DOM 08021	1009.1	4.54	25	LL5/L5
DOM 08023	834.1	4.57	25	LL6/L6
DOM 08025	566.1	4.44	24	LL6/L6
DOM 08031	325.9	4.66	25	LL6/L6
DOM 10002	1621.5	4.61	25	LL5/L5
DOM 10003	1104.2	4.53	24	LL5/L5
DOM 10005	1083.3	4.64	25	LL6/L6
DOM 10007	583.7	4.42	25	LL6/L6
DOM 10008	471.2	4.71	24	LL5/L5
DOM 10200	445.9	4.55	24	LL6/L6
DOM 10300	409.6	4.47	25	LL6/L6

1 - Classified as LL using immersion oils reported in AMN [1-4].
2 – Newly measured Fa content.
3 – Revised classification based on electron micro-probe and magnetic susceptibility data.

Conclusions: The Dominion Range harbors a large ordinary chondrite shower that appears to be L chondrite material, not LL chondrite as reported in previous Antarctic Meteorite Newsletters. 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. This new information will be used to help classification of the DOM 14 season samples.

References: [1] Ant. Met. Newslett. 33, nos. 1 and 2; [2] Ant. Met. Newslett. 34, nos. 1 and 2; [3] Ant. Met. Newslett. 37, nos. 1 and 2; [4] Ant. Met. Newslett. nos. 1 and 2. [5] Ant. Met. Newslett. 39, no. 1; [6] Lunning, N. et al. (2012) 43rd Lunar and Planetary Science Conference, abstr. #1566; [7] Welten, K. et al. (1999) MaPS 34, 559-569; [8] Welten, K. et al. (2011) MaPS 46, 177-196. [9] Folco, L. et al., (2006) MaPS 41, 343–353; [10] Righter, K. et al. (2013) 76th Annual Meeting of the Meteoritical Society, Edmonton, Canada. Abstrr. # 5232.

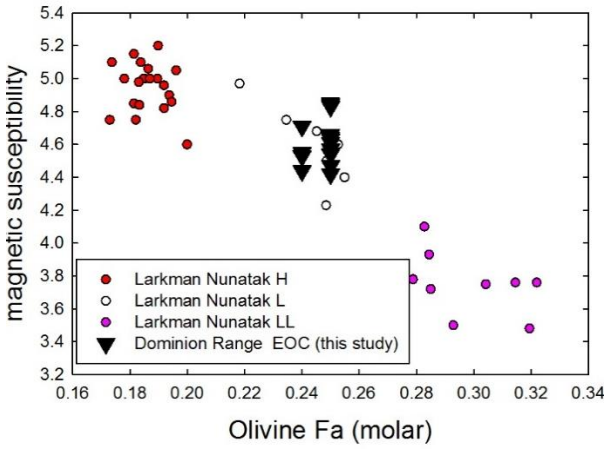

Figure 1: Magnetic suceptibility versus olivine Fa content (molar) for samples studied here form the Dominion Range (triangles) compared to Larkman Nunatak H, L and LL chondrites from [10].