PROCESS OF THE SUEVITE GENESIS OF THE RIES CRATER, GERMANY

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Introduction: The processes of formation and transport of particles in suevite during impact crater formation remain poorly understood and were investigated at the 15 Ma old, 25 km wide Ries crater, Germany. The suevite of the Ries crater occurs in three different geological settings: 1) Crater suevite in the central crater cavity inside the inner ring; 2) Outer suevite on top of the continuous ejecta blanket; and 3) Dikes in the crater basement and in displaced megablocks. For suevite genesis, the following processes have been discussed to-date in literature: 1) Fall-back of material into the crater and its periphery upon collapse of an ejecta plume [1], and 2) Horizontal transport of ejected material, akin to a) an impact melt flow [2], b) a pyroclastic flow [3], c) initiated by phreatomagmatic explosion [4].

Methods: In order to differentiate between these emplacement modes we analyzed at different locations inside and outside the crater: 1) The three-dimensional shape and orientation of the suevite particles, 2) The stereometric parameters of melt particles and lithic clasts (grain shape, grain size distribution, and content of particles), and 3) The chemical composition of the melt particles compared to their corresponding matrix.

Results: The suevite can be distinguished in the following subunits: 1) Suevite with similar melt and matrix composition, which can be considered as original impact melt; 2) Strongly altered suevite, with similar melt and matrix composition; 3) Suevite containing K-poor and K-rich melt with either silicate matrix similar in chemistry to the melt, or non filled pore spaces; and 4) Suevite with different melt and matrix composition.

Discussion: Five stages can be distinguished for the formation and deposition of the Ries suevite: 1) An early ejecta plume, mainly composed of projectile and sediments, is formed during the excavation stage and is deposited (< 2 m thick) inside and outside the crater on top of the Bunte Breccia after crater formation, 2) After a hiatus, the interaction of water with the impact melt lake induce a phreatomagmatic explosion of the upper melt lake, 3) A basal, non erosive pyroclastic surge, initiated by the explosion, moves radially outward and is deposited inside and outside the crater, 4) At the same time an ejection column rises. After its collapse, a density stratified pyroclastic flow is initiated which propagates to the crater margin and partially covers the first deposited suevite layer, 5) The collapse of the ejection column creates contemporaneously an upward rising ejecta plume, where accretionary lapilli are formed. Finally, these lapilli, together with the residual plume material, are deposited in the inner crater a) into an existing water layer, or b) reworked by incoming water in the crater at a later time.

References: [1] Stöffler, D. 1977. *Geologica Bavaria* 75:443-458. [2] Osinski, G.R. et al. 2004. *Meteoritics & Planetary Science* 39:1655-1683 [3] Newsom, H.E.. 1986. *J. Geophysical Research* 91:E239-E251 [4] Artemieva, N.A. et al. 2009. 40th Lunar and Planetary Science Conference. A1526

Additional Information: This work was prepared at the Museum für Naturkunde, Berlin, and was supported by the Deutsche Forschungsgemeinschaft (RE 528/4-1).