THE USE OF MICROSCOPY (SQUID AND SPECTROSCOPY) IN THE REINVESTIGATION OF THE ALH84001 CARBONATE BLEBS. J. Buz[1] and J. L. Kirschvink[1,2], [1]Caltech (Pasadena, CA, USA jbuz@gps.caltech.edu), [2]Earth Life Science Institute, Tokyo Institute of Technology (Meguro, Tokyo, Japan).

Introduction: The Martian meteorite ALH84001 is well known for the magnetite-containing carbonate blebs it contains in fracture surfaces [1]. A fraction of the magnetite crystals in these blebs are strikingly similar to magnetosomes created by magnetotactic bacteria [2]. We seek to use new and improved analytical techniques to reinvestigate the ALH84001 carbonates.

Methods: We have scanned 6 sequential fracture-containing slices of the ALH84001 meteorite using both an Ultra High Resolution Scanning SQuID (UHRSS) microscope with a spatial resolution of ~20 μm and an Ultra Compact Imaging Spectrometer (UCIS) with a spatial resolution of ~80 μm. From the UHRSS magnetic data we are able to quantify the direction and strength of dipoles within the meteorite using a dipole inversion technique [3]. The UCIS data allows us to determine the mineralogical variations within the sample. We have also extracted some of the carbonate blebs from the fracture surfaces by carefully flaking them off using a non-magnetic needle. We are then able to demagnetize individual carbonate blebs and apply standard paleomagnetic techniques, such as the fuller test of NRM.

Results: We have observed that most of the dipoles identified in our UHRSS data cluster roughly in one direction while the rest form a great circle path through this cluster. A variety of interpretations exist to explain this data including potential preservation of Martian dynamo true polar wander [4]. The demagnetization of a single carbonate bleb has revealed a clear magnetization up to 8 mT.

Future: We will use the demagnetization data in conjunction with demagnetization of a saturating isothermal remanent magnetization in order to determine the efficiency of magnetization in the carbonate.

References: [1] Mckay et al., Science 273:924, 1996 [2] Thomas-Keprta et al., PNAS 98:2164, 2001 [3] Lima et al. JGR 2009:10.1029/2008JB006006: [4] Perron et al., Nature 447:840, 2007.

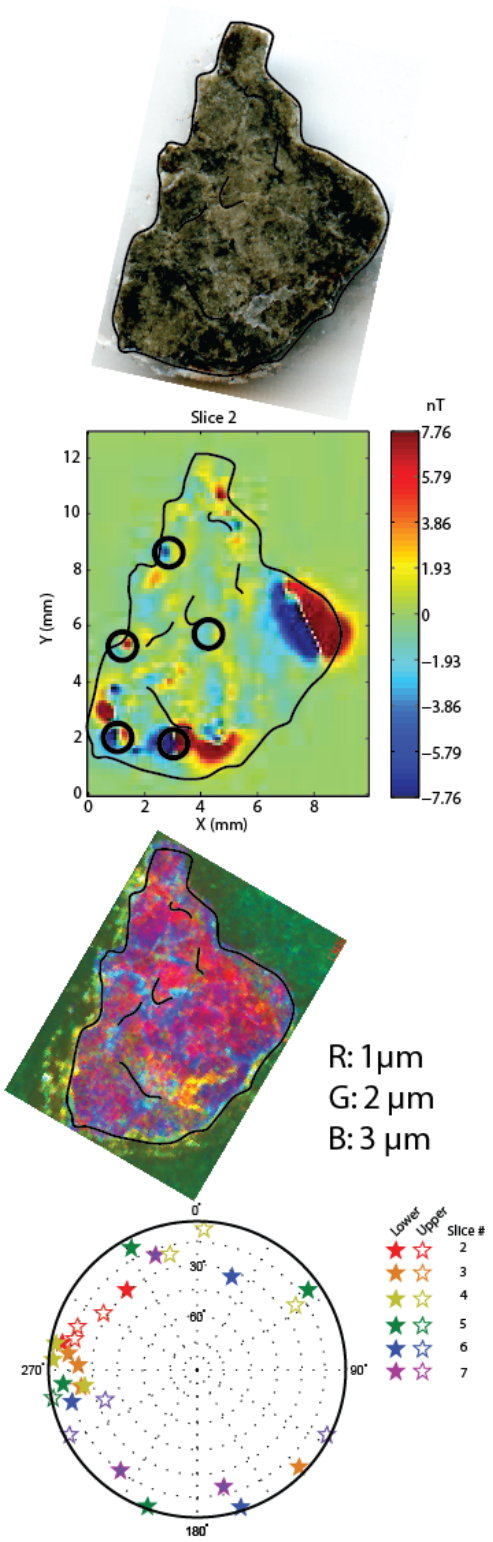

Figure 1: (Top) Visible image of a slice of ALH84001 meteorite with some fracture surfaces indicated. (Second) Magnetic scan of the same slice of ALH84001 showing heterogeneous magnetization and individual dipoles. Circles indicate dipoles used in inversion and plotted at bottom (Third) Decorrelation stretch of UCIS data highlighting variability in composition. Note fracture surfaces are clear using this technique (Bottom) Equal area diagram showing dipole directions for all six slices. Note clustering around 270°.