TRANSPORT MECHANISMS OF THE RIES SUEVITE, GERMANY: FROM STEREOMETRIC ANALYSES.

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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. 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, 3) maximum grain size, 4) particle size distribution represented as fractal dimension [3].

Results: 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 outbound from Enkingen to Otting. 4) The fractal dimension of the lithic clasts is always higher for small particles than for large ones. The fractal dimension of the small particles decreases outbound whereas it increases for large particle.

Discussion: Our stereometric results imply a secondary comminution process after the shock wave passage, pressure release, and transient cavity formation where the clasts will be comminuted and sorted as a function of their size, density (per volume), and distance to the crater center, and where particle-particle interactions could occur. 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.