DIGITAL TERRAIN MODELS AND RECTIFIED COLOR RATIO MOSAICS IN THE MARE ORIENTALE REGION DERIVED FROM CLEMENTINE IMAGE DATA; M. Wählisch, W. Zhang, T. Roatsch, J. Oberst, A.C. Cook, H. Hiesinger and R. Jaumann, DLR, Institute of Planetary Exploration, Rudower Chaussee 5, D-12489 Berlin, Germany

Abstract and Introduction. We used Clementine UVVIS images to derive a Digital Terrain Model (DTM) and a rectified color ratio image mosaic along a narrow strip crosscutting the Northern Mare Orientale basin. Combining topography with precisely registered color filter images allow us to study the structure, mineralogy and chemistry of this multi-ringed impact basin in unprecedented detail.

Data. To derive the terrain model, we used 43 reference images that were obtained by the Clementine UVVIS camera from orbit 338 (May 1st, 1994), when the camera was tilted sidewards over the region of 88° to 90° West and -20° to +10°North. These data were combined with nadir-pointed stereo partner images obtained from the same area during orbit 333 (April 30, 1994). The images have a ground pixel size of approximately 100 to 200 m/pixel. 129 color images (obtained from orbit 333 with three filters 415 nm, 720 nm and 900 nm) were used to derive the color ratios, in order to analyse compositional trends in the area.

Method. The terrain model was derived using methods that require photogrammetric adjustment of camera pointing data [1] and automated digital image matching [2]. During matching, each reference image was processed with three stereo partners. To obtain color ratios, the color filter images were first radiometrically calibrated [3] and photometrically corrected using the Hapke photometric function [4]. To evaluate the Hapke function, precise illumination angles were computed which take into account the topography from the terrain model. Images of different color filters were rectified using photogrammetrically adjusted camera pointing data and the available DTM. These were then combined to form mosaics. The procedure allowed us to obtain precisely registered color filter images. From these, the (720-415) µm to (720+415) µm ratio, the 720 µm to 900 µm ratio and the 415 µm to 720 µm ratio were produced which reflect titanium content, maturity state, and mafic character of the soil. Finally, the ratios were recombined into a RGB-color image in which colors represent specific compositional trends.

Results. The terrain model (Fig. 1) has a grid spacing of 200m and a height precision of 50m over an area of 60 x 900 km. It shows undulating corrugated terrain, broad ridges, as well as isolated domes with mean elevations varying from +4000m near the Cordillera Ring to -3000m near the basin floor. The basalt-filled Lacus Veris depression and several impact craters, such as Kopff, Kopff D and E are prominent features visible in the terrain and the color ratio data. Photometric brightening on slopes facing the Sun become apparent when the image data are compared with the terrain model. Preliminary analysis of the spectral ratio mosaics show well-defined basalt boundaries, fresh materials exposed within the craters and on the slopes of hills and faults, as well as mafic to non-mafic trends in the surface materials.

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When the ratio composite and the digital terrain model are combined, the compositional trends can be correlated directly with the topographic structure of the area. The acquired data set will allow us to perform further detailed studies of the structure as well as the mineralogy and chemistry of the surface soil in this basin.

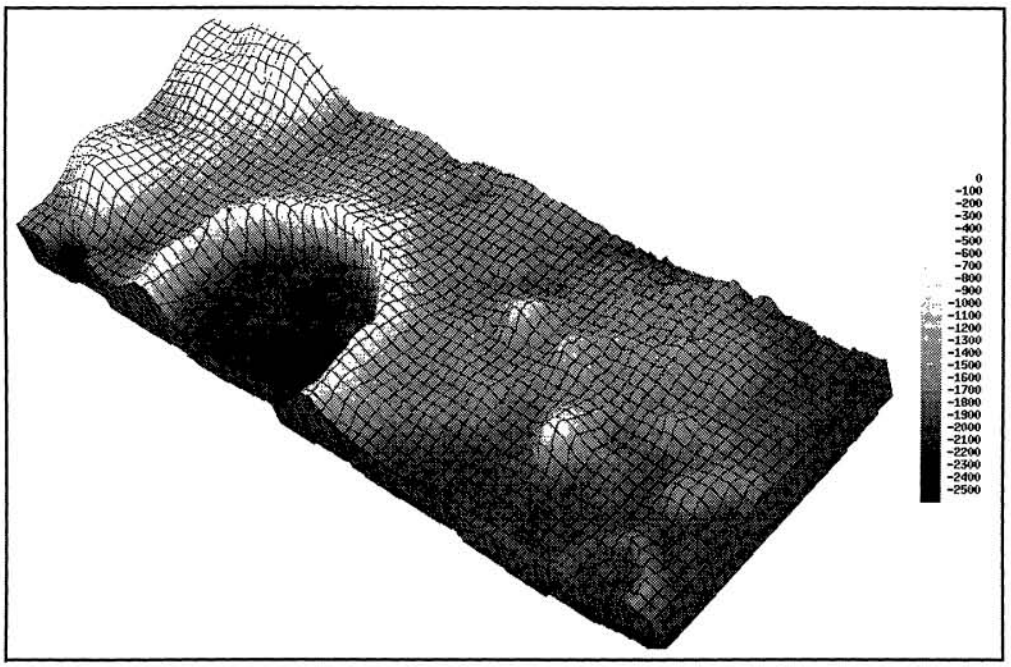

Fig.1 Oblique view of a part of the terrain model as viewed from the South-West. The 36 km-size crater Kopff is located in the center.

Acknowledgements. We wish to thank our co-workers A. Hoffmeister and A. Rexin for much help during the processing of Clementine data. Software contributions from Technical University of Berlin are acknowledged. We are also grateful to M. Robinson, A. McEwen, C. Pieters ,T. Duxbury, and C. Acton, who supplied UVVIS radiometric and geometric calibration data and computer algorithms.

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