

Meteor Falls and Other Natural Phenomena  
Between 1392–1863  
As Recorded in the Annals of the Chosôn Dynasty (Korea)\*

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## 1. Introduction

During the 17th century, there was a long-term drop in overall global temperatures, which led to a sharp reduction in agricultural production. This, in turn, brought about widespread famine and epidemics and had major social and political repercussions. The extended abnormal temperature drop of this period has been recognized by natural scientists, who have called this the "Little Ice Age." However, little research has been done on the cause or causes of this temperature drop beyond John A. Eddy's work on the decline in sunspot activity. After I came across the 17th-Century Crisis theory in the works of Western scholars, I felt that the Annals of the Chosôn Dynasty (*Chosôn wangjo sillok* in Korean; hereinafter referred to as the "Annals") could potentially be a valuable source of reliable information for this time period. The scribes who compiled the Annals were faithful and meticulous in recording all natural and unusual (often seen as supernatural) phenomena, in accordance with the distinctive Confucian view of nature. Because of this, I believed that these records could provide much valuable insight into phenomena that attended and perhaps led to the Little Ice Age. After ten years of research, I can demonstrate that my initial expectations were correct.

At first I concentrated on records from the 17th century, but in tracing the frequencies of the various natural phenomena, I had to push the starting point back to the end of the 15th century. I also covered the records for the period immediately after the Little Ice Age for comparative reference, so in the end, I examined records spanning

470 years in the Annals. Based on these records, I have concluded that the Little Ice Age began as early as the end of the 15th century and lasted until the middle of the 18th century. Furthermore, the data suggests that the cause of the Little Ice Age is linked to the abnormally high number of meteors which fell over an extended period of time.

I am still in the midst of processing the massive amount of data obtained from the Annals--some 25,000 separate records. Therefore, I ask the reader to excuse the fact that I am presenting a work which is not entirely complete, in the hopes of enhancing my research results and analysis with input from other researchers who are working in different but related areas. I welcome healthy debate as well as constructive criticism and will update this paper as a need to arises. (Last revision: 04/16/99)

## **2. The Annals of the Chosôn Dynasty**

The Chosôn Dynasty was founded in 1392 and ended in 1910. Although it was renamed as the Great Han Empire in 1897, the royal line remained the same. The Chosôn monarch left us with many documents and records, but as the official court records, the Annals are certainly the most representative and the most important. The Annals span 518 years and cover the reigns of 27 monarchs. The entries are recorded by year, month and day and comprise a total of 1,945 volumes divided into 940 books--a massive undertaking indeed. The scribes recorded every kind of natural phenomena and astronomical observations, in according with the Confucian precept that natural phenomena reflected the current status of society. In other words, Confucians interpreted aberrations in nature as a celestial warning that humans were doing something wrong. This was especially relevant for the monarch, who as the head of the state, was ultimately responsible for all human activities. Thus monarchs kept a faithful record of phenomena such as eclipses, unusual movements in the constellations, comets, lightning and thunderstorms in the winter, hail, droughts and other unusual occurrences as a gauge of the problems of their administration and an indication that they should repent. Furthermore, they believed that observing and recording such phenomena were a form of paying respect to the heavens.

Confucianism was the predominant ideology of the Ming and Ching Dynasties in neighboring China as well. But for the following reasons, the official Annals of the Ming and Ching Dynasties fail to match the Chosôn Annals as a reference source. First, the transition from the Ming (1368–1662) to the Ching Dynasty (1663–1911) at the beginning and the middle of the 17th century was marked by constant warfare, which in itself constituted a 17th-century crisis. Another factor is the fact that the Chosôn Annals were kept off the public record from the start. This principle ensured independence from the sovereign, and therefore greater impartiality. The Ming and Ching Annals, however, were a matter of public record, and thus more susceptible to the prerogatives of the ruling monarch. Under such conditions, scribes may have been pressured to document natural phenomena with less than absolute objectivity. In Korea, the records were kept in specially designed archives to which not even the monarch had access. Finally, the Chosôn Dynasty was the longest running dynasty in the world, after the 15th century. When considering the significance of the natural phenomena to the Confucian political system, and the degree of integrity evident in the record-keeping, the Chosôn Annals are an unsurpassed record of five centuries of natural phenomena. As such, they are an unmatched source of data, an invaluable reference for studies of the Little Ice Age.

Any claims regarding the value of this material would not be complete without a reference to the astronomical observation of the Chosôn monarchs. By the early 15th century, the nation already boasted advanced observatories and other instruments and facilities, which were maintained throughout the 16th century. Among the most highly developed instruments was an astrolabe which used the horizon to measure the movements of planets, comets, and other moving bodies by minute intervals. These were known to be highly sophisticated and accurate instruments. They were kept in duplicate, one set at the royal court, the other at the Office for Observance of Natural Phenomena, which was responsible for observing all astronomical phenomena and weather. At night, five astronomers would take their turn going to the office for observation, to ensure utmost accuracy. Most of the measurements were taken in Seoul, since such facilities were not installed in the provinces. However, phenomena taking place in the

provinces which could be seen by the naked eye were all reported to the king.

The world's first rain gauge was invented in Korea in 1442. By 1444, they were installed in 260 counties throughout the country. Every time it rained, officials recorded what time it rained and how much, which they then reported to the central weather administration. This data was used to predict the coming harvest, as well as to assess taxes on crops. Since the tax rate was affected by natural phenomena, officials were instructed to report everything. In this way, a highly centralized bureaucracy was able to administrate an agrarian-based economy based on the regular collection of astronomical and meteorological data from all over the country.

Of course, the Chosŏn Annals also include observations that now seem ridiculous when measured by the standards of modern science. But we cannot conclude that the Annals were in any way fabricated or unreliable. Furthermore, my research focused only on the years from 1392 to 1863. I did not include the latter sections because the reigns of the two monarchs who ruled after the year 1863 are characterized by exceptional circumstances. Nevertheless, the sheer volume of the records documenting 471 years of 25 monarchs comprise 1,893 volumes--888 books in all. From them, I have found 25,000 references to unusual natural phenomena.

### **3. Analysis Results: Distribution of the Phenomena by Time Period and Region**

In my study, I did not include records of solar eclipses, lunar eclipses, and unusual movements of the planets,<sup>1</sup> since they cannot really be considered "abnormal" natural phenomena according to today's modern standards.

Table I shows the distribution of the records of abnormal phenomena I examined, divided roughly into 50-year periods. Looking at Table I shows that the records of unusual phenomena were concentrated from Period 3 to Period 7, or the period from 1501–1750. This 250-year period comprises 63% of the total period examined, yet it accounts for 80% of the recorded phenomena. Therefore, it seems safe to assume

that there was a high frequency of abnormal natural phenomena concentrated during this period.<sup>2)</sup>

**TABLE I**  
**Total Number of Occurrences for Each Period**

Period	Corresponding Years	Total Number
Period 1	1392–1450	2117
Period 2	1451–1500	1420
Period 3	1501–1550	6109
Period 4	1551–1600	4785
Period 5	1601–1650	3300
Period 6	1651–1700	3563
Period 7	1701–1750	2716
Period 8	1751–1800	936
Period 9	1801–1863	724
	<b>Total</b>	<b>25670</b>

Of course, there are instances where the records may be suspect due to negligence on the part of the observers. Also, the editors of the Annals would sometimes merely summarize phenomena which were repeated over and over. All in all, though, they were consistent in keeping accurate and faithful records. Out of the entire period covered, there is a higher than average percentage of faulty records from the 10-year period from 1496 to 1506, and the roughly 20-year period from 1568 to 1590. During the earlier period, the reigning monarch was a despot who did not want to hear officials telling him to be penitent as they reported the unnatural phenomena, and so he ordered them not to make such reports at all. For the second period, most of the records of that particular ruler, whose reign began in 1567, were lost during the invasion of Korea by the Japanese warlord Toyotomi Hideyoshi in 1592.

Table II shows how frequently each phenomenon occurred in Seoul and in the provinces. According to this, most of the phenomena which occurred in the sky--meteors, colored vapors in the sky, comets and *gaekseong* or "guest stars", changes in the sun or moon, halos around the sun and moon, and the appearance of Venus during the daytime--were observed and recorded in Seoul.

**TABLE II**  
**Regional Distributions of Disastrous Natural Phenomena Recorded in the Chosŏn Dynasty**

Phenomena	Seoul	Other areas	Total
Meteors	3363	68	3431
Colored vapors	1018	34	1052
Strange sounds in the Heavens	10	0	10
Comets	1212	2	1214
"Guest stars" or New stars	265	0	265
Abnormal sun	82	14	96
Abnormal moon	19	1	20
Halo effect / sun	4459	28	4487
Halo effect / moon	1139	3	1142
Daytime appearances of Venus	4882	5	4887
Thunders, lightning	1434	936	2370
Hail	630	1376	2006
Frost	170	435	605
Unseasonal snow	68	309	377
Heavy rain	129	58	187
Frightful rainstorms	303	330	633
Violent windstorms	92	140	232
Heavy snow	21	15	36
Colored snow and rain	43	47	90
Dust storms (Micrometeorites)	25	4	29

Daytime darkness	46	8	54
Fog	621	30	651
Earthquakes	216	1284	1500
Tidal waves	4	108	112
Change of water color	8	25	33
Unusually low temperature	40	24	64
Unusually high temperature	61	26	87
<b>Total</b>	<b>20360</b>	<b>53110</b>	<b>25670</b>

This is because the facilities needed for advanced astrological observation were only available at the Office for Observing Natural Phenomena in Seoul. Most of the reports from the provinces were events that could be easily seen by the naked eye or things that were extraordinarily unusual. As can be seen from the table, a small number of reports on meteor movements, colored vapors in the sky, changes in the sun, and halos around the sun, were also recorded in the provinces. In any case, the fact that most of the observations were made at one location can be a benefit since it helps guarantee the consistency of the records.

#### **4. Analysis Results: Most Common Phenomena between 1500–1750**

We can analyze the cause of the unusual natural phenomena between 1500–1750 by examining the various types of phenomena which occurred most frequently during this period. As shown in Table III, these include: 1) meteor appearances and fallings; 2) colored vapors in the sky (white vapors, black vapors, red vapors, "fire" vapors, bright lightning flashes); 3) the daytime appearance of Venus; 4) halos around the sun or moon; 5) thunder and lightning; 6) hail; 7) violent windstorms; 8) frost; 9) unseasonal snow; 10) sudden darkness during the day; 11) dust (micrometeorite) storms; 12) fog or fog-like clouds; 13) changes in the sun or moon; 14) colored snow or rain; and 15) earthquakes. While there are also high frequencies of droughts, floods, plagues, and pestilences during this period, these are more the result of natural phenomena rather than phenomena themselves, and so I have excluded them from this examination. As can be seen in Figures

1–11, the fact that the above mentioned phenomena all occurred at an unusually high frequency over the same period suggests that there is a close relationship between them. Below are individual analyses and explanations of each phenomenon.

#### 4. 1. Meteor Appearances And Fallings

Meteors were recorded according to three different names: *yuseong*, *biseong* (flying stars) and *yongduseong* (flame-headed stars).

According to astronomy texts of that time, *yuseong* were meteors which moved downward and from east to west, while *biseong* moved upward and disappeared in the distance, and *yongduseong* were meteors which fell during the daytime. The records on the appearances and fallings of these meteors were done in one of the following formats.

- A) A description of where the meteor appeared from and where it went, or the direction it was going
- B) A description of the meteor's size and shape, the length of its tail, and its color.
- C) A description of the meteor's radiance and loudness
- D) A detailed description of where the meteor fell.

For records in B) format, the size and shape were compared to a drinking cup, a bottle, a fist, a pear, a water jar, a small box, a round barrel, and a bowl, while the color was described as red, white or blue. Records in C) format referred to the sound it made when it passed by or the light it gave upon the land. The four different formats of the records were not differentiated according to size; rather, the system for describing details changed according to the times, as evidenced by the trend in the records from Period 6 and Period 7 generally showing a rough sketch. Only meteors which were thought to be

usually large or bright were recorded; smaller meteors or shooting stars were not recorded from the very start.

**TABLE III**  
**Periodic Distribution of Disastrous Natural Phenomena Recorded in the Chosŏn Dynasty**  
*(See Table I for a definition of periods P1–P9)*

Phenomena	P1	P2	P3	P4	P5	P6	P7	P8	P9	Total
Meteors	103	69	422	387	766	740	695	239	10	<b>3431</b>
Colored vapors	48	9	333	325	211	61	61	3	1	<b>1052</b>
Strange sounds in the Heavens	0	0	4	4	2	0	0	0	0	<b>10</b>
Comet observations	21	198	221	102	37	102	84	75	374	<b>1214</b>
Actual comets	5	8	6	8	4	8	5	3	14	<b>61</b>
"Guest star" or New star observations	0	0	0	127	102	0	14	22	0	<b>265</b>
Actual "Guest stars" or New stars	0	0	0	3	1	0	3	2	0	<b>9</b>
Abnormal sun	6	0	16	27	23	9	13	2	0	<b>96</b>
Abnormal moon	0	0	1	10	6	1	0	2	0	<b>20</b>
Halo effect / sun	424	352	1662	1378	266	121	239	44	1	<b>4487</b>
Halo effect / moon	27	16	145	557	78	116	176	27	0	<b>1142</b>
Daytime appearances of Venus	252	339	1186	397	829	1141	388	116	239	<b>4887</b>
Thunders, lightning	264	108	547	456	209	250	282	211	43	<b>2370</b>
Hail	177	68	578	260	223	295	262	108	35	<b>2006</b>
Frost	107	11	145	38	84	121	81	17	1	<b>605</b>
Unseasonal snow	37	3	70	32	35	117	65	18	0	<b>337</b>
Heavy rain	63	1	38	13	5	22	21	17	7	<b>187</b>
Frightful rainstorms	149	112	59	34	134	89	47	7	2	<b>633</b>
Violent windstorms	46	4	61	28	30	42	16	3	2	<b>232</b>
Heavy snow	2	7	7	0	2	14	4	0	0	<b>36</b>

Colored snow and rain	14	8	29	18	8	11	1	1	0	<b>90</b>
Dust storms (Micrometeorites)	0	0	1	2	7	19	0	0	0	<b>29</b>
Daytime darkness	0	0	1	0	14	24	13	2	0	<b>54</b>
Fog	144	20	45	280	91	22	48	1	0	<b>651</b>
Earthquakes	183	78	482	287	110	185	157	13	5	<b>1500</b>
Tidal waves	4	1	7	5	14	33	38	7	3	<b>112</b>
Change of water color	14	0	1	0	1	12	5	0	0	<b>33</b>
Unusually low temperature	8	1	28	3	11	9	4	0	0	<b>64</b>
Unusually high temperature	24	15	20	15	2	7	2	1	1	<b>87</b>
<b>Total</b>	<b>2117</b>	<b>1420</b>	<b>6109</b>	<b>4785</b>	<b>3300</b>	<b>3563</b>	<b>2716</b>	<b>936</b>	<b>724</b>	<b>25670</b>

If the records on meteors are understood as was described above, then there is a high probability that the large number of meteor appearances from Period 3 to 7 had a large influence on the other phenomena which also occurred during that period. Altogether, about 3,330 relatively large meteors were observed over the 250-year period just in Seoul, which means that the number of meteors which enter the atmosphere throughout the world must have been enormous. If that many meteors fell to the earth concentrated during the designated period, the dust given off as they burned or exploded would have had a considerable effect on the other phenomena.

*(click charts for a larger image)*

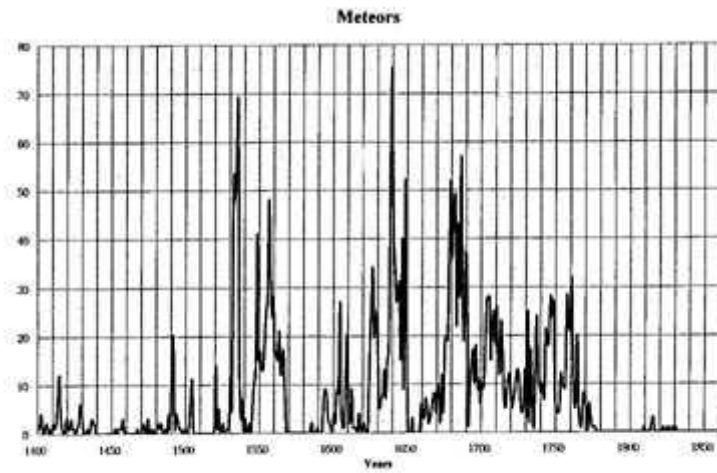


Fig. 1. Meteors (source: Annals of Chosŏn Dynasty in Korea).

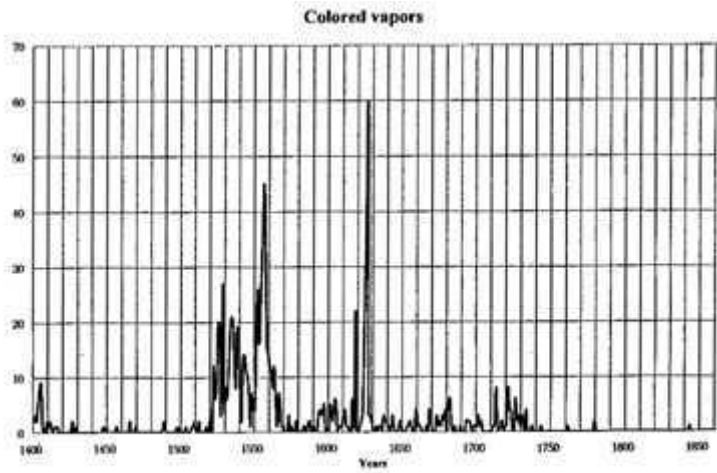


Fig. 2. Colored vapors (source: Annals of Chosŏn Dynasty in Korea).

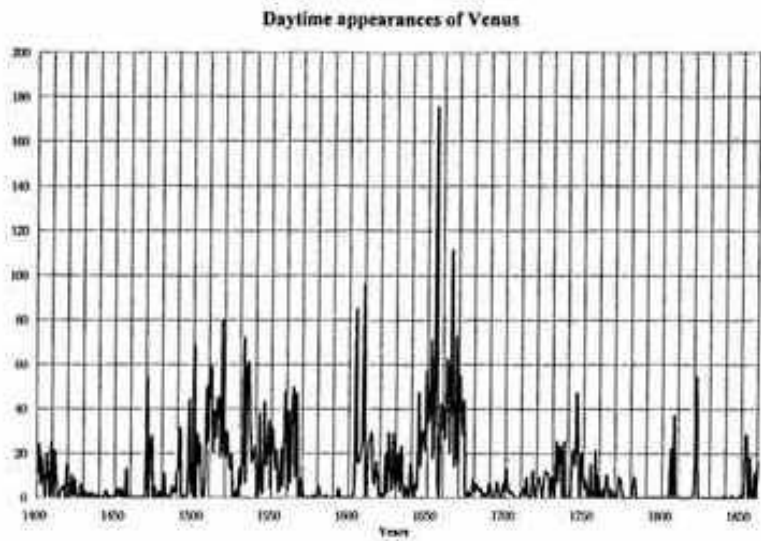


Fig. 3. Daytime appearance of Venus (source: Annals of Chosŏn Dynasty in Korea).

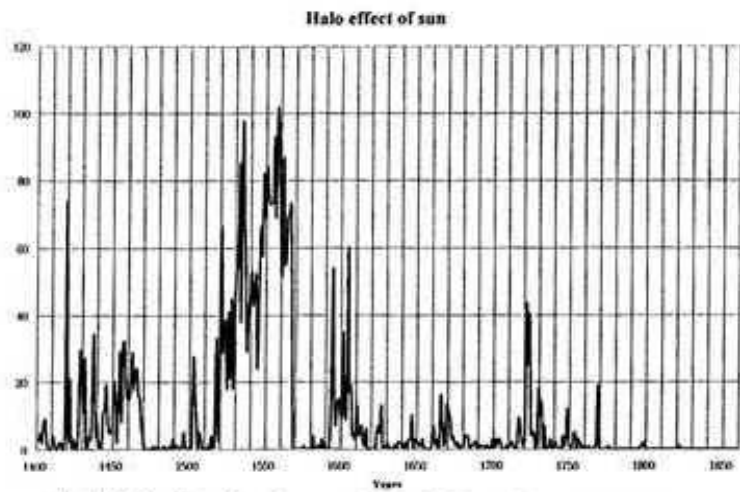


Fig. 4. Halo effect of sun (source: Annals of Chosŏn Dynasty in Korea).

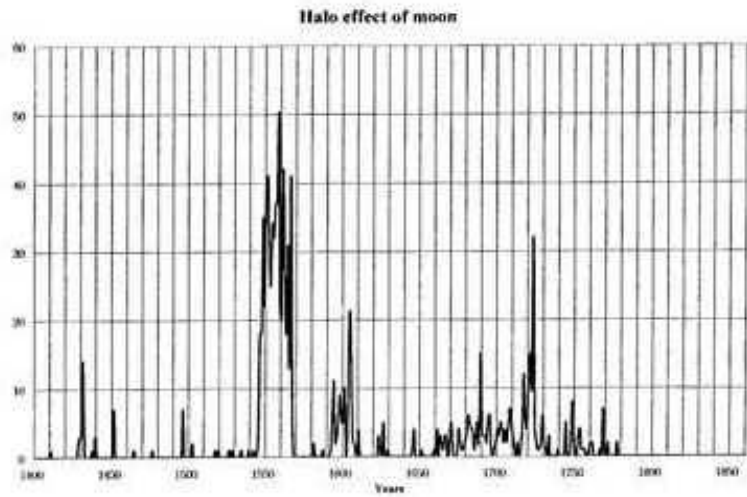


Fig. 5. Halo effect of moon (source: Annals of Chosŏn Dynasty in Korea).

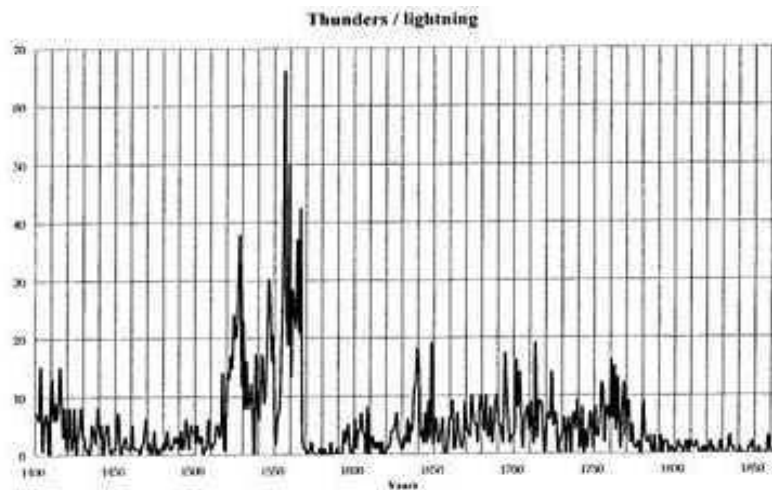


Fig. 6. Thunder, lightning (source: Annals of Chosŏn Dynasty in Korea).

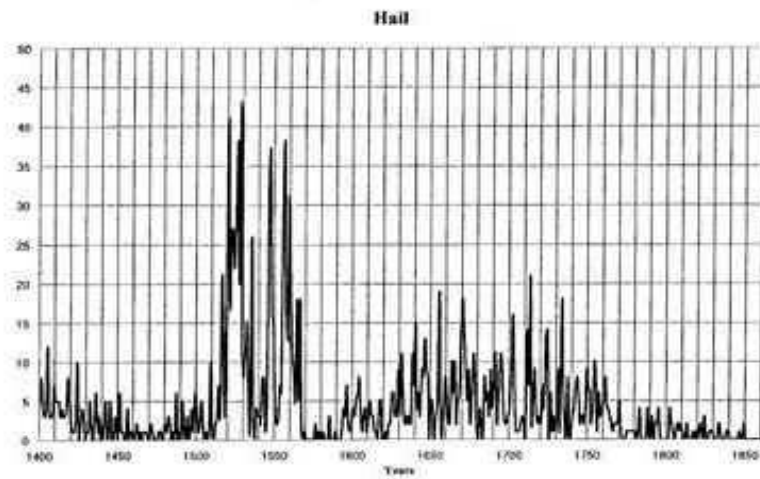


Fig. 7. Hail (source: Annals of Chosŏn Dynasty in Korea).

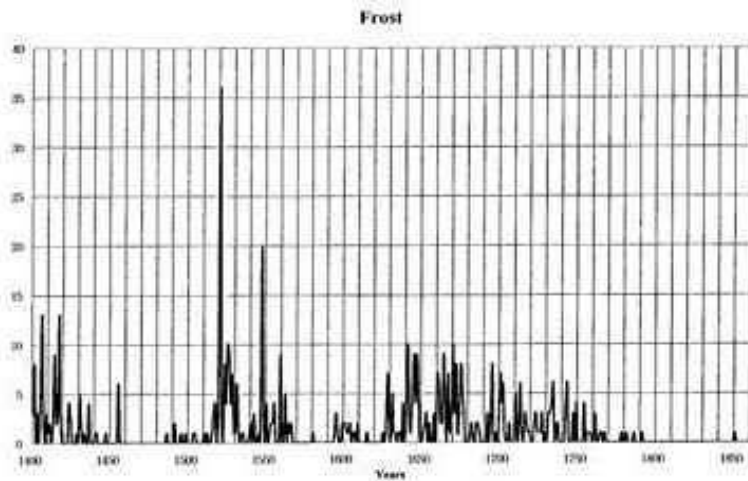


Fig. 8. Frost (source: Annals of Chosŏn Dynasty in Korea).

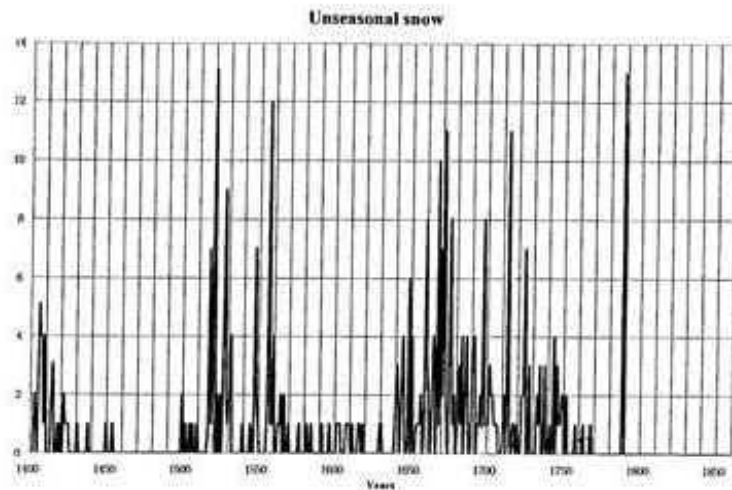


Fig. 9. Unseasonal snow (source: Annals of Chosŏn Dynasty in Korea).

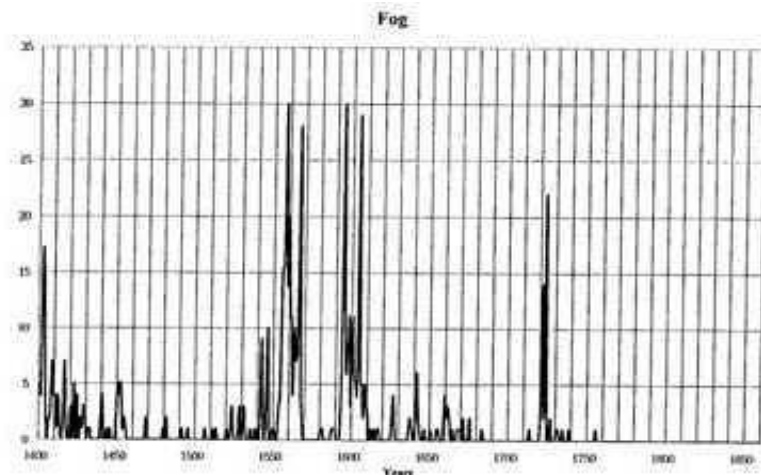


Fig. 10. Fog (source: Annals of Chosŏn Dynasty in Korea).

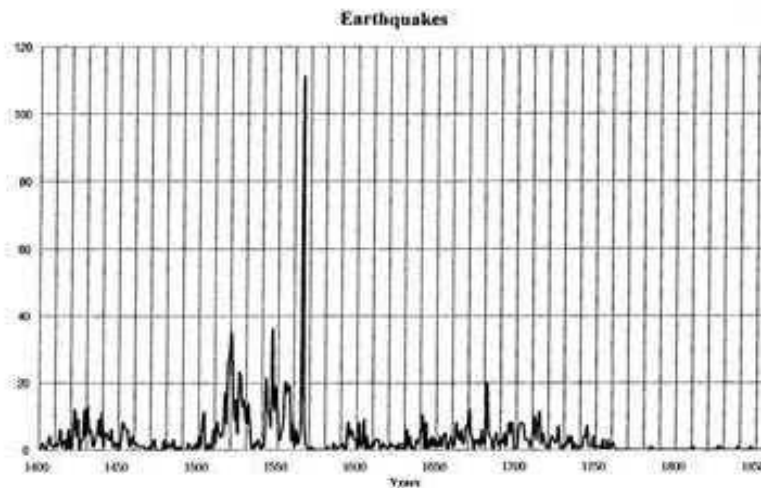


Fig. 11. Earthquake (source: Annals of Chosŏn Dynasty in Korea).

#### 4.2. Colored Vapors In The Sky

Among the recorded phenomena I examined, the one which would appear to be most closely related to meteor fallings would be the colored vapors in the sky. Altogether, there were 1,052 records of colored vapors, which were described in the following manner: *paekki* ("white vapors"), *heukki* ("black vapors"), *cheokki* ("red vapors"), *hwagi* ("fire vapors"), and *cheon-gwang* ("bright lightning flashes"). Of the 1,052 records, 94% or 991 records occurred from Periods 3 through 7.

On March 24, 1933, a meteor fell from the sky at Pasamonte, New Mexico, in the United States. Dr. H. H. Nininger has done a well-known study of this event. What interested me most from the Pasamonte research were the pictures of the site of the meteor falling.

Charles M. Brown, who was directly under the object's line of fall, captured a wonderful picture of--(a) "the fireball" and 15 minutes after that photo, C. R. West, 160 miles to the north in Timpas, Colorado, snapped (b) the "luminous dust cloud of the Pasamonte meteorite." (see figure 12) Picture (a) is an almost exact representation of one of the records of meteor sightings commonly found in the Annals--"Its shape was like a pear and its color was white, while its tail was a certain length." The white and black cloud shown in picture (b) can be well described by the countless records of "white cloud-like vapors," "black cloud-like vapors," "silk- (or cotton) lined white vapor," "white vapors," or "black vapors" found in the Annals. This picture was taken around 5:20 a.m. and the dust was too low for the luminosity to be affected by sunlight. There are many incidents recorded in the Annals of these white or black vapors appearing at night. Taking all of this into consideration, of the records of colored vapors found in the Annals, the records of white and black vapors can be interpreted as being signs of a meteor passage. This means that these recorded incidents should be added to the total number of meteors observed to have entered the earth's atmosphere.

Figure 12



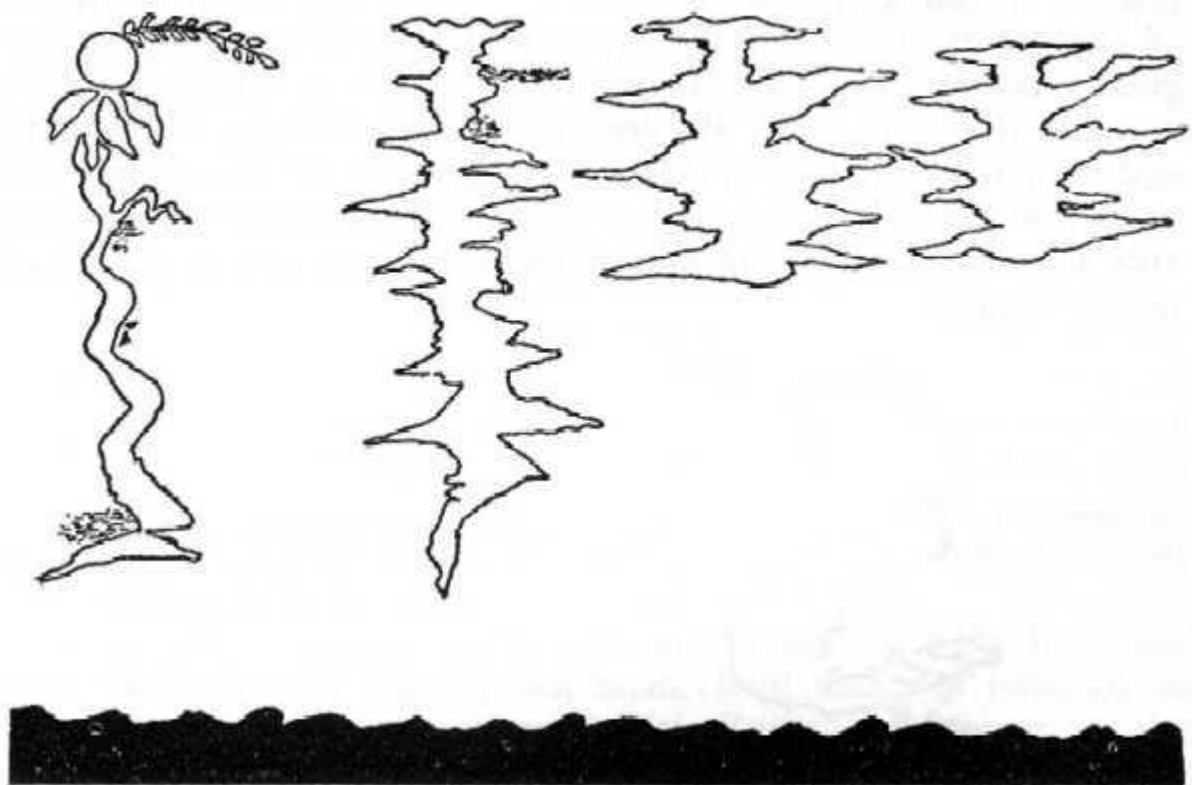


FIGURE 6

The above four sketches have been copied from drawings made by Victor M. Martinez at Wagon Mound, N. M., March 24, 1933. Sr. Martinez was an eye-witness to the great Pasamonte meteor, seeing the fireball before its final burst. He was in almost direct line of flight. An amateur artist of some talent who kept his sketching materials on a little table at an east window, he was near the table when the meteor appeared slightly north of due east.

These sketches, left to right, are timed at 5:04, 5:05, 5:25 and 5:26 A.M. Two additional ones were dated 5:35 and 5:55 A.M., the latest of which shows the sun just rising slightly to the south of the meteoric cloud.

One can imagine a bit of poetic embellishment but in general his No. 1 sketch agrees with the photograph by Chas. M. Brown and the two off-shoots to the south were verified by several different witnesses. The spiraling recorded in the Brown photo is also indicated here.

From *Out of the Sky*, by H.H. Nininger (1952)

Also included in the colored vapor category are the records of the red vapors, the fire flashes, and the bright lightning flashes. It seems more than likely that the fire vapors and the bright lightning flashes are similar or related to the luminosity seen at Pasamonte. The red vapors are generally considered to be observations of the aurora borealis, but the number of red vapors recorded is too high for all of them to be considered auroras. As is well-known, on June 30, 1908, at 7:15 a.m. (local time), a small asteroid struck the earth at Stony Tunguska River in Siberia. It is said that the "fire in the sky" was so bright that people

were able to play cricket and read newspapers by the resultant light some 5,000 kilometers away in England, and that in Belgium a huge red flame was seen over the horizon after the event. Based on this, many of the red vapors, fire flashes and lightning flashes recorded in the Annals can be interpreted as being phenomena witnessed near the site of meteor collisions.

#### 4.3. Daytime Appearance of Venus

There are 4,887 instances of Venus appearing during the daytime recorded in the Annals. Of these, 3,941 or 87% of them took place during Periods 3 through 7. Records on this phenomena can be divided into the following four formats:

- A) Venus appeared during the daytime.
- B) Venus appeared at \_\_\_\_\_ (time of the day)
- C) Venus appeared at \_\_\_\_\_ (time of the day) and at \_\_\_\_\_ (location)
- D) Venus appeared due south.

Records in A) format appear in all the Periods, but are particularly numerous in Periods 1, 2, 8, and 9. On the other hand, records in the B), C), D) formats are mostly found between Period 3 through 7. Most of the appearances occurred between 11 a.m.–1 p.m. or 1–3 p.m., with the location being southeast, due south, or southwest. Records in format D) were records in C) format of Venus appearing due south, cautioning that it appeared brightly. In Eastern astrology, Venus is the representation of *yin* in the yin–yang philosophy. In other words, it is the direct counterpart of the sun, the representation of yang. Under this system of belief, the appearance of Venus during the daytime constitutes a warning. The reason given for this phenomenon was that the light and heat of the sun generally became weaker. As is explained later, in Periods 3 through 7, there are countless reports of dust falling from the sky and darkness covering the ground in all directions like fog and also the sun losing light. These phenomena are the result of the dust caused by the large number of meteors which entered the atmosphere and burned or exploded concentrated over an extended

period of time. The reason that Venus appeared so often during the daytime is quite possibly that the rays of the sun were partially blocked by meteor dust in the atmosphere, thereby weakening the sunlight.

#### 4.4. Halos Around the Sun and the Moon

Halos around the sun and the moon appeared at a similar frequency to the daytime appearance of Venus. Out of a total 5,629 recorded instances (4,487 solar halos, 1,142 lunar halos), 4,739 or 84% were sighted in Periods 3 through 7. Most of the records were in the following formats:

- A) The sun (or moon) had a halo.
- B) The sun had a halo, with two "rings" appearing on the sides.
- C) The sun had a halo, with two "rings" on the sides, a certain shape appearing on the top or the bottom, and the color.
- D) The sun had a double halo. The inner halo had two "rings" on the sides, a certain shape appearing on the top or the bottom, and a pale rainbow wrapped around the sun.

Most of the records on halos found in Periods 1, 2, 8, and 9 were of the simpler A) and B) formats, particularly format A). In contrast, the majority of the records from Periods 3 through 7 were the more complex B), C) and D) formats. The sun was the symbol of the king, the source of all creation, and any unusual changes in its appearance could not help but attract special interest. The more complex the changes, the more shocking this phenomenon was.

Simple halos such as those described in format A) occur when there is a lot of moisture in the atmosphere, so they cannot be considered as a problem. However, more complex halos such as those described in formats B), C), and D) cannot be seen so easily are phenomena which are related to the irregular conditions in the earth's atmosphere during that period. In other words, it appears that atmospheric anomalies such as the presence of so much meteor dust led to the formation of these strange halos.

#### 4.5. Thunder And Lightning and Hail

Altogether there were 2,370 records of thunder and lightning, 74% of which, or 1,746 cases, took place during Periods 3 through 7. Records of hail storms amounted to 2,006 incidents, with 81% or 1,622 happening during the crucial Periods 3–7.

The natural climatic conditions of Korea are such that thunder and lightning usually occur during the summer months. Looking at Table IV shows that during Periods 3 through 7, thunder and lightning were spread out over every month and concentrated from the eighth month to the twelfth month (by the lunar calendar) of the year. In fact, the summer months--the 4th, 5th, and 6th lunar months--had comparatively low totals. It is safe to say that these occurrences were unrelated to seasonal patterns. On the other hand, the records of hail are concentrated in the 4th, 5th, and 6th lunar months. The fact that thunder and lightning and hail occurred so frequently out of season means that the underlying reasons for these phenomena were not seasonal-related.

There were many records of thunder/lightning and hail occurring simultaneously; in other words, oftentimes hail mixed with rain would be falling as thunder and lightning struck. The hailstones were variously described as being the size of bird's egg, a hazelnut, a chicken egg, a duck egg, a small pot, a small box, and a round barrel. When larger-size hailstones fell, not only were crops destroyed, but there were many instances where animals and even people were killed by the falling hailstones. The frequent occurrences of hail storms mixed with thunder and lightning during a time when many meteors were appearing and falling brings to mind the "impact winter" or "cosmic winter" predicted in the great asteroid-collision theory propounded by Luis Alvarez and others.

#### 4.6. Violent Windstorms, Frost, and Unseasonal Snow

According to the Alvarez team's theory, an asteroid with a diameter of 10km struck the earth some 65 million years ago. If it hit the earth, it would inject a huge cloud of dust up through the stratosphere, which would block sunlight. Hail and snow would fall continuously, and the earth would be covered in darkness and cold for several years. If it

landed in the ocean, it would send great amounts of water vapor and steam into the air, which would temporarily produce a greenhouse effect and cause temperatures to rise. Shortly after, this vapor would turn into rain and fall to the earth's surface and the dust particles in the upper atmosphere would initiate global cooling.

Of course, the meteors which fell in such concentration between c.1500–1750 are not comparable in size to the huge meteorite thought to have struck the earth 65 million years ago. However, a larger than normal number of smaller meteors falling to earth over a long period of time could conceivably produce a scenario similar to that caused by the Alvarez meteor, at least in terms of nature if not in size.

**TABLE IV**  
**Monthly Distribution of Disastrous Natural Phenomena during 1501–1750**  
**Recorded in the Chosŏn Dynasty Annals**  
*(Lunar calendar)*

Phenomena	mo n 1	mo n 2	mo n 3	mo n 4	mo n 5	mo n 6	mo n 7	mo n 8	mo n 9	mo n 10	mo n 11	mo n 12	Tota l
Meteors	183	180	184	185	111	229	305	309	475	388	242	219	<b>3103</b>
Colored vapors	139	151	141	71	66	63	38	41	37	77	72	95	<b>991</b>
Strange sounds in the Heavens	0	3	0	1	1	0	1	3	0	1	0	0	<b>10</b>
Comets	38	55	5	22	9	26	101	37	46	87	65	55	<b>546</b>
"Guest stars" or New stars	39	15	2	1	1	1	5	11	41	13	68	46	<b>243</b>
Abnormal sun	6	13	19	16	3	2	1	0	11	3	7	7	<b>88</b>
Abnormal moon	3	1	7	2	0	0	0	0	0	3	0	2	<b>18</b>
Halo effect / sun	493	495	488	409	308	162	179	231	193	193	215	300	<b>3666</b>
Halo effect / moon	144	133	108	88	47	31	54	80	87	90	105	105	<b>1072</b>

Daytime appearances of Venus	531	261	158	173	184	276	438	408	408	362	359	383	<b>3941</b>
Thunders, lightning	73	28	13	41	40	55	24	150	492	479	222	127	<b>1744</b>
Hail	8	43	117	388	333	106	71	142	211	144	47	8	<b>1618</b>
Frost	0	2	55	183	93	22	14	76	22	1	0	1	<b>469</b>
Unseasonal snow	0	0	107	94	29	8	6	24	43	8	0	0	<b>319</b>
Frightful rainstorms	7	9	12	20	37	52	70	84	38	14	12	8	<b>363</b>
Violent windstorms	9	6	8	31	18	15	30	29	19	7	2	3	<b>177</b>
Heavy rain	1	1	2	4	9	19	25	14	10	4	9	1	<b>99</b>
Heavy snow	1	7	0	1	1	0	0	0	0	1	3	13	<b>27</b>
Colored snow and rain	8	12	22	16	3	2	2	1	1	0	0	0	<b>67</b>
Dust storms (Micrometeorites)	1	1	11	13	0	0	0	0	0	1	2	0	<b>29</b>
Daytime darkness	0	6	18	12	3	1	0	0	1	2	7	2	<b>52</b>
Fog	34	23	32	25	17	21	17	17	23	64	119	94	<b>486</b>
Earthquakes	120	95	102	96	93	79	46	97	112	104	129	148	<b>1221</b>
Tidal waves	0	1	2	6	13	13	23	18	6	5	7	3	<b>97</b>
Change of water color	0	0	2	3	6	1	2	4	0	1	0	0	<b>19</b>
Unusually low temperature	3	1	5	11	4	4	4	6	2	4	6	5	<b>55</b>
Unusually high temperature	0	0	1	0	1	1	3	4	11	9	8	8	<b>46</b>
<b>Total</b>	<b>1841</b>	<b>1542</b>	<b>1621</b>	<b>1921</b>	<b>1430</b>	<b>1189</b>	<b>1459</b>	<b>1786</b>	<b>2289</b>	<b>2065</b>	<b>1706</b>	<b>1633</b>	<b>20473</b>

There are many instances recorded in the Annals of violent windstorms occurring with thunder and lightning mixed with hail or rain during this period. The monthly distribution of the storms recorded during this period indicates that these were not ordinary seasonal typhoons. Even if they were not accompanied by thunder, lightning, or hail, many of these storms were unimaginably strong.

An observer from Cholla-do reports, "The head regent of Yosan-ku said that on the 13th day of the 6th month, between 3-5 p.m., a white dragon appeared in the middle of clear skies, whose wriggling form was clearly visible. A little while later, a fog cloud covered the land everywhere which was so thick that one could not discern things even at close range. A severe rainstorm stirred up, with heavy thunder and lightning. Official Min Chung-il's house in the town was destroyed by the storm and the things inside were sent flying in air landing no one knows where. A three-year-old girl also disappeared and could not be found after much searching. His 80-year-old father and wife were both struck by lightning. They are in comas, and will die any moment." This is a unusual natural phenomenon. (Annals 25-084a, 06 29, 1605)

The numerous records of frost and unseasonal snow which also occurred during this period help attest to the overall temperature drop related to the meteor fallings. As can be seen in Table IV, unseasonal snow fell frequently, not only in the 3rd, 4th and 9th lunar months, but even during the 5th, 6th, 7th, and 8th lunar months.

#### 4.7. Darkness, Dust (micrometeorite) Storms, Fog and Fog-like Clouds, Changes in the Sun or Moon, and Colored Snow or Rain

Table III shows that there were many instances recorded where dust fell almost unendingly, or the land became dark everywhere, or a "fog-like element" covered the land. Related to these are the phenomena where the sun or the moon lose their light and turn red or dark, or where there appear to be two or three suns or the sun is shaking. The report on the weather situation in Seoul from the 12th day of the 3rd lunar month to the 24th day of the 4th lunar month in 1661 give a gook account of the irregular climatic conditions.

Seoul, 1661:

- 12 March: For the past three days, the skies all around have been darkened and gray as if some kind of dust were falling
- 13 March: It was dark all day. The sun was a purplish color when it came up, and at night, the moon was a crimson color
- 14 March: Frost formed
- 18 March: Frost formed. It has been dark all around for seven days
- 1 April: We are experiencing a severe drought
- 8 April: Frost formed in the early morning. When the sun came up it was very reddish.
- 9 April: From 6 a.m. to 6 p.m., the skies all around were darkened and gray as if some kind of dust had fallen
- 11 April: From noon to 6 p.m., the skies all around were darkened and gray as if some kind of dust had fallen
- 12 April: From morning to evening, the skies all around were darkened and gray as if some kind of dust had fallen. In the evening, the sun was a purplish color. At night, the moon was red and dim
- 13 April: The whole day, the skies all around were gray
- 18 April: Frost formed in the morning. From morning to evening, the skies all around were gray
- 19 April: From morning to evening, the skies all around were gray
- 21 April: From morning to evening, the skies all around were gray
- 22 April: From the morning throughout the day, the skies all around were gray
- 23 April: From the morning throughout the day, the skies all around were gray
- 24 April: From the morning throughout the day, the skies all around were gray

Since it has been confirmed that a large number of meteor appeared and fell during this period, it is not that hard to figure out the reasons for these phenomena. The dust resulting from a meteor falling would have accumulated, covering the area like a fog, even to the point of approaching darkness. The light of the sun and the moon would have been blocked by this layer of dust, which would have caused them to

appear red. The sun appearing in double or triple, or the sun shaking are also both phenomena which would have been caused by the refraction of the sun's rays by dust. The black rain, "grass-seed" rain, the "grain-seed" rain or "pineflower dust" rain, or the red/yellow/black snow described in the records would have been caused by the meteor dust being mixed with the rain or snow.

**TABLE V**  
**Reports on the Meteor Falling at around 7 P.M. on the third Lunar Month of 1533 in Kangwon-do Province.**

Area	Position relative to impact site	Phenomenon and time	Location of appearance	Tail length	Meteor appearance and color	Special details about its motion	Earthquake, thunder
Kumsong	impact site	Meteor and earthquake around 7 P.M.	In middle of sky from south to north		flame		after fall, earthquake, thunder sound
Kimhwa	28 km SSW	Meteor	from southwest to northwest		small vase-like fire	Spinning, became dark all around	explosion sound like thunder
Cholwon	40 km SW	Meteor		2 chok (0.6m)	jar	Firecracker-like noises while flying	Thunder sound
Pyonggan-g	25 km W	Meteor	In middle of sky from west to east		flame		
Ichon	60 km NW	Meteor	In the southeast from south to north		fireball		Thunder sound, (from east to west)
Hapgok	72 km NNE	Earthquake	from south to west				Earthquake
Seoul	110 km SSW	Meteor, evening	from below the Polestar fortress to the	8-9 chok (2.4-2.7m)	water jar-like flame, red	gave light to the land, slowly spinning	

			northern sky				
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### 4.8. Earthquakes

An extremely large number of earthquakes took place during Periods 3–7. Of the total 1,500 recorded instances, 1,225 or 81% took place during this critical period. This means that over the 250–year period, an average of six earthquakes took place every year. Nowadays, earthquakes occur so infrequently in Korea that it is considered to be an earthquake–safe area by modern standards. Given Korea's geological situation, it is hard to believe that there were so many earthquakes recorded during this period, particularly since there were no recording instruments. However there seems to be no reason to question the records themselves. Looking carefully at the records, the observers used different terms according to the severity of the shaking and also differentiated between country–wide and regional earthquakes, which would lead us to believe in the faithfulness of their recording. In one town in the northern part of the Korean peninsula, an "earthquake swarm" is recorded to have taken place from the 6th day of the 9th month of 1565 to the 26th day of the 1st month of 1566, with total 99 earthquakes taking place during the four–month–plus period. It would be difficult to explain such frequent repetition of earthquakes simply through the movement of the earth's tectonic plates.

At the time of the previously mentioned 1908 Siberia meteorite collision, a strong tremor was measured on earthquake sensors in the city of Irkuts, located along the shores of Lake Baikal. Researchers on comets and meteoroids say that if a fireball such as a comet or meteor impacts, the intense heat puts tremendous pressure on the ground and compresses the surrounding area. A shock wave is created which then becomes a seismic wave which travels around the globe. Table V is based on the reports from the towns closest to a site in Kangwon–do province where a meteor fell between 7–9 p.m. on the 9th day of the 3rd month of 1533. Related to this, two areas about 72km north–northeast of the impact site reported experiencing earthquakes, and the towns within 40 km reported hearing a violent, thunder–like explosion. Judging from this, many of the records of earthquakes and thunder found in the Annals are not ordinary earthquakes and thunder,

but rather the shock waves and explosion sounds caused by meteor fallings being mistaken as such. The fact that the observers used phrases like "a violent thunder-like explosion occurred" instead of the more formal "thunder occurred" demonstrates that the observers felt a slight, but noticeable differences in what they experienced.

#### 4.9. Fires

Among the records of meteor falling, there are many quotes and comments that fires burst out when they hit. The people of that time differentiated such fires from other fires caused by lightning by calling them "heaven-sent fires." There is record (Sept./09/1503) from a region in Pyong-an-do Province that in 1503 a private household's grain supply was burned by "heaven-sent fire," although there was also a note that after that event, grain grew better on the land, which had been recently reclaimed from the sea, and so the people were happy. Four years later, a record frequent appearances of flame-like red vapor in the sky, fire broke out on a far-away high mountain, burning several acres, which many said was related (Jan./12/1507). From a branch office in Koseong in Kyongsang-do Province, there is a report that on the third day of the seventh month of 1538, a dark cloud covered the skies and thunder and lightning appeared. Suddenly, rain started falling and the skies darkened; then heaven-sent fire fell and burned a pine grove. (Chonsonwanjo sillok 18-191) And there is another report from Chongju in Pyongan-do Province that on Sept/16/1602, some instruments and objects made out of grass which were piled up a private house caught afire and burned up, even though it was raining (CWS 24-422).

For a long time, no formal measures were taken to help those who suffered damage from fires caused by meteor collisions. However, as such instances and damage increased, the government initiated emergency relief measures for such victims beginning in 1660, which is detailed in Table VI.

**TABLE VI**  
**Emergency Relief Measures for Victims of Unnatural Fires in the 17th and Early 18th Centuries**

Date	Location (Province)	Extent of Damage	Remarks
1/20/1668	Chongsong (Kyongsang-do)	50 commoners' houses	Violent windstorm
2/05/1668	Seoul and Nearby Areas		Daily fires
3/14/1668	Haeju (Hwangjae), Seoul		
6/29/1676	Kyonggi-do	Royal tomb ritual altars	
3/07/1680	T'ongchon + 4 towns (Kangwon-do)	536 households	Violent winds and mountain fires
3/14/1682	Pyongyang (Pyongan-do)	344 households	
8/25/1683	Chongju (Pyongan-do)	Crops	Thunder/lightning
2/27/1684	Kanghwa-do Island (Kyonggi-do)	Extremely severe damage	
3/08/1684	Pyonghae (Kyongsang-do)		
5/11/1685	Pyongyang (Pyongan-do)	1,000households	
3/04/1686	Chonju (Cholla-do) Pyonghae (Kyongsang-do)	Commoners' houses	
2/10/1687	Chongson (Kangwon-do)		
4/10/1688	Koch'ang (Cholla-do)		
4/10/1690	Kaeryong (Kyongsang-do)	300 households	3 or more deaths
6/11/1690	Nak'an (Cholla-do)	150 households	

10/03/1690	Nak'an (Cholla-do)	200 households	
2/14/1691	Nangch'on (Kangwon-do)	Commoners' houses	7 deaths
5/20/1692	Okgu (Cholla-do)	About 60 households	
4/23/1710	Kansong +3 towns (Kangwon-do)	Rows of houses destroyed in large fire	

The type of fires described in Table VI were not human-caused fires but unpreventable fires caused by natural phenomena, which is why the government decided to target measures for these victims. While there are no detailed descriptions of the actual circumstances, it is safe to assume that many were related to meteor impacts since they were accompanied by thunder, lightning and violent gales.

## 5. Conclusion

The findings of my analysis of the records found in the Chosôn Annals on unusual natural phenomena between 1500–1750 can be summarized as follows:

1. The existence of the Little Ice Age can indeed be confirmed, but its time frame must stretched beyond the 17th century to begin around 1500 and end around 1750.
2. The basic cause of the Little Ice Age was the numerous meteor which fell consistently over a long period of time. Among the records in the Annals, there are many more phenomena which are consistent with the Alvarez collision theory than those which support Eddy's theory on the decline in sunspot activity.
3. The Little Ice Age was accompanied by drought, floods, plague, famine, pestilence and other calamities. Discussion of these disasters and the political, social, and economic repercussions they brought about has been initiated by historians of the "17th-Century General Crisis" school, but a more rigorous and detailed

analysis of the records in the Annals has great potential in stimulating further discussion and understanding. Study of the undoubtedly terrifying natural phenomena which occurred when meteors fell would provide new perspective on the tremendous religious and ideological changes which took place around the world.

4. The material in the Annals include detailed observations of comets, as exemplified in Reference Note 7, and other unusual astronomical phenomena, which I feel could be excellent material for expert analysis. Scientists could use this material to further refine their understanding of the earth's environment at that time.

### Reference Notes

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1) The Korean term *seongbyon* used to describe when planets would switch places in the course of their movements, which was thought to be abnormal. The Chosôn observers figured out what was happening by the middle of the 15th century and discontinued recording such observations at the time, but as more and more strange phenomena were witnessed in the skies during the 16th century, they began to observe and record these events once again. Yi Taejin, 1996, p. 96.

2) Some may question whether the wide gap in the frequencies of these periods and the other periods could be due to the failings or lack of consistency of the observers. However, Periods 2 and 8 were among the most politically stable and economically prosperous times in the 500 years of the Chosôn Dynasty, and the records in the Annals for those periods are considered to be among the most accurate and meticulous, which should dispel such doubts. In fact, it would be accurate to view the political stability and economic development of these period as having stemmed from the reduction in natural disasters.

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