CHARACTERIZATION OF GLASSES IN IMPACT BRECCIA DYKES AT THE MISTASTIN LAKE IMPACT STRUCTURE, LABRADOR. A. C. Singleton[1], G. R. Osinski[1], R. A. F. Grieve[1], C. Shaver[1], [1]Centre for Planetary Science and Exploration, Depts. of Earth Sciences/Physics and Astronomy, University of Western Ontario, 1151 Richmond St., London, ON N6A 5B7 (asingle2@uwo.ca)

Introduction: Asteroid and comet impacts are an important geological process on all solid planetary bodies, including Earth. They generate pressures and temperatures that may reach several hundred GPa and several thousand K over very limited spatial and temporal scales. This results in the vaporization and melting of rocks, which alters the target material on both megascopic and microscopic scales [1]. Through this process both impact melt rocks and impact melt-bearing breccias are created.

This study investigates the characteristics of such material, specifically glass clasts in impact melt bearing breccia, intruded in to the central uplift in the Mistastin (Kamestastin) Lake crater. It has been found that there are two main morphologies in the glass clasts and that the composition varies from that of the main impact melt sheet. The implications of this are discussed.

Geologic Setting: The Mistastin (Kamestastin) lake crater is located in northern Labrador, Canada (55°53′N 63°18′W). This structure is a complex impact structure that has a diameter of approximately 28 km [2]. The age of the Mistastin event is 36 ± 4 Ma [3]. The central uplift of the structure is in the form of a 3 by 4 km island in the middle of Mistastin Lake. This landmass (Horseshoe island) is the main site for this study. This island was mapped by Currie (1971) and consisted mainly of mangerite and anorthosite.

Most of the rocks on the island are highly weathered and eroded and are primarily found in the form of flat lying outcrops scattered on the island. The remainder of the island is covered with dense brush and moss and some wooded areas. The main target rocks in the area are mangerite and anorthosite. There are also a few occurrences of impact melt bearing breccia and impact melt rock which exist in dykes that can be seen along the shore of the island [4].

Methodology: Fieldwork was conducted over two weeks during the summer of 2010 on Horseshoe Island. On this island 103 sites were visited and documented and 76 samples were collected. The majority of these sites consist of flat-lying outcrops of either mangerite or anorthosite. Four sites along the eastern coast contain apparent dikes of impact melt bearing breccia and these sites and the material there from are the focus of this study.

Thin sections were made of samples from these locations and three sections were selected from three separate sites and these were examined using optical spectroscopy. In these sections glass clasts were located and were further examined with a scanning electron microscope and an electron microprobe in order to better image and explore the chemical compositions of the glass.

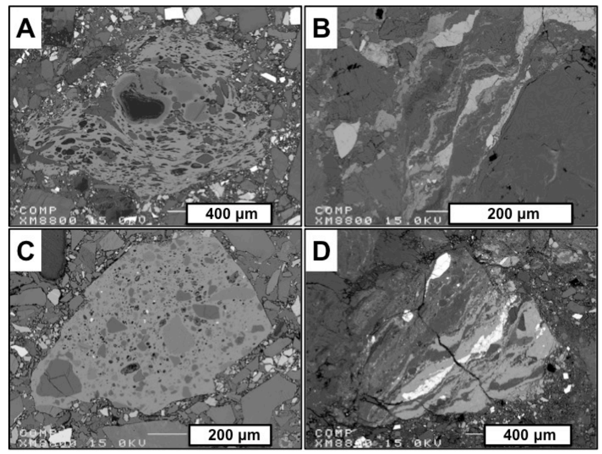

Fig 1. Examples of the two types of impact melt clasts. Frames A and C are of type one with A showing a frothy texture with stretched vesicles. Frames B and D are of type 2 and both clearly show a differentiated texture.

Results and Discussion: It is convenient to divide the clasts found in the material examined for this study into two types based on morphology (Fig. 1). Type 1 are glassy and have vesicles and/or lithic clasts within them which have conceivably had time to mix and thus are homogeneous. They are more likely to represent samples from the original melt sheet. These are the clasts that will be examined more quantitatively using microprobe data. Type 2 will be more briefly considered in a qualitative sense.

The compositions of the three type 1 clasts that are considered here are fairly similar to each other and the microprobe data points fall in three distinct groups on the plots (Fig. 2). The broad ranges for the main oxides are: Mn 0.17- 0.23 wt%, Ti 1.03-1.90 wt%, Fe 8.8-14.3 wt%, Ca 3.14-6.24 wt%, Al 13.3-15.2 wt%, K+Na 5.52-7.29 wt%, and Mg 1.47-2.13 wt%.

When we examine the data collected on the electron microprobe it can be seen that in most cases the data falls neatly between the points for mangerite and anorthosite (the two main rock types in the area) with regards to silica but in the case of the other chemical being considered (e.g., Al) the points are noticeably higher or lower than both mangerite and anorthosite (Fig 2). This is different than the results obtained by Marion and Sylvester [5] in their analysis of the main impact melt sheet. In their data the points form a roughly linear trend between mangerite and anorthosite end-members.

The deviation from this trend that can be seen in the data in this study would seem to indicate that there is a “missing" component contributing to the melt aside from the two major rock types. To explore this possibility points were plotted for the more minor rock types in the area: granodiorite, gneiss, and granite. It was found that except in the cases were the chemical is low (Ca and Al) these rock types cannot account for the high content of some elements in these glasses, therefore, the possibility of other contributors must be considered, such as an unidentified target rock. Whole rock analyses of a variety of target rocks are ongoing in order to address this question. Also, in some cases, enrichments in siderophile elements (such as Fe and Mn) may indicate the inclusion of a small amount of meteoric material [6]. Another possibility is that the variation in composition both from the main host rocks and between the melt clasts could indicate that these melt clasts formed before the main melt sheet when the melt was not fully homogenized, as these dykes were likely emplaced during the excavation stage of the crater’s formation. We are continuing to test these competing hypotheses and explore others.

References: [1] Langenhorst, F. (2002) *B. Czech Geol. Survey 77,* 265–282. [2] Grieve R. A. F. (1975) *Geol. Soc. of America Bulletin* 86, 1617-1629. [3] Grieve, R. A. F. (2006) *Geol. Assoc. of Canada*. 16, 115–120. [4] Singleton A. C. (2011) *LPS 2011,* Abstract #2250. [5] Marion, C. L, Sylvester, P. J. (2010) *Planetary and Space Science* 58, 552–573. [6] Therriault, A. M. et al. (2002) *B. Czech Geol. Survey* 77, 253-263.

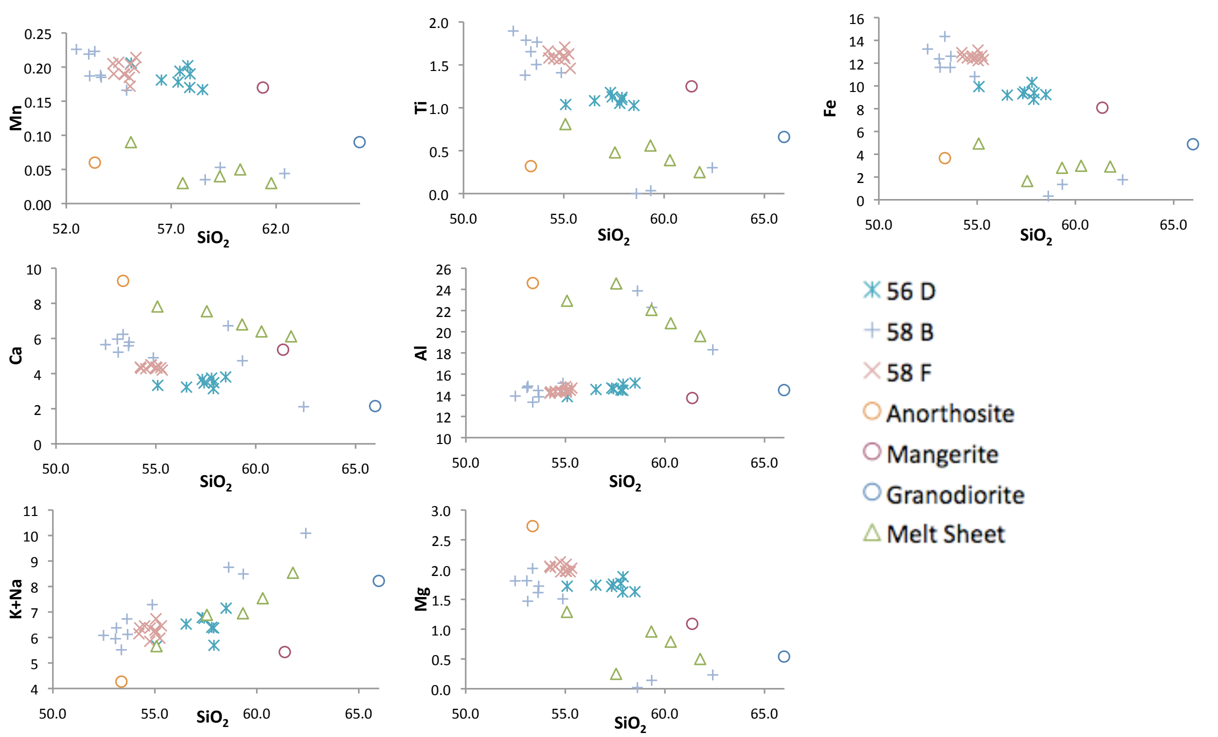

Fig 2. Microprobe data showing the compositional variation of melt clasts from impact melt bearing breccia, the main melt sheet, and the major target rocks.