Origin of the Penalver Formation in northwestern Cuba and its relation to K/T boundary impact

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The Penalver Formation in the northwestern Cuba is a < 180 m thick, normal-graded calcareous clastic deposit. Biostratigraphically constrained age and presence of altered vesicular glasses and shocked quartz grains which are discovered from basal and lower to most-upper part of this formation suggest this formation was formed in association with K/T boundary impact. Based on the analyses of composition, sedimentary structure, and grain size distribution, the Penalver Formation is considered to be formed by an initial grain flow and settling from high density suspension produced by the following huge tsunami waves caused by the impact. Distribution of ejecta materials indicates arrival of grain flow and the first tsunami wave may have occurred within 1 to 12 hours after the impact.