THE AGE OF THE CRISIUM IMPACT BASIN. C. H. van der Bogert[1], H. Hiesinger[1], and P. Spudis[2], [1]Institut für Planetologie, Westfälische Wilhelms-Universität, Münster, Germany (vanderbogert@uni-muenster.de); [2]Lunar and Planetary Institute, Houston, TX, USA.

Introduction: Fragments of Crisium impact melt were presumably collected by the Luna 20 sample return mission, and the radiometric age for a feldspathic, KREEP-poor sample is reported as 3.895±0.017 Ga [1]. Earlier radiometric analyses suggested an age of ~3.84 Ga [2-4]. However, Swindle et al. [1] argue that the sample they analyzed is more likely to represent Crisium than the others. Updated Apollo 17 sample ages, thought to represent Crisium, range from 3.88 to 3.93 Ga [5]. Based on stratigraphy, Wilhelms [4] proposed that Serenitatis is younger than Crisium, which would set the lower age limit for Crisium to < the proposed age of Serenitatis: 3.87±0.012 Ga [6] or 3.825±0.048 Ga [5]. Neukum [7] reported crater densities for Crisium that yield an absolute model age of 3.99 Ga. However, more recent work by Spudis et al. [8] and Fassett et al. [9] indicates that Serenitatis may be older than Crisium, consistent with Baldwin [10,11]. Thus, the Serenitatis age could instead be an upper limit for the age of Crisium.

Recent geological mapping identified remnants of the Crisium basin impact melt sheet, based on their morphology and composition [12]. Some of the exposures exhibit cracked and fissured morphologies consistent with those at both fresh craters (e.g., Tycho and King craters [13]) and older impact melts (e.g., Orientale [4,14]), and show embayment by subsequent mare basalt flows [12,15]. Their compositions, determined from Clementine data, indicate that they have less FeO (~8.3 wt. %) than the surrounding basalts (>15 wt. %), attesting to their affinity to lunar highlands compositions [15]. We measure the crater size-frequency distributions (CSFDs) of these newly documented exposures to expand our understanding of the age of the Crisium basin and its position in the basin chronology.

Results: Our preliminary results, taken from the largest and most prominent of the melt deposits identified by Spudis and Sliz [15], indicate that Crisium basin formed at 3.85±0.05 Ga, using the production and chronology functions of [16] and fit using Poisson timing analysis [17] (*Fig. 1*). This result is consistent with the younger of the radiometric ages derived from samples thought to originate from Crisium. Our result is younger than that derived via crater statistics [7]. Even if we fit the CSFD using a cumulative fit and the functions of [7], we derive an age of 3.87+0.044-0.063 Ga. This age is closer to the radiometric age determined by Swindle et al. [1], but still younger than the absolute model age of [7] and younger than the oldest Ap17 sample ages. Finally, if we apply our newly derived

$N(1)$ to the graphical representation of the lunar cratering chronology, the positioning of the Crisium point moves lower and better fits the Neukum et al. (2001)[16] lunar chronology function.

Conclusions: The identification of impact melt units associated with Crisium basin allows independent evaluation of its formation age using CSFDs. Our results indicate that Crisium basin formed between 3.85 and 3.87 Ga, rather than closer to 4 Ga. Impact melt units are interesting and important sites (e.g., [12,18]), which if directly sampled can provide additional calibration points for the lunar chronology [7,16,19,20].
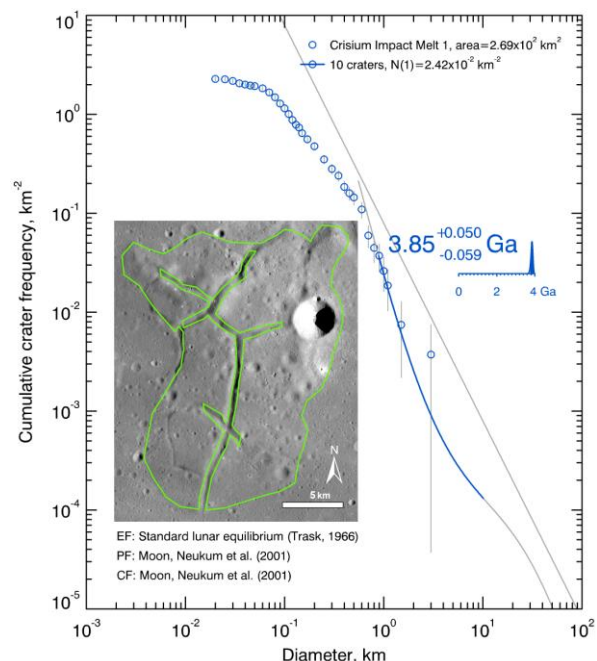

Figure 1. CSFD and derived AMA for the largest exposure of the Crisium impact melt deposit identified by Spudis and Sliz (2017)(inset, SELENE mosaic).

References: [1] Swindle et al. (1991) *PLPSC* 21, 167-181. [2] Cardogan and Turner (1977) *Philos Trans R Soc London* A284, 167-177. [3] Deutsch and Stöffler (1987) *GCA* 51, 1951-1964. [4] Wilhelms (1987) *USGS Prof Pap* 1046-A, 71 pp. [5] Schmitt et al. (2017) *Icarus*, 10.1016/j.icarus.2016.11.042. [6] Podosek et al. (1973) GCA 37, 887-904. [7] Neukum (1983) *NASA TM-77558*, 153 pp. [8] Spudis et al. (2011) JGR 116, 10.1029/2011JE003903. [9] Fassett et al. (2012) *JGR* 117, 10.1029/2011JE003951. [10] Baldwin (1987) Icarus 71, 1-18. [11] Baldwin (1987) Icarus 71, 19-29. [12] Spudis and Sliz (2017) *GRL*, 10.1002/2016GL071429. [13] Howard and Wilshire (1975) *J Res USGS* 3, 237-251. [14] Scott et al. (1978) *USGS Map* I-1034. [15] Sliz and Spudis (2016) *LPSC* 47, 1678. [16] Neukum et al. (2001) *Space Sci Rev* 96, 55-86. [17] Michael et al. (2016) *Icarus* 277, 279-285. [18] Ryder et al. (1989) *EOS* 70, 1495-1509. [19] Stöffler and Ryder (2001) *Space Sci Rev* 96, 9-54. [20] Stöffler et al. (2006) *New Views of the Moon, Rev Min Geochem* 60, 519-596.