GEOLOGICAL MAP OF THE RIMA BODE REGION: A POSSIBLE LANDING SITE FOR FUTURE LUNAR EXPLORATION. S. Mikolajewski1, H. Hiesinger1, C. H. van der Bogert1, and N. Schmedemann1
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Introduction: Studies of the nearly 400 kg of lunar samples retrieved by the Apollo, Luna, and Chang’e-5 missions or delivered in the form of lunar meteorites have enabled significant advances in our understanding of the lunar geologic and volcanologic evolution. Hence, new carefully selected lunar samples from unexplored sites will offer additional opportunities to further develop both our scientific and technical knowledge. This study presents a new preliminary geological map of the Rima Bode region in preparation for potential future missions [1, 2]. The Rima Bode region is located south of Mare Imbrium at 12°N, 4°W. The region is characterized by an extensive rille in the northern part of the area and various mare and pyroclastic deposits of different ages distributed over the area. The pyroclastic deposits are of particular interest for in situ resource utilization (ISRU) studies [e.g., 3].

Data/Methods: Multispectral data and mosaics from several studies [4-15] have been used to explore the Rima Bode region (Fig. 1). We used recent Lunar Reconnaissance Orbiter Camera (LROC) datasets to create a detailed geologic map of the region and investigate possible landing sites for future missions (Fig. 1A, C, D). In ArcGIS, we used the Clementine FeO and TiO2 [4, 5] (Fig. 1B) as well as Kaguya mineral maps [6], and LROC images and mosaics [7] to define morphological and compositional geologic units in the Rima Bode region. Using digital terrain models [9] (Fig. 1C), and slope maps (Fig. 1D), we examined the topography and rock distribution.

Results: The presumably oldest units in the study area are the Fra Mauro Formation (fF) and the Montes Appeninus (lap). In the northern part of the study area, the foothills of the Montes Apenninus (Fig. 2: lap) are exposed. This unit is characterized by a rough knobby surface compared to the mare unit Im. In the eastern part of the study area the Fra Mauro formation (fF) is exposed (Fig. 2). The unit is characterized by a smoother surface compared to unit lap but not as smooth than unit Im. The albedo of this unit is brighter than Im and the surface is also covered with several
small craters ranging from 100 m up to 5 km. The dark mare unit Im in the west (Fig. 2) is slightly younger than the aforementioned units. Im is characterized by a smooth, dark surface with sparse craters ranging from several 100 m up to the 7 km large Bode C crater. There are also several wrinkle ridges and ray material from Copernicus crater in the western part of unit Im (Fig. 2). Located in the eastern part of the map area and west of unit If is unit Ip which is smoother compared to If and its albedo is also brighter. A rugged, darker unit (Ir) is located in the southern part of the study area (Fig. 2). Compared to Im it has few large craters ranging from one up to five kilometer. Idp1 is located (Fig. 2). The surface is smoother compared to units Iap and Ir. The albedo of unit Idp1 is darker compared to unit Im. In the northern part of this unit is Rima Bode located. This graben runs across unit Idp1, Im and an Im brian crater (Fig. 2, lc). Unit Idp1 is also characterized by several graben running across its surface mostly in the northern parts (Fig. 2). Southwest of unit Idp1, unit Idp2 is located (Fig. 2). The albedo of this unit is darker and also smoother compared to unit Idp1. Across the whole study area are crater unit of different age located (lc, Cc; Fig. 2).

Discussion: The area north of unit lc (red star) close to Rima Bode would be interesting to study as suggested by [2] because it permits access to a crater and also the investigating of volcanic material. Nevertheless, we favor the area south of Bode C (green star) as described by [1]. There we would have access to ray material from Copernicus crater, could investigate pyroclastic material from Idp1 and Idp2, and could investigate the wrinkle ridge north of Bode C. Therefore, with one landing site multiple goals could be achieved. Compared to [15] we mapped at a scale of 1:250,000, which allowed a more detailed investigation of the area. To make it more clear that the dark plains units are older than crater Copernicus we renamed them from unit Clr [15] to Idp1 and Idp2.

Conclusion/Future work: We identified at least three pyroclastic units in the study area. Two of them are in close proximity to Bode C and are within reach of a mission targeted to this area. Getting more samples from lunar pyroclastic material would increase our knowledge of the timing and evolution of volcanism in that specific area. In the future mapping process we will further specify the different mare units from which are hère mapped as unit Im.


Figure 2: Excerpt of the geological map of the Rima Bode region located at the southern limb of Mare Imbrium. The colored stars mark the two possible landing sites in the study region.