PROCEEDINGS OF THE TWENTY-SEVENTH ANNUAL KECK RESEARCH SYMPOSIUM IN GEOLOGY

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2013-2014 PROJECTS

MAGNETIC AND GEOCHEMICAL CHARACTERIZATION OF IN SITU OBSIDIAN, NEW MEXICO*:*
Faculty: *ROB STERNBERG*, Franklin & Marshall College, *JOSHUA FEINBERG*, Univ. Minnesota, *STEVEN SHACKLEY,* Univ. California, Berkeley, *ANASTASIA STEFFEN*, Valles Caldera Trust, and Dept. of Anthropology, University of New Mexico
Students: *ALEXANDRA FREEMAN*, Colorado College, *ANDREW GREGOVICH*, Colorado College, *CAROLINE HACKETT*, Smith College, *MICHAEL HARRISON,* California State Univ.-Chico, *MICHAELA KIM*, Mt. Holyoke College, *ZACHARY OSBORNE*, St. Norbert College, *AUDRUANNA POLLEN*, Occidental College, *MARGO REGIER*, Beloit College, *KAREN ROTH*, Washington & Lee University

TECTONIC EVOLUTION OF THE FLYSCH OF THE CHUGACH TERRANE ON BARANOF ISLAND, ALASKA*:*
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Students: *BRIAN FRETT*, Carleton College, *KATE KAMINSKI*, Union College, *BRIANNA RICK*, Carleton College, *MEGHAN RIEHL*, Union College, *CLAUDIA ROIG*, Univ. of Puerto Rico, Mayagüez Campus, *ADRIAN WACKETT*, Trinity University,

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Research Advisors: James Rougvie, Beloit College and Joshua M. Feinberg, University of Minnesota

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GEOCHEMICAL VARIABILITY OF OBSIDIAN IN WESTERN NEW MEXICO WITH LABORATORY-BASED PXRF

KAREN ROTH,Washington and Lee University
Research Advisor: Jeffrey Rahl

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BASIC PALEOMAGNETIC PROPERTIES OF OBSIDIAN FROM THE MOUNT TAYLOR REGION OF NEW MEXICO

MICHAELA KIM, Mount Holyoke College
Research Advisor: Michelle Markley

INTRODUCTION

The purpose of this study is a basic paleomagnetic analysis of obsidian from three locations in the Mount Taylor volcanic field in order to explore if paleomagnetic analysis of obsidian samples can discriminate source locations. The results of this study may be useful in the sourcing of archeological tools and artifacts. The three main obsidian sources in the Mount Taylor volcanic field are Grant's Ridge, Horace Mesa, and La Jara Mesa. The Grant's Ridge obsidian deposit was formed by a rhyolite dome which was subsequently perlitized, forming 'Apache tears' or small nodules in the perlitized, weathered matrix (Shackley 2005). The nodules at Grant's Ridge are generally larger, but less aphyric than the obsidian found at the other localities. The Grant's Ridge obsidian also contains small phenocrysts of sanidine which indicate a slower cooling time than the other two sources (Shackley). Both Horace Mesa and La Jara Mesa are plateaus of basalt that have obsidian nodules in the float/alluvium at the surface. The surface of the obsidians is more dull and weathered than the comparatively fresh nodules present at the other locality. Additionally the obsidian samples are more aphyric and lack the sanidine crystals present in the Grant's Ridge obsidians.

METHODS

The sampling methods for each of the three field sites varied slightly because the density of nodules varied at each site. For Grant's Ridge we collected samples from the perlite walls and from the float. We georeferenced a point and took samples from nearby to that GPS point. We did this all along the perlite wall and in a few spots in the float. For Horace Mesa the nodule density was much less than Grant's Ridge, so we split into groups and sampled in transects, taking samples between successive GPS points. At each end point we took a specifically georeferenced sample which was bagged separately from the samples we collected between GPS points. La Jara Mesa had the lowest nodule density, so we collected as many samples as possible, taking down a GPS point for each sample we collected. We collected hundreds of samples, but I ended up only testing a small fraction of the samples we collected. In total I tested seventeen samples from Grant's Ridge, eight samples from La Jara Mesa, and twenty samples from Horace Mesa.

I prepared the samples using a rock saw and split some of the larger samples into halves or thirds. I abraded off all the dirt and weathered surfaces to make sure that contamination wouldn't alter the readings. I then measured susceptibility and alternating-field (AF) demagnetization on my samples in the paleomagnetics lab run by Laurie Brown at the University of Massachusetts-Amherst. Susceptibility of each sample was measured using a Sapphire Instruments Susceptibility Meter and then the numbers were normalized using a standard density of obsidian of 2.6 g/cc. I measured the natural remnant magnetization (NRM) for all of the samples using a 2G Enterprises 3-axis Cryogenic Magnetometer, Model 755, and then proceeded to perform AF demagnetization on them at various steps: 10, 20, 30, 40, 50, 60, 80, and 100 mT. The Molspin Limited Alternating Field Demagnetizer was used to demagnetize the samples at the various intensities and then the cryogenic magnetometer was used to measure the samples. Once I had all of the data, I uploaded the files to Excel and used it to produce J/J(0) (the remaining remanence at each step normalized by the NRM) vs. demagnetization step plots, susceptibility vs. NRM plots, and plots of the variation of the susceptibility in relation to the sample numbers.

RESULTS

Figure 1 shows the plot of NRM vs. susceptibility (cc/g) for all three sites. Most of the points plot in the same general area. There are two outliers from La Jara Mesa which have unusually high NRMs when compared to all the other samples. There is also one outlier from Horace Mesa which has a slightly stronger NRM than the other samples. The AF demagnetization plots for all three localities showed at least some grouping of the samples' curves. Grant's Ridge appeared to have two to three groupings of curves with some more unusual curves that went between the groups (Fig. 2). The graph overall has a lot of noise, not making the groupings distinct. Some of the curves on the Grant's Ridge plot are steady, shallow curves and others are steeper in the beginning and then fall off gradually. The samples for Horace Mesa had one main cluster where all the samples curves were similar in shape and slope. There were three or four curves that were outside this main grouping, showing a steep decline initially and then levelling off to a more gradual curve (Fig. 3). There is also a fair amount of variation in this data even in the main groupings of the curves. The samples for La Jara Mesa grouped only into one group with some outliers (Fig. 4). The outlier curves on the AF demagnetization plots belong to the same samples which are outliers on the NRM vs. Susceptibility plot.

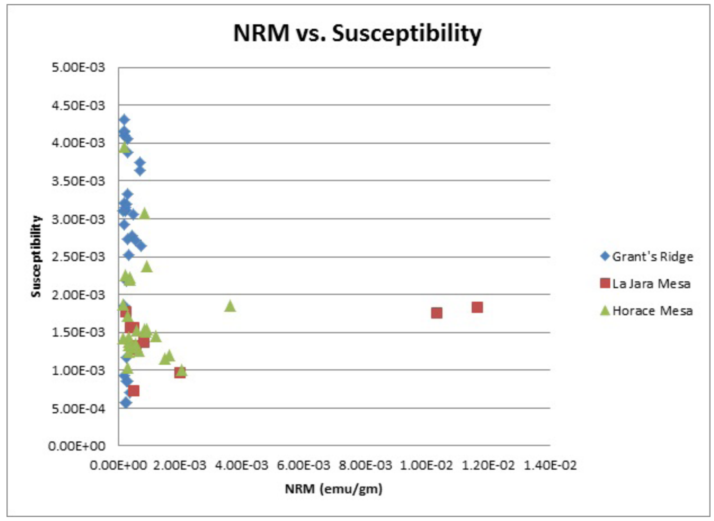

Figure 1 shows the normalized susceptibility (in cc/g) plotted against the measured NRM values (in emu/g) of every sample from each of the three localities. The diamonds indicate Grant's Ridge samples, the squares are La Jara Mesa samples, and the triangles are Horace Mesa samples.

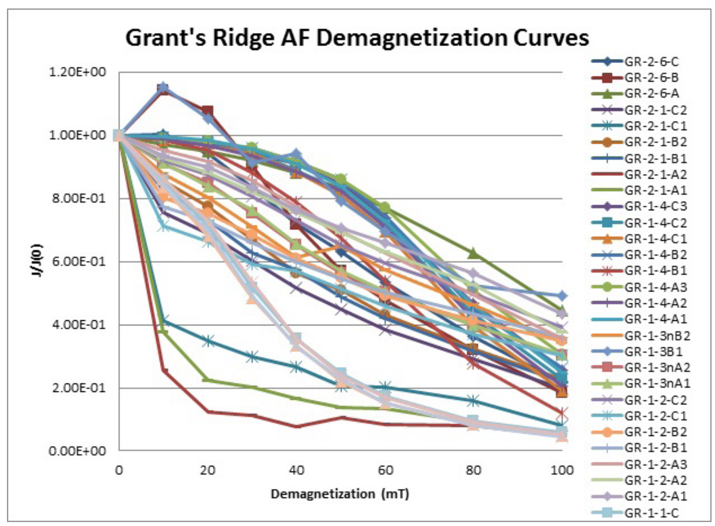

Figure 2 shows the demagnetization curves for all of the samples tested for Grant's Ridge. The plot is the remaining remanence at each step normalized by the NRM vs. the demagnetization step in mT.

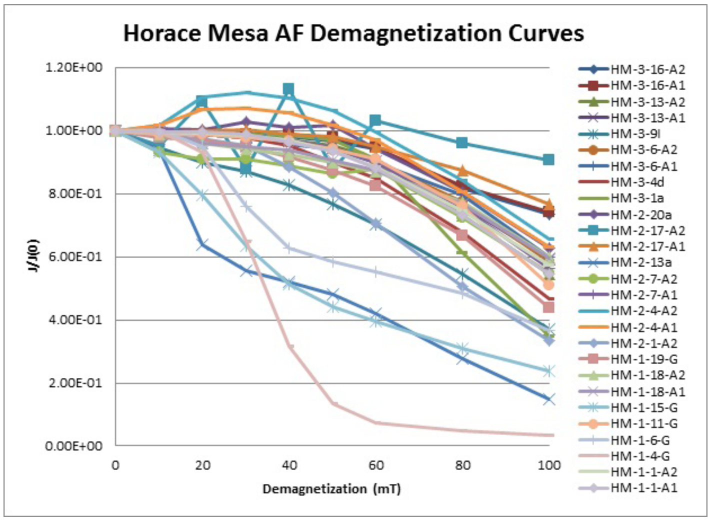

Figure 3 shows the demagnetization curves for all of the samples tested for Horace Mesa. The plot is the remaining remanence at each step normalized by the NRM vs. the demagnetization step in mT.

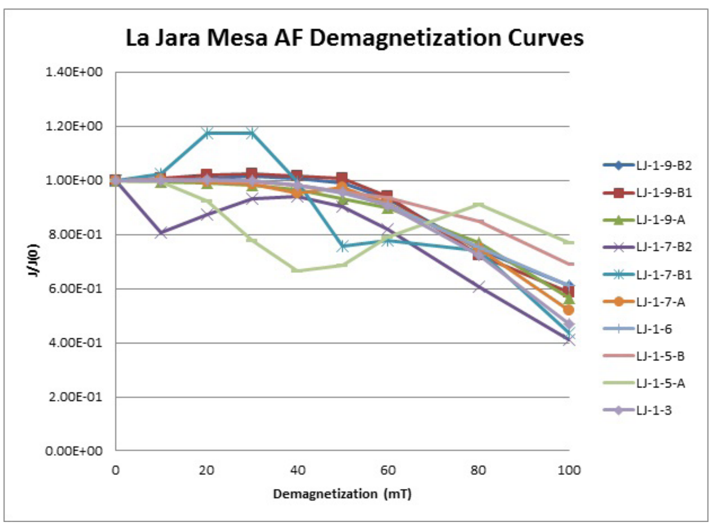

Figure 4 shows the demagnetization curves for all of the samples tested for La Jara Mesa. The plot is the remaining remanence at each step normalized by the NRM vs. the demagnetization step in mT.

CONCLUSIONS

All three of the localities at Mount Taylor show some grouping in their AF demagnetization plots, but there is generally a lot of noise, making differentiating between the different groupings rather difficult. The amount of variability in each of the plots in general does not make a strong case for intra-flow variations. The susceptibility does not show any distinguishable variation between the three different localities. The outliers correspond more to unusual samples than to either inter or intra flow variations. In general the data do not really show very distinct inter and intra flow variations.

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REFERENCES

Shackley, M. Steven. *Obsidian: Geology and Archaeology in the North American Southwest*. First ed. Tucson, AZ: The University of Arizona Press, 2005. Print.