MATHEMATICAL MODEL AND IMPACT CONDITIONS FOR WETUMPKA IMPACT CRATER, ALABAMA, USA.

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Synopsis: Wetumpka impact structure, located in Elmore County, Alabama, USA (centered at N32º 31.3', W86º 10.4'), is a locally prominent, semi-circular, rimmed feature with a structural diameter of 7.6 km and a modern rim height of as much as 120 m [1,2]. This impact structure is composed of relatively highly indurated crystalline rock, which forms the impact-structure rim, and an unconsolidated mélange of resedimented and (or) deformed Upper Cretaceous sedimentary formations comprising two impact-structure related sedimentary terrains: (a) within the crystalline rim (interior unit); and (b) directly outside the crystalline rim on the southern side (extra-structure or deformed unit) [1,2]. Both the marine target setting and composite target stratigraphy had a profound effect upon the shape and sedimentology of this impact structure [3,4]. In marine setting, which was less than 100 m deep, a water crater was opened and then collapsed with a violent resurge. The inability of the missing southern rim to withstand this resurge is interpreted to be the origin of an early modification stage rim collapse event.

Analytical Method and Results: According this model [5], the asteroid diameter is ~ 246.5 m, with a velocity and impact angle of ~ 18.46 km/s and 43.18° respectively. The number of rings are calculated in ~ 0.84 with a initial crater profundity of ~ 572.68 m, this quantity could be altered across the passage of time to ~353.03 m, the melt volume is ~ 2.2E10 m³ or ~ 22.03 km³. The number of ejected fragments are estimated in ~ 2.55E6 with average sizes of ~ 1.81 m, and a cloud of dust with diameter of ~ 9,498 km. The total energy in the impact is calculated in ~ 7.7E25 Ergs, i.e., ~ 1,833 megatons. Before of the erosion effects the transient crater is estimated in ~ 4.29 km, the hydrothermal zone (hydrothermal systems) is of ~ 338.08 m to 2.15 km from the nucleus of impact. The lifetimes estimated are of ~ 37,077 years to 57,874 years with uncertainties of ~ +/- 0.67 % to +/- 3.00 %, i.e., from +/- 249 years to +/- 1,737 years. Hydrothermal temperatures from 0.25 years to 1,400 years are estimated in ~ 158.14°C to 61.35°C respectively. The fragments are ejected to ~ 87.74 km from the impact center, with a velocity of ejection of ~ 2.2 km/s, ejection angle of ~ 5.14° and maximum height of ~ 1.97 km. The density of the asteroid is calculated in ~ 4.97 g/cm³ and the combined density (maximum and minimum) for the ejected fragments is estimated in ~2.08 g/cm³. The maximum height of Tsunami for 400 m and 7.5 km from the source is ~ 414 m and 22 m respectively. The seismic shock-wave magnitude is calculated in ~ 8.1 in the Richter scale. The maximum time of permanency for the cloud of both dust and acid in the atmosphere is ~ 28 days and 4.6 months, respectively. The temperature peak in the impact is calculated in ~ 1.17E3 times the temperature of the solar nucleus, by a space of time of ~ 1.16 ms. The pressure to 1.01 km of the center of impact is ~ 4.18 Gpa.

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