

**TEKTITES AND MARTIAN METEORITES IN NUMERICAL MODELING OF IMPACTS.** N. A. Artemieva, Institute for Dynamics of Geospheres Russian Acad. Sci., Leninsky Prospect 38/6, Moscow, Russia 117939 (nata\_art@mtu-net.ru.).

**Introduction:** Impact origin of SNC-meteorites and tektites is beyond the question now. Martian meteorites come from the upper layers of the youngest martian terrains [1]. Terrestrial tektites have geophysical and geochemical properties, which show their origin from the high-temperature melt, produced by impact from the top few hundred meters of a target and solidified in the upper Earth atmosphere with low oxygen content [2]. Very different in their nature, both types of ejecta are very similar in the place of their origin (upper target layers near the impact site) and in their high velocities (needed for tektites - to overcome distances of 100-1000 km and needed for meteorites - to escape Mars gravity). Principal difference is in a degree of shock compression: we should find melted material for tektites and, in opposite, unmelted pieces with modest shock modification features - for meteorites. Nevertheless, from the viewpoint of numerical modeling, both, SNC and tektites, may be treated identically.

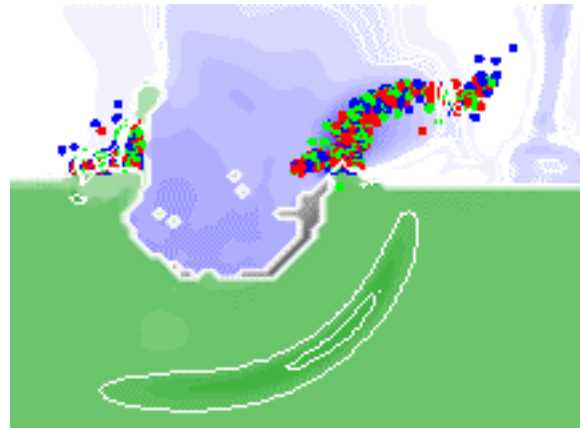
Previous modeling of these very special cases of impact ejecta concerns mainly initial stage of the impact - compression of the material and its acceleration after decompression. First runs show that tektites (high-temperature surface melt) may be produced by high-velocity ( $>20$  km/s) impact into silica-rich targets with impact angles in the interval  $30-50^\circ$  (very oblique impacts are not needed - in this case melt is contaminated by projectile material) [3]; porous and wet target is desirable; water is lost just after melt ejection from the crater [4]. The main result for the SNC-meteorites [5] is that appreciable amount of unmelted high-velocity material is produced in the case of  $15-60^\circ$  impact - with maximum for  $30^\circ$ . These first steps gave important results, with one principal disadvantage: discrete particles (tektites and meteorites) were described in the frame of hydrodynamic modeling, i.e. as continuous medium. It is reasonable for the early stage of crater growth, but later real discrete properties of particles (their size, mass, shape, velocity) may be of great importance for the motion through atmosphere.

The goal of this work is to extend the previous modeling to the stage of discrete particle ejection through the atmosphere together with expanding impact vapor plume.

**Hydrocode and EOSs in use:** Oblique impacts are simulated with three-dimensional version of the SOVA code [6] complemented by ANEOS equation of state for natural rocks [7]. The code allows to model multi-dimensional, multi-material, large deformation, strong shock wave flows. Particles' motion, heat and mo-

mentum exchange with air and vapor are described by multi-phase hydrodynamics. The method of representative particles [8] is used (each marker describes a motion of a great number of real fragments having approximately the same parameters and trajectories). Spatial resolution of 10 cells per projectile radius is used for all the runs. A set of special massless tracers is used to define maximum shock pressure and to separate melted and unmelted materials.

**Transformation of ejecta into discrete particles** is a principal point of the model [9]. First, it is necessary to determine size distribution of ejected particles. For unmelted material (possible meteorites) distribution, obtained in the experiments with powerful TNT-explosions is used. Diameter for melted particles (possible tektites) is taken in the range from 1 to 5 cm. Disruption occurs at the moment when material density drops below normal density. Initial particle velocity corresponds to the local material velocity just before disruption.



**Results** will be presented at the conference. Post-impact flow (projectile diameter 200 m, velocity - 10 km/s, impact angle -  $45^\circ$ ) with particles (red- 5 cm in radius, unmelted) is shown in the Figure

**References:**[1] Warren P.H. (1994) *Icarus* 111, 338-363. [2] Koeberl C. (1994) *GSA Special Paper* 293, 133-151. [3] Artemieva N.A. (2001) *LPS XXXII*, #1216. [4] Artemieva N.A. (2001) ESF "Impact" workshop-6, 5-6 [5] Ivanov B.A. and Artemieva N.A. *LPS XXX*, #1309. [6] Shuvalov V.V. (1999) *Shock waves*, 9, 381-390. [7] Pierazzo E., Vickery A.M. and Melosh H.J. (1997) *Icarus* 127, 408-422. [8] Teterov A.V. and Nemtchinov I.V. (1993) *LPS XXIV*, 1415-1416. [9] Shuvalov V.V. (2001) *LPS XXXII*, #1126.