

# Earliest record of a candidate aurora found in Chinese annals

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后廢二少帝諸呂作亂

蕭子顯齊書曰齊東昏侯永元中夜天開黃色明照頃有物絳色如小甕漸大如倉廩聲如雷墜大湖野雉皆雥其年東昏見廢

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天光

書紀年曰周昭王末年夜清五色光貫紫微其年王南巡不返

漢書曰成帝元延元年四月無雲有雷聲光四下至昏乃止  
 晉書曰晉穆帝永和十年前涼張祚之元年正月夜天有光如車蓋明年祚被殺

宋書曰文帝元嘉十八年七月天有黃光洞燭至二十一

One of the variant fragments of the Bamboo Annals, an excerpt from the "Ancient Text of the Bamboo Annals" cited in (b) Tàipíng Yùlǎn (太平御覽), v. 874, f. 4b; MS Nu-3. Credit: National Diet Library of Japan

A celestial event mentioned in an ancient Chinese text turns out to be the oldest known reference to a candidate aurora, predating the next oldest one by some three centuries, according to a recent study by Marinus Anthony van der Sluijs, an independent researcher based in Canada, and Hisashi Hayakawa from Nagoya University. This finding was recently published in the journal *Advances in Space Research*.

The Bamboo Annals, or Zhushu Jinian in Mandarin, chronicle the history of China from the earliest legendary time to the time of their probable composition, in the 4th century BCE. Historical events aside, unusual observations in the sky make an occasional appearance in the text. Although this chronicle has been known to scholars for a long time, a fresh look at such old texts sometimes yields surprising new insights.

In this case, the authors examined the mention of a "five-colored light" seen in the northern part of the sky on a night towards the end of the reign of king Zhao of the Zhou dynasty. While the exact year is uncertain, they used up-to-date reconstructions of Chinese chronology to settle on 977 and 957 BCE as the two most likely years, depending on how Zhao's reign is dated.

They found the record of the "five-colored light" to be consistent with a large geomagnetic storm. When the mid-latitude aurora is sufficiently bright, it can present a spectacle of multiple colors. The researchers cite several examples of this from [historical records](#) much closer to our time. The earth's north magnetic pole is known to have been inclined to the Eurasian side in the mid-10th century BCE, about 15° closer to central

China than at present. Therefore, the auroral oval could have been visible to observers in central China at times of significant magnetic disturbance. The study estimates that the equatorward boundary of the auroral oval would have been located at a magnetic latitude of  $40^\circ$  or less on the occasion.

This would be the earliest datable record of an aurora known from anywhere in the world. The finding comes barely two years after that of the previous holder of this distinction—several records of candidate aurorae inscribed on cuneiform tablets by Assyrian astronomers in the period 679–655 BCE. Some scientists have also associated Ezekiel's vision, which is now dated to 594 or 593 BCE, with auroral visibility in the Middle East, but caveat must be noted for its reliability. Otherwise, another datable record of an early candidate aurora has been found for 567 BCE in the astronomical diary of the Babylonian king Nebuchadnezzar II.

Why did it take so long for scientists to recognize the aurora in the five-colored light of this chronicle entry? One reason is that the Bamboo Annals had a checkered history. The original manuscript was lost, rediscovered in the 3rd century CE and lost again during the Song dynasty. In the 16th century, a variant text was printed in which the object in the sky was not a five-colored light, but a comet. Now the new study shows that this cannot have been the original reading.

It is interesting in itself that popular descriptions of the northern lights can be pushed this far back in time. Such historical information is valuable for other reasons as well, however. It helps scientists to model long-term patterns in space weather variability and [solar activity](#), on timescales from decades to millennia. Understanding these fluctuations can, in turn, help societies prepare for future solar eruptions of great magnitude and the disruption of technological infrastructure that they may cause. This record is now the only known historical reference to a

space weather event before the Homeric Grand (Solar) Minimum (810–740 BCE), which should preferably be called the Neo-Assyrian Grand Minimum owing to Homer's controversial historicity and dates.

**More information:** Marinus Anthony van der Sluijs et al, A candidate auroral report in the Bamboo Annals, indicating a possible extreme space weather event in the early 10th century BCE, *Advances in Space Research* (2022). [DOI: 10.1016/j.asr.2022.01.010](https://doi.org/10.1016/j.asr.2022.01.010)

Provided by Nagoya University

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