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Possible microscopic traces of the Tunguska meteorite

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The author studied the branch, found in a small funnel in the peat bog on the northern islands of the southern marshes on the site of the Tunguska phenomenon. By X-ray microanalysis and cathodoluminescence was studied in a branch, found in the peat bog on the northern islands of the southern marshes on the site of the Tunguska phenomenon. It found trace minerals, the origin of which can usually be both space and terrigenous

Key words: Tunguska meteorite, native metals, diamond, moissanite, cathodoluminescence

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A key element in studying the nature of the Tunguska meteorite is the question of how it was material (elemental and isotopic) composition. Starting with the expedition, LA Kulik, finding the substance of the Tunguska meteorite was occupied for several generations of researchers. The results of these long-term efforts are reflected in the numerous reviews and original publications. However, today it can be argued that the cosmic matter, which could be guaranteed to be identified with the substance of the Tunguska meteorite has yet been found. The substance of the hypothetical Tunguska meteorite was found in any significant numbers, but were found microscopic silicate and magnetite pellets, as well as an increased content of some elements, indicating a possible origin of cosmic matter. Thus, the Italian researchers analyzed the particles found in the resin in 1908 [*Longo et al., 2003; Serra et. al., 1994*], were found to differ from the particles of the earlier and later. The resin on the roots of a fallen tree they saw as "retarded trap", since the substance of the meteorite has been falling after the explosion, and the roots were gradually from the ground, and then they separated resin. The resulting samples were studied in the University of Bologna with an electron microscope. A distinguishing feature of most predominant particles found in the resin in 1908 was their shape with smooth edges, sometimes spherical, indicating a strong thermal effects. The particles found in the resin before and after 1908, usually have pointed edges, or "fluffy" appearance that is characteristic of many background particles are always present in the air (dust, cosmic, volcanic, biological or industrial origin). The observed difference led to the conclusion that most of the particles belonging to 1908, came to the resin directly from the blown up space body, they could not be raised by the blast from the ground, because then no time to warm up to the melting point.

Thus, the Italians had shown promising analysis of particles trapped in the resin or other parts of the tree to identify the substance of the Tunguska meteorite. However, their results must be supplemented by modern methods of research that was done.

The author studied the branch, found in a small funnel by E.V.Dmitriev in the peat bog on the northern islands of the southern marshes on the site of the Tunguska phenomenon. Initially the discovery was a small sprig of 5 cm long, 2 mm in diameter. Sprig was very similar to a charred. However, she had a polished surface, differed from other similar entities. She did not leave a trace on the paper. Color of branches, even in thin sections, was completely black. On the assumption that the particles of meteoric matter in the explosion penetrated into the wood, the particles were collected from the surface layer of twigs. They were transferred to double-sided carbon tape. Analyzed the chemical composition of microparticles using a energodispersive spectrometer Drycool Oxford Instruments, and then carried out cathodoluminescence study of luminous particles in the spectrometer Mono CL3 firm Gatan. The chemical composition of the most interesting particles, identified by the review cathodoluminescent shooting, was studied after the shooting. A similar technique was previously used in the study of samples from the Cretaceous-Paleogene boundary (Gams, Austria, Stevens Klint, Denmark [*Grachev et. .al., 2009; Korchagin et. al., 2011*]).

As a result, the particles were detected minerals which can have both outer and terrigenous origin. By cosmic particles may include findings of grains that could be generated by strongly reducing conditions. These include particle: native Sn (Fig. 1), Zn (Fig. 2, Fig.6), W (Fig. 3), Cr (Fig. 4), Ni, Al, Fe (Fig. 5). Perhaps the presence of metal carbides. Among these findings highlights the diamond particles (Fig. 8) and moissanite (Fig. 3, Fig. 6). These findings are the best markers of impact events. Similar findings were made in the study of Cretaceous-Paleogene boundary, which is also assumed to impact [*Grachev et. .al., 2009; Korchagin et. al., 2011*]. High-carbon spheroids are shown in Fig. 7. The same was found previously in the boundary sediments in the Permian-Triassic Nedubrovo [*Korchagin et. al., 2010*]. Fine particles of diamond (3x3 mm) and moissanite (2x3 mm) were found by using cathodoluminescence spectrometer. City cathodoluminescence image is shown in Fig. 9. Cathodoluminescence spectra of diamond and moissanite are shown in Fig. 10, 11. The obtained grain diamond is one of the faces of titanomagnetite telluric origin. Apparently, in the process of shock-thermal effects of the fall of the Tunguska meteorite was epitaxial growth of diamond on the brink of titanomagnetite. Both minerals may have a similar crystalline structure. A similar phenomenon - the growth of cosmic matter in the earth with impact - before there was the author of the study astrobleme Tsenher (Mongolia). It was found fusing native iron in the magnetite particle [*Saltykovsky et. al., 2011*].

For telluric minerals include magnetite particles findings, titanomagnetite, iron sulfides, pyroxenes, muscovite, amphibole, quartz, aluminum silicates of different composition. The origin of olivine and iron sulfides may be ambivalent. Of special note finds organic matter whose identity microprobe method is difficult or impossible. Thus, grains of native Al and W are carbon particles containing Al and W in the form of impurity, but rather – in the form of nanoparticles whose size is much smaller than the physical features of X-ray method.

Conclusion. A set of minerals of cosmic origin can be attributed to the discovery E.V.Dmitriev 1908, the fall of the Tunguska meteorite. Clear value for further research of wood disastrous period for the detection of minerals - markers of cosmic matter.

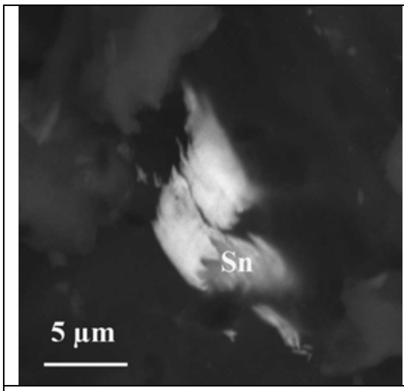


Fig. 1. A particle of native Sn

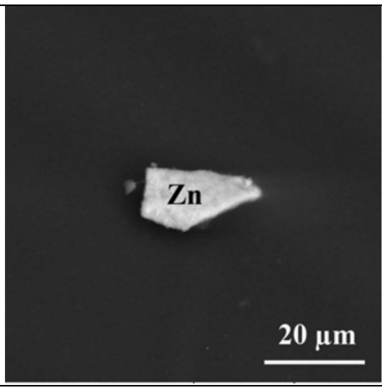


Fig. 2. A particle of native Zn

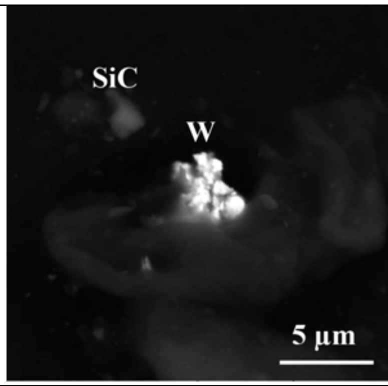


Fig. 3. A particle of native W and SiC moissanite

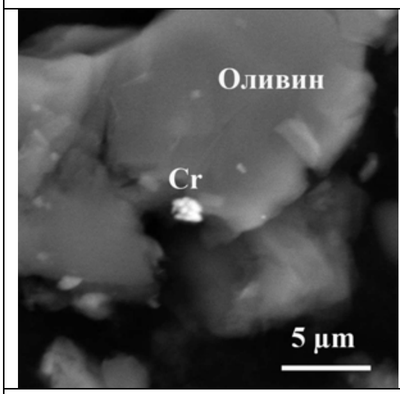


Fig. 4. A particle of native Cr on olivine

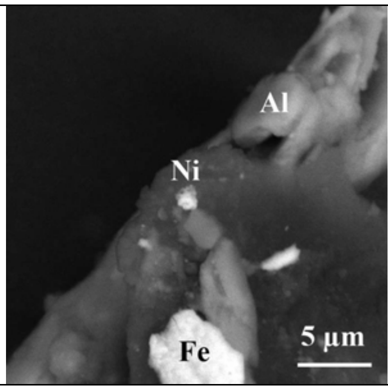


Fig.5. Particles of native Ni, Al, Fe

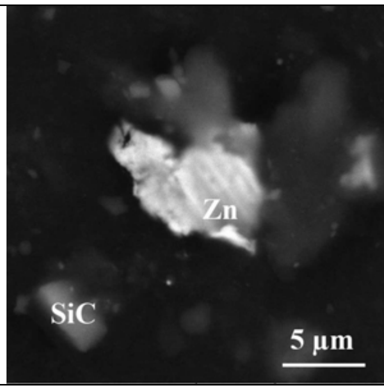


Fig.6. Particles of native W and SiC moissanite

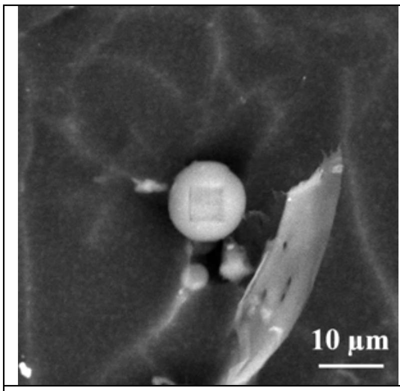
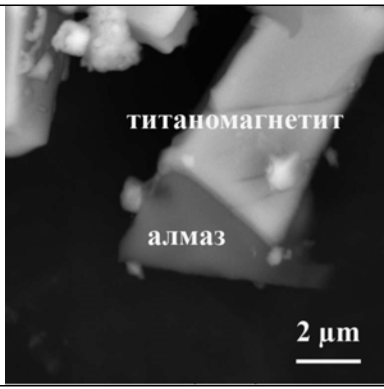


Fig. 7. The organic microspheres



Fig, 8. Diamond in the titanomagnetite, BSE detector

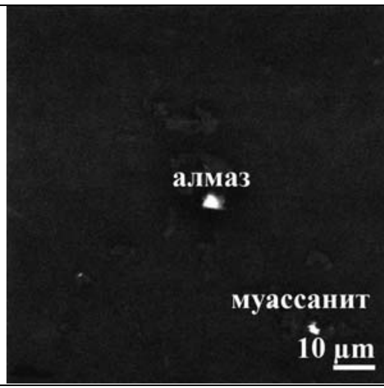
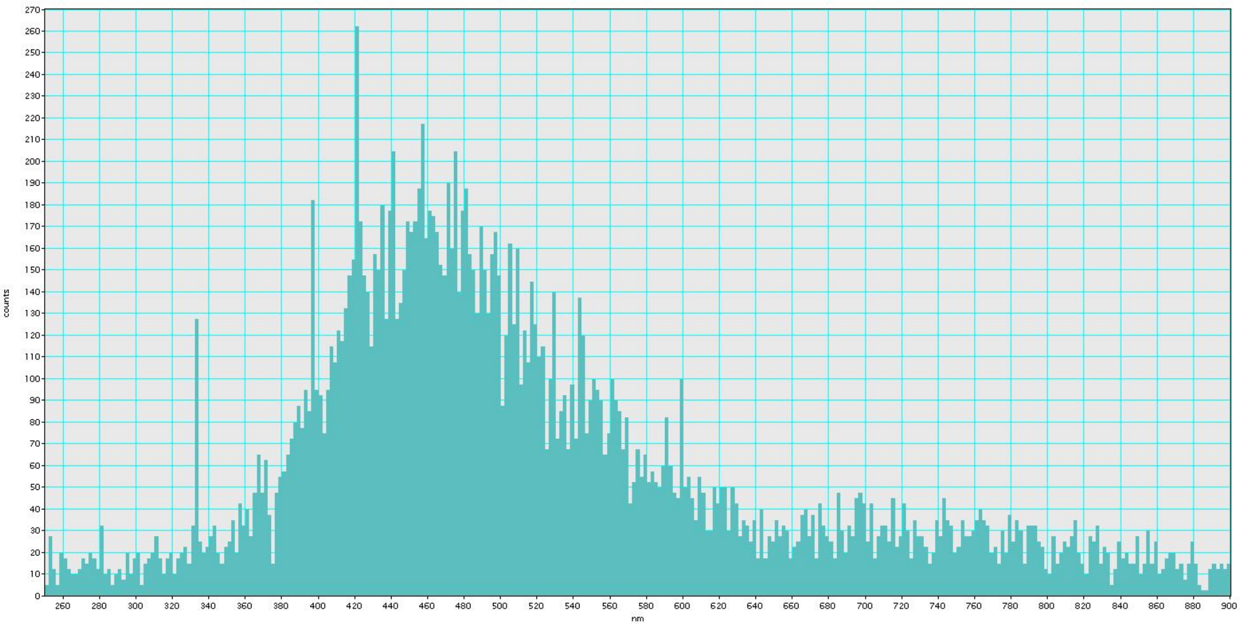


Fig. 9. Cathodoluminescence glow-diamond and moissanite



Fig, 10. Cathodoluminescence spectrum of diamond grains (blue glow)

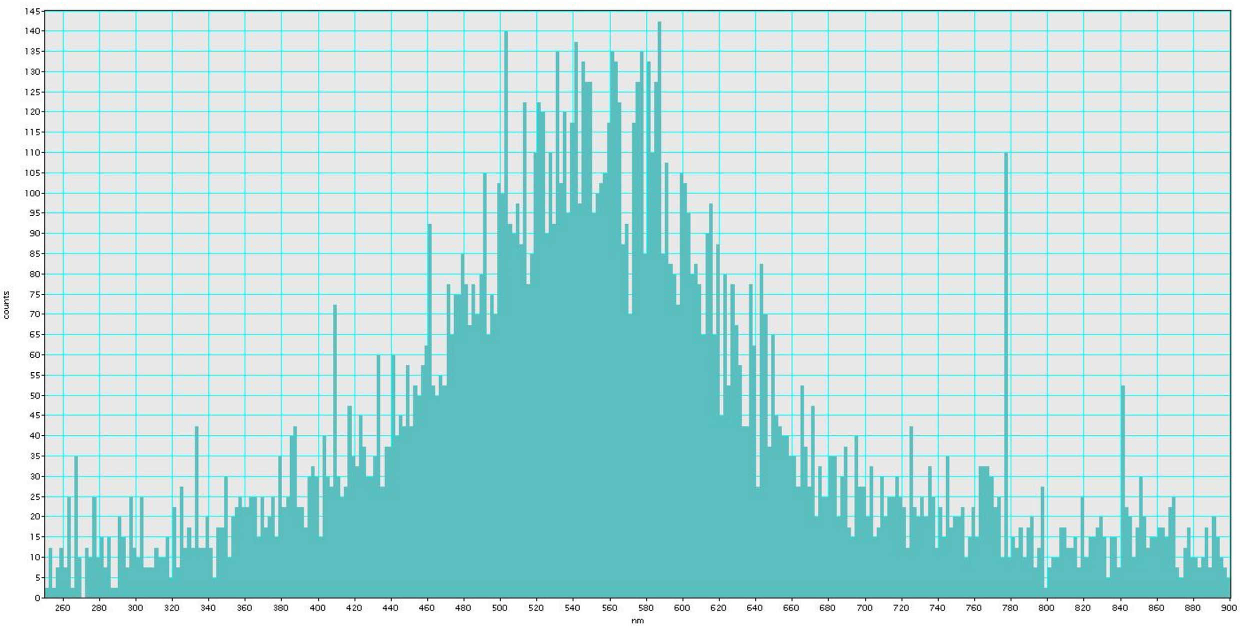


Fig. 11. Cathodoluminescence spectrum of moissanite grains (orange glow)

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