ANALYSIS AND CLASSIFICATION OF OPPENHEIMER CRATER AS A CLASS FLOOR-FRACTURED CRATERS

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INTRODUCTION

The paper presents the study of Oppenheimer Crater using Miniature-Radio Frequency SAR (Mini-RF) and Lunar Orbiter Laser Altimeter data (LOLA). This combined study uses variations in crater morphology and regional distribution to explore the reason behind formation mechanisms. The distribution of crater features from Electrical and Physical parameters differentiate materials within ejecta deposits and helps in knowing the surface topography and scattering behavior [1]. Complex morphology of the Crater has been analyzed in paper. The paper points out the importance of SAR and LOLA data by classifying Oppenheimer Crater to one of the FFC subclasses. We propose this tendency to be supportive in knowing the mode of evolution, formation of features and also in classifying the crater classes.

STUDY AREA

Oppenheimer crater (205 km diameter, 35.4S, 166.0W) is located within the farside South Pole Atikten Basin [2]. Its floor is composed of plains and three smaller craters. Crater consists of rilles that are typically less than a km wide parallel to the crater walls. There are dark mantle deposits (low albedo material) which are basically the pyroclastic deposits[3].

DATASETS AND ITS ANALYSIS

Using datasets from the Mini-RF and LOLA detailed study of electrical and physical parameters of crater and its systematic classification of FFC is carried out using the methodology given by Schultz [4]. Mini-RF active sensor which transmits RCP and receives linear horizontal and vertical polarization in PDS format[5]. Received backscattering coefficient values are used to analyze the scattering behavior using m-chi decomposition.

m-Chi [6] decomposition of SAR data is based on m (the degree of polarization) and chi (the Poincare ellipticity parameter). m-chi can easily differentiate materials within ejecta deposits and their relative thicknesses. m-chi decomposition consists of the three types of scattering i.e. surface scattering, double bounce and volume scattering. In m-chi blue color indicates single bounce scattering (If an incident wave, with a particular polarization, has a simple interaction with a target i.e. lunar regolith), red corresponds to double bounce that might occur between two surfaces at an angle to one another (due to presence of bedrocks beneath the surface) and green color represents the randomly polarized constituents or volume scattering (the incident wave undergoes many bounces before returning to the radar).

RESULTS & DISCUSSION

Pyroclastic material and plains on Oppenheimer’s floor shows surface and double bounce scattering. Eroded rim crest and ejecta exhibits dominant volume scatter from surface and subsurface layer. In-between gaps of wall terraces are featured by double bounce mechanism as bedrocks and lava deposits beneath and above the surface respectively. LOLA analysis shows the depth distributions along the transect line. It demonstrate the wall slumps or terraces at the degraded rim crest and small impact deposits in central region, with flat plate-like floor while moving along the crater diameter. Volcanic eruptions might have caused the pyroclastic deposits near the crater rim. Lava material from impact phenomenon and volcanic activities have marked the crater floor the number of small impacts, multiple rilles inside secondary craters, fractures, ejecta deposits making irregular crater floor with eroded rims.

Many lunar craters are classified under population of Floor-Fractured Craters (FFC) [8] and mapped according to their distribution on the Moon. The population of FFCs was categorized according to the classes outlined by Schultz. He classified FFC into 6 types based on their crater depth, most notably their fractures and shallow floor. The fractures can be radial, concentric, or polygonal. [8] Oppenheimer is a FFC crater yet its category is not defined. SAR and LOLA analysis will help classifying the crater’s category & fitted into FFC classification. Figure 5 highlights the characteristics and distribution of oppenheimer crater similar to the Class 5 FFCs.

CONCLUSION

Mini-RF image data reveal the presence of distinctive floor fracturing associated with the crater floor. The radar backscattered images at every pixel helps in understanding the scattering phenomenon of the target on lunar surface. Thus from the above analysis Oppenheimer crater can be considered as class 5 FFC category. Future work will include the classification of FFC crater under under suitable class and their detailed study of physical and electrical properties of the lunar in order to understand phenomenon behind the surface features.

REFERENCES


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