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Prediction of comet bombardments (the Tunguska event)

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Abstract

The Tunguska event (30 June 1908) is a unique occurrence of interaction of a cosmic object with the Earth. After the Tunguska event cosmic substance has been dispersed over large territory, a small axis of the dispersion ellipse has a size of >3000 km. Based of this fact we came to the conclusion that the cosmic body had exploded not far from a boundary of the Earth' magnetosphere ~50 min before a beginning of the Tunguska disaster. Similar explosions of comets could be detected via interactions of comet particles with Earth' radiation belts and via absorption of day glow by water (atomic oxygen) in the ultraviolet line 130.4 nm. A precursor of the Tunguska disaster could be anomalous glows of the atmosphere both in the Europe and near the Antarctica in the last day before the event.

1. Fragmentation

The following facts are evidence of the fragmentation of the Tunguska cosmic body long before its entrance into the dense atmosphere. Firstly, anomalies of day atmosphere, which were connected with noctilusent clouds [1], were recorded in Oxford and Oslo only a few hours after the disaster. It is difficult to explain such quick expansion of these anomalies at a distance of ~6500 km through the transfer of cosmic substance from the epicenter of the explosion. Secondly, the territory over which the substance of the Tunguska cosmic body dispersed, has a huge size of >18 million km^2. This territory includes the field of noctilucent clouds, an area with rapid tree growth and a zone of sound effects (Fig. 1). The area of ~2 million km^2, where the growth of trees after the disaster increased, stretches from the epicentre to the north by a distance of >1500 km [2]. It is supposed that the rapid growth of trees is connected with dispersion of the Tunguska cosmic body substances.

The zone with sound effects is a territory, where, according to eyewitnesses, the flight of the cosmic object was accompanied by sounds. It is important to note, that >70 eyewitnesses affirm that they heard a sound during the flight of the Tunguska cosmic body. These sounds were similar to thunderclaps, crackles of gunfire or gunshots. Furthermore, 31 eyewitnesses reported that they had heard the sounds before they located the flying object. In several places inhabitants went outside when they heard the sound and saw the cosmic body in flight.

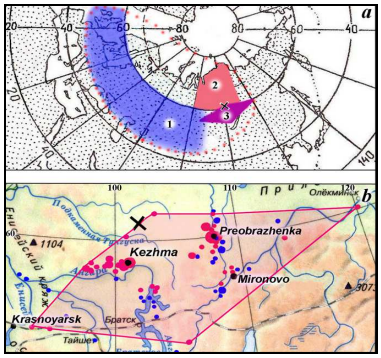

Fig. 1. The cartography of the Tunguska event. (a) The scattering region of a cosmic substance (dashed line). Sign: X – the epicentre of the disaster; 1 – an area with anomalous airglow (noctilucent clouds); 2 – an area with rapid growth of trees [2]; 3 – an area of sound effects. (b) The area with sound effects. Sign: X – the epicentre; red points – settlements, where the flight of the body was accompanied by sounds; blue points – the flight without sounds.

As far back as 1927, Kulik noted another peculiarity in the propagation of sounds during the disaster. According to his opinion, the inhabitants were convinced that the body fell somewhere closely: "beyond the grove, behind the fence, outside the village" [3]. It is well known, that sound transforms when it spreads through the air and human ears are able to separate off thunderclaps or gunshots at a short distance from a remote bursts. Without a doubt, sound or shock waves from the object flying with

cosmic speed a large distance away from people could not form these sound effects close to the ground. Therefore, it can be assumed, that these sounds were connected to explosions of fragments of the Tunguska cosmic body. It is important to note that settlements, where sounds were registered during the flight, adjoin with points where the sound was not fixed (Fig. 1b). This evidence of the locality of places with sound effects does not contradict the supposition that the sound was caused by explosions of separate fragments near the ground. The area of sound effects has a transversal size of ~1600 km, so it can be affirmed, that fragments of the Tunguska cosmic body passed ahead of main object at a distance of > 800 km. Therefore, the cosmic body had exploded long before its entrance into the dense atmosphere.

3. Disintegration

We can estimate the altitude where the Tunguska cosmic body disintegrated, based on the area of dispersion of its substances. Both the south boundary of field of noctilucent clouds and north boundary of the region with a rapid growth of trees are located at a distance of L~1500 km from the epicentre. During the explosion of the Holmes Comet, a speed V_H of expansion of thrown down covering was ~0.5 km/s. This is the maximal speed of a comet covering, which was measured exactly. It is necessary ~50 min to remove fragments at a distance L from the trajectory of the cosmic body with a speed V_H. If we take the speed of this body as ~30 km/s, we find that the explosion of the Tunguska cosmic body was at a distance of ~14 radius of the Earth. Therefore, this object exploded near the boundary of the Earth's magnetosphere.

A time interval of 50 minutes between the explosion of the Tunguska cosmic body and a beginning of the Tunguska disaster could allow for the prevention of disastrous influence of comet bombardment. Explosions of comets accompanied by production of gases and dust particles, which are ionized as a result of body disintegration or due to interaction with cosmic rays. On the one hand, penetration of ionized particle flows inside the magnetosphere must influence the states of radiation belts of the Earth. On the other hand, molecules of water could be registered via absorption of airglow in ultraviolet near line of atomic oxygen (130.4 nm) [4].

4. Forerunners

The Tunguska cosmic body moved towards the Earth from the Sun and we can suppose that its flight was accompanied by fragments. We have following information about forerunners of the Tunguska disaster. First, bright twilight and noctilucent clouds were observed during 10 days before the disaster. The territory where these phenomena were sighted gradually increased (Fig. 2a) and culminated in the day of the disaster. Secondly, members of the British Antarctic expedition, who were located not far from volcano Erebus (Antarctica) observed an “extensive glowing aurora” [5]. The earliest strong aurora was noted 12.5 hours before the Tunguska event and lasted 2 hours. The next airglow was extraordinary in size, it started 8 hours before the disaster and was seen for ~6 hours (Fig. 2b). It is important to note that “anomalous aurorae” were observed both before and after the catastrophe. A third possible forerunner are weak regular continuous magnetic oscillations, which were registered in Kile [6]. The time intervals between these oscillations were fixed, as shown in Fig. 2c.

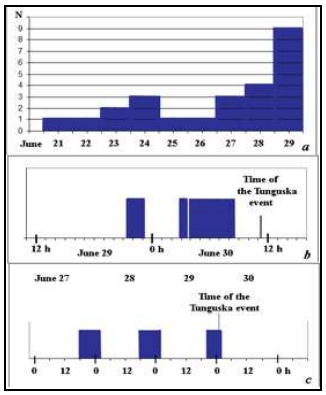

Fig. 2. Possible forerunners of the Tunguska disaster. a – Number reports about anomalous glows of the atmosphere before the Tunguska event. b – time intervals, when aurora in Antarctica was observed [5]. c – time intervals, when weak regular magnetic oscillations were registered [6].

References

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