# BARRINGER IMPACT CRATER, AZ, USA: A TERRESTRIAL RAMPART CRATER?

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**Introduction:** The Barringer crater in northern Arizona is one of the youngest and best-preserved terrestrial impact craters. The approximately 50 kyr old impact crater is a simple crater with a crater diameter of 1.2 km and a pronounced crater rim of 40-50 m [1-4]. The crater structure shows a square shape caused by two mutually perpendicular sets of vertical joints [e.g. 1, 5]. The well-preserved proximal ejecta blanket of Barringer Crater is composed of an inverted sequence of Coconino, Toroweap, Kaibab, and Moenkopi strata [1, 2, 6]. The Barringer Crater Sample Collection makes geologic samples from the Barringer Crater ejecta blanket available that were obtained during the 1970's [6]. The data allow extensive digital analyses of the geologic data using latest and advanced computer techniques. Here we present preliminary results showing the interpolation and reconstruction of the morphology of the ejecta blanket of the crater as well as the structural uplift of the crater rim and the paleo-surface.

**Methods:** We used extracted mapping information of the autochthonous-allochthonous ("ejecta base") intersections from the geologic map of Barringer Crater [7], and descriptions of 147 drillings made available by the Barringer Crater Sample Collection to interpolate the morphology and thickness variation of the ejected material outside the crater. In addition, we included elevation data of the present-day weathered surface of the ejecta to obtain minimum thickness estimations in regions outside the crater. Therefore, a digital elevation model with 1 m resolution (collected by M. Palucis through the NSF-sponsored National Center for Airborne Laser Mapping (NCALM)) and geologic information were combined in ArcGIS 10.4 by ESRI.

**Results:** The interpolated paleo-surface shows a relatively flat terrain with only minor scattered hills or ridges. A regional trend from NE to SW is recognizable with higher elevation values in the SW (~7 m/ 1000 m), similar to older studies [6]. The difference between the paleo-surface and the interpolated autochthonous-allochthonous boundary ("ejecta base"), defined by the contact between ejected material and the Triassic Moenkopi formation (Tm), can be used to estimate the extent of the structural uplift. The mean structural uplift at the crater rim is approximately 35 m (maximum of 52 m) and is detectable to a distance of ~340 m from the crater rim or 1.56 crater radii from the crater center. The ejecta thickness distribution deviates distinctly from a steady decrease with radial range, as seen for lunar craters [8]. In contrast, the ejecta at some parts of the crater rim appears to be thinned out or highly eroded whereas the ejecta thickness shows local highs in a distance of 300-600 m from the crater rim, especially in the southern part.

**Discussion:** Different explanations are conceivable for the uneven ejecta distribution and ejecta accumulation. The higher ejecta thicknesses in the southern part could be due to an oblique impact from NNW building thicker deposits in downrange direction, as postulated by Poelchau et al. 2009 [5]. The ejecta thickness profile shows similarities to rampart-like ejecta morphologies of Martian and some terrestrial impact craters that show accumulation of ejecta in distal parts [9-11]. Possibly, the wetter climate conditions during the Wisconsin period [12] allowed the formation of a weakly pronounced but detectable rampart, at least in the southern part. Interestingly, recent studies of the Barringer Crater Sample Collection indicate more complex crater excavation and ejecta emplacement processes for the distal ejecta parts, with mixed facies better described as "chaotic" deposits [13, 14].

**Conclusions:** The ejecta thickness distribution beyond the crater rim of Barringer crater shows significantly higher values in the southern part and similarities to rampart-like ejecta morphologies. Therefore, we suggest that Barringer crater shows a weakly pronounced but detectable eroded remnant of a small ejecta rampart.

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