NEW INSIGHTS ON THE CRATERING HISTORY OF LUNAR FARSIDE. S. Marchi[1] and W. F. Bottke[2], [1]Department of Astronomy, Padova University, Vicolo dell'Osservatorio 3, 35122 Padova, Italy (simone.-marchi@unipd.it), [2]Center for Lunar Origin and Evolution (CLOE), NASA Lunar Science Institute, Southwest Research Institute, 1050 Walnut St., Suite 300, Boulder, Colorado 80302, USA.

Introduction. The most ancient lunar terrains are located on its farside. In order to achieve a better understanding of the early evolution of the Moon and, in particular, of its early cratering history, we performed new crater counts on some of the oldest terrains of the farside. In particular, we investigated Pre-Nectarian and Nectarian terrains within the so-called Feldspathic Highlands Terrane (FHT) and within the largest impact basin in the whole Solar System, namely the South-Pole Aitken basin (SPA). In this paper, we present the derived cumulative distributions of craters for those terrains and also discuss the observed differences and similarities.

New crater counts on FHT and SPA regions. A high resolution Clementine shaded relief map of the Moon has been used to perform crater counts over selected regions of the lunar farside [1]. The resolution of the map was 64 px/deg, corresponding to 0.4738 km/px. Crater counting has been performed with a semi-automated code according to the following steps: i) the regions of interest have been divided in sub-regions of about 10x10 deg^2; ii) within each sub-region, craters have been registered by mouse clicking on 5 points over their rims; iii) the 5 selected points are used to fit a circle, returning the center position and the diameter of the craters; iv) all identified craters are saved on a ASCII file for post processing.

In this work we focused mainly on craters larger than about 20 km. This is because craters smaller than 10-20 km may be severely affected by secondary craters, i.e. formed by fragment ejected by other craters [2,3].

Moreover, it is difficult to recognize, characterize, and count smaller craters on a shaded relief map when (i) we are near the resolution limit and (ii) the farside terrains investigated are covered with enormous numbers of small craters.

In order to validate our counting procedure, we compared the crater counts made on established terrains to those that existed in the literature [3,4]. We found our distributions were in fairly good agreement (within the error bars) for terrains near or on a number of lunar basins (e.g Nectaris, Moscoviense, Apollo, Ingenii, Birkoff; see Figure 1 for some examples). In total, we identified over 2000 craters on the southern hemisphere (SPA) and more than 3500 craters on the northern hemisphere (FHT).

Discussion and conclusions. Here we present crater counts on Nectarian and Pre-Nectarian terrains within FHT (see Figure 2) as established by the geologic mapping methods (see Plate 6 of [3]). The crater counts for the Pre-Nectarian terrains within the SPA basin as established by [3] (see Plate 6), as well as those for younger SPA terrains, are also shown (see Figure 3).

Concerning the FHT, we find that the Pre-Nectarian distribution, as expected, has a higher density of craters than the Nectarian regions. Nevertheless, the shape of the two distributions is similar, indicating that no substantial variation in the size distribution of the impactor population occurred between the different epochs.

On the other hand, Pre-Nectarian terrains within SPA show some differences with respect to FHT. In particular, for the crater range D=20-60 km, the FHT is steeper than SPA. Moreover, the crater cumulative distribution of the Pre-Nectarian portion of SPA is also remarkably different to the one of the whole SPA basin (see Figure 3). This may be due to strong crater erasing triggered by the formation of several impact basin within SPA.

While the results presented here are still preliminary, they appear to provide new insights into the most ancient times still recorded on the Moon. The next task is to model the evolution of the population that created these craters following the approach done by [5] as well as assess what these regions can tell us about the timing of events that occurred early in solar system history.

References. [1] Data available here: http://www.mapaplanet.org/explorer/moon.html [2] Wilhelms et al. (1978) Proc. Lunar Planet. Sci. Conf 9th p. 3735-3762. [3] Wilhelms (1987) U.S. Geol. Surv. Prof. Pap. 1348, 302 pp. [4] Neukum and Ivanov (1994) Hazards due to Coments and Asteroids, 359. [5] Marchi et al. (2009) AJ 137, 4936.

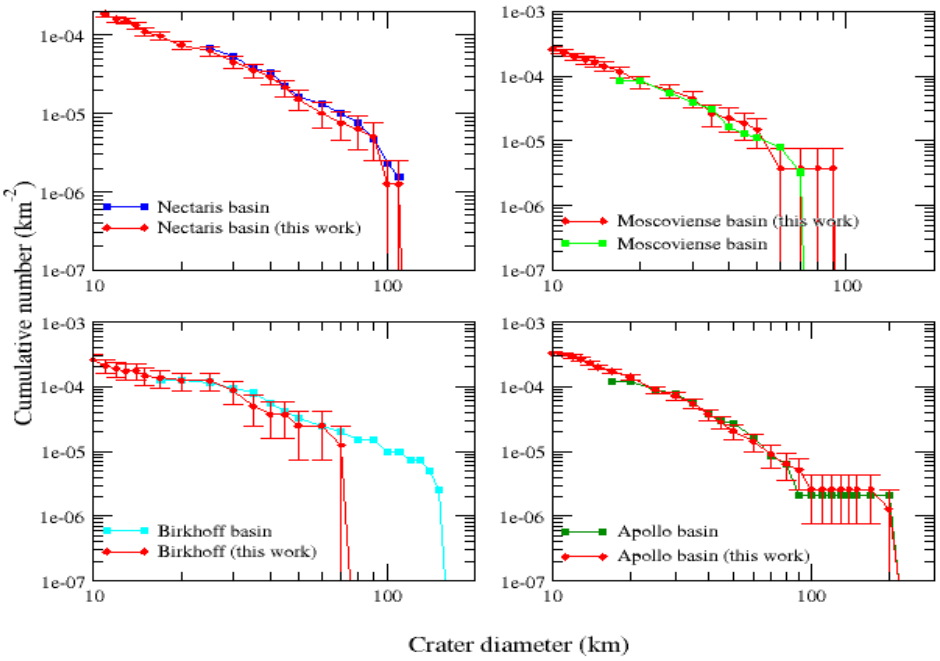

Figure 1: Comparison of our own crater counts of selected basins with published distributions (data from [3,4]).

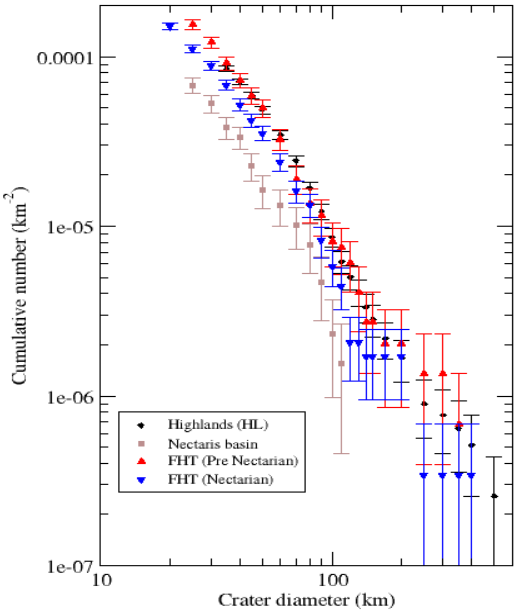

Figure 2: Cumulative distributions of Pre-Nectarian and Nectarian terrains within FHT. The distribution for Nectaris basin and the average lunar highlands (both from [4]) are also shown.

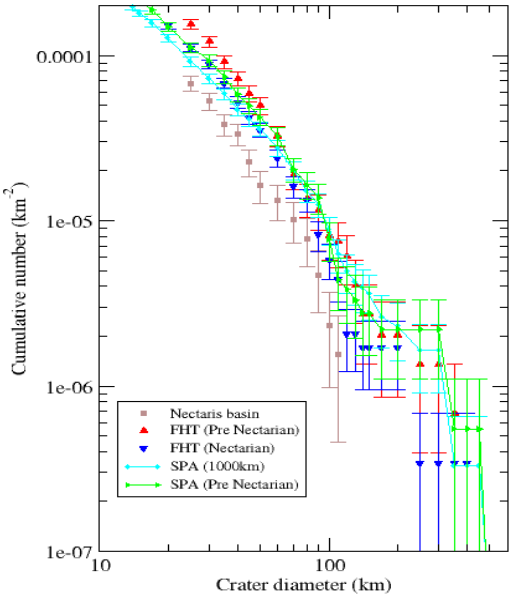

Figure 3: Cumulative crater distribution of Pre-Nectarian terrains within SPA region. The distribution of the whole SPA basin is also shown. For this, we considered a region having a radius of 1000 km centered at longitude=180 deg and latitude=-56 deg. Distributions from Figure 2 are also shown.