

**PREATMOSPHERIC PARAMETERS AND FRAGMENT DISTRIBUTION: A CASE STUDY FOR KOŠICE METEOROID.**

M. Gritsevich<sup>1,2,3</sup>, Vladimir Vinnikov<sup>3</sup>, Daria Kuznetsova<sup>4</sup>, Tomáš Kohout<sup>5,6,2</sup>, Yuri Popyrev<sup>7</sup>, Jouni Peltoniemi<sup>5,1</sup>, V. Lupovka<sup>8</sup>, V. Dmitriev<sup>8</sup>, Juraj Tóth<sup>9</sup>, Daniel Britt<sup>10</sup>, Leonid Turchak<sup>3</sup>, and Jenni Virtanen<sup>1</sup>

<sup>1</sup>Finnish Geodetic Institute, Finland. E-mail: maria.gritsevich@fgi.fi. <sup>2</sup>Finnish Fireball Working Group, Finland. <sup>3</sup>Dorodnicyn Computing Centre RAS, Russia. <sup>4</sup>Lomonosov Moscow State University, Institute of Mechanics, Russia. <sup>5</sup>Department of Physics, University of Helsinki, Finland. <sup>6</sup>Institute of Geology, Academy of Sciences of the Czech Republic. <sup>7</sup>Steklov Mathematical Institute RAS, Russia. <sup>8</sup>Moscow State University for Geodesy and Cartography, Russia. <sup>9</sup>Comenius University, Slovakia. <sup>10</sup>Department of Physics, University of Central Florida, USA.

We present results on our investigation on the Košice meteorite - one of the recent falls with well derived trajectory and large number of recovered fragments. A fireball appeared over central-eastern Slovakia on February 28, 2010. The landing area was successfully computed on the basis of data from the surveillance cameras operating in Hungary and lead to a fast meteorite recovery [1]. 218 fragments of the Košice meteorite, with a total mass of 11.285 kg, have been documented [2].

Based on the statistical investigation of the recovered fragments bimodal Weibull, bimodal Grady and bimodal lognormal distributions are found to be the most appropriate for describing the Košice fragmentation process. The most probable scenario suggests that the Košice meteoroid, prior to further extensive fragmentation in the lower atmosphere, was initially represented by two independent pieces with cumulative residual masses of approximately 2 kg and 9 kg respectively [2]. About 1/3 of the recovered Košice fragments were thoroughly studied, including magnetic susceptibility, bulk and grain density measurements reported in [3] revealing that Košice meteorites are H5 ordinary chondrites originating from a homogenous parent meteoroid.

To estimate the dynamic mass of the main fragment we studied the first integral of the drag and mass-loss equations, and the geometrical relation along the meteor trajectory in the atmosphere. By matching these equations to the trajectory data [1] we determine key dimensionless parameters responsible for the meteoroid drag and ablation rate along its visual path in the atmosphere. These parameters allow us to estimate the preatmospheric mass, which is in good agreement with the photometric estimate derived in [1]. Throughout this study we permit changes in meteoroid shape along the trajectory. Additionally, we provide insights on the initial shape of the Košice meteoroid based on statistical analysis [4]. We also conclude that two to three larger Košice fragments of 500-1000g each should exist, but were either not recovered or not reported by illegal meteorite hunters.

**References:** [1] Borovička J. et al. 2013. *Meteoritics and Planetary Science* 48(10):1757–1779. [2] Gritsevich M. et al. 2014. *Meteoritics and Planetary Science* 49(3):328–345. [3] Kohout T. et al. 2014. *Planetary and Space Science* 93–94:96–100. [4] Vinnikov V. et al. 2014. 45th LPSC Abstracts. LPI Contribution No. 1777, p.1439.