STRATIGRAPHY OF THE RIES SUEVITE, GERMANY, FROM STEREOMETRIC ANALYSIS.

C. Meyer[1], D. Stöffler[1], M. Jébrak[2], and W.-U. Reimold[1], [1]Museum of Natural History - Leibniz Institute at the Humboldt University Berlin, Germany; email: cornelia.meyer@museum.hu-berlin.de, [2]Université du Québec à Montréal, Canada

Introduction: The suevite of the 14.35 Ma old, 25km wide Ries crater in southern Germany occurs in 3 different geological settings: 1) the crater suevite in the central crater cavity inside the inner ring, 2) the outer suevite on top of the continuous ejecta blanket, 3) dikes in the crater basement and in displaced megablocks [1]. The mechanisms of transport of particles in the suevite remains poorly understood. In [2] the following processes are discussed: 1) "aerial" transport in a gaseous medium, 2) ground surging in a turbulent flow, 3) interaction of a temporary melt sheet in the central crater with surface water leading to "phreatomagmatic" explosions and subsequent aerial transport.

We measured the shape and size distribution of particles in several drill core sections (thickness of suevite in parentheses): Nördlingen, inside the inner ring (300m); Enkingen, at the inner ring (80m); Wörnitzostheim, between inner ring and crater boundary (80m); and Otting, outside the crater (9m). The drill cores were studied by digital stereometric analysis. Grain sizes and shapes of lithic clasts and melt particles were measured on the plane surface of the half cores and on thin sections of the same core sections. The following grain parameters were measured in the size range of +2 to -6 phi (0.25 to 63mm): 1) particle content, 2) aspect ratio = minor axis/major axis, 3) maximum grain size = mean of the ten largest particles, 4) particle size distribution represented as fractal dimension [3].

Observation and subdivision of the Ries suevite: The crater suevites can be divided into stratigraphic subtypes. They differ in their stereometric parameters and show distinct differences between the central part and the outer part of the inner crater. The Nördlingen drill core can be subdivided into four suevite units: 1) Upper redeposited suevite (296–314m), 2) "Graded" suevite (314–330m), 3) Melt-rich suevite (331–520m), and 4) Melt poor suevite (520–602m). The Enkingen drill core can be subdivided into four units: 1) Upper suevite (21–40m), 2) Middle suevite (40–66m), 3) Lower suevite with intersection of coherent melt layers (66–86m), and 4) coherent impact melt (below 86m). The Wörnitzostheim drill core can be subdivided into three units: 1) Upper suevite (19–25m), 2) Melt-rich suevite (25–80m), 3) Melt-poor suevite (80–100m). The Otting drill core is homogenous.

A comparison of the characteristics of all drill cores can be summarized as follows: 1) The suevite of Nördlingen shows the lowest content of melt particles decreasing with depth in the lower section, and the highest lithic clast/melt ratio. 2) In the suevites of Enkingen and Wörnitzostheim the maximum grain size and content of melt particles increase with depth. From Enkingen to Otting the maximum grain size of all particles, and especially of the melt fragments, is decreasing with increasing distance from the crater center. 3) The aspect ratio of the lithic clasts is rather similar for all drill cores whereas the aspect ratio of the melt particles increases from Enkingen to Otting. 4) The fractal dimension of the lithic clasts is for small grain sizes always higher than for large ones. Whereas the fractal dimension of the large grain sizes increases from Enkingen to Otting, it decreases for the small grain sizes from Nördlingen to Otting.

Discussion: After [5] the grain size distribution of comminuted material formed during the cratering process, should follow a log-normal grain size distribution with the same fractal dimension for all grain sizes. In this case the fractal dimensions of the grain size distribution in ejecta deposits should not depend on the radial distance from the crater center. However, our observations of variations in the fractal dimension indicate that the fragmented and ejected particles were subjected to additional comminution processes. As the fractal dimensions of the larger particles are increasing and the maximum grain size is decreasing with distance, a process is required where the clasts will be comminuted and sorted as a function of their size, density (per volume), and distance to the crater center. As the aspect ratio of the melt particles is also increasing with distance from the crater center a process is required for the transport where particle-particle interactions could occur.

Conclusion: Our stereometric results imply a secondary comminution process after the shock wave passage, pressure release, and transient cavity formation. A secondary milling and sorting process in a gas dominated suspension seems to be feasible. Our observations are compatible with the new model for the suevite genesis proposed by [2].

References: [1] Stöffler et al. (2009), LPSC, XL, abstr. [2] Artemieva et al. (2009), LPSC, XL, abstr. [3] Rousell et al. (2003) Earth Sc. Rev. 60, 147-174. [4] Houghton \& Schmincke (1989) Bull. Volc. 52, 28-48. [5] Melosh (1989) *Impact cratering; a geologic process.*