CHARACTERIZATION OF IMPACT GLASS CLASTS FROM THE MISTASTIN IMPACT STRUCTURE USING SYNCHROTRON RADIATION SPECTROSCOPY.

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Introduction: Asteroid and comet impacts are an important geological process on all solid planetary bodies and generate pressures and temperatures that may reach several hundred GPa and several thousand Kelvin over very limited spatial and temporal scales. This results in the vaporization and melting of rocks, and through this process, both impact melt rocks and impact melt-bearing breccias are created [1]. This study investigates the characteristics of such material, specifically glass clasts in impact melt bearing breccia, intruded in to the central uplift at the Mistastin Lake impact structure [2].

Geologic Setting: The Mistastin Lake impact structure is located in northern Labrador, Canada. It is a complex impact structure with an age of 36 ± 4 Ma and a diameter of approximately 28 km [3]. The central uplift of the structure is in the form of a 3 by 4 km island, Horseshoe Island, consisting mainly of mangerite and anorthosite in Mistastin Lake.

Methodology: Detailed mapping of Horseshoe Island has revealed a series of impact melt bearing dykes. Samples from these locations were examined using optical spectroscopy revealing the presence of small melt clasts within the breccia. These melts were further examined using scanning electron microscopy, electron microprobe, synchrotron-based microbeam x-ray fluorescence (μXRF) microscopy and x-ray absorption spectroscopy (XAS). μXRF microscopy was used to collect data and produce concentration maps for all elements present in both fragments of the host rocks and the clasts, and XAS, which allows for determination of the oxidation state of elements of interest, was employed for iron speciation.

Results and Discussion: When microprobe data is examined it can be seen that generally clast compositions range between those of mangerite and anorthosite with reguards to Si, Mg, K and Na. However in the cases of Fe, Mn, and Ti the weight percent present in the clasts is noticeably higher than would be expected and in the cases of Al and Ca are lower [2]. The clast compositions also differ from the main impact melt sheet [4].Variations between the compositions of the main host rocks in the area and small melt clasts found in the dykes suggests that another contributing component must be involved..

μXRF microscopy results found that compositions of the glass clasts differ from the main breccia components. For example Fe concentration in the clasts reaches 24 $\mu g/cm^2$ compaired to approximtely 3 $\mu g/cm^2$ in some portions of the host rock. This confirms microprobe results including the detection of high iron in the melt clasts.

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