COMPARATIVE PETROGRAPHIC AND MICROANALYTICAL INVESTIGATION OF APOLLO AND TERRESTRIAL IMPACT BRECCIAS TO UNDERSTAND "SUEVITE" FORMATION

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Introduction: The term "suevite" is currently defined as "a polymict breccia with a particulate matrix, containing lithic and mineral clasts in all stages of shock metamorphism, including impact melt particles" [1]. The term has now been applied across various spatial and geologic contexts, raising concerns that the term has been misused [2,3]. The term suevite can even be seen in early analysis of some lunar breccias, with some authors directly comparing lunar impact craters to the Ries crater [4–7]. A common problem associated with the formation of suevites is that the application of the geologic conditions associated with the Ries impact crater are often used in the modeling in the formation of suevites [8]. A critical question is the role of volatiles in the formation of "suevites". Indeed, recently molten-fuel-coolant interaction, whereby impact melt interacts with water, has become the leading explanation for the formation of Ries suevites [9,10]. However, Osinski et al. [11] recently demonstrated the need for an alternative mechanism for the formation of the Onaping Formation, a lithology believed to have formed in manner similar to "suevites", at the Sudbury impact structure. The goal of this study is, therefore, is to gain a better understanding of the formation of polymict impact breccias with "particulate" matrices – on the Moon and Earth.

Mistastin Lake Polymict Impact Breccia: In order to better understand the formation of polymict impact breccia with "particulate" matrices suevites and fragmental breccias from the Mistastin Lake impact structure will be compared to lunar samples from the Apollo 14 and 16. The Mistastin Lake impact structure was chosen for similarity to lu6nar material (anorthosite-rich) and its known use as a lunar analogue site [12]. The most commonly occurring form of the melt-bearing polymict impact breccias with particulate matrices occur proximally to impact melt rock. This has been inferred to be the result of hot impact melt flowing over cooled, ballistically emplaced melt-free to melt-poor polymict impact breccias [12]. As seen in Figure 1A, a clear flow–like texture can be found in this melt-bearing polymict breccia. This particular breccia is situated in the transitional zone between the clast-rich impact melt rock and melt-poor polymict impact breccias. As seen in Figure 1B, coarse grains of feldspar are surrounded by a fragmental matrix. The nature of the matrix, whether crystalline impact melt rock or lithic is difficult to determine. Within this one sample it becomes clear that a complex mixing process occurred during the formation of these melt-bearing polymict impact breccias as the overlying impact melt rock was emplaced.

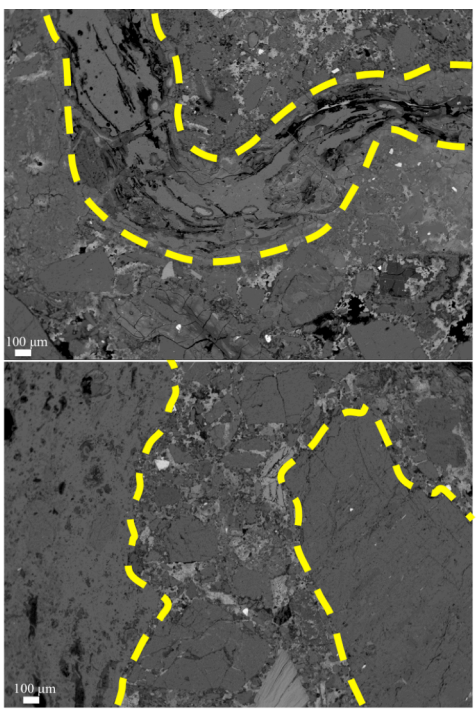

Figure 1: (A) A vein of impact melt rock cutting through the ground mass of a polymict impact breccia; (B) A large grain of feldspar sorrounded by a fragmental matrix before coming contact with impact melt rock.

Lunar Fragmental Breccias: The 2017 spring CAPETEM meeting awarded 13 Apollo 16 and 15 Apollo 14 impact breccias to study the formation of fragmental breccia and the implication for terrestrial suevites. We will be presenting the similarities between these lunar samples to impact breccias from the Mistastin Lake impact structure and the implications for formation.

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