FIRST DESRIPTION OF GENUINE SHATTER CONES IN UPPER JURASSIC LIMESTONE CLASTS FROM THE BUNTE BRECCIA IMPACTITES OF THE RIES CRATER.

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Introduction: Shatter cones are the only macroscopic indicator for shock metamorphism [1;2;3], yet, their formation mechanism(s) are contested [4;5;6;7]. They occur in (par)autochthonous target rocks and allochthonous breccias of many terrestrial impact craters and a few meteorites. This study reviews the occurrence of shatter cones in the Ries and reports the first finds of shatter cones in Upper Jurassic limestone clasts within the Bunte Breccia.

Ries shatter cones. In the Ries crater, shatter cones have been identified as components in the proximal ejecta Suevite, an impact-melt bearing breccia, in Bunte Breccia, which is polymict but does not contain impact melt particles, and in monomict limestone breccias (e.g., [8]); a deep drill core in the inner crater region recovered shatter cones in amphibolite of the parautochthonous crater floor [9]. Shatter cones have also been identified in distal, blocky Ries ejecta in SW Germany [10] and Switzerland [11], at distances of up to 180 km from the crater.

Observations: Aumühle quarry lies at a distance of 9 km from the crater's center, or 3 km inside the crater rim. Quarry operation constantly produces new exposures of Suevite and Bunte Breccia. In this quarry, Bunte Breccia contains Upper Jurassic limestone fragments that are generally missing in the ejecta blanket to the NE of the crater; these limestone fragments were found to contain shatter cones (Fig. 1 A–B).

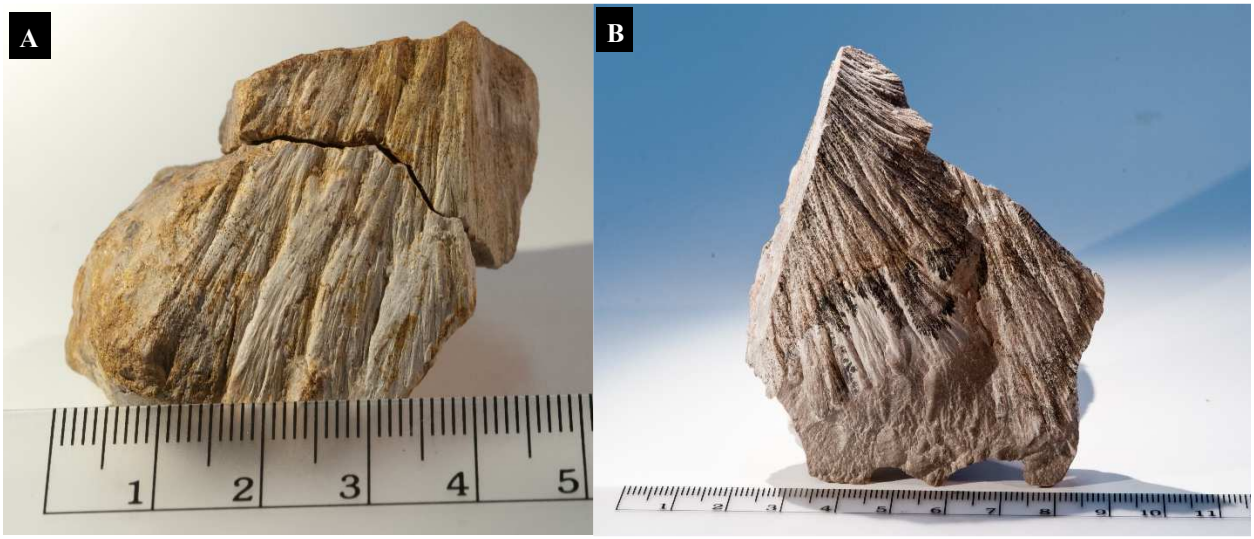

Fig. 1. A–B. *Delicate shatter cones in Upper Jurassic limestone clasts of Bunte Breccia deposits from the Aumühle quarry of the Ries crater. Photos courtesy of Erwin Geiss, Bayerisches Landesamt für Umwelt.*

Summary: The Ries crater produced a wealth of lithologies that host shatter cones. Although relatively rare, their occurrence is useful for the identification of shock metamorphic overprints on the order of 2 to 30 GPa [2;3] in parautochthonous target rocks as well as in proximal and distal ejecta. Thus, the two shatter cones from the Aumühle quarry must have formed very early during the cratering process. Shortly thereafter, they were incorporated in the impact excavation flow from a near-surface location between the 30 and 2 GPa pressure isobars and were ballistically deposited. Crater modification commenced with the collapse of the transient cavity and the mass movements that built the terrace zone and crater rim, [2] and ended with the emplacement of Suevite.

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