Likely Impact Sites of Large Fragments of the Tunguska Cosmic Body

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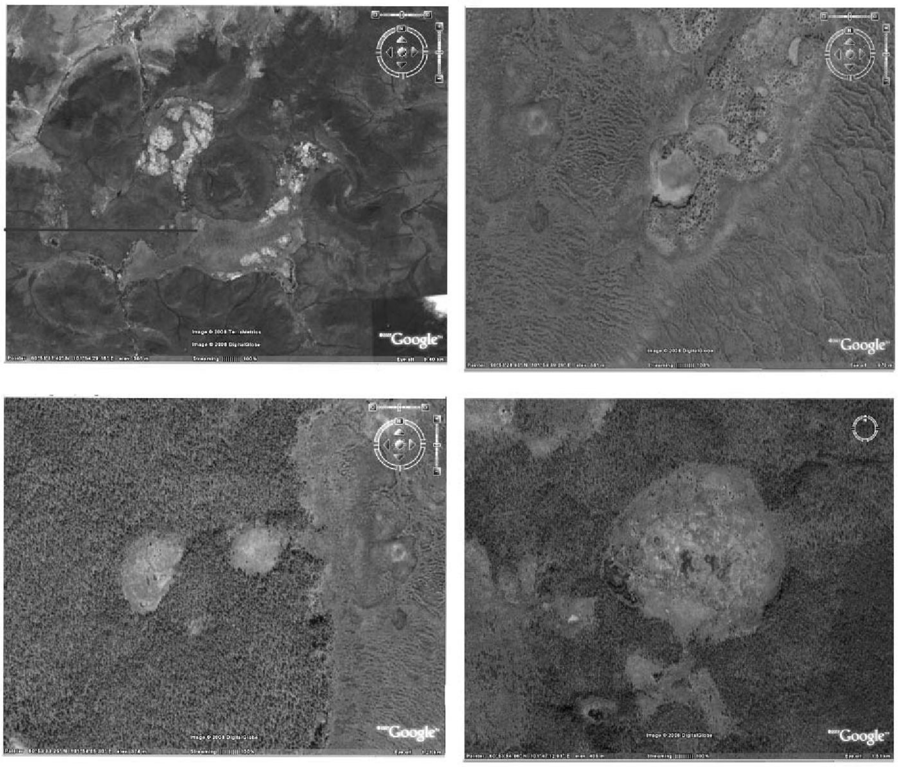
Based on the large-scale stereo aerial survey of the Tunguska catastrophe region and application of three-dimensional models, we determined the possible impact sites of Tunguska cosmic body (TCB) fragments. Some of these sites were earlier determined by L. A. Kulik.

Kulik schematized the tree fall around the Cranberry Hole and at the Southern Bog in order to elucidate the possible location of meteorite fragments. We cut a channel in the Suslov Hole, and drained water from it [1]. A stub was found at the crater bottom. Ice of unknown (possibly cometary) origin was also discovered. Comparing the stub photographs from the Suslov hole with the photographs of a stub from the Sikhote Alin holes, we can assume that trees were possibly broken in a similar manner when large meteorite fragments fell [2].

Then we drilled three boreholes at the bottom, the first one on the northern slope since Kulik considered that the meteorite flew from south to north and could get deep into the hole on the northern slope. This borehole penetrated a 25-m-thick permafrost layer and 6-m aquifer below the permafrost. The second borehole was drilled at the hole center to a depth of 20 m. The third borehole was drilled on the southern slope.

Kulik schematized tree fall on the Southern Bog and around the Cranberry Hole and selected the centers where TCB fragments might be located. However, he did not find any Tunguska meteorite fragments in the Suslov Hole. We consider that it is necessary to verify the Kulik proposal and to perform at first georadar investigations in the Suslov and Cranberry holes and then drill in the craters to find possible meteorite fragments.

Pit layer enrichment of different elements and isotopes relating to 1908 that was found by E. M. Kolesnikov et al., might have purely terrestrial causes. Firstly, deep structures of a paleovolcano may release gases during an explosive earthquake [3]. Gaseous and aerosol elements are redistributed during any earthquake [4]. These elements differ from a refractory matter of



Possible sites where TCB fell.

traps. Secondly, aerosols erupted from the Ksudach volcano in Kamchatka in 1907 could change the composition of precipitation in the Tunguska region. Thirdly, recent data indicate that comets are mostly enriched in deuterium, whereas Kolesnikov et al. thought that comets have a decreased content of this element. Different positive and negative isotopic anomalies are observed when tectonic structures (fault and mud volcanoes) release gases. At last, enrichment in iridium and platinum-group elements can be related to volcanic activity. Extremely high concentrations of iridium were registered during the eruption of the Kilauea volcano [5]. Rhenium and platinum-group elements deposits are formed in Kuril volcanoes.

Thus, element and isotope anomalies are possibly not pertinent to the Tunguska meteorite. One should search for large pieces of meteorite in order to elucidate the real situation.

Large TCB fragments can be sought in Cranberry and Suslov holes studied by Kulik (see Figure), near northern tributaries of the Ugakit Creek, and in the Bagel bog region. Lake Cheko, studied by V. A. Koshelev as long ago as 1961, can also contain TCB pieces.

This work, executed by modern 3D methods both remote sensing and ground ones, has studied the zone of probable dissemination of the Tunguska space body fragments a little to the east from its main trajectory. Further task is to explore all the zone of possible dissemination of the fragments as L. A. Kulik planned some time ago. The next task is to calculate parameters of the dissemination.

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