MINERALOGY, PETROLOGY, AND SHOCK HISTORY OF LUNAR METEORITE SAYH AL UHAYMIR 300: A CRYSTALLINE IMPACT MELT BRECCIA. J. A. Hudgins[1,*], E. L. Walton[2], and J. G. Spray[1]. [1]Planetary and Space Science Centre, Department of Geology, University of New Brunswick, Bailey Drive, Fredericton, New Brunswick E3B 5A3, Canada, [2]Department of Earth and Atmospheric Sciences, 1-26 Earth Sciences Building, University of Alberta, Edmonton, Alberta T6G 2E3, Canada. *Correspondence author's e-mail address: jillian.hudgins@unb.ca.

Introduction: The Sayh al Uhaymir (SaU) 300 meteorite was found 42 km SSE of Ghaba, Oman, on 21 February 2004. It weighed 152.46 g.

Mineralogy and petrology: An investigation of two thin sections of the meteorite reveals that it comprises a microcrystalline igneous matrix (grain size <10 μm), dominated by plagioclase, pyroxene, and olivine, with a troctolitic anorthosite normative composition. Pyroxene geothermometry indicates that the matrix crystallized at ~1100 ˚C. The matrix encloses mineral and lithic clasts that record the effects of variable levels of shock. Mineral clasts include plagioclase, low- and high-Ca pyroxene, pigeonite, and olivine. Minor amounts of ilmenite, FeNi metal, chromite, and a silica phase are also present in the meteorite. A variety of lithic clast types are observed, including glassy impact melts, impact melt breccias, and coarse-grained plutonic (igneous) clasts of gabbroic anorthosite, anorthosite, anorthositic norite, troctolitic anorthosite, and gabbro. One clast of granulitic breccia was also noted. The composition of the plagioclase (average An_{95}), high Cr content in olivine (up to 0.49 wt% as CrO), lack of hydrous minerals (except for terrestrial weathering products), and presence of FeNi metal signify a lunar origin for this meteorite. Both matrix and clasts have been locally overprinted by shock veins and melt pockets.

SaU 300 has previously been described as an anorthositic regolith breccia with basaltic components and a granulitic matrix [1], [2], [3], [4], but we here interpret it to be a polymict, crystalline impact melt breccia with an olivine-rich anorthositic norite bulk composition. SaU 300 is enriched in siderophile elements, indicating a history dominated by impact events. It lacks any mare or KREEP-rich components, which suggests a provenance far removed from the PKT, possibly in the far-side FHT. Alternatively, the sample could have formed before mare and KREEP-rich material were present in any significant volume on the lunar surface.

Shock history: The varying shock states of the mineral and lithic clasts suggest that they were shocked by impact events in target rocks prior to their inclusion in the matrix. The sample has undergone at least two episodes of brecciation and shock metamorphism: one event was responsible for forming the impact melt matrix and entraining the lithic and mineral clasts. A second ejected the rock from depth and from the lunar surface, shocked and deformed the mineral and lithic clasts, and resulted in the formation of the shock melt veins and melt pockets. Overall, SaU 300 belongs to Shock Stage 1b, which corresponds to an equilibration shock pressure of 20 – 22 GPa and a post-shock temperature of 200 ^{o}C. The development of melt pockets and veins indicates the occurrence of a subsequent S4 shock excursion event, which locally attained shock pressures of >35 GPa. This event was probably responsible for lofting the sample from the lunar surface. Subsequent fracturing is attributed to atmospheric entry and probable breakup of the parent meteor.

Conclusions: We interpret SaU 300 to be a polymict, crystalline impact melt breccia. Based on its composition, we propose that SaU 300 represents a new lunar meteorite that is unpaired with any currently known samples.

References: [1] Bartoschewiz R. et al. (2005a) abstract #5023 *68th Met. Soc.*, [2] Bartoschewiz R. et al. (2005b) abstract #5024 *68th Met. Soc.*, [3] Hsu W. et al. (2006) abstract #5200 *69th Met. Soc.*, [4] Bartoschewiz R. et al. (2005c) abstract # 5026 *68th Met. Soc.*