

Triton Fun Company

Science Newsletter July 2007

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Cosmic Collision: The Lake Cheko — Tunguska 1908 Bolide Event

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Special points of interest:

Cosmic collision

Triton Fun stuff

Superfluous questions

Objects in space are colliding all the time. We don't think about them much. However, space object collisions were brought to the public's awareness dramatically in 1994 with the collision of the 3-mile-wide Comet Shoemaker-Levy 9 with Jupiter in 1994. This comet broke into about 20 impacting bodies which produced Earth-sized blast events which became apparent in Jupiter's atmosphere as grayish dark spots. Such collisions have occurred on Earth in its past, the most recent significantly notable events being that produced by the Tunguska Space Body (TSB) object in 1908 and the first videotaped small impact event last year (02 May 2006) on the Moon.

Many theories have been given during the century since the 30 June 1908 event. [This is the date on our modern Gregorian calendar; witness accounts use 17 June 1908 on the Julian calendar which was in effect at the time in Russia (a displacement of 13 days of accumulated leap year days)]. On that day, something, presumably an impactor of uncertain type, hit the Earth and devastated the mostly uninhabited forested area near Tunguska in the remote Russian wilderness. Significant luminescent night skies were reported for days over Europe and Scandinavia [you could read a book by it!].

Russian scientists, mostly unrecognized for their significant efforts, have spent a century trying to figure out this impact event. Some of the speculations involved seismic events, or some "outside of the box" ideas, such as a micro-black hole impacting the Earth, and others involving "mirror matter", that is, matter consisting of anti-particles. Many astronomers believed that a small comet, meteor, or small asteroid-like object collided with the Earth on that date. This was a *bolide*: a bright meteor or fireball that explodes in the air and/or hits the Earth. Recent research over the last decade indicates that a meteoroidal object may well be the cause of the impact and subsequent devastation.

An interesting article will appear in the August 2007 issue of the European multi-geoscience societies' journal *Terra Nova* [solid earth and planetary sciences] pertaining to the 1908 bolide event over Siberia in Russia. This region contains permafrost, thermokarst, taiga, and boreal forests. The recent research was conducted by scientists at the Institute of Sea Biology of the University of Bologna of the National Research Council of Italy.



Trees flattened by Tunguska impact in 1908; the region still looks like this almost 100 years later

The research details results of an expedition at *Lake Cheko* in central Siberia. Lake Cheko may have been formed from a fragment of the impacting body from this 1908 event. Previous research in 1960 of this lake yielded nothing due to insufficient sensitivity of instruments.

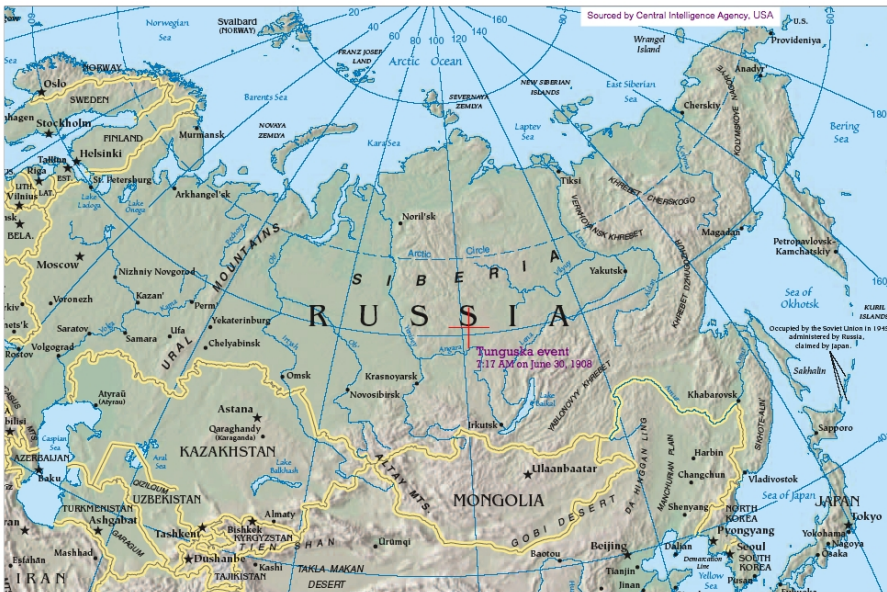
The lake is about 5 miles (8 km) north-northwest of the event's airburst epicenter. The impact produced a Richter magnitude 5 earthquake seismic shock wave through the ground and multiple air pressure waves resulting in the flattening of an estimated 80 million trees radiating from the site for nearly 1,000 square miles.

We are always looking for **contributors** to the Science Newsletter. If you would like to write an article about a science subject you are excited about, or contribute a superfluous question, or if you would like to be on our **mailing list** for future newsletters, please e-mail us at:

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Cosmic Collision, continued

Photos/Graphics: Institute of Sea Biology of the University of Bologna, National Research Council of Italy; Central Int Agency Fact Book; NASA/art by Don Davis; illustration is not to scale

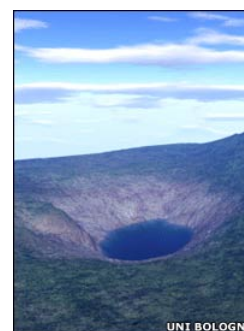


Map showing location of 1908 impact event

The hypersonic burst resulted in mass macro-fires and literally wiped small towns and villages off the map with the force equivalent of 1,000 times the energy of the first atomic bombs used at the end of World War II. The 164 foot deep (50 m) lake is shaped like the conical funnel shape of the Odessa impact site in Texas. (That impact from a meteor occurred around 25,000 years ago; the meteor hit the Earth and came in at a shallow angle, creating a weird and unusual-shaped crater near what is now Odessa, Texas.) Sonar and seismic wave analyses seem to show a surviving meteorite in Lake Cheko which is reflecting some of the waves. The potential object or very compacted sedimentary layers 33 feet below the lake bed is to be explored by the same Italian team next year.

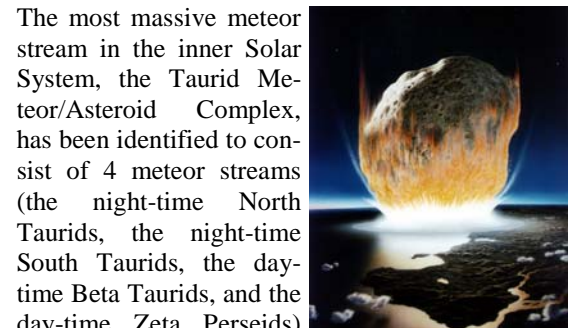
The progenitor object of the Tunguska impact event is thought to be 60 meters across and is believed to have exploded 5.3 miles (8.5 km) above the ground.

It is thought to have decreased in size (from atmospheric ablation) to around 10-40 meters and traveled at an inclination of 3-15 degrees from over the horizon with a brightness greater than that of the Sun. Its true bearing was 125 degrees from the southeast towards the north-northwest. It is believed to be an object from the daylight meteor shower of the Beta Taurids and impacted sometime shortly after 7 a.m. in the morning local time, after decelerating from about a Mach 5 velocity (1,700 meters per second). It apparently split into pieces, most of which ablated/evaporated in the Earth's atmosphere explosively, and was heard by distant surviving witnesses who reported that it sounded like a military ballistic artillery barrage.



Far left: Lake Cheko as it looks today

Left: Simulation showing how Lake Cheko would look if top 40 meters of water was drained away; note crater shape



The most massive meteor stream in the inner Solar System, the Taurid Meteor/Asteroid Complex, has been identified to consist of 4 meteor streams (the night-time North Taurids, the night-time South Taurids, the day-time Beta Taurids, and the day-time Zeta Perseids) consisting of 2 major branches. The 5 mile wide (4 km radius) periodic Comet Encke (2P/Encke) is a Jupiter family comet and is the cause of much of the Taurid meteoroidal complex stream. Comet Encke and the Taurid meteor stream is thought to be a remnant of a larger comet which disintegrated 20,000-30,000 years ago. The Beta Taurids daytime approach meteor shower, which can be detected by radio and radar observations, appears to be the source of the Tunguska object. The core of this Taurid shower, one component of which produces the known "Halloween fireballs", appears to display "wild skies" about every 3,000 years. Some researchers think it may have inspired Earthlings to create megalithic structures such as Stonehenge. Another interpretation is that they were "The Star of Bethlehem". The next core Taurid stream to approach Earth is expected to occur in about 1,000 years.

References:

- (1.) A possible impact crater for the 1908 Tunguska event, L. Gasperini, et al., *Terra Nova*, 7 pages, preprint, 2007
- (2.) Farinella P, et al., Probable asteroidal origin of the Tunguska Cosmic Body, *Astron. Astrop.*, **377**, 1081 (2001)
- (3.) Foschini L, A solution for the Tunguska event, *Astron. Astrop.*, **342**, L1 (1999)
- (4.) Klacka J, E.M. Pittich, Origin of the Taurid meteor stream, *Planet. Space Sci.* **46**, 881 (1998)

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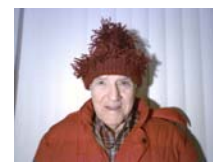
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** Send us your superfluous questions for a future issue ! They can be on any subject. The funnier, the better. M.D., our editor, appreciates the help and will send you a free Triton Fun coffee mug as compensation for your question. Or write an article for us and be read by professional and amateur astronomers and scientists in the U.S. and Canada ! **

Superfluous Questions:

1. What year did women in America get the right to vote (by Congress passing the 19th Amendment) ?
a) 1898 b) 1915 c) 1920 d) 1925
2. In what movie did Danny Kaye play twins who were opposite in personality (one shy, one extroverted) ?
a) Knock on Wood b) On the Riviera c) Wonder Man d) The Kid from Brooklyn
3. Tirane is the capital of what country ?
a) Bulgaria b) Azerbaijan c) Albania d) Belarus
4. What spacecraft first detected the van Allen radiation belts in Earth's magnetic field ?
a) Pioneer 1 b) Mariner 1 c) Explorer 1 d) Apollo 1

—> ANSWERS in next months issue of the Science Newsletter ! <---

** ANSWERS to June's Superfluous Questions: 1. a) 1790 2. c) Barbara Barrie 3. d) subatomic particles 4. c) compound.. tin