# Solved: Riddle Of Siberia's Flattened Forest

A century on [later], scientists say massive explosion was caused by comet collision

By Steve Connor, Science Editor

**http://www.independent.co.uk/news/science/solved-riddle-of-siberias-flattened-forest-1720004.html**

***Note from Pastor Kevin Lea: This scientific study may also answer what happened during the long day of Joshua. My detailed comments follow this article.***

*Friday, 26 June 2009*

**Alamy**

Trees flattened by the explosion at Tunguska - the blast was equivalent to a 20-megaton nuclear bomb

A massive explosion that flattened an entire forest in northern Russia over an area of 800 square miles more than a century ago was almost certainly caused by the Earth colliding with a comet, according to a study by rocket scientists in the United States.

The explosion in 1908 occurred in the sky at a remote location in Siberia near the Tunguska river. It is estimated to have been equivalent to a 20-megaton nuclear bomb, which would have decimated everything within the M25 had it occurred over London rather than a largely uninhabited region.

> *Note: The **M25 motorway**, also known as the M25 corridor or London Orbital, is a 117 mile (188 km) orbital motorway which encircles Greater London*

Tunguska has long been the subject of intense speculation, with suggested causes ranging from the release of a gigantic cloud of explosive methane gas from underground, to a collision with anti-matter particles from deep space, or even the crash of a visiting extra-terrestrial spacecraft.

One of the most likely explanations, however, had been that the Earth was hit by a piece of space rock – but a number of scientific expeditions to the area failed to find the impact crater, suggesting that if such a meteoroid had struck the Earth in 1908 it must have exploded high enough in the atmosphere to have disintegrated before reaching the ground.

Now a team of researchers studying the plumes of water vapor created by the rocket engines of the Space Shuttle believe they have found the crucial evidence in favor of another theory: a collision with the icy heart of a comet.

This would have released huge volumes of water vapor at very high altitude, creating highly reflective clouds **that may explain why the sky was lit up for days after the collision, with people as far away as London saying that they could read newspapers outdoors at midnight, the scientists said [emphasis added]**.

"It's almost like putting together a 100-year-old murder mystery," said Michael Kelley professor of engineering at Cornell University in New York. "The evidence is pretty strong that the Earth was hit by a comet in 1908."

**The dramatic illumination of the night sky in the day after the event on 30 June 1908 was probably caused by the formation of "noctilucent" clouds** – named because they are visible at night – which are made up of ice particles formed at very high altitude and low temperatures, Professor Kelley said.

A study of exhaust plumes from the Space Shuttle have shown how noctilucent clouds can form a day after a shuttle launch and many miles from its flight path due to high-speed winds generated at this altitude, the scientists found. The exhaust plume is a model of how a comet would have created similar noctilucent clouds, they said.

**The appearance of skies bright enough to read newspapers at night as far away as London – some 3,000 miles away from Tunguska** – could be explained by the transport of huge volumes of water vapor arising from the comet by the high winds of the upper atmosphere where these clouds form, Professor Kelley said.

> *Note from Pastor Kevin Lea: The Bible contains a story referred to as, "The Long Day of Joshua." It records how Joshua prayed that daylight would be extended so Israel could continue defeating five armies of the Amorites on the battlefield. God answered the prayer by allowing daylight to be extended and Israel was victorious.*
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> *Many have scoffed at this biblical history saying the only way the sun and moon could continue giving light is for the earth's rotation to stop. This in turn would cause a global cataclysm as the angular momentum of the earth was reduced to zero and then another cataclysm as God started the earth turning again. Christians know that nothing is impossible with God, and He could have provided a miracle to answer Joshua's prayer (providing the light of the sun without stopping the earth, stopping the earth without allowing a cataclysm, etc.)*
>
> *However, it is also possible that God performed this miracle by the timing of a comet that entered earth's atmosphere creating noctilucent clouds, thus providing the same illumination that occurred one hundred years ago when Londoners were able to read their papers at midnight.*
>
> *Let's carefully look at the biblical record (using the New American Standard Translation) to see if we can determine if this was the case.*
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> > Josh 10:11 And it came about as they [*the fleeing armies of the five Amorite kings*] fled from before Israel, {while} they were at the descent of Beth-horon, that the LORD threw large stones from heaven on them as

far as Azekah, and they died; {there were} more who died from the hailstones than those whom the sons of Israel killed with the sword.

*Comets are often referred to as "dirty snowballs" consisting of solid rocks of various sizes as well as water. Therefore, if a comet collided with the earth during this battle between Israel and her enemies, some solid debris (meteorites) could have survived the heat of entry and showered the area of the battlefield. This historical account records how the meteorite shower targeted the area occupied by the enemies of Israel.*

12 Then Joshua spoke to the LORD in the day when the LORD delivered up the Amorites before the sons of Israel, and he said in the sight of Israel, "O sun, stand still at Gibeon, and O moon in the valley of Aijalon." 13 So the sun stood still, and the moon stopped, until the nation avenged themselves of their enemies. Is it not written in the book of Jashar? And the sun stopped in the middle of the sky, and did not hasten to go {down} for about a whole day.

*Could this observed phenomena have been the result of a comet hit that produced a massive noctilucent cloud directly over the Middle East? Could the reflective properties of the noctilucent cloud have caused the sun's light to be reflected in a way that made it appear like the sun did not set? If a comet hit 3,000 miles away allowed people in London to receive enough reflected light to read their papers at midnight in 1908, couldn't it be possible that Joshua's troops also had enough light to fight all night in the immediate area of a comet that may have hit in their day.*

*Some may counter that if it were a comet hit like the one in 1908, then all the people in the area would have been killed. But comets come in different sizes and velocities. Dr. Walt Brown's website (http://www.creationscience.com/onlinebook/Comets6.html) documents that house-sized comets frequently enter earth's upper atmosphere at very low velocity. The one in Joshua's day could have been much larger but with a low enough velocity that it would create a non-cataclysmic meteorite shower but with enough water volume that it created a day like no other day as Joshua 10:14 concludes:*

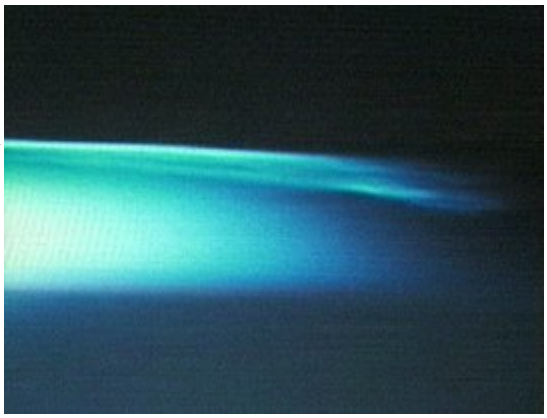
14 And there was no day like that before it or after it, when the LORD listened to the voice of a man; for the LORD fought for Israel. (NAS)

# Strange Clouds

**http://science.nasa.gov/headlines/y2003/19feb_nlc.htm**

The crew of the ISS have been observing electric-blue "noctilucent" clouds hovering on the edge of space.

Listen to this story via streaming audio, a downloadable file, or get help.



**February 19, 2003:** They hover on the edge of space. Thin, wispy clouds, glowing electric blue. Some scientists think they're seeded by space dust. Others suspect they're a telltale sign of global warming.

They're called noctilucent or "night-shining" clouds (NLCs). And whatever causes them, they're lovely.

"Over the past few weeks we've been enjoying outstanding views of these clouds above the southern hemisphere," said space station astronaut Don Pettit during a NASA TV broadcast last month. "We routinely see them when we're flying over Australia and the tip of South America."

**Right**: Electric blue clouds viewed from the ISS. Photo credit: Don Pettit and NASA TV.

Sky watchers on Earth have seen them, too, glowing in the night sky after sunset, although the view from Earth-orbit is better. Pettit estimated the height of the noctilucent clouds he saw at 80 to 100 km ... "literally on the fringes of space."

"Noctilucent clouds are a relatively new phenomenon," says Gary Thomas, a professor at the University of Colorado who studies NLCs. "They were first seen in 1885" about two years after the powerful eruption of Krakatoa hurled plumes of volcanic ash as much as 80 km high in Earth's atmosphere.

Ash from the Indonesian volcano caused such splendid sunsets worldwide that evening sky watching became a popular past time. One sky watcher in particular, a German named T.W. Backhouse who is often credited with the discovery of noctilucent clouds, noticed something odd. He stayed outside after the sun had set and, on some nights, saw wispy filaments glowing electric blue against the black sky. Scientists of the day figured they were some curious manifestation of volcanic ash.

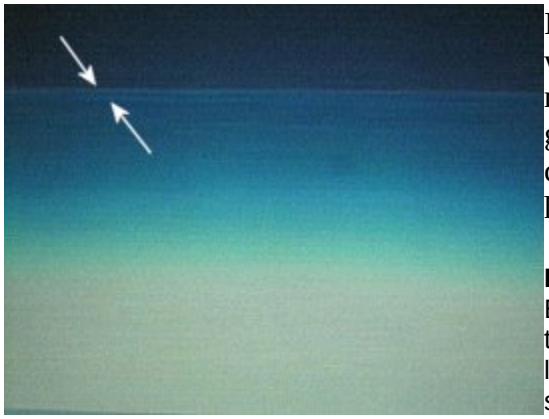
Eventually the ash settled and the vivid sunsets of Krakatoa faded. Yet the noctilucent clouds remained. "It's puzzling," says Thomas. "Noctilucent clouds have not only persisted, but also spread." A century ago the clouds were confined to latitudes above $50^{o}$; you had to go to places like Scandinavia, Russia and Britain to see them. In recent years they have been sighted as far south as Utah and Colorado.

**Above**: Noctilucent clouds over Finland. The orange hues near the horizon are ordinary sunset colors, notes Gary Thomas. NLCs, on the other hand, are usually "luminous blue-white or sometimes just pale white," he says. Image credit Pekka Parviainen.

Astronaut Don Pettit is a long-time noctilucent cloud-watcher. As a staff scientist at the Los Alamos National Laboratory between 1984 and 1996, he studied noctilucent clouds seeded by high-flying sounding rockets. "Seeing these kinds of clouds [from space] ... is certainly a joy for us on the ISS," he said on NASA TV.

"Although NLCs look like they're in space," continues Thomas, "they're really inside Earth's atmosphere, in a layer called the mesosphere ranging from 50 to 85 km high." The mesosphere is not only very cold (-125 C), but also very dry--"one hundred million times dryer than air from the Sahara desert." Nevertheless, NLCs are made of water. The clouds consist of tiny ice crystals about the size of particles in cigarette smoke.

How ice crystals form in the arid mesosphere is the essential mystery of noctilucent clouds.



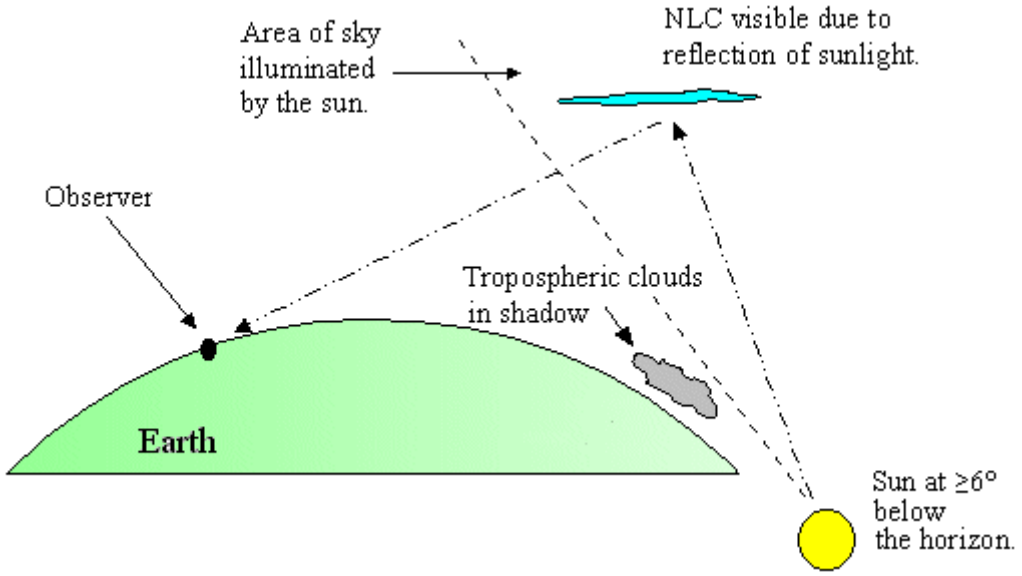
Ice crystals in clouds need two things to grow: water molecules and something for those molecules to stick to--dust, for example. Water gathering on dust to form droplets or ice crystals is a process called nucleation. It happens all the time in ordinary clouds.

**Left**: Another noctilucent cloud seen from the ISS. Earth's horizon has been deliberately overexposed to reveal the faint cloudtops. "That little diaphanous line you see paralleling Earth's horizon is an NLC," said Pettit. Photo credit: Don Pettit and NASA TV.

Ordinary clouds, which are close to Earth, get their dust from sources like desert wind storms. It's hard to waft wind-blown dust all the way up to the mesosphere, however. "Krakatoa may have seeded the mesosphere with dust in 1883, but that doesn't explain the clouds we see now," notes Thomas. "Perhaps the source is space itself," he speculates. Every day Earth sweeps up tons of meteoroids--tiny bits of debris from comets and asteroids. Most are just the right size to seed noctilucent clouds.

The source of water vapor is less controversial. "Upwelling winds in the summertime carry water vapor from the moist lower atmosphere toward the mesosphere," says Thomas. This is why NLCs appear during summer.

One reason for the recent spread of noctilucent clouds might be global warming. "Extreme cold is required to form ice in a dry environment like the mesosphere," says Thomas. Ironically, global warming helps. While greenhouse gases warm Earth's surface, they actually *lower* temperatures in the high atmosphere. Thomas notes that noctilucent clouds were first spotted during the Industrial Revolution--a time of rising greenhouse gas production.




**Above**: The optimum viewing geometry for noctilucent clouds. Sunlight scattered by tiny ice crystals in NLCs is what gives the clouds their characteristic blue color. [more]

Are NLCs a thermometer for climate change? A telltale sign of meteoroids? Or both? "So much about these clouds is speculative," says Thomas.

A NASA spacecraft scheduled for launch in 2006 will provide some answers. The *Aeronomy of Ice in the Mesosphere* satellite, or AIM for short, will orbit Earth at an altitude of 550 km. Although it's a small satellite, says Thomas, there are many sensors on board. AIM will take wide angle photos of NLCs, measure their temperatures and chemical abundances, monitor dusty aerosols, and count meteoroids raining down on Earth. "For the first time we'll be able to monitor all the crucial factors at once."

Meanwhile, all we can do is wait ... and watch. There's never been a better time to see noctilucent clouds. "During the summer months, look west perhaps 30 minutes to an hour after sunset when the Sun has dipped $6^{o}$ to $16^{o}$ below the horizon," advises Thomas. If you see luminous blue-white tendrils spreading across the sky, you've probably spotted an NLC. Observing sites north of $40^{o}$ latitude are favored.

One more thing: don't forget your camera. According to astronaut Don Pettit, "you can never have too many pictures of noctilucent clouds."

Editor's note: Astronaut Don Pettit's remarks and his pictures of NLCs that appear in this story were first broadcast on NASA TV in January 2003.