THE GREAT METEOR PROCESSION OF FEBRUARY 9, 1913

OR

THE PARADE OF SAINT CYRIL

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On the evening in question I happened to be returning from a snowshoe tramp, and was in the act of tightening up the straps on my foot when my companion called out: "Look! Look!" and I immediately threw my head up and caught sight of the large meteor, which appeared to be traveling very slowly – so slowly that the stateliness of its motion excited my liveliest surprise and wonderment…While my gaze was riveted on the large body, and just when it was about passing out of sight, my companion again called out "Look! There and there!" and I looked up an saw the first group of following meteoric bodies…Before I could recover from my astonishment a new group of smaller ones…came sailing along…I likened them at the time, and the resemblance seems yet apt and appropriate to a large battleship moving ahead with attendant squadrons of torpedo-destroyers and torpedo boats (the report of eyewitness Walter L. Haight)

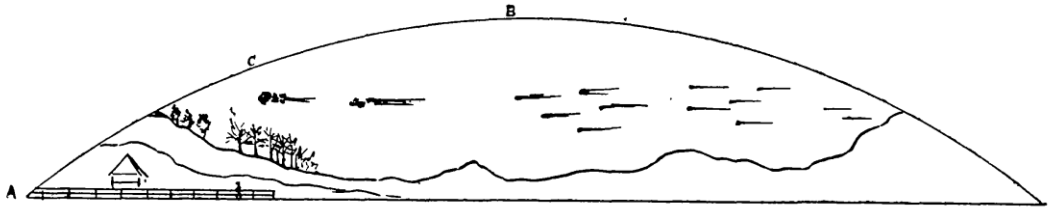


Figure 1. Sketch of the flight of the meteors as drawn by Walter L. Haight observing from Parry Sound, 120 miles north of Toronto (from Chant's 1913 paper).

Nearly a hundred years ago, on the night of February 9, 1913, something extraordinary took place in the skies above Canada, the United States, and the Atlantic Ocean. Canadian astronomer Clarence A. Chant, without whom the phenomenon would probably have been forgotten, called it "a meteoric display…quite without parallel". British meteor expert W. F. Denning , who had seen thousands of meteors during his long career, agreed: He had neither seen nor heard of anything quite like what became known as the *great meteor procession*. Decades later, United States astronomer John A. O'Keefe would study the event and connect it to a sixth century Alexandrine saint. The procession entered popular literature in a book by iconoclastic writer Charles Fort. But meteor expert C. C. Wylie thought the whole thing was a mistake, while still others placed the events of that night in the realm of UFOs rather than meteors.

The event itself was of short duration, taking but a small part of a single night. Gathering the observations, interpreting and reinterpreting them to arrive at a conclusion, took decades. Here we reexamine the story of the meteor procession. What happened was not photographed. We have only reports made after the fact -- the accounts and, more rarely, the drawings of those who saw and sometimes heard the phenomenon. In telling this story we do have the advantage that the most important papers dealing with the meteor procession, containing many eyewitness reports, are freely available through the NASA Astrophysics Data System (http://adsabs.harvard.edu/abstract_service.html).

Clarence Chant Investigates

Clarence A. Chant (1865 – 1956) was one of the pioneers of Canadian astronomy, and it is thanks to him that the event of February 9 attracted lasting attention, but he himself did not witness it. At the time, Chant taught at the University of Toronto where he championed astronomy and, so far unsuccessfully, argued for the acquisition of a major telescope. In his original account of the phenomenon Chant reported that, although telephone calls soon alerted him to the passage of fireballs through the sky, it was not until he read accounts in the newspaper the next day that he appreciated how extraordinary those fireballs were. Prompted by these initial reports, Chant appealed to local newspapers to publish a request for observations. The newspapers complied and numerous replies soon arrived.

Chant published an extensive account of the February 9 display titled "An Extraordinary Meteoric Display" in the May-June issue of the *Journal of the Royal Astronomical Society Canada* (vol. 7, p 145). It is worth repeating his summary in full:

> "GENERAL DESCRIPTION [As seen in Western Ontario)
> "At about 9.05 on the evening in question there suddenly appeared in the northwestern sky a fiery red body which quickly grew larger as it came nearer, and which was then seen to be followed by a long tail. Some observers state that the body was single, some that it was composed of two distinct parts and others that there were three parts, all travelling together and each followed by a long tail. The front portion of the body appears to have been somewhat brighter than the rest, but the general color was a fiery red or golden yellow. To some the tail seemed like the glare from the open door of a furnace in which is a fierce fire; to others, it was like the illumination from a search light; to others, like the stream of sparks blown away from a burning chimney by strong Wind.
>
> "The first suggestion which occurred to many who saw the body was that someone had set off a great sky—rocket. In the streaming of the tail behind, as well as in the color, both of the head and the tail, it resembled a rocket ; but, unlike the rocket, the body showed no indication of dropping to the earth. On the contrary it moved forward on a perfectly horizontal path with peculiar, majestic, dignified deliberation; and continuing in its course, without the least apparent sinking towards the earth, it moved on to the south—west where it simply disappeared in the distance.

“As we all know, most shooting stars are visible for but a very short time, and the brilliant ones very generally descend rapidly towards the earth, seemingly (as one of my correspondents remarked) ` in a mighty hurry to reach their destination’; but here were bodies moving leisurely along, giving ample time for the fortunate observer to make several wishes if he were so inclined. Some report that just before disappearing this body burst, leaving behind it a trail of stars. Before the astonishment aroused by this first meteor had subsided, other bodies were seen coming from the north-west, emerging from precisely the same place as the first one, Onward they moved, at the same deliberate pace, in twos or threes or fours, with tails streaming behind, though not so long nor so bright as in the first case. They all traversed the same path and were headed for the same point in the south-eastern sky. Gradually the bodies became smaller, until the last ones were but red sparks, some of which were snuffed out before they reached their destination. Several report that near the middle of the great procession was a fine large star without a tail, and that a similar body brought up the rear.

“To most observers the outstanding feature of the phenomenon was the slow, majestic motion of the bodies; and almost equally remarkable was the perfect formation which they retained. Many compared them to a fleet of airships, with lights on either side and forward and aft ; but airmen will have to practice many years before they will be able to preserve such perfect order. Others, again, likened them to great battleships, attended by cruisers and destroyers. Should these bodies strike the earth they might prove destroyers indeed ! Still others thought they resembled a brilliantly lighted passenger train, travelling in sections and seen from a distance of several miles. The flight of the meteors has also been compared to that of a flock of wild geese, to a number of men or horses in a race, and to a school of fish, startled and darting off in a single direction. These and many others interesting details will be found in the reports of observations printed below.

“Just as the bodies were vanishing, or shortly afterwards, there was heard in many places a distinct rumbling sound, like distant thunder or like a carriage passing over rough roads or over a bridge. In some cases three such sounds, following at short intervals, were heard; while a number of people felt a shaking of the earth or of the house.

“As to the number of bodies there is great diversity of statement. The usual estimate is from 15 to 20 but some say 60 or 100, while some say there were thousands. Various reasons can be assigned for the discrepancy between these numbers. Those giving the small numbers probably refer only to the chief bodies, and as some people have better eyesight than others, where one would see a single body others would see its different parts. Those who report the large

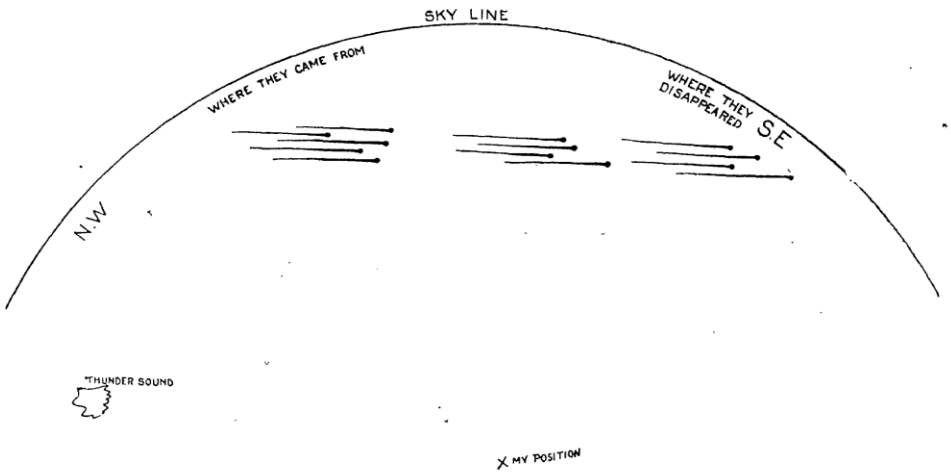


FIG. 4.—The flight of the Meteors, as sketched by Mr. A.W. Banfield at Berlin. The observer was at X and faced north-east. The place where the sounds appeared to come from is indicated in the left foreground.

Figure 2. Chant provided this sketch, drawn by A. W. Banfield, of the display as seen some 58 miles from Toronto.

numbers undoubtedly included fragments of the larger bodies and also the many red stars bringing up the rear. The only person that I have heard of who viewed the meteors with any instrumental assistance was Master Cecil Carley, a pupil of the Trenton High School, who used an opera glass. He says: `There were about ten groups in all and each group, as seen through the opera glass, consisted of from twenty to forty meteors.'

"The entire time occupied by the display cannot be determined accurately, but is given below as perhaps 3.3 minutes. This is an extraordinarily long time for such a phenomenon, but there is good evidence that it is not an exaggeration. The stretch of country over which the display was seen is also unprecedented. In September, 1868, a fire-ball was traced from over the Black Sea to France, about 1500 miles; and on December 21, 1876, such a body first became visible in Kansas and disappeared near Niagara Falls, thus covering a distance of over 1000 miles; but in the present case persons living 2500 miles (one—tenth of the earth's circumference) apart saw the same bodies. Moreover the description[s] furnished by observers in Bermuda, in Ontario and in Saskatchewan do not materially differ."

Chant was doubtless very sorry that he had not stepped outside a few minutes after 9pm on that winter evening. A splendid painting of the meteor procession by Canadian artist Gustav Hahn, a version of which was included in Chant's paper, gives an impression of the meteors as seen from Toronto. The painting, once on display at David Dunlap Observatory, is now part of the archives of the University of

Toronto. The version below is courtesy of Wikimedia Commons.

Hahn's painting would much later provide a clue to Donald Olson in his search for the inspiration of a poem by Walt Whitman (Sky and Telescope, July, 2010).

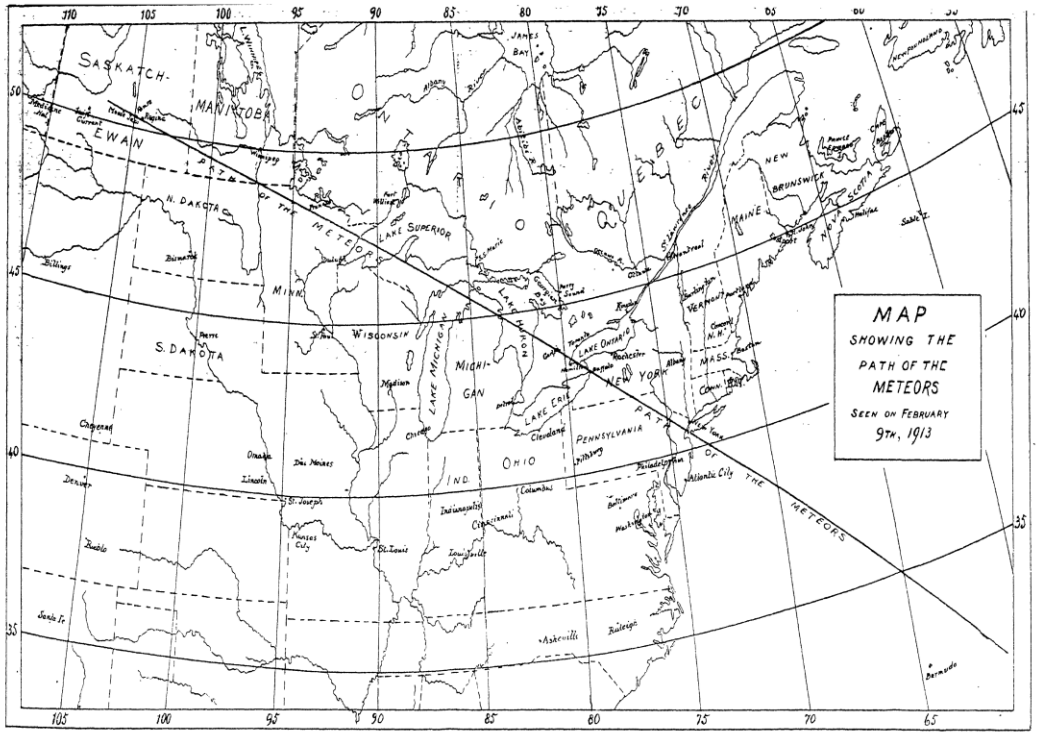


FIG. 2.—MAP SHOWING THE COURSE OF THE METEORS FROM SASKATCHEWAN TO BERMUDA, NEARLY 2500 MILES

Figure 3. Chant provided this map showing the path of the meteor procession in his 1913 paper.

Impressive as Chant's summary is, readers may want to read for themselves the many eyewitness accounts given in Chant's paper. Just a few of these accounts are included below to give the reader a better feeling for the phenomenon and the impression that it made upon those who saw it.

James H. Bolton, observing some 23 miles from Toronto, wrote:

> "When I saw the first meteor at 9.05 it was a little west of north-west from here and travelling nearly toward me. I took it for an aeroplane with both headlights lit, and as it came nearer the sparks falling behind it made it appear still more like one. However, after a minute or a minute and a half I could see it was a meteor, and the tail seemed to cover about half the sky distance when it was passing. It was very low, apparently just above the hills, and by this time I noticed about 12 or 15 more following it. Would guess that it was about 3 minutes from the time I saw the first and largest one until it got out of sight.
>
> "The smaller ones were going a little more slowly, and some of them died out just as they passed over, though they were not directly over me, but a little to the southwest. Would think it about 5 minutes from the time of first notice until they were all gone.
>
> "About 2 minutes after they disappeared there was a heavy noise like a clap of thunder at a distance. Half a dozen of us were together and all noticed it distinctly; in fact it was too heavy to go unnoticed.
>
> "There would be 12 or 15 passing at one time, so would think there were about 30 in the whole procession.
>
> "I have been fortunate enough to see nearly every big meteoric display for the past 50 years, but never saw anything as fine as this."

In Bermuda, Colonel W. R. Winter's sighting was also spectacular, but lacked the ensuing rumble of thunder:

> "I saw two leading bodies like large arc lights in appearance, slightly violet in color; diameter, as far as the brilliance would permit of judgment, equal to that of the moon; one lower than the other and a little in advance of it. Both were coruscating or breaking into small pieces. As these pieces separated from the parent bodies they developed trails of sparks and gas. There were about l00 of these followers. Each had a nucleus, and perceptibly dwindled away in length as they got behind, from a length of about 13° near the head of the procession to small spots re-sembling pieces of wind—driven burning brown paper at the end. The longer ones were slightly scimitar-shaped and of a yellowish—red appearance, the nucleus being very bright. As they shortened up the color became more red, until at the last they were quite red, with a bluish

flame above—exactly as if they were burning. These latter appeared to driift with the wind. The short ones preceding these were apparently egg-shaped. They were travelling horizontally, with a slight downward tendency as a whole. "

Winter included a sketch of the procession as seen from his location.

FIG. 5.—From a rough sketch of the Meteoric Display made by Col. W. R. Winter, Bermuda. Apparent course N.W. to S.S.E. Wind, N.W. about 20 miles. This represents about 3/5 of the entire display, 1/5 more requires to be inserted at each arrow. (The curvature of the tails must have been apparent, not real.—C. A. C.).

Figure 4. Winter's sketch of the procession as seen from Bermuda.

Though Chant had difficulties in computing the heights of the meteors from the available observations, he decided that they were probably lowest, perhaps 26 miles (42 km) high, in the Toronto-Hamilton area, where the thunderous sounds followed the passage. Timings of the passage of the procession were not so accurate as to allow Chant to easily determine the speed of the bodies, though he noted that an object traveling as a satellite not far above the surface of the earth would have a speed of about 5 miles/second (8 km/sec). Chant thought that the procession bodies had a speed between 5 and 10 miles per second.

Chant's conclusion: "It would seem that the bodies had been traveling through space, probably in an orbit about the sun, and that on coming near the earth they were promptly captured by it and caused to move about it as a satellite."

The Flight Path Gets Longer Still

Chant's paper attracted immediate attention and further discussion followed in succeeding issues of the *Journal of the Royal Astronomical Societ*y. Papers by Chant himself, W. H. S. Monck, M. Davdison, And William Frederick Denning were published in late 1913 and early 1914. Denning (1848 – 1931) had long been ranked among the most important observers of meteors, even gaining mention in H.G. Wells's *War of the Worlds*. Chant's account of the meteor procession impressed this seasoned observer. He remarked that "I have been in the habit of watching the heavens since 1865 and have never noticed anything similar". Though he had a few quibbles over the details of Chant's interpretation of the event, he accepted Chant's picture of a meteor procession stretching over more than 2500 miles of the Earth's surface. Denning did propose that the meteors, when over the Toronto area, were somewhat higher than Chant determined, nearer to 38 miles than 26 miles, and that the meteors were higher still at other portions of their observed path. He accepted that at least some of the larger fragments of the meteor

survived to make the whole journey, but thought that smaller pieces disappeared along the way to be replaced by debris torn from the larger meteors (*Journal of the Royal Astronomical Society of Canada*, 1913, Vol 7, p. 404).

Since the meteors seemed to be going strong when they disappeared from view in Bermuda, Denning wondered whether they might have been observed from ships ploughing the Atlantic Ocean. His appeal to the *Nautical Magazine* asking for observations was published in their April, 1914, issue. Almost a year passed before it bore fruit in the form of shipboard observations beyond the location of Bermuda. Then a letter arrived from A. Y. Porter, who had been aboard the SS Bellusia, reporting that the meteors had been seen from that vessel. Still later, a report arrived from W. W. Waddell, first mate of the SS Newlands. Though the SS Newlands was off the coast of Brazil, some 5500 miles from the first sighting of the procession in Saskatchewan, Waddell's account is similar to many from earlier along the path:

"Eight Bells, midnight. – Had just gone on bridge and Fo'castle Head, and I was just about to leave the deck for my bunk when my eye was caught by a bright shooting star in the western sky that traveled away across the heavens at a height of about twenty degrees above the horizon. As it went it seemed to drop stars for all the world like a rocket when it explodes…I had time to yell out to the second mate, who had relieved me on the bridge, asking if he had seen that, when a whole shower of stars of the same kind came shooting across in the wake of the first one, each of the stars wavering at the same speed and keeping regular distances from one another, all leaving a train of smaller stars in their wake that seemed to be drawn after the parent star" (*Journal of the Royal Astronomical Society of Canada*, 1916, vol. 10, p. 294).

Discussions of the meteor procession continued into the 1920s. Astronomer W. H. Pickering (1858 – 1938) rediscussed the meteor procession in series of papers published in *Popular Astronomy* magazine (1922, vo. 30, p. 632; 1923 vol 31, p. 96, p. 443, p. 501). An inquiry by Pickering led to the discovery by the U.S. Navy Hydrographic Office of two additional probable observations of the meteor procession by seagoing vessels. However, neither of these extended the path of the meteor track beyond the location of the SS Newlands. Although differing with Chant in some details, Pickering's interpretation of the procession was similar to Chant's.

Willard J. Fisher (1928 *Popular Astronomy*, vol. 36, p. 398) introduced an important point. He pointed out that, if the meteor procession consisted of objects in temporary orbit near the earth's surface, their path would not trace an exact great circle route over the surface of the earth. The rotation of the earth during the flight would cause the path to curve to the west. Fisher also pointed out that the equatorial bulge of the earth would prove an additional obstacle to the flight of the meteors:

> "But a satellite-meteor starting from latitude 50° or 43° and traversing a nearly circular orbit toward the equator would find rising before it the equatorial bulge of the spheroidal earth, and above this an atmosphere in which it would continually become more deeply entangled."

Fisher concluded:

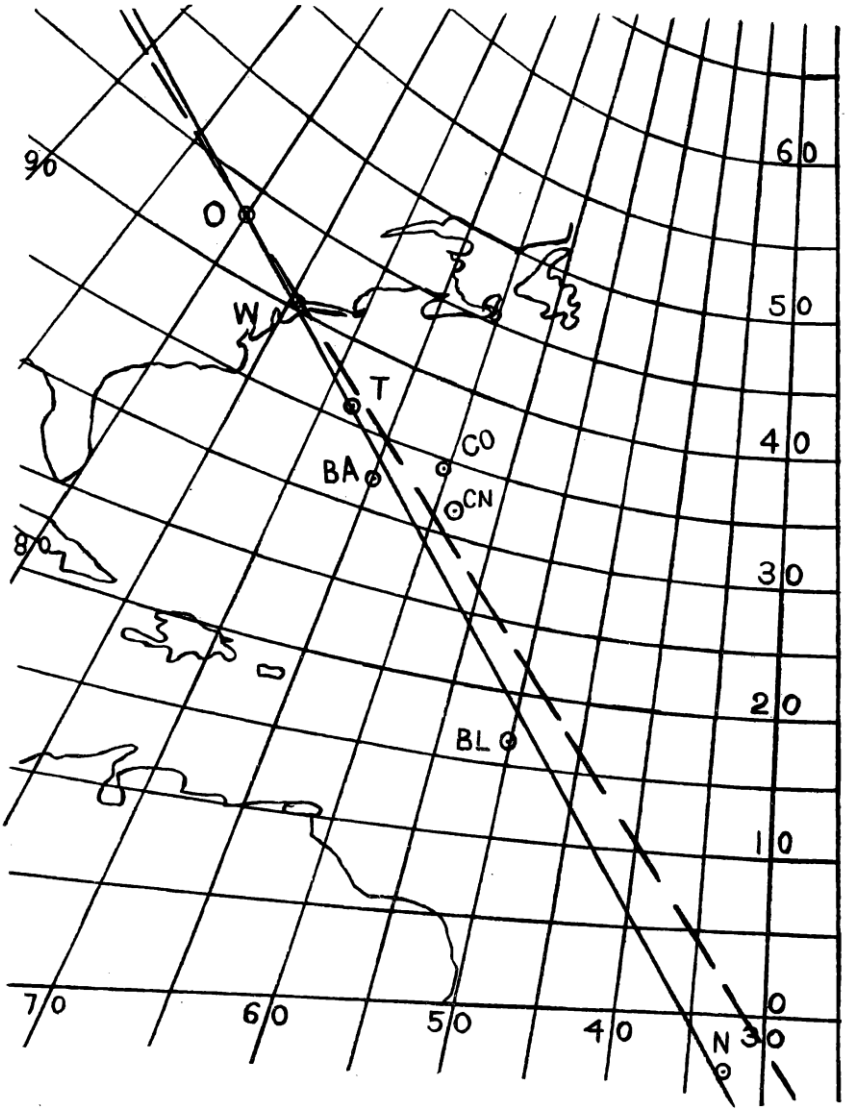
> "It is not impossible, and the writer is inclined to believe, with Davidson, that the objects seen in Saskatchewan were partly destroyed by atmospheric ablation, partly entangled in the deeper atmosphere over the equatorial bulge and sunk in the Atlantic.; and that the objects which passed the equator were originally higher members of the stream or swarm of meteors, some of which may even have escaped from the equatorial bulge and got away again."

Charles Fort has Some Doubts

It is an understatement to say that Charles Fort (1874 – 1932) did not accept everything that astronomers happened to write. In his 1919 volume *The Book of the Damned*, he collected accounts of phenomena that he believed could not be explained by science, and which had been unjustly ignored because of that. Astronomers tended to fare particularly badly in Fort's writings.

In 1923, Fort published a book, *New Lands*, that continued the thrust of *The Book of the Damned*. In this book Fort refers to the meteor procession of 1913, but in a decidedly skeptical tone:

> "According to data published by Prof. Chant, in the Journal of the Royal Astronomical Society of Canada, 7-148, the most extraordinary procession in our records was seen, in the sky of Canada, upon the night of Feb. 9, 1913. Either groups of meteors, in one straight line, passed over the city of Toronto, or there was a procession of unknown objects, carrying lights. According to Prof. Chant, the spectacle was seen from the Saskatchewan to Bermuda, but if this long route was traversed, data do not so indicate. The supposed route was diagonally across New York State, from Buffalo to a point near New York City, but from New York State are recorded no observations other than might have been upon ordinary meteors, this night. A succession of luminous objects passed over Toronto, night of Feb. 9, 1913, occupying from three to five minutes in passing, according to different estimates. If one will think that they were meteors, at least one will have to think that no such meteors had ever been seen before. In the Journal, 7-405, W.F. Denning writes that, though he had been watching the heavens since the year 1865, he had never seen anything like this. In most of the observations, the procession is described as a whole — 'like an express train, lighted at night' — 'the lights were at different points, one in front, and a rear light, then a succession of lights in the tail.' Almost all of the observations relate to the sky of Toronto and not far from Toronto. It is questionable that the same spectacle was seen in Bermuda, this night. The supposed long flight from the Saskatchewan to Bermuda might indicate something of a meteoric nature, but the meteor-explanation must take into consideration that these objects were so close to this earth that sounds from them were heard, and that, without succumbing to gravitation, they followed the curvature of this earth at a relatively low velocity that can not compare with the velocity of ordinary meteors.



GREAT CIRCLE CHART OF OBSERVERS' STATIONS, 1913 FEBRUARY 9.
O, Ontario station; W, Watchung, N. J.; T,*S.S. Tennyson;* BA, Bermuda; CO, *S.S. Calvo;* CN, *S.S. Custodian;* BL, *S.S. Bellusia;* N, *S.S. Newlands;* solid line, Pickering's great circle; dotted line, Chant's great circle.

Figure 5. Alternative paths of the procession from Fisher's 1928 paper.

"If now accepted that again, the next day, objects were seen in the sky of Toronto, but objects unlighted, in the daytime — I suppose that to some minds will come the thought that this is extraordinary, and that almost immediately the whole subject will then be forgotten. Prof. Chant says that, according to the Toronto Daily Star, unknown objects, but dark objects this time, were seen at Toronto, in the afternoon of the next day — 'not seen clearly enough to determine their nature, but they did not seem to be clouds or birds or smoke, and it was suggested that they were airships cruising over the city.' Toronto Daily Star, February 10 — 'They passed from west to east, in three groups, and then returned west in more scattered formation, about seven or eight in all.'"

Fort has his advocates even today. His books are still read and a magazine, *The Fortean Times*, continues to publish reports of oddities and the unexplained. His discussion of the procession of 1913 does not add anything in the way of actual observations to Chant's account. The question of whether the trail of the meteors from Saskatchewan to Bermuda was continuous is, however, important, and is a point to which later investigations would add much. As for the supposed daytime observations, the complete account as given by Chant is:

> "In conclusion I shall refer to a curious observation reported in *The Toronto Daily Star* for Monday, February 10. At about 2pm on that date some of the occupants of a tall building near the lake front saw some strange objects moving out over the lake and passing to the east. They were not seen clearly enough to determine their nature, but they did not seem to be clouds, or birds, or smoke, and it was suggested at the time that, perhaps, they were airships cruising over the city. Afterwards, it was surmised that they may have been of the nature of meteors moving in much the same path as those seen the night before."

To me, this report is much too vague a tale on which to hang any weighty conclusion. It implies a single group of observers, as compared to the many of the night before, and even they do not appear to have been able to see the objects clearly. Any connection with the nighttime meteors seems weak. With nothing else to go on, it does not appear possible to weave this report into the story of the meteor procession itself.

While some have reported that Fort interpreted the meteor procession lights as a fleet of extraterrestrial spaceships, he does not actually go that far in *New Lands*. Perhaps, however, he would have been more sympathetic to the idea than were Harvard Observatory director Donald H. Menzel and Lyle G. Boyd, who in their 1963 book *The World of Flying Saucers*, wrote condemningly that "if the UFO cult had existed in 1913, the flying-saucer enthusiasts would probably have regarded the fireball procession as a fleet of spaceships, and would have speculated on the problem of what planet dispatched them and for what purpose."

C.C. Wylie Seriously Doubts

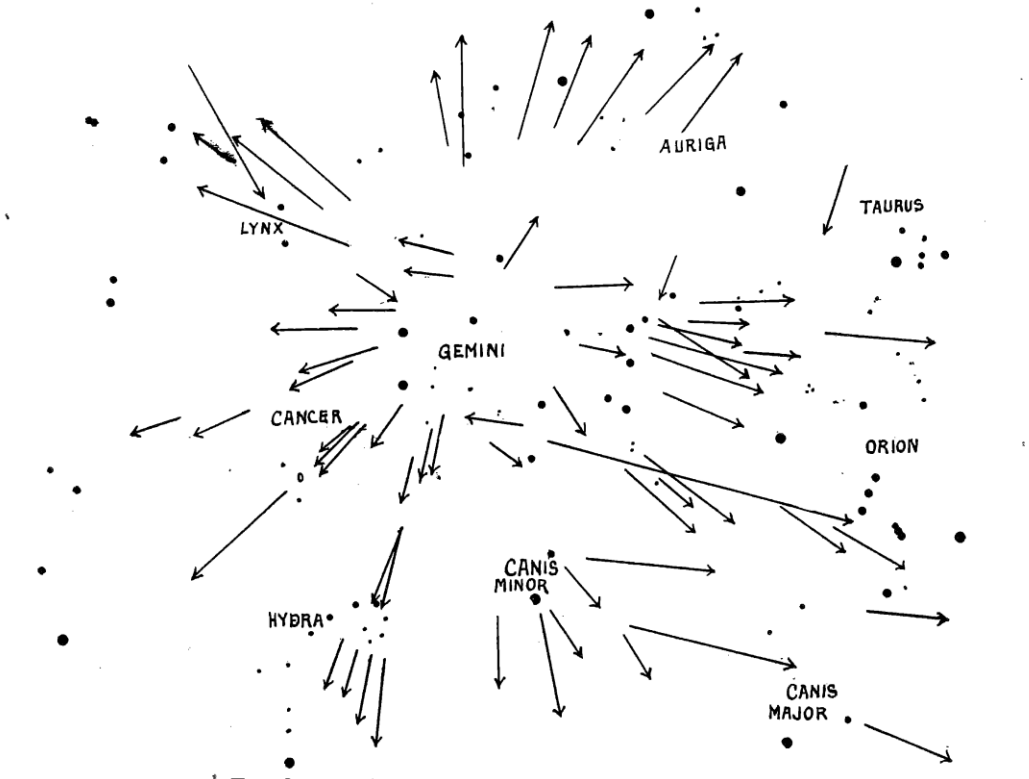
Charles Fort may have been skeptical of astronomers, but his was a voice not likely to be given much credence by scientists. The same could not be said of another critic. Unlike Charles Fort, Charles Clayton Wylie (1886 – 1976) was a credentialed academic. For many years he was a professor at the University of Iowa and his name appears frequently as the author of papers on meteors during the 1930s and 1940s. Many of his papers are investigations of brilliant meteors where only the chance observations of surprised and untrained observers could be used to trace the path of the objects through the sky. The titles of two of these papers serve to illustrate the kind of objects with which Wylie was concerned:

> *The daylight meteor of February 19, 1935* (1935, *Popular Astronomy*, vol. 43, p. 459)
>
> *The detonating meteor of January 24, 1934* (1935, *Popular Astronomy*, vol. 43, p. 379)

In investigating these and other bright fireballs, Wylie interviewed many eyewitnesses. These observers were essential to determining what was actually seen, but Wylie often found that he had to sift wheat from chaff to make sense of the reports of people caught by surprise and not at all used to observing meteors. Wylie summarized the problems that he had encountered in a paper published in 1940 (*Popular Astronomy*, vol. 47, p. 206). Titled "Psychological Errors in Meteor Work", this paper included a list of difficulties frequently encountered when one tried to interpret observations of meteoric fireballs made by the general public. This perhaps led him to approach reports of the meteor procession with a skeptical eye.

In 1939, Wylie turned his critical approach to the 1913 meteor procession (*Popular Astronomy*, vol. 47, p. 291). Wylie began by crediting Chant for the initial investigation of the event, but his interpretation of the observations was very different than that of Chant, and indeed other earlier investigators. To understand Wylie's paper, it is necessary to comment a little on the difference between a meteor procession, as envisioned by Chant, and a more ordinary meteor shower.

The reader may be familiar with certain annual meteor showers, such as the Perseids which peak each August. The Perseid meteors get their name because they appear to come from an area in the constellation Perseus, called the radiant.



THE GEMINID METEORS ON DECEMBER 11, 1914, 8^h-13^h.

Figure 6. Nels Bruseth published this figure of the apparent paths of meteors seen on the night of Dec. 11, 1914. Most, though not all, are members of the Geminid meteor shower and thus their paths trace back to a radiant in the constellation Gemini. (Popular Astronomy, vol. 23, p. 100).

Though the objects responsible for the Perseid meteors are moving on nearly parallel paths through space when they encounter the earth, when we see them as shooting stars perspective causes them to follow apparent paths that diverge but trace back to the radiant. Observers in all parts of the earth for which the radiant is above the horizon, and which have dark skies, can see Perseid meteors, but the meteors do not all follow a single path across the sky. There are several well-known and reliable annual meteor showers with radiants in different constellations. The meteoroid particles associated with these meteor showers, that become shooting stars when they entered the earth's atmosphere, are small pieces of material that were originally within comets. The Perseid meteors, for example, began as part of comet Swift-Tuttle. When released from the comet, the particles continue to orbit the sun in orbits similar but not necessarily identical to the orbits of the comet itself. The annual nature of these meteor showers is a consequence of earth crossing the orbital stream of meteoroid particles at the same time each year. The Perseids in August and the Geminids in December are often the most productive of meteors of the annual showers, with as many as 50-100 meteors being visible per hour under favorable circumstances.

However, not all meteor showers are annual. In some instances, the earth does not intersect the stream of particles each year. The November Leonid meteors provide an example of the variability of a meteor shower. Often, watchers of the Leonids see at most 5 or 10 meteors per hour at the peak of the display, shooting from a radiant in the constellation Leo. However, in some years the earth penetrates denser streams of Leonid particles and, for an hour or two the number of meteors climbs to thousands an hour, providing observers with a meteor storm rather than a shower. Nor are all meteors associated with known meteor showers. In fact, most of the fireballs known to have dropped meteorites to the surface of the earth are singular events, not associated with showers.

The reader will recall that Chant and other early interpreters of the 1913 event concluded that it was not like an ordinary meteor shower: Though there was more than one meteor, the meteors did not spread in all directions from a radiant, but followed closely similar paths across the sky.

Wylie concluded that this interpretation was wrong. Instead, in his view, there had been two distinct meteoric phenomena that combined to mislead Chant and the others. There was a low detonating and fragmenting fireball that gave rise to the thunderous noises heard in the vicinity of Toronto. This meteor was, however, seen only in that area. There was no procession stretching from Saskatchewan to the tropical Atlantic. What, then was seen from the other locations? There was an unexpected shower of meteors originating in a radiant in the north-northwestern part of the sky. The detonating meteor may have belonged to this shower, but the shower members did not follow a procession through the sky.

Wylie made several points in debunking the meteor procession. He noted the lack of observations reporting fireballs rising above and then setting below the horizon. He pointed out that only low meteors, perhaps 25 or 30 miles above the ground, were known to produce audible explosive sounds. Such a low meteor could only travel some 8 or 10 miles against air resistance, and thus the detonating meteor observed from Toronto could not have traveled far from that locale. He put forward a probable orbit about the sun for this detonating meteor before its final encounter with our planet. Wylie would

reiterate his interpretation of the 1913 meteors in a paper published in *Science* (1953, vol. 118, p. 124) entitled “Those Flying Saucers”.

So is that the end of our story? Was the meteor procession as originally described by Chant all a mistake? Obviously not, or this discussion would end here. But Wylie’s paper was influential. J.H. Pruett, writing in the March 1952 issue of *Sky and Telescope* magazine accepted Wylie’s explanation. In a letter to *Science*, answering a criticism of Wylie’s 1953 paper by Alexander D. Mebane (who will figure importantly in the next stage of the story), Wylie noted that his suggestion of a new article on the meteor procession was turned down by the editor of *Sky and Telescope* on the grounds that another article was not needed yet but that “Perhaps in a couple more years it would be interesting to remind people of the situation once again” (*Science*, vol. 118, pp. 725-726). Wylie’s interpretation may have gained the upper hand by the early 1950s, but soon two new investigations would reawaken interest in the 1913 event.

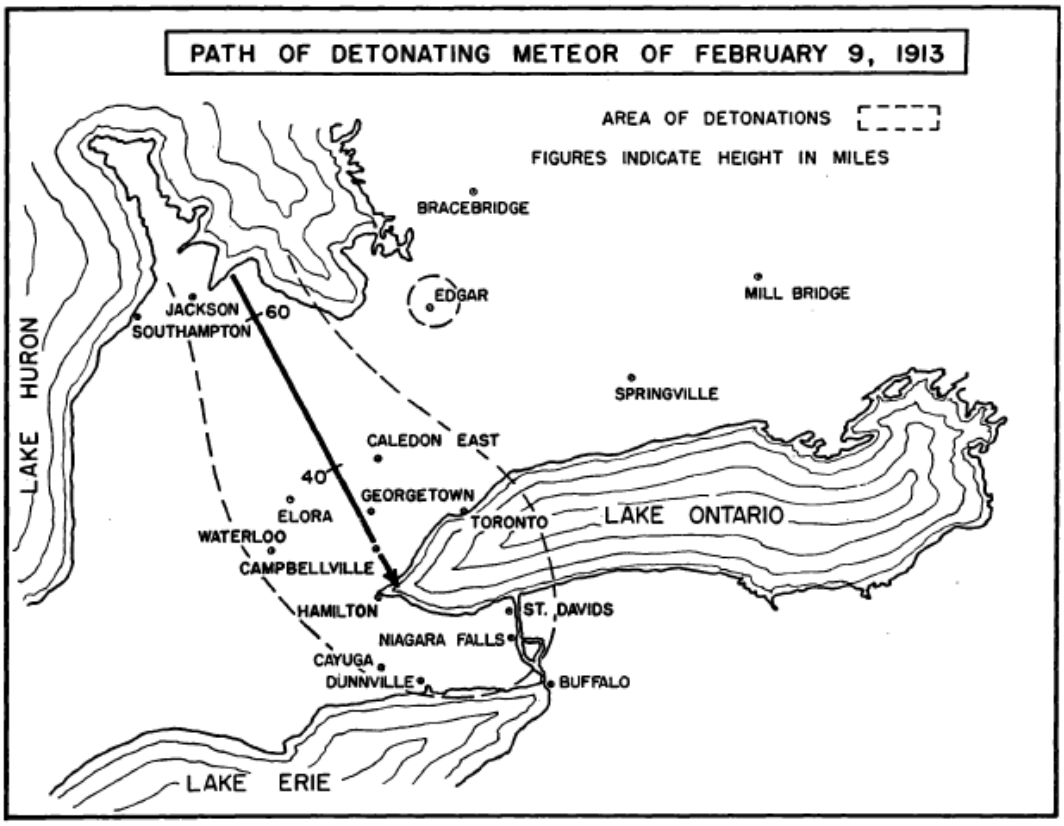


Figure 7. Wylie’s 1939 diagram showing his path for the detonating meteor seen in the Toronto-Hamilton area.

Dusty Newspapers Answer a Question

Not everyone was persuaded by Wylie's revisionism. Lincoln LaPaz did not think that Wylie's rejection of earlier work on the procession was the final answer. LaPaz (1897 – 1985) was, like Wylie, an academic astronomer. He joined the University of New Mexico after the Second World War where he was the first director of the Institute of Meteoritics . By the mid-1950s, LaPaz and Wylie had already crossed swords over scientific issues relating to meteoritics, and he was not satisfied to let Wylie have the last word on the meteor procession.

One of Wylie's (and Fort's) objections to the natural satellite hypothesis was the lack of observations from important regions along the supposed flight path of the procession. The skies over the northeastern United States were at least partially clear, so why were so few observations known from that region? The paucity of report's from the densely populated northeastern United States was consistent with Wylie's conclusion that the fireballs seen in the Toronto area were a local phenomenon. If additional observations could be discovered along the route that the meteors would have taken as they traversed New York, Pennsylvania, and New Jersey, then the argument for a continuous meteor procession would be greatly strengthened. But how could such observations be found four decades after the event occurred? Chant had canvassed for observations in the vicinity of Toronto, but perhaps there were still undiscovered accounts buried in the files of newspapers published in U.S. cities along the Chant trace.

Encouraged by LaPaz, Alexander D. Mebane (1923-2004) of New York City set off on a search for new data, focusing particularly on the apparent lack of observations of the procession over the northeastern United States. By profession, Mebane was a chemist not an astronomer, but he had broad interests. As noted in the epilogue, Mebane was interested in the UFO phenomenon which flourished in the 1950s, being one of the founders of the Civilian Saucer Intelligence group in 1954. Mebane set to work, seeking information from some 615 newspapers located near Chant's great circle route, asking the local editors to search their files for relevant information. LaPaz allowed Mebane to use the name of LaPaz's Institute of Meteoritics in his mailings, giving an academic imprimatur to Mebane's efforts. 274 editors answered Mebane's appeal, though their searches yielded positive results in only 27 instances.

Mebane did not stop there. He wrote to weather bureaus in the relevant states, and also approached local historians in New York state. That was a lot of work, and Mebane noted that the "results of this extensive canvass have been somewhat meager in view of the effort expended…" Nonetheless, the results he obtained were important, and he published his findings in the journal *Meteoritics* (1956, vol. 1, no. 4, p. 405).

Mebane's queries turned up previously unknown observations of the meteors from Minnesota, Michigan, New York, Pennsylvania, and New Jersey, though in Pennsylvania and the New York City area the observations were fewer than Mebane had hoped. Nonetheless, the additional observations did much to confirm that the meteor procession was indeed seen across the northeastern United States. Mebane also confirmed that the sounds associated with the procession were heard only in southern

Ontario, northwestern New York state, and portions of Pennsylvania. Near Nunda, New York, "the atmospheric muttering lured more than one man to the barn to see what the horses were about".

Mebane concluded that Wylie's criticisms were largely incorrect. Whatever happened on the night of February 9, 1913 was much more like Chant's original meteor procession than Wylie's meteor shower with a detonating fireball. Mebane did, however, conclude that the same fireballs were not seen from all locations along the path. In his view the procession was formed by multiple objects, traversing closely similar but not identical paths. No single meteor was visible all the way from Saskatchewan to the tropics.

Mebane's *Meteoritics* paper was preceded by a short paper by Lincoln LaPaz, very critical of Wylie's "unscientific" approach to the problem (1956, *Meteoritics*, vol. 1, p. 402). LaPaz's disagreements with Wylie were by no means limited to Wylie's interpretation of the 1913 event, and a personal animosity may peek though in LaPaz's words.

The Meteor Procession or the Cyrillids?

John A. O'keefe (1916 - 2000) was a planetary scientist who joined fledgling NASA in 1958. In a 1959 paper published in the *Journal of the Royal Astronomical Society of Canada* (vol. 53, p. 59), O'Keefe took up the question of the nature of the 1913 meteor procession, addressing the concerns that had led Wylie to oppose Chant's natural satellite interpretation. He, too, concluded that Wylie's arguments were weak or wrong and that Chant's view, bolstered and modified by the later findings of Mebane, was closer to the truth.

Whereas Wylie had concluded that the meteors were the result of an ordinary meteor shower accompanied by a low altitude detonating meteor in the Toronto-Hamilton area, O'Keefe found that a satellite-like orbit provided a better fit to the observations over the entire length of the sightings. Wylie had also objected that no one had reported seeing the meteors of the procession rise above or set below the horizon. By 1959, O'Keefe could note that observations of rising or setting were rarely reported for the artificial satellites that had then been launched. O'Keefe did suggest that the meteors seen at one location were not the same as those seen from other spots, with only the lower members of a similarly moving group of objects being incandescent at any given time. In an article in the January, 1961, issue of *Sky and Telescope* magazine (p. 4), O'Keefe suggested that pieces might have begun to separate from a main body responsible for the 1913 display at a perihelion point in its orbit before the many meteoric bodies were seen over North America.

If one accepts that the meteor procession consisted of natural objects in a low earth orbit, could those objects have completed an entire orbit around the earth, continuing long beyond the position observed from the SS Newlands? A satellite in low earth orbit takes about 90 minutes to complete a single orbit. Had the procession returned for a second pass, it would have crossed over areas of Canada and the United States about 23 degrees west of the original track. O'Keefe's extensive search of newspapers covering the relevant western states discovered no sightings of the meteor procession (1961, *Science*, vol. 133, p. 562). Thus, there is no evidence that a complete circle was achieved. O'Keefe's efforts to

find still more previously unknown observations of the meteor procession yielded very few positive results (1968, *Journal of the Royal Astronomical Society of Canada,* vol. 62, p. 97).

O'Keefe ventured to give a name to the meteor procession. He noted that the August Perseids were sometimes called the Tears of Saint Lawrence, since August 10 is the saint's feast day. February 9 was the feast day of Saint Cyril of Alexandria. The meteors of the meteor procession therefore became the Cyrillids (1960, *Astronomical Journal*, vol. 65, p. 495). O'Keefe also wondered whether the Cyrillids might have a connection with a type of meteorite known as tektites. Tektites are glassy rocks found strewn across certain areas of the earth. O'Keefe considered whether tektites might have been produced by objects like those responsible for the meteor procession, although there was no evidence of any meteorites attributable to the 1913 procession meteors themselves. He would go on to suggest that tektites might have a lunar origin, and that the Cyrillid fragments might be remnants of a ring of material once tossed from the moon (1991, *Abstracts of the Lunar and Planetary Science Conference*, vol. 22, p. 995). However, most researchers have not been persuaded by O'Keefe's hypothesis, and instead think that tektites are a consequence of large meteorite impacts on the earth.

Alas, O'Keefe's naming of the meteor procession objects after Saint Cyril was somewhat spoiled when a 1969 revision by the Roman Catholic Church moved St. Cyril's feast day from February 9 to June 27.

Natural Earth Satellites

If the Cyrillids were natural satellites of the Earth, which were, however, unable to complete a single orbit once they entered deeply into the atmosphere, might there be other such objects? There have been other meteors with long paths, similar to if not as extraordinary as the meteor procession of 1913, but finding a small natural satellite which is above the atmosphere is not easy. In a photographic search the target must reflect enough sunlight to be seen, but a small satellite is likely to be a dim target. Moreover, any such search carried out today would be vastly complicated by the large number of artificial earth satellites. However, just before the dawn of the satellite-era, Clyde Tombaugh, discoverer of Pluto, directed a photographic search for just such natural satellites (Tombaugh et al. 1957, Publications of the Astronomical Society of the Pacific, vol. 69, p. 400; Tombaugh, 1959, *The Search for Natural Earth Satellites,* Final Technical Report, New Mexico State University). Tombaugh's search was unsuccessful, but did set limits upon the sizes of natural satellites in the vicinity of the earth.

In a recent paper, Mikael Granvik, Jeremie Vaubaillon, and Robert Jedicke reinvestigated theoretically the possibility of natural earth satellites (2012, *Icarus*, vol. 218, p.262). They found that at any given time there ought to be at least one natural earth satellite of diameter 1 meter or more, whose stay with the earth is likely to be temporary. In fact, at least one such object appears to have been discovered in recent years. Kwiatkowski et al. (2009, *Astronomy & Astrophysics*, vol. 495, p. 967) concluded that the small 3-meter asteroid RH_{120} was in orbit about the earth for a year.

Has there been anything like the meteor procession since 1913? Of course, since 1957 reentering artificial satellites have in part duplicated the appearance of the procession. When the Mir space station deliberately reentered in 2001, it broke apart with its fragments decreasing in altitude from 60 miles (100 km) to impact in the South Pacific in a timespan of about 16 minutes. During that time span, Mir

traveled about 5600 miles (9000km), a distance comparable to the minimum distance traversed by the 1913 procession. However, the Mir fragments were in continuous descent during this time, whereas the noises heard in the Ontario-New York area indicate that parts of the 1913 procession were particularly low at that intermediate location along their path.

There have been natural meteors that duplicated parts of the phenomena associated with the 1913 procession. The daylight fireball of August 10, 1972, photographed from several places along its path and monitored by space-based sensors, penetrated the atmosphere over Utah, descended to a height of about 36 miles (58 km), and later escaped the atmosphere over Alberta, Canada, flying off into space once more (Z. Ceplecha, 1994, *Astronomy & Astrophysics,* vol. 283, p. 287; R.D. Rawcliffe et al., 1974; *Nature,* vol. 247, p. 449). The observed trajectory of this meteor, some 940 miles (1500 km), is much less than that of the 1913 procession, nor did the flight of the 1972 fireball involve a procession of meteoric objects.

As noted above, Donald Olson et al. (2010, *Sky and Telescope,* vo. 120, No. 1, p. 28) proposed that a string of fireballs analogous to the 1913 procession inspired Frederich Church's painting *The Meteor of 1860.* These July 20, 1860 fireballs were studied by James H. Coffin (*Smithsonian Contributions to Knowledge,* vol. XVI, p. 1), who deduced a path remarkably similar to that of the 1913 procession, but with observations extending only from Michigan to Long Island.

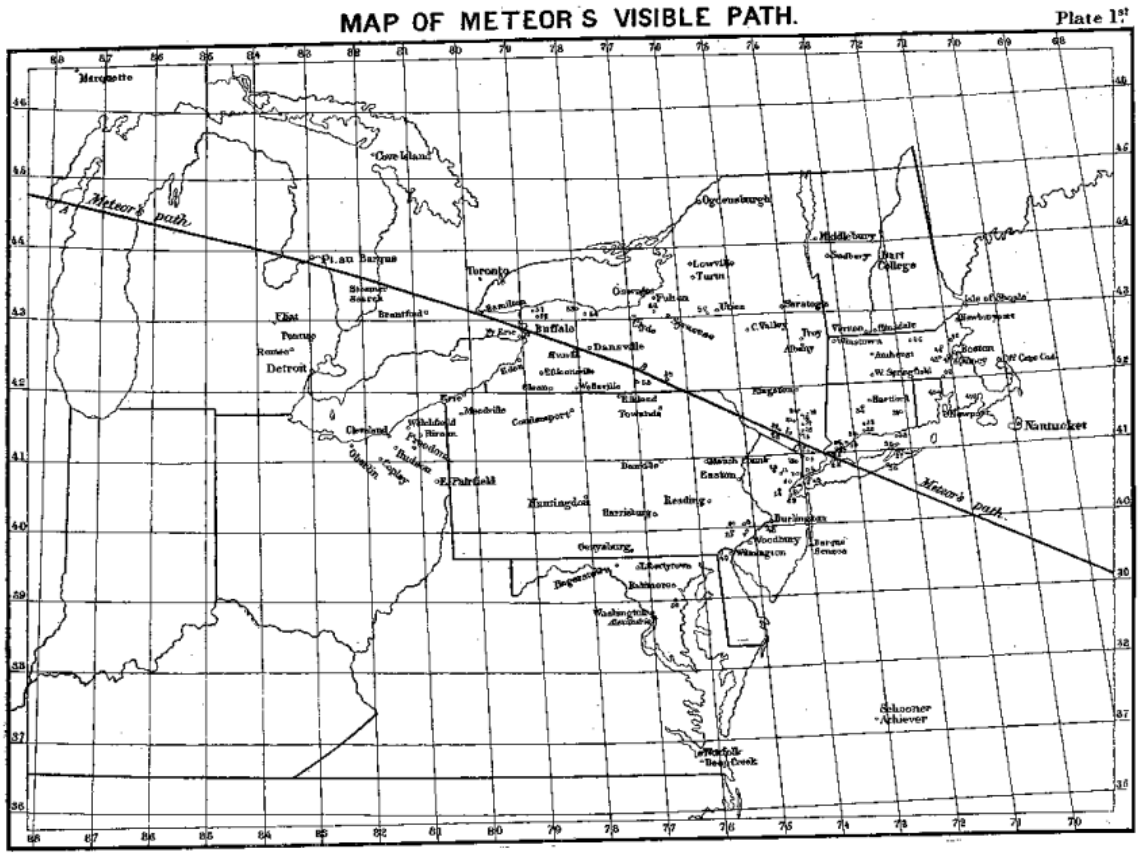


Figure 8. The path of the fireballs of July 20, 1860, according to James H. Coffin.

These, and a few other reports, indicate that the procession of February 9, 1913 may not be entirely a one of a kind event. Nonetheless, the length of the path of the 1913 meteor procession, the large number of meteoric bodies, and the number of observations made as it traversed the sky, together make it a still unique phenomenon.

Addendum: A Hundred Years Later

As reported in the February, 2013, issue of *Sky and Telescope (p. 32),* Donald W. Olson and Steve Hutcheon were remarkably able to extend the observed path of the 1913 meteor procession to a still greater length. Assisted by archivists in Britain and Germany, they discovered several previously unnoticed shipboard sightings of the meteors. Observations from the sailing ship J. C. Vinnen extended the path of the procession to some 7000 miles (11,000 km). The meteor procession still seemed to be going strong as seen from this ship sailing the south Atlantic, at latitude $14^{o}41'$ south.

Epilogue: UFOs

In light of the sometimes made suggestion that the meteor procession of 1913 was in some way connected with what would, in the 1940s, be called flying saucers and, later, unidentified flying objects, it is perhaps worth mention that several of the main characters in the story were all in one way or another connected with the UFO controversy. C.C. Wylie, ever the critic, titled his 1953 paper in *Science* "Those Flying Saucers" (*Science*, vol. 118, 124). Besides debunking flying saucer reports, Wylie would, as we have seen, use this paper to reiterate his view that Chant's interpretation of the 1913 meteors was in error. In the late 1940s, Lincoln LaPaz would investigate for the Air Force sightings of so-called "green fireballs", thought by some to be UFOs . As briefly noted above, Alexander D. Mebane was also involved in the investigation of UFO reports during the 1950s and 1960s. The 1913 meteor procession figures as an illustrative event in *The Scientific Study of Unidentified Flying Objects,* directed by Edward Condon. There is undoubtedly an interesting interplay between these investigators' experiences with meteor observing and the way in which they approached UFO reports, but a detailed investigation of that aspect of the story requires more information than the public paper trail reveals.