NEW FINDS OF SHATTER CONES IN DISTAL RIES EJECTA, BERNHARDZELL, EASTERN SWITZERLAND
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Introduction: A thin horizon of impact ejecta comprising angular fragments of upper Jurassic limestone (up to 30 cm in size), fragments of Triassic pelites and shocked quartz grains is known from three outcrops near St. Gallen in eastern Switzerland. The best outcrop is located on the left bank of the Sitter river near Bernhardzell. The impact horizon is hosted by Miocene marls of the Swiss Molasse basin. A zircon-bearing, 14.4 to 14.6 ± 0.06 Ma old tuff [1] stratigraphically located 70 m above the impact horizon constrains the age of the impact layer. At the time of discovery in 1945, the horizon was interpreted as volcanic [2]. The impact nature was recognized in 1973 after the discovery of a limestone block containing shatter cones [3], and a connection with the Ries was made plausible [4] after recognition of high-speed ejection processes. In recent years several blocks of limestone with shatter cones have been found in the best exposure near Bernhardzell, among the new finds is one with particularly well developed shatter cones allowing the measurement of a statistically valid number of angles between striations (V-angle).

Comparison of Bernhardzell and Steinheim shatter cones: A well-preserved Bernhardzell shatter cone has a higher mean V-angle of 32 ± 5 ° as compared with samples from the Steinheim basin (6 samples yielded 13 ± 2, 17 ± 4, 20 ± 5, 20 ± 2°, 16.4 ± 2.2 24.7 ± 5.5, all measurements 17 ± 5°, n = 93). Based on a model that relates the angle between shatter cone striations with increasing distance from the impact center [5], and the fact that the Steinheim shatter cones seem restricted to the central uplift close to the impact center, the larger angles in the Bernhardzell ejecta suggest a different origin. It is thus likely that these samples are derived from a larger distance from the impact center, such as a peripheral position in the Ries crater.

Ejection processes: Located at a distance of 160 km from the center of the Ries crater, an ejection velocity of at least 1.3 kms⁻¹ is required. While this appears possible in case of limestone, processes of ejection of low-strength pelitic rock fragments up to 10 cm in size remain poorly constrained.