

## ASTRONOMY

# The Oldest Celestial Atlas

A study of the oldest existing celestial atlas has revealed that Chinese astronomers in the 7th century already displayed a mastery comparable to that of 16th century European astronomers.



Among the Mogao Cave's manuscripts (above), this 7th century celestial atlas (left) is the most ancient complete map of the skies.



**O**ne thousand three hundred stars spread across 257 constellations. On a parchment so delicate that it is almost translucent, the 13 panels extend across nearly two meters. They are attached to an equal-length treatise on divination, which would rely on cloud shapes to make predictions for the year ahead. Jean-Marc Bonnet-Bidaud, of the Multi-scale interaction astrophysics laboratory (AIM),<sup>1</sup> has recently completed the most detailed study of this 7th century Chinese scroll.<sup>2</sup> Buried deep in the collections of the British Museum for decades, it is in fact the oldest known—and remarkably advanced—map of the heavens.

This treasure could well have been lost. Walled up around 1000 A.D. in a Buddhist monastery of the Mogao Caves, in the Dunhuang oasis in Western China, it was rediscovered at the end of the 19th century. A monk who had taken possession of the site unexpectedly found it in a cache behind a false partition where it had been hidden—together with 40,000 other manuscripts.

In 1907, British explorer Aurel Stein realized the inestimable value of this find and shipped several thousands of the documents to London, where they were archived and then almost forgotten. This is why the first

**The Mogao Caves (Western China), where 40,000 manuscripts dating from before 1000 A.D. were found.**



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mention of the atlas—a brief citing in a monumental work devoted to Chinese science by sinologist Joseph Needham—only dates back to 1959. “In the late 1980s, I learned of the existence of the Dunhuang map when studying the reports of Chinese astronomers on a supernova explosion in 1054—the only ones to mention it,” explains Bonnet-Bidaud. “And over the years, I became convinced of its scientific importance.” To check how accurate the Chinese astronomers were, Bonnet-Bidaud compared the positions of the stars on the atlas to their known position in the sky. The atlas was so precise that any errors detected were smaller than one to three degrees, depending on the different stars under study. “We believe that this was the result of a systematic use of mathematical projections that allowed the rigorous transcription of an image of the celestial sphere onto paper,” explains Bonnet-Bidaud. “One of these—called cylindrical projection—was used for the twelve panels of the sky divided along the celestial equator.<sup>3</sup> The other, known as azimuthal projection, was used on the 13th panel, centered around the North Star.”

Surprisingly, these mathematical tools, similar to those currently used in cartography, were only introduced in Europe during the 16th century, almost a thousand years after the Chinese atlas was completed. “We do not know of any other Chinese work contemporary or prior to the Dunhuang map, that describes these mathematical projections. And this raises many questions,” says Bonnet-Bidaud. Particularly since painstaking research, mostly based on the characters used in the atlas, has enabled the scientists to determine its true age.

The Dunhuang scroll is now considered to be the oldest known celestial atlas. Historical sources mention a map compiled in the 2nd

century by the Greek astronomer Ptolemy, and one by the Chinese scholar Chen Zhuo, in the 3rd century, but there remains no physical traces of their work. As for the Egyptian Zodiac of Denderah, a bas-relief dating from 50 B.C., or the Farnese Globe, a Greek statue from the 2nd century, they only represent the mythological figures associated with the constellations, without indicating the stars' positions.

Outside China, it was only in 986 A.D. that the maps compiled by the Persian astronomer Al-Sufi showed the stars within their constellations. And even then, their relative position in the sky was not given. It is only in the mid-15th century that the Vienna manuscript, the first authentic celestial map, based on Ptolemy's catalog of stars, was documented in Europe.

“Although we have thought for a long time that the tradition of astronomy originated from Greece and the Mediterranean world, it now seems plausible that the source of this knowledge was in China, where the Dunhuang atlas represents a pinnacle of knowledge and technical skill,” concludes Bonnet-Bidaud.

**Mathieu Grousseau**

## → For more information:

[http://irfu.cea.fr/Sap/en/Phoea/Vie\\_des\\_labos/Ast/ast.php?t=actu&id\\_ast=2615](http://irfu.cea.fr/Sap/en/Phoea/Vie_des_labos/Ast/ast.php?t=actu&id_ast=2615)

1. Laboratoire astrophysique interactions multi-échelles (CNRS / Université Paris-VII / CEA).
2. J.M. Bonnet-Bidaud et al., “The Dunhuang Chinese Sky: A Comprehensive Study of the Oldest Known Star Atlas,” *Journal of Astronomical History and Heritage*, 2009, 12: 39-59.
3. The celestial equator is the circle obtained by projecting the terrestrial equator on the sky.



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