

Phenomenal Disaster

America's Deadliest Forest Fire

Kenneth E. Pinkham

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DEDICATION

To my mom Sally Pinkham, whose genuine interest in this story and encouragement gave me the confidence necessary to complete this book.

I miss you and love you always...

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Thanks to my Dad who lives in Door County, a critical thinker who thinks I might be on to something. Also thanks to my Dad, I was able to visit many of the towns that I was writing about, spread out over hundreds of square miles of beautiful Wisconsin. Thanks to Gerry for getting us to Green Island and to John Asher who owns Green Island. Thanks to Peshtigo Fire Museum Volunteers for answering my numerous questions and letting me take photographs. Thanks to Jacki for too many things to mention!

“Here the necessity and the action of time is more important. A storm may be in the vigour of its commencement, when the cause which produced it has already ceased, the greatest circumspection is therefore necessary in treating of such important questions.” J. D. Potter, 1872

THE GREAT FIRE

The Peshtigo Fire

Sunday October 8th 1871 is a day that every American should know about. That evening a fire-storm of unimaginable proportions, in a remarkably short time devastated the lives of thousands of people. Also known as the Great Peshtigo Fire, that name could mislead one to believe that it was a localized event. The fire-storm in Wisconsin and Michigan that began around 9:00 pm was the deadliest natural disaster in American History.



Peshtigo Map published September 1871, one month before the fire. I added the compass legend and highlighted the location numbers.

Many have heard of the Chicago Fire, it began at nearly the same time on that same evening and some writers even discuss them together as one event. For many sources that I found, the Peshtigo Fire is a footnote to the

Chicago Fire. It is hard to imagine the scope and the magnitude of the Chicago Fire which killed upwards of 300 people over two days, burning 3.3 square miles.

The Peshtigo Fire killed more than 1200 people in a few hours while it burned more than 900 square miles in four counties in Wisconsin and Michigan. Historians and researchers would agree that the true number of lives lost can't be known and some suggest it could have been as high 2500 lost. Inhabitants included Belgian, German and French settlers and also an unknown number of native American Indians who populated the entire region.

Writers and researchers have weighed in on the matter repeatedly over the years, some implying that settlers were partially to blame due to their careless logging and industrial practices. In addition to the wood fuel created by farmers and loggers, a moderate drought that year, sporadic smoldering fires, and a cold front (low pressure) apparently is all that was necessary to spawn mega twin fire-storms like the country has never seen.

Years of researching October 8, 1871 have led to this, my first book. My hope is that people will learn about the fire regardless of how they believe it started. One possibility that has not been considered well from what I can tell, seems like a much better explanation. That is the death and destruction could have been caused by a large meteor airburst 10+ miles above Peshtigo Harbor. This makes much more sense after consideration of numerous survivor stories from the burned areas of Peshtigo, Sugar Bush, Williamsonville, Brussels and others, and equally stories from the near misses which were barely spared including Oconto, Marinette, Green Island, Sturgeon Bay, the upper peninsula of Door County, Green Bay and most amazingly Peshtigo Harbor.

If the current explanations are correct then the fires accelerated their own momentum with the help of wood debris left laying around. Sporadic fires suddenly combined simultaneously into two monstrous fires, on both sides of Green Bay, throwing debris five miles over water to Green Island. It does not correlate with survivor accounts which describe a blast before the fire, on both sides of the bay.

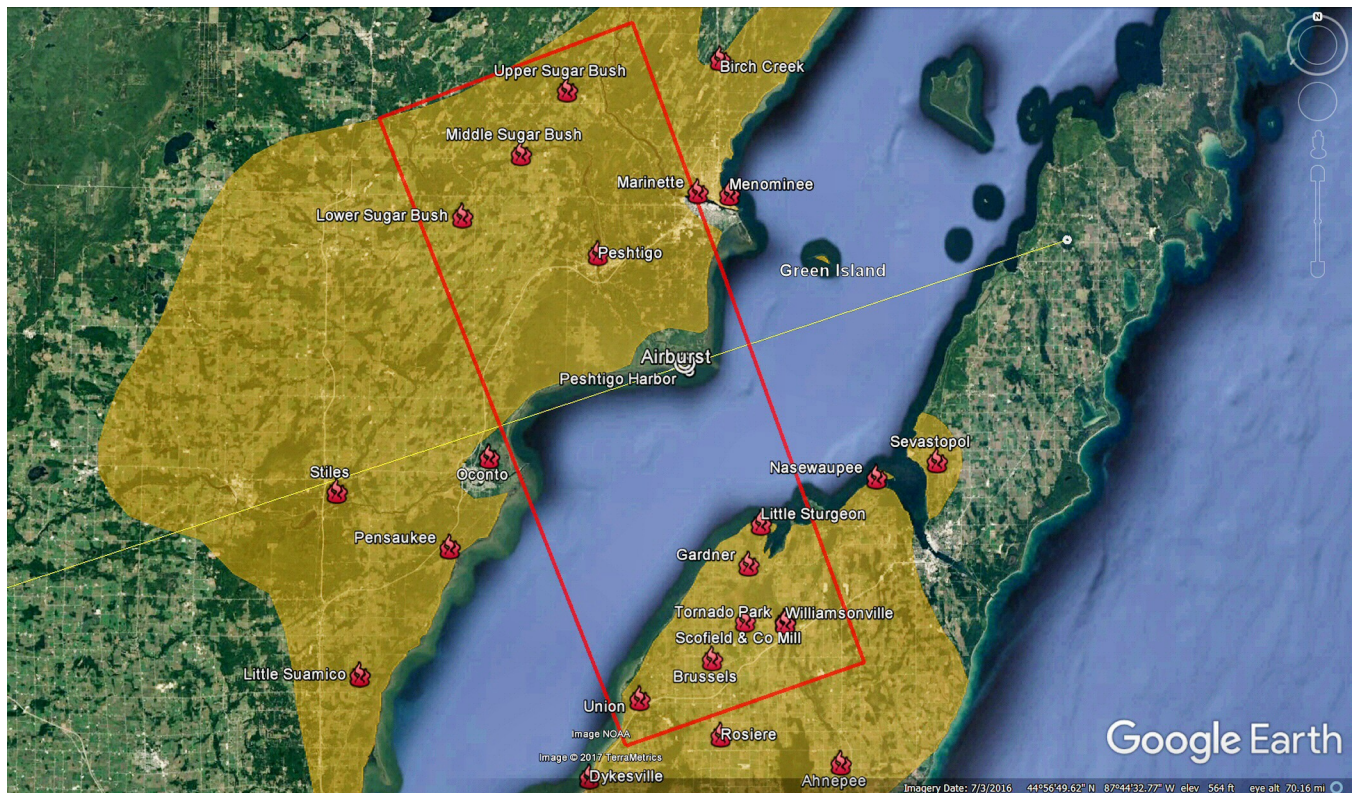


Viewing the October 8th 1871 fire area from a high perspective southeast of Williamsonville, about two miles altitude and heading north. Google Earth Flight Simulator.

The spread of the fire was witnessed from different surrounding locations including Marinette and Green Island. Mary the lighthouse keeper on Green Island said

“The whole shoreline to the southwest was ablaze. Between the clouds of smoke, flames could now be seen leaping high into the sky and racing northward across the still unburned treetops at lightning speeds.”

Southwest from Green Island is Peshtigo Harbor. South and east of Peshtigo Harbor is nothing but water. How do all of the previously burning fires unite at this of all spots? If the fire did race north up the coast then the wind must have been from the south, which is the direction of unburned Peshtigo Harbor and lots of water. Peshtigo is more than six miles inland, is due west of Green Island and northwest of Peshtigo Harbor. Mary's account is substantiated by the testimony of Judge Noyes who witnessed the fire from Marinette, eight miles north up the coast. The accounts of Mary and Judge Noyes are quoted in the next chapter. The next question is, how does the fire spread to or from southern Door County which is southeast across more than nine miles of water?



Google Earth view of northeastern Wisconsin. Shaded area indicates locations that burned October 8, 1871. The rectangle encloses the area where most of the 1200+ deaths occurred. The straight line traces my theoretical trajectory which crosses Peshtigo Harbor and right across the middle of the rectangle.

If you're not familiar with the area then it is probably hard to visualize based on any of the descriptive accounts such as Mary's from Green Island. At least it was for me. The descriptions of distances and directions of towns relative to each other, like in the previous paragraph, can be confusing and does not necessarily paint a detailed picture on the greater scale. If anything could be achieved from this book I hope that it helps others to grasp the true scale, timing and magnitude of what took place within a thirty mile radius of Peshtigo Harbor on October 8th, 1871. Researching this event requires sorting out other fires which occurred in eastern Michigan and also the relatively famous Chicago Fire.

Even though I have my own idea of what happened which I will describe here, I'm more interested in sharing the resources that I used to search for a plausible cause. Some insist that the cause is known, but I believe the official explanation does not stand up to scrutiny considering the destruction. Is there anything in nature that could be this destructive over such vast distances? The answer is yes, an airburst from an exploding meteor is very destructive. Just look at the Tunguska Event which flattened trees for hundreds of square miles in 1908 over a similarly sized area that was about forty miles across. The main problem with meteorite, meteor or bolide theories which have

been proposed, whether from asteroid or comet, is that as far as mainstream science is concerned there is no known mechanism for a bolide, even one as large as Tunguska to ignite fires on the ground.

On a map if we draw a rectangle centered over Peshtigo Harbor, thirty-six miles wide by fourteen miles long it will enclose the areas where most of the deaths occurred. The rectangle is approximately 500 square miles and fortunately one third of that area was mostly uninhabited, occupied by the waters of Green Bay. Peshtigo and Sugar Bush are on one side of the rectangle, about nine miles of water then Williamsonville and Brussels on the other side. What I suggest as possibly the final path of the bolide, a line from Lapham Junction to Thorp Pond cuts through the middle of the rectangle and Peshtigo Harbor.

The rectangle only represents the areas where the most deaths occurred, not the entire burned areas. You would need a shape of more than double that area, at least 900 square miles to cover the entire burned area for this fire. It stretched up the western coast of Green Bay into northwestern Michigan and across from the eastern shore of Green Bay all the way across to the shore of Lake Michigan.

To understand how the destruction that occurred in 1871 can be fully explained by the destructive reach of an expanding airburst aka over-pressure, we have to look at some basic physics. According to an airburst simulation published by Sandia Lab, *"Moving away from ground zero, the outward component of blast wind speed quickly picks up and levels all trees radially from zero point. This phenomenon is known as the Mach stem, where surface winds intensify with distance from ground-zero and further adds to the destruction caused by an airburst."*



Peshtigo Harbor was here! The Peshtigo River flows into Green Bay where large ship piers once stood.

On this large scale various aspects of the blast would reach Peshtigo at different times. The light would be instant but the sound and blast wave would be delayed by dozens of seconds to minutes. If Peshtigo Harbor was ground zero then mach stem should reach Peshtigo, seven miles away in just over a minute after the airburst. Witnesses said that fierce winds came snapping trees then sheets of fire came from the sky and engulfed everything. Rail cars full of wood were blown 100 feet and burned in wide open area near the Peshtigo River. Within the hour more than 600 people in Peshtigo were dead while others were wounded and struggling to survive the night.

Farther out from Peshtigo to the northwest at least 200 hundred people are dead and to the west and southwest of Peshtigo at least another 200 people are dead. Across the Green bay, ten miles southwest of ground zero over 130 more people in Little Sturgeon, Williamsonville and Brussels are dead, while other towns were destroyed in three counties. Since Peshtigo Harbor was under the blast it was not destroyed because there was no debris or flaming debris, just air pressure coming straight down.

At the same time, settlers and townspeople across a 1500 square mile region saw the sky light up through the overcast smoke and thought a fire was coming. Most had escape plans but depending on distance from Peshtigo Harbor most would have had less than a few minutes to respond before the initial wind and then a few more minutes for the fire that followed. In Peshtigo Reverend Peter Pernin witnessed an orange light in the sky, towards the west that he interpreted as a reflection in the clouds of a forest fire on the ground.



View from above Green Island looking towards Peshtigo Harbor, left and Peshtigo, center. This view was about the same as the light tower that was built onto the house.

Ten miles northeast of Peshtigo Harbor surrounded by the waters of Green Bay, Green Island lighthouse keeper, Mary saw a light in the southwest sky through occasional breaks in the overcast, like nothing she had seen before. At that time the bay was calm with a light breeze from the south, however minutes after seeing the strange light they had tornadic winds, tempestuous seas, embers falling from the sky and a three masted schooner wrecked on the shoal. From the island they witnessed the fire burning along the coast to the southwest, spreading north up the coast at incredible speed. Keep in mind that shortest distance from the coast to Green Island is three and a half miles from Seagull Bar peninsula Marinette, but since Marinette didn't burn the closest shore to Green Island is just south of Marinette and is more than five miles of water.

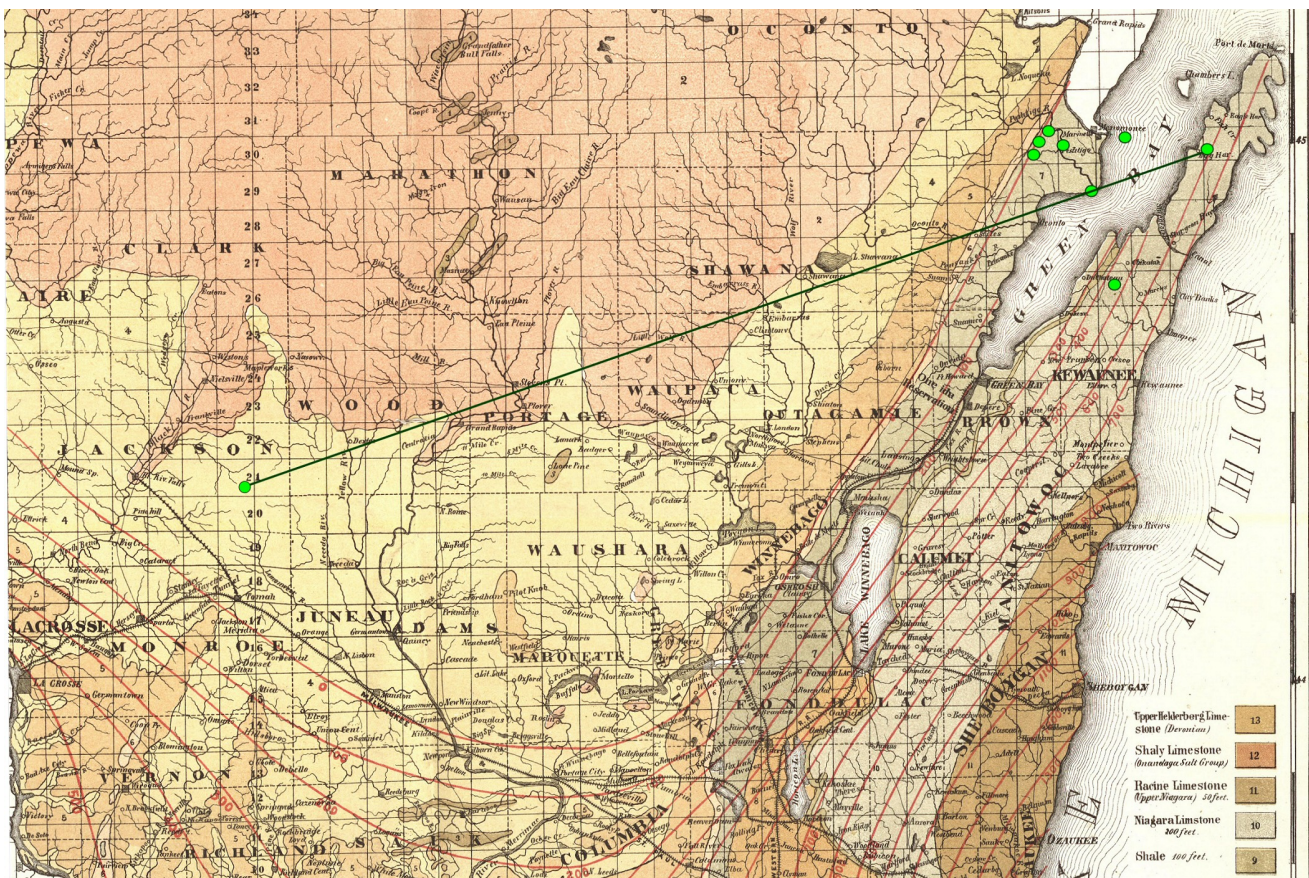
Across ten miles of water to the southwest of Peshtigo Harbor in Williamsonville the churchbell rang for two minutes and then all at once trees were snapping and blowing into piles and then the fire descended from over the

tree tops and ignited everything.

Deforestation by loggers and farmers was occurring on a large scale and has been blamed for fueling the fire into a firestorm which caused so many deaths and so much destruction. Industrial practices like clearing fields for homes, farming, building and manufacturing by settlers also introduced firefighting practices and preparations that were beneficial to all and actually saved many lives. Writers or researchers who propagate the notion that the fires were man-made or somehow intensified by human activity could not know that conclusively. With that in mind I think that everyone should give those early settlers the benefit of doubt.

If an airburst did occur over Peshtigo Harbor in 1871 then there is nothing anyone could have done differently that would have prevented the conflagration. Actions of those brave pioneers were heroic both before and after the great fire. Here is at least one plausible explanation that fits with extraordinary details given by survivors.

The number of square miles that you must consider while trying to understand the Peshtigo Fire is enormous. For instance Upper Sugar Bush (north of Peshtigo), where many deaths occurred is more than thirty miles from Williamsonville (between Sturgeon Bay and Brussels in Door County) where many more deaths occurred. Although I won't be the first person to suggest that a meteor (or comet) was the root cause of the conflagration, I propose some specifics which are testable, but will require future work.



This map was created by Increase A. Lapham in 1869. The green dots which I've added are from left to right; Lapham Junction, Lower Sugar Bush, Middle Sugar Bush, Upper Sugar Bush, Peshtigo, Peshtigo Harbor, Williamsonville, Green Island and Thorp Pond. The line from Lapham Junction to Thorp Pond traces the suspected trajectory.

Wisconsin is proud of Increase Lapham and proudly proclaims him as the Father of Meteorology. Increase Lapham an amateur scientist who is credited as being key in helping to form the National Weather Bureau, which is now known as the National Weather Service. After Lapham investigated the fire he attempted to explain what

he suspected was the root cause to the Wisconsin State Legislature *"We may compare these moving, burning masses of gas with those meteors that are called shooting stars."* The only other scientist consulted via correspondence was skeptical though replying *"Extraordinary claims require extraordinary evidence!"*.

For consideration of plausibility I developed an impact model to better estimate the material, mass, volume, speed, entry angle and path, plotting the last 170 miles of a bolide's flight to determine an approximate size and energy that correlate with the destruction that occurred October 8th, 1871. In the process I found that the pattern of destruction, relative to the large area of flattened trees, is similar to that of the 1908 Tunguska event. There was also consideration of survivor stories from numerous sources including the investigation by Increase Lapham. As the meteor descended from 100 miles above Lapham Junction it exploded 12-15 miles above Peshtigo Harbor and then impacted the forest in northern Door County, now known as Thorp Pond. I believe the impact went relatively un-noticed and no deaths likely would have been caused by the impact into the dense uninhabited forest.



Aerial view of Thorp Pond (center) and the surrounding woods in Door County near Egg Harbor Wisconsin.

Imagine about 18 seconds before impact, 100 miles above the earth a large asteroid entering the stage, 144 miles southwest of Peshtigo. Just seconds before becoming visible, below this point two unassuming roads meet and that spot is currently known as Lapham Junction. Once a railroad junction, the train tracks have been converted to roads long ago. The junction was likely named after Increase Lapham, the father of meteorology. It's curious having found this only after tracing back survivor stories trying to determine a possible trajectory. Coincidental I'm sure, but surprising considering Lapham's involvement investigating the fire and his original conclusion of what triggered the conflagration.

It is not clear how Lapham Junction was named but I'm sure Increase Lapham could have named that spot if he wished since he was a very accomplished mapmaker. You can easily find his beautiful maps from the mid 1800s via an internet search (see previous page). Perhaps he privately held on to his original conclusion presented to the Wisconsin State Legislature and he knew we would figure it out someday. Lapham Junction could be his way of saying I told you so. *"We may compare these moving, burning masses of gas with those meteors that are called shooting stars."*¹ We'll talk more about Increase A. Lapham in chapter 3.

The deadly fires were stoked from previously smoldering fires and driven by blast winds caused by an exploding

meteor miles above Peshtigo Harbor. The over-pressure was the blast and wind that snapped trees and tossed rail cars like they were toys. The deadliest locations had in common fires that had been smoldering in the swamps, between them and Peshtigo Harbor. The smoldering debris from the dried up swamps were plowed outwards from Peshtigo Harbor by the force of the blast and rained down on helpless towns.

If an airburst did occur then the air might have been spiked with very fine (colloidal) magnesium and iron dust. The particles that make up the dust are known as MSP which stands for meteoric smoke particles. NASA has studied MSP dust, which is always present in our atmosphere. Using sounding rockets with sensitive detectors NASA found MSP to be dominantly composed of positively charged particles of magnesium and iron. Chapter four primarily focuses on research about meteoric smoke particles.

Several meteor airburst greater than 1 kiloton energy are detected in our atmosphere every year. The MSP smoke is so diluted and widely dispersed that it is usually benign. However with an explosion of several megatons like the one that occurred over Tunguska Russia in 1908, MSP dust could play a factor on the ground especially in dry conditions and where fire was already present on the ground. To see how magnesium and iron dust would react to fire look up magnesium fire starter and fire poi which is burning steel wool.

The fire came from Peshtigo Harbor but did not burn the town of Peshtigo Harbor. It swerved to miss Marinette, yet burned Menominee which is past Marinette and across the Menominee River into Michigan rapidly spreading for dozens of miles up the coast. Oconto and Sturgeon Bay also both barely escaped destruction. Though they are on opposite sides of the bay they have something in common with Marinette. None of the three towns had smoldering forest or swamps between themselves and Peshtigo Harbor. From ~13 miles above Peshtigo Harbor the blast wave traveled mostly over water to the spared towns of Oconto, Marinette and Sturgeon Bay.



Tornado Rd is about one half mile down the road from Tornado Memorial Park, Door County Wisconsin.

An obvious problem considering the current explanation is that people survived right next to people who perished.

This fact alone should make it highly unlikely that it was two separate five mile wide tornadoes of fire, one on each side of the bay, over ten miles apart. That is what one often cited 2003 book by Denise Gess and William Lutz titled *Firestorm at Peshtigo* seems to suggest.

The explanation (as of 2017) that is published on the weather.gov website is in part the following by Tom Hultquist in a story titled *The Great Midwest Wildfires of 1871*;

“The fire in Peshtigo resulted from a number of factors, including prolonged drought, logging and clearing of land for agriculture, local industry, ignorance and indifference of the population, and ultimately a strong autumn storm system occurring in the presence of conditions supportive of a large, rapidly-spreading fire.”

From his words I'm left with the notion that humans were partly to blame. The author goes on to describe the accompanying weather “*reanalysis*” maps created from data collected in 1871.



Increase A. Lapham posing for photo while examining a meteorite that was found in Wisconsin.

Here is how an author from TIME magazine website explained the event.

“Although no direct cause was ever conclusively determined, prolonged drought and high temperatures in the Upper Midwest led to fire-prone conditions. Additionally, the introduction of extensive farming, logging and industrial practices in the area made for large clearings and increased the likelihood of sparks. Whatever the cause, much of Wisconsin and Upper Michigan were engulfed in firestorms — a fire that is so strong it creates its own wind system and becomes a tornado-like column. At one point the roaring blaze reportedly jumped several miles over the waters of Green Bay.”

In the article by Everett Rosenfeld from June 08, 2011 he states that no direct cause has ever been determined, but then suggests that farming, logging and industrial practices increased the likelihood for sparks. Yet another story that suggest inhabitants were a likely factor that contributed to the great intensity of the fire.

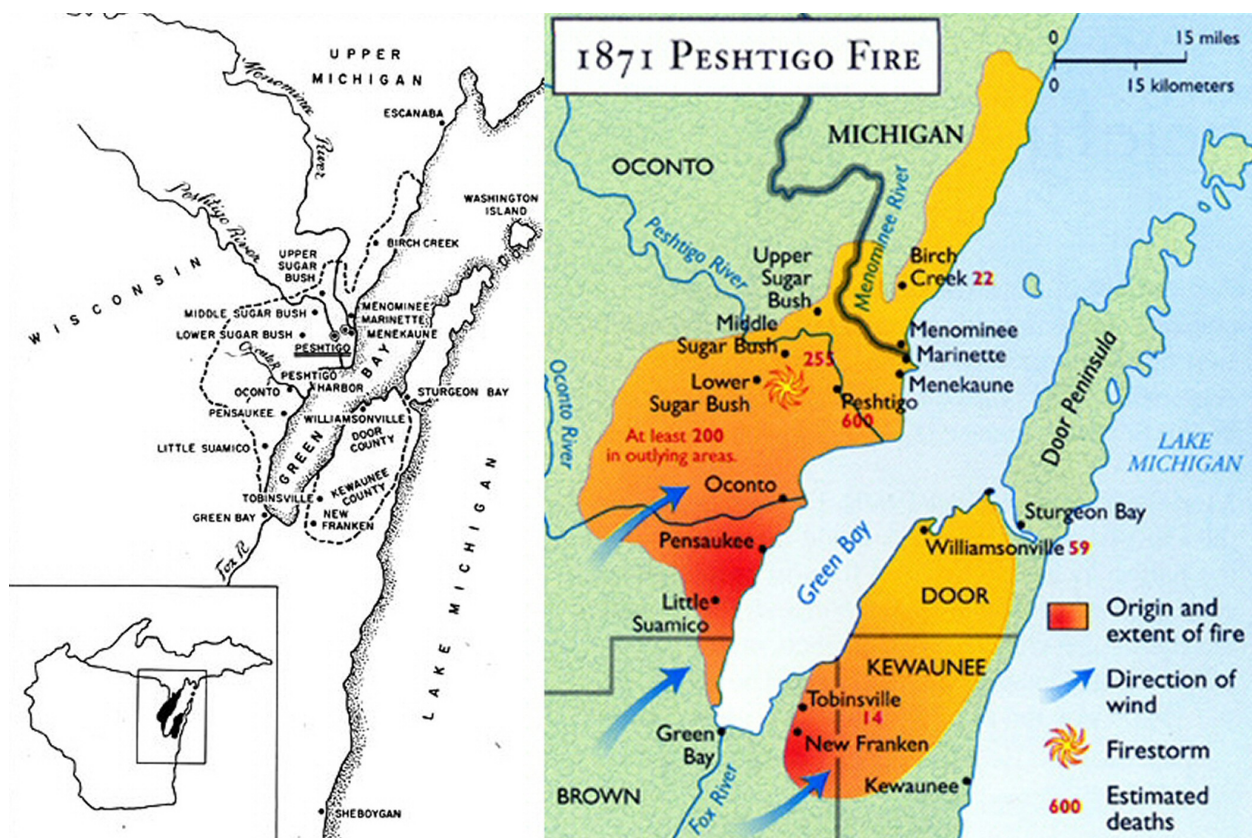
Increase Lapham was not the only person of significance who believed that the carnage on that night arrived from space. Ignatius Donnelly was a congressman, fringe scientist and writer who wrote an 1883 book titled Ragnarok: The Age of Fire and Gravel. In this book he postulates that the Chicago Fire and the Peshtigo and Michigan fires were all caused by Biela's Comet which had mysteriously gone missing. Donnelly asks his readers;

"Did anything out of the usual order occur on the face of the earth about this time?"

Answering his own question he continues,

"Yes. In the year 1871, on Sunday, the 8th of October, at half past nine o'clock in the evening, events occurred which attracted the attention of the whole world..."

Although there really was a missing comet (or pieces) that might very well have struck the earth, his claim that gas from the comet survived re-entry without being burned or absorbed or diluted high in the atmosphere was not convincing. In his version of events, burning gas from pieces of Biela's Comet, entered the atmosphere sparking and fueling the fires to their unprecedented ferocity and causing some of the phenomena that was noted on that night. Donnelly believed that a comet was *"a solid nucleus, giving out fire and gas"*. Mainstream scientists have probably never suggested comets *"give out fire"* in space. His theory fails to describe a plausible link between a meteor, high in our atmosphere and fires on the ground.



Variations of Tiltons early fire map illustrating the burned areas.

In 1871 Peshtigo Harbor was a bustling town of about seven-hundred people situated on the western coast of Green Bay. It is important to note that Peshtigo and Peshtigo Harbor are more than seven miles apart. Time has erased almost all traces of the former town of Peshtigo Harbor. Significant buildings, railroad tracks, bridges and piers are all long gone and only a handful of newer residential houses can be found nearby, west of the harbor along the coast. Based on the numerous aerial images of Peshtigo Harbor dating back to 1938, the coast to the

east of the harbor has changed considerably due to lake and river erosion and changing lake levels.

One detail that I discovered actually increases the burn area relative to what is typically shown on maps. This new location is on southwest section of the upper peninsula of Door County. This represents another large span of water, over one and one half mile across the bay from Little Sturgeon. It is more coastline that burned that night and that coast happens to face Peshtigo Harbor and the other fires.

There are only a few different fire damage area maps that have been re-published over the years. The most popular seem to be two maps, one from an 1800s newspaper story and a newer 2003 version by Gess and Lutz that appears to copy the burn area from the older map graphic. In both versions (and others) there is no burn area indicated on the upper peninsula of Door County.

In 2016 I happened to notice a small sign with the name Sevastapol on it while driving through. Realizing that I had seen that name in a lists of towns that burned on October 8, 1871, I also realized that Sevastapol was not on any of the illustrative maps that I had found, mainly the two that I mentioned in the last paragraph. Sure enough, when I searched through my sources I found that Sevastapol did report property loss.

One reason this is important is because it was already hard to explain how the fire jumped the waters of Green Bay, which it is now widely accepted that it did not. But then what are the odds that such an historically unique event could occur simultaneously and independently of each other, ten miles apart. If you refer back to the map on the third page of this chapter I have included the burn area based on the detailed description that I found.



View of Sevastopol shore that burned from about .75 mile out, view entering Sturgeon Bay from Green Bay.

There was only one property damage report for Sevastapol that I found, however further searching turned up a fairly detailed description of the burned area. It seems that due to the sparse population of the upper peninsula this relatively small area of about nine square miles (5500+ acres) that burned might have seemed insignificant.

I used details from a Door County Advocate story October 12th, 1871 to update the burned area on my map;
*“About 9 o'clock Sunday night a terrible Tornado swept down from the southwest thru the western side of the county, carrying death and destruction in it's awful career. Beginning at the Belgian settlement in Brussels, it swept through the towns of Union, Gardner, the western part of Forestville, Nasewaupee, **the western part of Sevastopol and down the east shore of the bay.**”*

For me, this new detail about Sevastopol raises additional questions and introduces more complications for the current accepted explanation of how the fire started and progressed. This also adds another six miles of coastline that burned areas in addition to the one-hundred plus miles of coast that burned on the other two shores. The Sevastopol coastline also happens to face towards Peshtigo Harbor which could support my idea.

I hope this chapter helps to understand the enormous scale of the devastation and the approximate locations of the towns most affected by the conflagration of October 8th, 1871. Now we can hear the human stories...

TORNADO MEMORIAL PARK

Door County, Wisconsin

If you are heading southwest from Peshtigo you would reach Peshtigo Harbor after about seven miles and if you continued that direction across the waters Green Bay you would reach the opposite shore after about ten miles. Passing Little Sturgeon and Gardner about six miles inland, in 1871 thrived the village of Williamsonville. From the bridge in Peshtigo to Williamsonville is more than twenty-two miles. From many different sources, here are some of the heroic and tragic stories that I found, starting with the furthest towns from Peshtigo.



A small park is dedicated to the former village of Williamsonville. In addition to this monument, the original well-site has also been memorialized with a separate monument in Door County, Wisconsin.

Today you can find a small memorial park at the well site with several plaques,

"Here was the village of Williamsonville, with a population of 77 persons on October 8, 1871. The village was blotted out by a tornado of fire. Sixty persons sought refuge in an open field surrounding this spot and were burned to death."

The site known as Tornado Memorial Park is just over nine miles southwest of Sturgeon Bay. Areas north, east, south and west of Williamsonville and in the neighboring counties Brown and Kewaunee to the south were also affected by the fire, total death toll for this entire area was upwards of one-hundred and thirty people. The burned area stretched across the lower half of the peninsula which is surrounded by the waters of Green Bay to the west, Sturgeon Bay to the North and Lake Michigan to the east.

Williamsonville, Wisconsin, Thomas Williamson

In Door County, only two of eleven members of the Williamson family, Thomas and his mother survived the night of October 8, 1871. Thomas later detailed his account of events which were included in a book by news reporter Frank Tilton who had toured the devastated area.² Excerpts from Tilton's work were presented to the Wisconsin State Legislature in 1872.¹ Thomas survived the the most unbearable moments of the fire by laying face down in a sixteen foot bed of charcoal and ashes from a log pile they had burned the previous spring. After the fire passed, with the clothes burned off his back and his feet burned he found his mother who had managed to survive under the shelter of a wet blanket. She had huddled in a clearing with dozens of other folks who were found afterward by Thomas, as heaps of dead when he discovered only his mother still alive.²



Tornado Memorial Park, the former site of Williamsonville "Well Site - During the fire of October 8, 1871 this well site was used by seven persons as a place of refuge. The last man to the well found the wood curb on fire. After tearing off the curb he entered the well and pulled a blanket over the opening. Five of the seven survived."

According to Thomas ten days before October 8, their clearing of ten acres was surrounded by fire from one half

to one mile from the edge of the clearing. The fire was a back-fire, intentionally set during calm winds to create a buffer around the settlement. A small fire rekindled on the afternoon of October 8th and was quickly doused. Quantities of water were stored in areas of potential flare ups.²

“In a few minutes after that there came a heavy puff of wind, the trees fell in all directions, and I saw the reflection of a big fire south of us. I thought it was a mile and a half off. In less time than it takes to write this, there came another heavy gale, and the flames came rolling through the woods up to the back of the barn.”²

A considerable amount of time passed between the first winds that blew down trees and when the extreme heat became unbearable and he described the first winds as two gales. It was during the second gale that the fire quickly reached the settlement. Thomas then went to the store to alert the men, then went to the mill and doused some fires, then he meets up with his brother John Williamson who had become excited. He tells John not to get excited and his feeling was, *“At that time I did not think our lives were in danger.”²*

Thomas then went to his mother's house and with the help of some other men he attempted to extinguish a fire in a wood-pile that connected the houses but they soon gave up. Knowing that the houses would soon be in flames he told his mother and the other women to put on men's pants and prepare to evacuate. Thomas then headed to the mill, where he met up with John again and sees that no buildings are on fire yet. Thomas told John that Mother's house will soon be on fire and that they should save their lives. Thomas then went to the boarding house, where his Mother and the other women had already fled to. Thomas suggested that they all grab wet blankets and follow the blacksmith to the potato patch and they did. Thomas gave his wet blanket to his sister because she didn't have one.²



Aerial view of the southern coast Door County, west of Williamsonville and south of Little Sturgeon. Peshtigo and Peshtigo Harbor is on the left, about nine miles across Green Bay.

After making it to the field himself he saw about thirty-five people huddled in the center of the field and six or seven men pacing around but couldn't tell who anyone was. He decided to run about eighty feet through the fire and spotted the bed of ashes where he ended up.²

“I lay down there on my face. The smoke was so thick that I thought I could not live. I rolled on my back and side and rooted with my face in the ground for air. Every time the wind blew I thought was my last. The trees fell

around me every minute, and I thought they would fall on me. One top fell within ten feet of me. My feet were burning, and my vest caught fire; I could feel the fire burning my back. Twice I put my hand on my back and tried to wring the cloth of my vest to put the fire out. Then I thought I would roll into the big blaze and die quick. Still I lay there; I think I became unconscious.”²

During the most intense heat of the fire Thomas said “Every time the wind blew I thought was my last.”, suggesting the wind was not steady, and also, he said wind, not gale as before. The strongest winds should have occurred when the fire was most intense and should have been steady, if tornado.

“The general phenomena of the fire, so far as we can learn from survivors, were not very different from those on the west shore. There was the same intense heat that melted the nails in kegs so that the metal run like water, and the same appearance of combustion in the air.”²



Woods near the former site of Williamsonville in Door County, Wisconsin.

Aid Sent From Sturgeon Bay, Wisconsin

Relief efforts were quickly launched from surrounding communities that barely escaped the fire. The people of Sturgeon Bay sent men and supplies to the aid of Williamsonville. They didn't have to wait for news to arrive because they had seen the enormous fire to the south. The following account of the relief efforts of Sturgeon Bay is preserved by the work of Hjalmar Holand is unbelievable what they encountered.

“We started for the tornado district with a mule team well loaded with supplies for the destitute ones. The road was filled with burnt and burning trees and at about 4 o'clock in the afternoon a distance of only four miles had been made toward Williamsonville. It was evident that to get the team to Williamsonville (six miles distant) would consume the time of at least another day; hence a portion of the crowd loaded themselves with what they could carry, and set out on foot, while the team retraced its steps. The journey was dreadful! The odor of wild birds and animals, together with that of hogs, cattle and horses that had been roasted alive, mingled with the dense smoke

of burning timber, was almost stifling. Some portions of the road were blocked with trees nine deep - burning and smoldering, making the journey both slow and difficult.”³

The reason that I began with Williamsonville instead of Peshtigo is to emphasize the enormity of what took place. More than twenty miles from Peshtigo, with nearly ten miles of water between, both towns suffered the same fate at the same time. Nothing like this event has ever occurred in U.S. history, so it is hard to believe that it happened twice at the same time. With more than one-hundred miles of Wisconsin coastline destroyed, not counting rivers, the fire tornado explanation gets a bit soggy in my mind.

Some authors have suggested that a cyclonic weather system created the winds that whipped up the fire tornadoes (five miles wide!) which then generated even bigger winds, or that the cyclonic system combined many smaller fires into two large fires. One major problem with that explanation is that there were no unusually strong winds to begin with. At 9:00 pm Sturgeon Bay reported winds of only 19 kph (12mph)⁴ and others in the region, like the lighthouse keepers on Green Island, who were closer to Peshtigo, reported calm conditions at 9:00 pm. Another problem with the fire tornado explanation is that according to most survivor accounts, the tornadic winds preceded the fire.

Peshtigo, Wisconsin “Big” John and Jennie Mulligan

Big John had just carried his wife Jennie across the bridge in Peshtigo right before it collapsed with so many people on it.



Triptych mural on the prominent back wall of the Peshtigo Fire Museum by Luanne Harff-Burchinal July 4, 1967.

“After dark on the very warm night of Sunday, October 8, 1871, many people in Peshtigo had either retired to their beds for a restless sleep or were sitting on the porches hoping for a cool breeze. Suddenly, the wind grew stronger and became very hot. Startled folks saw a frightful orange glow in the distance which grew quickly into a low roaring sound. The alarm spread through Peshtigo. Panic and chaos mixed with frantic digging to bury family valuables before the fire struck. It came far faster than anyone could have imagined.”⁵

“Big John told Jennie that they had to make it to the river. They both took off out Hale's boarding house door into the maelstrom of running people and flaming debris. The searing air was moving at tornado speed and Jennie ran as fast as she could, but she was no match for the long muscular strides of her husband, who soon was ahead of her by yards. John realized Jennie had fallen behind and ran back to fetch her. He grabbed her wrist and pulled her along behind him as he ran, but she was still not able to keep up and she fell. Scooping her up in his arms, the ex-boxer ran down the dirt road toward the bridge. Half a mile down the road he crossed the burning span over the river, which collapsed within minutes of their crossing as a large number of people were on it. All the buildings of the village were now aflame. As John carried Jennie down the steep, 30 foot bank, to the mudflats along the river's edge, they were nearly deafened by the thunderous roar of the inferno and blinded by the smoke and lightning it caused.”⁵

Big John and Jennie made their way down to the river and both survived. After the fire, in the early morning hours of October 9th, Jennie helped the injured and Big John set off towards Marinette, six miles northeast to find help.⁵ Due to the masses of trees blocking the road the journey was treacherous. Big John returned later that same day with help.⁶

“As the day wore on, help came in slowly from the northward. Several railroad gangs had escaped annihilation, and one gang, led by an ex-prize-fighter named Mulligan, came with promptness and efficiency to the rescue, through miles of burning prairie and blockaded roads.”⁶



View of the Peshtigo River from the bridge looking north, memorial park on the left.

Peshtigo, Wisconsin, Emina Johnson

Seventeen year old Emina Johnson described the same horrible chaotic scene of people from both sides of the river fleeing to cross the bridge, she also watched it collapse from the weight. She viewed the scene from a bluff overlooking Peshtigo just prior to making her way to the river with eight year old Fred Williams in her guard. Emina's story and the stories of other survivors are revealed and preserved through the immense work of Joan M. Jensen ⁷ in her book *Calling This Place Home*.

“By the time Emina and her sweetheart returned home from church that October evening, they could see red spots rising and falling on the horizon. The air was deadly still —almost ominous. They heard a low rumble from the southwest. Villagers soon crowded into the home to rouse Sheppard, who had gone to bed early, exhausted from fighting forest fires the week before.”⁷

Emina also spoke of previous fires and dry conditions, with the insight that her boss was William Sheppard who was the assistant manager of the lumber mill was also in charge of the firefighters. Based on the location of the lumber mill and boarding house the view from bluff was towards the west.

*"The red spots on the horizon quickly lengthened into tongues of flame borne on what seemed to be a tornado. Great balls of fire shot through the air, followed by huge burning logs. Villagers had approached the earlier fires with grim determination to save the village, but fighting this fire seemed impossible. They ran for the river."*⁷

*"From the bluff, Emina and Fred watched the villagers below as they attempted to escape the firestorm. People clung to logs and booms in the water as tongues of flame and burning logs showered down on them. The big boarding house shook on its foundation. That was all Emina saw, for Sheppard ordered her to take Fred to shelter under the river bluff. After burying a gun, a violin, and silverware, the two men joined them."*⁷



Men surveying what remains of a factory next to the Peshtigo River.

Peshtigo, Wisconsin, Writer

Edger J. Goodspeed (1833-1881) was a Chicago Clergyman and fire historian who toured the burned areas shortly after the fires, documenting survivor stories and his own observations.

*"The noise grew in volume, and came nearer and nearer with terrific crackling and detonations. The forest rocked and tossed tumultuously; a dire alarm fell upon the imprisoned village, for the swirling blasts came now from every side. In one awful instant, before expectation could give shape to the horror, a great flame shot up in the western heavens, and in countless fiery tongues struck downward into the village, piercing every object that stood in the town like a red-hot bolt."*⁶

"Rushing to the river from this direction [east] the swirling blast met the victims full in the face and mowed a

swath through the fleeing throng. Inhalation was annihilation. Scores fell before the first blast.”⁶

“Although the onslaught of fire and wind had been instantaneous, and the destruction almost simultaneous, the fierce stifling currents of heat careered through the air for hours. These Currents were more fatal than the flames of the burning village.”⁶



This was all that remained of the railroad yard in Peshtigo.

“The tornado was but momentary, but was succeeded by maelstroms of fire smoke, cinders and red-hot sand. Wherever a building seemed to resist the fire, the roof would be set whirling in the air, breaking into clouds of flames as it fell. The shower of sparks, cinders and hot sand fell in continuous and prodigious force, and did as much in killing the people as the first sirocco that succeeded the fire.”⁶

“On the bank of the river fish killed by the lusting flame are still to be seen, which the day after the fire were soft and white and unwounded.”⁶

“The timber land, much of it very valuable, had been ravaged by previous fires and looked very desolate; but the pathway of the great fire, which swept up from the south on that memorable Sunday night, presents a heart sickening appearance. From two to four or five miles wide in places, and extending north and south indefinitely, so far as I could see, forests, fences, barns and houses were swept away.”⁶

Five Miles From Menominee, Michigan

Joan Jensen also shares a story from a woman about a sawmill worker who survived seven miles north of

Peshtigo, five miles northwest of Menominee. According to the sawmill survivor they were in the process of fleeing a fire from the direction of Peshtigo, had just left their camp in a wagon when the *"tornado that preceded the fire"*⁷ came from the direction of Peshtigo and lasted for several minutes. They survived the winds by sheltering along a creek bank before getting back in their wagon and returning to camp and then to a pond. This must have taken several minutes. Only then were they directly threatened by the approaching fire.

*"One sawmill survivor told her that he, too, first heard a distant rumbling. It sounded like the roar of breakers or of a railway train passing through hilly country, at times dying away and again increasing to such violence that the windows shook. Then fine cinders began to fall. ...This crew told him the town of Peshtigo was probably burning, judging by the glare and the awful fire raging in that direction."*⁷



What remains of building and railroad cars in Peshtigo.

*"They planned to take a wagon to the village of Menominee, another five miles away, but just then the tornado that preceded the fire crossed the river and swept toward them, breaking down the forest, twisting off huge trees by the roots and laying them flat in all directions. Instead of fleeing in the wagon, all took refuge under a high stream bank. In about two minutes the tornado swept over without harm. They went back to the camp to collect valuables and then returned to the pond. Balls of fire as large as a person's head began to shoot like bombs from the coming fire. Soon the balls were falling all around, and a hundred fires blazed in the clearing. The balls did not fall directly from the sky but shot over from the woods in a parabola, like a shell fired at short range. They dashed pails of water over each other. Then, the survivor wrote, "a wave of fire over a hundred feet high came rolling through the woods, lit up everything with a fearful glare, reared its awful crest for a moment towards heaven and then swept like lightning in huge tongues of flame across the clearing."*⁷

Other survivors in Peshtigo said fierce winds came snapping trees. Rail cars full of wood were blown 100 feet and burned in wide open area near the Peshtigo River, great pine forests were leveled, sheets of fire came from the sky and engulfed everything.⁸

Sugar Bush, Wisconsin

The Sugar Bush was a large farming region dominated by maple trees which were tapped by settlers and natives to produce syrup. The region was home to the communities known as the Upper, Middle and Lower Sugar Bushes. The large area of settlements and farms spanned more than eleven miles from north to south, about ten miles inland from the bay. About nine miles west of Peshtigo was the Lower Sugar Bush township. Five miles northeast of Lower Sugar Bush was the Middle Sugar Bush and between the two communities they suffered at least 200 fatalities. Six miles northeast the Upper Sugar Bush also suffered at least 200 fatalities.⁷



No Place To Hide

“There crews found 241 burned bodies, almost half of them children. Women who worked at some sixty logging camps scattered around Peshtigo also died.”⁷

“Much has been said of the intense heat of the fires which destroyed Peshtigo, Menekaune, Williamsonville, &c., but all that has been said cannot give the stranger even a faint conception of the reality. The heat has been compared to that engendered by a flame concentrated on an object by a blow-pipe, but even that would not account for some of the phenomena. For instance, we have in our possession a copper cent, taken from the pocket of a dead man in the Peshtigo Sugar Bush, which will illustrate our point. This cent has been partially fused but still retains it's round form and the inscription upon it is legible. Others in the same pocket were partially melted off, and yet the clothing and the body of the man was not even singed. We do not know any way to account for this, unless, as is asserted by some, the tornado and fire were accompanied by electrical phenomena.”⁹

Lower Sugar Bush, Wisconsin, Alfred Griffin

Many survivors witnessed a phenomena they described as fire-balloons. Dark balloon shaped clouds of dust that descended at great speed and burst into flames upon contact with the ground.

“When I heard the roar of the approaching tornado I ran out of my house and saw a great black balloon-shaped object whirling through the air over the tops of the distant trees, approaching my house. When it reached the house it seemed to explode, with a loud noise, belching out fire on every side, and in an instant my house was on fire in every part.”⁴

Birch Creek, Michigan

A small community Twelve miles northeast of Peshtigo, seventeen miles north of Peshtigo Harbor.

“Near Marinette at Birch Creek, a settlement of about forty families, every building burned and twenty-two bodies were later identified. As in other places, families that tried to outrun the flames died.”⁷

“One woman recalled that the great forests lay row after row, as though cut with a scythe, their tops pointing north. Near Birch Creek, she said, the fire burned so deeply into the peat bogs near the river that smoke came up through the snow that winter and the bogs were still smoking the following summer.”⁷



Sharp shoal off Green Island where the three-masted schooner George L Newman ran up on October 8, 1871.

Green Island, Wisconsin, Lighthouse Keepers

Samual Drew and his family survived on Green Island and had a unique perspective of the events of that fateful evening. Ten miles northeast of Peshtigo Harbor, five miles off the coast in the bay, Samual's wife, Mary Drew saw a glow in the southwest sky through occasional breaks in the overcast, like nothing she had seen before. At that time the bay was calm with a light breeze from the south, however within minutes after seeing the strange light they suddenly had tornadic winds, tempestuous seas, embers falling from the sky and a three masted schooner wrecked on the shoal. From the island they witnessed the fire burning along the coast to the south, spreading north up the coast at incredible speed.¹⁰

“The early evening of October 8th was quiet. The lake was still and there seemed to be a light breeze from the

south, which afforded a bit of relief from the ever present smoke.”¹⁰

*“As she was putting the younger children to bed on the second floor, after evening prayers, Mary thought she noticed an unusual orange glow on the very distant shoreline to the southwest. With the smoke, it was faint and occasional, so she thought at first it might be a reflection or mirage, but it was the first time she had seen such a thing. Not much later, the wind grew stronger and became hot. It stung the lungs of those outside tending to the last chores of the day and soon, all those awake were watching the crimson shore through breaks in the smoke.”*¹⁰

*“The whole shoreline to the southwest was ablaze. Between the clouds of smoke, flames could now be seen leaping high into the sky and racing northward across the still unburned treetops at lightning speeds. Burning embers began filling the sky over the island and dropping onto the wooden shingles of the lighthouse and outbuildings. ...By this time the entire shoreline was in flames and the roar of the searing winds could be easily heard inside the brick building. Tornadic winds swept over the island and smoke so thick it was almost impossible to breath. The burning ash was now large chunks of burning timber carried on the ferocious winds.”*¹⁰

*“In the midst of it all, the light was virtually invisible to boats in the Bay. At 9 p.m. that night, the three-masted schooner GEORGE L NEWMAN ran up on one of the sharp shoals off the island, tearing it's hull and taking on water in the now tempestuous waves.”*¹⁰



Nasewaupee shore that burned, view from about .75 mile out, entering Sturgeon Bay from Green Bay.

Little Sturgeon Bay, Wisconsin

From *History Of The Great Fires*, this account from Goodspeed speaks to the large scale suddenness of the fire. Little Sturgeon Bay is on the west coast of the Door County Peninsula, about four miles northwest of Williamsonville and about seventeen miles southeast of Peshtigo.

“A friend, who was in a sailboat on Little Sturgeon Bay, describes the fire blowing off the shore as terrific, so much so that trees on an island about half a mile from shore were set on fire, and the island burned over. He says

that after the fire he could have picked up a yawlboatful of birds in the bay, that had gotten burned in their flight, and dropped into the water.”⁶

Marinette, Wisconsin, Judge Noyes

Judge Noyes account was submitted to the Wisconsin State Legislature.¹

“On the night of the fire, we watched, with intense interest the progress of the conflagration as it swept by Marinette, the edge of the main tornado passing to the west and northwest of us, and within about fifty rods of where we stood. From the ground to hundreds of feet above the tree tops, seemed at times to be a mass of sheeted flame, rolling in tremendous billows, and passing with a continuous roar, loud as the loudest thunder or artillery! Beyond, and ahead of the main volume of flame, it seemed as if whole acres of flame would flash out in the air almost instantaneously, lighting up the country with a fierce lurid glare.”¹

“On the village plat of Peshtigo, that was left a seared and blackened ruin, it was observed that in several instances metals were melted in the open streets, and apparently at some distance from anything combustible.”¹



Burnt pier pilings on Menominee side looking towards Marinette (right). Green Island is on horizon to the left.

Marinette, Survivor

Another account by a Marinette survivor from a newspaper article.

“Standing out on the Peshtigo road, we were a witness to the awful scene. The fire swept through the swamp and destroyed several out buildings ... At this time the direction of the wind changed rapidly blowing from several points of the compass alternately. First from the south-west, then from the west, then from the north-west, then back again to the south, during which time we were visited by a series of whirlwinds which showered cinders and sparks in every conceivable direction.”¹¹

Up to this point the immense area involved and the short amount of time, less than six hours, are difficult to imagine. From Williamsonville to Birch Creek is about thirty miles. From those two towns you could go west sixteen miles to form a 480 square mile rectangle that most of the twelve-hundred deaths occurred within. That was the true size of the event that occurred at Tornado Memorial Park. The burned area was much larger than that, greater than 800 square miles.



Keeping the story alive is the Peshtigo Fire Museum located in Peshtigo Wisconsin.

Peshtigo, Wisconsin, Reverend Peter Pernin

Reverend Peter Pernin survived the night by making it to the river. In 1873 his story was published as a book with his hopes of raising money to help rebuild the church in Peshtigo.¹² The book is a great insight to the human endurance, suffering and loss on that night. His descriptions are detailed however due to his writing style the story jumps around making the exact sequence of events hard to follow. The version that I used is from the University of Wisconsin Digital Collection.¹²

What Caused The Fire?

Reverend Pernin's frequently cited account is the most popular and has been used by researchers to form an opinion of what transpired October 8, 1871. A good example of this is an in-depth 2004 article in *Fire Management Today*, U.S. Forest Service by Hutch Brown "*The Air Was Fire*": Fire Behavior At Peshtigo In 1871, cites Pernin numerous times. Brown points out that the first version of Pernin's account was compiled by F.B. Hough who "*reprinted or summarized reports on the Peshtigo Fire by Father Peter Pernin (1874)*". The article discusses the various theories that have been discredited over the years and forwards the conclusions of modern researchers which I have also cited.¹³

"According to Haines and Kuehnast (1970), the low-level jets had a "strong anticyclonic shear." Resulting turbulence would have mixed the lower atmosphere, jolting the region's smoldering fires to life and driving them together..."

The erratic cross-currents make burning gases roll and spin, forming fiery funnels of enormous energy."⁵⁰

Before fleeing to the river Reverend Pernin rushed back into his house one last time to save his dog and the sacred chalice when he noticed a *"strange and startling phenomenon"*. He observed clouds of sparks that blazed with a detonating sound and flew from room to room. This detail suggests that there was some spontaneously combustible element present in the air, which is not consistent with an approaching forest fire. The *"startling phenomenon"* is plausibly explained in the MSP chapter.



Painting at Peshtigo Fire Museum by Gustav Rehberger. Date unknown, likely possibly mid 1960s.

Based on Pernin's account, what doesn't make much sense, as for the tornado of fire, low grade tornado or swamp gas fueled explosion theories is that during his flight to the river after 9:00 pm, which he said was typically a six minute walk, he encountered gale force winds and dead bodies. He described these winds as *"continually revolving circle of opposing winds, cleared the atmosphere"*¹², which is not very consistent with a large firestorm moving towards Peshtigo. If the winds were fire generated then they should have been rushing only towards the fire, not away. If an approaching fire had spun a fire tornado from a distance as has been suggested, that would have required an immense amount of heat on the ground in Peshtigo at that moment.⁴ The problem is according to Pernin the heat did not become unbearable until about hour later when he and others entered the river.

Reverend Pernin also described the month leading up to the fire, he tells of some recent close calls that he and Peshtigo had with fires. There had been fires in all directions from Peshtigo. One fire nearly devoured Peshtigo just two weeks prior to October 8th, on September 24th, but it was bravely fought off for two days by the townspeople and company crewmen.

"The wind had suddenly risen and was blowing a gale from the northwest. The fires in the timber were burning

more fiercely than ever, and were approaching the river directly opposite the factory... But now a new danger arose. The fires to the west of the town were approaching rapidly, and it seemed that nothing short of a miracle could save it from utter destruction. A cloud of hot, blinding smoke blew in our faces and made it extremely difficult to see or do anything; still prompt and energetic means were taken to check the approaching flames. “¹² September 24, 1871

The people of Peshtigo were a sufficient force to protect life and property when it came to defending against a fire driven by “*sustained gale force winds*” on September 24th 1871. Burned trees were felled and doused while the town soon returned to business as usual.¹² Due to the many close calls most families had escape plans and supplies prepped for speedy evacuation. They had the tools and manpower to fight off the gale force wind driven forest fire and as a result of previous fires they had a significant burned out buffer around Peshtigo. Earlier in the day on October 8, Reverend Pernin recalled that in the previously burned area, he noticed some burned tree stumps suddenly blaze out after a gust of wind.¹² Conditions certainly were conducive to fires rekindling and spreading.

One study by Haines and Kuehnast that was cited in numerous sources, examined weather patterns by using historic weather data entered into a computer simulation. It was then possible with some accuracy to view the regional conditions at any given time back to 1870. They concluded that there was nothing extreme about the weather in the Great Lakes Region on October 8, 1871, it was “*benign*”.¹⁴ The conclusion of the Haines and Kuehnast study agrees with survivors of the fire who claimed that the weather was calm prior to the fires.

Another study by Lorimer and Gough 1982, cited by Moran 1990, determined the drought index based on over one-hundred years of data and found that relative to other periods the 1871 drought was only moderate, not severe.⁴ Northeastern Wisconsin from 1864 to 1979 experienced higher frequency of severe drought in 29 of those years.⁴

How the firestorm became large enough (twice) to create it's own strong inflow from all directions, as one theory suggests, is not very clear (Van den Dool, 2012). Some theories seem to hinge on a factor that the fire produced it's own wind. Moran suggest in his work that a fire whirlwind feeds itself and that it “*occupies an air column that is heated intensely by the underlying burning ground cover*”.⁴

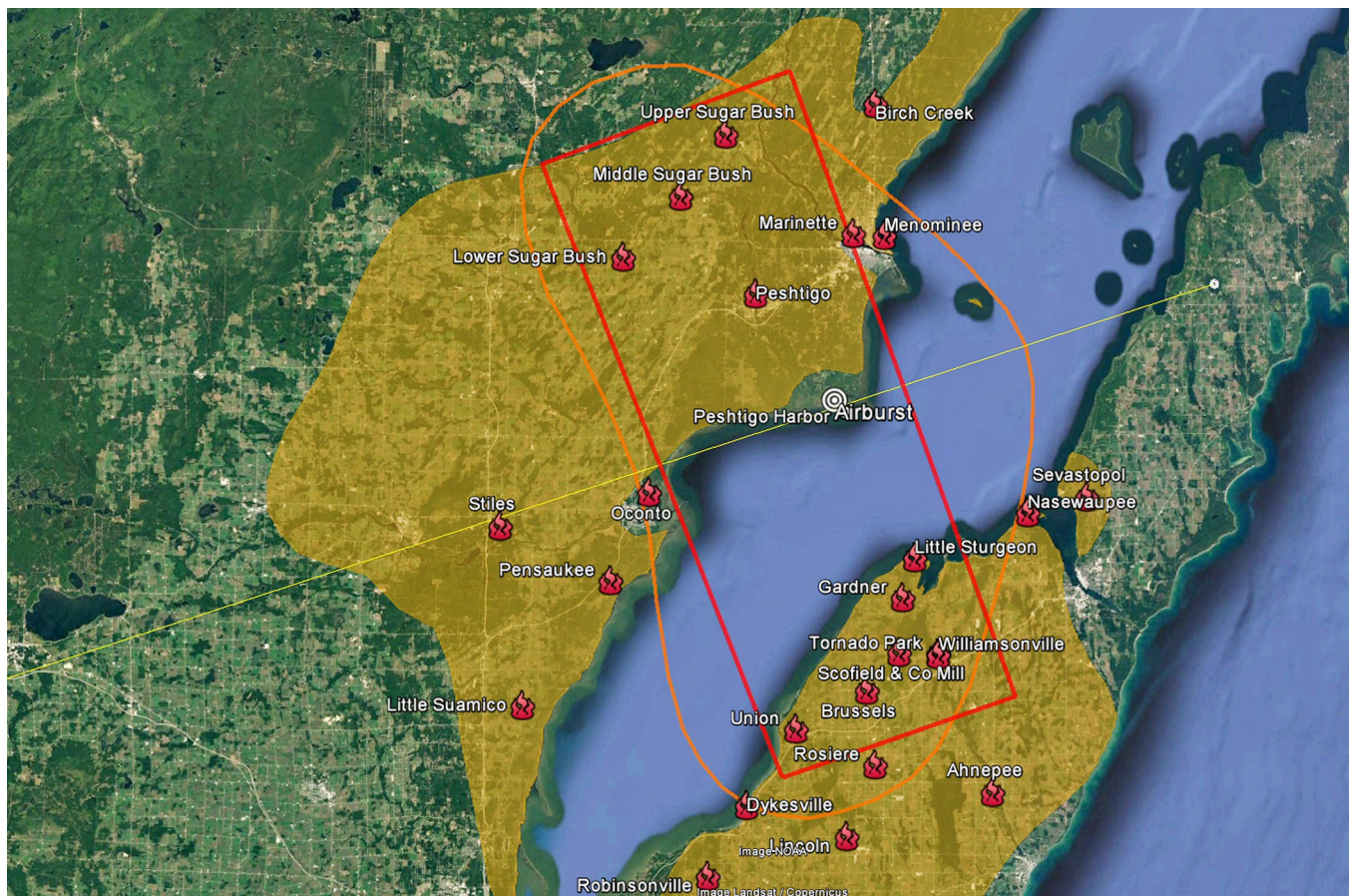
At 9:00 pm on October 8, 1871 Sturgeon Bay reported 12 mph wind the same time Mary reported calm at Green Island. It is difficult to reconcile the accounts of people who were there with any of the explanations that I have found. The first winds were described as a blast, fierce gust or puffs that changed directions and occurred before the fire, affecting well over five-hundred square miles at about the same time. This does not sound like a tornado that produces a sustained air-flow, moves at a slow speed and creates an obvious path of destruction.

So how could we determine if an airburst is a legitimate possibility?

PESHTIGO BUTTERFLY

How an airburst could plausibly explain the phenomenal aspects of the October 8, 1871 firestorm.

In June of 1908, an estimated 196 ft asteroid entered the atmosphere and exploded in an airburst over Tunguska, Siberia.¹⁵ It's estimated to have exploded between 5-10 km (3-6 mi) above the Ural Mountains terrain with the explosive force of ~12.5 megatons of TNT.¹⁵ For comparison, the two nuclear bombs that ended WW2 were thirty-five kilotons combined.

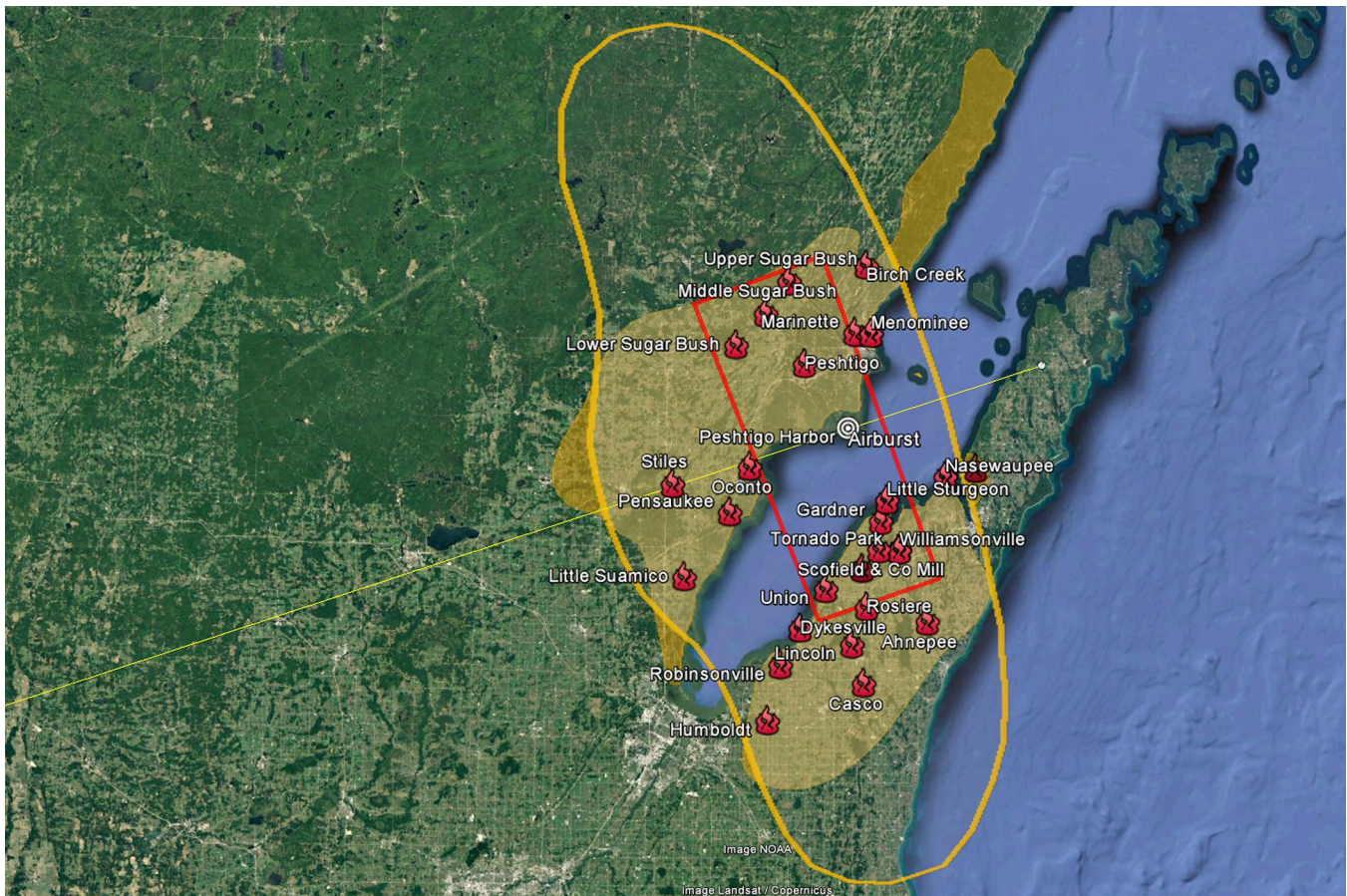


The orange outline is the approximate shape and size of the 1908 Tunguska airburst damage area that included hundreds of square miles of flattened trees. It is 42 miles by 22 miles and is centered over Peshtigo Harbor.

The blast area of Tunguska was defined by the pattern of fallen trees which was not circular. The blast wave had formed a somewhat symmetrical shape resembling the spread out wings of a butterfly.¹⁵ A similar pattern was simulated by a scientist named Zotkin in 1968 using a scaled down laboratory experiment consisting of a rapidly moving explosion descending at an angle. This moving explosion flattened numerous vertically arranged wooden sticks in a similar pattern¹⁵ supporting the theory that the Tunguska trees were flattened by an extremely fast moving and descending exploding object. Zotkin's simulation was convincing evidence that the destruction in Tunguska was likely caused by the airburst of an exploding bolide, and not from any kind of ground impact. No confirmed crater has ever been found, although a lake inside the blast zone has been seriously investigated over the last decade, it has not been proven to be related.

The blast pattern was dubbed the Tunguska butterfly. An important detail to note is a circular zone of about 8 km area that was relatively unaffected by the blast.¹⁶ This zone also occurs in laboratory simulations and is also noticed directly below high altitude nuclear detonations. This would explain how Peshtigo Harbor managed to escape destruction while Peshtigo and other nearby town were flattened.

With witness accounts and damage reports from around Peshtigo Harbor arranged on a map, it is apparent that the worst devastation occurred along a forty plus mile path, fifteen miles wide running from northwest to southeast. After placing a stylized forty mile wide Tunguska size blast zone, centered over Peshtigo Harbor, the butterfly outline of the Tunguska zone covered over 95% of the deaths and the worst destruction reported on October 8, 1871 in Wisconsin and northwestern Michigan.

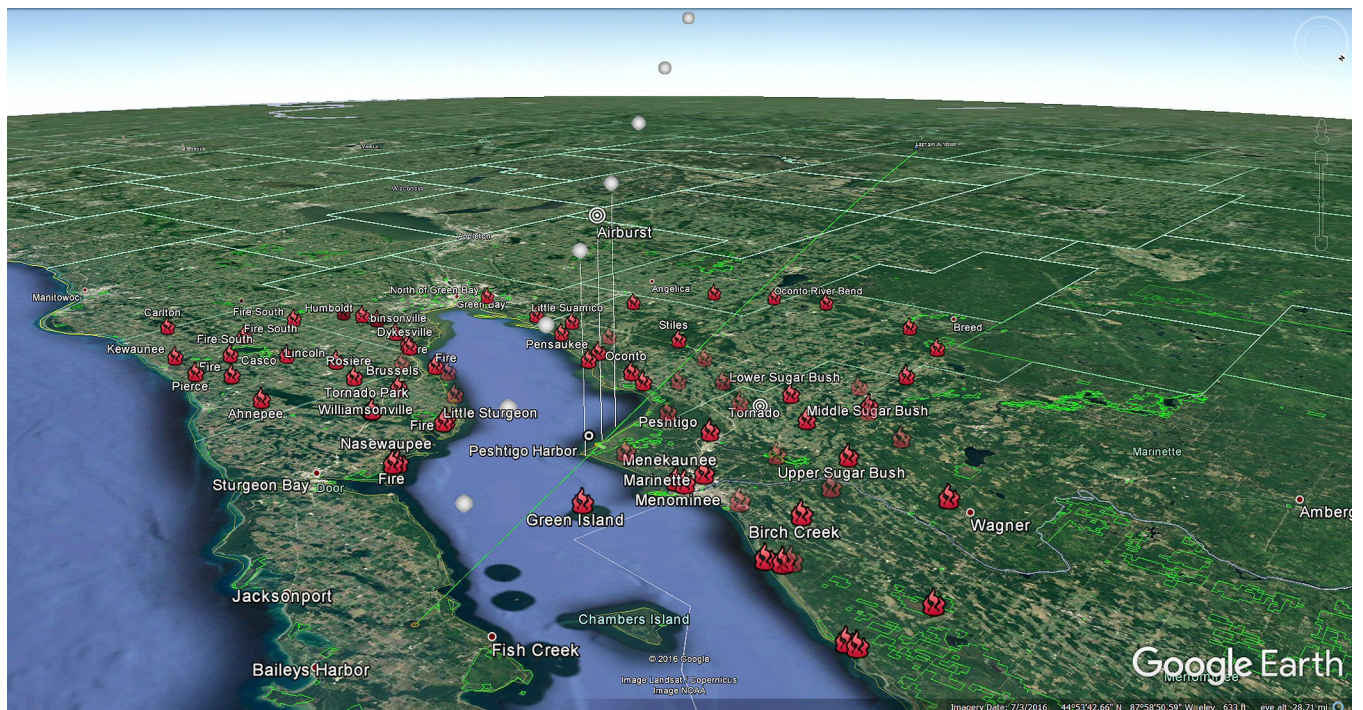


The yellow outline is the approximate size and shape of the "overpressure" or airburst of the the superbolide that exploded near Chelyabinsk February 15, 2013. The area is approximately 95 x 38 miles and was determined by reported glass damage by Olga Popova and Peter Jenniskens.

Survivor accounts of the direction of light first noticed I used to develop a possible path that originated from west southwest of Peshtigo. The opposite direction pointed to Thorp Pond in the upper peninsula of Door County, a feature that I personally have long suspected of being a young crater. Upon visiting Thorp Pond over fifteen years ago I found some curious things, but also that the rock (evidence) necessary for a conclusive determination is buried. According to the Wisconsin Geologic Survey and the Impact Database, Thorp Pond is not a recognized crater. Due to my suspicion that Thorp Pond is a recently formed impact crater, for the purpose of this model I'll use the location as a hypothetical impact site.

The Peshtigo Harbor airburst and Thorp Pond impact hypotheses are independent of each other. An impact site is not required to determine if an airburst occurred, like in Tunguska. Also, confirmation of an airburst is not required to determine if Thorp Pond is a meteor crater. Both can be tested because evidence will be there if true.

On February 15, 2013 a bolide approximately sixty-five feet across exploded near Chelyabinsk Russia with the force of five-hundred kilotons (half megaton) of TNT.¹⁷ The airburst occurred at about twelve miles altitude and it took about two minutes for the blast wave to reach unsuspecting people on the ground who were gazing at the persistent vapor train in the sky. In and around Chelyabinsk hundreds of people were injured in an instant when the invisible blast wave traveling about the speed of sound arrived shattering thousands of windows. The arrival of the blast was accompanied by a deafening two and a half minutes of continuous thunder and artillery-like sounds. Satellite observation data and hundreds of video documenting the event were obtained by numerous individuals and scientific institutions.¹⁷



Google Earth was used to visualize possible trajectories in three dimensions.

For my model the blast area and asteroid size are similar to the estimated mass of the Tunguska impactor in 1908 and with an energy release greater than ten million tons of TNT (10 megaton). The rough size of the 1871 blast is easily determined from survivor accounts, the shape of the blast is not. A general outline of the Tunguska blast pattern traced from tree damage map¹⁶ is centered over Peshtigo Harbor for comparison.

Many details are known about the Chelyabinsk airburst and NASA tracked the cloud for several months, so I'll use their estimated entry speed of 18 km/s. A terminal burst altitude of >10 miles is used which is lower than Chelyabinsk but higher than Tunguska.

The Earth Impact Effects Program (EIEP) was helpful in trying to determine the most realistic scenarios.¹⁸ The same airburst energy yield can be achieved by varying factors such as size/mass, entry speed, entry angle, density and target material. Having tested many different scenarios in the EIEP, results suggest that a larger bolide would burst at a lower altitude than a smaller bolide at the same entry angle. Also, a lower entry angle results in a higher altitude airburst. There are some variables that aren't accounted for in the program, for instance I can choose sedimentary bedrock as the target, but not account for depth of soil and forest cover.¹⁸

The EIEP results suggest that a two-hundred ft impactor would not form a crater. If you increase the asteroid size to 290 ft, the EIEP suggests a ~3500 ft crater forms, while a 289 ft asteroid does not form a crater.¹⁸ Since this is an estimating tool that uses conservative formulas and there are known impact craters much smaller than .7 miles, I did not exclude the possibility of a smaller impactor creating a crater. How large of an asteroid it takes to form a crater is debatable among various sources. Because of debate in this area and in light of evidence from the 2007 Carancas impact event¹⁹ and fairly young craters in Estonia²⁰, it seems possible that Thorp Pond could be an impact crater or at least an impact disturbance.



View from Peshtigo Harbor.

At about 9:00 pm on October 8, 1871, a 200 foot asteroid (dense rock) approached from the west southwest descending at an angle of less than 25 degrees to the surface of earth. Ironically, as mentioned before, you can trace the path on the ground by drawing a line from Lapham Junction to Thorp Pond, both in Wisconsin. As the bolide headed toward Peshtigo Harbor a hundred miles above Lapham Junction it began to light up the sky.

At an altitude of 75 miles, 165 miles ground distance it is still traveling faster than ten miles per second. The outermost exterior has heated from ram pressure, becoming a meteor, suddenly flashing intense light, increasingly brighter over the next six seconds. **At an altitude of 42.5 miles, 100 miles to impact, 95 miles ground distance, the mass is tumbling and crashing against the increasingly dense layers of the atmosphere like a boulder rolling down a hill. Fierce ablation of successive exterior layers forms a cylindrical persistent vapor train of meteoric smoke, possibly miles wide that shrouds and trails behind the advancing bolide. During the next 8 seconds the bolide travels 63 miles, descending just over 10 miles altitude, having gradually decelerated to less than 5-7 miles per second, it continues to ablate and shines brighter than the sun.**At an altitude of ~12 miles, 21 miles to impact, terminal burst occurs and the bolide explodes with the most violent of a series of incredibly energetic

detonations. Some fragments are scattered and slowed by the atmosphere however a considerable portion of the exploded fragments maintain a similar trajectory in a dense aerodynamically shaped cloud, traveling at 2-3 miles per second and impacts the forest 8 seconds after the airburst. According to EIEP the projectile bursts into a cloud of fragments at an altitude of 9570 meters = 31400 ft. The residual velocity of the projectile fragments after the burst is 5.83 km/s = 3.62 miles/s.¹⁸

A crater or disturbance more than sixteen hundred ft wide is formed by the impact. No fireball occurs from the ground impact and the blast wave from the ground impact was isolated to a few uninhabited miles of dense forest. What seems like the end of the story is just the beginning though. **Although the meteorite has already impacted across the bay, the blast wave from the airburst over Peshtigo Harbor takes nearly a minute to reach the ground directly below and just over a minute to reach Peshtigo. The epicenter of the terminal burst was above the south facing bay shores near Peshtigo Harbor, seven miles southeast of Peshtigo. The ground impact at Thorp Pond possibly registered a magnitude 5.0 on the Richter scale and the seismic waves would have reached Peshtigo and Williamsonville in about eight seconds¹⁸, both about twenty-five miles from Thorp Pond. Impact seismic vibrations could explain the perceived sounds, strangely audible muffled distant roaring, experienced by Reverend Pernin and others who felt the earth shake after the sky lit up but before the winds and fire arrived.

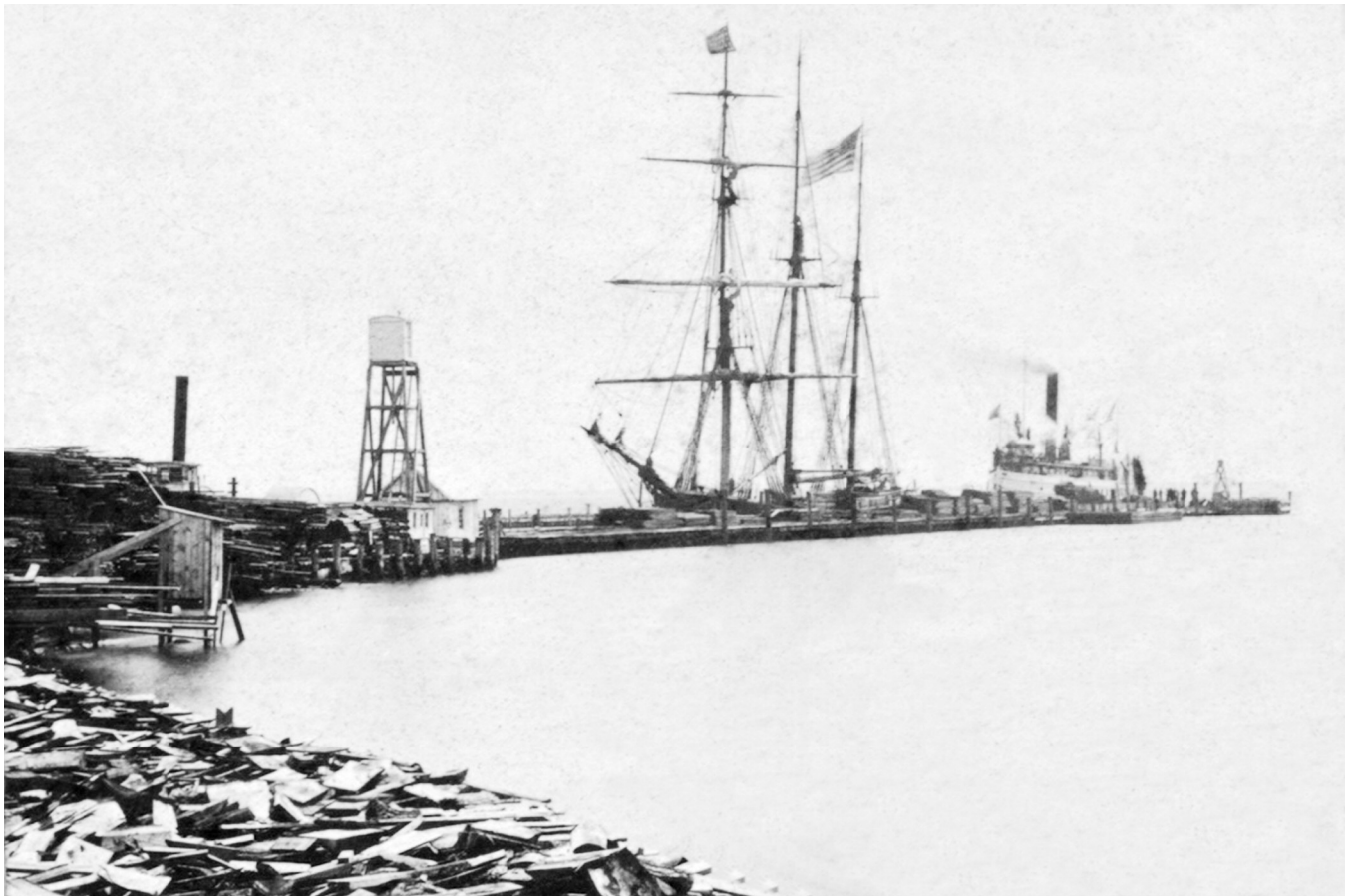


Photo of Peshtigo Harbor about 1867.

There were no debris between the exploding bolide and Peshtigo Harbor about ten miles below. Peshtigo Harbor would have experienced a sudden down burst of hot wind, stripping branches rather than leveling trees, accompanied by some thunderous sounds. Areas around Peshtigo Harbor were bombarded by ground debris, some smoldering, lofted by the blast wave spreading out from the harbor. Some of the debris included smoldering logs, trees and peat from the previous fires and from the smoldering peat bogs south of Peshtigo. For a great visual of what this might have looked like, there is a YouTube of a simulation of the Tunguska airburst by Peter Schultz using NASA's Ames Vertical Gun Range.²¹

The phenomenon known as Mach stem, where surface winds from an airburst intensify with distance from ground-zero²², reaches Peshtigo within minutes of the the airburst and catches people in the midst of their panicked attempts to flee. Green Island lighthouse keeper Mary Drew described it vividly;

*"The whole shoreline to the southwest was ablaze. Between the clouds of smoke, flames could now be seen leaping high into the sky and racing northward across the still unburned treetops at lightning speeds... The burning ash was now large chunks of burning timber carried on the ferocious winds."*¹⁰

"to the southwest" - From Green Island, southwest is the direction of Peshtigo Harbor which helps to illustrate the sharp transition between the Peshtigo Harbor settlement which was spared and Peshtigo seven miles northwest which was swept away. Green Island is more than three and a half miles off the coast and the "large chunks of burning timber" were not from the island, which only had small fires that were quickly extinguished.

Peshtigo before and during;

*"The tornado was but momentary, but was succeeded by maelstroms of fire smoke, cinders and red-hot sand... The shower of sparks, cinders and hot sand fell in continuous and prodigious force..."*⁶

"Sunday evening, after church, for about half an hour a death-like stillness hung over the doomed town. The smoke from the fires in the region around was so thick as to be stifling, and hung like a funeral pall over every thing, and all was enveloped in Egyptian darkness. Soon light puffs of air were felt; the horizon at the south-east, south, and south-west began to be faintly illuminated; a perceptible trembling of the earth was felt, and a distant roar broke the awful silence. People began to fear that some awful calamity was impending, but as yet no one even dreamed of the danger."

*"The illumination soon became intensified into a lurid glare; the roar deepened into a howl, as if all the demons of the infernal pit had been let loose, when the advance gusts of wind from the main body of the tornado struck. Chimneys were blown down, houses were unroofed, and, amid the confusion, terror, and terrible apprehensions of the moment, the fiery element, in tremendous inrolling billows and masses of sheeted flame, enveloped the devoted village."*⁸

Peshtigo After; *"Along the road where, before the fire, you could only see half a rod to the right or left, you can now see for miles in either direction. The trees, uprooted and twisted by the terrible wind, in falling have so interlocked that it would cost much more to clear the charred trunks away and level the roots than the land is worth,... The force of the tornado was so great that one [rail] car load of the lumber was carried more than one hundred feet, where it burned."*⁸

*"From two to four or five miles wide in places, and extending north and south indefinitely, so far as I could see, forests, fences, barns and houses were swept away."*⁶

*"In four hours, a ten-mile swath of fire cut through forty miles, killing an estimated twelve hundred people."*⁷

Twelve Miles North of Peshtigo; *"One woman recalled that the great forests lay row after row, as though cut with a scythe, their tops pointing north."*⁷

The firestorm suddenly burst north from an unknown point south of Peshtigo and leveled trees fifteen miles to the north. Because a bolide is moving many miles per second when it explodes, the explosion is described as a cylindrical expansion along the trajectory line.²⁴ The explosive forces extend much further in directions perpendicular to the trajectory path.²⁴ Because of this the explosive force also extended more than fifteen miles in the opposite direction southeast to Williamsonville and beyond in Door County.

"A firestorm is called nature's nuclear explosion. Here's a wall of flame, a mile high, five miles wide, traveling 90 to 100 miles an hour, hotter than a crematorium, turning sand into glass. How can you even comprehend that?" asks Lutz. "Still harder to understand is the capriciousness of that kind of storm, which destroyed Peshtigo and Menominee in a half-hour, skirted the edges of Marinette and destroyed Birch Creek, all the while leaving

Peshtigo Harbor alone."^{25*}

Although there had been drought and fires were known to be burning in isolated areas to the point that smoke affected visibility through-out, nobody seemed alarmed prior to a bright illumination at about 9:00 pm. Details reported by survivors that are consistent with a bolide event include seeing the sky suddenly light up, wind blasts accompanied by deafening sounds of continuous thunder or artillery rounds. Reverend Pernin and other survivors described an immense luminous crimson cloud above the smoke from the fires. Video of the February 15, 2013 Chelyabinsk persistent vapor train clearly show the cloud glowing internally more than five minutes after the meteor had passed. That persistent vapor trains from meteors sometimes glow is acknowledged by scientist and suggested to be superheated plasma, see photo Fig.1.¹⁷

Reported to 1873 Wisconsin Legislature, property losses included 27 school-houses, 9 churches, 959 homes, 1028 barns and stables, 116 horses and 930 cattle, cows, sheep and hogs.¹

Increase A. Lapham from Milwaukee, documented the fires while visiting burned areas and collected witness reports. He is considered by some to be the father of meteorology, he was the Wisconsin State Geologist at the time. It seems that Lapham conducted the only official scientific investigation of the conflagration, and according to Gess and Lutz, Peshtigo was the first documented firestorm.

Lapham's final conclusion that he submitted to the Wisconsin Legislature about the cause of the fires differs from his original theory which attempted to explain some phenomena associated with the fire. During his investigation Lapham struggled with a not so minor detail that he believed to be fact;

"That the fire " traveled in the air," in the cases noted, and for a distance of full twenty-five miles, is susceptible, of incontestible proof." Captain A. J. Langworthy was chairman of the relief committee and responsible for reporting findings to Wisconsin Governor and he held the same opinion as Lapham, also supported by Prof. Fisher of the naval academy in Annapolis Maryland.¹

"The explanation already given of the "traveling sheets of flame," is the correct one. Burning-gas (carburetted hydrogen) was produced by the excessive heat of the fire much faster than it could be consumed; hence it arose in great masses, taking the place of atmospheric air; these masses were driven about by the wind, and would cause death by suffocation, precisely as when common gas is allowed to fill a sleeping apartment. Such masses of combustible gas could only be consumed at the surface where they come in contact with the oxygen of the air; hence they would present the appearance of great balls of fire. Whenever the air is penetrated the gas, it at once becomes explosive. We may compare these moving, burning masses of gas with those meteors that are called shooting stars. They consist of gaseous matter projected into our atmosphere from the distant regions of space, which are consumed by contact with it's oxygen before they reach the ground.

*I. A. Lapham"*¹

"I have read all that appeared in the New York papers on the subject of western fires, and have carefully considered the observations you record in your note to me, but I am compelled to say that I have never seen anything which will lead me to accept the theory of combustible gases in the atmosphere. I think that these terrible fires can be explained by referring them to the common, well-known phenomena of combustion, such as peculiarly dry combustible material and favorable winds. That the production of inflammable gasses first would be necessary, is totally beyond anything that I have ever known to be observed, and the acceptance of this theory would require very strong proof.

*C. F. Chandler"*¹

"Of the theory of" flames traveling in the air," there is abundant and substantial proof notwithstanding Prof. Chandlers letter. In conversation with Prof. Fisher of the naval academy, Annapolis Maryland, whose reputation as a chemist stands high, said to me " I have read your report on the subject and have no doubt your theory is correct," I enclose the letters of Profs. Lapham and Chandler on the subject, and will send you the testimony of Judge Noyes.

A. LANGWORTHY,

Chairman Executive Committee of Relief ¹¹

Lapham suggested “*meteor*” for comparison however the chemistry he suggested for the observed phenomena was not convincing to Chandler. His meteor suggestion was dismissed entirely, probably because the specifics of his chemistry did not make much sense. Chandler thought that the phenomena could easily be explained by fuel, wind and combustion. If Gess and Lutz are correct, that Peshtigo was the first documented firestorm then it explains why Chandler's references were limited to “*all that appeared in the New York papers on the subject of western fires*”. Chandler concluded, politely as possible that he could not “*accept the theory of combustible gases in the atmosphere*”, and that “*acceptation of this theory would require very strong proof*”.

In 1871 helium had recently been discovered on the Sun (1868), but not on Earth until several years later²⁶, indicating that knowledge was limited in the field of chemistry at the time. In addition Lapham did not have a formal college education so his understanding of chemistry was probably very basic. E. F. Bean, Wisconsin State Geologist in 1936 described Lapham's experience.

*“He was at once a botanist, a zoologist, an archaeologist, a geologist, and a meteorologist. He was a distinguished example of the best order of the old school of all-around students of natural science. Probably we owe to Dr. Lapham, more than to any other single individual, the establishment of our Weather Service.”*²⁷

*“He did not have the advantage of a formal college education. Instead he gained his knowledge by observation, by reading, and by contact with scientist through correspondence and attendance at scientific meetings.”*²⁷

In 1875 Lapham submitted his conclusion which was likely influenced by his exchange with Prof Chandler, in his final report to the legislature submitted in 1875. He still insisted that there was some explosive element, perhaps swamp gas could explain the areal explosive component. Ignacious Donnley and others believe gasses from exploding comet explain the widespread devastation and phenomena. Modern researchers suggest that low level jets are the most plausible explanation for the winds.¹⁴

*“The observation that winds turned to the west at (near) hurricane force may not have been representative of the ambient weather conditions, but the result of the firestorm creating its own strong inflow near the surface, and from all directions (as asserted by the Chicago weather observer from first-hand experience).”*¹⁴

The possibility that an airburst occurred over Peshtigo Harbor on October 8, 1871 has not been investigated as far as I know. Peshtigo, the Sugar Bushes and Williamsonville all had in common, smoldering forest or swamps nearby from previous fires. This fact contributes to the conclusion reached by some researchers, that a wind whipped these fires into one big fire that created it's own winds and tornadoes. Looking at the exact sequence, path and intensity of events, the fact of previous fires could also support a conclusion that a blast wave from above Peshtigo Harbor blasted the smoldering forests towards the towns, spreading fires in it's wake.

METEORIC SMOKE PARTICLES

Having taken a serious look at the possibility that a meteor airburst contributed to the the October 8th, 1871 fire I wanted to learn more about what might have been in the air if an airburst had occurred. Airburst events are not unheard of however credible scientific observations of large airburst events are rare.

In the last decade numerous NASA experiments have utilized various technologies including ground based radar, high altitude balloons, sounding rockets and satellites to determine the composition and properties of meteoric smoke particles (MSP). Meteoric smoke particles result from the ablation of meteoroids, ranging in size from microscopic dust up to meters, upon entering the atmosphere at >14km/s. The light phenomena of meteors and formation of MSP ingredients are the result of vaporization, a cooling process and not burning or oxidizing. The resulting vapor condenses to form meteoric smoke particles.²⁸ *The major elements produced by meteoric ablation are Fe, Mg and Si* [iron, magnesium and silica] ²⁹.⁵²

At high altitudes in the mesosphere, oxygen and water vapor are abundant and react with meteoric iron and magnesium vapors to form metal hydroxide clusters.²⁹ At altitudes below 90km iron, magnesium and silica are thought to then form nano-particles such as olivine (Fe-Mg-SiO₄), based on compounds produced in laboratory experiments.²⁹ For the most common meteorite type which is chondritic, a majority of the original mass of a bolide is vaporized. In February 2013, 76% of the Chelyabinsk meteoroid, a chondrite, was vaporized, 19% was pulverized to dust and less than 5% or 4-6 tons survived as meteorites.¹⁷ The Chelyabinsk meteorite is classified as LL Chondrite¹⁷ and it had some unique characteristics, its in the group of ordinary chondrite, ~80% of all meteorite falls.³⁰

Ordinary chondrites are mainly composed of varying amounts of Silica, enstatite, forsterite and nickel-iron. Enstatite is the magnesium rich pyroxene end member while forsterite is the magnesium rich olivine end member. Most ordinary chondrites plot between 13-16% Mg and between 20-30% Fe.³⁰ A 200 ft chondritic asteroid with a conservative density of 3000kg/m³ would weigh over 750,000 tons. Using a very conservative estimate of only half of the mass vaporized, the vapor should consist of more than 5000 tons of colloidal magnesium and more than 10,000 tons of colloidal iron.

The Chelyabinsk bolide is estimated to have been ~65 ft diameter, entered at an angle of ~18° to horizon and was moving at ~19 km/s.¹⁷ The Chelyabinsk meteoroid mass was ~13 million kg (>14,000 tons) prior to entry and ablation.¹⁷ The Chelyabinsk airburst had the energy equivalent of ~500 kt of TNT.¹⁷ The visible persistent vapor train created by the Chelyabinsk bolide was not the only cloud. An unseen cloud of gas, dust and small fragments expanded at supersonic speed to occupy a volume of nearly 1000 cubic kilometers.²³

John Plane has conducted research into the airborne life of MSPs from 100 km to the earth's surface. Discussing sporadic layers of Mg⁺ in the Martian atmosphere, due to the reaction of oxygen to Mg⁻, he explains how neutralization of Mg⁺ could be slowed in a CO₂ rich atmosphere.³² The formation of MSPs from ablated

meteoroid silica and metals is thought to occur over several days.³² Due to time required for MSP formation³² and observations of the Chelyabinsk bolide airburst, invisible rapidly expanding gas and dust cloud³¹, then if there was a bolide airburst over Peshtigo Harbor, magnesium and iron could have reached the ground before oxidizing, likely being positively charged, which could explain every phenomenon that reportedly occurred October 8, 1871.

If you have ever used a magnesium fire starter, seen burning steel wool (fire poi), or flicked a Bic lighter then you should know the true combustible nature of the elements iron and magnesium when spread out rather than in solid masses.³³ Positively charged meteoric iron and magnesium particles would be attracted to the ground and especially to metal objects.



A one inch square piece of paper-towel covered with thin coating of powdered magnesium created these sheet flames when it was ignited.

Clouds of charged metal particles could explain why metal objects like iron stoves, nails, watches, bells and coins melted, many of these things seemingly too far from an adequate source of heat. A coin pulled from the pocket of a dead, unburned man was found melted on one side.² According to known principals, electrical resistance of metals increase with heat, turning a conductor into a resistor which heats internally relative to the amount of electrical current flowing. The melted objects mentioned all had in common a partially insulated connection to the

earth or electrical ground.

In Peshtigo, *“Here stood the fire-engine house, a small frame structure just large enough to hold a steam fire engine. The cupola was of open wood-work, but so intense was the heat that the bell, weighing several hundred pounds, was melted up.”*⁸

*“In the debris we find spoons by the dozen, all melted together, stove-pipes melted into balls not larger than your fist, crockery, china, glass and hardware all run together...”*⁸

*“... a train of platform cars loaded with green lumber stood at the time of the fire, all of which was destroyed excepting the iron wheels, which are partly melted.”*⁸

*“Every well in the city was turned into a flaming pit, and the very waters half evaporated by the heat.”*⁶

A common injury suffered by survivors including John and Mrs. Williamson was to lower extremities, like burned feet², but apparently not by heat from the ground. If heat rises and it was hot enough to burn feet, then the more sensitive upper body should experience similar if not higher temperature. Positively charged Fe and Mg particles accumulating on the body in the same manner as described, could explain some odd injuries, like Charles Helms, near Marinette;

*“Mr. Helms traveled a long distance in the fire. The calves of his legs burned loose; dragging on the ground, held by cords. Was taken to the hospital at Marinette, but soon died.”*¹

Charged particles carried by the wind would naturally be attracted to vertical surfaces like tree trunks and exterior walls, accumulating along the corners and bases of buildings and trees. Once significant densities of positively charged Fe and Mg atoms collect, the combined voltage potential became high enough for electrons to jump from ground, like a lightning bolt, bursting buildings into flames far from the fire as was claimed and launching roofs from the sudden ignition. When trees and buildings burned the flames ignited falling iron and magnesium atoms in a chain reaction extending high into the sky, appearing as sheets of fire described by survivors.

Consider the only house left standing in Peshtigo⁸, the framework of a house under construction.³⁴ A wing of the house caught fire which likely had raised walls because the wing was detached by the wind, blown into the woods, taking the fire with it. How the framed section could resist the wind is obvious but there is no reason why the wing and remaining framework did not burn equally. If charged particles accumulated on walls as previously suggested, it could explain why the framework did not burn, having low surface area to accumulate charged particles. In the following quote, note that the house is really close to the *“timber”*, suggesting that the heat was actually originating from somewhere other than the forest.

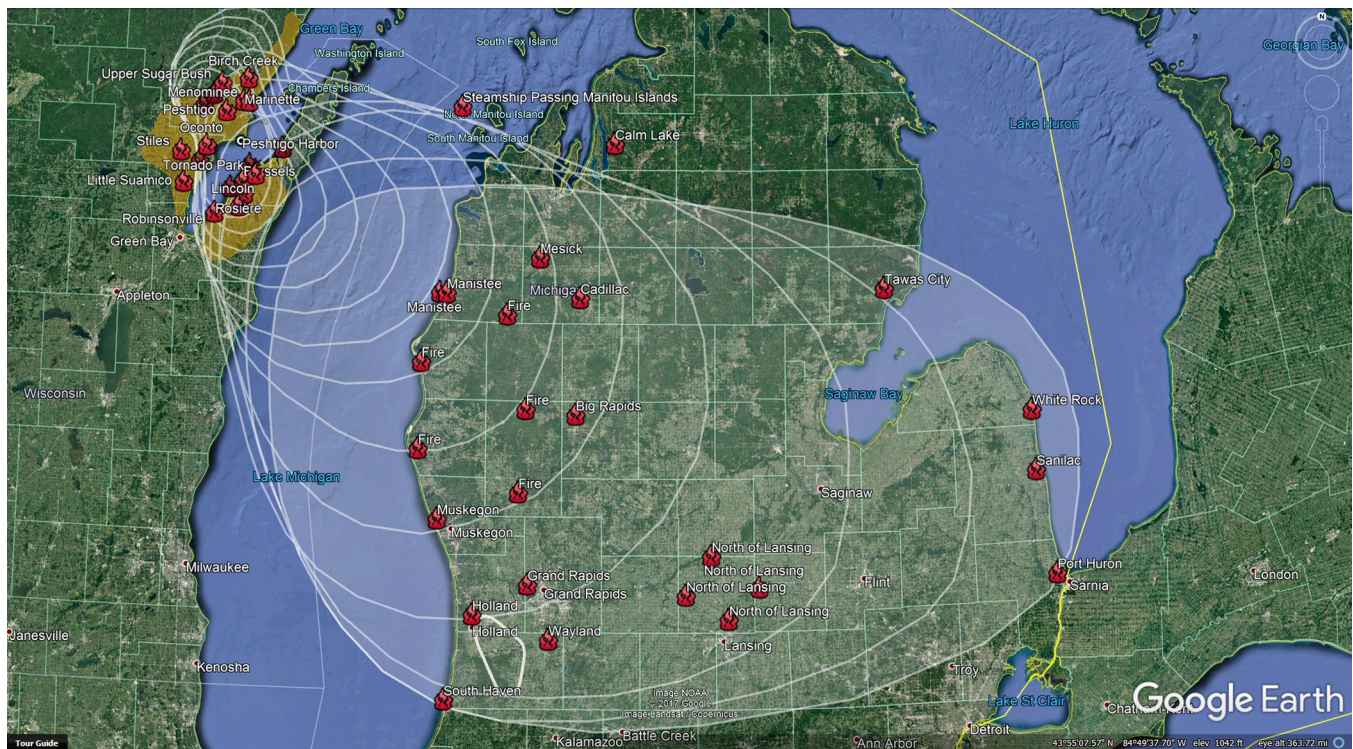
*“Some hundreds of feet to the right and rear of the last building, stands the only house left of the once flourishing town. The house had a gable end fronting the river, with an ell on the upper side, and was not finished. The fire struck the ell, which was destroyed in almost the time it takes me to tell of it, but such was the velocity of the wind that after the wing was burned off the fire was actually blown off, passing into the timber a few feet away, and the main house was saved.”*⁸

The dry conditions noted by investigators are actually conducive for this scenario and might have contributed to Fe and Mg atoms keeping their charge and not oxidizing before reaching the ground. Another possible contributing reaction is that of a thermite like reaction, which the particles of iron that have oxidized into Fe₂O₃ are still capable of further heat generating reactions when they interact with atoms of magnesium which turns Fe₂O₃ back into Fe, elemental iron ready to oxidize again. The spreading cloud from an airburst would have contained various sized particles, somewhat sorted.³¹ The smaller particles would be carried furthest by the blast wave (invisibly) and the heavier pieces would fall closer to the trajectory line³¹ and rain down within the vicinity of the blast zone.

A positively charged iron and magnesium aerosol could explain the “*strange and startling phenomenon*” that Reverend Pernin described.¹² Something notable that defied explanation, “*a cloud of sparks that blazed up here and there with a sharp detonating sound*” was possibly caused by currents of meteoric smoke that entered the house through the door, dissipating charges to metal objects and the ground, igniting in the process, “*like that of powder exploding*”. Electrons flowed to invisible atoms in the same manner as lightning and static sparks, as currents of MSP aerosol circulated through the house, “*and flew from room to room*”, convincing the reverend “*that the air was saturated with some special gas... this gas lighted up from mere contact with a breath of hot wind*”¹²

As the minutes passed, ever denser pockets and visible scattered clouds of varying metal concentrations descended. Some ignited before reaching the ground and were described as balls of fire by many. When clouds and pockets descended over fires the iron and magnesium ignited explosively. When iron and magnesium descended elsewhere they could spontaneously ignite from flowing electrons as they neared the ground, structures, trees and most unfortunately also people and animals. The “*fire balloons*” were described as dark ball shaped objects which exploded on contact with the ground.

“*All of the survivors with whom I conversed said that the whole sky seemed filled with dark, round masses of smoke, about the size of a large balloon, which traveled with fearful rapidity. These balloons would fall to the ground, burst, and send forth a most brilliant blaze of fire, which would instantly consume every thing in the neighborhood. An eye-witness, who was in a pool of water not far off, told us about the balloon falling right down on the Lawrence family, and burning them up.*”⁸



The white outlines illustrate how a cloud of meteoric smoke particles might have spread based on the weather system that moved through the area.

After the initial blast wave the winds reversed direction and became very turbulent. Within a half hour denser clouds of meteoric dust began to reach the ground swirling and mixing with the winds, creating the unbearable currents of heat that were reported. The strongest winds blowing north is evident by the direction of fallen trees in near Birch Creek. It is also evident that winds flowed towards a common center.¹⁴ Peshtigo Harbor was the center of the fires that burned the night of October 8, 1871.

Wind directions changed relative to the center of the system as it moved out to the southeast over Lake Michigan, which took several hours. The spreading of the cloud to the northwest was stalled by the eastbound cold front that is so often noted by other researchers^{14, 4}, then reversed as the entire lower portion of the cloud was pushed to the southeast by the front. This caused Peshtigo and Door County to get a double dose of colloidal Fe and Mg. The metal storm was likely twice the size of the Green Bay, not including the original vapor trail extending some fifty miles up into the mesosphere. As the storm tracked across Lake Michigan shipping was disrupted.

As the storm crossed the eastern coast of Lake Michigan at about midnight, the somewhat diminished blast front would have arrived hours before, still energetic due to less resistance over sixty miles of open water, enough to fan flames of smoldering fires. Due to the distance from the airburst things happened more gradually than they did in Peshtigo, Sugar Bush and Door County. By the time the storm reached Lansing Michigan, influence from the cold front had diminished and the storm gradually changed course tracking east then northeast over Michigan, Canada and then over the Atlantic Ocean.

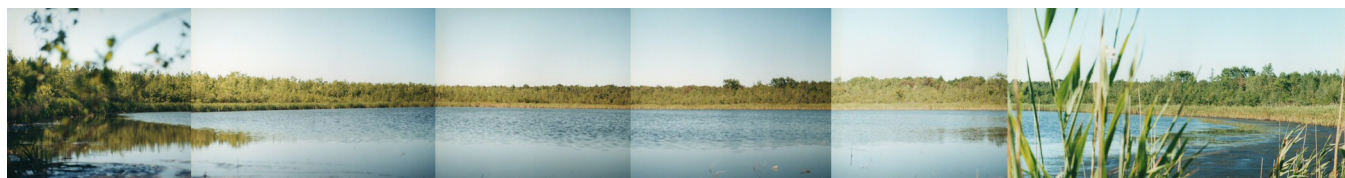
As the storm moved east it arrived as a large thunderstorm would in regards to wind, only this storm was dry and the dryer the ground conditions the greater the destruction. The pattern repeated until the storm reached the Atlantic, with lower altitudes of the cloud finally being somewhat neutralized by moisture, oxidation and dispersion. The track over the Atlantic might be determined from ship logs.

I left out one unique characteristic of magnesium before, that is, magnesium burns in water and does so more intensely than in atmospheric air alone.^{33,[39]} At least ten out of a dozen or more major fires that occurred between the October 8th and the 11th, from Peshtigo to the east beyond Port Huron, occurred on the coasts of Green Bay, Lake Michigan, Calm Lake and Lake Huron. The fact that over two-hundred miles of coasts burned, and the order they burned could be statistically supportive.

According to one study forest fire smoke or emissions are primarily “(CO₂,CH₄), NMVOC, NO_x, and aerosol”, NMVOC meaning non-methane volatile organic compounds.³⁵ There are no metals to speak of in forest-fire emissions. Possible signatures that might exist could include traces of iron, magnesium and nickel. Though common elements, they would not be associated with a typical forest fire. If traces were detected on artifacts, such as the objects on display at the Peshtigo Fire Museum and assuming testing by a university or certified laboratory, then specific isotopes like Fe60, a unique isotope of iron, could be tested for to help rule out terrestrial sources.

THORP POND

The first time I saw Thorp Pond was in 1996, while viewing the sights of Lake Michigan and Green Bay from about a thousand feet. I mentioned to the pilot, my dad, “*Hey, that looks like a meteor crater!*” He replied, “*Y ah, that's what I thought.*” I was a meteorite enthusiast and was very interested to know if there was an officially recognized impact crater on Door County upper peninsula. When I returned home I checked the impact database and there was no information at all even as suspected crater at that location. In 1981 I had spent the summer in a camper nestled in the woods, less than two miles away from Thorp Pond. I didn't know it was there at the time.



Panoramic view of Thorp Pond created from 35mm film captured in the late nineties.

Even though it wasn't listed in the impact database, some Door County locals believe it is a crater. Most people don't know about it though because it is so well hidden. Even though I figured that it probably wasn't actually an impact crater, it couldn't hurt to check. I had learned some things to look for and I thought it would be pretty easy to find reasons it is not a crater, if it is not. So I couldn't wait to check it out on the ground, but because I live about nine-hundred miles away, it wasn't until 1998 that finally I had the opportunity. My first son Josh and I spent a few days exploring the surrounding woods and eventually the lake.

The pond was not what I expected, either way. Based on what I found, at the time I didn't believe that it was a crater, or at least if it was it would be very difficult to prove. I still documented as much as I could by photographs (film) and collected a few things including mud/muck sample from the pond. I found exposed bedrock slanted, a rim feature and three pieces of what could be some kind of cemented material that contained wood.

Over the following years I learned much more about impact crater formation. Impact crater research is a slow moving field, so there is not a lot of new information available, especially about young craters. Most confirmed impact craters are several thousands to several millions of years old.

After becoming aware in 2009 of many details of the Peshtigo Fire, I wondered if Thorp Pond could be related to the Peshtigo Fire. Initially, the apparent detail that the upper peninsula did not burn was problematic until estimating the blast effects using the EIEP tool and discovering that for a 1600 ft crater, no fireball would form.¹⁸ From these same estimates a new problem emerged, Thorp Pond being twenty-five miles from Peshtigo and Williamsonville, the blast wave from the ground impact would be less than twenty mph at that distance. At first I tossed the notion that it could be related to the great fire of 1871, though I still held on to the young crater possibility which would be difficult to prove.

After the airburst in Chelyabinsk on February 15, 2013 I learned that an event of Chelyabinsk size or larger, the airburst would be more devastating to a larger area than the ground impact blast wave. Reviewing everything I had previously learned about the entire regional destruction, this time with the mechanics of an airburst in mind, it seems plausible. If it was an airburst then Peshtigo Harbor had to be the center. Thorp Pond as a possible impact site is a scenario that seems possible, especially after finding Lapham Junction at the other end..

Using everything I've learned so far it's not difficult to imagine the formation of a crater in dense forest from a bolide the size of Tunguska which was about two-hundred feet before entering the Earth's atmosphere. Assuming that the mass exploded over Peshtigo Harbor on entry and that what impacted consisted of a cloud of fragments and boulders several hundred feet across traveling at about three miles per second. Like from a giant shotgun blast of buckshot, all of the trees in that path were instantly shredded. The fragments then plowed into the forest floor and then the dolomite bedrock below, compressing and blasting out in all directions, blasting many of the surrounding trees upwards from underneath.



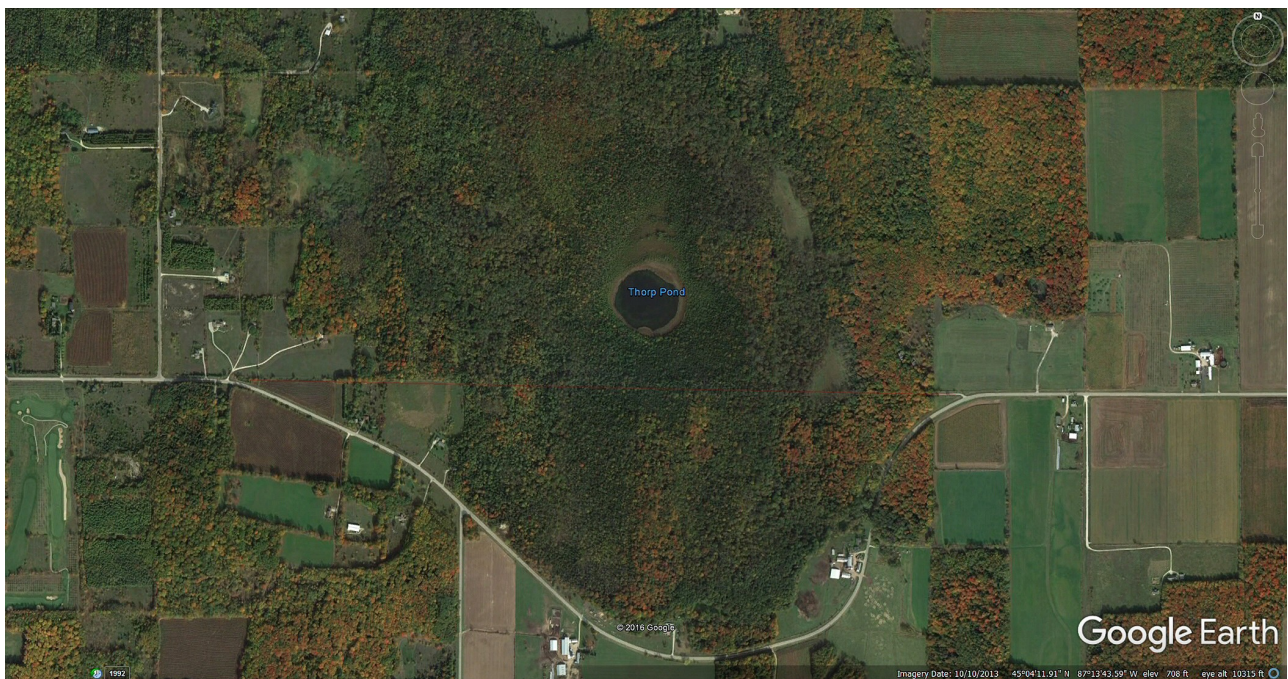
Here the forest floor is made of roots from trees growing on top of a web of tree trunks, covered with decaying plants, grass, moss and ferns. Beneath is an unknown depth of water and muck, holes center and foreground.

To reconcile the last paragraph with what I found at Thorp Pond, I believe it might be a crater about 1600 ft across that is mostly covered up by the trunks of the trees that were blasted up and then fell back down covering the crater floor like a giant nest of logs except for the 600 ft hole in the middle which is now the pond.

From the edge of the pond to several hundred feet away, tree trunks currently make up the forest floor. They are covered with ferns, moss, grass and other plants. The gaps between the trees making up the floor present hazardous holes which also reveal that the pond extends underneath where there is no solid ground only muck for at least six feet deep.

Several hundred feet out from the edge of the pond, the terrain of tree trunks abruptly becomes solid ground. In this area surrounding the pond to several thousand feet out there are ridges, hills and mounds and many fallen trees. The terrain features are significant and do not appear on topographic maps of the area, that I could find. Closer scrutiny of the trees, that I estimate all to be less than one-hundred years old, have fallen and it's clear that part of the reason most of them tipped is because they were too tall to grow in the poor unconsolidated mixture of rocks, sand, clay and a very fine grained calcium. This is the same type of material you would expect in an impact ejecta blanket from an impact into soil and dolomite.

Based on Door County history, current Co Rd E and EE likely follow the first trails crossing the peninsula and likely the only east west trails north of Sturgeon Bay in 1871, connecting Bailey's Harbor and Egg Harbor.³⁶ At some point the trail that likely became Co Rd EE appears to have been abandoned near Thorp Pond and detours almost one half mile to the south of the logical path for some reason. This can be seen from satellite imagery as well as something else that is notable. Two lakes, Lost Lake at ~50 ft elevation drop 4.3 miles southwest and the north inlet section of Kangaroo Lake at >100 ft elevation drop 4.25 miles southeast of Thorp Pond, both appear milky, possibly indicating an excess of colloidal sediments. I found that a geologic test well in the same area reported greater than four times "*dissolved solids*" than other test wells in the survey.³⁷



Thorp Pond is about 650 ft across. Aerial view from Google Earth.

Geology And Ground Water, Door County Wisconsin

Higher than normal dissolved solids in bodies of water and wells downstream and downwind could be expected near a crater.²⁰ According to the Geological Survey Water-Supply Paper 2047, the upper sandstone aquifer concentrations of iron, sulfate, chloride and dissolved solids exceed recommended limits. Water from the lower sandstone was similar having greater than 1900 mg/L dissolved solids with higher than recommended sulfate and chloride.³⁷ The upper and lower sandstone aquifer samples were obtained from a test well southwest of Jacksonport which is near the east coast of the upper peninsula.³⁷ Thorp Pond is at ~725 ft elevation less than two miles from the west coast of the upper peninsula and is situated in a shallow valley which gradually descends towards Jacksonport on the east coast of the peninsula. Jacksonport is approximately 600 ft above sea-level and about 6.5 miles southeast from Thorp Pond.

According to the Geological Survey Water-Supply Paper 2047 (fig. 4), line of equal thickness of Silurian dolomite map, Thorp Pond is situated on 400 to 500 feet of Niagaran Series bedrock, containing the Silurian

dolomite aquifer, water that collects in vertical joints and scarce bedding-plane joints.³⁷ According to the detailed Surficial Geology map included in the report, Thorp Pond is in the center of a one by one and a half mile oblong patch of alluvium, marsh and lake deposits, silt clay, and organic material with some sand. The alluvium patch is completely surrounded by a thin band (0.1 to 0.3 mile) of till, intermixed clay, silt, sand, gravel and boulders, which extends to the southeast, towards Jacksonport.³⁷ Within one mile from the shore of the pond in all directions except for southeast, thin till and near surface bedrock within four feet.³⁷



Dolostone (dolomite) bedrock exposed by this road cut near Thorp Pond shows a cross-section of the same bedrock underlying Thorp Pond.

According to the 1978 Wisconsin Soil Survey, the eastern side of Door County upper peninsula is part of the Niagara Escarpment, which is a stratigraphic range of Silurian carbonates having >50% dolomite $\text{CaMg}(\text{CO}_3)_2$, known as dolostone and dolomite rock.⁵¹ About three miles northeast of Egg Harbor, the pond is surrounded by approximately one square mile of postglacial organic sediments, peat and muck. The area surrounding this is mostly undifferentiated, thin till cover typically less than 5 feet to bedrock. According to 1993 Soils of Wisconsin map, the soils are of “Red Sandy Tills”. Water in the dolomite aquifer is of the very hard calcium magnesium bicarbonate.³⁸

In a 2002 study of the biology of impact craters, Cockell and Pascal point out that the topographic depression associated with an impact structure often results in an oasis of richer biota relative to the immediate surroundings. Of the many craters included in the study, two in Estonia are relatively young. “Two of the Ilumetsy craters, Estonia (57°58' N, 27°25' E) have become infilled with large amounts of peat, in contrast to their immediate surroundings.”²⁰ Though not diagnostic this is consistent with the geology of Thorp Pond according to Wisconsin geologic surveys and observations.

Meteoric Sand

An impact large enough to form a crater or disturbance the size of Thorp Pond would have definitely sent various organic materials and powdered bedrock high into the atmosphere. So when I came across a strange incident that happened in Sicily several months after the 1871 fire it seemed worth checking out. The unique composition of the material that rained from the sky on the other side of the world is actually what you might expect if you blasted a thousand foot wide hole in the upper peninsula of Door County.

The following story was published in the 1873 Annual Record of Science and Industry.³⁹ I only gave this a second thought because the organic matter that was collected and analyzed could be profiled by DNA testing and compared to specimens from Door County, if the 1872 samples still exist. After some extensive research I reached the conclusion that the substance examined by Silvestri seemed a better match to Door County biology and geology than to African sand red rain.



Exposed base of uprooted tree less than half mile from Thorp Pond. The top few inches of soil is dark like you would expect for forest but just a few inches down the soil becomes very light. Note literal whitewash of roots on left. Whitewash is made from lime and lime can be created from dolostone simply by application of heat.

The story from the journal;

“Analysis of Meteoric Sand

A meteoric sand which accompanied a heavy rain-storm in Sicily, on the 9th of March, 1872, has been reported upon by Silvestri, who states that the sand strained out from the water consisted of about seventy-five per cent. Of a clayey substance, colored yellow by oxide of iron, eleven per cent. Of carbonate of lime, and about fourteen per cent. Of organic matter. In this the microscope revealed numerous vegetable fragments, such as hairs of plants, membrane, scales, seeds, etc., with various diatoms and living infusoria, while the water contained carbonate of lime, carbonate of magnesia, carbonate of iron, sulphate of lime, chloride of potassium, sulphate of soda, etc.

---18 C, June 12, 1872, 377.”³⁹

Here I have translated the data from Silvestri into modern terminology, in the same order;
75% iron oxide stained clay, 11% carbonate, 14% organic matter

Water contained;

Calcium Carbonate CaCO_3 (calcite, dolomite),

Iron Carbonate FeCO_3 , (siderite),

Magnesium Carbonate MgCO_3 (magnesite)

Calcium Sulfate $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ (gypsum),

Potassium Chloride KCl (potash),

Sodium Sulfate $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$ (mirabilite)

Red rains over Europe are actually fairly common and their cause, being weather transported dust from African sand storms, was suspected long before 1872. Red rain collected from November 9, 1984 - March 4, 1992, from thirteen events, was analyzed and determined to be from three different sectors in Africa.⁴⁰ The data in the following table is arranged by median abundance and I have added mineral type and likely chemistry⁴⁰ (Avila et al. 1997, table3).

Illite - phyllosilicate or layered aluminosilicate - Median 37%

$(\text{K}, \text{H}_3\text{O})(\text{Al}, \text{Mg}, \text{Fe})_2(\text{Si}, \text{Al})_4\text{O}_{10}[(\text{OH})_2, (\text{H}_2\text{O})]$ - min 26.5, max 61

Quartz - silicon dioxide, silicate - Median 18%

SiO_2 - min 13, max 24

Smectite - hydrous aluminium phyllosilicates - Median 11.5%

variable Fe, Mg - min 0.5, max 33.5

Palygorskite - magnesium aluminium phyllosilicate - Median 8.5%

$(\text{Mg}, \text{Al})_2\text{Si}_4\text{O}_{10}(\text{OH}) \cdot 4(\text{H}_2\text{O})$ - min 4, max 12

kaolinite - weathered aluminium silicate mineral - Median 7%

$\text{Al}_2\text{Si}_2\text{O}_5(\text{OH})_4$ - min 0.5, max 13

Calcite - polymorph of calcium carbonate - Median 7.5%

CaCO_3 - min 0.5, max 21

Feldspar - tectosilicate mineral - Median 4%

KAlSi_3O_8 – $\text{NaAlSi}_3\text{O}_8$ – $\text{CaAl}_2\text{Si}_2\text{O}_8$ - min 0.5, max 8

Dolomite - calcium magnesium carbonate - Median 5%

$\text{CaMg}(\text{CO}_3)_2$ - min 0.5, max 9

A more recent study with similar findings has referred to the following list which gives the overall bulk composition of African dust;

*“The chemical composition of dust is mostly dominated by SiO_2 (59.99%), Al_2O_3 (14.13%), Fe_2O_3 (6.85%), CaO (3.94%), MgO (2.60%) and K_2O (2.35%)”*⁴¹

Other observations by Silvestri were published in The Year-Book of Nature, he described the 75% “clayey substance” as “siliceous and argillaceous matter”.⁴² Comparing Silvestri's data to modern data of red rain studies, there are several key differences. Proportions of silica and especially aluminum oxide are currently used to identify source regions of African dust. Quartz and feldspar fragments are major component of red rain with jagged and fragmented shapes up to $30\mu\text{m}$ ⁴³, but they are not mentioned by Silvestri, rather he describes spherical and discoid vesicle shapes $6\text{--}12\mu\text{m}$, “meniscus in form” (crescent) “with colorless transparent walls”.⁴²

*“Many spherical vesicles, 1/80 millimetre ($12.5\mu\text{m}$) in diameter, with thin walls, and a central yellow oval granular nucleus, marked with concentric lines. Many discoid vesicles, 1/160 millimetre ($6.25\mu\text{m}$) in diameter, meniscus in form, with colorless transparent walls, non-uncleated. A few irregular vesicles, 1/80 to 1/160 millimetre in diameter, uncovered, transparent, and smooth. Four species of diatoms already found by Bhrenberg in meteoric dust. Three species of infusorials of quick movement, also studied by Ehrenberg. The analysis showed : Siliceous and argillaceous matter 75.00, Carbonate of lime 11.65, Organic matter 13.19”*⁴²



Remnants of lime kiln in Door County near Williamsonville. Lime was created by controlled heating of dolostone.

In red rain, carbon only occurs in calcite and dolomite, which combined is only about 12.5% (median) of red rain minerals. Sulfur doesn't occur in the chemistry of the most common minerals found in red rain listed here.⁴⁰ Yet the “*meteoric sand*” is particularly carbon and sulfur rich. Then there is 13-14% organic matter in the sample Silvestri examined, “*vegetable fragments, such as hairs of plants, membrane, scales, seeds, etc., with various diatoms and living infusoria*”.⁴²

This rain of sand occurred during a fog event that lasted from March 7th to the 12th, 1872 in Sicily and was well documented by Professor G. De Lisa of the Observatory of Palermo.⁴⁴ It was preceded on March 6th by “*Unusual meteorological condition of the atmosphere. Slightly reddish aureole round the sun; barom. falling.*”⁴⁴ His observation of the aureole suggests that there were particulates in the atmosphere in the absence of clouds. His log continues, “*on the 7th dense fog, on the 8th a high and dark fog seen above the cumuli, the 9th fog universal; a very fine red dust deposited everywhere, on the 10th dense fog; rain mingled with a large quantity of fine dust, on the 11th dense fog and on the 12th fog, but not dense as before*”.⁴²

*“In general, it is to be remarked that the dense fog while it lasted was-very high, more elevated than the hills and clouds... It is evident that a great tempest gave rise to the phenomena we have described.”*⁴²

Professor De Lisa had no doubt that the dust in the rain had African origins. A letter had been received from Professor M.H.Tarry of Paris on February 28, 1872, De Lisa recounts his remarks;

“a cyclone which descended on Europe from 24th to 27th January had then its centre on Sicily i and he believed that it would return from the . S. about the 3rd or 4th of March, and that it was very probable that a fall of sand would be observed in Sicily or Spain. . . .”

“The phenomenon was also observed in the southern parts of Sicily, and the desert sand was abundantly deposited everywhere—a very fine and light powder, and of the colour of pounded terra cotta.”⁴⁴

The 1872 discussion turned to the “*remarkable solar phenomena*” of March 5th, also observed by P. Denza, P. Secchi, and Tacchini from different locations. At about the same time they also observed fine zodiacal light, auroras, and magnetic perturbations. Professor Tarry says that “*some might find that a connection between the dense fog and the coinciding solar phenomena, auroras, and zodiacal light is evident, however they would be mistaken*”.⁴⁴

“Here the necessity and the action of time is more important. A storm may be in the vigour of its commencement, when the cause which produced it has already ceased, the greatest circumspection is therefore necessary in treating of such important questions.”⁴⁴



Uprooted trees half mile northwest of Thorp Pond, note contrast between very dark and light soils.

Thanks to the holes excavated by the numerous uprooted trees around Thorp Pond, it is easy to see what is just below the surface, a snapshot of previous generations. The buried layer representing one-hundred and forty-six years ago should not be very deep and the contrasting material just below the rich dark surface soil is consistent with what an ejecta blanket might look like.

Bad news is that nothing that I have found so far relating to Thorp Pond is solid evidence that Thorp Pond is a meteor crater, let alone a meteor crater that formed only one-hundred and forty-six years ago. The good news is, if the right people are curious enough, it could be determined fairly conclusively if Thorp Pond is a crater and how old it is either way. Looking at Thorp Pond, it has a lot in common with the few young meteor craters that are known about in a similar climate. I know I'm going to keep working until the answer is confidently determined.

COINCIDENTAL PHENOMENA

I searched scientific journals, geological surveys and news published after October 8, 1871 for mentions of Iron or magnesium in the environment and anything else unusual. There were numerous stories and scientific discussions of auroras, magnetic storms, solar spectroscopic anomalies and electrical phenomena. Within these stories I found mentions of observations that are still unexplained and could be consistent with vast quantities of meteoric smoke in the atmosphere.

Measured along the forty-five degree line of latitude, Edinburgh England is approximately 4000 miles from Peshtigo Harbor. The following observation was noted six days after the fire.

*“Transactions of the Royal Society of Edinburgh, Volume 39, Part 1 - October 14, 1871 - Auroral light to the N.W. amongst clouds.”*⁴⁵

Auroras aren't typically associated with clouds in the troposphere, and noctilucent clouds high in the mesosphere typically have moved to the southern hemisphere by mid October. Assuming the auroral light was spotted on the evening, considering the distance from Peshtigo to Scotland and time since October 8th would have required an average of twenty-seven mph. At that speed the cloud might spread 600 miles per day, taking about 40 days for the cloud to circle the earth at lower altitudes.

By February 4th, 1872 the bulk of the cloud including troposphere could have circled the earth nearly 4 times and could have been widely dispersed. On this day, four months after the fire a *“World Aurora”* occurred. It was witnessed in United States, Paris, Turkey, Egypt, Bombay, Sydney, Cape of Good Hope, Tobago, Cuba and Mauritius. From the 1873 Annual Record of Science and Industry;

“Ground Currents and the Aurora of 1872

*The Journal of London Society of Telegraph Engineers contains a very interesting summary of the phenomena of “ground currents” as observed in connection with the aurora of 1872, February 4. Not only was this aurora one of the most remarkable of recent years, because of the wide extent of its visibility, but it seems to have been attended with electrical disturbances that are, as yet unparalleled in the annals of science for their intensity, if not for their duration and geographical extent.”*³⁹

From the 1873 Annual Record of Science and Industry; Volume2, Italian astronomer Angelo Secchi describes the February 4, 1872 aurora, the associated magnetic disturbance and a mysterious spectral absorption band³⁹ which I have found from a modern source was possibly nickel sulfide (NiS) at 450-560 nm converted from 5560 Angstrom's ray.⁴⁶

“Secchi on the Aurora of February 4, 1872

At first the aurora had the appearance of a broad, nebulous, phosphorescent band, which moved parallel to itself

*in the direction of the meridian. After passing the equator it's aspect changed. The whole heavens , except for a small portion in the south, shone with a purple light, which changed to a yellowish-green on the northern side. The magnetic needle was greatly agitated, changing by more than a degree. The spectrum of the crown was very vivid. **Angstrom's ray (5560) was visible in every part of the heavens...** He remarks also in general, the aurora is followed by a decided and extensive change in weather, and seems to be connected with great movements in the atmosphere.*"³⁹

If "*Angstrom's ray (5560)*" is nickel sulfide, then one explanation of why nickel would be detected from auroral light in 1872 could be MSP. Using the same conservative estimate of 10,000 tons of iron from previous chapter, most common ordinary chondrites (65%) H and L types contain 5% - 21% metallic iron, which would be at least 500 tons of metallic iron. Meteoric metallic iron is alloyed with anywhere from 7.5% - 25% nickel. Using the most conservative numbers again you would end up with >37 tons of nickel injected into the atmosphere.

In 1868 French astronomer Jules Janssen used solar spectroscopy to discover helium on the sun. Now known to be a major component of the sun, helium was not found on earth until 1895. The following quote from Nelson Leslie Reginald, Ph.D.- Solar Physics Division, NASA, gives some insight into the state of the science in 1871. It also suggests that if bands show up in the spectrum of the sun's light it could be from the sun or it could be atoms in the atmosphere absorbing light at those wavelengths.²⁶



View of 2017 Solar Eclipse from Nashville Tennessee.

*"The solar eclipse of 1871, Janssen discovered and identified absorption features in the solar spectrum. In 1814, Fraunhofer had been the first to label certain absorption features in the spectrum of the sun, and Janssen was able to identify some of Fraunhofer's lines in the coronal spectrum. Most of the Fraunhofer features in the solar spectrum are atomic lines that are formed in the solar photosphere, **although some are caused by molecules in the earth's atmosphere.**"*²⁶

In May of 1872 Italian Professor Pietro Tacchini was becoming concerned about the recent and increasing presence of **magnesium in the Sun**. He concluded based on his observations that the entire Sun was experiencing a magnesium expulsion, rather than a localized eruption and he thought it could mean a catastrophe for the Earth. It has since been well established that magnesium is only a minor component of the Sun,⁴⁷ so the magnesium that

was detected must have been present in our atmosphere in great quantities, not from the sun.

“A Possible Catastrophe. New York Times (Aug 18, 1872)

*Within the past month we have had the most remarkable auroral displays that have occurred within the memory of the present generation, while it is a matter of general remark that within the last twenty years the aurora, which was formerly rarely visible in this latitude, has become yearly more and more frequent.”*⁴⁸

*“That the sun is actually undergoing a remarkable change in the constitution of its luminous envelope is asserted by several eminent European astronomers. Signor Tacchini has just discovered by the spectroscope that an enormous quantity of magnesium has suddenly made its appearance in the photosphere.”*⁴⁸

Magnesium accounts for only ~0.0038% of all the atoms in the sun, which is only about 0.076% mass of the sun.⁴⁷ Although I could find no later reference explaining why the sun had experienced a magnesium expulsion, based on the known composition of the sun and historic insight from Dr. Reginald, the magnesium was possibly in our atmosphere. The magnesium detected by Secchi and astronomers in other locations occurred over a large time-span suggesting that it wasn't a local anomaly. Ten months would have allowed the estimated 10,000 tons of Fe and 5,000 of Mg to disperse globally in the stratosphere and upper troposphere, and it probably would have taken up to five years for all of the dust to reach the earth's surface.⁴⁹

Even if Thorp Pond and these phenomena are completely unrelated to what happened October 8th, 1871 to the areas surrounding Peshtigo Harbor, it does not change the possibility that an airburst might have caused the disaster. The evidence is there and some day we will know if that is what happened. I feel that it is important to know because most people could survive a Tunguska sized airburst if they understood what was happening.

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