CHEMICAL COMPOSITION OF MISTASTIN LAKE IMPACT GLASSES.

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Introduction: The Mistastin Lake Impact Structure in Central Labrador, Canada, has been recognized as an impact feature scientifically since the late 1960's (Taylor and Dence, 1969). The structure, which is ~38 Ma (Sylvester et al., 2013) is an oval-shaped lake with a ring of hills (~28 km diameter) surrounding. This ring of hills is generally thought to be the remnant crater rim (Grieve, 2006), and the island in the middle of the lake thought to be the central uplift. The 20 km long ovoid lake is ~3 km across (Grieve 1975). The impact occurred into a portion of the Canadian Shield known as the Mistastin Lake batholith, which is comprised of anorthosite, granodiorite and pyroxene-rich quartz monzonite/mangerite (Currie 1971; Emslie and Stirling, 1993). Grieve (1975) described melt rocks from samples collected at Mistastin Lake, and divided them into three main groups: 1) glassy-very fine grained melt with numerous inclusions (weakly to unshocked inclusions); 2) fine-grained microporphyritic melt with numerous inclusions (also weakly to unshocked inclusions), and fine-medium grained poikilitic melt, with relatively few recognizable inclusions. Marion and Sylvester (2010) focused more intensely on anorthositic impact melts to understand whether melt was modified as it entrained material from surrounding target rocks. Pickersgill et al. (2015) examined rocks from the region and completed an extensive study of shocked feldspars.

Samples and Methods: Eight glass samples (ranging in size from ~3x3 cm to ~6x6 cm) from the top of the Discovery Hill region at the southwest corner of Mistastin Lake impact structure were obtained for study. Geologically, this area contains the most melt sheet (volumetrically) exposed in the crater, however these samples were originally collected by co-author Loring as part of a cultural anthropological study involving obsidian arrowheads found along the eastern seaboard of North America. These melt rocks were collected along with the Innu tribes who recognized them as being unique to the area. Thin and thick sections were created from two of these. Backscattered electron images and energy dispersive spectroscopic maps were created of each section, with higher magnification images and maps created of inclusions. Electron microprobe analyses were conducted on the glassy regions and inclusions.

Results: The samples studied are all crystal free glass that contain occasional visible inclusions. Thin sections show this texture as essentially featureless glass, aside from these inclusions which generally range in size up to 400 microns in diameter, with few exceptions. Differences between the samples studied here and those of either Grieve (1975) or Marion and Sylvester (2010) lie in the textures exhibited in the rocks. Samples studied by those authors are much more crystalline and contain many more identifiable features/crystals. Those inclusions analyzed thus far are either pure SiO_2, or are similar to the bulk glass composition, which, averaged from three electron microprobe transects (of ~180 points each) is ~57 wt.% SiO_2, ~22 wt.% Al_2O_3, 3.5 wt.% Na_2O, 2 wt.% K_2O, 7 wt.% FeO, 8 wt. % CaO, 1 wt.% MgO, and 1 wt.% TiO_2. These compositions are very similar to those described by Marion and Sylvester (2010), including those collected from Discovery Hill. On a plot of SiO_2 vs. Na_2O+K_2O (Marion and Sylvester, 2010, Figure 5), these fall within their bulk analyses on the intersecting boundary of andesite, basaltic andesite, basaltic trachyandesite and trachyandesite. They also correspond with Grieve's (1975) low silica melt. Further analyses of the inclusions within these samples may provide more information on the specific precursor of these seemingly rare glassy melt rocks, and may give more insight into the initial melt rock composition and possible homogenization/contributing proportions of the country rock discussed by Marion and Sylvester (2010).

References: [1] Taylor and Dence, 1969, *Can. Journal of Earth Sciences* 6, 39-45. [2] Sylvester et al., 2013, *Mineralogical Magazine* 77:2295. [3] Grieve, 2006, *Impact Structures in Canada*. St. Johns NL, Geological Assoc. of Canada. 201 p. [4] Currie, 1971, *Bulletin Geol. Survey of Canada* 207:62. [5] Emslie and Sterling, 1993, *The Canadian Mineralogist* 31, 821-847. [6] Grieve, 1975, *Geol. Soc. of America Bulletin* 86: 1617-1629. [7] Marion and Sylvester, 2010, *Planetary and Space Science* 58, 552-573. [8] Pickersgill et al., 2015, *Meteoritics and Planetary Science* 9, 1546-1561.