Detection of subsurface megablocks in the Ries crater, Germany: Results from a field campaign and remote sensing analysis. M. Willmes[1], S. Sturm[1], H. Hiesinger[1], T. Kenkmann[2] and G. Pösges[3], [1]Institut für Planetologie, Westfälische Wilhelms-Universität Münster, Germany (malte.willmes@uni-muenster.de), [2]Albert-Ludwigs Universität Freiburg, Germany, [3]Rieskrater-Museum Nördlingen, Germany.

Introduction: The Ries impact crater, located in southern Germany, represents one of the best studied impact craters on Earth and is used as an archetype for complex craters across the solar system. However, its geologic structure still poses questions regarding crater formation mechanics. The complex geology of the Ries crater has been studied in detail by many researches over the last 40 years [e.g. 1 and references therein]. The megablock zone is located between the inner crystalline ring and outer crater rim and is characterized by a hummocky morphology. It consists of allochthonous blocks of crystalline and sedimentary material, Bunte Breccia deposits and parautochthonous sedimentary blocks that slumped into the crater during the modification stage [2, 3]. Analysis of Google Earth image data has revealed possible megablock structures in the near subsurface that have not been mapped in detail before (Fig. 1). They can be observed in fields with spare vegetation and show structures that are similar to megablock outcrops. Their visibility is related to humidity differences in the topsoil that is most likely caused by the different composition and/or permeability of the underlying megablock material.

Methods: We used a combination of remote sensing and field analyses to investigate the subsurface megablocks. Google Earth images with an average resolution of 1m/pxl were used to search the megablock zone for possible subsurface megablock structures. The mapping was done using ArcGIS software. The remote sensing analysis was followed by a field campaign in which we used shallow drilling devices like Prückhauer and Percussion Piston Corer to verify the observed structures in the near subsurface and to determine their composition.

Results: The connection between remote sensing analysis and shallow drilling has proven to be very successful. Most subsurface megablocks are found within a depth of < 5 m. However the shallow drilling was not always successful indicating that some of these blocks might be at greater depth. Weathered material of the megablocks can often be found mixed in with the top soil. This is another tool to locate the approximate location of subsurface megablock in the field. Different albedos were observed in the remote sensing data but connecting these with the depth of the megablock in the sub-surface is not trivial. In fact it depends on many different factors including soil type and humidity.

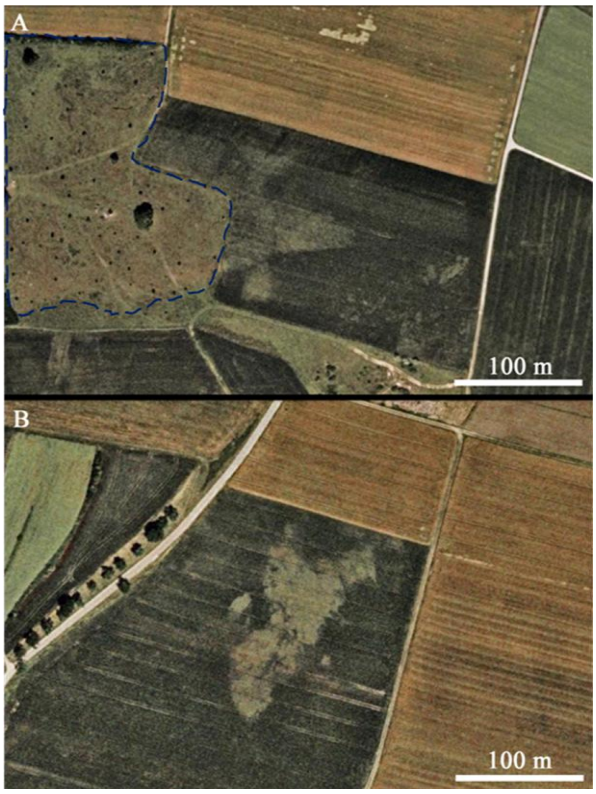

Fig. 1: *Google Earth images showing megablock structures in the subsurface, north is top. (A) Malm limestone megablock outcrop near Hürnheim (marked with blue dots). It dips into the subsurface and can be observed in the dark field on the right side. (B) Crystalline megablock near Marktoffingen that is covered by 40 cm of soil and sand deposits.*

Outlook: Further investigation of these features will include the use of a larger drilling device and the analysis of new high-resolution remote sensing images (HRSC-AX) complementing our current database. From the detailed analysis of the megablock zone we hope to gain a more in-depth understanding of the complex geologic history of the Ries crater. In addition this information can be used to better understand the emplacement mechanism of megablock structures in other complex craters on Earth and terrestrial bodies like Moon and Mars.

References: [1] Hüttner and Schmidt-Kaler, 1999, Geologica Bavarica, 104, 7-76; [2] Kenkmann and Ivanov, 2006, Earth and Planetary Science Letters, 252, 15-29; [3] Pohl et al., 1977, Impact and Explosion Cratering, Flagstaff, Arizona.