Possible mechanisms of the suevite deposition in the Ries crater, Germany, Otting site.

Meyer, Cornelia[1] Artemieva, Natalia[2] Reimold, Wolf Uwe[1] Stöffler, Dieter[1] Wünnemann, Kai[1]
[1]Museum of Natural History, Berlin, Invalidenstrasse 43, Berlin [2]Institute for Dynamics of Geospheres, Russian Academy of Sciences, Moscow, Russia

The goal of our project is to revisit the suevite problem in an interdisciplinary study by combining geological and petrograhic observations from available outcrops/drill cores with numerical models of crater and ejecta plume formation/deposition.

We investigated the drill core (10 cm in diameter) from the "Otting" suevite quarry, situated outside the crater rim, 17 km from the impact point, which comprises a 9 m thick suevite sequence on top of Bunte breccia. The mean particle size of the lithic clasts of the Otting core increases gradually with increasing depth, whereas the mean particle size of the melt particles decreases until about 300 cm depth and thereafter increase downward to the bottom. Generally, the lithic particles are always smaller than the melt particles. On average the melt content of the core is 4 times higher than the content of lithic clasts. The abundance of the lihic clasts and the melt clasts is constant throughout the length of the core. Magmatic and metamorphic lithic clasts could be observed throughout the core. Sedimentary rock clasts were more often found in the lower part of the suevite and most frequently in the last meter above the bottom. The orientations of the melt particles, which have mostly a strong elliptical shape, are almost horizontal throughout the core, whereas the lithic clasts with their almost isometric shape do not show a preferred orientation.

Our modeling results relevant to ballistic deposition (Meyer et al., 2008) do not allow to reproduce the observed ejecta in the suevite layer of Otting: 1) there is just very little melt in the modeled ejecta and 2) separation of sedimentary rocks from basement rocks does not occur. Separation and gradation of two layers (BB and suevite) by atmosphere (fallout) seems improbable as the total ejecta mass per unit area at the Otting site is substantially higher than the mass of the involved atmosphere. Deposition of a suevitic layer as a viscous flow (Osinski et al., 2004) seems also improbable, as viscosity of the flow with solid fragments (i.e. with temperature below the solidus) increases dramatically and prevents spreading to a few km from the transient cavity. We need another mechanism of the ejecta flow "fluidization". One possibility is a gas release (mainly water vapor from sediments) which allows dispersal of the smallest particles and suevite deposition above the ballistically deposited Bunte Breccia (similar to propagation of pyroclastic surge in volcanology) (Melosh, 1989).

It is quite possible that the mechanism of the suevite deposition was much more complicated: the occurence of density currents with various gas/solid material ratios makes a combination from diluted fallout to a dense basal flow deposition possible.

Melosh H.J. (1989) *Impact cratering; a geologic process.*
Meyer, C. (2008) *Large meteorite Impacts IV*, abstract
Osinski et al. (2004) *Meteoritics Planet. Sci.* **39**, 1655-1683.

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