USING IMPACT GLASSES TO EXPLORE PAST HABITATS, HABITABILITY, AND LIFE ON MARS. R. S. Harris[2], Simon J Clemett[3], Kathie L Thomas-Keprta[3] and Marcelo Zárate[4], [1]Brown University, Providence, RI, 02912, United States, [1]Fernbank Science Center, Atlanta, GA 30307, [3]ESGC/Jacobs, at NASA/JSC, Houston, TX, United States, 77058, [4]Instituto de Ciencias de la Tierra y Ambientales de la Pampa, La Pampa, Argentina

Introduction: Impacts on the Earth typically penetrate through loose sediments and involve basement rocks, whether sedimentary or crystalline. Many impacts on Mars, however, impact into unconformable aeolian deposits with thicknesses ranging from a few centimeters to more than 3km (e.g., Arabia). In the Noachian highlands, a thick mega-regolith derived from numerous impact basins also underlay these sediments. Consequently, impact materials on Mars may not resemble the classic suevites or dense tektites. Rather, they would resemble the vesicular impact glasses found in Argentina [1,2] where thick (300m) loessoid deposits have accumulated over the last 12 myr [3]. Rather than large clasts, individual minerals represent the clastic component. This target lithology results in greater amounts of impact melt, even at the lower impact speeds on Mars, and enable ensure rapid burial until re-exposed [4]. Cratering models indicate that distal impact melt products from large (100 km diameter) Hesperian craters cover much of Mars to depths from mm to meters and could be responsible for the mafic spectral signatures [5].

Emplacement Process: Argentine impact glasses exhibit a dynamic style of emplacement that results in trapped seams of target material. Indeed, some impact glasses contain well-preserved plant material down to the cellular level [6]. This raises three questions. First, what is the process of entrainment? Second, what is the process that allows preservation? And third, how is this relevant to Mars. The process of entrainment is a natural part of the excavation and emplacement process for impacts into non-lithified particulates, as documented in hypervelocity impact experiments (Fig. 1). The process of preservation has been discussed elsewhere [6-8]. The relevance for Mars is that impact glasses represent an ideal capture process for organic materials that otherwise would have been lost. Rather than plant materials, sediments trapped within seams could contain relicts of organic activity (bacterial signatures) sealed from later abrasion or chemical weathering. As a result, sampling certain types of impact glasses may be critical for recognizing evidence for past primitive biologic activity and should be collected, rather than ignored, in sampling strategies.

References Cited:

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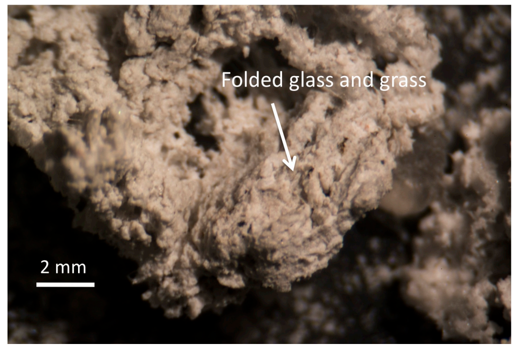

Figure 1A: Pampas grass trapped within glass produced during a hypervelocity impact experiment at the NASA Ames Vertical Gun Range.

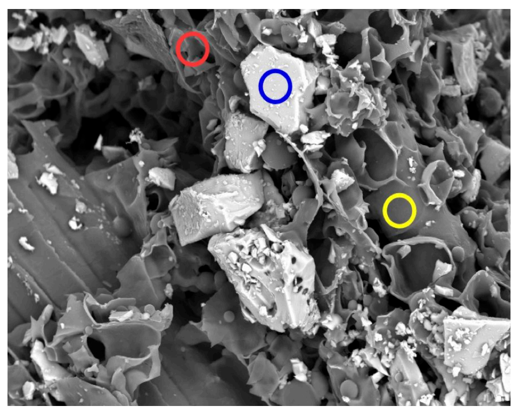

Fig. 1B: SEM view of impact glass (blue), plant material (yellow) and internal plant sheath (red). Circles correspond to sample sites in Fig. 1C.

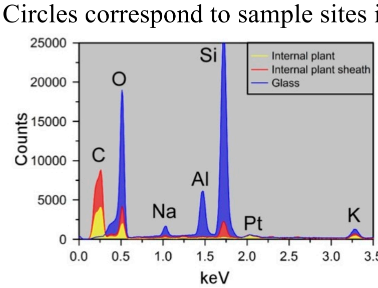

Fig. 1C: Analyses of spots in Fig. 1B demonstrating entrapment and preservation of organic material in impact glass