IMPACTS OF HIGHLY DISRUPTED PROJECTILES AND THEIR POSSIBLE GEOLOGICAL RECORDS. V. V. Shuvalov, Institute for Dynamics of Geospheres RAS, Leninsky pr. 38-1, 119334 Moscow, Russia.

The remarkable Tunguska impact [1] occured on June 1908 is the largest aerial burst recorded in human history. There are good reasons to belive that similar and even much larger events continiously occured during geological history. Wasson and Moore [2], Wasson and Boslough [3] suggested that radiation produced by the aerial bursts was capable of melting a several mm of sand and rocks in desert-like regions and could be responsible for production of layered tektites in South East Asia and Libyan Desert Glass found in Western Egypt. The radiation generated by the Tunguska event was not high enough to produce any surface melting. However Wasson and Boslough [3] and Svetsov [4] suggested that highly oblique impacts of larger meteoroids can produce thermal effects on the ground within large areas.

The model with radiation and ablation for the impact of Tunguska-like (several tens of meters in size) meteoroids, which penetrate to the Earth's atmosphere below 40 km has been elaborated by Shuvalov and Artemieva [5]. The model was used to study the impact of a 30-m-radius cometary projectile. The results, in particular, show that at altitudes of about 15 km the totally disrupted projectile transforms into debris jet and then, after total evaporation of solid fragments at an altitude of about 10 km transforms into air-vapor jet. It is important that the jet velocity (and kinetic energy consequently) is only slightly less than the preentry projectile velocity (and kinetic energy).

Basing on this results, we propose a mechanism of origin of layered tektites due to surface impact of highly disrupted and evaporated projectile. In the case of Tunguska the jet was formed at too high altitude (10-15 km) and did not reach the ground. If we increase a projectile size or strength several times, the jet will form near the ground and will strike the solid surface. Our numerical simulations show that such impacts are much more effective from the viewpoint of thermal effects on the ground than aerial bursts. In this impact (contrary to an aerial burst) only a minor energy is released in the atmosphere during the projectile flight, most of the kinetic energy is released at the surface. However, due to low air-vapor density in the jet, impact pressure does not exceed 10-100 MPa, that is considerably lower than typical strength of rocks. Therefore there are no crater and target material ejection. Instead of this a hot plasma cloud arises over the ground. Its temperature (up to several tens kK) is higher than the temperature of a fireball created due to aerial burst. Radiation and thermal conductivity provide strong heating, melting and even evaporation of the upper target layer over an area of about 10-100 km^2. This area will be much larger in the case of oblique impact of a larger projectile.

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