CHRONOLOGICAL BASED CRATER COUNTING ANALYSIS (CSFD) OF MARE CRISIUM BASIN USING CHANDRAYAAN-1 TMC AND LROC-WAC. S.Arivazhagan[1] and A.Karthi[2], Centre for Applied Geology, The Gandhigram Rural Institute-Deemed to be University, Dindigul, Tamilnadu-624 302, India ([1]arivusv@gmail.com, [2]karthiatkj@gmail.com)

Introduction: Mare Crisium basin is a multi-ring basin lies in the northeastern portion of the lunar near side in between latitude of 10° and 30º N and longitude of 50° and 70º E. Mare Crisium has 555 km (345 mi) in diameter and 176,000 square kilometers (68,000 sq. mi). The Main ring diameter is 740 km and the basin depth is 4.57 km.

The chronological based crater counting is a well-established technique for determining relative and absolute model ages of planetary surfaces of Mars, Moon, Mercury [1,2]. The lunar surface is categorized by craters of various sizes with various states of preservation in the different impact events [3]. Crater based age determination of surface features for any kind of planetary body is essential for understanding the categorization of geological events in the past [4].The relative ages of the units were converted to absolute ages by comparison to a curve calibrated data and crater counting will give the information about age of the basin [5].

The CSFD counting method requires that only primary impact craters be counted, so secondary craters must be avoided. Impact craters on planetary surfaces is a well-established method of statistical analysis of crater size-frequency distributions (CSFDs) to derive the absolute ages on the basis of utilized the remotely-sensed image data [6]. The crater count buffering method has been successfully integrated and analyzed as a new functionality in the crater tools extension for ArcGIS [7] and in order of new crater calibrations proposed to determine the lunar crater-age chronology [8]. The study aims to investigate the absolute model ages of the mare crisium basin using CSFD techniques.

Data: Chandrayaan-1 Terrain Mapping Camera and Lunar Reconnaissance Orbiter Camera (LROC) - Wide Angle Camera (WAC) data were used in the present study. The TMC had a high spatial resolution of 5m, stereo viewing capability in the panchromatic spectral range of 0.5–0.75 μm, and altitude data of 12-bit digitization. The TMC has push-broom mode of 20 km swath in the panchromatic spectral band of 0.5–0.75μm. For the mare crisium area three TMC-ortho datasets have covered the areas of the south central part, southwest part and south east part of the mare crisium. The LROC-WAC is a 7-color push-frame camera of the Moon at a uniform resolution of 100 m/pixel.

Method: The crater counting method of Crater Size Frequency Distribution (CSFD) used for the mare crisium region.

Crater Counting Analysis (CSFD): Crater counting is a method for estimating the age of a planet's surface based various size of the impact craters. The determination of Crater Size Frequency Distributions (CSFD) is a commonly used method to date surfaces of terrestrial planetary bodies. In this study, the craters were selected from the range in diameter of 0.6km to more than 20km by using ArcGIS integrated crater tool. From the range, we were employed the production function, which is valid for craters from 10 m to 100 km and lunar cratering chronology function, which defines the cratering rate. By combining the CSFD with a chronological and production function we can estimate the age of the surface [10]. The age estimation of production function and the chronology function were derived from Crater-Stats tool [11].

Results and Discussion: Mare Crisium basin has classified as zone 1 to 4 in the previous studies [5,9]. The Zone1, Zone 2, Zone 3, Zone 4 are having the age of 3.55Ga, 3.54Ga, 3.4Ga, 2.7Ga respectively. Figure 1 shows the model ages of mare crisium by using of LROC-WAC 100M resolution data. Table 1 shows chronological ages comparison of the mare crisium basin along with previous study results.

By using Chandrayaan-1 TMC data the Mare Crisium Southeast region has age of 3.4Ga, South-central region has age of 3.6Ga and Southeast region has age of 3.45Ga. The south central, southwest and southeast regions of the model ages are relatively matching with previous study [9]. Figure 2 is showing the portion of Mare Crisium located in southwest region which has 3.4 Ga age. Figure 3 is showing the southeast region which has 3.45Ga of the mare crisium. Figure 4 is showing the south central region which has a 3.6 Ga age of the basin.

Summary: The CSFDs were acquired for each count area and analyzed to determine the chronology of mare crisium basin by using LROC-WAC and CH-1 TMC. From the results, it is observed the basin surface has more number of the craters and having the age of 3.6Ga. The further validation could be done with the lunar 24 samples which is considered as ground truth of Mare Crisium.

Table 1: Comparison of the mare crisium basin age with previous study

S. NO	Zones	Craters counted	Aerial coverage (Sq.Km)	Model ages of Zones (LROC)	Model ages of Hiesinger et.al, 2011.	Model age of Boyce et.al, 1977. (Apollo topographic data)
1	Area 1 (Zone1)	440	44,175	3.55Ga	3.65Ga	Unit-I 3.65±0.07 G.a
2	Area 2 (Zone 2)	1360	85,036	3.54Ga	3.5Ga	Unit II- 3.5± 0.1 G.a
3	Area 3 (Zone 3)	720	47,472	3.4Ga	3.2Ga	
4	Area 4 (Zone 2	159	11092	2.7Ga	2.5Ga	Unit III- 2.5 ± 0.4 G.a

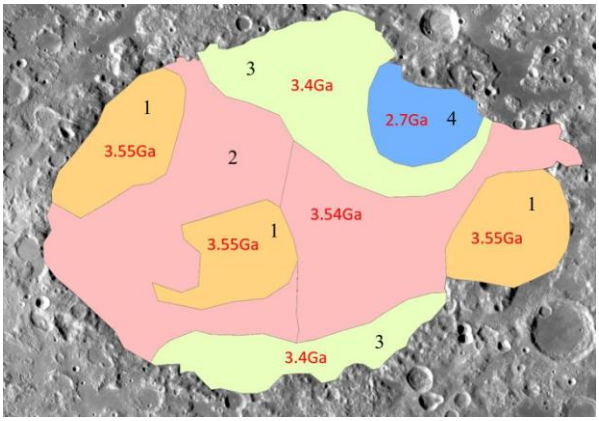

Fig.1.CSFD analysis model ages for the Mare Crisium basin by using LROC-WAC data analyzed based on model method of Hiesinger et.al. 2011. The Zone 1- Mango color (3.55Ga), Zone 2- Rose (3.54Ga), Zone 3- Olivine yellow (3.4Ga), and Zone 4- Blue (2.7Ga).

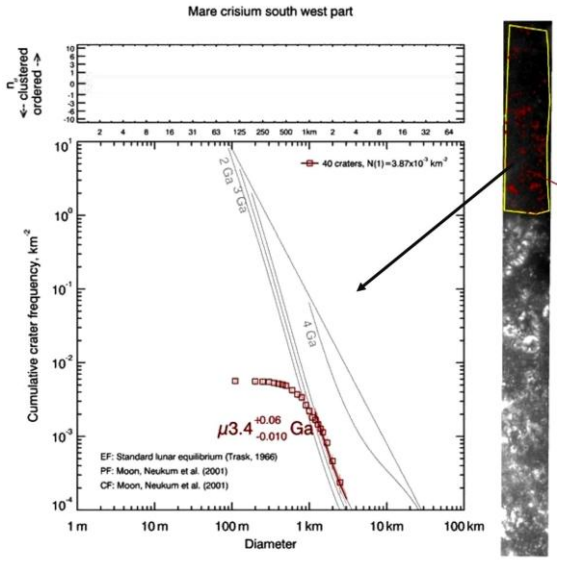

Fig.2.The Mare Crisium southwest region TMC - crater counting model gives an absolute age 3.4 Ga.

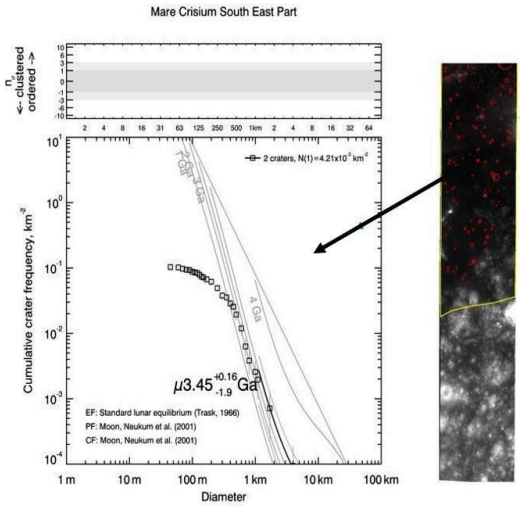

Fig.3. The Mare Crisium southeast region TMC - crater counting model gives an absolute age of 3.45Ga.

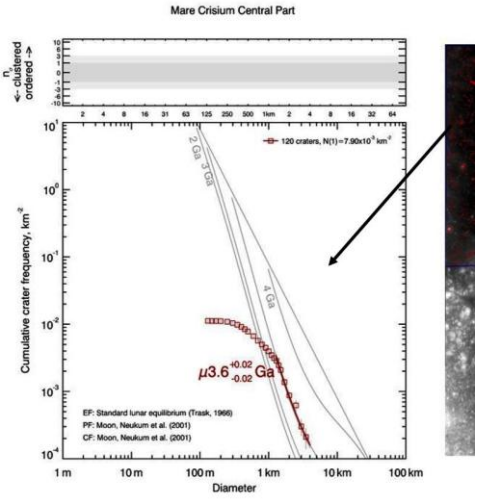

Fig.4.The Mare Crisium south central region TMC - crater counting model gives an absolute age of 3.6 Ga.

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