

Neo-Catastrophism and a New Global Interpretation of History

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Abstract

The theory of terrestrial impact which has been developed by the astronomy scientists since 1970s is employed for this article in a new angle that atmospheric conditions of our planet should be adopted in the interpretation of the history of mankind. Large and small terrestrial impacts must be acknowledged as key tasks in terms of the study of 'world history.' The Society of Interdisciplinary Studies has already advocated that the 'Bronze Age Civilization' was strongly influenced by the long term terrestrial impact phenomena. Based on historical materials from Korea, the present study was able to identify the years 680-880, 1100-1220, 1340-1420, and 1490-1760 as periods in which territorial impacts occurred.

Keywords

Neo-Catastrophism, Terrestrial impact, Asteroid, Natural disaster, Cosmic phenomena, Little Ice Age, German Flugblat, Annals of the Joseon Dynasty(Korea)

I. INTRODUCTION: THE DEVELOPMENT OF SPACE SCIENCE, *DEEP IMPACT* AND THE POST-MODERNITY OF HISTORICAL STUDIES

The success at the box office of movies such as *Deep Impact* clearly reflects modern man's fascination with space. The same phenomenon can also be used to explain the tremendous amount of media interest garnered by any news regarding space exploration. The advent of a new century has coincided with the publication of a profusion of news related to space exploration. The news at the end of 2000 that an asteroid might come into contact with the earth was enough to raise concern amongst numerous people. On November 3, 2000, the International Astronomical Union (IAU) announced that there was a possibility that the asteroid, '2000SG344' might crash on earth on September 21, 2030. This fearful news that a disaster similar to the one which loomed in 'Deep Impact' might come to pass a mere 30 years down the road. However, this outcome was ruled out during ensuing investigations by the National Aeronautics and Space Administration (NASA). The announcement was hastily made after a short observation of this asteroid. Truth be told, the possibility that the asteroid might crash on earth was not in fact truly completely refuted.

On February 12, 2001, NASA landed the NEAR-Shoemaker on 'Eros,' an asteroid 320 million km away from earth. This super large-sized asteroid was 33 km in length and 13 km in diameter and shaped like a yam or sweet potato. The decision to land the NEAR-Shoemaker on the asteroid was a surprising development. Astronomers have to date discovered about 2000 asteroids and been able to observe their orbits using electronic telescopes. As Eros was the 433rd asteroid discovered, its official name is 'Asteroid 433 Eros.'

NASA achieved another important breakthrough on July 9 2003 when it successfully landed the exploration rover Opportunity on Mars. To this end, it acquired many photographic materials pertaining to the Red Planet's geographical features and topography during the 240 days in which the rover canvassed its surface. The rover Opportunity's first task was that of collecting fragments of a meteorite from the surface of Mars. In May 2005, a robotic space-

craft named 'Mars Express' dispatched by the European Space Agency (ESA) in 2003 entered Martian orbit and sent back a photo of a large crater (24.4 km in length, 11.2 km in width, and 650 m in depth) that had been caused by the crashing of a large meteorite on Mars' surface.

Meanwhile, in January 2004, NASA launched a spacecraft called Stardust which had as its goal the orbiting of the comet called Comet Wild 2. The Stardust was the first spacecraft sent to directly observe a comet. The photos sent back of the Comet Wild 2 showed that the comet's surface was uneven. The elements that made this surface uneven were eventually revealed to be rocks. This changed the existing perception of comets as entities composed of dust and ice. On October 6, 2006, NASA disclosed a photo of a crater on the surface of Mars. The surface of this crater was so clean that it was reminiscent of a mirror. It was eventually called Lake Victoria just like the one in Africa.

A wide range of news related to space exploration in the 21st century has successively been disclosed. More such news will be reported in the future. Scientists who study near-earth objects (NEO) have focused on asteroids' role in the history of the birth of the solar system and universe. The analyses of elements found in asteroids, which were generated at the 'beginning of the world,' are expected to resolve the secrets of the birth of the solar system. This will also usher in a new turning point in terms of the explanation of the true features of not only the universe and solar system, but also the earth and human history. Astronomers have revealed the existence of an area between Mars and Jupiter called the Asteroid Belt where many asteroids can be seen floating around. They also shed light on the mechanism through which these large and small-sized asteroids entered the earth's atmosphere. Furthermore, they have also proved that at one point in time super large-sized asteroids hit the earth, thereby greatly altering its ecosystems. By arguing that the relationship between the earth and asteroids impacted not only the earth's history but also that of the humans who have lived on the earth, this study introduces a new interpretative framework for human history.

II. TERRESTRIAL IMPACT AND NEW STUDIES ON THE EARTH'S HISTORY

The solar system is composed of planets, asteroids, and comets. Scientists refer to asteroids and comets as near earth objects (NEO). Terrestrial impact refers to the phenomenon in which these near earth objects entered into the earth's atmosphere.

According to scientific studies conducted in fields such as astrophysics, asteroids can be found floating between the orbits of Mars and Jupiter, a region which is referred to as the Asteroid Belt. The term 'missing planet' has been thrown around a lot lately as one of the reasons why so many rocks can be seen floating in this region. This term was introduced to convey a situation in which these rocks somehow became during the process of the generation of a planet like the earth. Astronomy has been able to learn more about the composition of the universe through the development of space telescopes and spacecrafts. Recent estimates pertaining to the Asteroid Belt have claimed that there are 200 million asteroids of over 100 meters in length within the main belt.¹

As a result of the gravitational force of the sun, the small and large-sized asteroids found in this belt primarily make an oval-shaped orbit around the sun. When this oval-shaped orbit encounters that of the earth, these asteroids effectively enter into the earth's atmosphere. This is the basic principle behind the terrestrial impact phenomenon. Based on this mechanism, an asteroid or many asteroids could make their way into the earth's atmosphere.

Studies on the relationship between terrestrial objects and earth history began to come into their own in the 1970s. In 1977, three Canadian astronomers, namely P. Beland, J.-R Roy, and D. Russel, introduced the novel theory that a large-sized terrestrial impact had emerged 65 million years ago, or between the Neo-Cretaceous period of the Mesozoic Era and the Cenozoic Era, and that there was a possibility that this had led to large-scale extinction of animal species. However, devoid of any detailed proof, their

¹ The width of the main belt spans from about 28 million km to 598 million km to the exterior of the orbit of Mars, and 180 million km towards the interior of the orbit of Jupiter. Giles Sparrow, *The Planets: A Journey Through the Solar System* (London: Quercus, 2006), 132.

studies in the end amounted to the mere postulating of a theory. In 1980, a research team led by Luis Alvarez from UC Berkeley (University of California, Berkeley), who had been awarded the 1968 Nobel Prize in Physics, presented results that were supported by a weight of evidence.²

The study conducted by Luis Alvarez's research team initially discovered that thick layers of iridium had accumulated between the stratum of the Neo-Cretaceous period (at the end of the Mesozoic Era) and the Cenozoic Era.³ The iridium uncovered by the research team, which totaled more than 100 times what had been collected on earth, had been buried deep in the ground of the earth. After having reviewed various possibilities to explain how this significant amount of iridium accumulated on the lithologic layers, the research team concluded that it had in fact emanated from the extra-terrestrial world. Iridium is one of the substances found in asteroids. To this end, the team concluded that the presence of such a massive amount of Iridium could only be explained by the crashing of an asteroid on earth.

Luis Alvarez's research team calculated that, given the amount of iridium, the asteroid which collided with the earth must have been at least 10 km in diameter. They also identified the following phenomena as having occurred after this massive asteroid (Giant) collided with the earth.

(1) Immediately after the collision, a high-temperature heat emerged and great amounts of cosmic dust found their way into the stratosphere, thus leading to the generation of the greenhouse effect and serious hot weather within the earth's atmosphere.

(2) The hot weather soon gave way to rain and the emergence of deluges.

² L. W. Alvarez, W. Alvarez, F. Asaro, and H. V. Michel, "Extraterrestrial cause for the Cretaceous-Tertiary extinction," *Science* 208 (June 1980): 1095-108.

³ Walter Alvarez, *T. Rex and the Crater of Doom* (Princeton: Princeton University Press, 1997).

(3) The dust which covered the stratosphere continuously prevented the heat and light from the sun and as such, the atmosphere turned into a state of cosmic winter in which hail and snow constantly pounded the earth.

(4) At the same time, as the process of photosynthesis of plants could not be carried out, all the plants and trees froze or withered to death. The continuation of this state for several years caused all vertebrate animal species and herbivorous animals such as dinosaurs which had prospered during this period to disappear.

(5) The crashing of asteroids into the ocean or adjacent to the coastline caused the temperature of the ocean to increase, which in turn led to the emergence of a greenhouse effect. This caused the extinction of many sea animals and plants, and the generation of the red tide phenomena.

The publication of the results of the study conducted by Luis Alvarez and his team surprised not only those within the academic sector but also the rest of the world's population. Of particular interest was their conclusion that this incident might have been one of the causes for the extinction of the dinosaurs which had roamed the earth during the Neo-Cretaceous period (at the end of the Mesozoic Era). However, there were many objections to their theory. Opposition was particularly fierce amongst evolutionists. The notion of Catastrophism had already appeared during the 18th century, when it was used as a theory for the earth's ecosystem. However, this theory lost much of its appeal following the emergence of the theory of evolution in the 19th century. The theory put forward by Luis Alvarez and his research team, which took on the appearance of a new variant of Catastrophism rooted in astronomy, attracted the ire of the evolutionists. Alvarez's research team calculated the width of the crater caused by the crashing of the 10 km in diameter super asteroid on earth as having been 150-180 km in diameter. This calculation provided the grounds for objections because no crater of this size had been discovered as of 1980. Howev-

er, these objections largely dissipated in 1990 once satellite photos were used to identify the existence of a crater of some 150 km in diameter buried under the ground like a sinkhole on the Yucatan Peninsula in Central America. Furthermore, the airing of the photographs taken by the spacecraft Galilei in 1994 showing the comet Shoemaker-Levy crashing into Jupiter and the pieces scattering in seven different directions on TV had the effect of all but eradicating the doubts about the veracity of this theory.

The studies conducted by Luis Alvarez's research team provided an epochal opportunity to develop a new interpretation of the causes of the changes in the geological features of the earth. From a geological standpoint, the earth history's can be broken down into the Paleozoic Era, Mesozoic Era, and Cenozoic Era. However, it did not provide any special explanations as to how these geological features were altered. Amidst circumstances in which the answers to the changes in the geological features were not being sought for, the change in the earth's ecosystem was explored from the gradualist standpoint inherent in evolutionary theory. Luis Alvarez's research team suggested that the changes in geological features and ecosystems had not occurred gradually, but rather were the result of a catastrophe caused by terrestrial impact. At the very least, the detailed evidence provided by Luis Alvarez and his team can be used to explain the change from the Mesozoic Era to the Cenozoic Era.

In February 2001, a study was published which showed that the change from the Paleozoic Era to the Mesozoic Era had been caused by the same phenomenon. A group of five American scientists led by Prof. M. Rampino of Columbia University discovered fullerene, a molecule which contains a lot of carbon compounds made in asteroids, in the stratum between the Paleozoic Era and Mesozoic Era. Based on the amount of fullerene discovered, Prof. Rampino and his team concluded that the asteroid which crashed into the earth during this period was a mega one of 1-12 km in diameter. They concluded that an asteroid of this size could cause

the extinction of 90% of marine species and 70% of terrestrial species⁴.

The theory of terrestrial impact created an opportunity to organize our understanding of the history of the earth and solar system. It is estimated that the sun, which serves as the parent body of the solar system, is 4.567 billion years old. The planets, which make up the solar system, are fragments of the parent body that broke off and cooled down. The earth completely cooled down and took on its current shape features some 4 billion years ago. This estimate has been based on the fact that the oldest rock on earth has been estimated to be 3.85 billion years old. However, a big rock the size of Mars struck the earth ('boulder strike') about 537 million years ago as the earth was starting to take its form, a piece of which became the moon. The revelation of this theory regarding the birth of the moon has helped to shed some additional light on the study of earth history from the standpoint of terrestrial impact.

In the case of the earth, the heat of substances gradually cooled down after coagulating and mixing with the substances from the sun, thus leading to the creation of mountains and oceans. The first species to prosper on this planet was blue-green algae. Many life forms began to emerge when the temperature started to go down from the South Pole onwards some 600 million years ago, starting the era of algae. This great change called the Cambrian Explosion was a blessing for the earth. Based on this great change, geologists have classified the period into the Pre-Cambrian and Paleozoic Era. While a special bioform called the trilobite flourished during the Paleozoic Era, marine plants were especially prosperous. This bioform had a crystal-shaped head structure and lived in ecosystem conditions where it had to chase after polarized light in the water.⁵

Although it had flourished during the Paleozoic Era, the trilobite subsequently became extinct, with no trace of it discov-

⁴ Luann Becker, Robert J. Poreda, Andrew G. Hunt, Theodore E. Bunch, and Michael Rampino, "Impact Event at the Permian-Triassic Boundary: Evidence from Extraterrestrial Noble Gases in Fullerenes," *Science* 291 (February 2001):1530-33.

⁵ Carl Sagan, *Cosmos* (New York: Random House, 1980), 32.

ered in the stratum from the Mesozoic Era. The cause of the extinction of the trilobite, in the form of the terrestrial impact at the end of Paleozoic Era, was eventually brought to light.

The Paleozoic Era, which continued for some 375 million years, ended with the crashing of a 6-12 km in diameter asteroid into the earth. Herbivorous gymnosperms and reptiles flourished during the Mesozoic Era which started some 225 million years ago. The Mesozoic Era, which can be broken down into the Triassic, Jurassic, and Neo-Cretaceous periods, continued for about 160 million years. It was in turn brought to an end by the crashing of a 10 km in diameter asteroid into the earth. The ecosystem of the Cenozoic Era, which started 65 million years ago, continues to this day. Mammals and angiosperms have flourished within the ecosystem of the Cenozoic Era. One of these mammals, man, first emerged about 5 million years ago.

III. THE CURRENT STATE OF THE APPLICATION OF THE THEORY OF TERRESTRIAL IMPACT TO HUMAN HISTORY

1. THE SIS THEORY OF TERRESTRIAL IMPACT DURING THE LATE HOLOCENE

Over the past 20 years, a new understanding of the earth's history has emerged amidst the epochal development of sciences such as astronomy and geology that led the earth to be perceived as a part of the universe. The mechanism of a terrestrial impact is such that the collision of small and large-sized asteroids with the earth is a universal phenomenon which can occur at any time. Therefore, not only the earth, but also the human history which has spawned on it, is subject to this universal phenomenon.

As mentioned above, there are over 200 million asteroids in the Asteroid Belt. Among these asteroids, the biggest one is Ceres, which has a diameter of over 960 km (across).⁶ If we assume that a

⁶ Sparrow, *The Planet*, 132.

10 km-wide asteroid did in fact really crash into the earth, then we can surmise that asteroids of over 10 km in diameter can crash into the earth every 100 million years; those of several km in diameter every 20,000-200,000 years; and those several hundred meters in diameter every few centuries. Asteroids several hundred meters in diameter floating around in a group are attracted by the earth's gravity. That being the case, we can conclude, depending on the amounts of asteroids present in a particular group, that asteroids can be attracted to the earth's atmosphere over a long period of time ranging from several decades to centuries. The long-term entry of asteroids into the earth's atmosphere is alluded to in the observations of comets found in the *Choson wangjo sillok* (The Annals of the Choson Dynasty (Korea)). Such long-term entry of small asteroids into the earth's atmosphere has in all likelihood occurred on many occasions since mankind appeared on earth. Assuming that these asteroids arrived over a period of several decades or even centuries, we can surmise that the impact on the physical and spiritual world of mankind must have been humongous.

In 1975, the Society for Interdisciplinary Studies (SIS) was established in London. Led by Immanuel Velikovsky (1895-1979), it brought together scholars from disparate fields such as astronomy, geology, paleontology, dendrology, mythology, and anthropology (<http://www.knowledge.co.uk/sis>). This society was established as a response to the growing number of researchers interested in the theory of terrestrial impact.⁷ In July 1997, the Society for Interdisciplinary Studies (SIS) organized a biennial conference at Cambridge University whose theme was 'Natural Catastrophes during Bronze Age Civilizations – Archeological, geological, astronomical and cultural perspectives.'⁸ Although this conference used the term Bronze Age Civilizations, it dealt with the great disasters and influence exercised by the terrestrial impacts which had occurred with-

⁷ "Obituary: Dr. Immanuel Velikovsky (1895-1979)," *C&C Review* 4, no.1 (Autumn 1979).

⁸ Benny J. Peiser, Trevor Palmer, and Mark E. Bailey, eds., *Natural Catastrophes During Bronze Age Civilization: Archaeological, Geological, Astronomical and Cultural Perspectives* (Oxford: Archaeopress, 1998), 728.

in the earth's atmosphere over a period of about 3000 years (Late Holocene), or from c. 3500 to 500 BCE. This was the first conference which applied the theory of terrestrial impact to human history.

The Bronze culture was established in Egypt, the Near & Middle East, and Europe between 3500-3000 BCE, or at a time when the rest of the world was still in the throes of the Neolithic Age or New Stone Age. China and India, which have been singled out as members of the four original civilizations, were still in the Neolithic Age. The SIS conference at Cambridge University sought to prove in a scientific manner that terrestrial impacts have emerged. To this end, 19 papers dealing with the cultural changes wrought by these terrestrial impacts were presented.

Modern western scholars have helped to shed some much needed light on the ancient history of the Near & Middle East region. However, many questions have remained unresolved. Various scenarios have been suggested to explain the sudden extinction of city states and dynasties. During the early 1970s, Western archeologists attempted to establish a structural understanding of this uncertain period.⁹ They postulated that a widespread Dark Age whose scope spanned from Greece to Mesopotamia and Elam, from Anatolia to Egypt, and even beyond, had simultaneously struck. This Dark Age was composed of two periods.

The first period of the Dark Age began between 2500 and 2000 BCE. While the Sixth Dynasty of Egypt was destroyed around B.C. 2200, the Akkadian Empire also collapsed during this time. Byblos and many areas of Syria and Palestine were destroyed by fire and remained deserted for a certain period of time. The civilization of Troy II was also destroyed by fire; meanwhile, the centers of prosperous Lerna and Argolid, as well as the areas east and west of Anatolia, were also destroyed in a similar manner. It was estimated that about 75% of areas where people had lived went down the path of decline and destruction. A similar period of prosperity

⁹ Barbara Bell, "The Dark Ages in Ancient History," *American Journal of Archaeology* 75, no. 1 (January 1971): 1-26.

and decline has also been associated with the Indus Civilization (2100-1900 BCE) using carbon isotope dating.

The second period of the Dark Age began in 1200 BCE. The Hittite Empire in Anatolia suddenly disappeared. The Mycenaean Civilization in Greece collapsed and the Egypt and Assyrian civilizations went down the long path of decline. However, up until the 1970s, scholars limited themselves to stating that such events must have been caused by a natural disaster such as an earthquake or drought. Although this theory also falls under the sphere of Catastrophism, advocates of the theory that such disasters were in fact the result of terrestrial impacts subsequently emerged as a separate group that promoted what has come to be known as Neo-Catastrophism.

The SIS conference in Cambridge University decisively contributed to the resolution of the above questions from the standpoint of the theory of Terrestrial Impact. From an archeological standpoint, reports based on computerized precise, scientific analysis of the spots created where fire blasts hit 500 relics in Egypt and the Near & Middle East region, as well as of related substances, have been published. The organic substances hit by the fire blasts were identified as being related to a terrestrial impact and not as the result of volcanic explosions.¹⁰

Ash taken from the objects that were burnt as a result of the explosion created when an asteroid exploded in the air has been scientifically analyzed. Based on analyses of dendrologic sediment and tree ring dating, dendrologists have presented ample evidence supporting the theory that temperatures dropped during this period.¹¹ A large number of craters were identified in the Near East region, and numerous suggestions of midair explosions such as the

¹⁰ Marie-Angnès Courty, "The Soil Record of an Exceptional Event at 4000 B.P. in the Middle East," in *Natural Catastrophes during Bronze Age Civilizations*, ed. Benny J. Peiser et al.

¹¹ M. G. L. Baillie, "Hints that Cometary Debris played some Role in several Tree-Ring dated Environmental Downturns in the Bronze Age"; Lars G. Franzén and Thomas B. Larsson, "Landscape Analysis and stratigraphical and geochemical Investigations of Playa and alluvial Fan Sediments in Tunisia and raised Bog Deposits in Sweden," in *Natural Catastrophes During Bronze Age Civilizations*, ed. Benny J. Peiser et al.

Tongues Event of 1908¹² have been presented.¹³ In this regard, the participants in the SIS conference agreed that the actual impact must have been much greater than the number of craters.

Various estimates have been advanced as to when such extra-terrestrial impacts occurred. These have included the periods between 3600 and 3200 BCE; 3000 and 2500 BCE; 2350, 2345 or 2340 BCE; 1628 BCE; 1200 BCE; 1159 BCE; 850-760 BCE; and 600 BCE.¹⁴ Many other periods were also suggested as having fallen under the 'Dark Age'. While the identification of such periods has been based on scientific evidence, further research may very well lead to the identification of additional periods. That being said, the present studies should not be interpreted as meaning that such impacts continued from the beginning to the end of this overall period that spanned from 3500 to 500 BCE. Rather, the impacts occurred at intervals and the length of the impacts also varied. To this end, there is a strong possibility that further study will shed more light on the precise nature of such intervals.

The most outstanding results to come out of the SIS conference at Cambridge University as pertain to human culture are the reports pertaining to the emergence of beliefs and religions. Before the impacts started during the Late Holocene, mankind's spiritual world revolved around animism, or the belief that spirits lived in trees and rocks. However, from this age onwards, all of mankind, and this regardless of whether they were still in the throes of Neolithic or Bronze Culture, began to believe in gods. These gods either lived in the heavens or descended from the heavens. This spiritual change has been explained by some as having originated from the fear created in the people's hearts by the phenomenon of extra-terrestrial impacts. This phenomenon was accompanied by various

¹² Refers to the fact that an asteroid several hundred meters in size exploded midair in the sky over Tongues, Siberia in 1908. Sagan, *Cosmos*, 73-75.

¹³ Benny J. Peiser, "Comparative Analysis of Late Holocene Environmental and Social Upheaval: Evidence for a Global Disaster in the Late 3rd Millennium BC," in *Natural Catastrophes during Bronze Age Civilisations*, ed. Benny J. Peiser et al.

¹⁴ "Introduction," in *Natural Catastrophes during Bronze Age Civilisations*, ed. Benny J. Peiser et al.

natural disasters, such as thunder, lightening, and heavy rains causing floods and deluges. Thus, as it experienced such situations and difficulties, mankind started to believe in the presence of a fearful existence that emanated from the heavens.¹⁵

The notion of high gods found in theology is one in which the author of all beings, who serves as the Supreme Being unattached to any of the other sub-gods or spirits, is depicted as being moralistic, spiritual and perpetual. This Supreme Being, which subsequently developed into the core element of the creation myth within each culture, existed even amongst the most primitive of tribes. The likelihood that such notions were either diffused or spread by outside influences is practically non-existent. It has been shown that even in Australia, where there was practically no possibility of such notions being diffused by an external influence, both large and small groups possessed their own independent and unique high gods. This supports the notion of the simultaneous emergence of creation gods.¹⁶

Meanwhile, the importance of these high gods had a tendency to relatively decline vis-à-vis the other gods. While this change has been explained by the adjustment of man to his environment, this particular line of reasoning surfaced prior to the emergence of the theory of terrestrial impact. The decline of the importance of high gods can be regarded as a phenomenon in which the fear of terrestrial impact gradually disappeared during the intervals between such impacts. The high gods were equated with the heavens, regarded as beings that resided in the heavens and viewed as possessing attributes such as perpetuity, omniscience and omnipotence, generosity, morality, and creativity. Although a tendency in which the high gods were gradually overshadowed by sub-gods,

¹⁵ Peiser, "Comparative Analysis of Late Holocene Environmental and Social Upheaval"; Gunnar Heinsohn, "The Catastrophic Emergence of Civilization: The Coming of Blood Sacrifice in the Bronze Age Cultures"; William Mullen, "The Agenda of the Milesian School: The Post-Catastrophic Paradigm Shift in Ancient Greece, in *Natural Catastrophes During Bronze Age Civilisations Natural Catastrophes during Bronze Age Civilisations*, ed. Peiser et al.

¹⁶ Andrew Lang, *The Making of Religion* (London: Longmans, Green, 1898).

spirits and ghosts as time went by can be found, the origins of the high gods has never been extinct.¹⁷

Although capable of singling out the existence of the notion of high gods within indigenous societies, theology has proven unable to answer the question of why and how this notion of high gods emerged. The SIS conference at Cambridge University was in effect the first to postulate a concrete answer to this question. The majority of human culture began to revolve around ritual ceremonies for the gods from 3500 BCE onwards. Thereafter, it remained largely unchanged for about 3000 years. It is difficult to find any other case in human history where such a rigid spiritual situation continued for such a long period.

2. TERRESTRIAL IMPACT DURING THE LITTLE ICE AGE (C.1490-1760) AS VIEWED THROUGH THE *JOSEON WANGJO SILLOK* (THE ANNALS OF THE JOSEON DYNASTY)

During the 3rd session of the 18th International Congress of Historical Sciences held in Montreal in August 1995, which was called the Preliminary Program of the International Committee of Historical Demography, the author of this study presented a paper entitled "The causes of astronomical phenomena during the little ice age (c.1500-1750) – Analysis of the relevant records in the *Joseon wangjo sillok* (The Annals of the Joseon Dynasty) - (*Sobinggi [1500-1750] ui ch'eonch'e hyeonsangjeok wonin - Joseon wangjo sillok ui gwallyeon girok bunseok*)."¹⁸ This presentation on the application

¹⁷ Wilhelm Schmidt, *The Origin and Growth of Religion-Facts and Theories*, trans. Herbert Jennings Rose (1931; London: Methuen, 1935).

¹⁸ Tae-Jin Yi, "Astronomical Causes for the Little Ice Age (c. 1500-1750): An Analysis of the Annals of the Dynasty of Choson (Korea)," (paper presented at the 18th International Congress of Historical Sciences, Montreal, Canada, August 27–September 3, 1995). The Korean version of this paper is included in the *Guksagwan nonchong* 72 (1996). This proceeding paper was revised and published on *Celestial Mechanics and Dynamical Astronomy* 69, no. 1-2 (1997): 199-220, Kluwer Academic Publishers in the Netherlands. The new title was "Meteor Fallings and Other Natural Phenomena Between 1500-1750 as recorded in the annals of the chosŏn dynasty (Korea)."

of terrestrial impact to human history occurred two years before the above-mentioned review of terrestrial impacts during the Late Holocene that was conducted by the SIS.

As a specialist who majored in Korean history, I have long grappled with the question of how to explain the chaos that engulfed Korean history during the late 16th century – early 17th century, a period that saw the Hideyoshi invasions of Joseon and the two Manchu Invasions (Jurchens) push East Asia into disarray. Korea (Joseon) suffered great damage because of its lack of an early response to these invasions. The historians blamed the ruling class and their Confucian ideology for the defeat in these wars and the national chaos wrought by these losses on the battlefield. In other words, they attributed the responsibility for defeat in wars and the ensuing national chaos to wrongdoings on the part of the people. However, the fact that the Confucianism of the Joseon dynasty, which served as the ruling ideology, continuously helped to maintain stability within society for an additional 200 years after these devastating wars left me unable to agree with this simple explanation.

It was under such circumstances that I first came into contact with the notion of the ‘General Crisis of the Seventeenth Century’, a new area of debate that gripped Western historians in the late 1970s. The common conception amongst Western historians was that the disturbances of the seventeenth century were caused by the collapse of feudalism. Paying attention to the emergence during this period of uprisings, rebellions, wars, famine, and epidemic diseases in feudal Europe and the rest of the world, advocates of the notion of the crisis of the seventeenth century sought to link these occurrences to abnormal natural phenomena. Focusing on the little ice age phenomenon continuously suggested by geologists, these advocates interpreted that disturbances such as famine, epidemic diseases, riots, rebellions and wars had in fact emerged because of the decline in agricultural production occasioned by the drop in temperature.¹⁹ The term little ice age was used to empha-

¹⁹ Geoffrey Parker and Lesley M. Smith, *The General Crisis of the Seventeenth Century*, 2nd ed. (London: Rutledge, 1997).

size the fact that a visible drop in temperature occurred during this period.

Enticed by this theory of the 'General Crisis of the Seventeenth Century,' I began to think that perhaps Korea's *Joseon wangjo sillok* (The Annals of the Joseon Dynasty) could provide me with more precise answers regarding natural disasters. This historical record compilation includes comparatively detailed records of abnormal natural phenomena. This is because Confucianism, which served as the national ideology of the Joseon dynasty, boasts a rather unique understanding of why disasters occur. In this regard, abnormal natural phenomena were perceived as a warning from the Heaven that the leaders of the dynasty had failed to rule properly. To this end, the kings of the Joseon dynasty identified the observation and recording of abnormal natural phenomena as one of their most important missions. The *Joseon wangjo sillok* (The Annals of the Joseon Dynasty) contains records which cover events that occurred over a period of 471 years, more precisely from 1392 to 1863. I decided to read the *Joseon wangjo sillok* (The Annals of the Joseon Dynasty), and especially the sections dealing with events from the seventeenth century onwards, from the standpoint of the theory of the 'General Crisis of the Seventeenth Century' advanced by Western historians. I discovered many records pertaining to events caused by drops in temperature such as hail, frost, and unseasonable snow, as well as to natural disasters such as drought, flood and famine. There were in particular many records pertaining to the emergence of meteors. While only meteor sightings in the capital (Seoul) area were recorded, one nevertheless finds 3431 such entries over the 471 year span covered by this book. These were of course based on visual observations. Advocates of the 'General Crisis of the Seventeenth Century' identified the concept of the decline in solar activity introduced by John Allen Eddy as the main cause of the drop in temperature.²⁰ However, few records pertaining to any decline in solar activity could be found in

²⁰ John A. Eddy, "The 'Maunder Minimum': Sunspots and Climate in the Reign of Louis XIV," *Science* 92 (1976):1189-202.

the *Joseon wangjo sillok* (The Annals of the Joseon Dynasty). Rather, there were many records related to the emergence of meteors, Venus or an evening star during the day, as well as solar or lunar halos.

These records left me, who was very much a neophyte as far as astronomy and meteorology are concerned, feeling rather confused. However, after having been introduced to the results of the study conducted by Luis Alvarez and his team in 1980 by some of my colleagues who majored in astrophysics, I was able to better hone my own analysis. I then proceeded to classify many of the records pertaining to abnormal natural phenomena found in the *Joseon wangjo sillok* (The Annals of the Joseon Dynasty) into those related to the entry of meteors or asteroids into the earth's atmosphere and related phenomenon. Furthermore, I was able to identify the start and end points of this little ice age characterized by a marked drop in temperature as having respectively been the 1490s and 1760s. Advocates of the General Crisis of the Seventeenth Century generally believed that this period of instability lasted about 80 years, or from 1600 to 1680. However, based on an analysis of the *Joseon wangjo sillok* (The Annals of the Joseon Dynasty), the present author concluded that this period had in fact spanned some 270 years.

Table 1 breaks down the 25,670 recorded instances by 50-year units. According to this table, 83% of all records fall within the scope of units 3-7, which covers the period from 1500 to 1750. Thus, we can surmise that natural disasters continuously emerged over a long period of time. The little ice age started in 1490 and ended in 1760. As such, we can see that the span of the little ice age or the General Crisis of the Seventeenth Century was not limited to the 17th century, but in actuality started during the final period of the 15th century and continued up until the mid-18th century.

Table 2 breaks down the overall records by phenomenon and periods. Here, we can see that there were many cases of asteroid (meteor) sightings or collisions during chaotic periods. Thunder and lightning, flames, and colored vapors (red, black and white) are some of the phenomena which occur when a fireball enter into

the earth's atmosphere. Various descriptions of fireballs entering the atmosphere can be found. While some entries de-

Table 1. Total Number of Recorded Instances of Abnormal Natural Phenomenon for Each Period in the *Choson Dynasty Annals*

Period	Corresponding Years	Total Number
Period 1	1392-1450	2,117
Period 2	1451-1500	1,420
Period 3	1501-1550	6,109
Period 4	1551-1600	4,785
Period 5	1601-1650	3,300
Period 6	1651-1700	3,563
Period 7	1701-1750	2,716
Period 8	1751-1800	936
Period 9	1801-1863	724
Total		25,670

Table 2. Periodic Distribution of Abnormal Natural Phenomenon Recorded in the *Choson Dynasty Annals* (See Table 1 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	3431
Colored vapors	48	9	333	325	211	61	61	3	1	1052
Unusual sounds from sky	0	0	4	4	2	0	0	0	0	10
Comets	21※ (5)	198 (8)	221 (6)	102 (8)	37 (4)	102 (8)	84 (5)	75 (3)	374 (14)	1214 (61)
“Guest stars” or New stars	0※ (0)	0 (0)	0 (0)	127 (3)	102 (1)	0 (0)	14 (3)	22 (2)	0 (0)	265 (9)
Abnormal sun	6	0	16	27	23	9	13	2	0	96
Abnormal moon	0	0	1	10	6	1	0	2	0	20
Halo effect, sun	424	352	1662	1378	266	121	239	44	1	4487
Halo effect, moon	27	16	145	557	78	116	176	27	0	1142
Venus in daytime	252	339	1186	397	829	1141	388	116	239	4887

Thunder, lightning	264	108	547	456	209	250	282	211	43	2370
Hail	177	68	578	260	223	295	262	108	35	2006
Frost	107	11	145	38	84	121	81	17	1	605
Unseasonal snow	37	3	70	32	35	117	65	18	0	377
Heavy rain	63	1	38	13	5	22	21	17	7	605
Severe rainstorms	149	112	59	34	134	89	47	7	2	633
Violent windstorms	46	4	61	28	30	42	16	3	2	232
Heavy snow	2	7	7	0	2	14	4	0	0	36
Colored snow, rain	14	8	29	18	8	11	1	1	0	90
Dust storms (Micrometeorites)	0	0	1	2	7	19	0	0	0	29
Daytime darkness	0	0	1	0	14	24	13	2	0	54
Fog	144	20	45	280	91	22	48	1	0	651
Earthquakes	183	78	482	287	110	185	157	13	5	1500
Tidal waves	4	1	7	5	14	33	38	7	3	112
Water color changes	14	0	1	0	1	12	5	0	0	33
Unusually low temperature	8	1	28	3	11	9	4	0	0	33
Unusually high temperature	24	15	20	15	2	7	2	1	1	87
Total	2117	1420	6109	4785	330 0	3563	2716	936	724	25670

*The first number is the number of recorded observation. Inside parenthesis is the number of actual comets or guest stars.

scribed a peach-sized fireball with a long tail disappearing as it headed in a certain direction, others described a bright flying fireball that exploded creating sounds akin to thunder. The former involves high-altitude flight and the latter low-altitude flight. In both cases, the explosion of an asteroid would have resulted in pieces and dust scattering in midair to create a cosmic serpent. This was described in the *Joseon wangjo sillok* (The Annals of the Joseon

Dynasty) as white, black and red vapor. An asteroid that exploded closer to the ground was simultaneously accompanied by thunder and lightning, stormy winds and hail.

Darkness and a fog-like phenomenon emerge when the dust from the explosion of an asteroid accumulates within the atmosphere. This cosmic dust, which prevents the light and heat of the sun from piercing through, is the main reason for the drop in temperature. This dust led to a phenomenon in which a fog-like haze remained in place for days on end and strange odors noxious to the people emerged. Scientists have argued that the long-term presence of this phenomenon could potentially affect the DNA of animals and plants. Table 3 summarizes the records related to the emergence of deformed animals in the *Joseon wangjo sillok* (The Annals of the Joseon Dynasty). Here it should be noted that the periods in which such animals were noted is in keeping with those in which the little ice age is believed to have occurred. This means that certain life forms became deformed after having been exposed to cosmic dust during the 270 year-long little ice age. Thus, the *Joseon wangjo sillok* (The Annals of the Joseon Dynasty) can be regarded as proving the influence of terrestrial impact on the DNA of animals and plants.

The terms *ilbyeon* (日變, solar change) and *wolbyeon* (月變, lunar change) were used in the *Joseon wangjo sillok* (The Annals of the Joseon Dynasty) to indicate a state in which sun and moon in which the cosmic dust accumulated within the atmosphere of the sun and moon caused their color to change and their light to become dimmer. The emergence of a variety of solar and lunar coronas because of the presence of ice crystals in the atmosphere of the earth, which were caused by the drop in temperature occasioned by the cosmic dust, created great consternation amongst the people. An atmospheric phenomenon known as parhelion (幻日), in which the refraction of light through ice crystals results

Table 3. Records of Deformed Animals in the *Choson Dynasty Annals*

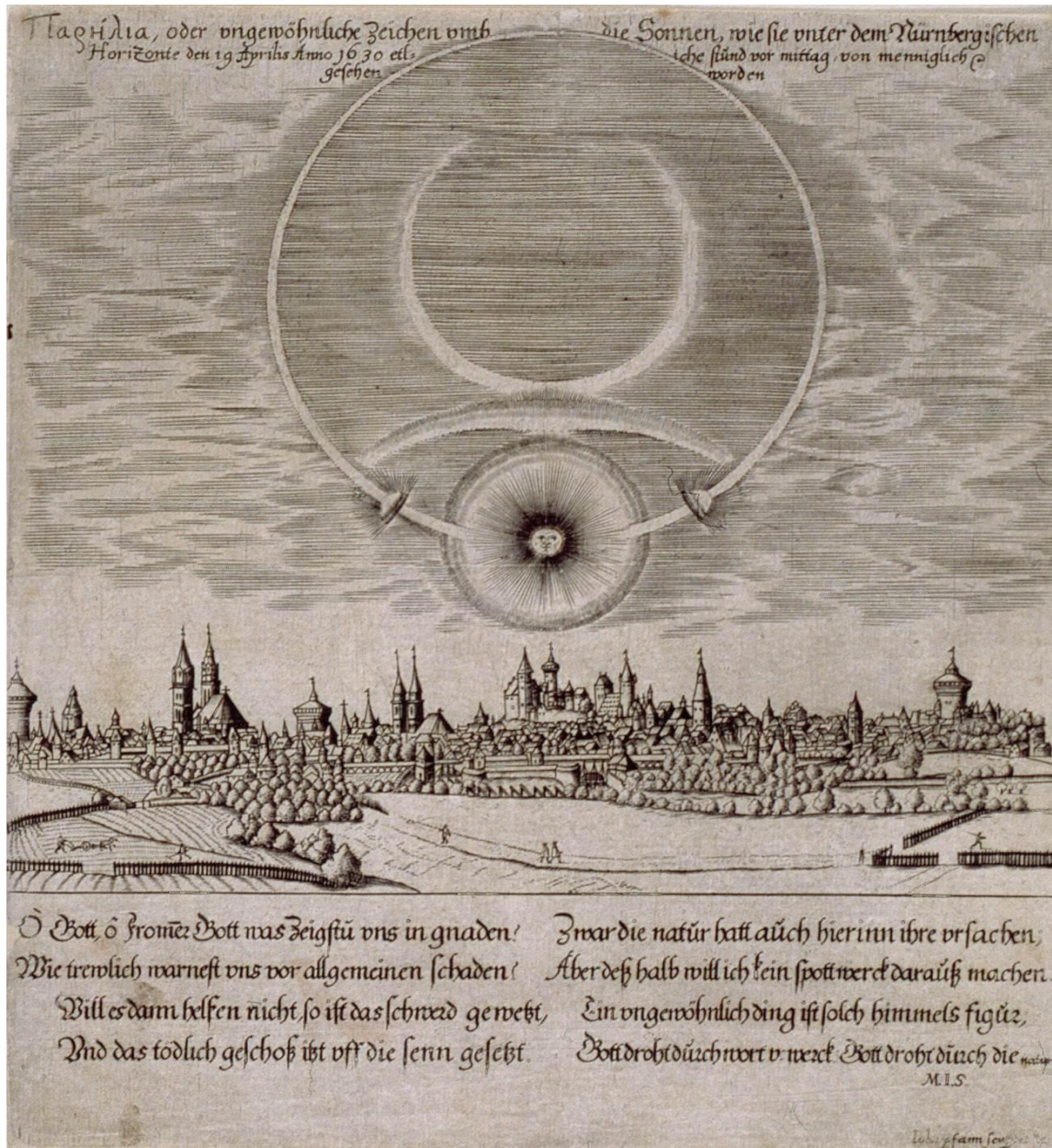
Time Period	Cows	Chickens	Horses	Dogs	Cats	Humans	Fish	Crows	Pigs	Others	Total Number
1392-1450	2	2									4
1451-1500	2	1					1				4
1501-1550	17	21	1	4	1					1 (Pheasant)	45
1551-1600	16	17	2	3	1		2	1	1	Duck 1, Sparrow 1, Pheasant 1, Antbirds 2, Swallow 1	49
1601-1650	11	11	2	1	1	1	1	1	1	Goats 2, Antbird 1, Sparrow 1	34
1651-1700	41	24	2	4	3	3		1	2	Bear 1	81
1701-1750	20	1	1			6			5	Swallow 1, Bird 1, Monstrous Beast 1	36
1751-	4	3									7
Total Number	113	80	8	12	6	10	4	3	9	15	260

in the emergence of two, three or four suns, also emerged. Double and triple-layered solar coronas created when round rings surrounded the sun, as well as rainbow-colored wheels, were also spotted [Figure 1, 2].

The darkness phenomenon caused by the cosmic dust caused Venus (evening star) to light up in the middle of the day. The emergence of Venus during the day proves that the atmosphere of the earth was covered by cosmic dust.

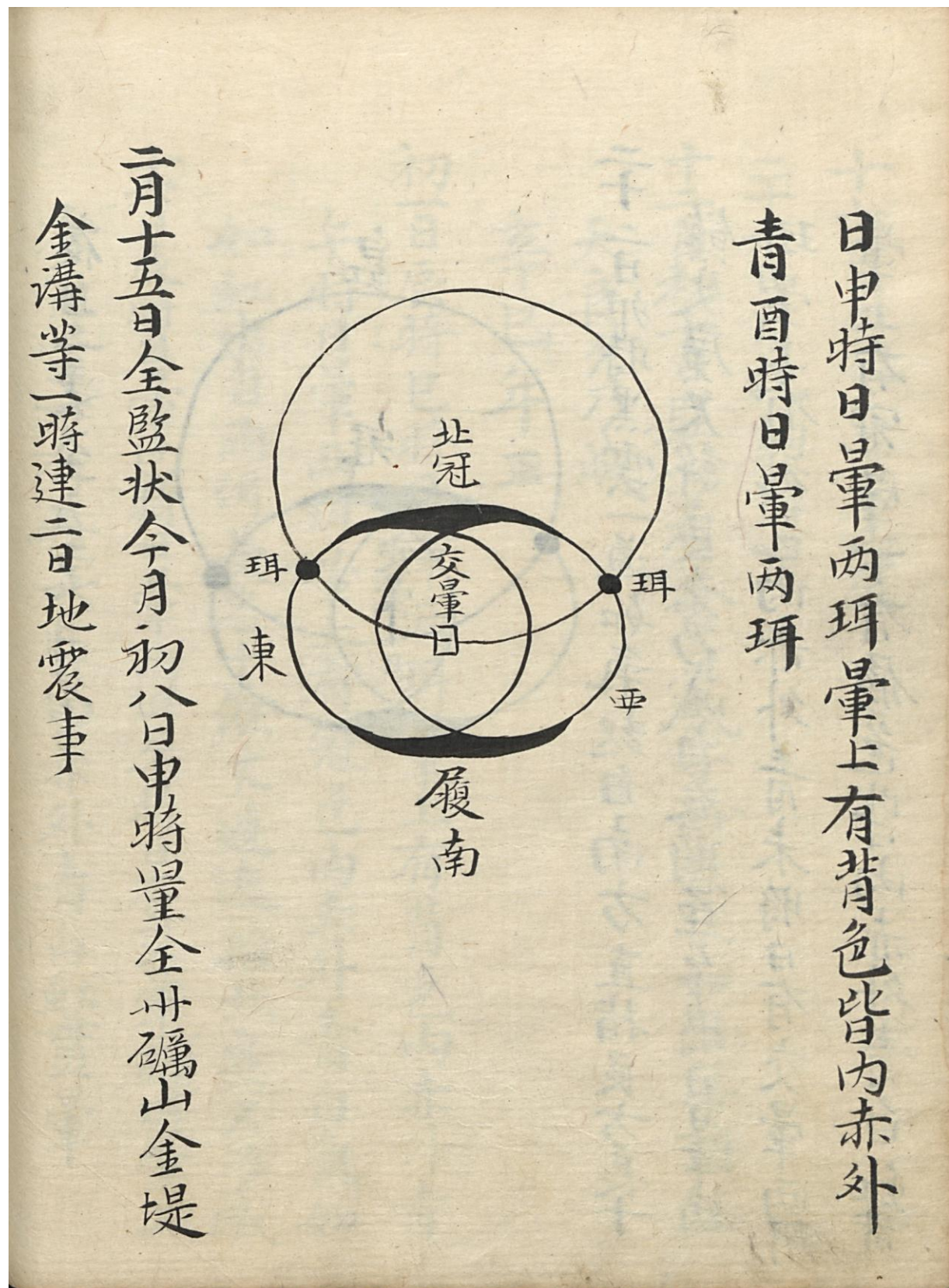
The covering of the atmosphere of the earth with cosmic dust and many ice crystals led to the emergence of various cold weather-related phenomena. Among the records related to frost during

Figure 1. Solar change Illustration which was occurred in April 19, 1630 at Nuremburg. Image courtesy of Germanisches National Museum, Nuremburg, Germany.



these periods, one finds many references of congealed frost falling and snow during the summer season. The abnormal state of the atmosphere where cosmic dust accumulated led to the unusual changes in the weather. Bouts of heavy floods were followed by searing droughts. While a heavy flood emerged in the southeast ar-

Figure 2. Diagram of Solar change from *Jae'igo* (災異考) or *Records of Natural Disasters*. Image courtesy of Kyujanggak Institute of Korean, Korea.



ea of the Korean peninsula, a serious drought lingered on in the northeast area as heavy hail pounded the east coast. All of this caused heavy damage, many injuries, and even deaths. One of the palaces in Seoul was even flooded, with water rising knee high. By the time the little ice age ended, the stream through the middle of Seoul (currently Cheonggyecheon) was continuously overshooting its embankments, thus forcing the government to conduct a large-sized embankment rehabilitation project (1759-1760).

The historical materials found in the *Joseon wangjo sillok* (The Annals of the Joseon Dynasty) are viewed as being highly reliable because they cover a prolonged period. However, materials from other countries that might substantiate these records should also be sought. To this end, after some effort, the author of the present study was able to locate a resource produced in Germany called the Flugblat. In this regard, the American geologist and specialist in aurora phenomenon Robert H. Eather served as an intermediary. Although Eather errantly judged the abnormal atmospheric phenomenon described in the Flugblat materials as aurora phenomenon, his bibliographical list nevertheless helped me gain knowledge of these German Flugblat materials.²¹

The diagrams in the Flugblat materials describe various phenomena caused by the asteroids' entry into the atmosphere of the earth. The detailed knowledge of the phenomenon that emerged during the little ice age which I obtained through my perusal of the *Joseon wangjo sillok* (The Annals of the Joseon Dynasty) helped me determine that the drawings in the Flugblat materials were not related to aurora phenomena. I visited agencies and organizations in Europe that housed the relevant materials in February 1997, and again in July-August 1999, in order to gain access to the 250 Flugblat materials related to phenomena during the little ice age. I then conducted a detailed analysis of 90 of the materials I had set aside. The results of this analysis are summarized in Table 4, where they are broken down by the period in which they were produced. The production and distribution periods of these materials

²¹ Robert H. Eather. *Majestic Lights: The Aurora in Science, History, and the Arts* (Washington, D.C.: American Geophysical Union, 1980).

Table 4. Periodic Distribution of Abnormal Natural Phenomenon Recorded in German Flugblat

Time Period	Number of Instances	Time Period	Number of Instances
1491-1500	1	1631-1640	1
1501-1510	1	1641-1650	2
1511-1520	0	1651-1660	4
1521-1530	0	1661-1670	4
1531-1540	1	1671-1680	5
1541-1550	4	1681-1690	3
1551-1560	15	1691-1700	1
1561-1570	8	1701-1710	0
1571-1580	12	1711-1720	1
1581-1590	10	1721-1730	0
1591-1600	2	1731-1740	0
1601-1610	1	1741-1750	1
1611-1620	3	Unknown	2
1621-1630	12	Total Number	94

* Collection of the German National Museum, Nuremberg

were identical with those related to the little ice age identified through the *Joseon wangjo sillok* (The Annals of the Joseon Dynasty). The various abnormal natural phenomena described in writing in the *Joseon wangjo sillok* (The Annals of the Joseon Dynasty) were described in drawing form in the Flugblätter materials.

An in-depth perception of the causes of the phenomena that occurred during the little ice age, of related phenomena, and of the duration of the phenomena, also helped to develop a better understanding of important historical events. Above all, the wars initiated by Toyotomi Hideyoshi and Nurhaci, which shook East Asia to its core at the end of the 16th and beginning of the 17th centuries, were caused by an imbalance in the East Asian trade system caused by the decrease in agricultural production which began in the early 16th century, and the conflicts and clashes between the states and

tribes motivated by this exhaustion of resources. The Jurchen invasions in the north were caused by the change in the steppes occasioned by the drop in temperature and the crisis pertaining to the supply of minimum carbohydrates.²²

Followers of Confucianism interpreted natural disasters as a warning from the Heaven regarding the wrongdoings of people. To this end, the king and his royal subjects must have hoped that this seemingly endless array of natural disasters would come to an end as they fretted about the future.²³ The worsening of these natural disasters spurred the people to focus on the development of measures to amend their wrongdoings. During the 16th century, advocates of Confucianism in Joseon Korea developed the notion of Mind Learning (心學, *simhak*) under which self-cultivation (脩省, *suseong*) was emphasized. While this in turn led to growing emphasis on the importance of the application of Elementary Learning (小學, *sohak*), under which norms of ethics and conducts were suggested, this eventually led to the development of Ritual Studies (禮學, *yehak*) as an extension of Elementary Learning (小學, *sohak*) during the 17th century. On the political front, the political conflicts and struggles surrounding the causes of wrongdoing intensified amidst the emergence of the *sahwa* (purge of literati scholars) and political warfare amongst the factions (*dangjaeng*).²⁴

The Flugblat materials from Germany [Figure 1, 3, 4] help to shed some light on the reaction of Christianity to abnormal natural phenomena. Those who produced the Flugblat materials concluded that abnormal phenomena such as solar coronas were part of God's Final Judgment, and urged the people to repent right away.

The conclusion reached based on the analysis of the materials from the *Joseon wangjo sillok* (The Annals of the Joseon Dynasty)

²² Tae-Jin Yi, "The Natural Disasters during the Little Ice Age and *Joseon Wangjo Sillok* (The Annals of the Joseon Dynasty): A Chapter of Global History," *Yeoksa Hakbo* 149 (1996): 203-36.

²³ Ibid.

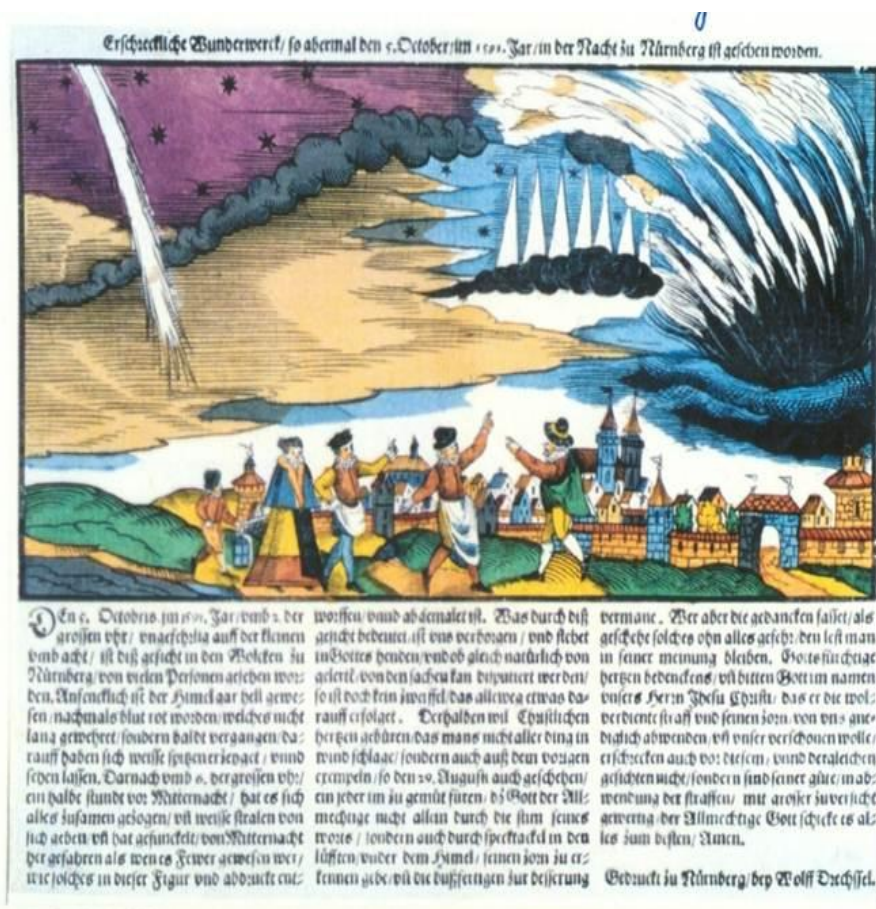
²⁴ Yi Tae-Jin, "Neo-Catastrophism and New Interpretation of Mankind History," *Yeoksa Hakbo* 164 (1999): 1-31.

Figure 3. Crashing Meteor in May 4, 1543 at Meyl von Phortzhaim, Germany. Image courtesy of Germanisches National Museum, Nuremberg.



that the phenomenon known as the little ice age started during the final period of the 15th century in turn made it possible to view the Reformation and religious wars that erupted within the Christian world during the 16th century in a new light. A recent study compiled based on the Flugblat materials of Germany concluded that Martin Luther's Protestant Reformation during the 16th century was greatly influenced by abnormal natural phenomena such as natural

Figure 4. Meteor Explosion in the sky in October 5, 1591 at Nuremburg, Germany. Image courtesy of Germanisches National Museum, Nuremburg, Germany.



disasters.²⁵ These reactions of the Christian world toward natural disasters during the little ice age can be regarded as a spiritual reaction akin to the notion of the ‘emergence of god’ raised during the SIS conference at Cambridge University.

The identification of the causes of the witch hunt of the 16th century in Europe has long been a matter of great interest amongst European historians.²⁶ It was revealed that this was one of the reactions of Christianity to the natural disasters of the 16th century. The ‘witch hunt’ was a social phenomenon akin to group hysterics that

²⁵ Volker Leppin, *Antichrist und Jüngster Tag: Das Profil apokalyptischer Flugschriftenpublizistik im deutschen Luthertum 1548-1618* (Gütersloh: Gütersloher Verlagshaus, 1999), 69.

²⁶ Brian P. Levack, *The Witch-Hunt in Early Modern Europe*, 2nd ed. (London: Longman, 1987), 21-6.

revolved around blaming the witches for the failure of farming and the prolonged abandonment of agriculture caused by abnormal natural phenomena. Witches originally referred to women who were charged with the conduct of the ritual ceremonies for agriculture. However, under group hysterics, they were blamed for the failure of farming and burnt to death. The oppression of perceived heathens such as Jews and Muslims also emerged under these circumstances. A similar phenomenon emerged in Joseon in the form of the purge of scholars (*sahwa*) and the political struggles (*dangjaeng*) between members of the ruling class.

III. CONCLUSION: THE FUTURE OUTLOOK FOR THE EXPANSION AND APPLICATION OF THE NOTION OF TERRESTRIAL IMPACT

The theory of terrestrial impact introduced above has only just begun to be employed in historical studies, and the results have so far been very limited. However, both large and small terrestrial impacts belong to the category of cosmic phenomena whose actuality cannot be refused any more. The identification of a 'long-term' terrestrial impact phenomenon during a specific historic era renders it necessary to reinterpret the history of this period from the standpoint of this phenomenon. These can be regarded as key tasks in terms of the study of 'world history' and 'big history'.

One important aspect of the theory of terrestrial impact is the extent to which the periods in which such impacts occurred in human history can be estimated. Based solely on historical materials from Korea, the present study was able to identify the years 680-880, 1100-1220, and 1340-1420 as periods in which terrestrial impacts occurred. As mentioned above, terrestrial impact phenomena are accompanied by various related phenomena. The application of the sets of related phenomena identified through the *Joseon wangjo sillok* (The Annals of the Joseon Dynasty) to the records of abnormal natural phenomena that emerged during earlier periods made it possible to see that in terms of frequency such related

phenomena were concentrated in these periods.²⁷ The natural disasters recorded in historical materials failed to garner any attention during the long years in which there was no knowledge about terrestrial impact. This is because they were regarded as unique seasonal phenomena that occurred within the atmosphere, the results of superstition, or the results of a traditional people's misunderstanding of astronomic phenomena. This can be compared to the 'historic loss' occasioned by the pride and prejudice spawned by the 'scientific knowledge' associated with the Industrial Revolution of the 20th century.

While modern studies began to develop during the 19th century, its focus was limited to mankind and the earth. This focus was further enhanced when the notion of gradualism represented by evolutionary theory became the basis of modern studies. Although catastrophism existed as a counterweight to gradualism up until the late 18th century, the runaway economic development wrought by the Industrial Revolution since the 19th century, a period in which no cosmetic disaster phenomena occurred, the rationalism of the Western world began to establish itself as the dominant school of thought the world over. As such, the 'cosmic conversations' left behind by other civilizations and cultures during the periods of terrestrial impact came to be regarded as mere superstitions and labeled as meaningless legacies. The acceptance of the theory of terrestrial impact is expected to restore these abandoned legacies and further enrich and supplement the contents of historical studies.

Terrestrial impacts were a cosmic phenomenon that influenced the entire earth. Therefore, there is a strong likelihood that those identified through Korean historical materials can be also identified through the historical materials of other regions. To this end, it is necessary to, based on remnant historical materials, relics, and the remains found in each region, actively conduct research

²⁷ Tae-Jin Yi, "Natural Disasters during the Goryeo ~ Mid-Joseon Era and the Change in the Perception of Heaven," in *Hanguk Sasangsa Bangbeopnon* (Seoul: Sohwa, 1997); Tae-Jin Yi, "The Natural Disasters during the Little Ice Age and *Joseon Wangjo Sillok* (The Annals of the Joseon Dynasty)."

that can identify such impacts. The fact that the above-mentioned periods were those in which critical historical events and changes simultaneously emerged all over the world only serves to highlight the need to expand and apply the terrestrial impact theory.