INFLUENCE OF SECONDARY CRATER CHAIN ON AGE ESTIMATION – EXPERIENCE FROM SINUS IRIDUM AREA ON THE MOON. Vilmos Steinmann[1], [1]Eötvös Loránd University steinmann.vilmos@gmail.com)

Introduction: Analysis of the size frequency distribution of impact craters on atmosphereless bodies support the age estimation of the given surfaces covered by these craters (1]). While previously mainly larger craters above km size were analyzed ([2]; [3]), based on the new images from Lunar Reconnaissance Orbiter ([4]) craters down to 2-4 m size could be identified and analyzed also. There is a knowledge gap in the understanding of the morphology ([5), formation plus degradation of these smaller craters, and they give information also on the current bombardment rate in the near Earth region ([6]).

Methods: For the crater counting and digitalization the CraterTools ([7]) and ArcMap and QGIS were used, for the age estimation Craterstats ([8]) with the newest available production ([9]) and chronology functions ([1]) were applied. Before the age calculation, a randomness analysis to filtering only the random populated crater diameter classes was done. The density map of the craters on Sinus Iridum (Figure 1) was made by Goldensoftware Surfer, with kriging interpolation (grid size: 10x10 km). During the crater counting the minimal diameter was 150 meters on the WAC image, and 10 meters on the LROC image.

Results: For the analysis the total area of the Sinus Iridum, the crater ray alone and the ejecta of 2 craters inside the ray were done. The age of the whole Sinus Iridum is $3.0^{+;-0.05}$ Ga based on the survey all of the craters in the area. The age of the Sinus Iridum without the main crater ray (Fig. 1- inset b) $2.8^{+;-0.07}$ Ga. Surveying only the crater ray, the age of the carter ray is $3.6^{+0.03;-0.04}$ Ga, what is much more, than the measured age for the whole Sinus Iridum.. The measured a crater ejecta, what are in the middle on the main crater ray (Fig. 1). On the crater ray it was measured 456 craters on 2070 km^2 size area, without this ray, it was measured 6522 craters on a 40135.4 km^2 area. The other measured craters and areas see in Table 1.

Crater datasets: The following table show the number of the measured craters, the area. The Area ID is the same like the insets letters on Fig. 2

Table 1: Numerical dataset from the analyzed areas

AREA ID	CRATERS	AREA(km^2)
a	456	2070
b	6522	40135.4
c	7008	42205.4
d	326	0.57

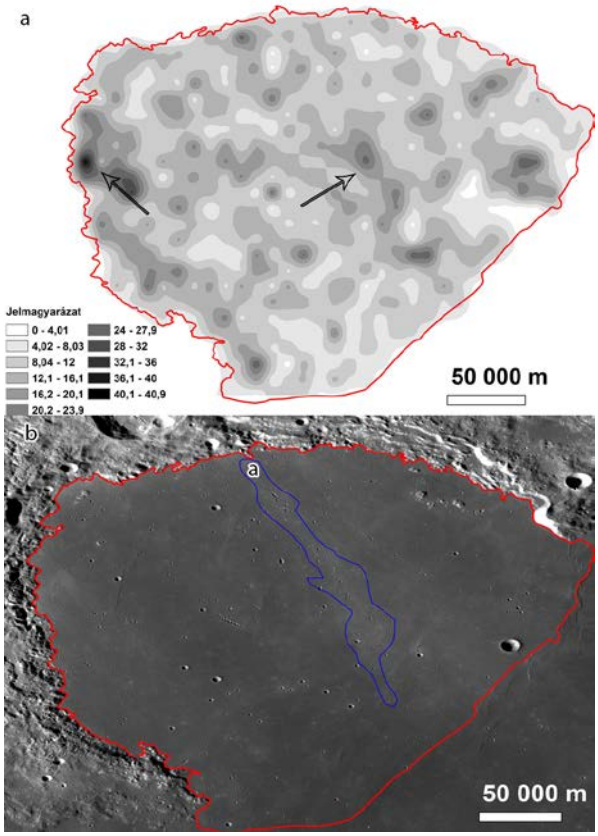

Fig.1: Overview of Sinus Iridum (b) and the crater ray (marked by the right arrows). Inset a shows the map of Sinus Iridum with the crater areal density. On instead b, the mark ‘a’ show the analyzed crater layer

Discussion: The crater density is much higher in the area of the crater ray (right arrow on Fig. 1), what is clearly visible in Fig. 2. The estimated age of the crater ray is also much higher (Fig. 2, inset a), than the estimated age of whole Sinus Iridum (Fig. 2 inset c),. The difference between the two calculated ages is 0.4 Ga what might come from the effect of the secondary craters along the impact ray. Most of the craters on the crater ray area bigger than the 500 meters. In this case, the estimated age is much higher, than the whole Sinus Iridum, and this estimated age is not relevant. The crater ray is the part of the crater Copernicus, because this crater is the closest one to the Sinus Iridum and big enough for creating rays. The estimated age of the Copernicus crater is about 779 $^{+110;-120}$ Ma [10]. The age of the secondary crater ejecta (part of the crater ray) is ~240 Ma, what is a more relevant age for the formation of the crater ray. This estimated age is in

agreement with the 20% of the used areas to estimate the age by Hiesinger et al[10].

Conclusion: For the better age estimation of the crater rays more number and area of ejecta of secondary carters ejacta has to measure . The standalone crater ray analysis and age estimation is not enough, in the case of the distorting effect of high numbered craters with big diameters (d=500 – 1000 m).

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References:

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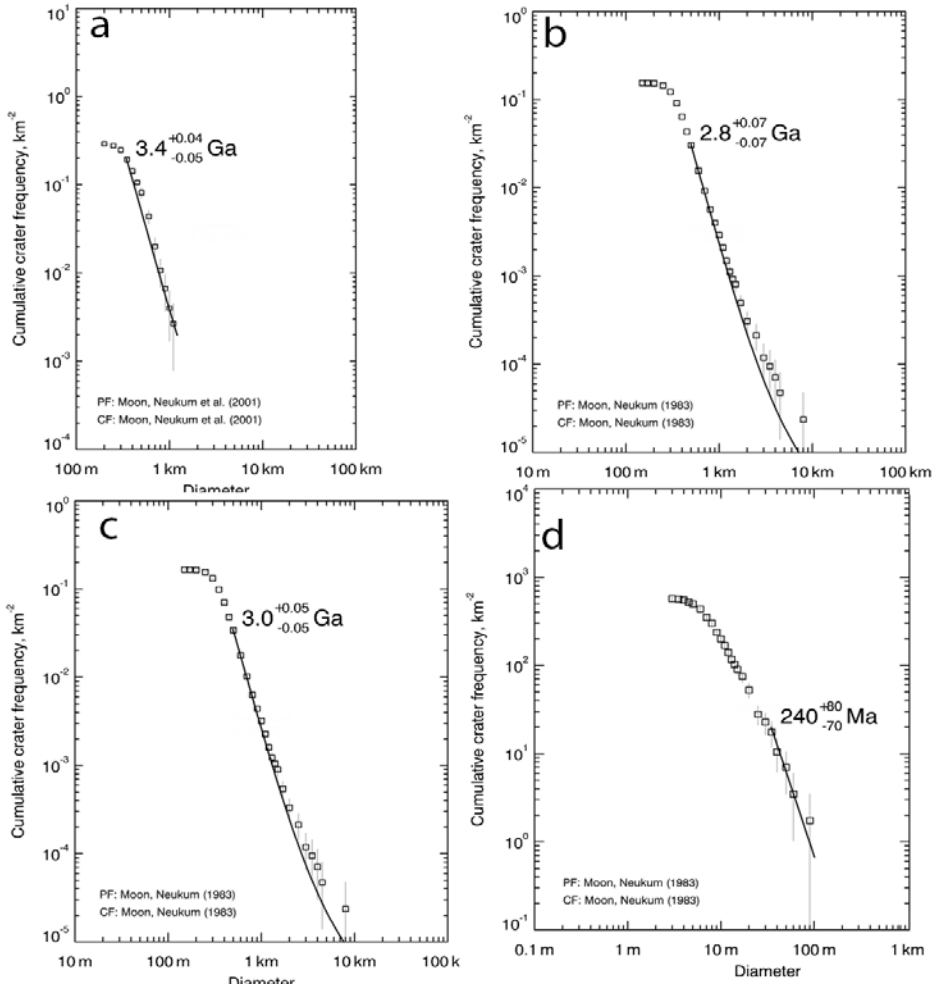

Fig.2: Ages of the analyzed areas (a-target area, b-Sinus Iridum without the crater ray, c-Sinus Iridum, d-secondary crater ejacta)