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A Chronology of Aurorae and Sunspots observed in China, Korea and Japan

Part 1

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Preface

Hermann Fritz illustrated the frequency of auroral appearance in the northern hemisphere by oval lines. In this illustration,** the most southern line in the far east is the 46 degree latitude, and on this line M=0.1 has been added. It means they can see aurora once in ten years on this latitude. This illustration has been quoted in many books, and seemed to receive universal approval. If it is true, south of the Great Wall in China, all of Korea, and the greater part of Japan have no connection with aurora. But a large part of the historical materials in his book "Verzeichniss beobachteter Polarlichter" are based on the records observed in Europe during the 18th—19th centuries, and there are few data in China, Korea and Japan. Now, we have had the catatalogue of historical aurorae in Japan. But when I began my research on the Chinese auroral records by the request of Prof. Takeshi Nagata, Tokyo University, there was no chronology of Chinese or Korean aurora. After searching into many history books, I have been greatly surprized that there are many precious records of aurorae and sunspots in such a low latitude area as China. The main reason is that China had a national astronomical and meteorological observatory from ancient times, (at least from the beginning of the 2nd century BC), and constant observations were continued by specialists there. The original records were lost, but a large part of them on the remarkable phenomena have been preserved in aucentic histories, like what is called the Twenty-four Histories (Standard Histories). So we can find the records of aurorae and sunspots among them. After 1368, the beginning of Ming Dynasty, we have many fundamental historical materials to search through together with the aucentic histories, but I have no mind to touch on them further, and on the Japanese and Korean materials I will not touch at all. Here, I would like to mention the excellent points of Chinese auroral records. They were recorded continuously as the duty of public officials, not by chance by private persons. Moreover, the greater part of them were written by specialists of the nationl astronomical observatory in the capital of each Dynasty, so the

*Hermann Fritz "Das Polarlicht", Leipzig, 1881. "Karte der geographischen Verbreitung des Nordlichtes"

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latitude and longitude of the place of observation is clear, the detailed dates have been presented in many records, and the descriptions are vivid with scientific accuracy. On the places of appearance or disappearance in the sky, the forms, the aspects, the motions, the colours etc., we can find many precious descriptions to judge their reliability. I believe, there are many good historical records of aurorae and sunspots in China, Korea and Japan which supply the shortage and lack of the occidental records.

I have collected the fundamental records of aurorae and sunspots observed in China, Korea and Japan by the end of 17th century, arranged them in chronological order, and have been making faithful translations with detailed notes.

I am an outsider of geomagnetism or aeronomy, but have been making a study of Chinese history, and the historical and seismological study on the Chinese earthquakes has become my life work.

I have received much help from Prof. Naoshi Fukushima, Tokyo University, and wish to extend hearty thanks to him.

On the Classification of the Reliability of the Materials

I have classified the reliability of the materials into five degrees: 1 means "certain", 2 "very probable", 3 "probable", 4 "doubtful", and 5 "unlikely". Though the greater part of the source books in my paper have high authenticity, yet the only problem here is limited to the reliability of the aurorae described in them. Judging the descriptions concerning the light forms in the materials from several points of view, the classification has been decided, the points being the place or the direction of the appearance and disappearance in the sky, the form, the colour, the state of the stationariness or the motion, the continuous hours of the appearance, etc.

Chronology

No. 1 Reliability 3

BC 687 *x* day[1] 莊公七年. 四月辛卯. 夜. 恒星不見. 夜中星隕如雨. 〔春秋, 莊公, 七年〕

At night ever-appearing stars (or ordinarily-perceptible stars)[2] were not seen. Stars fell like rain[3] during the night. (*Ch'unch'iu*, the 7th Year of *Chuangkung's* reign.)

note

(1) We have the study on the calendar of *Ch'unch'iu* (春秋) by the late Dr. Shinzô Shinjyô (新城新蔵), one of the famous astronomer in Japan. It may be possible to change the date of this record written in the Chinese style into Julian calendar by his work.

(2) The literal translation of the Chinese word *hêng-hsing* (恒星) in the

original is "fixed stars", but they are not used here as a technical term nowadays.

(3) "Stars fall (fell) like rain" is the literal translation of the original. The Chinese word *hsing* (星) means star or stars, *yün* (隕) fall or fell, *ju* (如) like, *yü* (雨) rain. I think this Chinese description has been interpreted "shooting stars" by sinologists, and in some cases this interpretation may be adequate, but I would assert it means "aurorae of raystructure" in general. I would like to explain my interpretation. See the records dated on BC 15. 3,23=15 BC March 23 rd, No. 16 data, in this paper. There are three different records of the same unusual phenomena observed this particular night at *Changan* (長安), the capital of the Former *Han* (漢) Dynasty (202 BC−8 AD), and these three records are found in three different parts of *Hanshu* (漢書), in vol. 10, 26 and 27. One may easily realize the following translation of the original in vol. 26 expressing the auroral phenomena with shaking motions. "At night a red form having 3 or 4 arms-stretches-round and drops 20—30 feet, shaking like a tree, appeared in the east. On its southern side a similar form of 4 or 5 arms-stretches-round and drops more than 100 feet. Both of these forms perished before reaching the earth". Please notice this record does not contain the description "stars fell like rain", but the other two records in vol. 10 and 27 contain it. The record in vol. 10 says "At night stars fell like rain", and the one in vol. 27 says "After midnight stars fell like rain, forming a continuing drops of 10-20 feet, and all of them perished before reaching the earth and all this stopped at cock-crow". While one may assert the two records in vol. 10 and 27 are talking about "shooting stars", one may also insist they mean "aurorae of raystructure". But if one interprets the record in vol. 26 means shooting-stars, I can definitely conclude it is wrong, for it is no other than aurorae. It is certain that the three different descriptions tell of the same phenomena, and among them the one in vol. 26 has been proved to mean the auroral phenomena. The other two in vol. 10 and 27 expressing the same phenomena are clear. I presume the three different descriptions mentioned above are based on the same record written by the observer in the national astronomical observatory in *Changan* on BC 15. 3,23 and afterwards it was divided into three independent sentences and was placed in three parts vol. 10, 26 and 27 of *Hanshu* by the author. I have verified my new interpretation of "stars fall like rain", and it may be safely applicable to the records of BC 15. 3,23. But as for the record dated BC 687, it is difficult to decide whether it means shooting stars or aurorae, because it contains possibilities of both sides. But, as for me, I would rather interpret it as aurorae.

No. 2 Reliability 4

BC 423 *x* day 威烈王三年. 冬十一月. 晉有火下于北方. 有声如鼓. 〔通鑑外紀巻10—周紀8〕

Fire fell down (from the sky) in the nothern part of ***Chin*** (晉)[1]. They heard sounds like a drum. (***Tungchienwaichi***[2] vol. 10)

note

(1) The old name of ***Shanhsi*** (山西) Province.

(2) The reliability of the text is doubtful.

No. 3 Reliability 3

x day from BC 207.12,7−206.1,4 (秦二世三年十一月＝漢高祖元年十一月)

項羽救鉅鹿. 枉矢西流. 枉矢滅亡象也. 物莫直於矢. 今蛇行不能直. 〔漢書巻26天文志〕

Hsiangyü (項羽) went to ***Chülu*** (鉅鹿)[1] to save his army[2]. ***Wangshih*** (枉矢)[3] ran westward. It is said, ***Wangshih*** is an omen (a portent) of the downfall. There is nothing so straight as an arrow[4], but it was meandering and could not go straight. (***Hanshu*** vol. 26)

note

(1) ***Chülu*** is situated 37° 13′ N., 115° 01′ E.

(2) We can be sure of the definite date when ***Hsiangyü*** went to ***Chülu*** by the monthly list in vol. 16 of ***Shihchi*** (史記). It says the affair was in Nov. (by the Chinese calendar) in the 3rd year of King II ***Ch'in***'s (秦) Empire.

(3) The most original of texts on the Chinese astronomical phenomena, ***T'ienkuanshu*** (天官書), vol. 27 of ***Shihchi*** (written in the 2nd century BC) says "***Wangshih*** is like a large shooting star, meandering and blue-black. It seems that there are something like animal hairs and feathers in it when it can be seen". The Chinese word ***wang*** (枉) means hook, curve, meander etc., ***shih*** (矢) means arrow. On page 46 in our paper "Archaeo-Aurora and Geomagnetic Secular Variation in Historic Time" (Journal of Geomagnetism and Geoelectricity vol. 20, No. 1, 1968), we ——N. Fukushima and I—— translated the same original on the ***Wangshih*** in ***Shihchi*** as follows, "arrows like large comets, snaky and blue-black, seeming to have hairs," but I have corrected it as mentioned above.

(4) See the nots 3 above.

No. 4 Reliability 4

BC 172. *x* day from 4,19——7,16 文帝八年. 夏. 有長星出于東方. 〔漢書巻4文帝紀〕

A long star[1] appeared in the east. (***Hanshu*** vol. 4)

note

(1) "Long star" is the literal translation of the Chinese word, ***chang*** (長) means long and ***hsing*** (星) means star. The note written by ***Wenying*** (文穎) (lived in the Later ***Han*** period = 1 − 2nd century AD) says, "A long star has a shaft of light making a straight form and sometimes it is so long that it seems to spread across the entire sky, but it does not have a fixed length, for example 100, 30 or 20 feet. This note has been included in ***Hanshu*** belonging to the text mentioned here.

No. 5 Reliability 3 ～ 4

BC 158. *x* day from 9,10——10,8 孝文後六年. 八月. 天狗下梁野. 〔漢書卷26天文志〕

T'ienkou (天狗)(1) fell on the field of ***Liang*** (梁)(2). (***Hanshu*** vol. 26)

note

(1) Chinese word ***t'ien*** (天) means heaven, ***kou*** (狗) dog. The explanation in ***T'ienkuanshu*** (天官書), vol. 27 of ***Shihchi*** (史記) says "***T'ienkou*** aspect is like a large running star. It has sound. Falling down on the earth, it resembles a falling dog and flaming fire. When it can be seen, a blazing fire seems to flame up to the heaven. The one, which is round in its lower part and sharp in its upper part, has a yellow colour, and the area in the lower part seems to be of several ***ch'ings*** (頃) (a). In our paper (b) we ——Fukushima and I—— translated the same original as follows "Heaven-liondog, like huge running stars with tails, like a flame going up to heaven", but I correct it as mentioned here. In this connection, I wonder if we can always apply the explanation of ***t'ienkou*** in ***Shihchi*** to the same word which was used among many Chinese historical records, because obserbers seems to have used this word at their own discretion.

(a) ***ch'ing*** (頃) is the Chinese areal unit for cultivated fields.

(b) "Archaeo-Aurora and Geomagnetic Secular Variation in Historic Time" Journal of Geomagnetism and Geolectricity vol. 20, No. 1. 1968

(2) The center of ***Liang*** (梁) was situated near 35° 06′ N., 116° 22′ E.

No. 6 Reliability 3 ～ 4

BC 155. *x* day from 8,8——9,5 孝景二年. 七月. 天狗下. 〔漢書卷26天文志〕

T'ienkou (天狗) fell down. (***Hanshu*** vol. 26)

No. 7 (A) Reliabiliity 3

BC 139. 6, 6 建元二年. 夏四月戊申 (24). 有如日夜出. 〔漢書卷6武帝紀〕

It was as if the sun were appearing(1) in the night. (***Hanshu*** vol. 6)

note

(1) We can find the sketches of aurorae having the aspect like the rising sun, for example on page 56-57 (a) of "Nordlicht-beobachtungen in Ungarn" (Budapest, 1963), on page 695 (b) of "Japanese meteorological historical records" 1939 (written in Japanese).

(a) The aurora observed at Trnava (48° 23′ N., 17° 35′ E.) on 1768 Dec. 5.

(b) The aurora observed at many places in Japan on 1770 Sept. 17.

No. 7 (B) Reliability 3

建元二年. 夏四月戊申 (24). 有星如日夜出. 〔前漢紀巻10武帝紀〕

There was a star as if the sun were appearing in the night. (*Ch'ienhanchi* vol. 10)

No. 8 Reliability 3～4

x day from BC134−128 元光中. 天星盡搖. 上以問候星者. 対曰. 星搖者民労也. 〔漢書巻26天文志〕

All stars in the sky trembled (1). The king (*Wuti* 武帝) asked an astrologist the reason, and he replied "Stars trembling is a sign of the people suffering". (*Hanshu* vol. 26)

note

(1) When they saw stars behind the shaking aurorae, it may be thought that they might assume all stars in the sky as trembling.

No. 9 Relibility 3

x day from BC134−128
x day from BC122−116
} 元光・元狩蚩尤旗再見. 長則半天. 〔史記巻27天官書〕

During *Yüankuang* (元光) (BC134−128) *Yüanshou* (元狩) (BC122−116) *Ch'ihyuchi* (蚩尤旗) (1) was seen two times, and they were so long that they covered half of the sky. (*Shihchi* vol. 27)

note

(1) The explanation on *Ch'ihyuchi* (蚩尤旗) in *T'ienkuanshu* (天官書), vol. 27 of *Shihchi* (史記) says "*Ch'ihyuchi* is like a comet but hooked in the back, and has the aspect of a flag". The note written by *Chinshao* (晉灼) quoting *Lüshihch'unch'iu* (呂氏春秋) (one of the Chinese classics compiled in 3rd century BC) says "Its colour is yellow in the upper part and white in the lower part". *Ch'ihyu* (蚩尤) is the name of the king who was defeated by *Huangti* (黄帝) in the battle field *Chuolu* (涿鹿), and both of them are the kings in the ancient tradition. The former has been thought of as the bad king in China. So it may be said that the name

connected with *Ch'ihyu* has something ominous about it. Chinese word *ch'i* (旗) means flag or flags.

No. 10 Reliability 3～4

BC 119. *x* day from 5,4−6,2 元狩四年. 四月. 長星又出西北. 〔漢書卷27下之下, 五行志下之下〕

A longs tar(1) appeared in the northwest again. (*Hanshu* vol. 27)

note

(1) See the note on the datum No. 4, BC 172 mentioned before.

No. 11 Reliability 3

BC 112. 12, 24 元鼎五年. 十一月辛卯(17). 夜. 若景光十有二明. 〔漢書卷6武帝紀〕

It was bright as if they had twelve propitious lights(1) at night. (*Hanshu* vol. 6)

note

(1) It may be supposed that they saw an aurora having the aspect of the rising sun that had twelve bundles of light.

No. 12 Reliability 3～4

BC 74. 2, 20 元平元年. 正月庚子 (2). 日出時有黒雲. 状如炎風乱髪. 転出西北. 東南行. 転而西. 有頃亡. 〔漢書卷26天文志〕

When the sun was rising, black clouds(1) like flaming wind and rumbled hair, rolled out from the northwest and moved southeastward, then turned to the west, and after a while disappeared. (*Hanshu* vol. 26)

note

(1) Of course, we can consider that they really saw such black clouds as mentioned here. But it may be possible to suppose that they used the word ""black" for "deep blue, green or purple colour", and "cloud" instead of "aurora". See the preface.

No. 13 (A) Reliability 2

BC 74. 4,5−6 昭帝元平元年. 二月甲申 (17). 晨. 有大星如月. 有衆星随而西行. 乙酉 (18). 群雲如狗. 赤色. 長尾三枚. 夾漢西行. 〔漢書卷26天文志〕

At dawn on Feb. 17th(2a) a large star(1) like the moon went westward accompanied by many stars, and on the 18th(2b) a mysterious red cloud like a dog with three long tails went westward on the Galaxy. (*Hanshu* vol. 26)

note

(1) The Chinese original word is *tahsing* (大星). *Ta* (大) means large, and *hsing* (星) means star or stars.

(2a, b) Both after the Chinese calendar at the time.

No 13 (B) Reliability 2

元平元年. 春二月甲申 (17). 晨. 有流星大如月. 衆星皆随西北. 〔漢書卷7昭帝紀〕

At dawn on Feb. 17 th. a shooting star(1) as large as the moon, and accompanied by many stars, went westward. (*Hanshu* vol. 7)

note

(1) The Chinese original word is *liuhsing* (流星). *Liu* (流) means stream, run etc. and *hsing* (星) means star or stars, so that the translation "shooting star" has been given.

No. 14 Reliability 2

BC 32. 5, 9 成帝建始元年. 四月辛丑 (8). 夜. 西北有如火光. 〔漢書卷27下之下, 五行志下之下〕

There was something like the light of fire in the northwest at night. (*Hanshu* vol. 27)

No. 15 (A) Reliability 1

BC 32. 10, 24 孝成建始元年. 九月戊子 (28). 有流星出文昌. 色白. 光燭地. 長可四丈. 大一圍. 動搖如龍蛇行. 有頃長可五六丈. 大四圍所. 詘折委曲貫紫宮. 西在斗西北子亥間. 後詘如環. 北方不合. 留一刻所. 〔漢書卷26天文志〕

A shooting star, white in colour, appeared at *Wênch'ang* (文昌)(1) and its light shone the earth. Its form was about 40 feet long, its size was about as big as an armful and was shaking and meandering like a dragon. After a while its form changed to about 50-60 feet in length, the size increased to about 4 arms-stretches-round, and turned and wound, passing through *Tzû-kung* (紫宮)(2), it went westward and reached the westside of Great Bear, and then was located between N. to N. N. W. It hooked backward making a form like a link, but did not make a complete circle in the north. It stayed there for about an hour. (*Hanshu* vol. 26)

note

(1) The Chinese constellation, consisting of six stars located before the first star of Great Bear.

(2) The Chinese constellation consisting of the pole-star and many other stars (over 170), covering Great Bear, Small Bear, Dragon, Cassiopeia, Cepheus, etc,

No. 15 (B) Reliability 2

建始元年. 九月戊子 (28). 流星光燭地. 長四五丈. 委曲蛇形. 貫紫宮. 〔漢書卷10成帝紀〕

A shooting star shining on the earth, 40-50 feet long, meandering and snaky, passed through *Tzŭkung* (紫宮). (*Hanshu* vol. 10)

Sunspot No. 1 Reliability 1

BC 28 *x* day 成帝河平元年. 三月乙未 (?). 日出黄. 有黒気. 大如銭居日中. 〔漢書巻27下之下. 五行志下之下〕

When the sun appeared, it was yellow. The black spot, as large as a coin, was in the sun. (*Hanshu* vol. 27)

No. 16 (A) Relibility 1

BC 15. 3,23 成帝永始二年. 二月癸未 (28). 夜. 東方有赤色. 大三四囲. 長二三丈. 索索如樹. 南方有大四五囲. 下行十余丈. 皆不至地滅. 〔漢書巻26天文志〕

At nignt a red form of 3-4 arms-streches-round and dropping 20-30 feet, like a shaking tree, appeared in the east, and on its southern side, a similar form of 4-5 arms-stretches-round and dropping more than 100 feet, both of them perished before reaching the earth. (*Hanshu* vol. 26)

No. 16 (B) Reliability 2

成帝永始二年. 二月癸未 (28). 夜過中. 星隕如雨. 長一二丈. 繹繹未至地滅. 至雞鳴止. 〔漢書巻27下之下, 五行志下之下〕

After midnight, stars fell like rain, forming a ceaseless drop of 10-20 feet and all of them perished before reaching the earth, and all this stopped at cock-crow. (*Hanshu* vol. 27)

No. 16 (C) Reliability 3

永始二年. 二月癸未 (28). 夜. 星隕如雨. 〔漢書巻10成帝紀〕

At night stars fell like rain. (*Hanshu* vol. 10)

note

See the note (3) of the No. 1 datum, BC 687. It is concerned with all the three records mentioned here.

No. 17 (A) Reliability 2

BC 12. 5, 20 成帝元延元年. 四月丁酉 (1). 日餔時. 天晦晏. 殷殷如雷声. 有流星. 頭大如缶. 長十余丈. 皎然赤白色. 従日下東南去. 四面或大如盂. 有如雞子. 耀耀如雨下. 至昏止. 郡国皆言星隕. 〔漢書巻26天文志〕

At sunset it was fine, but they heard a roaring sound like thunder. A shooting star, having a head as large as *fou* (缶)[1], the length of more than 100 feet, and having a clearly reddish white colour, went southeast from its place beneath the sun. Many stars, some as large as *yü* (盂)[2] and the other as egg, shining brightly fell on all sides like rain, but stopped when it became dark. All the provinces reported to the King that they observed the fall of

stars. (*Hanshu* vol. 26)

note

(1) Chinese earthenware with a big body and a small mouth which to put liquid in like wine in ancient times.

(2) In ancient China *yü* (盂) was a bowl for rice or water.

No. 17 (B) Reliability 2

元延元年. 夏四月丁酉(1). 無雲有雷声. 光耀耀四面下至地. 昏止. 〔漢書巻10成帝紀〕

There was no cloud, but thunder. Many lights shining brightly fell down to the earth on all sides, but in stopped at dusk. (*Hanshu* vol. 10)

No. 18 Reliability 3

BC 6. 3, 1 哀帝建平元年. 正月丁未 (14). 日出時. 有著天白気. 広如一匹布. 長十余丈. 西南行. 讙如雷. 西南行一刻而止. 名曰天狗. 〔漢書巻26天文志〕

At sunrise a white veil, looking like a piece of cloth and having a length of more than 100 feet, attached to the haven. Then it moved to the southwest, noisly like thunder, and moved further to the southwest and stopped after a while. They called it *T'ienkou*(1). (*Hanshu* vol. 26)

note

(1) See the note (1) on No. 5 datum, BC 158, mentioned above.

No, 19 Reliability 4

BC 5. *x* day from 1,7−2,3 哀帝建平元年. 十二月. 白気出西南. 従地上至天. 出参下. 貫天厠. 広如一匹布. 長十余丈. 十余日去. 〔漢書巻26天文志〕

A white veil appeared in the southwest, reaching from the earth to the sky. Appearing beneath *Shên* (参)(1), it penetrated *T'ienssŭ* (天厠)(2), as a wide piece of cloth more than 100 feet long, and then it disappeared after ten days or so. (*Hanshu* vol. 26)

note

(1) A Chinese constellation consisting of seven stars, containing the three stars in the southern part of Orion and other stars in its neighbourhood.

(2) A Chinese constellation of four stars located beneath *Shên*(参) mentioned above.

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