Introduction: Lunar ferroan anorthosite (FAN) 62236 is a 57.3 gram rock sample collected from the rim of Buster Crater by Apollo 16 [1]. 62236 has been previously described as ‘pristine’ due to its lack of meteoritic components [2]; however, its original cumulate texture has been subsequently modified to that of a cataclastic breccia and has been moderately to heavily shocked [3] (Fig. 1). 62236 is one of a suite of FANs that have been radiometrically age dated using the Sm-Nd isotopic system, and it yields a crystallization age of 4.29±0.06 Ga [4], which is the youngest FAN sample currently dated. This is a young age for what is hypothesized to be a sample of the primordial lunar crust and as such calls into question the efficacy of the lunar magma ocean (LMO) model as an all-encompassing explanation for the differentiation of the Moon especially since such a young age is overlapped with and superseded by some samples of the hypothesized later-forming Mg-suite [5]. To investigate the petrologic history of 62236, a crystal-by-crystal examination approach was used.

Methods: 5 thin sections (sub-samples .7; .12; .13; .14; and .58) were examined. Each thin section was imaged using a petrographic microscope in plane polar (PPL), cross polar (XPL), and reflected light (RL). Due to three of the thin sections (.12; .13; and .14) being much thicker than normal, only reflected light was usable for navigation and providing textural context for subsequent analyses. Major and minor element compositions for plagioclase, pyroxene and olivine minerals were obtained using a Cameca SX-50 electron microprobe. In-situ trace element analyses of plagioclase and pyroxene were obtained on thin sections .12; .13; and .14 using laser ablation ICP-MS at the MITERAC facility at Notre Dame. Trace element data were reduced using the GLITTER software [6]. Calcium was used as the internal standard while a NIST 612 glass was used as an external standard [7].

Results and Discussion: The highly cataclasized nature of 62236 was revealed in all thin sections (Fig. 1).

Electron Microprobe Analysis: Anorthite in plagioclase ranges from An91.7−98.9 (Fig. 2). There exists a general grouping of lower An values for thin sections .12 and .58 while a higher grouping exists for .13 and .14. Sub-sample .7 contains plagioclase that is intermediate in composition. The rims of the plagioclase grains yield slightly elevated FeO values than their corresponding cores consistently across all thin sections (0.03-0.07 percent higher on average per thin section). The expected crystallization trend for these plagioclase grains would be for FeO to increase with a decreasing An content, however, this trend is absent in these samples. Instead, the plagioclase grains in these samples show no crystallization trend between anorthite and FeO, which serves as evidence that these plagioclase grains have experienced some post-crystallization re-equilibration and/or are mixed lithologies. The general cataclasitic nature of this sample (Fig. 1) is consistent with this hypothesis. The pyroxene compositions of 62236 are displayed in Figure 3. Low-Ca pyroxenes yield Mg#s (calculated as molar...
Mg/[Mg+Fe]*100) ranging from 52.6-70.4, while high-Ca pyroxenes yield Mg#s of 67.1-76.8.

**LA-ICP-MS Analysis:** Trace element data were gathered on plagioclase and pyroxene grains for 3 of the thin sections available. Partition coefficients were calculated following the method outlined in [8] for plagioclase and [9-11] for pyroxene. All calculations were completed assuming a temperature of 1000°C as determined by Equation 3 in [12] assuming an initial LMO depth of 1000 km (Fig. 4). Plagioclase equilibrium liquids are variable and fall into 3 general types: flat, light rare earth element (LREE) enriched relative to the heavy REE, and LREE depleted relative to the heavy REE. Models of LMO evolution [12,14-17] allow for flat and LREE enriched liquid profiles for LMO products, consistent with the pyroxene equilibrium liquids and some of those derived from plagioclase. However, those that are LREE depleted are inconsistent with models of LMO evolution. The pyroxene equilibrium liquids show a LREE enrichment akin to a KREEP-like signature [18] with all having a normalized Ce/Yb ratio near or greater than 2 indicating some interaction with a KREEP component. The plagioclase liquids indicate these crystals were not derived from the LMO or underwent subsolidus re-equilibration after formation.

**Conclusions:** FAN 62236 is a severely cataclasized sample of the lunar crust. Major element analysis indicates that the plagioclase grains have likely undergone re-equilibration post-crystallization. The mechanism for this is unclear, however, the texture of the thin sections leads to the conclusion that this is likely impact related. Trace element data of plagioclase and pyroxene grains reveal that this sample contains some non-LMO derived material as well as evidence for interaction with KREEP. This sample likely represents a mixed lithology containing endogenous LMO material coupled with material modified either through the result of an impact or interaction with KREEP and is therefore not LMO-derived.