THE EXISTENCE OF THE GROUPS OF METEORITE-PRODUCING SPORADIC FIREBALLS AND METEORITES IN COMETARY ORBITS.

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Introduction: Meteorite-producing sporadic fireballs are produced by large meteoroids which are capable, under the suitable geometric and physical conditions, of producing meteorites. The meteorites can help us to understand the solar system genesis and the processes that occurred after the formation of small bodies of solar system. Meteorite and fireball instrumentally observations provide useful data for a study a link between meteoroids, meteorites and their parent bodies. The entry even of relatively small (of some decametres in diameter) meteoroids can cause substantial danger for a peoples and environment. We present here the result of the analysis of the possibility of existence of groups of linked slow moving sporadic fireballs and known ordinary chondrites meteorites, the atmospheric passage which was recorded instrumentally. According to provided data of instrumentally observations the orbits of investigated meteorites and fireballs are cometary and followed a JFC orbits. The main argument for the existence of groups of meteorite-producing fireballs is the existence of "clusters" of fireballs with mutually similar orbits and radiants as well as meteorites with correlated days-of-fall.

Method:. The selection of potentially meteorite-producing fireballs in the IAU MDC database [1] was based on the statistical criterion: pre-atmospheric velocity $V_\infty < 25$ km/s, the terminal height $H_e \leq 35$ km, terminal velocity $V_e \leq 10$ km/s, and terminal mass m_e over several tens of grams. On the base of this criterion in the time of 1.5-2 monthly periods of appearance of six known ordinary chondrite meteorites and the potentially meteorite-producing fireballs were selected. The well-known D_{SH} – criterion of Southworth & Hawkins [2], D_{Dr} –criterion of Drummond [3] and D_N –criterion [4] have been used to compare the similarity of each specified meteorite and fireball orbits. The threshold value Dc =0.2 for D_{SH}, D_N – similarity functions and the threshold value Dc = 0.105 for D_{Dr} –similarity function was selected, which should reduce the number of chance coincidences from the compiled set of fireballs. On the basis of selected orbits, a mean orbit of group of meteorite-producing meteoroids and known meteorite was calculated. A group of meteorite-producing meteoroids is a group of meteoroids and of each specified meteorite which contributed to the final mean orbit. In result six identified groups comprising a total of 95 meteorite-producing meteoroids associated with six known ordinary chondrites were found (Fig. 1).

Summary: In result the several tens of meteorite-producing sporadic fireballs, orbits of which are currently similar to orbits of studied six meteorites as possible members of groups were found and the possible source regions have been considered. The geocentric radiants and orbital elements of meteoroids confirmed sporadic nature and orbits of Jupiter family comets ($T_j \leq 3.1$) of these events. The calculated value of the aerodynamic pressure at the height of maximal brightness and terminal flare used to estimate the bulk density of the meteoroids. In result a value of bulk densities of meteoroids in these six groups about 1070-1250 kg m^{-3} were obtained and suggested the chondrite composition of meteoroids in these groups.

Conclusions: In solar system especially the bodies of the small sizes (50 – 100 m) on the Earth-crossing orbits on a time scale of a human civilization represent the natural hazard because of the greatest probability of risk of collision with the Earth. The identified six groups of meteorite-producing meteoroids and known ordinary chondrites may still contain large meteorite-producing bodies. In practical terms, this can serve as an incentive for purposeful monitoring of the indicated groups of the meteorite-producing fireballs in the identified periods of increased fireballs and meteorites activity by means of both of land fireball network and space tools established on orbital satellites that is important for the prevention of danger for the Earth.

References: [1] Lindblad B.A. et al (2003) *Earth, Moon and Planets* 93: 249L. [2] Southworth R.B. and Hawkins G. S. (1963) *Smith. Contrib. Astrophys.* 7: 261–285. [3] Drummond J.D. (1981) *Icarus* 45: 545–553. [4] Jopek T.J. et al. (1995) *Astronomy & Astrophysics* 302: 290–300.

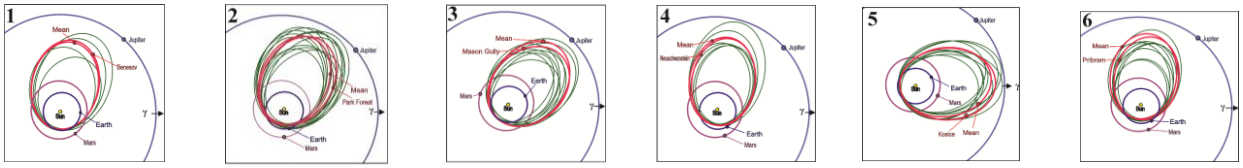

Figure 1. Orbits of meteorite-producing fireballs (green line), of known six meteorites and mean orbits of groups (red line).