



Discovery of a Paleozoic Impact Crater Strewn Field near Douglas, Wyoming, USA: Evidence from Microstructural Analysis, Satellite, and Drone Imagery

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More than thirty circular to ellipsoidal possible impact craters have been identified on the northeast facing flank of the Sheep Mountain anticline near Douglas, Wyoming, USA. Rim-to-rim diameters of craters range from 16 to 66 meters. The exposed strewn field has a minimum length of 6.4 kilometer in SE-NW direction. Satellite and drone imagery has revealed crater shape, orientation, and size. Eight of the craters have the compelling geomorphology of a simple impact crater with a raised rim and overturned flap, an apparent continuous ejecta blanket, and an ovoid shape oriented SE to NW coincident with the apparent strike of the strewn field implying an impact from SE towards NW. Some have resistant crescent shaped morphologies, with lowest spill point to northeast caused by strata tilting and erosional processes. Here we present the first proof of the impact origin of one of these craters with a diameter of 60 meters, centered on 42°39'07.35"N, 105°26'58.61"W [1]. This crater contains PDF lamellae with basal PDFs dominating. Quartz grains also exhibit Boehm lamellae and intensive fracturing. Deformation affected rounded quartz grains but not the quartzitic overgrowth seams suggesting that the impact occurred in un-consolidated sand prior to diagenesis. Shock lithification possibly made the craters more resistant to erosion and some partly became pedestal craters. The crater structures are exposed in the uppermost quartz-cemented sandstone of the Permo-Carboniferous Casper Formation and exhumed from beneath Permo-Triassic Goose Egg Formation Opeche Shale Member red beds (paralic mudstones). Strata were tilted by 15° E-NE during the Laramide Orogeny (Upper Cretaceous to Paleogene). Satellite imagery shows that the craters are only in this narrow stratigraphic band along strike at the top of the Casper Formation. The impact age is inferred to be immediately after Casper Formation deposition (lithostratigraphic age +/-280 Mya) because there is no crater filling with younger Casper sandstone. The original craters would have been eroded away in a short time without a rapid transgression and burial by Opeche muds. It is assumed there was originally an elliptical strewn field pattern but possible additional craters on the west side of the ellipse are eroded away and additional ones on the east side of the ellipse may lie below the Goose Egg Formation. More crater structures have been found on satellite imagery up to 14 kilometers SW and 19 kilometers NW of Sheep Mountain. These also are on the uppermost Casper Formation on analogous structural and erosional settings to Sheep Mountain. The additional craters extend the length of the Douglas Strewn Field to at least 33 kilometers. By context, the study has discounted other mechanisms for creating circular crater pit structures from volcanism, halokinesis, fluid or gas escape, or karst collapse. The inferred age and size make the Douglas Strewn Field the oldest and one of the largest impact crater strewn fields on Earth.

[1] Kastning, H., Huntoon, P. W. 1996. NASA's Wyoming Space Grant Fellowship Program 1995-6 Space Science Research: Graduate and Undergraduate Fellowship reports, p. 57-64.