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Distribution of megablocks in the Ries crater, Germany: Remote sensing and field analysis

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The Ries impact structure, located in Bavaria, southern Germany, has a diameter of 26 km. It is one of the best studied impact craters on the Earth and it is used as an archetype for complex craters across the solar system [e.g. 1, 2]. However its geologic structure still poses questions regarding crater formation mechanics and about the distribution of distinct morphologic units. Especially the hummocky terrain of the megablock zone, which is located between the so-called inner crystalline ring and outer rim of the crater, is not well understood [2]. On the one hand it consists of excavated allochthonous blocks of brecciated crystalline and sedimentary rocks that are embedded in Bunte Breccia (a polymict lithic breccia), on the other hand it is built up of sedimentary blocks that slumped into the crater cavity during crater collapse [2, 3]. Thus the megablock zone gives unique insights into processes of target damaging, fragmentation and excavation and interaction with collapse-induced slumping. Published geologic maps merely display megablocks that are exposed at the surface [4]. A preliminary analysis of the area utilizing Google Earth imagery (average resolution of 1m/pxl) additionally show abundant megablocks in the near subsurface covered by soil that were not yet recorded until now. They are clearly visible in fields with sparse or no vegetation and show a structure and morphology similar to megablock outcrops at the surface. The megablocks could not be observed in fields with dense vegetation and residential areas. Visibility of megablocks in the fields is likely due to differences in humidity in the top soil caused by the different underlying megablock material. Using a 1-3 m shallow drilling device (Pürckhauer) we were able to prove the existence of several megablock structures that are clearly visible in remote sensing images. Their top was reached at a depth of around 2-3 m.

A field campaign using a percussion piston corer in combination with the analysis of new high-resolution remote sensing images from the HRSC-AX Camera (resolution 20 cm/pxl) is carried out to further investigate the distribution, composition, and size of megablocks in the subsurface of the Ries crater as a function of radial distance to the crater center. The remote sensing images allow for a detailed mapping of the megablock structures while the field campaign provides ground truth. This is especially important since this detection technique has not been used on recognition of megablock structures before. To compensate for the problems of megablock visibility due to different levels of vegetation we will use Google Earth and HRSC-AX images that have been taken at different times. With the proposed combination of datasets, we will significantly increase our chance to observe megablock structures, thereby increasing our knowledge.

Extensive field work also allows for detailed composition and structural analysis of the megablocks at the surface. Combining existing geologic maps [4 and references therein] with our results will yield a comprehensive map of the megablock zone of the Ries crater. Detailed analysis will provide a more in-depth understanding of the Ries impact crater, its complex geologic history and the emplacement mechanism of megablock structures in complex craters. These results can then be compared to similar complex impact craters on the Earth and on other terrestrial bodies like the Moon and Mars.

References

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