INVESTIGATIONS OF THE RIES CRATER EJECTA USING A DIGITAL GEOLOGICAL MAP, DEM and GIS. J. Pohl[1] and E. Geiss[2], [1]Institut für Allgemeine und Angewandte Geophysik, Theresienstr. 41, D-80333 Munich, Germany, pohl@alice.geophysik.uni-muenchen.de, [2] Bayerisches Geologisches Landesamt, Hess-Str. 128, D-80797 München, Germany, erwin.geiss@gla.bayern.de

Introduction: For a new and updated edition of the Geological map of the Ries crater at the scale of 1:50000 the map was digitized at the Bayerisches Geologisches Landesamt and incorporated into a geographical information system. This gives us the possibility to make new investigations of the impact formations such as allochthonous ejecta and parautochthonous blocks within the megablock zone and fall-out ejecta outside of the structural boundary of the crater. In the map blocks larger than 25 m are treated as separate units. Masses containing parts smaller than 25 m are included in the so-called Bunte Breccia. The complete geological mapping of impact formations is of course hampered by numerous biases due to erosion, difficulties to recognize units in the field, coverage by later sediments etc.

In addition to the digital geological map detailed digital terrain models are also available. Both data sets can be used for combined statistical geological and morphological investigations of the radial and azimuthal distribution of the ejecta, of their block sizes as a function of radius, of their elevation position relative to the elevation of the autochthonous pre-impact formations etc..

Target stratigraphy: The pre-impact stratigraphy in the Ries crater consisted from top to bottom of a thin cover of 0 - 50 m of unconsolidated Tertiary sediments (0 - 50 m), of 100 - 150 m of Malmian, predominantly limestone, of ca. 150 m of Dogger, mainly sandstones and marls, of ca. 30 m of Liassic, mainly marl and limestone, of about 230 m of Keuper, mainly sandstones and shale, of possibly 30 m of Muschelkalk and may be some additional tens of meters of lower Triassic and upper Permian deposits above the crystalline basement, predominantly granites, gneisses and amphibolites.

Ejecta distribution: In a first step we began to separate different stratigraphic units in the allochthonous ejecta formations, differentiating the Jurassic (Liassic, Dogger and Malmian), the Triassic and the crystalline basement, including the highly shocked suevite. The figure shows the distribution of the mapped blocks larger than ca. 25 m. The distribution of the Bunte Breccia, which contains variable amounts of the sedimentary cover formations, but almost no crystalline rocks, is shown on the lower right.

Strongly asymmetrical distributions are evident. The lack of ejecta north of the structural crater rim has been interpreted as the effect important erosion since the crater formation. Other asymmetries are not easily understandable assuming a centro-symmetric ejection. The small amount of Liassic ejecta may be due to the small thickness of Liassic target, but from the rather thick Triassic a more imprtant contribution to the ejecta could be expected. In order to estimate the possible amounts of ejecta of the different target rock formations we use in a first step a z-model calculation for evaluating the ejecta distribution of the different pre-impact formations, taking into account their dipping in NS and EW directions and the probable variations of thickness in the target area. Other causes of asymmetries should of course also be considered, especially the possible effects of oblique impact, which have been discussed recently. Asymmetries in the Ries crater are not only visible in the ejecta distribution. There are also pronounced asymmetries in the sub-surface structure of the crater, especially in the morphology of the inner ring surrounding the central crater. A structural asymmetry may also be reflected in the gravity anomalies of the Ries crater with an offset of the minimum to the north of the crater center. This offset has been interpreted until now as an effect of the regional gravity field.

References: Bayerisches Geologisches Landesamt (1998), Geologische Karte des Rieses 1: 50 000, 2nd edition, in press. Engelhardt, W. v. (1990) Tectonophysics 171, 259-273, and literature therein. Pohl, J. et al. (1977) in Roddy et al. (eds.): Impact and explosion Cratering, 343-404, and literature therein.

Figure: Distribution of ejecta in the Ries crater (blocks larger than ca. 25 m). In the upper left the distribution of crystalline ejecta is shown. Granites and suevite are plotted together to give an idea of the overall distribution of crystalline ejecta, although suevite is a breccia with clasts of a maximum size of a few dm. In the lower right the distribution of the Bunte Breccia is shown, which may contain single clasts up to about 25 m.

EJECTA OF THE RIES IMPACT CRATER: J. Pohl and E. Geiss