

# Passage graves from an astronomical perspective

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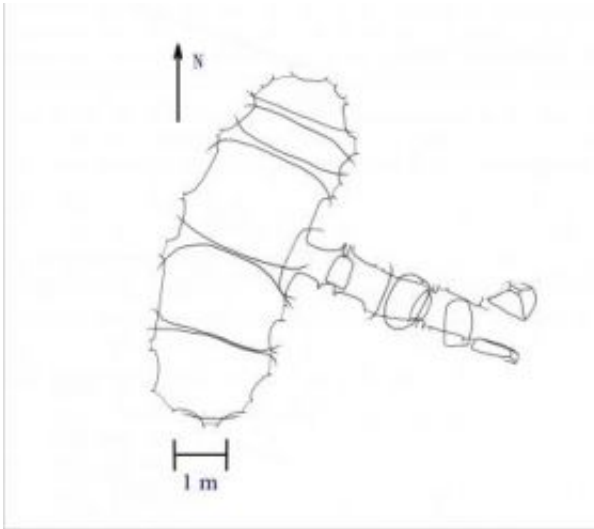


Shown here is the passage grave "Nordenhoj" at Kaerby near Kalundborg in Denmark. Credit: The National Museum of Denmark

Passage graves are mysterious barrows from the Stone Age. New research from the Niels Bohr Institute at the University of Copenhagen indicates that the Stone Age graves' orientation in the landscape could have an astronomical explanation. The Danish passage graves are most likely oriented according to the path of the full moon, perhaps even according to the full moon immediately before a lunar eclipse. The results are published in the scientific journal *Acta Archaeologica*.

Claus Clausen, who graduated as astronomer from the Niels Bohr Institute, has also always been interested in archeology. There are many

Stone Age graves in Denmark, where archaeologists estimate that around 40.000 large stone graves were built from around 3500 to 3000 BC. Only about 500 of the large passage graves, called giant tombs (in Danish Jaettestuer) are preserved today, but one of the great mysteries is their orientation in the landscape.



This is the layout of a typical passage grave, here the passage grave "Nissehoj" in North Zealand. The outlines of the horizontal and level stones are shown. Credit: The National Museum of Denmark

With the help of GPS, a compass and a surveying instrument Claus Clausen measured the orientation of entrance tunnels of approximately 100 passage graves. It turned out that there was a remarkable concentration of certain orientations. Claus Clausen had a theory that it could be a calendar system, but the theory did not hold up. Astronomer and supervisor of the special project, Per Kjærgaard Rasmussen suggested that he look at the connection between the sun and the moon and especially lunar eclipses, because there were two orientations that

occurred frequently and that could suggest something with specific full moons.

## **Ancient Almanac**

Astronomer Ole Einicke, who for many years has calculated data for the Danish Almanac, had made a computer program that could calculate the position of the planets for the next year. The program was now used to calculate back in time. Directions to the rise of the Sun are easy to calculate. The orientation of the rise of full moon and the timing of lunar eclipses are more difficult to calculate due to the sun's disturbing influence on the moon's orbit around the earth, that results in the orbit of the moon rotates in a period of 18.6 years. But the biggest complication is that the earth's rotation has changed through time so that it now rotates slower than before so it required special calculations and corrections to calculate more than 5.500 years into the past and see whether the lunar eclipses could be seen from Denmark.

## **Patterns in the sun and moon**

There is a significant concentration of orientations towards east/southeast as seen from within the passage grave. It can be interpreted that the passage graves are oriented according to the winter sunrise. But researchers think it more likely that they are positioned according to the rise of the full moon, for example, the first full moon after the spring equinox.

The calculations show, that in the period from 3.300 to 3.100 BC there was an over frequency of 50 percent in the number of lunar eclipses that could be seen in Denmark. And the exciting thing was that the pattern indicated that it could fit with the rise of the full moon immediately before a lunar eclipse.

How the Stone Age people had known that a lunar eclipse would come after a full moon is unknown, but astronomer Per Kjærgaard Rasmussen explains, that if one had observed a lunar eclipse there is a very strong likelihood that another lunar eclipse would come either 12 months or 18.6 years later.

The passage graves had been used for burials and the orientation of the entrance is concentrated towards the full moon points to a ritual practice that involved the moon.

Source: University of Copenhagen

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