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Interpolation of the Bunte Breccia Ejecta Deposits of the Ries Impact Crater, Southern Germany.

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Abstract

Preliminary interpolation results of the thickness variation of the south-western continuous ejecta blanket outside the Ries impact crater are presented. They indicate a systematic thickness distribution that deviates from a steady decrease with radial range.

1. Introduction

The Ries impact structure is a ~25 km diameter relatively pristine, complex impact crater in Germany that was formed during the Miocene (14.34+-0.08 Ma) [1, 2]. The oblique impact [3] occurred in a two-layered target consisting of ~650 m partly water-saturated and subhorizontally layered sediments (limestones, sandstones, shales) of Triassic to Tertiary ages underlain by crystalline basement rocks (mainly gneisses, granites, and amphibolites) [4, 5]. The rock that builds up the continuous ejecta blanket is the Bunte Breccia, a polymict lithic breccia of mainly unshocked to weakly shocked sedimentary target clasts plus a minority of basement clasts and reworked surficial sediments (Fig. 1). Previous interpretations of the Bunte Breccia assumed analogies to the Moon: (I) ballistic emplacement, which triggered a ground hugging debris surge [6, 7], or (II) a rolling and gliding surge under high localized confining pressures [8]. But the influence of water in the target and ejecta blanket on ejecta emplacement was not considered sufficiently. Here we present new interpolation results of the continuous ejecta blanket of the southwestern part of the Ries crater showing significant thickness variations.

2. Methods

We used extracted mapping information of the autochthonous-allochthonous ("Bunte Breccia base") and allochthonous-suevite ("Bunte Breccia top") intersections from the geologic map [9], descriptions of nine NASA drilling sites [7], and included up to 40 drillings carried out by the Bavarian Environment Agency to interpolate the morphology and thickness variation of the ejected Bunte Breccia outside the crater (Fig. 1).

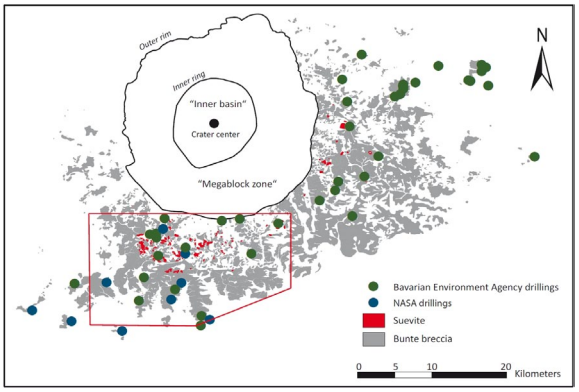

Figure 1: Distribution of the Bunte Breccia (grey) and Suevite (red) deposits outside the Ries impact crater with plotted Bavarian Environment Agency (green) and NASA (blue) drilling site locations. The interpolated surface area is shown by the red box.

Digital elevation data and geologic information were combined in ArcGIS (ESRI) and RockWorks14 (RockWare) to extract the elevation of the lower contact plane ("paleo-surface") and the contact between the Bunte Breccia and the overlain Suevite deposits. In addition, the recent weathered Bunte Breccia morphology was included to obtain minimum thickness estimations outside the Ries impact crater. The software RockWorks14 was used

to build interpolation data between elevation points for further reconstruction of the paleo-surface and the Bunte Breccia upper contact using the software ArcGIS. The interpolation method "kriging" delivered the best results of the morphology of the base and top of the Bunte Breccia with regard to geologic interpretation (Fig. 2).

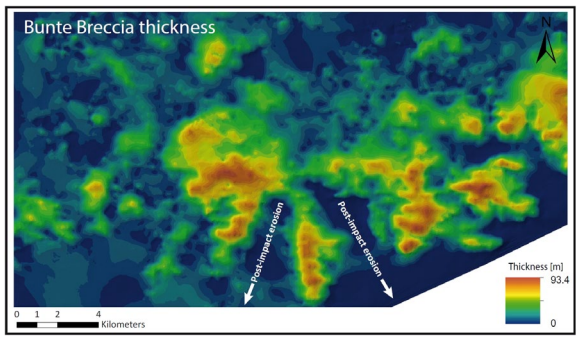

Figure 2: Results of the interpolated topography of the Bunte Breccia thickness.

3. Results and Discussion

The southwestern part of the ejecta blanket provides the most promising data density and quality for this study and delivered a more or less continuous morphology and thickness distribution of the Bunte Breccia deposits outside the Ries crater. The preliminary interpolation results show that the morphology and thickness of the Bunte Breccia varies with increasing distance from the crater center (Fig. 2). The interpolated Bunte Breccia thickness south of the crater decreases beyond the outer crater rim to a few meter thickness at 16 km distance from the crater center (1.28 crater radii). The ejecta thickness increases up to 93.4 m at a radial distance between 19 and 25 km from the crater center (1.52 to 2.00 crater radii). Beyond this concentrically trending ejecta ridge, the thickness decreases rapidly to less than 40 m with the farthest extent of the southern ejecta blanket at 32 km distance (2.56 crater radii). The analysis shows that the ejecta thickness distribution clearly deviates from a steady decrease with radial range what would be expected as a result of pure ballistic sedimentation. Instead a ridge of thick Bunte Breccia could be identified at ~2 crater radii. In the following interpolation steps we will expand the used area of investigation and incorporate additional allochthonous-autochthonous boundary information. The results will be used for comparative planetological studies of impact crater formation .

Acknowledgements

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