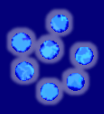
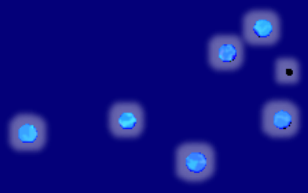


The artefact known as the Sky Disc, found in Nebra, Germany, is an ancient, high-status bronze and gold artefact of great beauty that has the appearance of having some hidden astronomical or celestial meaning embedded within its design. The Sky Disc is considered as possibly the most important archaeological discovery of the twentieth century. The problem lies in trying to work out what it is and reveal hidden information contained in an object that apart from being unique, is of a form that shares no obvious similarity with any other object that we understand, leaving us at a loss as to what it could be. The technology available today in terms of analytical methods and computing power are invaluable in facilitating the ability to forensically test the physical properties of the disc and discover what metals were used in its construction and even where those metals were likely to have been mined and when and where the disc was made, but the most important questions, why was it made?, and what purpose did it serve? remain unanswerable until we learn to understand the way in which our ancient ancestors thought and interpreted the world they lived in. The answers to all our questions are lying before us both under and above our noses as it were, embedded within the Sky Disc and in the pattern of stars. It seems surprising that as with the earlier Neolithic stone circles, something constructed by our ancestors some three thousand six hundred years ago would be so completely misunderstood by the best brains available today. There is obviously a mismatch in the way we and our ancestors thought and perhaps a problem with academia and its approach when it comes to problem solving. Perhaps we suffer from the problem of assuming that our ancestors were simple people and therefore limit the scope of our investigations. A different new approach is required if the Sky Disc and the capabilities of our ancient ancestors is to be fully understood.



The Sky Disc of Nebra – Decoded

The Sky Disc is a beautiful ancient bronze disc with a copper green patina, 31.8cm in diameter (100.0cm in circumference) decorated with gold dots, a circle, crescent and bows. The disc is referred to as a "Sky Disc" on account of its appearance with gold dots resembling stars, against the blue-green background of the night sky. In particular, a cluster of seven dots are thought to represent the Pleiades in the constellation of Taurus whilst a large gold circle and a gold crescent may represent the Sun and Moon. Furthermore, the ends of two bows of gold (one missing) along opposite sides of the disc's edge appear to coincide with the range of movement of the Sun along the horizon at sunrise and sunset throughout the year at the approximate latitude ($51^{0}17'17''$ N, $11^{0}34'39''$ E) where the disc was found in Nebra, Germany. There is a further arc or bow represented on the disc with multiple curved striations along its length with "feathered" edges of uncertain identity which has been variously described as a solar barge or the milky way. The disc has a ring of 39 holes drilled through its outer edge of unknown purpose. The disc was discovered by metal detectorists in 1999 at a site near Nebra, Saxony-Anhalt along with several bronze swords and associatively dated to c.1600 BC. The disc is a very beautiful object enhanced by its bright golden shapes inlaid in a crystalline oxidised copper surface formed over three millennia and although on first sight the design appears to have an elegant simplicity there is a strong sense that there is more to this amazing disc than meets the eye.

Introduction

The purpose of the disc has been the subject of extensive studies by archaeologists, astronomers and physicists and significant progress has been made in terms of determining the discs authenticity, its age and likely place of construction, but in terms of the disc's purpose, apart from the significant finding that the bows coincide with the Sun's range of movement along the horizon at the approximate latitude where it was found, very little progress has been made. The pattern of stars depicted on the disc as gold dots has been analysed by investigators using computer programs to determine whether the pattern of gold dots matched the position of stars in the night sky, but despite extensive analyses there were no close matches found and the star dot patterns were concluded not to indicate constellations and to be just a decorative representation of a starry night sky.

Computer programs are written by people and the analyses that a program can make are limited by the questions the programmer asks the computer to answer. Whilst it may seem obvious to us today that if stars are indeed represented on the disc as gold dots we might compare their positions on the disc with the pattern of stars seen in the night sky and expect to be able to match the two patterns for some particular time and place, there is perhaps a flaw in the premise lying at the heart of the investigation; why would the representation of only one such sky be of any significance, or more importantly what use would that serve apart from a decorative one? Furthermore, the large circle on the disc is thought to represent the Sun and yet appears alongside the stars which are never visible when the Sun is above the horizon in which case perhaps the circle represents a full moon but then there is the problem of a full Moon and Crescent Moon being depicted together. More pertinently, given that the most prominent pattern of dots on the disc is a cluster of seven dots represented through antiquity as being associated with the Pleiades or Seven Sisters, when the actual pattern of stars in the Pleiades is examined, there is no match between the pattern of stars in the Pleiades and the seven dots on the disc and yet despite this set-back we remain convinced that those seven dots do represent the Pleiades. Our heads are forced into accepting the verdict of the computer but perhaps we are simply asking the wrong questions. Maybe the decoration of the disc is indeed just an artistic representation of the night sky but in which case why would the maker of the disc choose to have two overlapping dots on the inner edge of the western bow that have been interpreted as representing an adjustment of the position of a mispositioned dot? If this was the case then why would the movement of the dot by only a few millimetres make any significant difference to the decoration of the disc? Perhaps the attempted mapping is too literal and simplistic and that the interpretation of the patterns of only 33 gold dots, a circle and two crescent shapes on the disc must be more flexible, perhaps much more ingenious than we might expect from such an ancient object.

Matching the Sky Disc Gold Dots to stars - A New Approach

It seems surprising that such a precious, carefully made object would be just randomly or artistically decorated with a pattern of gold dots when the arcs representing the Sun's movement were so precisely positioned to mark the two, 82degree angle of eastern and western bows that describe the range of Sun positions on the horizon between the winter and summer solstices. It is perhaps remarkable enough that such an ancient disc of Northern European origin appeared to depict the Sun's apparent movement along the horizon for the year, and that the Sun, Moon and Pleiades appeared to be represented on this disc, but what of the other stars and the thirty-nine 3mm holes located around the perimeter of the disc and what purpose, if any, might they have served?

Looking at the Sky Disc objectively we might conclude that in order for so few gold dots to represent a significant number of patterns of stars in a universe containing so many stars, requires that if recognisable patterns of stars are to be revealed on the disc then an alternative way of presenting that information must have been devised. One way in which this could have been achieved may have involved trial and error to cleverly position a minimum number of gold dots so that they could be joined together in many different ways to reveal patterns of gold dots that are recognisable as patterns of stars and constellations. Perhaps overlays of many different night skies are depicted on the disc and rather than try to precisely map those gold dots as a whole onto star maps, the overlaid patterns of dots need to be disentangled in order to make sense of the disc. This at first seems like an impossibly complicated challenge and where would a person start this process of decoding without understanding the original purpose of the disc and the intentions of the ancient craftsman who constructed it?

The disc had to be re-examined but this time, human and artistic insight together with an intimate knowledge of the stars would be needed to understand the way in which another person, an ingenious ancient astronomer, had thought and toiled so cleverly to create this very special item. Meanwhile an Archaeo-astronomical computer program Sky Map Pro II would support the endeavour by allowing us to turn back time to allow us to see the same night skies as the man who first designed the Sky Disc so long ago.

Interpretation of the gold dots on the disc

If the dots on the disc represent stars there are at least five possibilities to consider

1) The dots are decorative and there is no significance to their pattern

2) The dots represent a pattern of stars on a night that was perhaps special to the person who made the disc

3) The dots represent stars that can be joined up in different ways to represent several patterns of stars or constellations seen on different nights

4) The dots can be joined by lines to form other recognisable shapes

5) The dots represent some kind of markers for star alignments

The computer analysis identifies that option 2 is not possible but the conclusion that the pattern must therefore be simply decorative, as in possibility (1), is premature because other possible options (3, 4 and 5) have not been investigated.

Given that the cluster of seven gold dots on the Sky Disc represents the Pleiades in a way that does not perfectly match the position of those stars within the cluster, then perhaps there are also other important star groups or constellations that have not been recognised by the computer program similarly represented in a stylistic but recognisable manner. It is interesting that despite the "mismatch" we are still reluctant to conclude that the pattern of seven dots does not represent the Pleiades. The reason for this is the fact that there are other ancient examples of the Pleiades being portrayed in a similar way* and stories stretching back into the mists of time relating that the Pleiades are associated with seven stars associated in mythology with Seven Sisters which are engrained in our collective memory. In fact there are more than seven stars associated with M45, the Pleiades, but four or five of these are too small to be easily visible and the cluster has always been popularly associated as having seven stars. Rather than recognising the pattern that the seven brightest stars in this cluster make, which in any case is not discernible with the naked eye, when we see seven dots depicted as stars, we “know” instinctively from our long history that the association is likely to be with the Pleiades. The unknown cluster of stars known as “the Nine Maidens” might similarly be represented by nine gold dots, not necessarily positioned to replicate the shape of those stars as they appear in the sky. Perhaps the recognition and acceptance of this kind of numerical symbolism and the search for other star groups represented on the disc in a similarly stylistic fashion may be the way in which we might start to decode the Sky Disc.


* Cave painting in Lascaux, France approx. 15000BC showing the Pleiades as six black dots located next to a bull with horns that reflect the shape of the stars in the constellation of Taurus. Clay imprint of a Mesopotamian Blue Chalcedony cylinder seal from Nineveh, Iraq 750-850BC, showing the Pleiades as seven raised dots.

Part I

The Key to Decoding the Sky Disc

One option in trying to decode the Sky disc is to first break it down into simpler component parts. The approach can be both logical and intuitive and the process is largely about asking questions and recognising the answers that are revealed. It was considered that in order to divide a decorated disc into smaller parts, the logical way to achieve this was the same as cutting a cake to create equal segments to see whether any more sense could be made of the patterns within individual segments than had been made with the Sky Disc as a whole. The first stage was to choose the positions of the lines dividing the disc into a number of segments. The lines dividing the disc should have some relevance to the pattern of symbols on the disc and the first step was to recognise that the two bows along the edge of the Sky Disc relate to the eastern and western horizons and the Sky Disc should be orientated to respect this.

To divide the disc into four, the Sky disc is arranged so that the golden bows are aligned along the East-West axis which is drawn as a diameter bisecting the bows. The North-South axis can then be drawn that bisects the upper gold dot and the lower gold dot to create a line that is perpendicular to the East-West line and which divides the disc into quadrants.

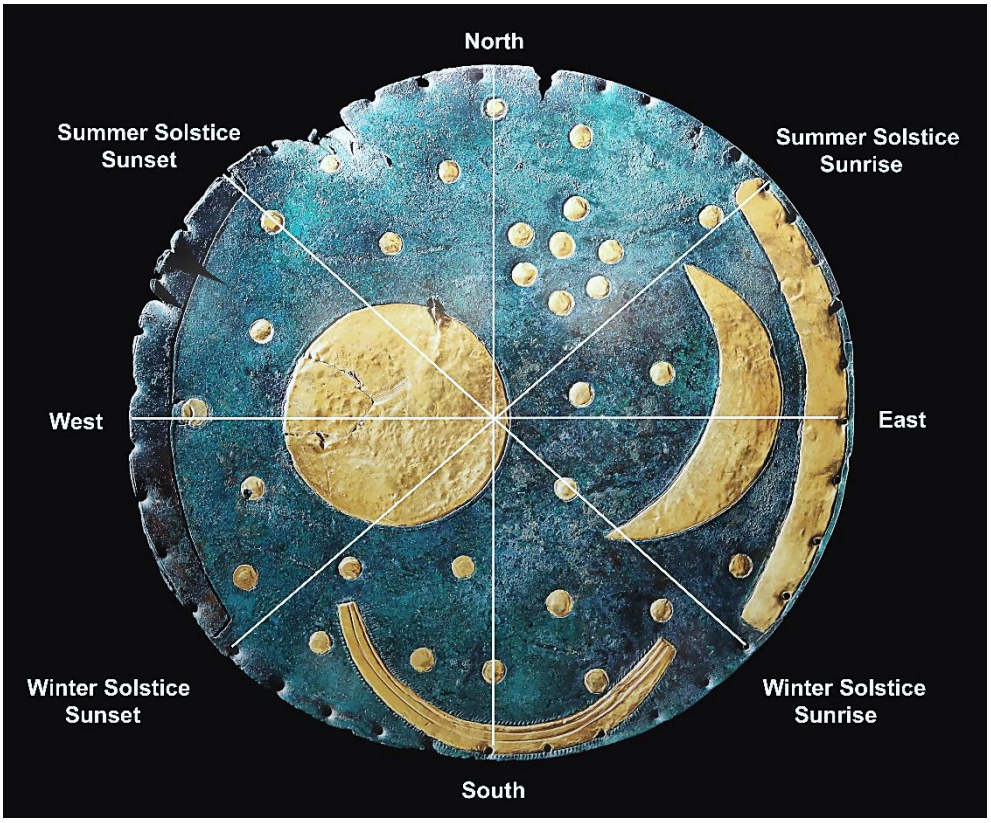


Diagram 1 Axes that break the disc down into Eight Segments

The two bows corresponding to the range of alignments of the Sun on the horizon at sunrise and sunset at the summer and winter solstices were used to create two further lines of axis to divide the disc into eight segments. A line was drawn from the top hole of each arc to the centre of the disc at the intersection of the East-West and North-South axes and extended through that point to the other side of the disc. It can be seen that the disc is neatly divided into eight approximately equal segments whose pattern of gold dots can now be individually examined. The next challenge is to recognise what the division of the Sky Disc has produced.

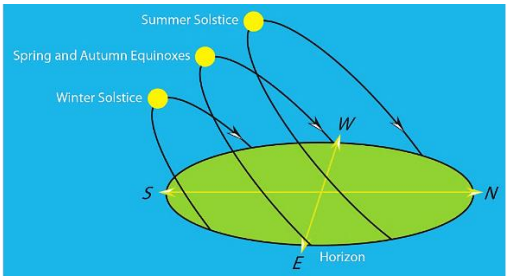


Diagram 2 showing the apparent movement of the arcs of the Sun throughout the year

The key to starting to decode the disc is to consider the pattern of gold dots present in each of the eight segments produced by the four axes. Now instead of observing a random arrangement of stars, distinct discreet patterns emerge in the top two segments and bottom two segments of the disc. Only the upper and lower two segments contain

sufficient gold dots to create recognisable shapes having three or more dots bounded by the axes. Simple geometric shapes; two triangles, a square and a cluster of dots emerge from the apparently random pattern of gold dots.

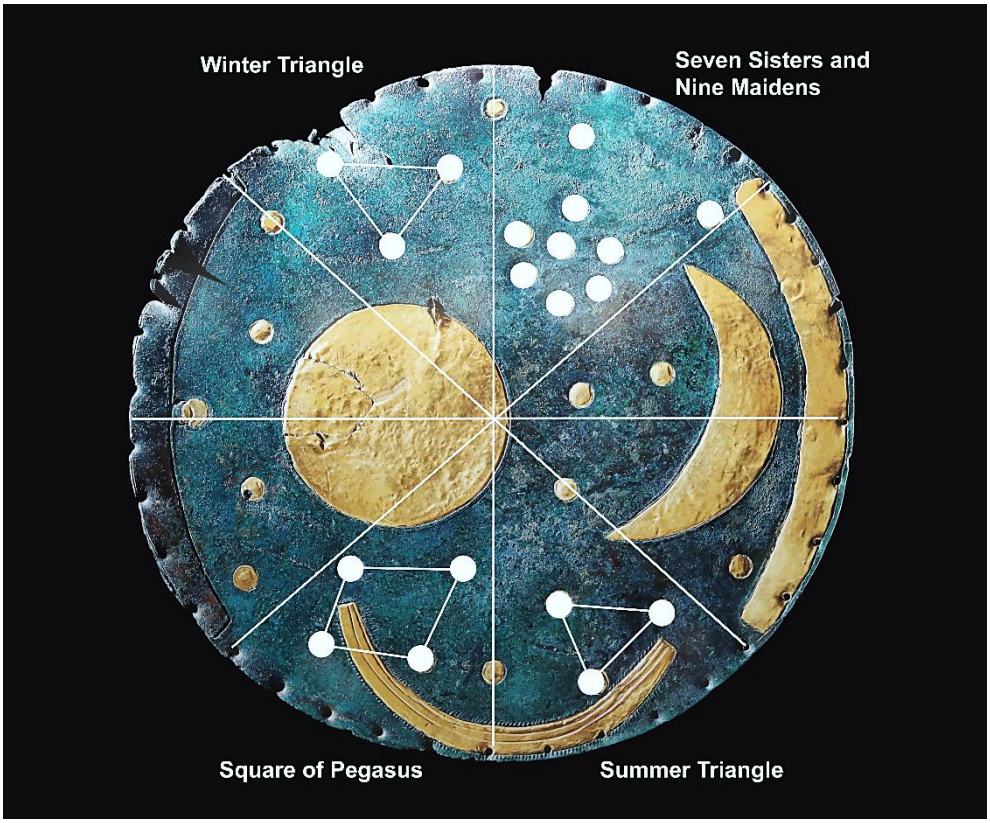


Diagram 3 Star Groups Revealed by Dividing the Disc into Eight Segments

The possible significance of these shapes is that there are well known groups of stars in astronomy that are associated with these simple geometric patterns. Apart from the seven stars representing the Pleiades, the square formation of gold dots might represent the "Square of Pegasus" whilst the two triangles may represent two important triads of very bright stars one comprising Deneb, Vega and Altair popularly known as the “Summer Triangle” and the other group, the “Winter Triangle” consisting of the bright stars Betelgeuse, Procyon and Sirius. However, if we were simply looking for dots in the shape of constellations, we would be disappointed because the triangles and square may be considered as short hand symbols joining the brightest stars in three different constellations in the cases of the Summer and Winter Triangles and only the four brightest stars in the constellation of Pegasus. In addition, the cluster of seven stars we associated with the Pleiades may be a bit more complicated than it first appears because on closer inspection there are actually an additional two gold dots in this segment making a total of nine dots which may indicate that a group or cluster of nine stars was also important. There is a cluster of nine stars in Coma Berenices that is referred to as Mel 111 but to our forefathers this group of stars was known as the "Nine Maidens", this top right segment may therefore be considered as possibly representing two individual star

groups identified with groups of celestial females, namely the Seven Sisters and the Nine Maidens.

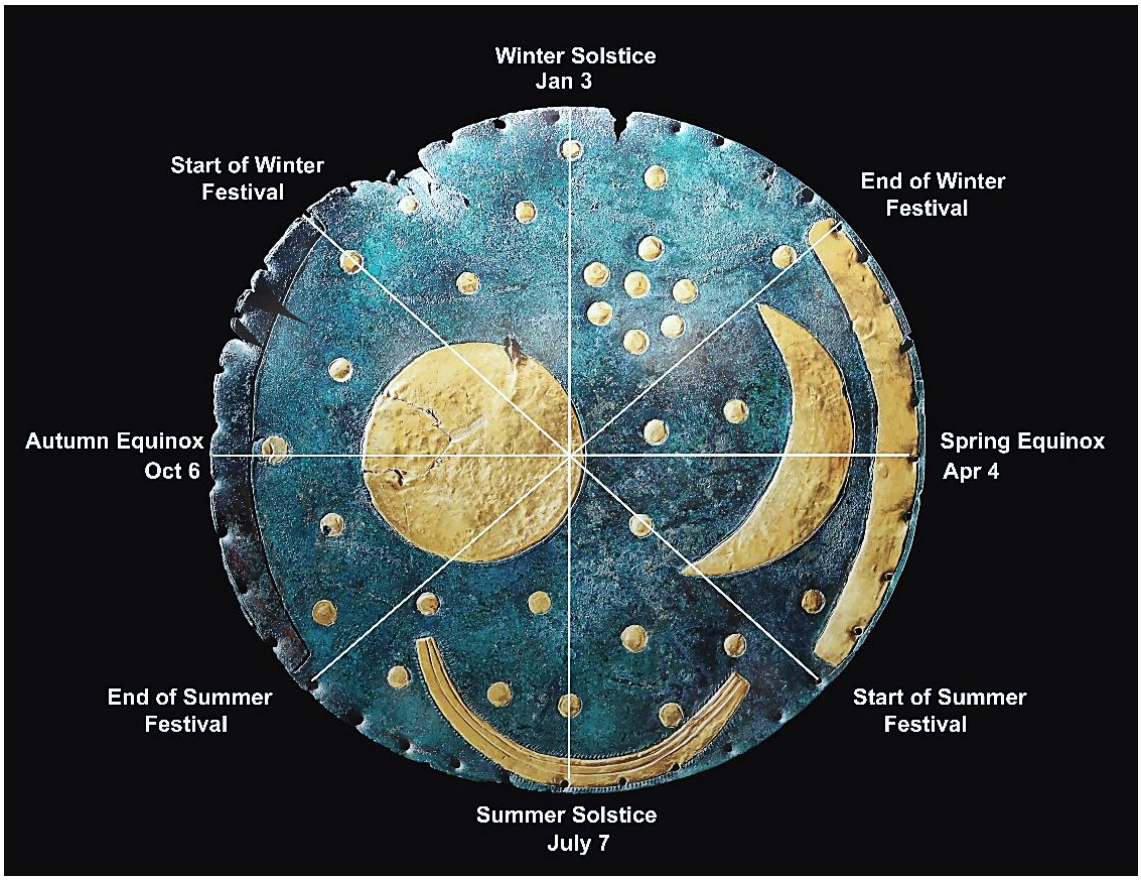


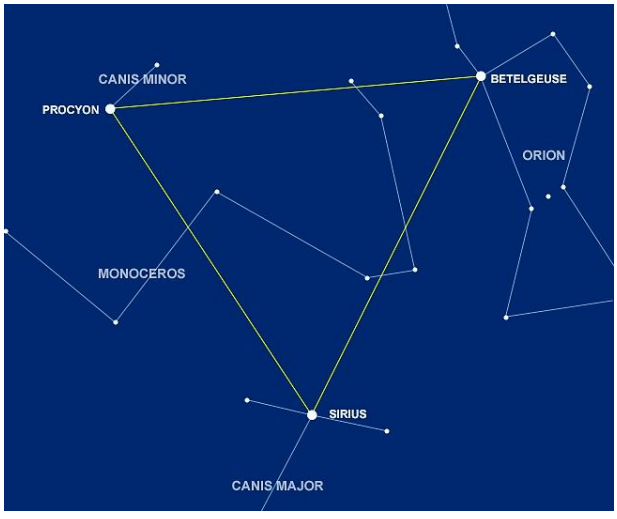
Diagram 4 With the four lines of axes drawn, the division of the Sky disc takes on the appearance of the Wheel of the Year, an archaic way of representing a calendar, with the eight spokes representing eight festival days similar to that used in the ancient Wiccan calendar.

The North spoke representing the winter solstice, the eastern spoke, the spring equinox, the southern spoke, the summer solstice and the western spoke the autumn equinox. Midway between these solar festivals another four festivals; the End of Winter, the Start of Summer, the End of Summer and the Start of Winter were also celebrated. The two triangular symbols, the square symbol and the cluster of 7/9 dots represented in the top two and bottom two segments representing the Winter Triangle, the Seven Sisters and the Nine Maidens, the Summer Triangle and the Square of Pegasus can be examined with respect to the proposed eight festivals indicated by the eight equally spaced festivals drawn on the disc to determine whether there was any significant relationship between the star groups denoted in the segments and the proposed solar festival days.

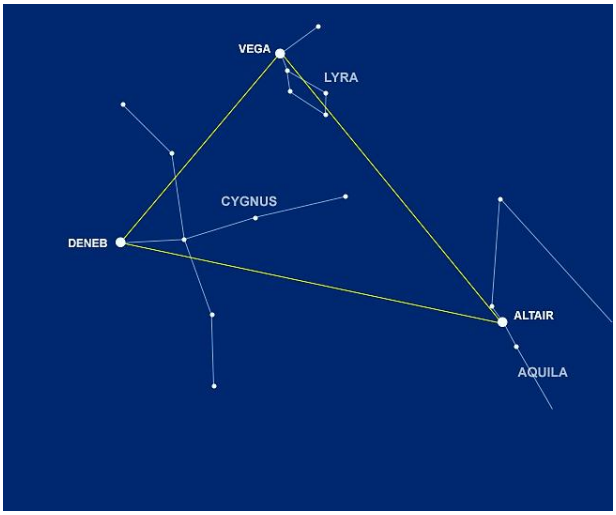
Before starting the analysis, the mechanism of how solar and star festivals may have been identified in pre-historic times needs to be described. The bright stars associated with the pattern of gold dots represent Vega, Altair and Deneb, comprise the Summer Triangle, whilst Betelgeuse, Sirius and Procyon comprise the Winter Triangle and Alpheratz, Scheat,

Markab and Algenib form the Square of Pegasus. The cluster of seven gold dots and nine gold dots represent the Seven sisters or Pleiades, M45 in Taurus and the Nine Maidens or Mel 111 in Coma Berenices respectively. A pantheon of deities may have been associated with these stars and festival days dedicated to these star gods may have been celebrated on the days when these stars appeared due South in the night sky. The short hand method of using the Summer Triangle and Winter Triangle allows the inclusion of six different bright stars that may have been aligned on different days providing a simpler symbolic way of portraying many possible alignments of stars from different constellations. The problem with this idea is that the stars appear to move across the sky each night as the Earth rotates and a specific time of alignment is therefore required as a reference point to identify a particular festival day. Without the aid of a clock, that alignment could be conveniently made at the moment when the star appeared due South at dawn or at dusk, more precisely, at the time referred to as Civil Twilight, when the Sun lies six degrees below the horizon and it is just dark enough to see only the brightest stars in the sky either at dawn before sunrise at the Start of Civil Twilight or at dusk after the Sun has set at the End of Civil Twilight. The effect of Civil Twilight is that of switching a very bright star off or on at two specific times of day at the Start and End of Civil Twilight respectively and only the brightest stars are visible at these times being the last to switch off at dawn before the Sun has risen and the first to switch on at dusk just after the Sun has set. This appearance or disappearance of bright stars therefore provides two useful reference times when the Sun fleetingly lies six degrees below the horizon at dawn or dusk. These times could be used to define the cardinal alignment of the bright stars.

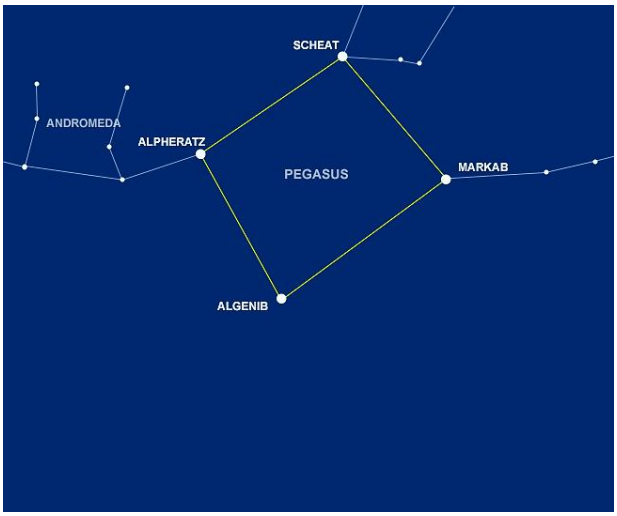
The stars making up the Winter Triangle and the Summer Triangle and the Square of Pegasus are shown in the following diagrams.



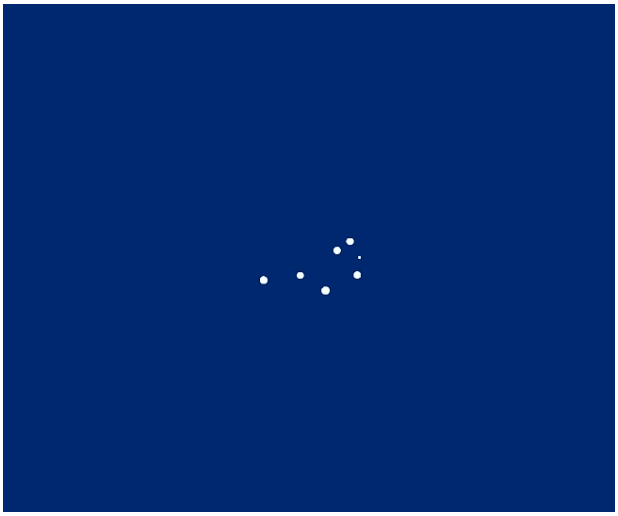
The Winter Triangle joins the stars Betelgeuse, Procyon and Sirius



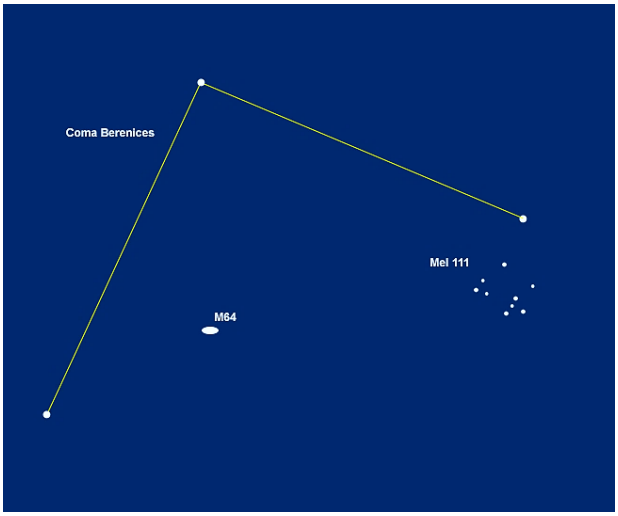
The Summer Triangle is formed by Deneb, Vega and Altair



The Square of Pegasus is formed by Scheat, Alpheratz, Algenib and Markab



The Pleiades, M45 or the Seven Sisters in Taurus



Star cluster Mel 111, the Nine Maidens in Coma Berenices

The Pleiades in the constellation of Taurus are typically represented as seven stars popularly known as the “Seven Sisters” and the stars known as the “Nine Maidens” are believed by the author to be a cluster of nine stars in Coma Berenices known by astronomers as MEL 111 (See appendix).

Alignment of Stars and Deep Space Objects at the Eight Solar Festivals

The easiest festivals to determine are the solar festivals represented by the summer and winter solstices and the spring and autumn equinoxes in 1600BC as the dates of these festivals are known. The other four festivals were calculated as occurring midway between the known solar festival days. The archaeo-astronomy program, Skymap Pro II, was used to turn back the celestial clock to take account of precession of the equinoxes and see the night skies that a person using the disc in Nebra would have seen around 3600 years ago to identify which stars occupied prominent positions in the night sky on these days in 1600BC. The following table of the alignments seen in the sky at Civil Twilight shows Summer Triangle stars depicted in blue, Winter Triangle stars in Green, Pegasus in Red and the Pleiades and Mel 111 in purple

Festival	Date	Alignment at Dusk End of Civil Twilight (Symbol)	Alignment at Dawn Start of Civil Twilight (Symbol)
Winter Solstice	January 3rd	Altair West (Summer Triangle)	Vega East (Summer Triangle)
End of Winter Festival	February 18th	Pegasus West (Square) Betelgeuse South (Winter Triangle)	Spica West
Spring Equinox	April 4th	Mel 111 East (Nine Dots) Regulus South Alphard South	Saturn Nebula South
Start of Summer Festival	May 20th	Altair East (Summer Triangle)	Deneb South (Summer Triangle)
Summer Solstice	July 7th	Pegasus East (Square)	Pegasus South (Square) Betelgeuse East (Winter Triangle)
End of Summer Festival	August 22nd	Saturn Nebula South	Pleiades South (Seven dots)
Autumn Equinox	October 6th	Deneb South (Summer Triangle)	Virgo East
Start of Winter Festival	November 21st	Pegasus South (Square)	Procyon West (Winter Triangle) Mel 111 South (Nine dots)

Table 1 Cardinal alignments of stars and deep space objects occurring on the solar festival days representing the solstices and equinoxes and the four mid festival days in 1600BC .

By examining the positions occupied by bright stars and deep space objects on these eight festival days at Civil Twilight we find that the symbols on the disc proposed as representing star groups coincide remarkably closely with the alignment of stars associated with those symbols. The disc can therefore be used to describe and follow the changing night skies throughout the year and the sequence of star group alignments that occur as a function of time.

Starting at the winter solstice on January 3rd at dawn, Vega is aligned East and later at dusk the star Altair in the Summer Triangle is aligned West. The starting point on the Sky Disc is the bottom right segment triangular symbol on the disc representing the summer triangle consisting of Altair, Deneb and Vega. The next festival, the winter festival occurring midway between the winter solstice and the spring equinox, around February 18th has Pegasus positioned due West and Betelgeuse of the Winter Triangle, in Orion positioned due South, these may be represented moving clockwise from the Summer Triangle represented on the bottom right segment of the Sky Disc, to the square of Pegasus indicated by the bottom left segment square on the disc and then continuing to move clockwise upwards to the Winter Triangle represented as the top left segment triangular arrangement of three gold dots. Moving clockwise again, the top right segment with nine dots may represent the alignment of the Nine Maidens due East on April 4th, the day of the spring equinox. On the Start of Summer festival around May 20th, at the Start of Civil Twilight, Deneb in the Summer Triangle is due South represented again by the bottom right triangular arrangement of dots as we continue the downwards, anticlockwise movement. The next festival is the summer solstice, as we continue to move clockwise around the disc to the next symbol, the square of dots represented in the lower left segment, this is consistent with the finding that the Square of Pegasus is positioned due South on the day of the summer solstice July 7th at the Start of Civil Twilight. Betelgeuse in the winter Triangle is located due East on the day of the summer solstice corresponding with the top left triangular symbol depicted on the disc. The next festival day, the End of Summer festival around August 22nd has the Pleiades or Seven sisters positioned South at the Start of Civil Twilight reflecting the pattern of dots in the next segment at the top right of the disc. Continuing the clockwise movement around the disc the next symbol is once again the triangular arrangement of dots in the bottom right segment representing the Summer Triangle, which this time reflects the alignment of Deneb in the Summer Triangle due South at the autumn equinox festival on October 6th. The next festival representing the Start of Winter festival on November 21st has Pegasus due South at the end of civil twilight reflecting the next segment containing the square arrangement of dots on the disc. Continuing the clockwise movement the upper left segment triangular arrangement of dots may reflect the alignment of Procyon West at the Start of Civil Twilight on November 21st and finally the alignment due South of the Nine maidens on the same day completing the eight festivals.

△□▽ 9*△□▽ 7*△□▽ 9*

Passage of the year represented by the clockwise sequence of the different gold dot patterns in the different sectors of the Sky Disc starting with the point-up triangle representing the Summer Triangle whilst the square represents Pegasus and the inverted triangle represents the Winter Triangle with 7* and 9* representing the Pleiades in Taurus and Mel 111 in Coma Berenices respectively.

The progress of the festival days through the year can therefore be represented by the sequence of symbols as depicted in the segments of the Sky disc. However, this sequence is better represented as a cyclical clockwise movement as illustrated on the Sky Disc itself.

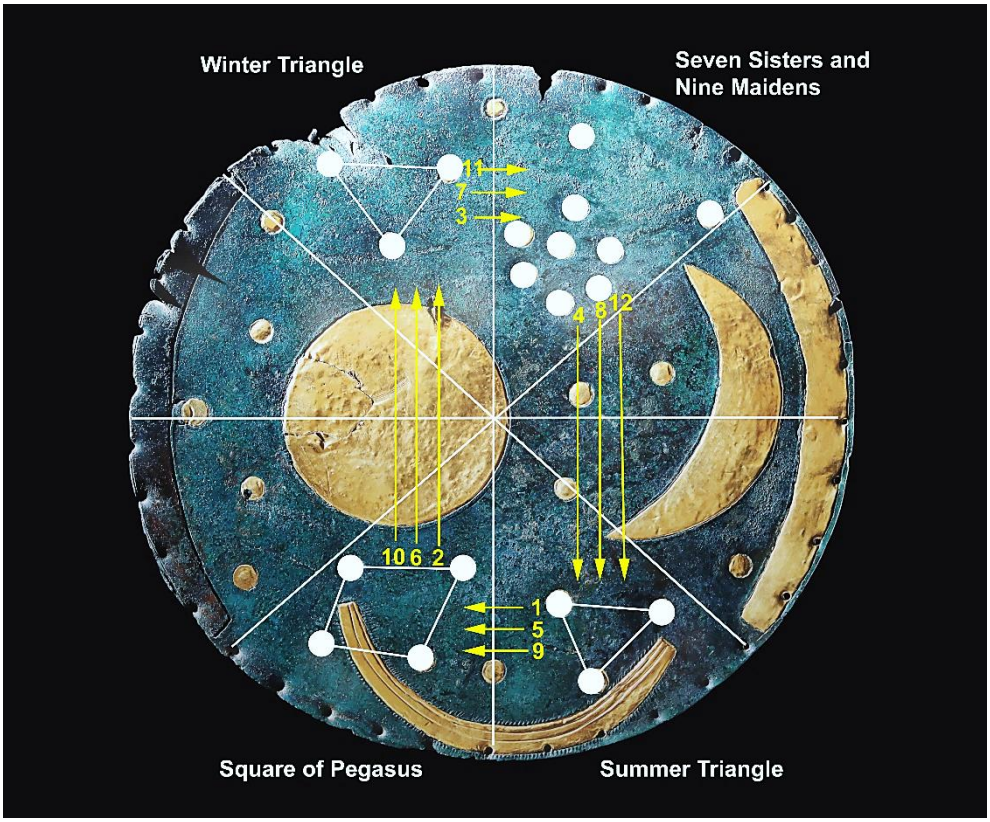


Diagram 5 The arrows between the four symbol shapes revealed on the Sky Disc can be used to illustrate how the cyclical alignment of stars in the Summer triangle, the Square of Pegasus, the Winter triangle and the 7/9 star patterns can be used to describe the passage of the year divided into eight festival days.

The pattern of stars on the disc may therefore be compared to a clock face where the significance of portraying these groups of stars may relate to the passing seasons of the year in which they appear due South in the sky at Civil Twilight at dusk or dawn.

Each of the numbered yellow arrows in the diagram are described in the following table to show how the clockwise cyclical journey around the disc provides a good match in

describing the cyclical pattern of stars seen in the night sky as the year progresses as the Earth rotates about its axis and orbits our star, the Sun.

Yellow Arrow Number	Festival	Alignments on Disc	Star Alignment Dawn (Start of Civil Twilight)	Star Alignment Dusk (End of Civil Twilight)
1	Winter Solstice to End of Winter Festival	Summer Triangle Square of Pegasus	Vega East	Altair West Pegasus West
2	End of Winter Festival to End of Winter	Square of Pegasus Winter Triangle		Pegasus West Betelgeuse South
3	End of Winter to Spring Equinox	Winter Triangle Nine Maidens		Betelgeuse South Mel 111 East
4	Spring Equinox to Start of Summer Festival	Nine Maidens Summer Triangle	Deneb South	Mel 111 East Altair East
5	Start of Summer Festival to Summer Solstice	Summer Triangle Square of Pegasus	Deneb South Pegasus South	Altair East Pegasus East
6	Summer Solstice to Summer Solstice	Square of Pegasus Winter Triangle	Pegasus South Betelgeuse East	Pegasus East

7	Summer Solstice to End of Summer Festival	Winter Triangle Seven Sisters	Betelgeuse East Pleiades South	
8	End of Summer Festival to Autumn Equinox	Seven Sisters Summer Triangle	Pleiades South	Deneb South
9	Autumn Equinox to Start of Winter Festival	Summer Triangle Square of Pegasus		Deneb South Pegasus South
10	Start of Winter Festival to Start of Winter Festival	Square of Pegasus Winter Triangle	Procyon West	Pegasus South
11	Start of Winter Festival to Start of Winter Festival	Winter Triangle Nine Maidens	Procyon West Mel 111 South	
12	Start of Winter Festival to Winter Solstice	Nine Maidens Summer Triangle	Mel 111 South Vega East	Altair West

Table 2 The passing year can be followed through the alignment of just the stars of Pegasus, the Summer and Winter Triangles and the Pleiades and Nine Maidens as symbolically represented on the Sky Disc.

This may represent the first significant breakthrough in deciphering the pattern of dots on the disc and the relevance of those dots as star groups and visible deep space objects that were aligned on solar festival days thereby providing a calendar based on the changing patterns of stars in the night sky. The use of only four symbols is clever in that it allows eight groups of stars to be represented for alignments on the eight festival days. However, despite the progress in decoding the disc, by dividing the disc into eight segments and recognising the pattern of gold dots in four of those sectors as five recognisable groups of stars and seeing how these star groups could be used as markers for eight solar festival days during the year, this is just the beginning of the journey in deciphering the Sky Disc. In order for the disc to be more fully understood and for it to

have served a more useful purpose than acting simply as a kind of pre-historic wall calendar, then another layer of decoding is required. Although the pattern of gold dots in the upper two and lower two segments have been recognised as star groups there are constellations associated with those bright stars which may be present on the Sky Disc. The possibility exists that the computer program failed to identify patterns of stars on the Sky Disc as constellations just as it failed to recognise the Winter and Summer Triangles and the Square of Pegasus. The next challenge is to try and match the pattern of gold dots with stars to reveal constellations and perhaps it requires the eyes of a human to recognise those patterns created by another human so long in the past.

Part II

The Sky Disc as a Sky Map revealing the Constellations and their Brightest Stars

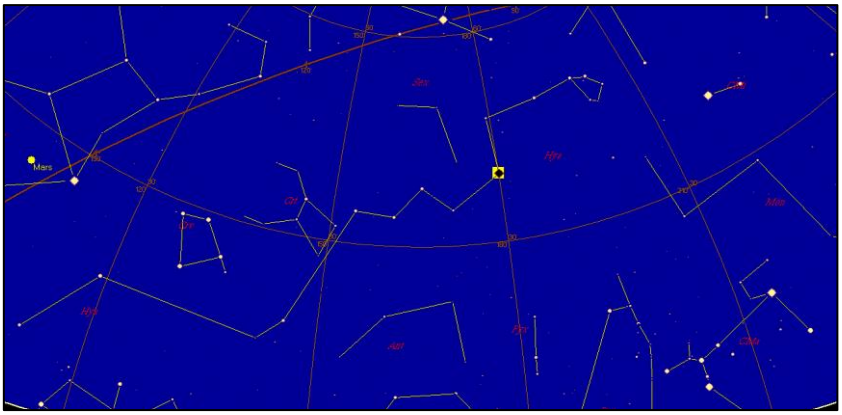
The computer analysis of the pattern of dots on the disc was unable to match the gold dots with known constellations by mapping gold dots onto star maps of the night sky for different times and places. We have already shown that the Sky Disc can be made to reveal hidden arrangements of gold dots that could have represented groups of stars known as the Summer Triangle, the Winter Triangle, the Square of Pegasus and the star clusters M45 and Mel 111 and that these groups of bright stars are associated with patterns of stars known as constellations. If the Sky Disc has patterns of gold dots that could be representations of constellations it would be expected that the six constellations associated with the stars forming the Winter Triangle and Summer Triangle would be the ones most likely to be represented on the Sky Disc together with the constellation of Pegasus and constellations associated with the other bright stars aligned with cardinal points on the festival days comprising the Solar Wheel of the Year such as Spica in Virgo, Alphard in Hydra and Regulus in Leo (Table 1). The starting point for the search was the Great Serpent, Hydra the largest constellation in the sky, as it was considered as having a string of stars arranged in a pattern that might most easily be identified on the Sky Disc by joining a series of gold dots on the disc.

Constellation of Hydra

Diagram 6 Alphard, the brightest star in Hydra is shown with a black dot at its centre.

At the Spring equinox at the End of Civil Twilight, the brightest star in the constellation of Hydra, Alphard was aligned due South. The pattern of gold dots on the Sky Disc was examined to see whether a group of dots could be joined in such a way as to replicate the pattern of stars seen in the constellation of Hydra.

After many attempts a pattern of eleven consecutive dots was found that had quite a similar appearance to the constellation of Hydra as shown in the Sky Map Pro II program shown below. Alphard, the brightest star in Hydra is outlined with a yellow square.



Hydra with its brightest star Alphard depicted by a yellow square

Diagram 7 A second pattern of gold dots was found that appeared to almost mirror the first Hydra-like arrangement producing two near mirror-images of the Great Serpent, Hydra either side of the gold circle.

When the disc is rotated 90 degrees anticlockwise the two serpents and the gold circle take on the appearance of the Uraeus and Sun disc as represented in ancient Egypt. The two proposed serpents are shown in white and green. The cluster of seven dots could be used to create the head of Hydra as depicted in green but the original Hydra in white appears to have been beheaded but its shape closely follows the same pattern as the constellation and the stars comprising the head of Hydra are very faint and may have been interpreted as the forked tongue rather than the head.

Solar disc with two uraeus cobras, Karnak, Egypt

The alignment of Alphard with the cardinal points on the days of the solar festivals changes with both time and location. At the time that the Sky Disc was made around 1600BC, Alphard was aligned due South at dusk at the spring equinox on April 4th whilst the head or forked tongue of Hydra was due South at dawn at the autumn equinox on October 6th.

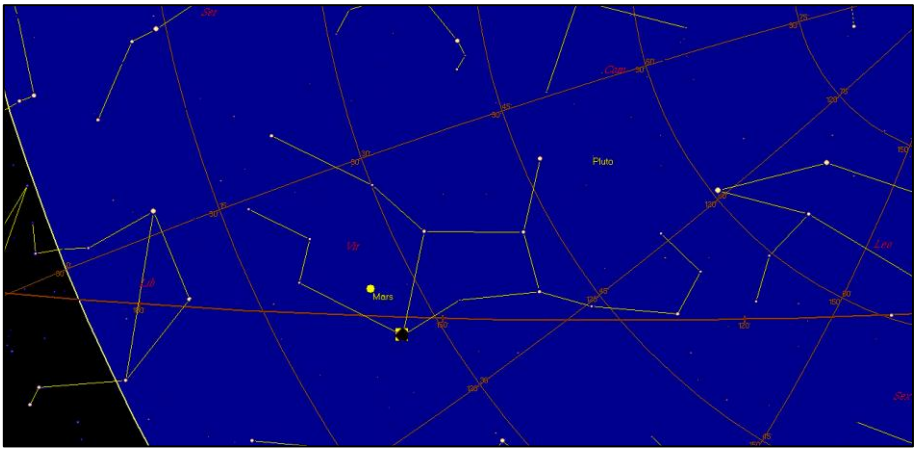
In Ancient Egypt it is proposed that Alphard was used as a marker of the solar festivals at the autumn equinox as it aligned South in the sky at dawn, whilst at the spring equinox it appeared South in the sky at dusk, and at the winter solstice it aligned East at dusk and appeared East at dawn at the summer solstice. The possible role of Alphard as a marker of the solar festivals is reflected by the many examples of carved hieroglyphs of two cobras of the uraeus representing the constellation of Hydra either side of the solar disc.

Having seen the possibility of the stars along the western arc representing the constellation of Hydra as a pattern that had a recognisable resemblance rather than an

exact one, the pattern of gold dots can now be followed around the disc in search of other constellations. The next pattern of dots which overlaps that of Hydra are those of Virgo

Constellation of Virgo

Diagram 8 The brightest star in Virgo is Spica and is shown with a black dot, the same gold dot that represented Alphard, the brightest star in Hydra.



Star Map 2 Constellation of Virgo, the brightest star Spica is marked by a yellow square.

The similarity of shape is clear but the pattern of stars is not precisely replicated by the position of the gold dots but it can be seen how representations of the constellations

might be formed from gold dots on this disc. Forms that are recognisable to the human eye but invisible to a computer program searching for precise mappings of constellation stars amongst the stars of neighbouring constellations.

The Constellation of Lyra

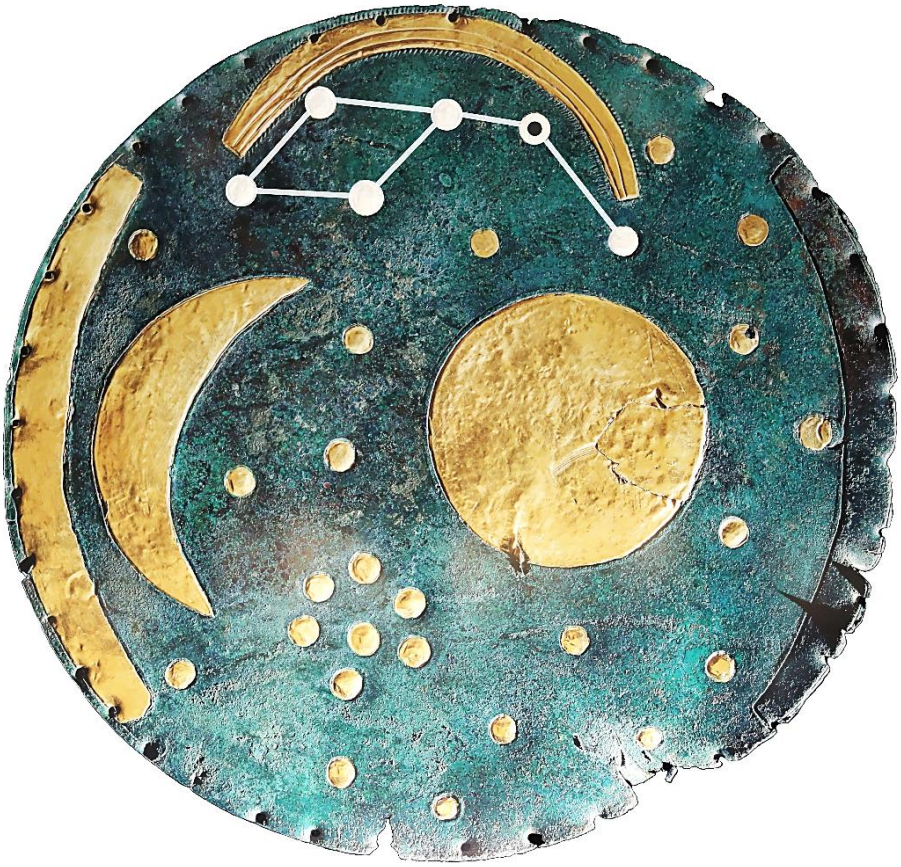
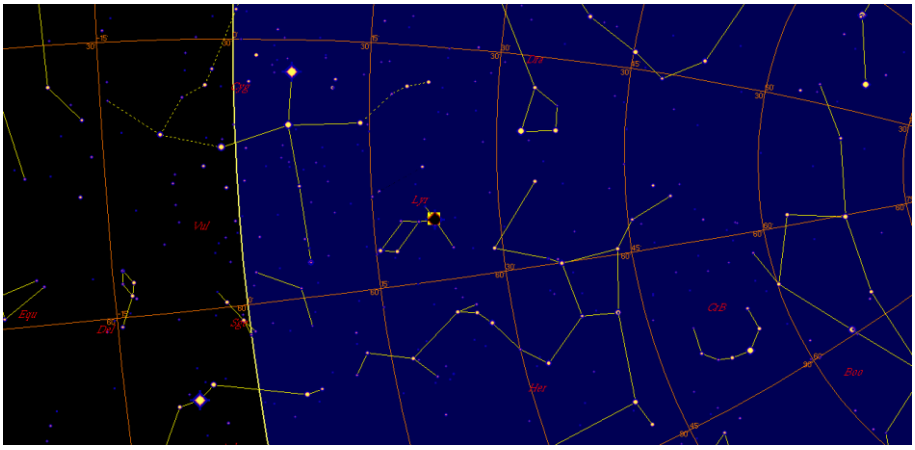


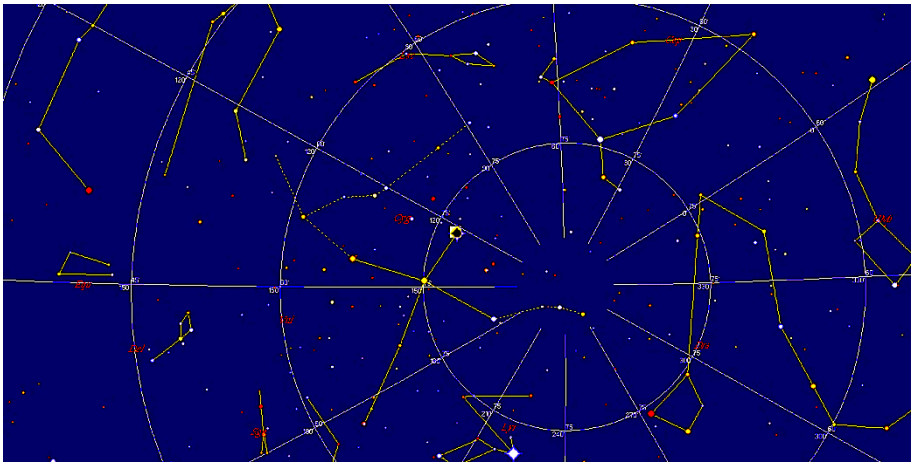
Diagram 9 The constellation of Lyra shown in its normally viewed attitude with the disc rotated through 180 degrees. The brightest star in Lyra, Vega is shown with a black dot, that again is represented by the same gold dot as both Alphard and Spica, the brightest stars in Hydra and Virgo respectively.



Star Map 3 Constellations of Lyra with the brightest star in Lyra, Vega shown by the yellow square.

The Constellation of Cygnus

Diagram 10 The constellation of Cygnus with its brightest star Deneb indicated with a black dot at its centre. Once more the same gold dot on the disc represents the brightest star in the constellation in Cygnus

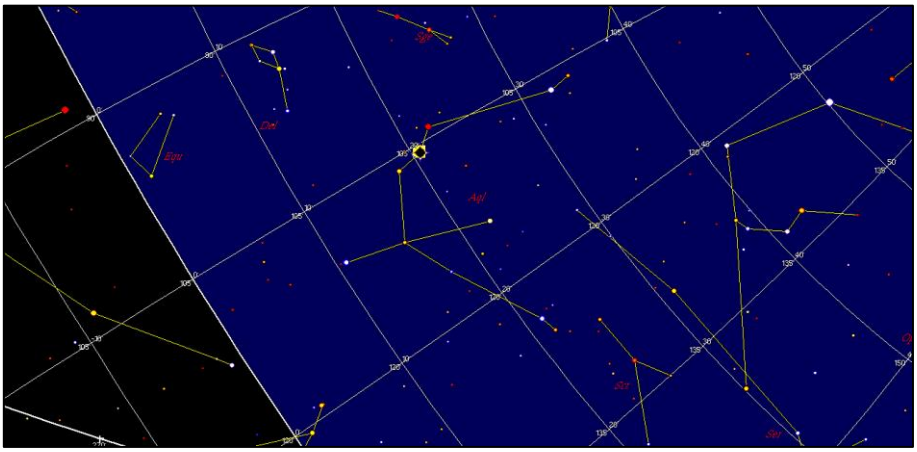


Star Map 4 Constellation of Cygnus shown with the brightest star Deneb indicated with a yellow square

It is interesting that for each of the proposed four constellation patterns for Cygnus, Hydra, Virgo and Lyra the brightest star in each of the four constellations, Deneb, Alphard, Spica and Vega are represented by the same gold dot on the Sky Disc. Moving anticlockwise around the disc the next constellation is Aquila, the Eagle.

The Constellation of Aquila

Diagram 11 The brightest star in Aquila, Altair is identified with a black dot. This is a new golden dot representing the brightest star in the constellation.

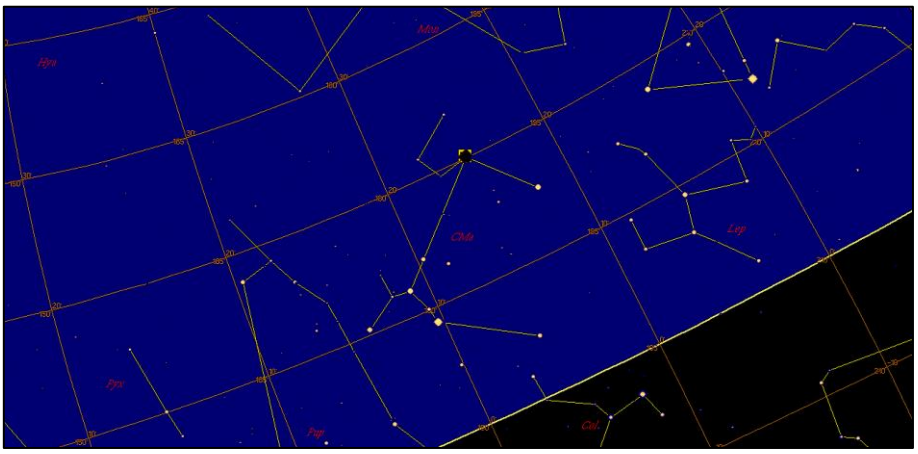


Star Map 5 The constellation of Aquila with Altair identified by a yellow square

The formation of the constellation of Aquila from the gold dots on the disc can be seen for the selective method that it is with this constellation because only 3 gold dots of the 7 gold dots in the cluster on the Sky Disc are used to represent stars in the constellation. The other four stars are not required and indeed do not appear in the close vicinity of Aquila.

The Constellation of Canis Major

Diagram 12 The constellation of Canis Major as can be represented on the Sky disc with the brightest star in the constellation, Sirius depicted with a black dot, again occupying the same gold dot on the disc as Altair in Aquila.

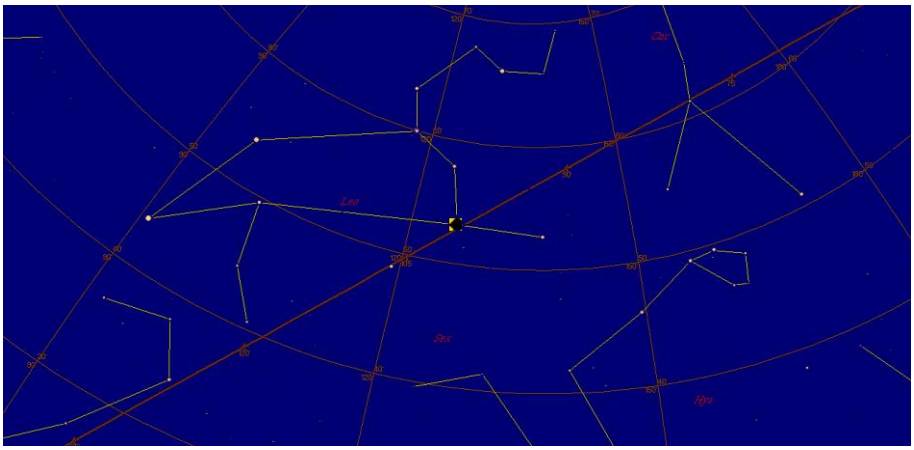


Star Map 6 Constellation of Canis Major with Sirius outlined by a yellow square

Once again, a passable resemblance of the constellation can be made by careful selection of gold dots on the Sky Disc and once again the idea that it occurs by design is suggested by the use of a common single gold dot to represent the brightest star in several constellations.

Constellation of Leo

Diagram 13 Constellation of Leo on the Sky Disc with the brightest star Regulus identified by a black dot at its centre occupying the same gold dot as Altair and Sirius in Aquila and Canis Major.



Star Map 7 The constellation of Leo with its brightest star Regulus marked by a yellow square.

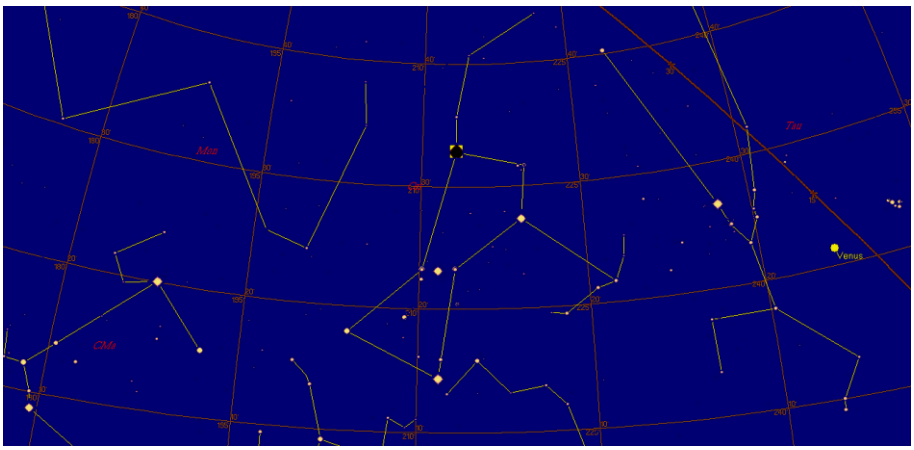
Again, the same gold dot in this section of the Sky Disc represents the brightest stars in the constellations of Aquila, Canis Major and Leo. The significance of four constellations being represented in one area of the disc by gold dots where the brightest star in the constellation in each of the four constellations is represented by the same single golden

dot seems remarkable, but the chance that moving around the disc to the next group of gold dots representing three further constellations which also share the coincidence of the brightest star in each constellation being represented by a single gold dot is perhaps strong evidence that despite the apparently subjective nature of the process of "joining-the dots", these patterns occur by design rather than chance. The gold dot covered by the eastern golden bow allows the pattern of stars in the constellation of Leo to be completed.

Constellation of Orion

Moving to the top of the disc, the constellation of Orion can be identified by the characteristic angle of dots, representing the pattern of the stars Betelgeuse, Meissa and Bellatrix, whilst the belt of Orion can be formed from three of the cluster of seven dots.

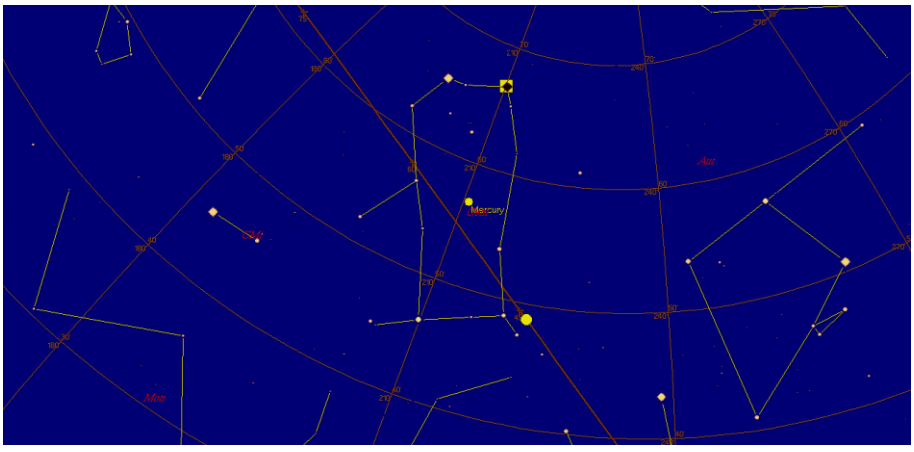
Diagram 14 Constellation of Orion with its bright star Betelgeuse identified with a black dot.



Star Map 8 The constellation of Orion with the brightest star Betelgeuse marked by a yellow square.

Constellation of Gemini

Diagram 15 Gemini can be depicted on the Sky disc with its brightest star Castor identified by the black dot. Again, the brightest star is represented by the same gold dot as it was for the brightest stars in the constellations of Orion and the reflected image of Hydra. Even the white dot inside the rectangular grid marking the classic shape of the constellation has its counterpart in the constellation of Gemini with the bright star Iota Geminorum.



Star Map 9 Constellation of Gemini with its brightest star Castor depicted with a yellow square.

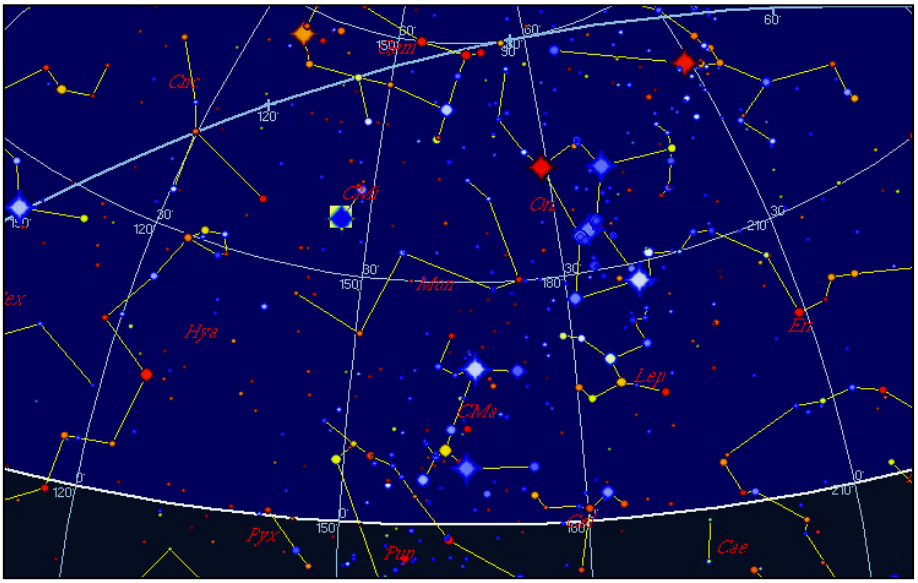
There is one further bright star, Procyon in the constellation of Canis Minor which might be expected to be depicted on the disc but as the constellation consists essentially of only two bright stars, it is too easy to make any pair of gold dots conform to the linear constellation pattern in isolation and it would not move our proposal any further forward. However, since we have already proposed a pattern of gold dots to represent the near-by constellation of Canis Major, it might be possible to use this pattern as the reference to identify Canis Minor. The constellation of Monoceros, the Unicorn lies between Canis Major and Canis Minor, this constellation makes the general pattern of a "W" and by drawing lines between five gold dots lying above the dots representing Canis Major to form this “W” shape, there are two gold dots remaining above Monoceros which can be considered as coinciding with the constellation of Canis Minor. Furthermore, the brightest star in Canis Minor, Procyon coincides with the same gold dot that was found to represent the brightest/most important stars in Gemini and Orion, namely Castor and Betelgeuse.

Constellation of Canis Minor

Diagram 16 Procyon in Canis Minor shown with a black dot. Monoceros shown as a "W" beneath it and Canis Major beneath Monoceros. Once again the brightest star in Procyon is represented by the same gold dot as the brightest star in two other constellations.

We therefore can make eleven constellations appear (including Monoceros which does not have any very bright stars that would be visible for normal alignment purposes at Civil

Twilight) as patterns of gold dots in three different areas of the disc and in each group the same dot represents the brightest star in the constellations represented.



Star Map 10 Canis Minor with Procyon marked with a yellow square shown in relation to Monoceros and Canis Major reflecting a similar pattern to the arrangement of gold dots seen on the disc.

This final interpretation of gold dots is a special one because in this star map, rather than picking out individual constellations as separate groups of gold dot patterns to represent a single constellation in isolation, here we have 15 gold dots joined by imaginary lines to form three constellations located in approximately the correct positions relative to each other. This finding encourages us that perhaps the disc has other more complex representations of stars and deep space objects embedded within its clever design.

We can conclude that the gold dots can be joined in ways where various patterns can be made to appear that share a similarity of shape with both known star groups and constellations that are similarly formed by joining bright stars with imaginary lines to make recognisable shapes. The division of the disc into eight segments allowed the Winter Triangle, the Summer Triangle, the Square of Pegasus and the Pleiades and Mel 111 cluster to be revealed. Then on further examination, groups of gold dots could be joined to form representations of the constellations Lyra, Virgo, Cygnus, Hydra, Orion, Gemini, Canis Minor, Leo, Aquila and Canis Major as well as Monoceros. This takes the number of identifiable star patterns represented by gold dots on the disc to twelve constellations, two stellar Triangles and two visible star clusters. Although it might be argued that such an arrangement of gold dots may be joined up in any number of ways to make a desired object appear from out of the blue, there is supporting evidence that this occurs on the Sky Disc by design rather than chance. The first evidence is that the star groups revealed by dividing the disc into eight segments, comprise stars that are

good markers of the passage of the year as they are cardinally aligned on the solar festival days which divided the year into eight festivals. The second piece of supporting evidence that the constellations appear by design is that in all cases the brightest star in each constellation is represented by a gold dot that represents at least another two of the brightest stars from at least two other constellations as portrayed on the Sky Disc. It is as if the person who made the Sky Disc is telling us not only which are the most important constellations and what they look like but also which of the stars in those constellations are the brightest and important for alignment purposes on the festival days dedicated to the stellar deities identified with those constellations.

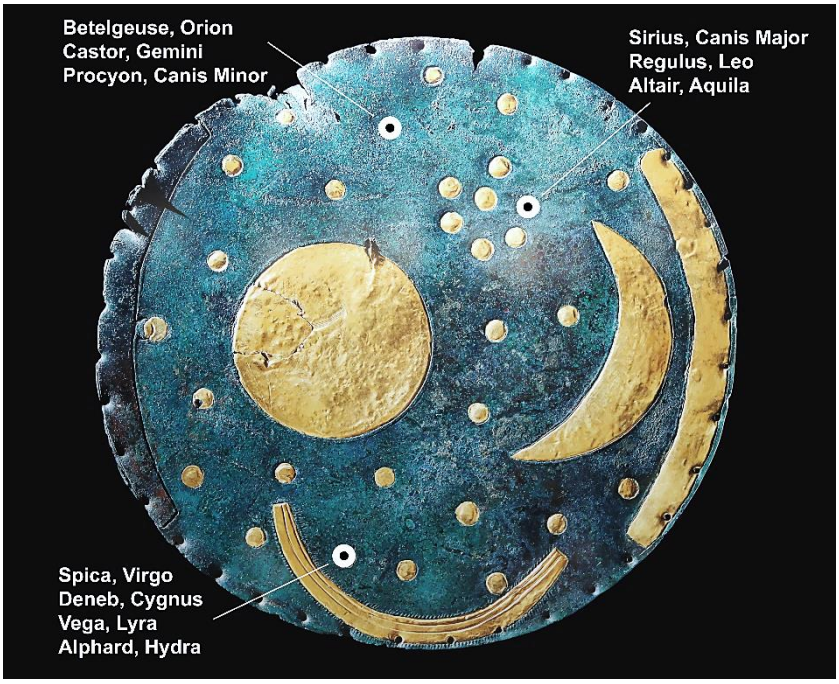


Diagram 17 The three gold dots used to represent the brightest stars in the constellations of Virgo, Cygnus, Lyra, and Hydra then Canis Major, Leo and Aquila and finally Orion, Gemini and Canis Minor

Furthermore, the stars Alphard, Spica, Vega, Deneb, Altair, Betelgeuse and Procyon are not only either the brightest or most important stars in the constellations of Hydra, Virgo, Lyra, Cygnus, Aquila, Orion and Canis Minor but together with the star clusters M45 and Mel 111 and the stars comprising the Square of Pegasus are the stars which are cardinally aligned on the eight festival days proposed as forming the Wheel of the year calendar based on the solar festival days including the equinox and solstice days (Table 1). The choice of position of each of the gold dots on the Sky Disc is ingenious in allowing so many constellations to be depicted in a recognisable, albeit stylised way and not a precise match for the pattern seen in the night sky. Indeed, it would be impossible to indicate so many constellations with so few stars (33) in any other way and perhaps we need to reconsider any preconceived ideas we might have about the intellectual abilities and astronomical knowledge of our ancient ancestors.

The diagram below shows that the constellations formed by joining the gold dots in various ways result in constellations that overlay each other but which can be disentangled to reveal the pattern of stars in each of the individual constellations together with an indication of the brightest star in that constellation (gold dots with small black central dots).

We therefore can make ten constellations appear as patterns of gold dots in three different areas of the disc and in each group, the same dot represents the brightest star in the constellations represented.

Diagram 18 The image above shows the ten major constellations overlaid on the Sky Disc together with the brightest star in each constellation represented by three gold dots with a black central dot. All that has to be done is to separate the constellations to reveal each of the constellations individually.

It is intriguing that two bright stars and their constellations that can be made to appear on the Sky Disc, by joining gold dots, namely Sirius and Castor in Canis major and Gemini respectively, were not involved in any alignments on the eight festival days suggested by the Wheel of the Year Solar Calendar but perhaps this just indicates that there are more Sky Disc discoveries to be made. Perhaps these stars were markers of other festival days related to a calendar based primarily on the alignment of stars and deep space objects rather than the solar calendar based on the solstices, equinoxes and mid-point festival days. The Sky Disc may also have more information embedded within its design that relates to a practical use that is still to be discovered. The images of star groups and constellations “hidden” within the pattern of golden dots decorating the sky disc opens

the possibility that apart from the disc presenting a star map of star groups, constellations and their brightest stars, and a suggestion of a calendar, based on the Eight-spoke Wheel of the Year calendar, the Sky Disc may have also fulfilled the function of allowing these and other festival days to be identified using the Sky Disc by some as yet unidentified method.

Part III

The Sky Disc as a Portable Calendrical Sighting Device

There is a chance, given that images of bright stars, constellations, star groups and visible deep space objects are embedded within the pattern of gold dots and that the gold bows along the eastern and western edges of the disc describe the path of annual movement of the rising and setting Sun along the horizon, that the Sky Disc represents a tool of some astronomical and celestial significance that in some way combined these two properties. The most likely possible use, given the holes around the Sky Disc's perimeter and the gold bows demarcating the range of positions that the Sun occupies on the horizon during the year, is that the holes may have been fitted with small vertical pegs in the manner of a miniature stone circle that may have been used for alignment purposes to identify festival days by aligning a peg with the Sun or the stars on the horizon on special festival days in the manner of a calendrical sighting device.

To explore this interesting concept further there are two areas of the Sky Disc that have not yet been explored. They are the thirty-nine holes punctuating the perimeter of the Sky Disc and the four segments, two to the East and two to the West that were formed when the Sky Disc was divided into eight segments but whose gold dots were too few to form geometric patterns.

The holes in the disc's perimeter are the only obvious features of the disc that have an ugly utilitarian appearance that might be considered as potentially useful for alignment purposes if for instance they served as peg-holes where pegs were used as vertical markers to align with the Sun on the horizon at sunrise and sunset. A solar alignment might be made with an eye positioned at the peg looking across the disc to the Sun on the horizon in the manner of a sun-dial but a dial used to follow the passage of the rising and setting Sun along arcs on the horizon with the passing year as the Earth orbits the Sun rather than what we today understand as a conventional sundial that simply measures the time of day from the changing orientation of the shadow produced by a gnomon during each daily cycle as the Earth makes a complete rotation about its own axis where the Sun appears to rise in the East and set in the West. Whilst we remember the use of a sundial to measure the time of day we have completely lost the idea of a Sun alignment device since the introduction of a date based calendar that had no apparent

connection with the movement of the Sun and stars, the loss to our memory perhaps also being encouraged by changes in religious beliefs.

The apparent movement of the Sun along the horizon with the passage of the year is illustrated below and the position of the Sun might be used as a marker of the day of the year or rather two days of the year as each position on the arc coincides with two days as the Sun moves northwards from the winter solstice to summer and then retraces its path southwards from the summer solstice to winter.

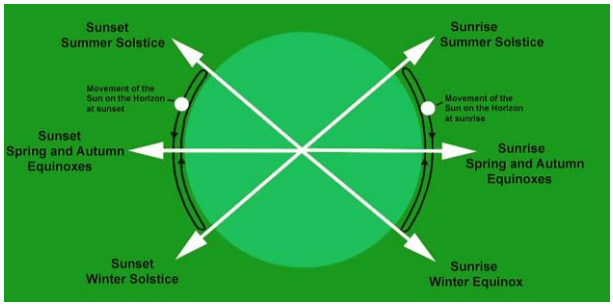


Diagram 19 The Sun rises in the East and sets in the West but the precise position of rising and setting on the horizon changes as the year progresses and also varies with latitude. The Sun moves northwards along the horizon in the first half of the year and southwards after the summer solstice (as illustrated by the white circle). In this way the same position of the Sun on the horizon occurs on two days either side of the solstices

In Northern Europe the Sun rises and sets in the general directions of the North-East and North-West in the long warm days of summer and rises in the South-East and sets in the South-West during the short cold days of winter. The Sun moves between these extreme solstice positions during the year following an arc along the eastern horizon at sunrise and western horizon at sunset. As the winter passes, the Sun's position on the horizon moves steadily northwards until it rises due East and sets due West at the spring equinox. The Sun continues to move northwards until the summer solstice after which its movement changes direction and starts to track back southward along the horizon until it once again rises due East and sets due West at the autumn equinox before continuing to travel southwards to its southerly limit at the winter solstice before once again changing direction and moving northwards once more in an ever-repeating annual reciprocating cycle.

Diagram 20 The highlighted eastern and western segments of the Sky Disc are the focus of the search for a sighting device. These areas represent the range of sunrises and sunset

The answer to deciphering the functional purpose of the disc comes when the remaining four segments to the East and West of the disc corresponding to the areas bounded by the golden bows are considered. These segments corresponding to the arcs of the annual range of sunrise and sunset positions on the horizon contain several gold dots that have too few visible dots (either one or two) in each of the four segments to form recognisable star groups with any confidence and these stars may serve an entirely different purpose. The disc can be laid down flat so that the bows on the perimeter of the disc are oriented due East and due West (with the seven gold dots of the Pleiades situated to the approximate North-East). As the Sky Disc has holes around its perimeter, alignments can be made between a peg placed in a hole and the Sun on the horizon by placing your eye at the peg and aligning the Sun on the horizon with one of the gold dots across the surface of the disc in the opposite segment, such that the Sun on the horizon aligns with the gold dot and peg on particular days of the year. This is the key to opening up the possibility that the Sky Disc could have been used as a sighting device to identify the special days when these alignments occurred. Perhaps the Sky Disc represents a portable version of a stone circle and therefore a useable calendrical tool where instead of the alignments being made with megaliths, the alignment of a peg, a golden dot and the Sun on the horizon marked special festival days.

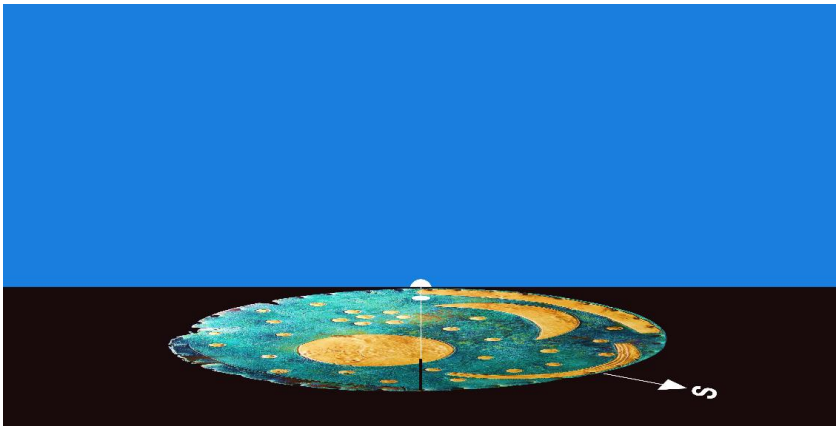


Diagram 21 Proposed alignment of the rising Sun using the Sky Disk with a peg in hole 26 and dot F on the day of the summer solstice, (July 7th 1600BC, Pommelte, Germany)

There are five gold dots within the segments bounded by the eastern and western bows (two are hidden or partially hidden under the gold eastern bow) and nine or ten holes in the perimeter arc corresponding to the same bows on either side of the Sky Disc. Two peg-holes might therefore have been aligned with each gold dot on the opposite side of the disc which could define up to twenty days when the Sun on the horizon at sunset aligned with a peg positioned in a hole in the eastern arc and one of the gold dots decorating the disc within the western arc segments.

Sunset Alignments using the Sky Disc

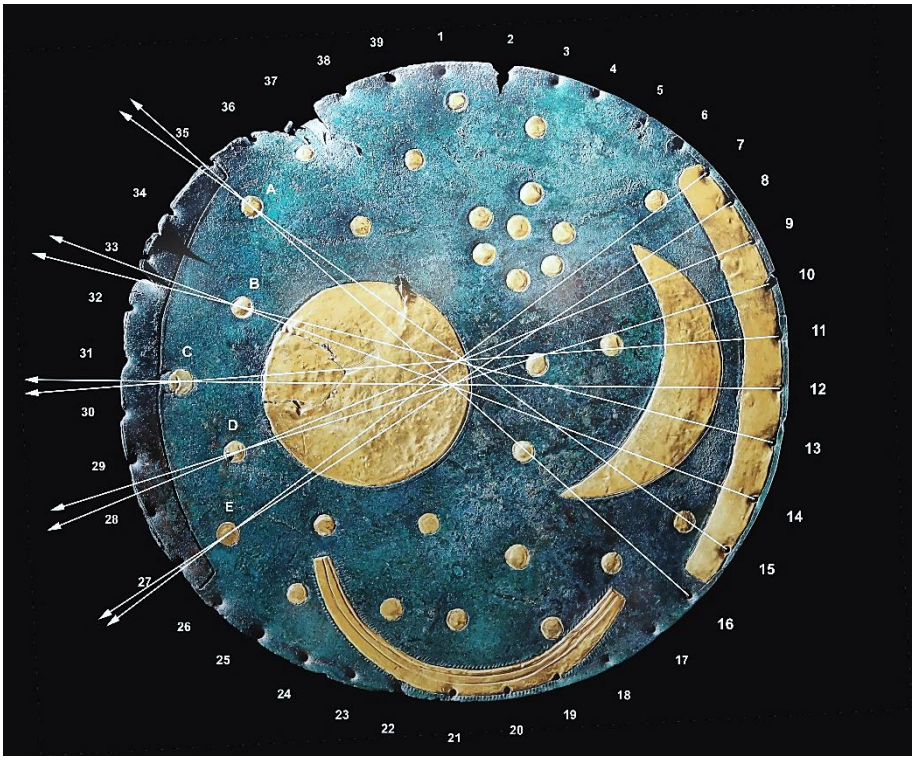


Diagram 22 Alignments between eastern peg-holes (16-7) and star dots (A-E) for sunset alignments. The numbers (7-16) indicate the holes used to locate a peg on the eastern perimeter of the disc. The alignment

of the peg with its corresponding gold dot diametrically opposite the peg is shown by the white lines which are considered to carry on towards the western horizon and align with the setting Sun on particular days.

The sunset alignments intersect at two points on the edge of the gold circle near the centre of the Sky Disc, with five alignments at each point. The regularity of the pattern produced by the alignment of peg holes and gold dots, despite the unique nature of the alignment method, gives some confidence that perhaps this was the way in which the alignments were intended to be made.

If the disc is aligned East-West with respect to the gold bows on opposite sides of the disc and a peg is placed in one of the ten holes on the eastern bow, then it is possible by putting your eye to the peg to align the Sun on the horizon at sunset by looking across the diameter of the disc. Perhaps the alignment of the Sun on the horizon and its reflection lighting up the surface of a particular aligned gold dot in the western segment with the sighting peg marked special festival days in the calendar. Conversely at sunrise, a peg could be placed in one of the ten holes along the western bow and aligned with the rising Sun on the eastern horizon and one of the gold dots in the eastern segment. The bottom peg on the eastern bow aligns with the uppermost gold dot in the western segment at sunset at the summer solstice whilst the top peg within the eastern bow would align with the lowest gold dot in the western segment at sunset around the winter solstice. The peg is then moved up a hole after the summer solstice and a few days later, an alignment made between the same top gold dot and the Sun at sunset from this peg. Some days later an alignment could be made from a peg in the third hole up in the eastern segment and the next gold dot down from the top in the western segment. This pattern of peg movement and alignment with gold dots could be continued until the top hole in the eastern segment (7) was reached and aligned with the bottom gold dot (E) in the western segment when the direction of movement, like that of the Sun itself on the horizon reverses and the solar alignments work back down the eastern arc peg holes. The same procedure would be adopted on the other side of the disc to indicate days of solar alignment at sunrise. In this manner the five gold dots and the ten peg holes could be used to identify up to twenty days when the rising Sun aligned with the dots and pegs and a further twenty days identified by alignment with the opposite arc of pegs and gold dots with the setting Sun.

Sunrise Alignments on the Sky Disc

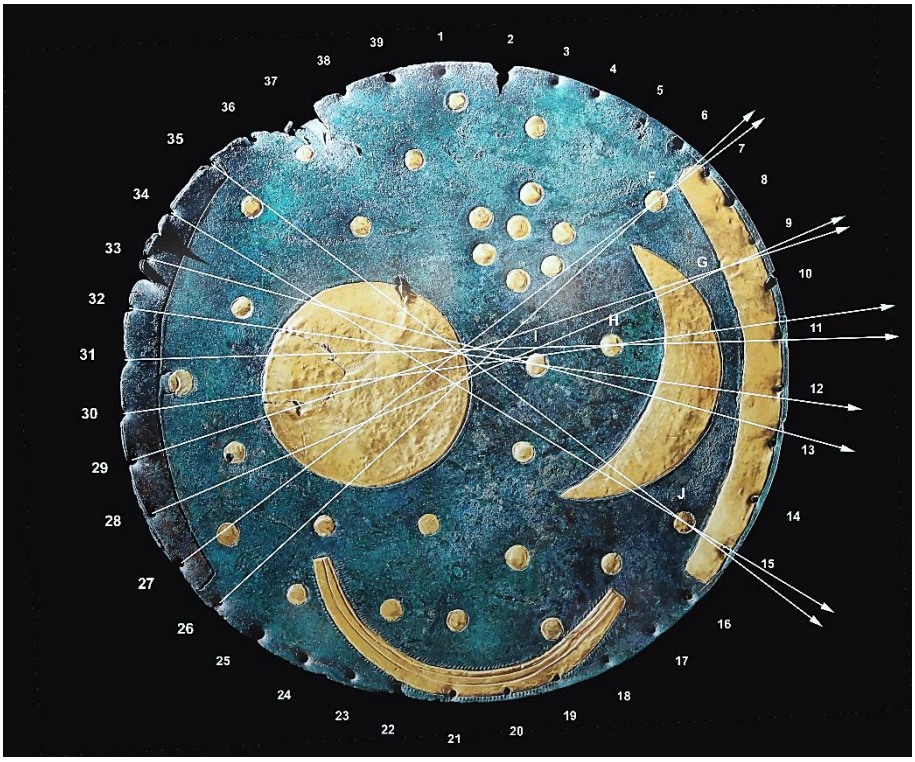


Diagram 23 Alignments between western pegholes (26-35) and the star dots (F-J) for sunrise alignments

The sunrise alignments intersect at three points, three alignments intersect at each of two points situated at the edge of the gold circle whilst a third point to the west of one of the gold dots is the point at which four alignments intersect.

When the same pattern of connecting pegs and gold dots on the opposite side of the disc is applied, for sunrise alignments, the regularity that resulted for the sunset alignments is not quite so pronounced. The first issue is that rather than five gold dots in the arc sector, only four are clearly visible, whilst two more positioned on the perimeter of the disc have been covered by the addition of the gold bow inlay. The question is whether either or both of these hidden dots was meant to be used for alignment purposes or whether they were initially added but then changed or that they served some other purpose. Observing the two covered dots, the upper dot is much more visible than the lower dot as both the circular outline of the upper dot can be seen as a distinct indented ring and the superimposed bow itself appears to have a curved edge that follows the largely concealed dot. The impression of the lower dot can just be made out under the gold bow, but part of the dot sticks out from beneath the bow and has lost its gold layer. The lower dot is also to a large extent masked by the two gold dots positioned towards the centre of the disc with respect to radial alignments from the peg holes on the opposite side of the disc. Although the analysis is subjective, the first thought is that in order to be able to follow the same general pattern of alignments between ten peg holes and five

dots, that the top concealed dot (G) is included and the bottom (unlabelled) dot serves some other purpose. The following alignments and their bearings are found

The next task is to measure the bearings of the series of alignments between the holes and gold dots and then identify the days indicated by the measured bearing alignments at sunrise and sunset.

Alignment Sunset	Bearing	Alignment Sunrise	Bearing
16A	312.5	26F	047.4
15A	307.3	27F	052.5
14B	292.1	28G	067.3
13B	285.9	29G	072.5
12C	271.8	30H	082.7
11C	266.6	31H	089.0
10D	253.4	32I	098.9
9D	248.6	33I	106.5
8E	236.6	34J	123.4
7E	233.2	35J	128.7

Table 3 Bearings of Sky Disc alignments made between holes 7-16 and 26-35 and gold dots A-J

Days indicated by the Sky disc alignments

On closer inspection of the Sky Disc sunrise and sunset alignments it can be seen that of the ten sunrise alignments and ten sunset alignments, six sunrise alignments are the mirror images of six sunset alignments (within 1 degree) suggesting that these twelve alignments actually comprise six sets of alignments coinciding with six sets (usually pairs) of festival days. This suggests that despite the gold dots on either side of the disc occupying completely different locations and forming different patterns that they must have been specially positioned in order to achieve these mirrored pairs of sunrise and sunset alignments that indicate the same festival days. The mirrored pairs are coloured similarly in Table 3 (the addition of their measured bearings relative to North is 360^0 +/- 1^0)

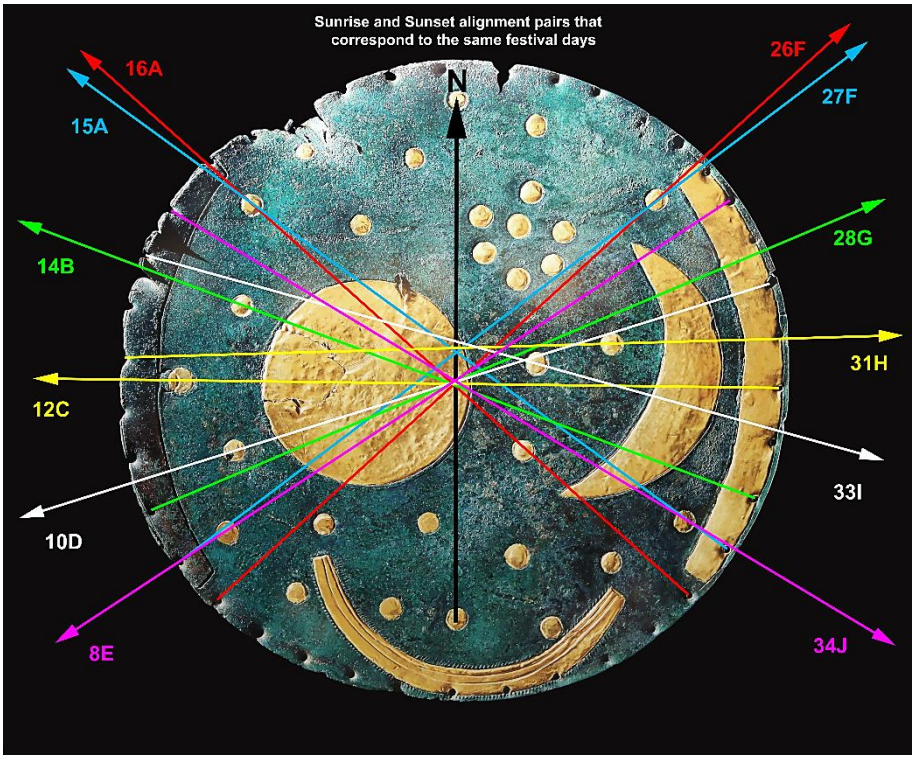
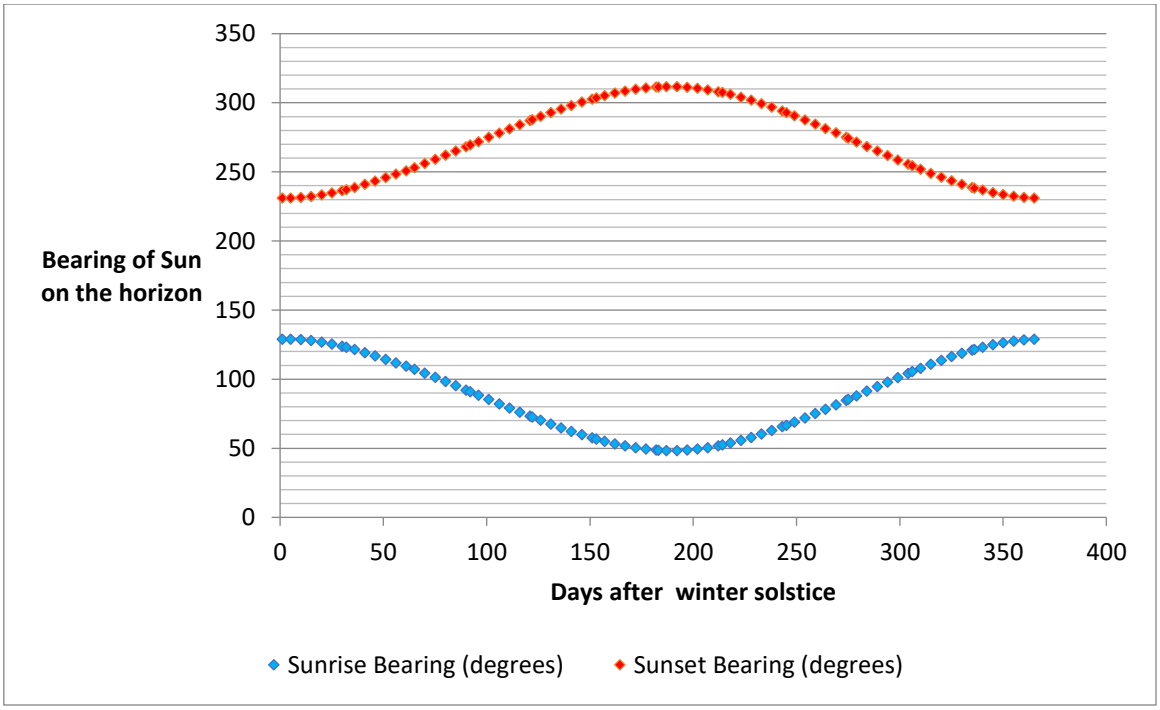


Diagram 24 Six sunrise alignments that mirror within one degree, six sunset alignments.

The days that correspond to the proposed Sky disc alignments can be determined by considering the cyclic movement of the Sun along the eastern and western horizons at sunrise and sunset during the year which can be plotted for Pommelte, Germany as shown below.



Graph 1 Bearings of the Sun on the horizon at sunrise and sunset throughout the annual cycle

The days represented by the alignment of pegs and the star dots on the Sky Disc can be calculated from the curves. The graph shows that each bearing, apart from the days of the solstices themselves, represents two dates either side of the summer or winter solstice.

In order to identify the days when the solar alignments occur, the bearings of each gold dot can be measured with respect to its two associated peg-hole positions. The measured bearing is then compared with the bearing of the Sun on the horizon. The bearing of the Sun at sunrise and sunset varies as a function of location in particular the latitude, so it is useful as a first step to determine where the Sky Disc was designed to be used.

Location where the Sky Disc was used

The metallurgical and radio-isotopic examination of the Sky Disc has suggested that the gold used to make the Sun symbol originated from Cornwall but that the copper used to make the bronze disc itself had the same metallurgical fingerprint as copper extracted from Alpine mines in Mitterburg, Austria. This finding together with the bows on the Sky Disc describing an angle of 82 degrees suggests that the Sky Disc was made and used somewhere within Bronze-Age Germany. Although the Sky Disc was found buried in Nebra together with other items such as swords of the Unetice culture which can be used to associatively date the disc to around 1600BC, it would be interesting to try to narrow down a location that gives the closest match for the positions of sunrise and sunset at the summer and winter solstices especially as determining the precise days of alignment are sensitive to variations in latitude.

Diagram 25 Angles between the arcs may coincide with the angles between the sunrise positions and sunset positions on the East and West horizons respectively corresponding to the range of bearings between the summer solstice and winter solstice.

The bearings for sunrise and sunsets at the summer and winter solstices can be calculated for different locations to see which gives the closest match for the 82 degree angle measured on the Sky Disc. Locations from as far South as Mitterburg where the copper for the bronze may have originated to Hamburg in the North of Germany at the approximate northern limit of the Unetice culture were used to compare the range of angles describing the arcs between the position of the Sun on the horizon between the Winter and Summer solstices.

Table 4 Arc angles between the positions of sunrise and sunset at the winter and summer solstices suggest that the closest match for the location where the Sky Disc was made (based on the 82 degree angle demarcated by the gold bows on the disc) is somewhere North of Nebra in the vicinity of Pommelte, famous for its large pre-historic wooden henge that has been reformed. The latitude and longitude of Pommelte was chosen for archaeo-astronomy calculations.

Place	Latitude Longitude	Summer Solstice		Winter Solstice		Arc Angle (Degrees)
		Sunrise	Sunset	Sunrise	Sunset	
Hamburg	53°34′31″N 10°0′55″E	45 26′ 58″	314 33′17″	131 27′46″	228 32′26″	86.01
Berlin	52°31′28″N 13°24′38″E	46 48′45″	313 11′18″	130 16′30″	229 43′46″	83.46
Pommelte	**52°0′0″N 11°50′0″E**	**47 27′12″**	**312 33′0″**	**129 42′59″**	**230 17′13″**	**82.26**
Nebra	51°17′1″N 11°31′7″	48 17′8″	311 43′3″	128 59′12″	231 0′59″	80.70
Munich	48°13′51″N 11°58′20″E	51 23′17″	308 36′51″	126 15′44″	233 44′25″	74.87
Mitterberg	47°27′0″N 13°56′0″E	52 4′52″	307 55′11″	125 39′7″	234 21′9″	73.57

Time of Alignment of Sunrise and Sunset using the Sky Disc

The time referred to as sunrise is measured as the time when the Sun's very top edge rising from below, breaks the horizon and sunset is measured as the time that as the Sun sinks, its top edge just disappears into the horizon. Given that we are proposing that the Sky Disc was used to align with the Sun at sunrise and sunset it would be easier for an alignment to be made when at least some part of the Sun was still above the horizon. The Sun's angle of rising and setting changes as the seasons progress from winter to spring to summer and autumn. The steepest angle of setting occurs at the equinoxes whilst the shallowest angle occurs at the solstices. It can be seen from the diagrams below that from the moment the Sun appears to touch the horizon to its sunset position the Sun appears to move about one degree along the horizon at the solstices and about two thirds of a degree at the equinoxes. The time it takes for the Sun to completely set from touching the horizon varies from about 3.5 minutes at the equinoxes to about 4.5 minutes at the solstices. The approximate time when alignments can be most easily made with the Sun on the horizon was chosen as 3 minutes before the time of sunset and conversely 3 minutes after the time of sunrise. Part of the reason for choosing this time was that there

would be a sufficient part of the rising and setting Sun above the horizon to produce a reflection of the Sun on the gold dots used for alignment purposes. An Archaeo-astronomy program was used to match the date when alignments on the Sky Disc corresponded to the bearing of sunrise or sunset. The time of sunrise or sunset was determined for those dates and then 3 minutes was added to these times for sunrise alignments and 3 minutes subtracted for sunset alignments and the bearings of the Sun at these revised times determined and compared with the bearings of the alignments made on the Sky Disc between the holes and the gold dots until a match was found.

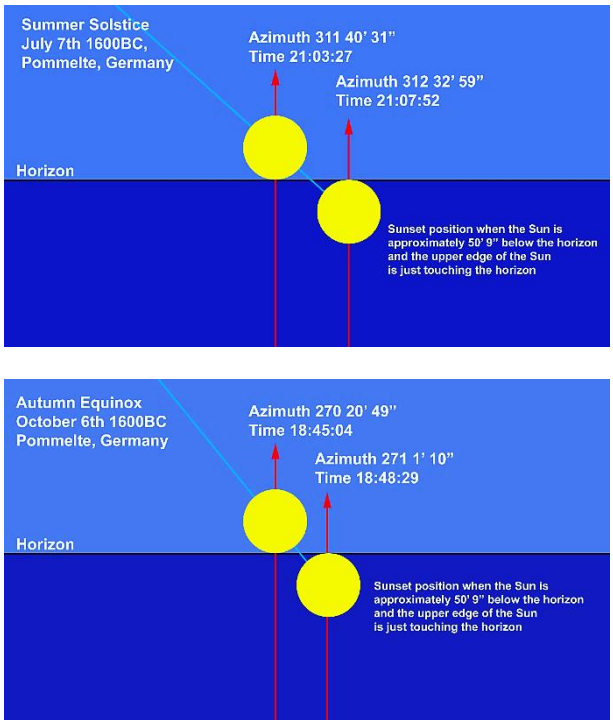


Diagram 6 illustrates the setting of the Sun into the horizon and the time it takes to set from touching the horizon to setting and for alignment purpose, the small but significant change in Azimuth that occurs during that time. The same pattern occurs at the Winter solstice and Spring Equinox whilst at sunrise on these days the Sun on the horizon conversely occurs 3.5-4.5 minutes after the time of sunrise.

Before examining all the alignments indicated on the Sky Disc it would be interesting to first concentrate on the six alignments for sunrise and sunset whose clockwise and anticlockwise bearings relative to the North-South Axis gave the same angle within one degree suggesting that the days indicated by these alignments both at sunrise and sunset were perhaps more important festival days (as indicated by the group of six similarly coloured pairs of bearings in Table 3)

Sky Disc Alignments	Disc Bearing	Date (1600BC)	Sunset Sunrise	Sun on Horizon (-/+ 3 minutes)
16A	312.5	Jul 7	312 32′ 59″	**311 57′ 19″**
26F	047.4	Jul 7	47 27′ 11″	**48 2′ 51″**
15A	307.3	June 11	308 2′ 50″	**307 27′ 10″**
		Aug 2	307 45′ 34″	**307 9′ 56″**
27F	052.5	Jun 12	52 0′ 17″	**52 35′ 57″**
		Aug 2	51 50′ 46″	**52 26′ 25″**
14B	292.1	May 10	292 57′ 45″	**292 22′ 11″**
		Sep 2	292 44′ 28″	**292 8′ 55″**
28G	067.3	May 11	66 32′ 26″	**67 7′ 59″**
		Sep 2	66 54′ 13″	**67 29′ 49″**
12C	271.8	Apr 6	272 38′ 37″	**272 3′ 6″**
		Oct 4	272 20′ 54″	**271 45′ 27″**
31H	089.0	Apr 5	88 18′ 47″	**88 54′ 14″**
		Oct 6	88 38′ 28″	**89 13′ 58″**
10D	253.4	Mar 7	253 59′ 17″	**253 23′ 52″**
		Nov 1	254 3′ 36″	**253 28′ 15″**
33I	106.5	Mar 7	106 16′ 7″	**106 51′ 29″**
		Nov 1	105 40′ 19″	**106 15′ 43″**
8E	236.6	Feb 2	236 56′ 35″	**236 21′ 17″**
		Dec 3	236 54′ 56″	**236 19′ 40″**
34J	123.4	Feb 2	123 11′ 51″	**123 47′ 8″**
		Dec 3	122 56′ 16″	**123 31′ 34″**

Table 5 Bearings of the Solar Alignments using the Sky Disc peg-holes and gold dots and their associated dates

The dates indicated by the alignments on the Sky Disc can be plotted as a "Wheel of the Year" to see how the dates divide the year into possible festival days. A total number of eleven days are indicated (one day is the single day of the summer solstice and the other ten indicated by 5 (x2) alignments)

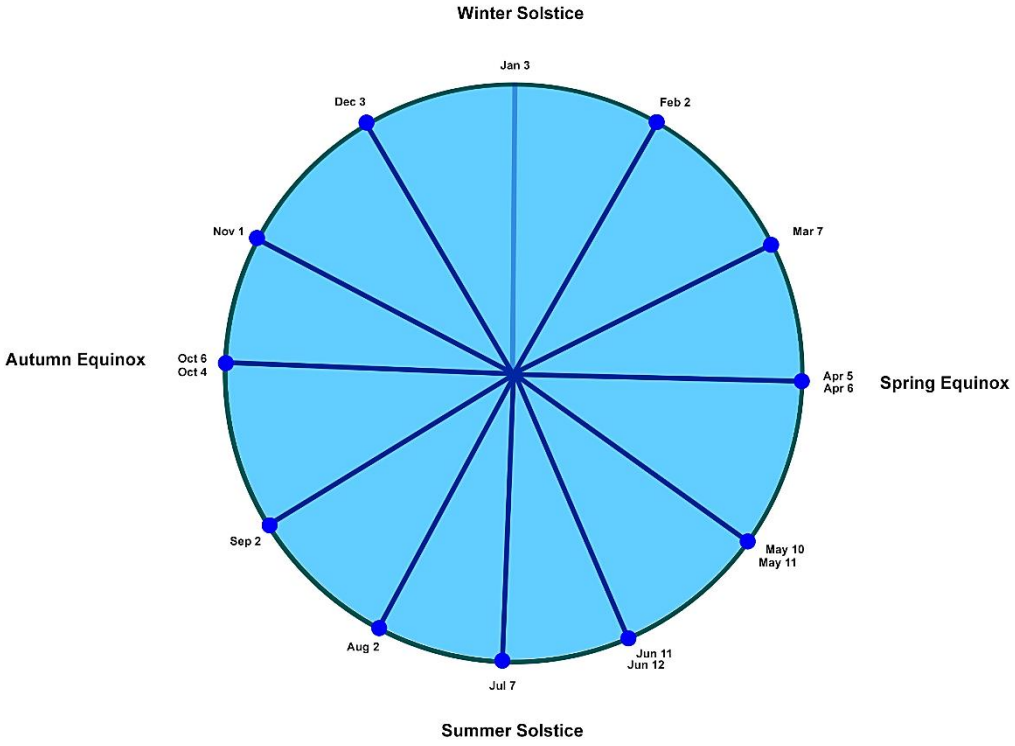


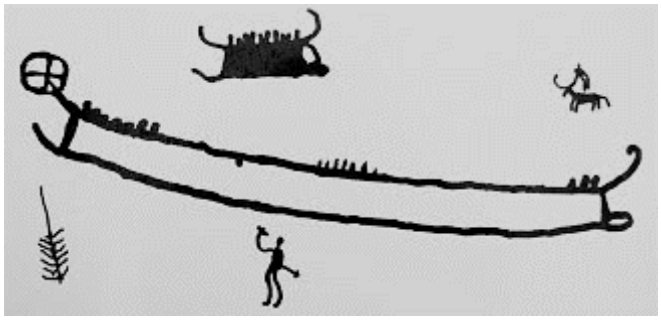
Diagram 27 Division of the year by the six common sunrise and sunset alignments indicated on the Sky Disc.

The division of the year can be seen to be very symmetrical about the winter and summer solstice festivals and the eleven festival days extremely evenly divided. However, the winter solstice festival is missing from the alignments and has been included as a faint line to complete the symmetry of the calendar.

The Missing Winter Solstice Alignment

The day of the winter solstice is not indicated on the disc by an alignment with gold dots on either the East or West of the disc for sunrise and sunset alignments with pegs. However, the day of the winter solstice would have been an important day and could have easily been determined by aligning a peg with an alternative gold symbol present on the Sky Disc, namely the gold arc or bow located at the bottom southern edge of the disc. This bow symbol has been described as possibly representing the Milky Way but is more likely to have represented a Solar Barque or Sun Boat. It is interesting that the gold arc is decorated with striations that could represent wooden planks of a solar barque and the edges of the arc are decorated with a feathered edge which might aid the journey of the barque through the heavens. In Ancient Egypt the Sun in the form of Ra was envisaged

as travelling through the sky in a solar barque but the idea of the Sun travelling in a boat is also depicted in many images carved in stone in close-by Sweden from the Bronze Age that may go back to Neolithic times in Northern Europe.



Rock carving from Tanum, Sweden of the Sun Boat dating from the Bronze Age where the Sun is depicted as a circle and cross symbol. Note the similar feather-like markings to those on the Sky Disc.

Solar Barque carrying the Sun painted on a wooden stele of the 26th dynasty, Egypt

It may have been considered that during the winter months, with shorter colder days, that the protection of the Sun was especially important and the solar barque may have played a particularly important role at the time of the winter solstice and the turning around of the Sun on the horizon so that days once again became longer as the Sun returned and life became more comfortable and the land more bountiful. If a peg is placed in hole 9 and an alignment drawn with the western end of the gold solar barque it precisely aligns with the position of the Sun on the horizon at sunset on the day of the winter solstice at Pommelte. When a peg is placed in hole 19 in the western bow it aligns with the eastern end of the gold solar barque and the Sun on the horizon at sunrise on the day of the winter solstice. These lines from peg-holes 9 and 19 to the ends of the solar barque form a near-tangent to the gold Sun symbol and a line that almost bisects the Sun symbol respectively and intersect near the edge of the Sun symbol. The Sky Disc takes on the appearance of a circle with a cross, similar to the symbol used to represent the Sun on the solar barque carved in stone from Tanum (above). The symbolism of the solar

barque given its association with carrying the Sun is likely to have been identified as a constellation that had a special relationship with the Sun during the winter months.

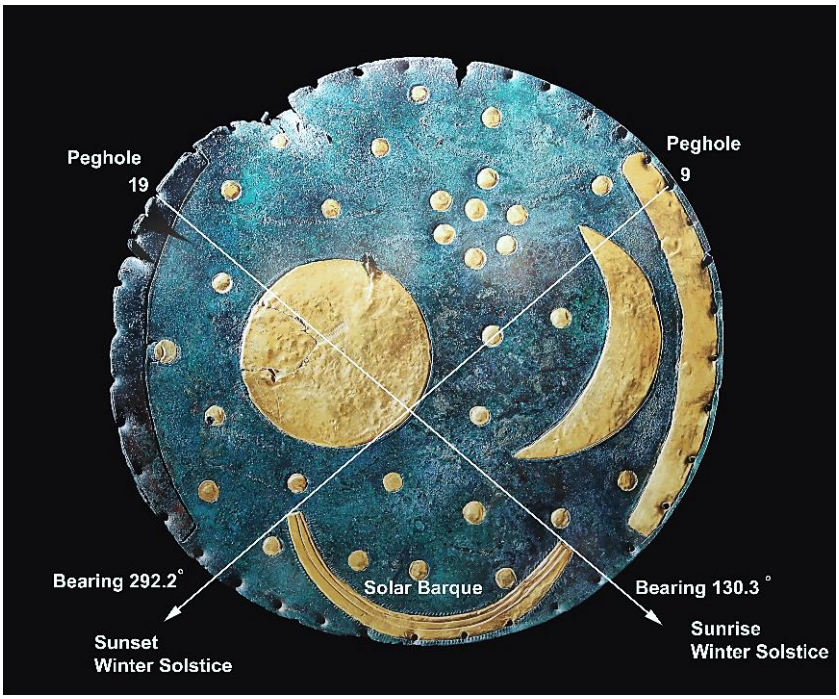
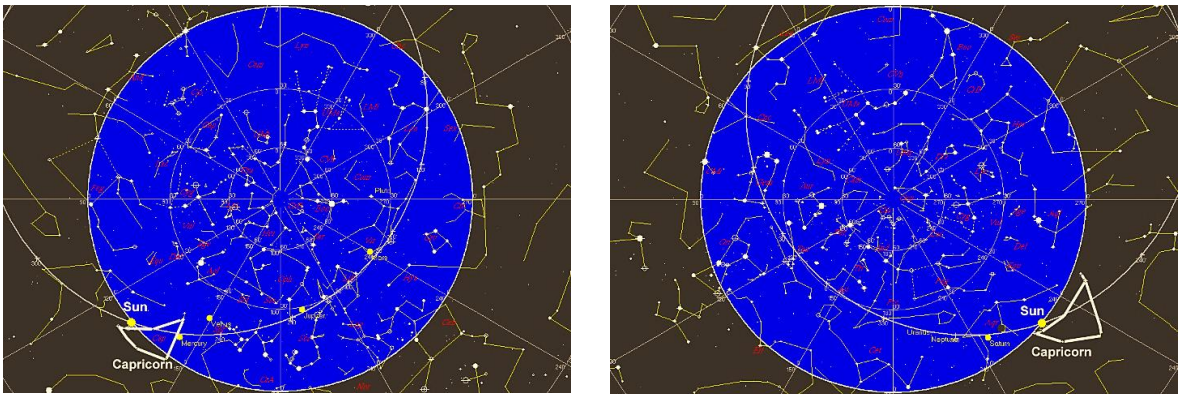


Diagram 28 Winter Solstice alignments on Jan 3rd 1600BC. Sun's azimuths on the horizon 3 minutes before sunset and 3 minutes after sunrise are 229 6′ 40″ and 130 18′ 14″ respectively.

A good candidate for the solar barque would be the constellation of Capricorn which as well as having the appearance of a boat when its brightest stars are joined, rose and set with the Sun during the winter months at this time and was therefore not visible in the night sky during the winter months and as well as fulfilling the function of transporting the Sun across the skies it may also have been considered as the Guardian of the winter Sun after it had set in the West and travelled through the "underworld" back to the eastern horizon to rise again the following morning.



Star Map 11 Sunrise (Left) and sunset (Right) at the Winter Solstice (Jan 3rd, 1600BC) showing the Sun apparently sitting on the constellation of Capricorn

Stellar Alignments occurring on the Days of the Sky Disc Solar Alignments

Apart from dividing the year neatly into twelve approximately equal periods of time the question arises as to what stellar alignments occurred on these festival days that made these days important days.

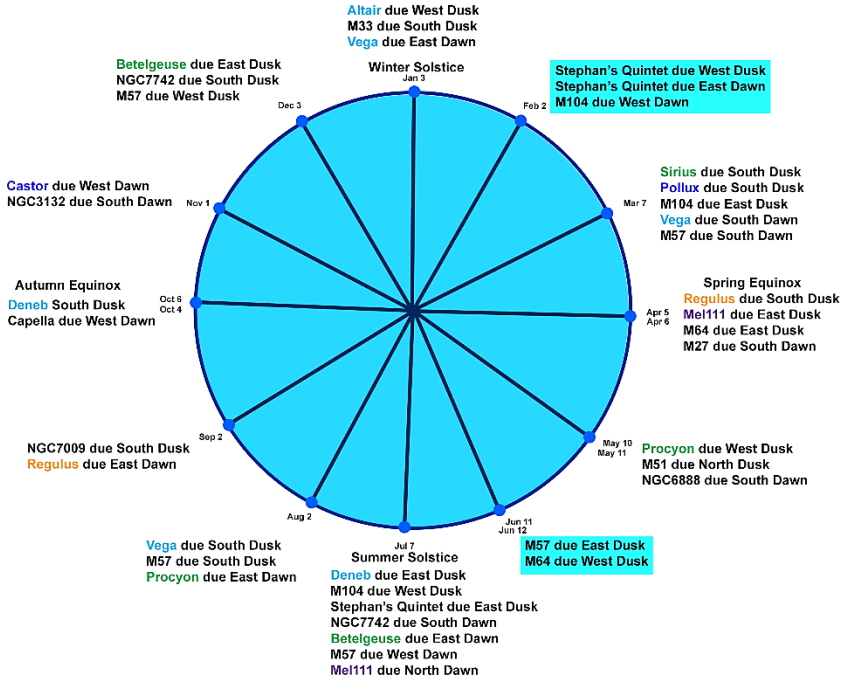


Diagram 29 Alignments of bright stars and deep space objects occurring on the festival days indicated by the six common Sky Disc alignments at sunrise and sunset and the winter solstice alignments with the solar barque arc symbol.

Of the 12 festival days indicated by the Sky Disc alignments, 10 can be identified as festival days where bright stars and visible deep space objects are aligned either due South, due East, due West or due North at the Start or End of Civil Twilight. Furthermore, the bright stars involved are mainly the same stars comprising the Summer Triangle and the Winter Triangle whose stars are aligned on seven of the twelve festival days. The stars and constellations that were revealed as patterns of gold dots on the Sky Disc but not involved in the eight solar festivals of the wheel of the year calendar namely Sirius, and Castor appear to be involved in the alignments on two of the newly identified twelve festival days. Castor, the brightest star in Gemini is aligned due West on the festival day on November 1st. Meanwhile, Sirius in Canis Major and Pollux, the twin of Castor in Gemini are aligned due South at the End of Civil Twilight on the festival on March 7th, although Vega was also aligned on this festival day due South at the Start of Civil Twilight perhaps suggesting that this festival day celebrated two deities identified with Sirius and Vega. Two festival days (highlighted in turquoise) however, are not marked by the alignment of

bright stars but the alignment of deep space objects does occur on these two days involving galaxies and nebulae (Stephan's Quintet, the Sombrero Galaxy, the Ring Nebula and the Black Eye Galaxy) located in the constellations of Pegasus, Virgo, Lyra and Coma Berenices. The regularity of the calendar pattern produced by the festival dates forms what appears to be a good calendar but the regularity of the calendar festival days does depend on the inclusion of these two festival days where the alignments that occur at Civil Twilight are those with deep space objects cardinally aligned.

All the days identified by alignments between Peg-holes 7-16, 26-35 and gold dots A-J

The position of stars and deep space objects on all the festival days indicated by the alignments between peg-holes 7-16 and 26-35 and gold dots A-J are described below

Peghole (East)	Star Dot (West)	Disc Bearing (Degrees)	Sunset Date (1600BC)	Sunset Bearing (Pommelte)	Sun on the Horizon Bearing (3min before)
16	A	312.5	JULY 7	312 32' 59"	311 57' 19"
15	A	307.3	AUGUST 2 JUNE 11	307 45' 34" 308 2' 50"	307 9' 56" 307 27' 10"
14	B	292.1	MAY 10 SEPTEMBER 2	292 57' 45" 292 44' 28"	292 22' 11" 292 8' 55"
13	B	285.9	APRIL 28 SEPTEMBER 13	286 16' 12" 286 2' 7"	285 40' 37" 285 26' 36"
12	C	271.8	APRIL 6 OCTOBER 4	272 38' 37" 272 20' 54"	272 3' 6" 271 45' 27"
11	C	266.6	MARCH 28 OCTOBER 12	266 57' 15" 267 1' 52"	266 21' 46" 266 26' 27"
10	D	253.4	MARCH 7 NOVEMBER 1	253 59' 17" 254 3' 36"	253 23' 52" 253 28' 15"
9	D	248.6	FEBRUARY 27 NOVEMBER 9	249 19' 35" 249 11' 35"	248 44' 12" 248 36' 15"
8	E	236.6	FEBRUARY 2 DECEMBER 3	236 56' 35" 236 54' 56"	236 21' 17" 236 19' 40"
7	E	233.2	JANUARY 25 DECEMBER 11	234 3' 38" 233 59' 14"	233 28' 22" 233 23' 58"

Table 6 Table to show the closest dates associated with all ten alignments made using the Sky Disc and the Sun on the horizon as the Sun sets into the horizon.

Peghole (West)	Star Dot (East)	Disc Bearing (Degrees)	Sunrise Date (1600BC)	Sunrise Bearing Pommelte	Sun on Horizon Bearing (3 mins after sunrise)
26	F	047.4	JULY 7	47 27' 11"	48 2' 51"
27	F	052.5	JUNE 12 AUGUST 2	51 50' 46" 52 0' 17"	52 26' 25" 52 35' 57"
28	G	067.3	MAY 11 SEPTEMBER 2	66 32' 26" 66 54' 13"	67 7' 59" 67 29' 49"
29	G	072.5	MAY 2 SEPTEMBER 10	71 42' 2" 71 43' 53"	72 17' 34" 72 19' 28"
30	H	082.7	APRIL 15 SEPTEMBER 26	82 2' 17" 82 0' 8"	82 37' 46" 82 35' 40"
31	H	089.0	APRIL 5 OCTOBER 6	88 18' 47" 88 38' 28"	88 54' 14" 89 13' 58"
32	I	098.9	MARCH 20 OCTOBER 21	98 21' 20" 98 35' 53"	98 56' 43" 99 11' 20"
33	I	106.5	MARCH 7 NOVEMBER 1	106 16' 7" 105 40' 19"	106 51' 29" 106 15' 43"
34	J	Est. (123.4) (Buckled between holes 18 and19)	FEBRUARY 2 DECEMBER 3	123 11' 51" 122 56' 16"	123 47' 8" 123 31' 34"
35	J	128.7	JANUARY 17 DECEMBER 20	128 8' 52" 128 17' 56"	128 44' 7" 128 53' 11"

Table 7 Table to show the closest dates associated with possible alignments made using the Sky Disc and the Sun on the horizon just after sunrise.

Although there is a remarkable degree of symmetry found in the bearings of alignments made on the Sky Disc between the peg-holes and gold dots on either side of the disc, suggesting that eleven of the festival days were indicated by alignments made both at sunrise and sunset, there are other festival days that were indicated only by an alignment at either sunrise or at sunset.

The cardinal alignment of stars and deep space objects at Civil Twilight on the days indicated by the Sky Disc alignments with the Sun on the horizon are shown below in Table 8

Date (1600BC)	Dusk Stellar alignments (End of Civil Twilight)	Dawn Stellar alignments (Start of Civil Twilight)
JULY 7	Deneb, Cygnus due East **M104** Sombrero Galaxy due West **Stephan's Quintet** due East	**NGC7742** Egg Nebula due South Betelgeuse, Orion due East **M57** Ring Nebula due West Mel111 due North
AUGUST 2 JUNE 12	Vega, Lyra due South **M57** due South **M57** due East **M64** due West	Procyon due East
MAY 10 SEPTEMBER 2	Procyon due West **M51** due North **NGC7009** Saturn Nebula due South	**NGC6888** Crescent Nebula due South Regulus due East
MAY 2 SEPTEMBER 10	**NGC2264** due West Mel 111 due South **NGC6888** Crescent Nebula due South	**NGC6888** Crescent Nebula South Betelgeuse due South M31 due West
APRIL 28 SEPTEMBER 13	Betelgeuse due West Mel111 due South **NGC6888** Crescent Nebula due South	

APRIL 15 SEPTEMBER 27	**NGC3132** Eight Burst Nebula due South	**NGC7009** Saturn Nebula due South **M27** due South Procyon due South
APRIL 5 OCTOBER 6	Regulus due South **M64** due East Mel 111 due East Deneb, Cygnus South	**M27** due South Capella due West
MARCH 28 OCTOBER 12	M45 due West M45 Pleiades, Taurus due East **NGC7293** Egg Nebula due South	**M33** Pinwheel Galaxy due East M45 Pleiades due West
MARCH 20 OCTOBER 21		**M31** Andromeda Galaxy due East Altair due South Mel 111 due East **M64** due East Regulus due South
MARCH 7 NOVEMBER 1	**M104** due East Sirius due South Pollux due South	Vega due South **M57** due South **NGC 3132** due South Castor due West
FEBRUARY 27	**NGC2237** due South	

NOVEMBER 11	**NGC 2264** due South Vega due West	Betelgeuse due West
FEBRUARY 2 DECEMBER 3	**Stephan's Quintet** due West Betelgeuse Orion due East **NGC7742** Egg Nebula due South **M57** due West	**Stephan's Quintet** due East **M104** Sombrero Galaxy due West
JANUARY 17 DECEMBER 20	**M77** Cetus due South Pollux due East **NGC2264** Cone Nebula, due East **M31**AndromedaGalaxySouth **M64** Black Eye Nebula due **North**	**NGC6888** due East Alphard due West Mel 111 due West
JANUARY 25 DECEMBER 11	M45 due South Alphard due East Mel111 due North	Deneb due East Scheat due East Regulus due West
JANUARY 3	Altair due West **M33** due South	Vega due East

Table 8 Alignments of stars and deep space objects in the night sky at dawn and dusk at civil twilight for the days indicated by the Sky Disc peg and gold dot alignments. Winter Triangle stars coloured Green, Summer Triangle stars coloured Blue, other visible stars and visible deep space objects (M45 and Mel111) coloured purple. 40 alignments of galaxies and nebulae, 11 star cluster alignments and 29 stellar alignments.

Of the eighty alignments occurring on the 28 festival days there are 29 stellar alignments and 11 alignments of the two star clusters, M45 and Mel 111. There are however 40 precise alignments of galaxies and nebulae occurring on these same festival days. Whilst common sense tells us this must be coincidental, it is interesting that there are so many cardinal alignments of deep space objects on these festival days which if we can remain objective, poses the question as to whether these alignments of invisible to the naked eye deep space objects occur by chance.

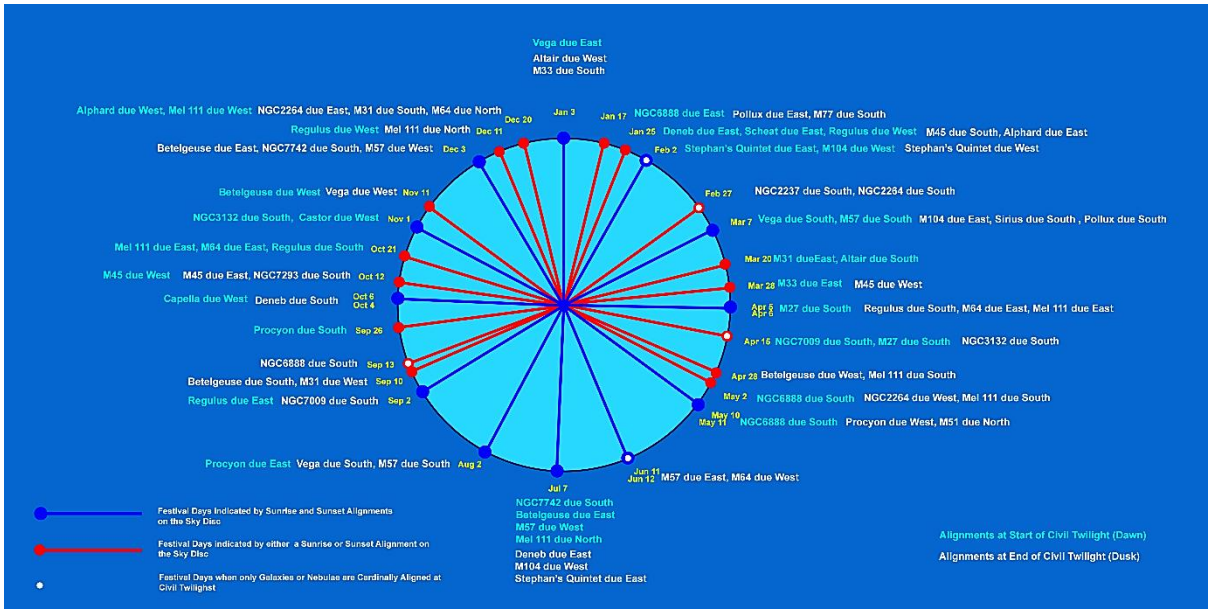


Diagram 30 The festival days indicated by the Sky disc alignments between pegholes 7-16 and 26-35 and gold dots A-J can be plotted as a Wheel of the Year calendar.

It appears that the remaining festival days (in red) indicated by the alignments between the peg-holes and the gold dots lie between the equally spaced alignments in blue which were indicated by both sunrise and sunset alignments on the Sky Disc. Moreover, these additional festival days appear exclusively between September and May and not during the summer months this distribution suggesting that there may be other alignments from peg-holes positioned out-with the eastern and western bows. The only holes that could be used for additional alignments with gold dots and the Sun on the horizon are those located at the bottom of the Sky Disc between holes 16 to 26.

Before looking for the missing summer festival days it might be interesting to ask the question as to why there are so many holes around the perimeter of the Sky Disc when the only ones that are required for alignment purposes are those in the eastern and western segments and possibly additional ones in the bottom segments for the missing summer festival alignments. This means that there are still ten holes at the top of the Sky Disc that appear to be redundant at least as peg-holes for alignment purpose.

One way that a circle of 39 holes could be used to represent a calendrical device is to represent the festival days indicated by the alignments with the Sun from the eastern and western peg-holes, by inserting some marker pins to indicate the different festival days and convert the Sky Disc into a visual representation of a Wheel of the Year type calendar thereby tying together its function as a sighting device to a calendar and facilitating knowing when in the year it was and when the alignment for the next festival day occurred.

Part IV

The Sky Disc as Both a Calendar and a Sighting Device

It has been shown how the Sky Disc could be used as a simple calendar by following the star group alignments consisting of the Summer Triangle, the Square of Pegasus, the Winter Triangle and Mel 111 and the Pleiades. This calendar based on the division of the year into eight solar festivals based on the equinoxes and solstices and festivals midway between these festival days. However, it has now been shown how the Sky Disc could have been used as a sighting device to identify 28 festival days based on alignments made between pegs in 20 peg-holes at the eastern and western arcs of the Sky Disc and ten gold dots decorating the disc and the Sun on the horizon at sunrise and sunset. A Wheel of the Year Calendar could be formed that replicated this calendar using the Sky Disc to identify the twenty-eight festival days by putting markers at the festival days around the perimeter of the disc. This would explain why there are 39 holes around the entire perimeter of the Sky Disc when only 20 holes are required for alignment using pegs inserted into ten holes on the eastern side of the disc for sunset alignments and a further ten holes on the western side of the disc for sunrise alignments. The holes perforated through the top of the disc and the bottom of the disc must have some other purpose as they cannot be used for solar alignments at sunrise and sunset and one possibility is that festival day markers may have been inserted in the holes to give the Sky Disc the appearance of a Wheel of the Year Calendar where the festival days could be easily seen and followed with the passing year. The next objective is to see how the holes could have been used to show the festival days.

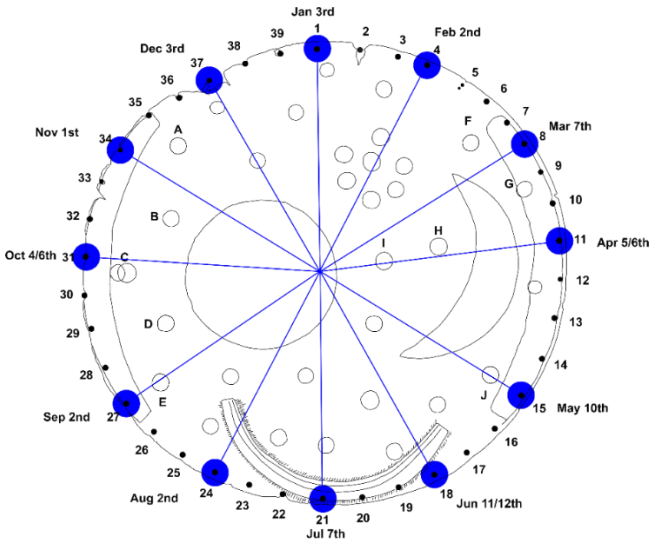


Diagram 31 There is a reasonably close pattern produced for the twelve festival days identified by the Sky Disc solar alignments.

As a first step, the twelve festival days identified by Sky Disc alignments with the Sun on the horizon at both sunrise and sunset were laid over the Sky Disc holes to see whether a reasonable fit could be made.

Perhaps positioning the April 5/6th marker at hole 12 instead of hole 11 might produce a more even distribution of festival days but by choosing hole 11, the distribution of holes on either side of the disc between the twelve major festivals is more symmetrical in terms of the number of holes between the twelve festival days. The spaces between the major festival days have either two or three holes between them and the pattern of holes on either side of the disc is symmetrical about the North-South axis going through holes 1 and 21, with the exception of the gap between markers in holes 4 and 8 which have three holes whereas there are only two holes between festival markers in holes 34 and 37.

The next thing is to show the holes used for alignment purposes that identify the calendar festival days to see how the festival marker holes are related to the peg-holes used for alignments.

Each of the twelve festival days can be individually examined for clarity and combined later.

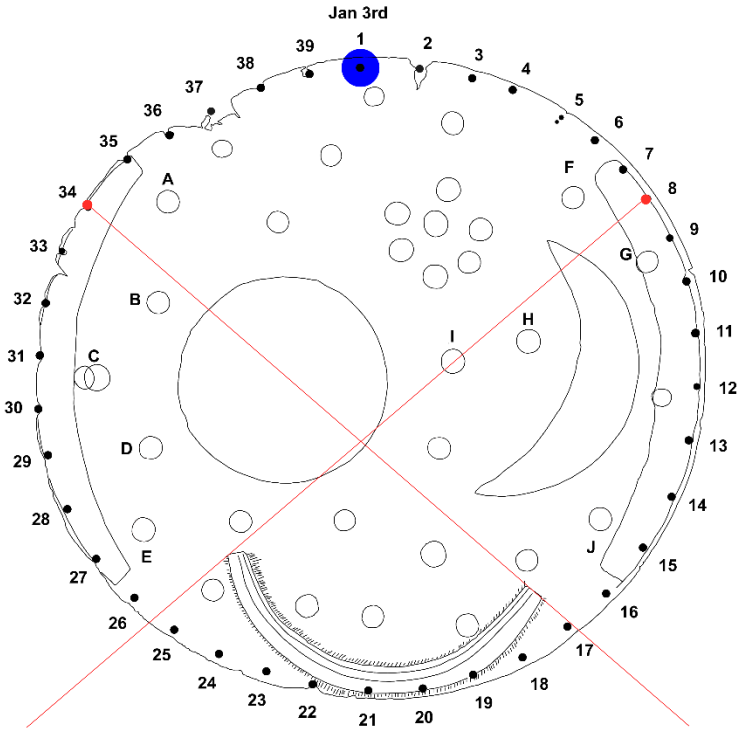


Diagram 32 The first hole represents the Winter Solstice and here the alignments were made between pegs inserted in holes 8 and 34 for sunset and sunrise alignments made with the Sun on the horizon that aligned in this instance not with gold dots but the ends of the solar barque as shown.

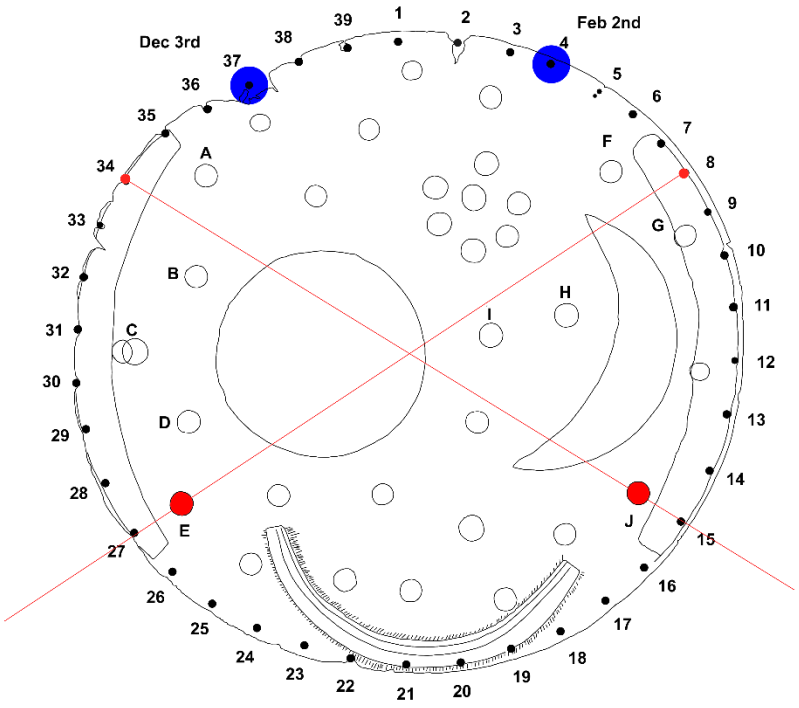


Diagram 33 The next festival days indicated by both sunrise and sunset alignments are those made again with pegs 8 and 34 but this time with gold dots E and J respectively.

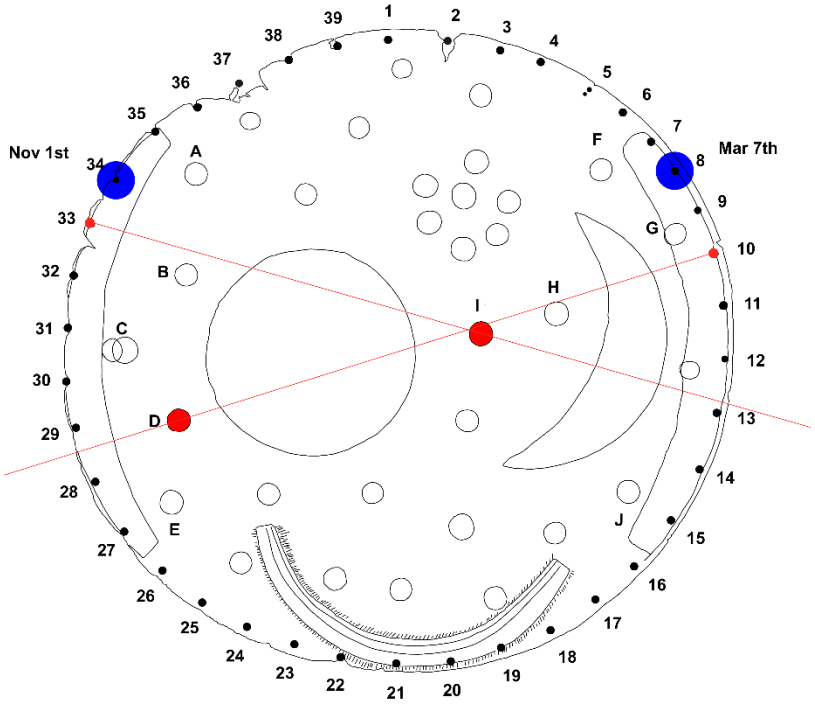


Diagram 34 The festival markers for March 7th and November 1st are placed in holes 8 and 34. The pegs used to align with the Sun on the horizon on these days are located in peg-holes 10 for the sunset alignment with gold dot D and peg-hole 33 for the sunrise alignment with gold dot I.

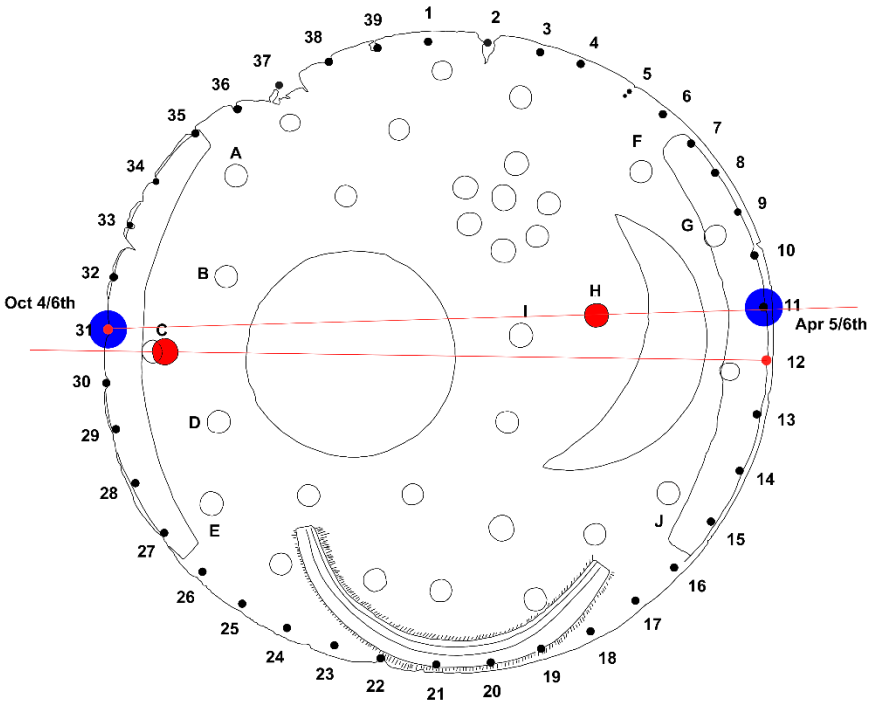


Diagram 35 The autumn equinox and spring equinox festival markers on October 4/6th and April 5/6th are located in hole 31 and hole 11 respectively.

The alignment peg for the autumn equinox festival is situated in the same peghole (31) as its festival day marker, perhaps indicating that the marker had a central hole through it to allow the peg to protrude above it for alignment purposes.

The peg for the spring equinox however occupies the hole (12) beneath the spring equinox marker hole (11). The gold dots used in the alignment between the pegs and the Sun on the horizon are labelled C and H for the sunset and sunrise alignment respectively.

Each of the remaining festival days can be similarly depicted by placing two festival day marker in a hole on either side of the Sky Disc in a position that reflects its date position on a Wheel of the year calendar and two alignment pegs in the two pegholes one on either side of the Sky Disc that give the alignment with the Sun at sunrise and sunset and the gold dots on those festival days.

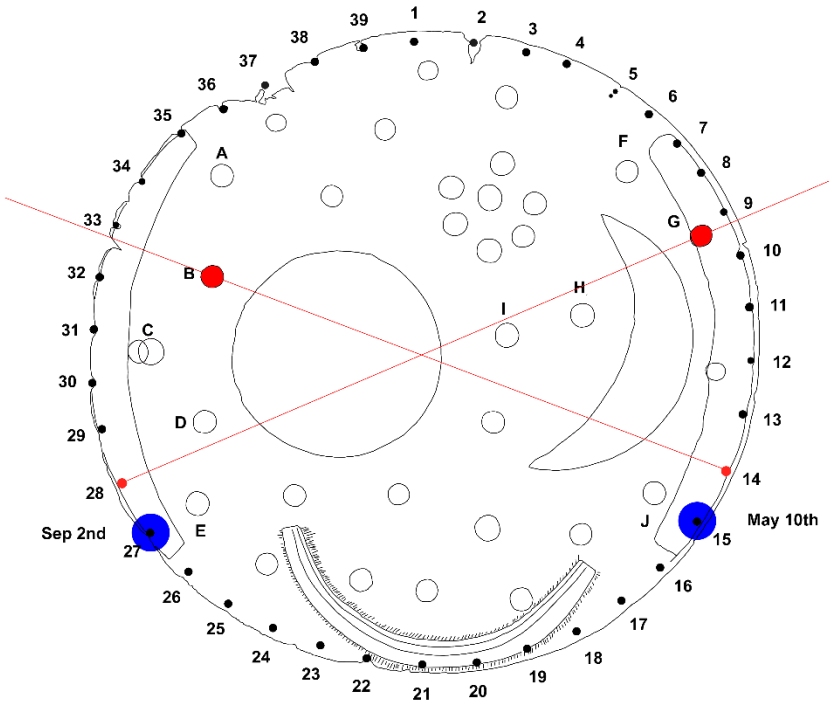


Diagram 36 Sunrise and sunset alignments made between peg-holes 28 and 14 with gold dots G and B occur on May 10th and September 2nd.

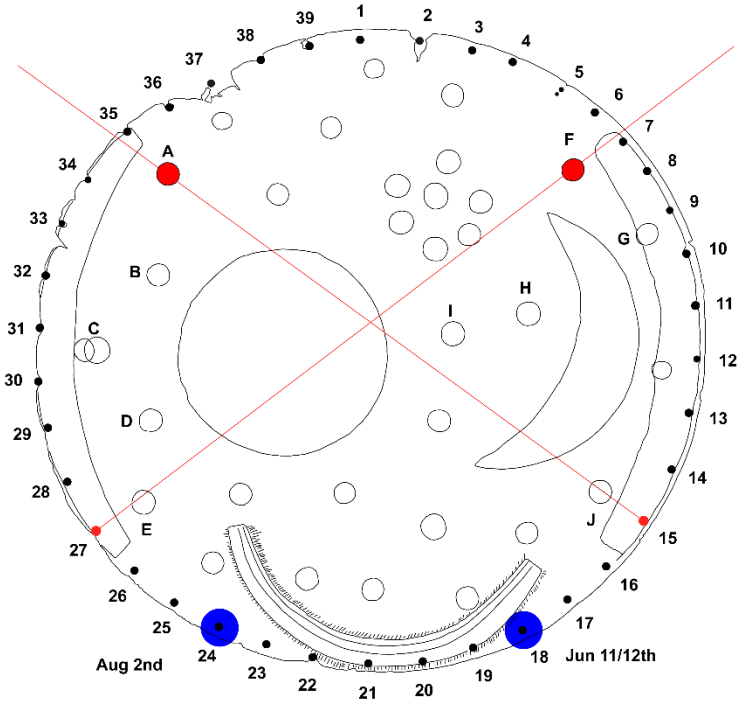


Diagram 37 Alignments between peg-holes 27 and 15 with gold dots F and A on June 11th and August 2nd.

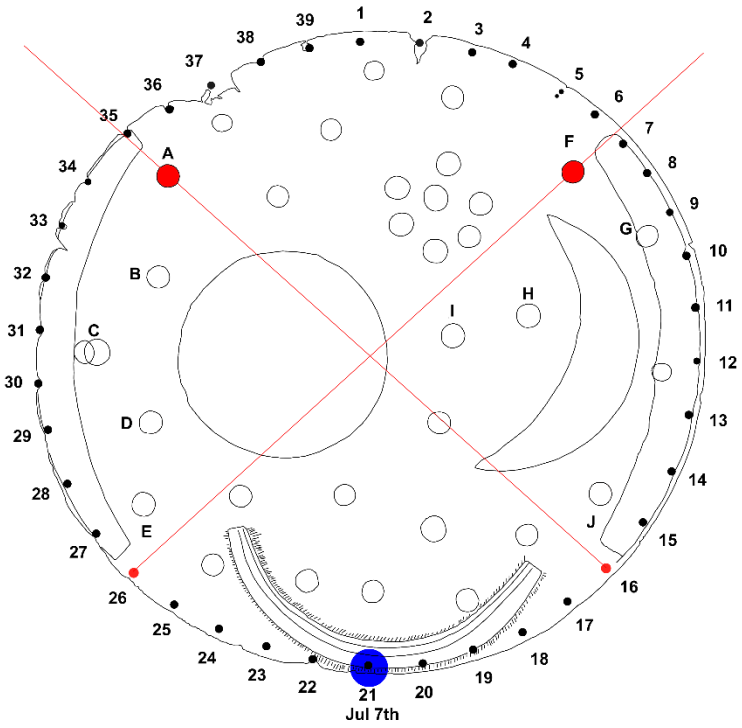


Diagram 38 Alignments between peg-holes 26 and 16 with gold dots F and A occur on the Summer solstice on July 7th.

The twelve festivals can be overlaid to show the position of the Festival Markers together with the solar alignment pegs used to identify the same festival days. Each of the festival day markers has been individually coloured or usually pairs of markers similarly coloured and the alignment peg coloured to match its festival marker.

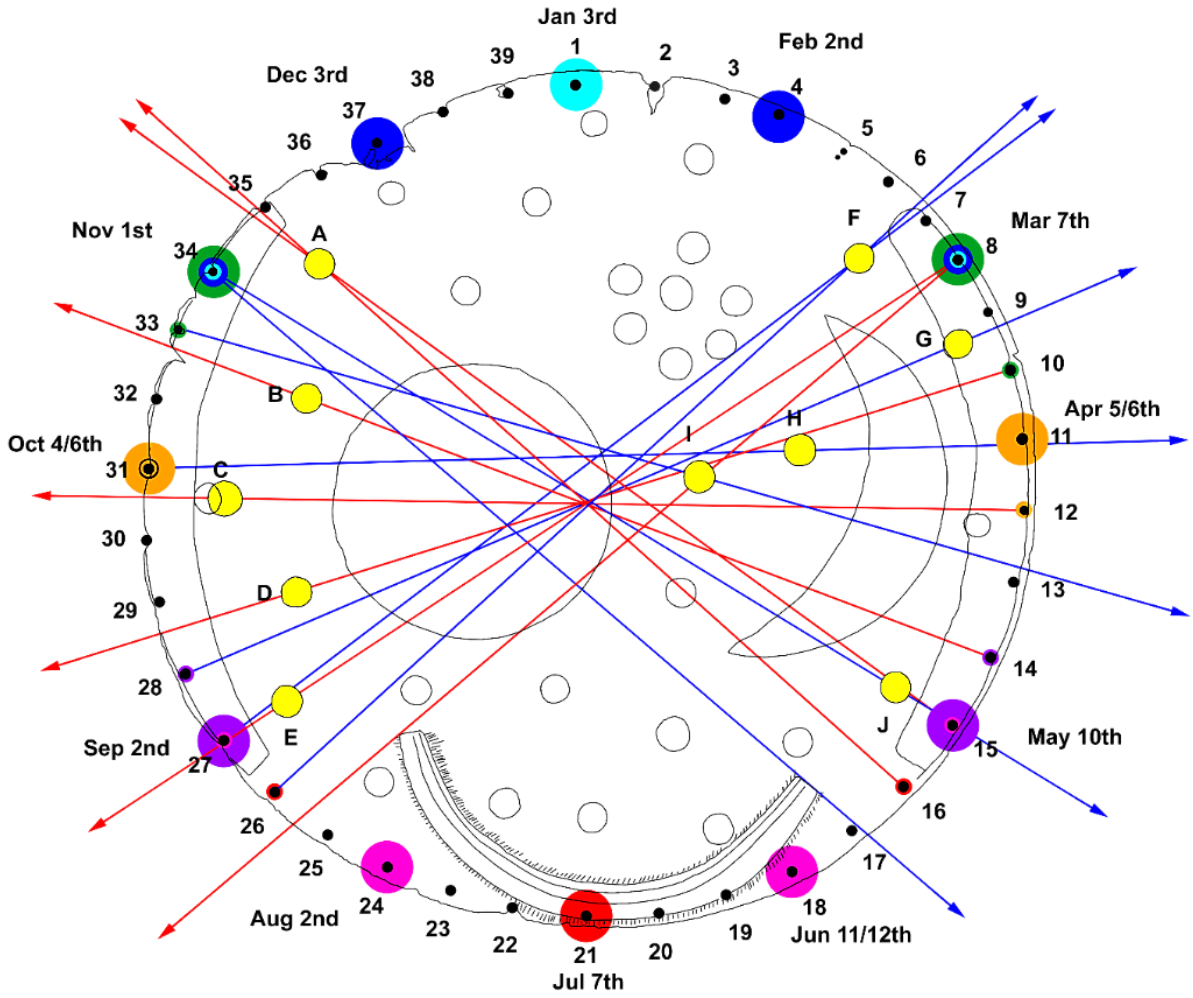


Diagram 39 Alignments for the Major 12 Festivals. Connecting the Calendrical use of the Sky Disc with its purpose as a sighting device to identify those festival days.

Sunrise alignments are depicted in blue and sunset alignments are in red. The Wheel of the Year festival markers are the big coloured circles whilst the peg-holes used to identify these festival days by alignment are the small coloured rings surrounding the holes. The yellow dots are the gold dots used for alignments between the pegs and the Sun on the horizon.

It can be seen how three holes at the top of the disc (37, 1 and 4) and three holes at the bottom of the Sky Disc (24, 21 and 18) can be used to locate festival marker pins along with holes 8,11 and 15 along the eastern bow and 27, 31 and 34 along the western bow. This however still leaves eight holes at the top and six holes at the bottom which are unoccupied by either an alignment peg or a festival marker pin (holes 9, 13, 29, 30, 32

and 35 are occupied by alignment pegs for the intermediate festival days shown in the following section) . The next stage is to look at the intermediate festival days identified by either a sunrise alignment or sunset alignment using the Sky Disc and add their alignment pegs and festival marker pins to the holes. The remaining 16 festival days indicated by the Sky Disc solar alignments made between peg-holes 7-16 and 26-35 and gold dots A-J can be similarly depicted by placing festival day marker pins and the alignment pegs used to identify these days in the holes between the twelve main festival days already positioned. For these festival days however, only one alignment identifies the festival day either a sunrise alignment or a sunset alignment, rather than the two alignments at both sunrise and sunset used to identify the twelve major festival days.

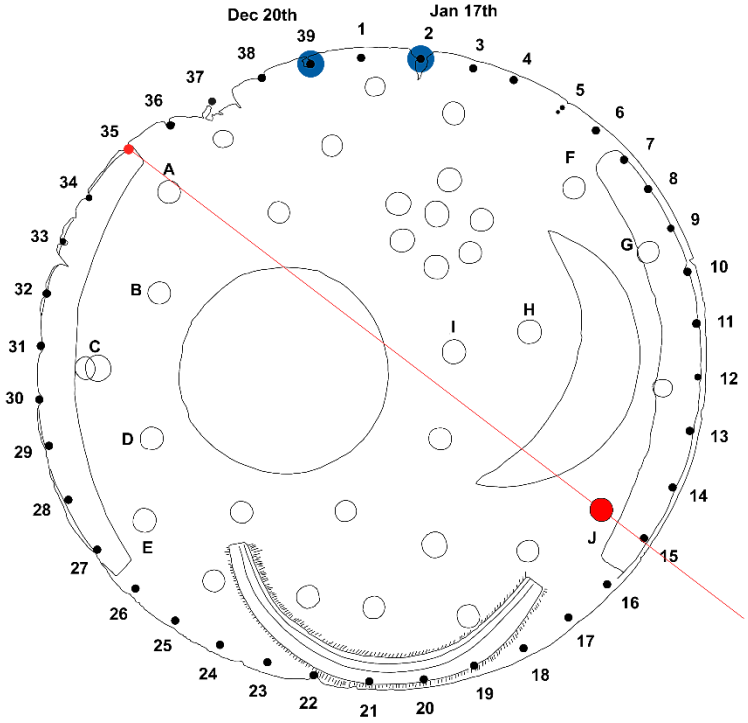


Diagram 40 Sunrise alignment between peg-hole 35 and gold dot J on December 20th and January 17th.

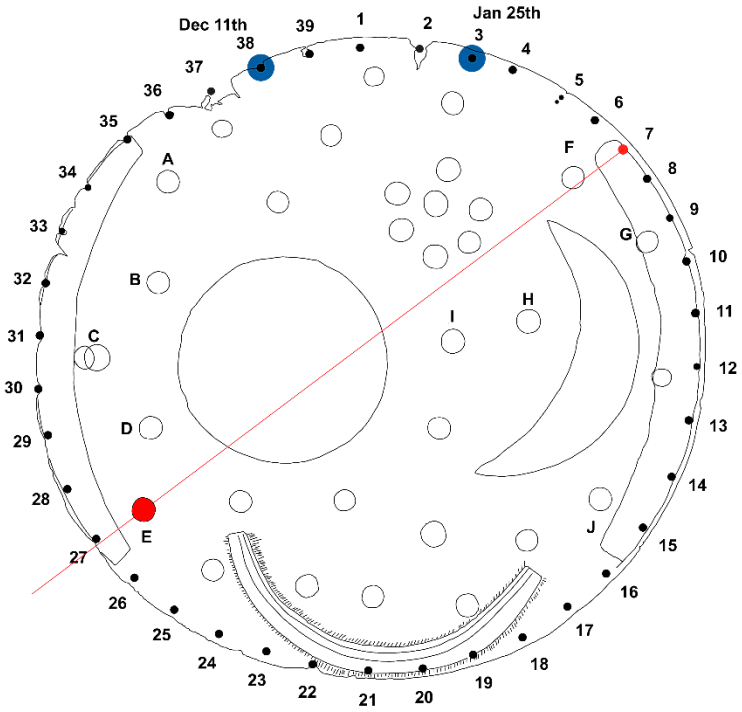


Diagram 41 Sunset alignment between peg-hole 7 and gold dot E on January 25th and December 11th.

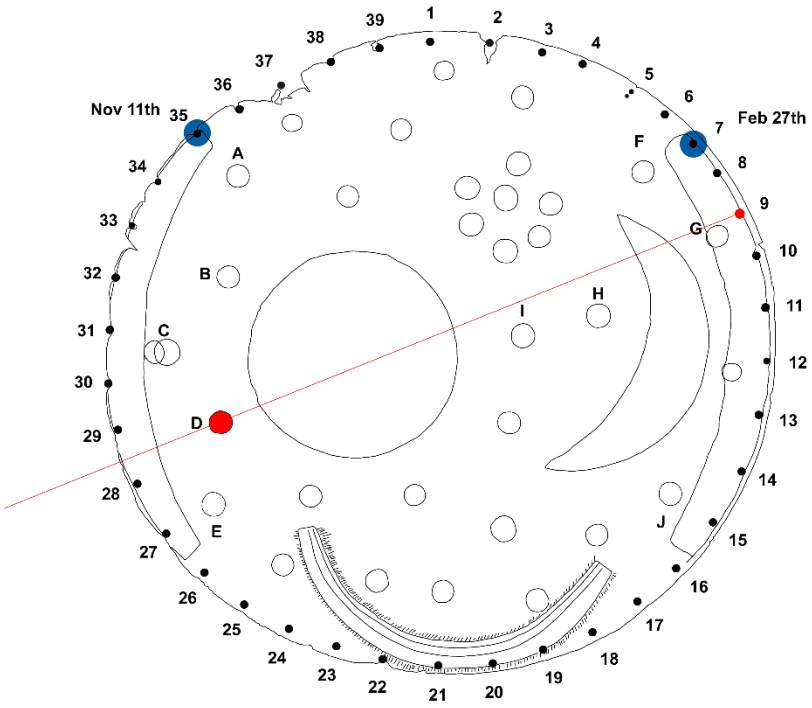


Diagram 42 Sunset alignment between peg-hole 9 and gold dot D on February 27th and November 11th.

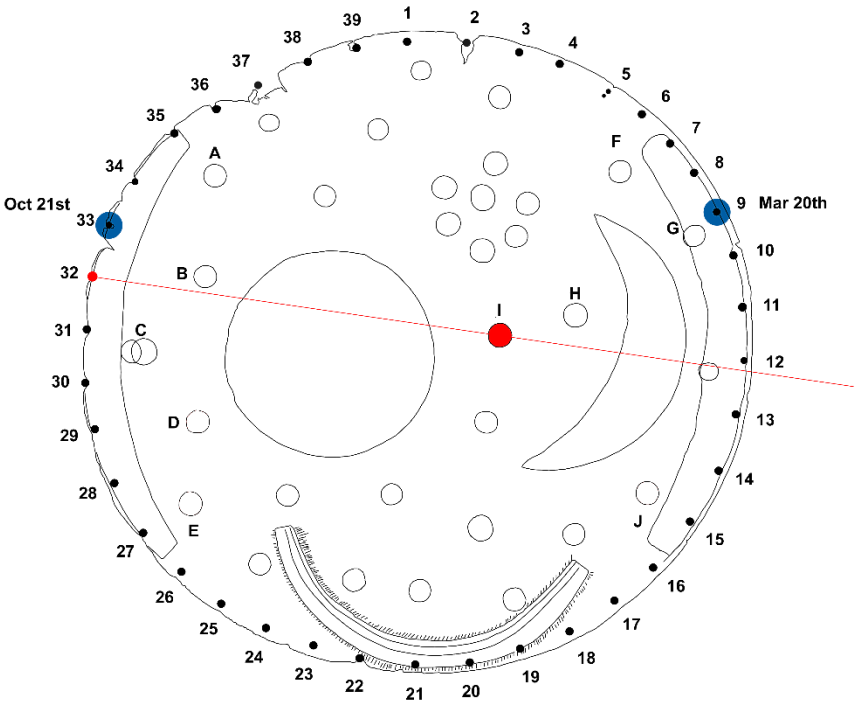


Diagram 43 Sunrise alignment between peg-hole 32 and gold dot I on March 20th and October 21st.

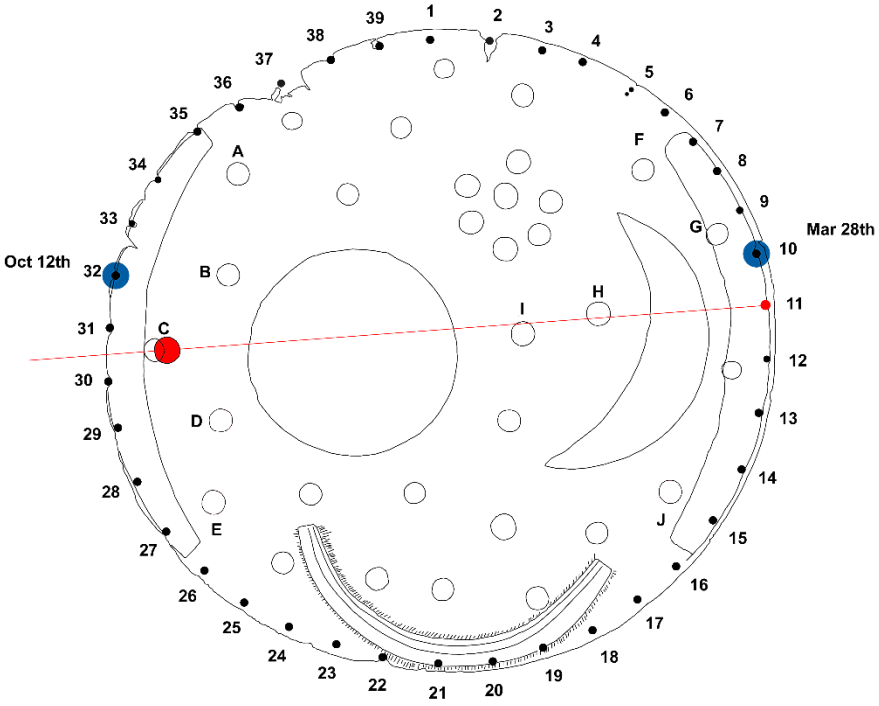


Diagram 44 Sunset alignment between peg-hole 11 and gold dot C on March 28th and October 12th.

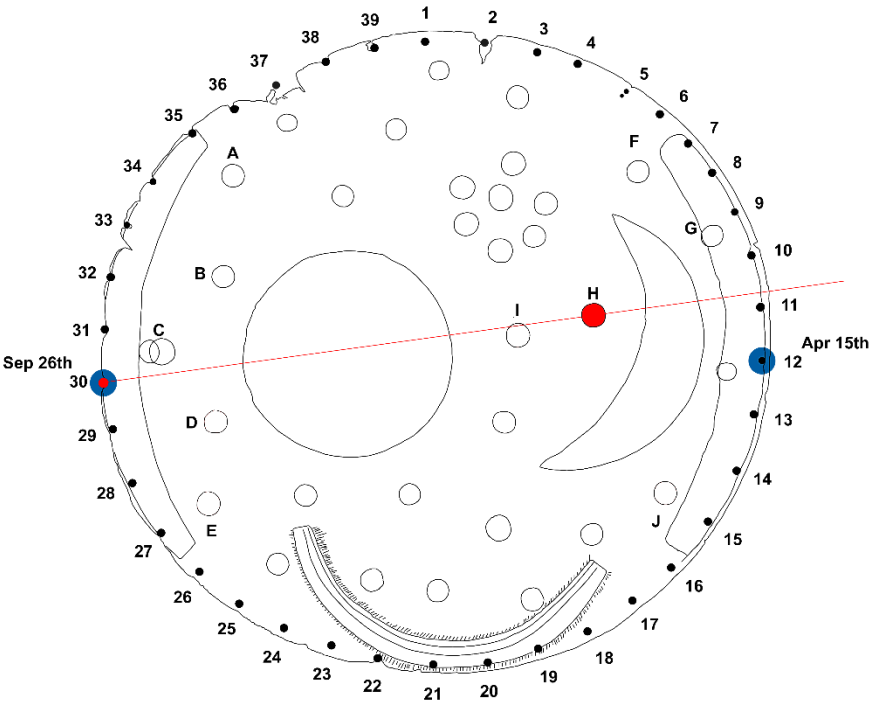


Diagram 45 Sunrise alignment between peg-hole 30 and gold dot H on April 15th and September 26th.

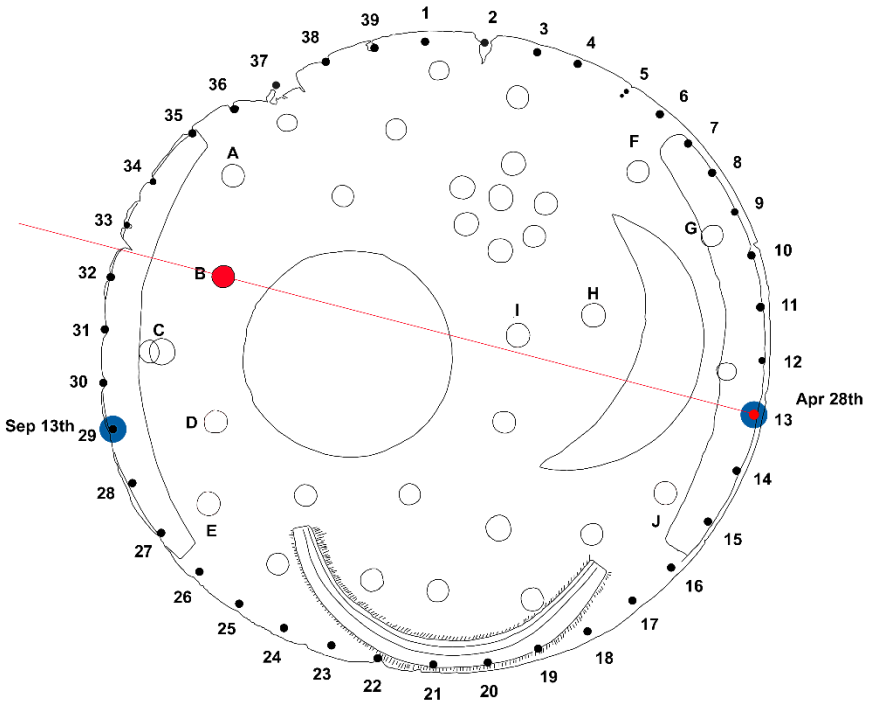


Diagram 46 Sunset alignment between peg-hole 13 and gold dot B on April 28th and September 13th.

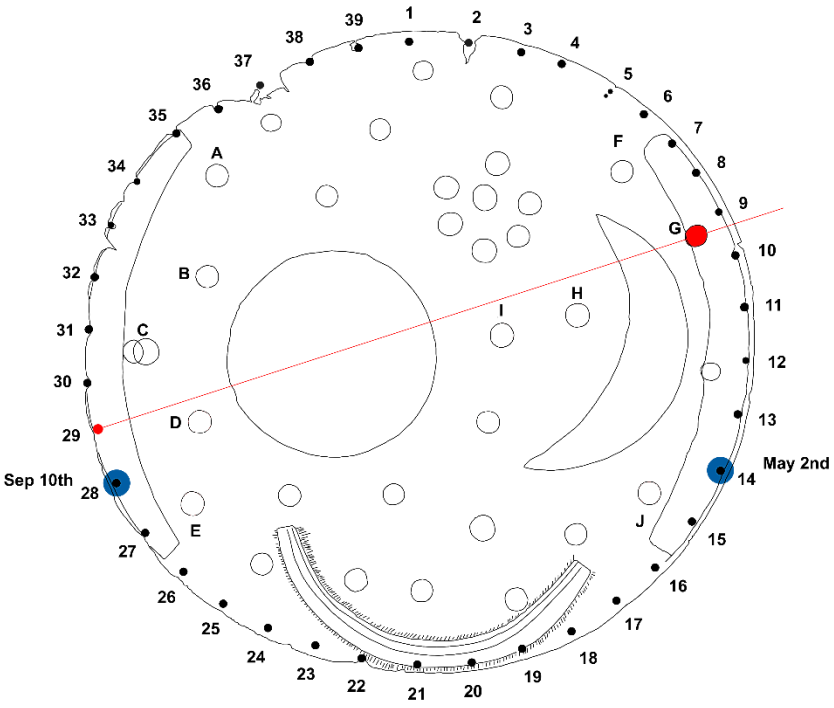


Diagram 47 Sunrise alignment between peg-hole 29 and gold dot G on May 2nd and September 10th.

Again the festival day markers and the solar alignment pegs used to identify these days can be overlaid to show the pattern of markers and their pegs and the relationship between them.

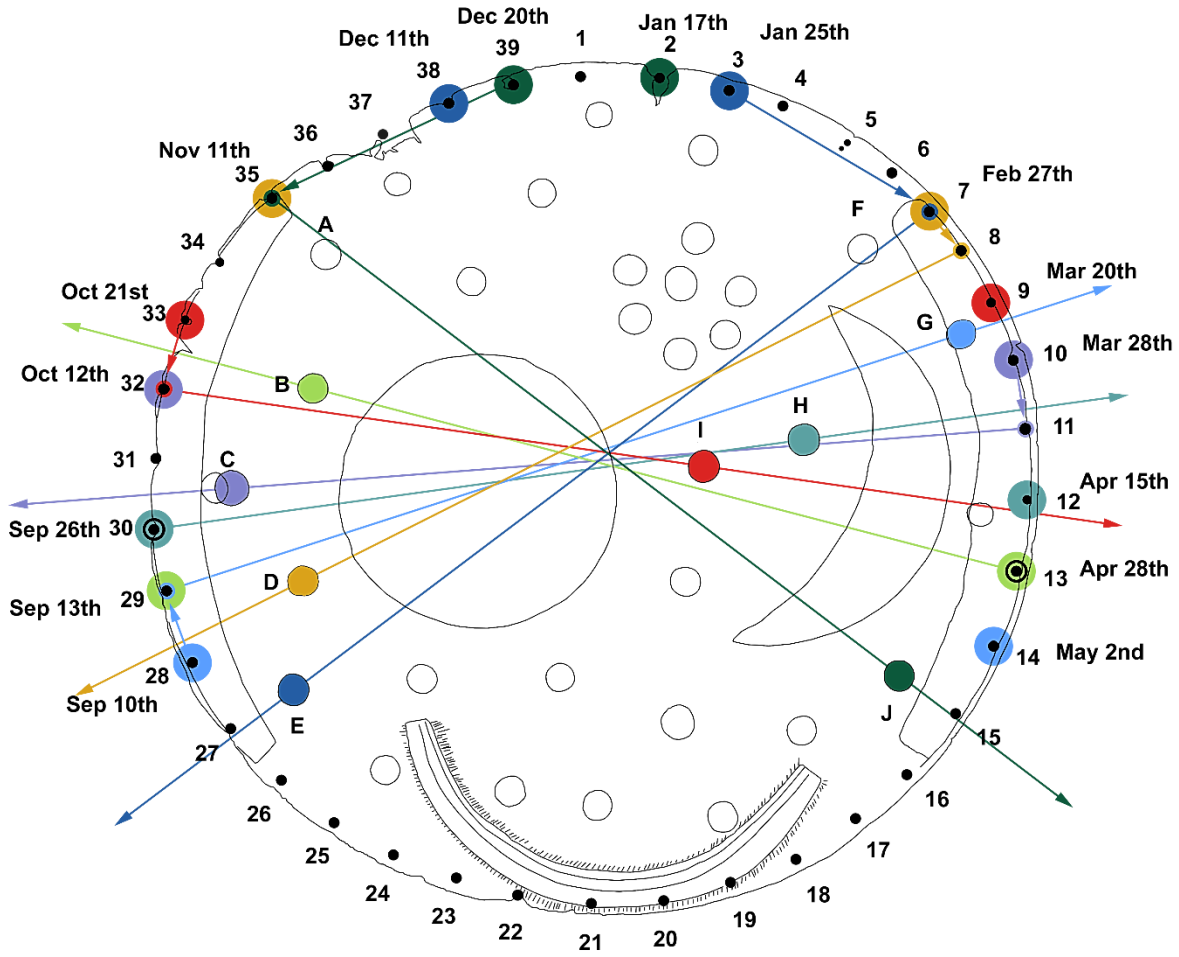


Diagram 48 The 16 Intermediate Festival Days overlaid to show how the festival day markers are linked to the positions of their alignment pegs and gold dots that identify those days. For clarity the Festival marker pins (large circles) have been linked to the alignment pegs used to identify those days by arrows of the same colour and the gold dots used to align with the peg and the Sun on the horizon also coloured with the same colour as the Festival Marker pin and the Alignment Peg.

Combining the festival day marker pins and the alignment pegs of the main twelve festival days with the sixteen intermediate festival days marker pins and their alignment pegs to see which of the 39 holes in the Sky Disc are utilised in displaying the Wheel of the Year Calendar and the alignment pegs used to identify those days.

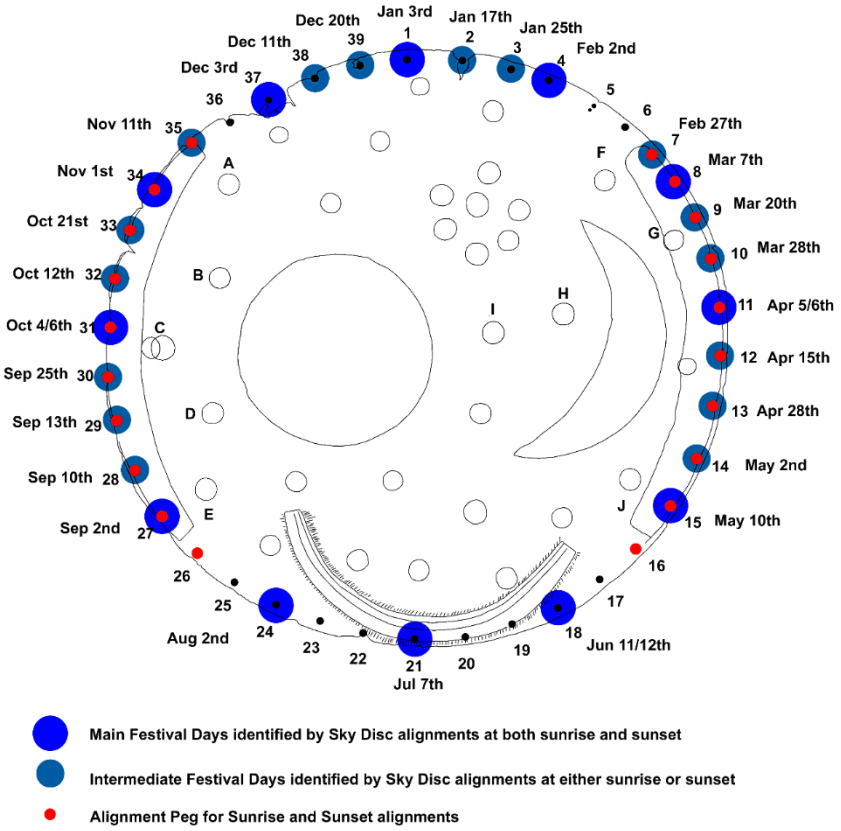


Diagram 49 Holes occupied by Festival Marker Pins and Alignment pegs for festival days indicated by alignments between holes 7-16 and 26-35 and gold dots A-J

It can be seen that following the inclusion of the 16 intermediate festivals to the 12 main festival days identified by the Sky Disc alignments made from the alignment peg-holes 7-16 and 26-35 with the gold dots A-J, thirty of the thirty-nine holes can be occupied by festival marker pins and alignment pegs. 18 holes (7-16 and 26-35) are occupied by both a festival marker pin and an alignment peg, 10 holes (1-4, 18, 21, 24, and 37-39) are occupied by just festival marker pins and two holes are occupied by just alignment pegs (16 and 26). Three holes at the top of the Sky Disc (5,6 and 36) are unoccupied by either Festival marker pins or alignment pegs as are six holes at the bottom of the disc (17, 19, 20, 22, 23 and 25).

Missing festival days

It can be seen from the Wheel of the Year calendar identifying the 28 festival days indicated by the alignments made from peg-holes 7-16 and 26-35, that although the main festival days indicated by the larger blue circles give a complete and evenly spaced coverage of the year, there are gaps in the occurrence of intermediate festival days in February, May, June July, August and November. It is likely that there are other alignments to be made from other peg-holes and gold dots decorating the Sky Disc. Working backwards, hole 5 or 6 could represent a missing intermediate festival day between February 2nd and February 27th whilst hole 36 represents a festival day between November 1st and December 3rd. When the night skies are examined between February 2nd and the 27th no significant stellar alignments are observed at the Start of Civil Twilight but when the End of Civil Twilight is examined a very significant alignment is found to occur on February 21st when Betelgeuse in Orion is aligned precisely due South. This is therefore a very likely candidate for a missing festival day. Continuing to work backwards the bearing of the Sun on the horizon at sunrise and sunset can be calculated using the archaeo-astronomy program to be 114^{0} 14′ 48″ giving an alignment above the horizon 3 minutes later of 114^{0} 50′ 7″. Looking at the Sky Disc an alignment could have been made between peg-hole 35 and gold dot H at sunrise on February 21st. It is perhaps significant that two further gold dots (X and K) are also aligned with peg-hole 35 but not perfectly aligned in a straight line, perhaps reflecting the pattern of the three stars in Orion's Belt that are likewise staggered in their alignment. No sunset alignment for February 21st was found on the Sky Disc consistent with the pattern found with all the intermediate festivals that were either indicated by a sunrise alignment or a sunset alignment but not both. Hole 6 was allocated for the Festival Marker pin for the 21st February due to its proximity to hole 7 which is the festival marker for the 27th February only 6 six days later.

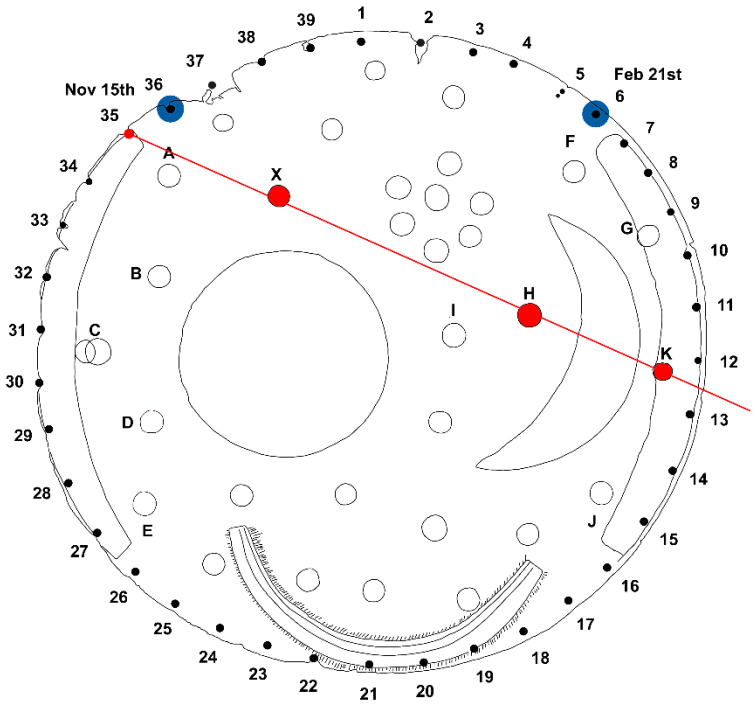


Diagram 50 Sunrise Alignment between peg-hole35 and gold dots X, H and K which occur on February 21st and November 15th.

Hole 5 appears to be slightly different from the other holes on the disc as it seems smaller on the front face of the disc and has a second small indentation next to it, whilst on the back of the disc the hole is flush with the surface whereas the other holes emerge from a slightly raised mound surrounding the holes formed possibly as a result of the way in which the holes were drilled or punched. Hole 5 therefore remains empty and perhaps it served some other purpose either as a means of suspending the disc or perhaps as an East-West alignment peg marker to be used in combination with hole 37 whose position is difficult to assess due to metal loss and the radial arrangement of southern pin markers at the bottom of the disc that may have been used to estimate how many days it would take for a bright star to become aligned due South at Civil Twilight (see Appendix).

The other festival day indicated by the sunrise alignment (bearing 114^{o} 50’ 7”) is November 15th (Festival Marker pin 36). This day is accompanied by alignments of Mel 111 due South at the Start of Civil Twilight and NGC2264, the Cone Nebula aligned due West, whilst at the End of Civil Twilight Stephan’s Quintet is aligned due South and Vega is aligned due West.

The inclusion of these two festival days (Feb 21st and Nov 15th) fill in a gap in the Wheel of the Year Calendar but the bottom of the calendar between May and September appears to be missing several intermediate festival days that need to be found to complete the symmetry of the calendar.

Identification of Festival Days between May and September

Holes 17, 19, 20, 22, 23 and 25 are empty and there are no intermediate festival days identified by Sky Disc alignments between holes 7-16 and 26-35 and gold dots A-J although three major festivals are identified by alignments at sunrise and sunset (Jun 11/12th, Jul 7th and Aug 2nd). The Intermediate festival days can be estimated by considering possible alignments made between peg-holes at the bottom of the disc (17-25) and gold dots on the disc which give rise to significant patterns of alignment with bearings that indicate days that lie between the major festival markers 15, 18, 21, 24 and 27. The first holes to consider are holes 16 and 26 that are actually peg alignment holes for the summer solstice on Jul 7th, but may also have been associated with festival day marker pins. Alignments between hole 24 (three holes to the West of hole 21) and two gold dots (M and K (K is hidden but visible under the western gold bow) at sunrise and between hole 18 (three holes to the East of hole 21) and gold dots L and D at sunset correspond to the alignment of pegs in these holes with the Sun on the horizon on May 25th and August 19th.

Looking at the sky at Civil Twilight at dawn and dusk the alignments that occur on these days, Deneb is due South at the Start of Civil Twilight and Mel 111 due West at the End of Civil Twilight. On Aug 19th the Pleiades are aligned due South at the start of Civil Twilight whilst Alphard is due East and at the End of Civil Twilight, the Dumbbell nebula M27 is aligned due South.

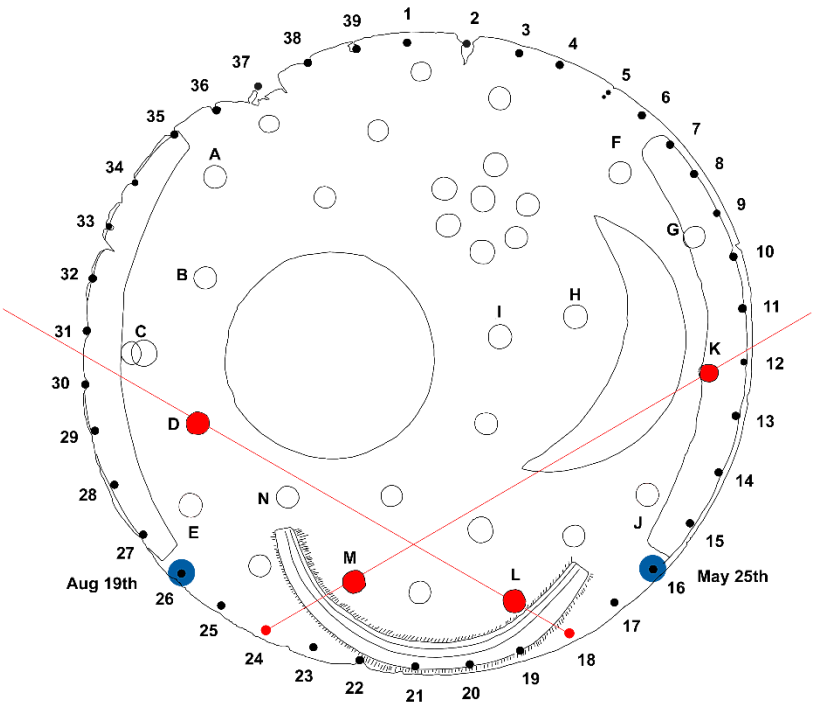


Diagram 51 Alignments between peg-holes 24 and 18 with gold dots M and K and L and D which occur on May 25th and August 19th.

The next intermediate festival days appear to be marked by holes 17 and 25 that may correspond to alignments made from pegholes 19 and 23 respectively. Again, the sunrise alignment is between a peg-hole and two gold dots (P and K) whilst the sunset alignment is made between peg-hole 19 and gold dots D and N

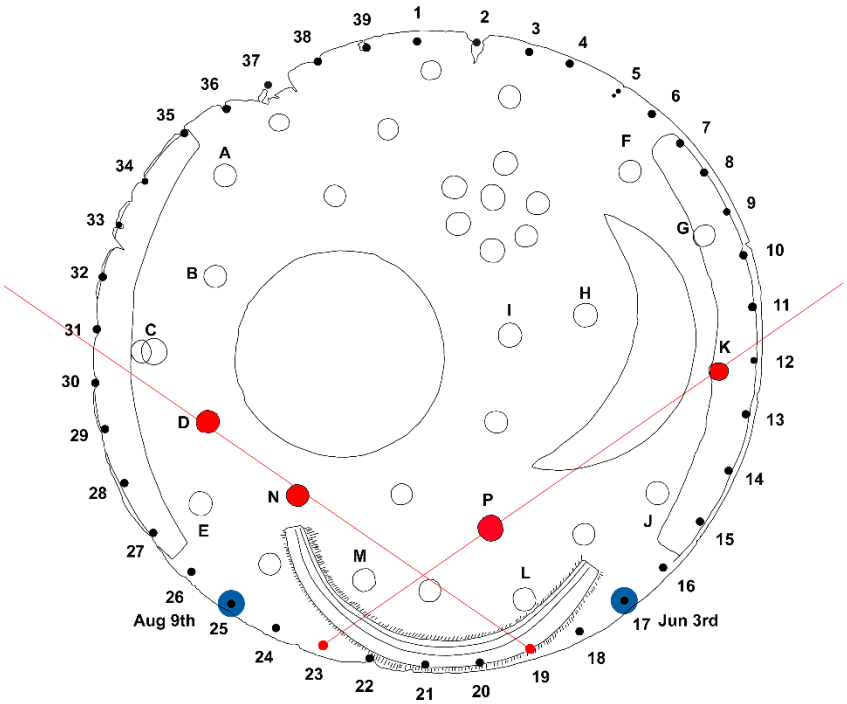


Diagram 52 Alignments between peg-holes 23 and 19 with gold dots P/K and N/D on June 3rd and August 9th.

The festival days June 3rd and August 9th are associated with alignments of the Helix nebula NGC7293 due South and the Pleiades, M45 due East at dawn on Jun 3rd and at the End of Civil Twilight, Alphard is aligned due West. On Aug 9th at the End of Civil Twilight, Altair is aligned due South whilst the Andromeda galaxy M31 and the Pinwheel galaxy M33 are both aligned due East.

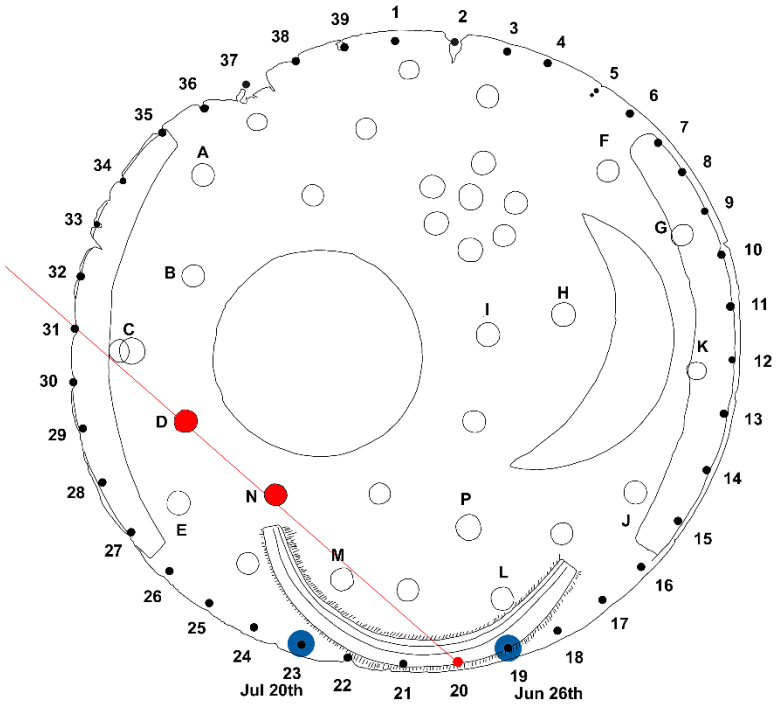


Diagram 53 Sunset alignment between peg-hole 20 and N/D on June 26th and July 20th.

Finally, two remaining festival days may be marked by pins in holes 20 and 22, either side of the summer solstice festival marker (21). A sunset alignment between hole 20 and gold dots D and N coincide with the bearing of the Sun on the horizon at sunset on June 26th and July 20th.

On June 26th at the Start of Civil Twilight Stephan's Quintet in Pegasus is aligned due South whilst at the End of Civil Twilight the Crescent Nebula NGC6888 is aligned due East. On the 20th July the Andromeda Galaxy M31 is aligned due South and the Cone Nebula NGC2264 due East at the Start of Civil Twilight.

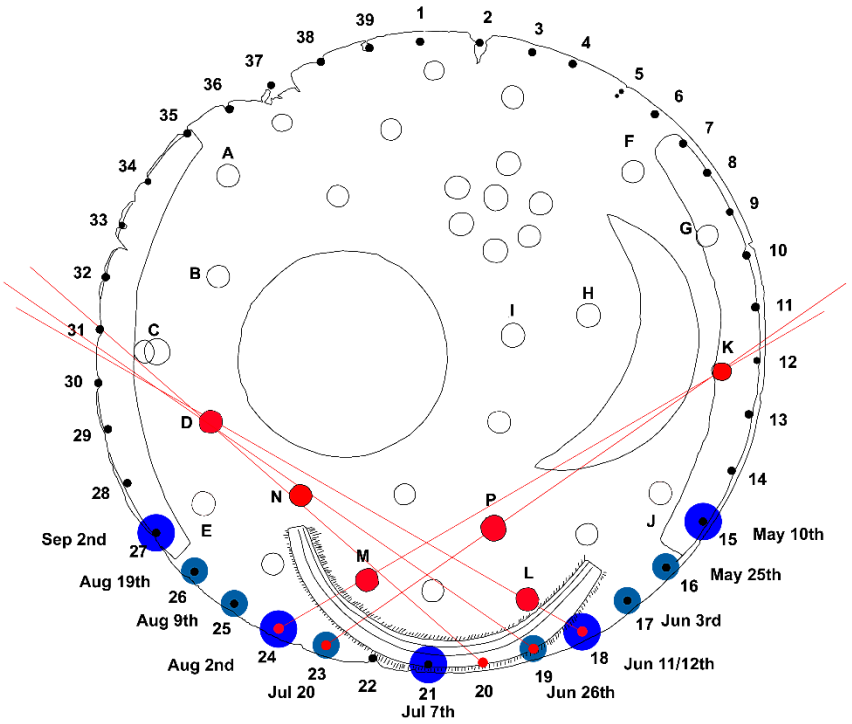


Diagram 54 The missing intermediate festival day markers and their alignment pegs can be inserted to show that all but one of the bottom holes on the Sky Disc are occupied

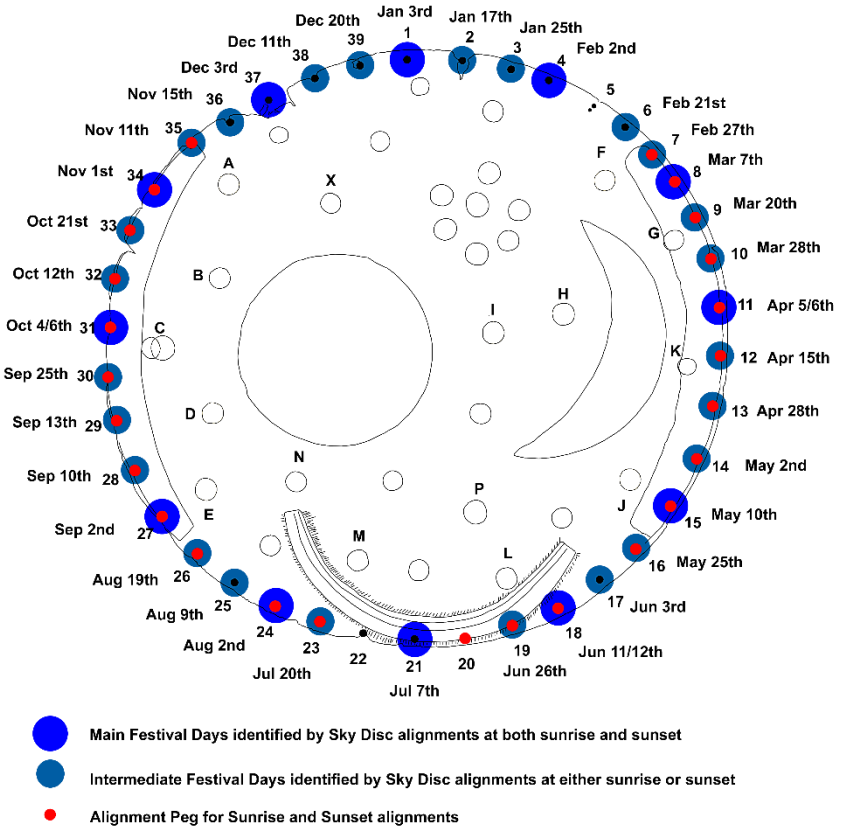


Diagram 55 Holes occupied by Festival Marker Pins and Alignment Pegs

The Blue and green circles centred on the holes around the disc mark the festival days displayed as a Wheel of the Year Calendar with the blue circles representing the twelve major festivals evenly distributed throughout the year and indicated by alignments with the Sun on the horizon using the Sky Disc both at sunrise and sunset. The Green Circles mark intermediate festival days between the twelve main festival days. These festival days are indicated by alignments with the Sun on the horizon using the Sky Disc at either sunrise or sunset but usually not by both.

The Red dots centred on the holes represent alignment pegs which would protrude vertically up from the holes and allow the alignment of the Sun on the horizon with a gold dot on the Sky Disc to be identified. The Yellow dots are the gold dots on the Sky Disc used for the alignments between the Peg and the Sun as it sits on the horizon.

It can be seen that most of the holes (36/39) could have been fitted with festival marker pins in the manner of representing the year as a Wheel Calendar with the northern-most marker representing the winter solstice, the eastern-most market the spring equinox festival, the southern-most marker the summer solstice festival and the western-most marker the autumn equinox festival. The periods between these four major solar festivals being almost evenly divided into three by two other main festival days dividing the year into twelve by these main festivals (1, 4, 8, 11, 15, 21, 24, 27, 31, 34 and 37). A further twenty four festival days occur between these twelve festivals. There are 25 alignment pegs arranged in holes 7-35, around the Sky Disc. Two holes (22 and 5) are empty but may have had alignment pegs to measure the southern alignment of stars at Civil Twilight where perhaps holes 20,21 and 22 were used for alignment viewed from a reference peg located in hole 1, whilst holes 5 and 37 had pegs to identify the East-West cardinal alignments of stars.

Many of the festival markers (24) require both festival marker pins and sighting pegs to be installed in the same hole. This could be most easily achieved by having a festival marker that had a central peg protruding through it. The peg used for sighting might be decorated in a similar way to its Festival Day marker to identify that pairing (as it usually occupies a different peg-hole) so that the user could easily know what festival day on the Wheel of the Year Calendar was identified by the solar alignment obtained by a certain peg. This might be achieved by using pairs of semiprecious stones of the same colour or engraving festival marker and alignment peg with symbols to create easily recognisable pairings. The provision of festival marker pins and alignment pegs could have been done in such a way that the beauty of the Sky Disc was further enhanced. The combination of decorated festival marker pins and alignment pegs would very neatly tie the two calendrical functions of the Sky Disc together by producing a visible representation of the Wheel of the Year calendar and a calendrical sighting device to identify the days on which those festival days occurred. Minute symbols such as the triangles, square, seven dots

and nine dots could be used to mark the festival day marker with its alignment peg/s in the same way that these symbols portrayed as arrangements of gold dots were used on the Sky Disc.

Alignments of Peg-holes and Gold Dots on the Sky Disc identifying the 36 Festival Days

The additional alignments required to complete the 36 festival days can be added to the original Sky Disc alignments made between peg-holes and gold dots for sunrise and sunset alignments.

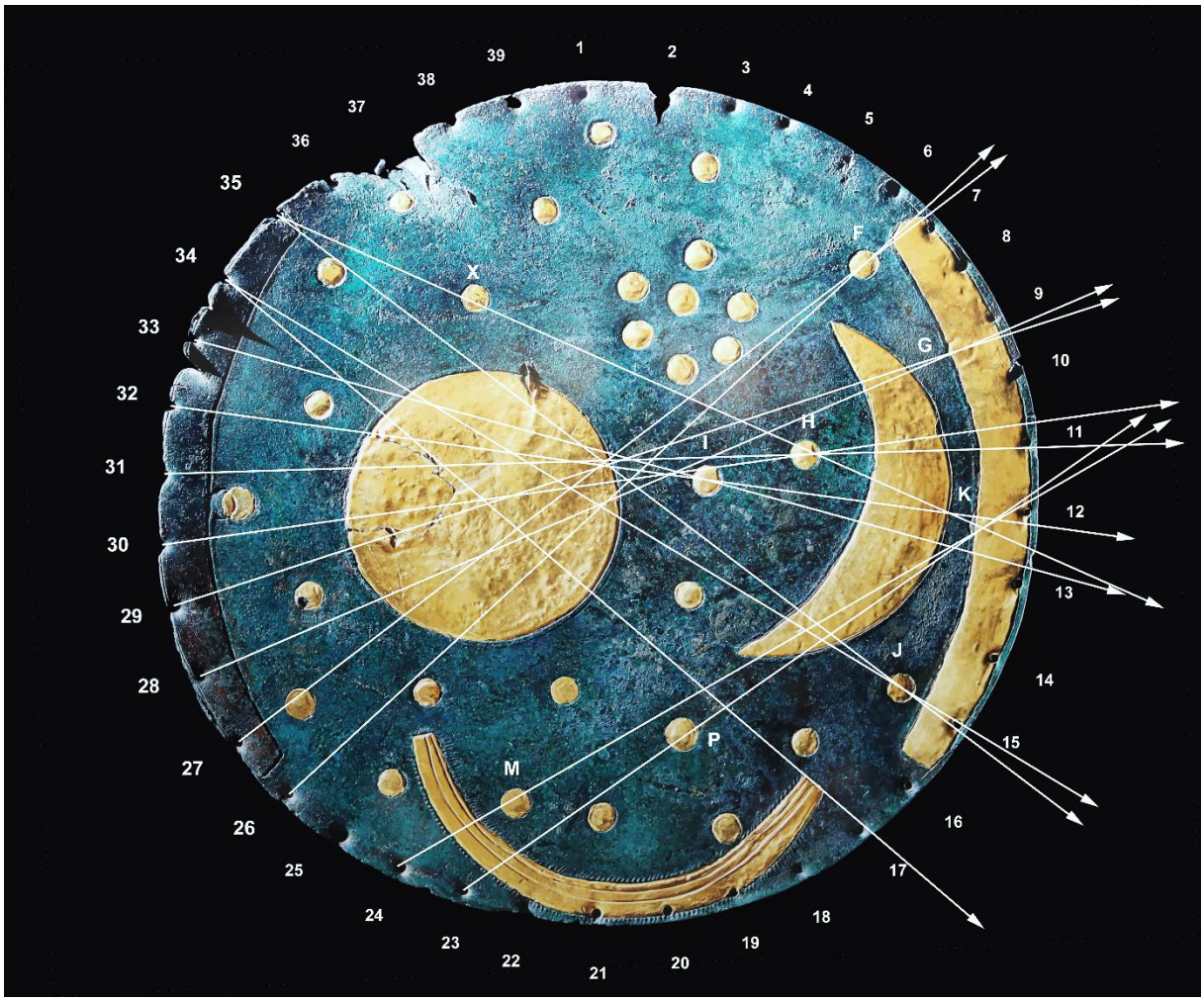


Diagram 56 Sky Disc showing all Sunrise Alignments between Peg-holes and Gold Dots for the 36 Festival Days

The sunrise alignments between peg-holes 23 and 35 are neatly arranged from holes 26-35 to gold dots F-J each gold dot having two peg-hole alignments. The three additional alignments at sunrise from holes 23, 24 and 35 all bisect the gold dot marked “K” which lies under the gold bow inlay on the eastern edge of the Sky Disc. The winter solstice is unique in being identified by an alignment at sunrise between peg-hole 34 and the eastern end of the solar barque represented as the gold bow lying at the bottom of the Sky Disc.

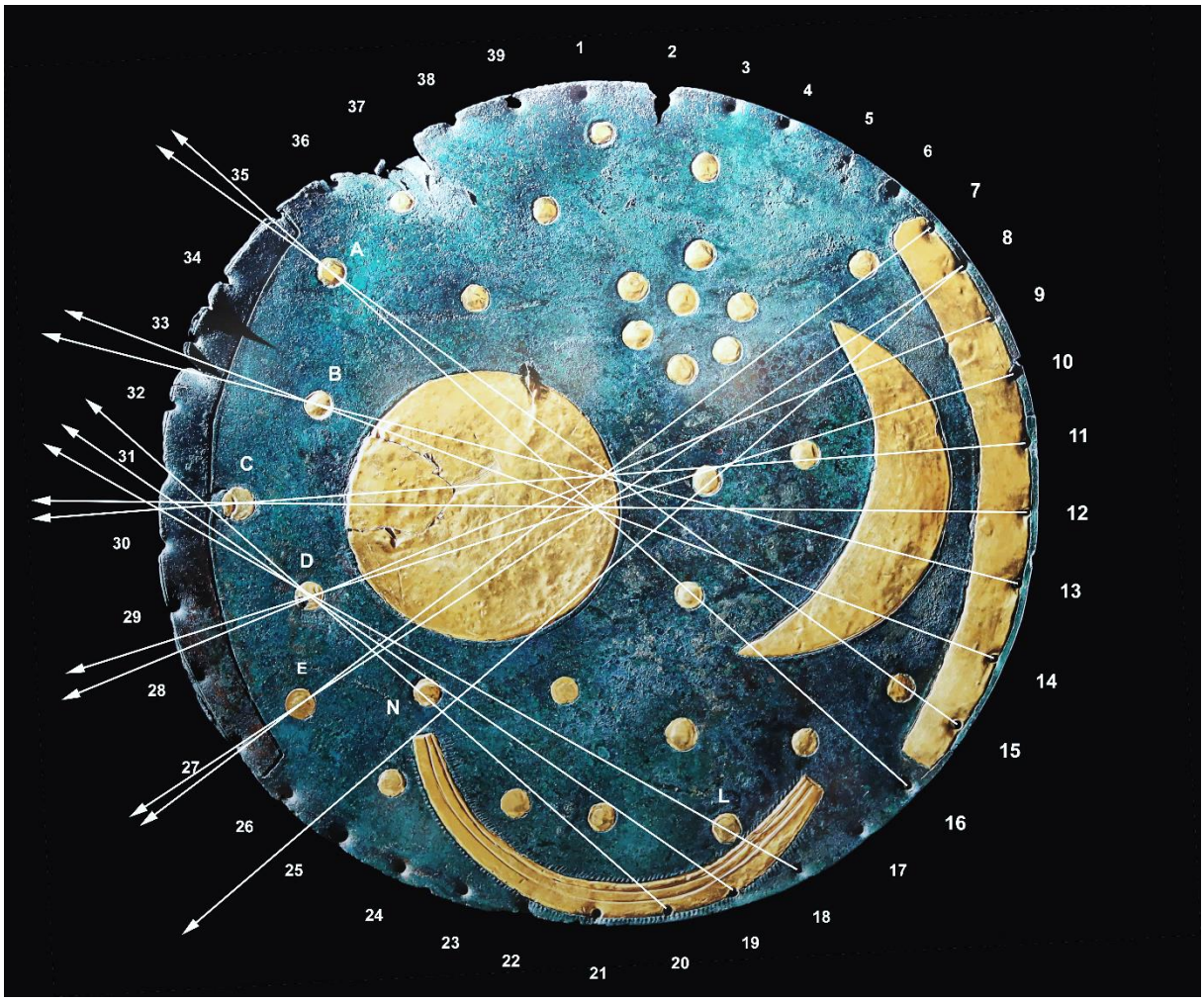


Diagram 57 Sky Disc showing all Sunset Alignments for the 36 Festival Days

The sunset alignments on the Sky Disc between peg-holes 7 and 20 and gold dots A-E are very neat and regular forming three radial patterns for the thirteen alignments. Two of the patterns are between holes 7 and 16 where each gold dot from A-E is bisected by two adjacent peg-holes. The intermediate festival days lying between May and September are indicated by sunset alignments made from peg-holes 18-20 that each bisect gold dot D. There is one festival day, the Winter solstice on January 3rd that does not align with a gold dot, but aligns from hole 8 to the western end of the solar barque symbol represented as a gold bow at the bottom of the Sky Disc.

Wheel of the Year Calendar identified by solar alignments made with the Sky Disc

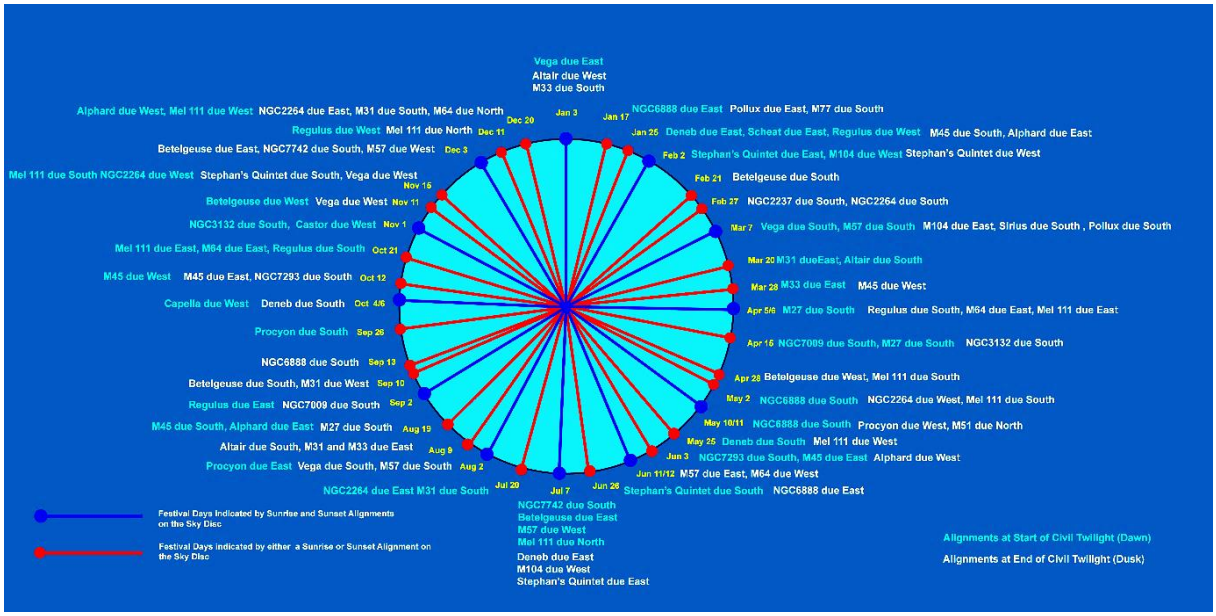


Diagram 58 The thirty six festival days identified by the Sky Disc alignments are shown to complete the calendar of 12 main festivals in blue including the four solstice and equinox festival days and 24 intermediate festivals shown in red. The alignment of stars and deep space objects that occur at Civil Twilight are indicated where those cardinal alignments depicted in blue occur at the Start of Civil Twilight at dawn and those in white are those stars and deep space objects that are cardinally aligned at the End of Civil Twilight at dusk.

Of the 36 festival days indicated by the Sky Disc alignments seven of the festival days cannot be identified by a cardinal alignment with a bright star or visible deep space object at either the Start of Civil Twilight or the End of Civil Twilight.

Most of the days indicated by the solar alignments at sunrise and sunset have bright stars or visible deep space objects aligned precisely due South or due East or due West at either the Start or End of Civil Twilight. Moreover, it may be significant that the stars that are aligned on these days are the brightest stars in their respective constellations. It is also interesting that the stars associated with the Summer Triangle and Winter Triangle which have previously been proposed as being represented in the lower right segment and upper left segment respectively of the Sky Disc, are so prominent in the alignments found with Vega, Deneb and Altair comprising the Summer Triangle having six alignments; Vega being the most important with three alignments, Deneb has two and Altair one alignment. Whilst Betelgeuse, Sirius and Procyon forming the Winter triangle are involved in nine alignments, five alignments for Betelgeuse, one for Sirius and three for Procyon. It is however intriguing that there are more deep space object alignments than alignments of bright stars on the festival days. Looking at the alignment of stars and deep space objects on the 28 festival days there are seven days that cannot be identified as festival days by considering only the alignments of galaxies, nebulae and the two star clusters M45 and Mel 111. The alignment of deep space objects, most especially galaxies and nebulae

require further examination to determine whether these alignments do occur by chance as would be expected if they were not visible.

The Sky Disc can be used to identify 36 festival days where Stars and deep space objects are aligned either due South, East, West or North at Civil Twilight. The main twelve festival days depicted in blue are evenly spaced days that include the solar festival days of the summer solstice, the winter solstice and the spring and autumn equinoxes. These festival days are indicated by alignments of the Sun on the horizon using the Sky Disc both at sunrise and sunset. These twelve festival days perhaps are a precursor to the presently used system of dividing the year into 12 months. However, two of these festival days do not have stellar alignments occurring on these days (February 2nd and June 11/12th). A further five of the intermediate festival days also do not have stellar alignments on these days (February 27th, April 15th, June 26th, July 20th and September 13th). The evenly spaced symmetrical appearance of the Calendar is completely lost if these seven days are omitted from the calendar.

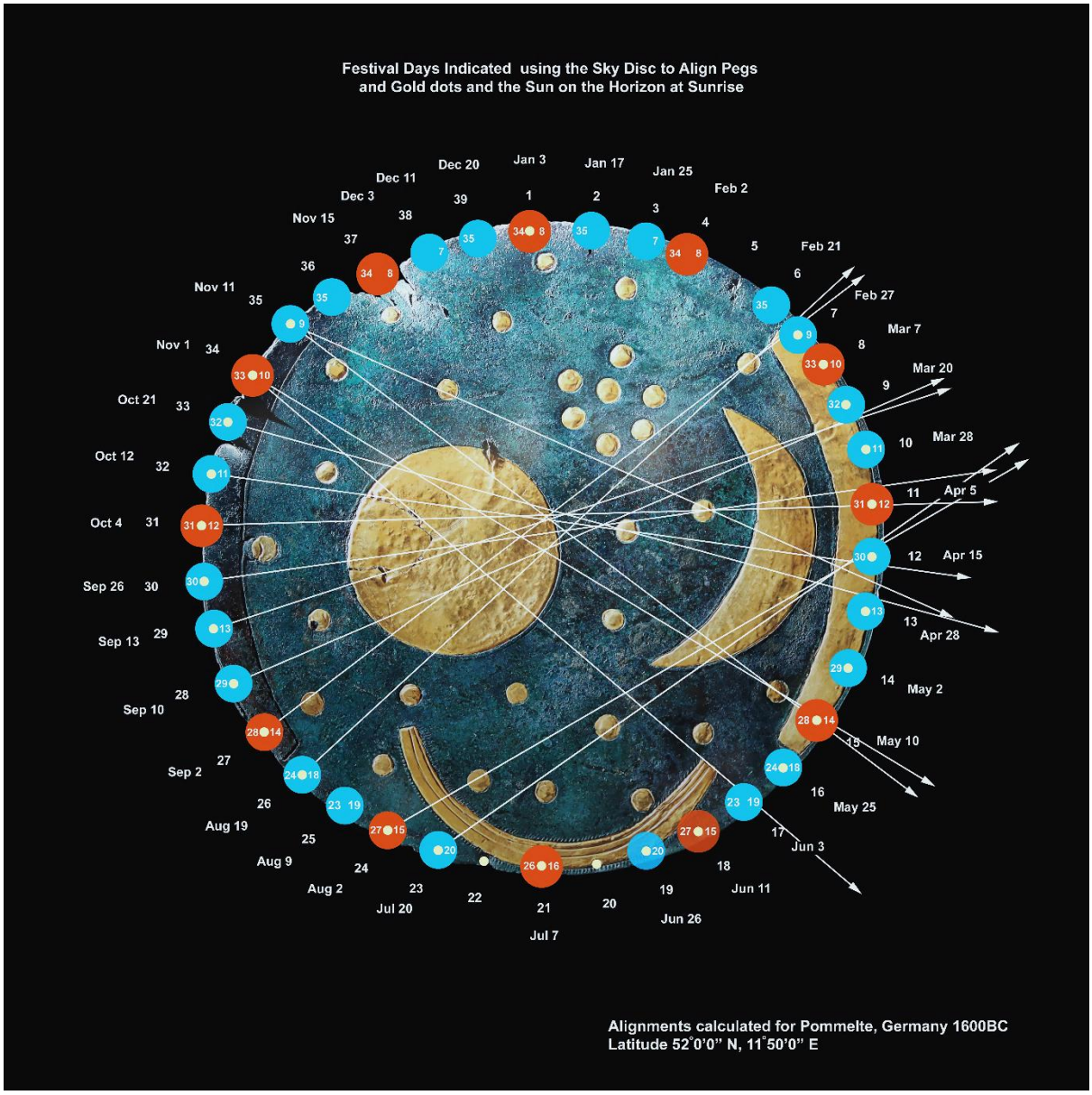


Diagram 59 Sunrise alignments made using the Sky Disc to identify the festival days by aligning pegs in holes 23-35 with gold dots and the Sun on the horizon.

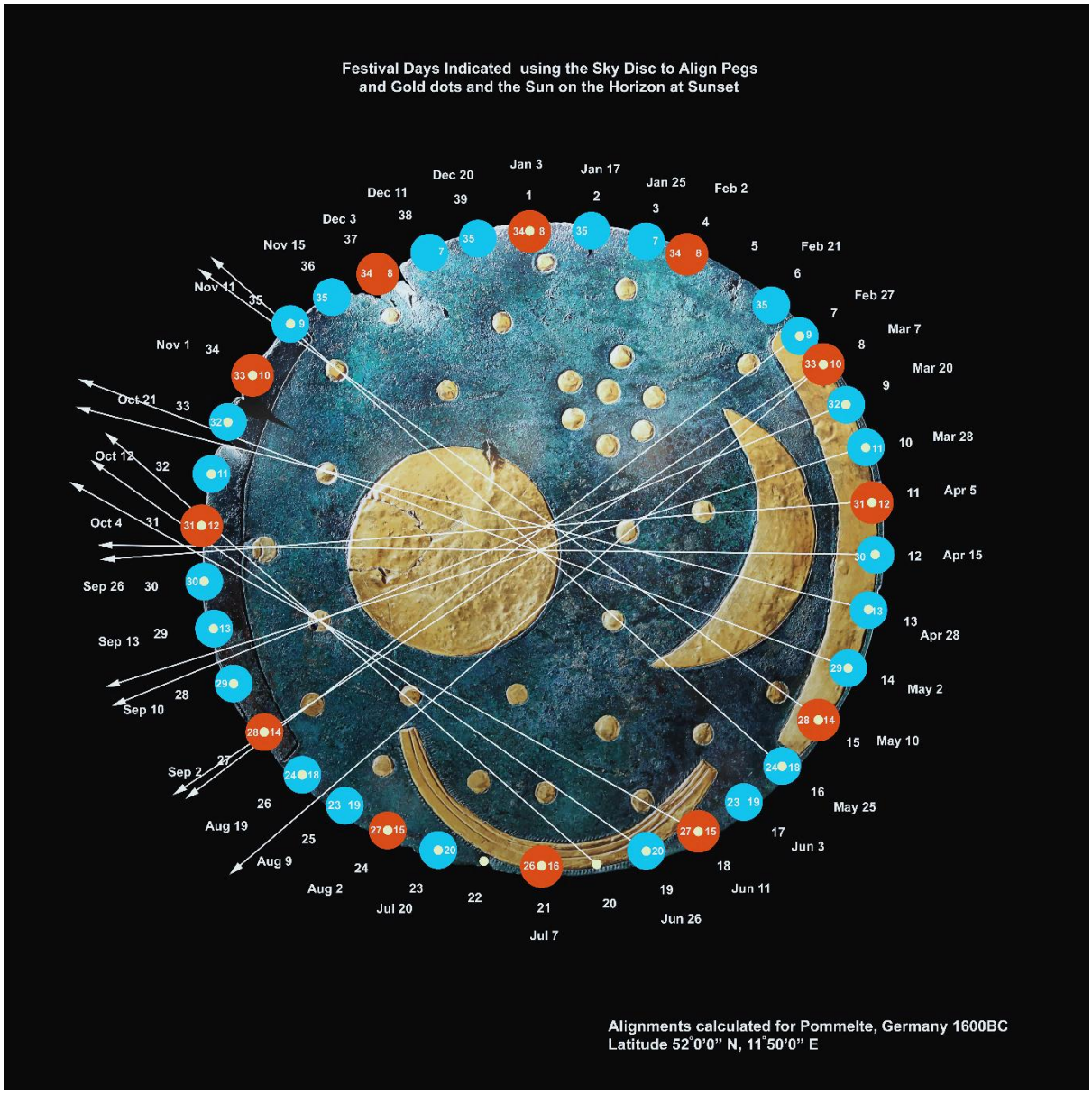


Diagram 60 Sunset alignments made using the Sky Disc to identify festival days by aligning pegs in holes 7-20 with gold dots and the Sun on the horizon.

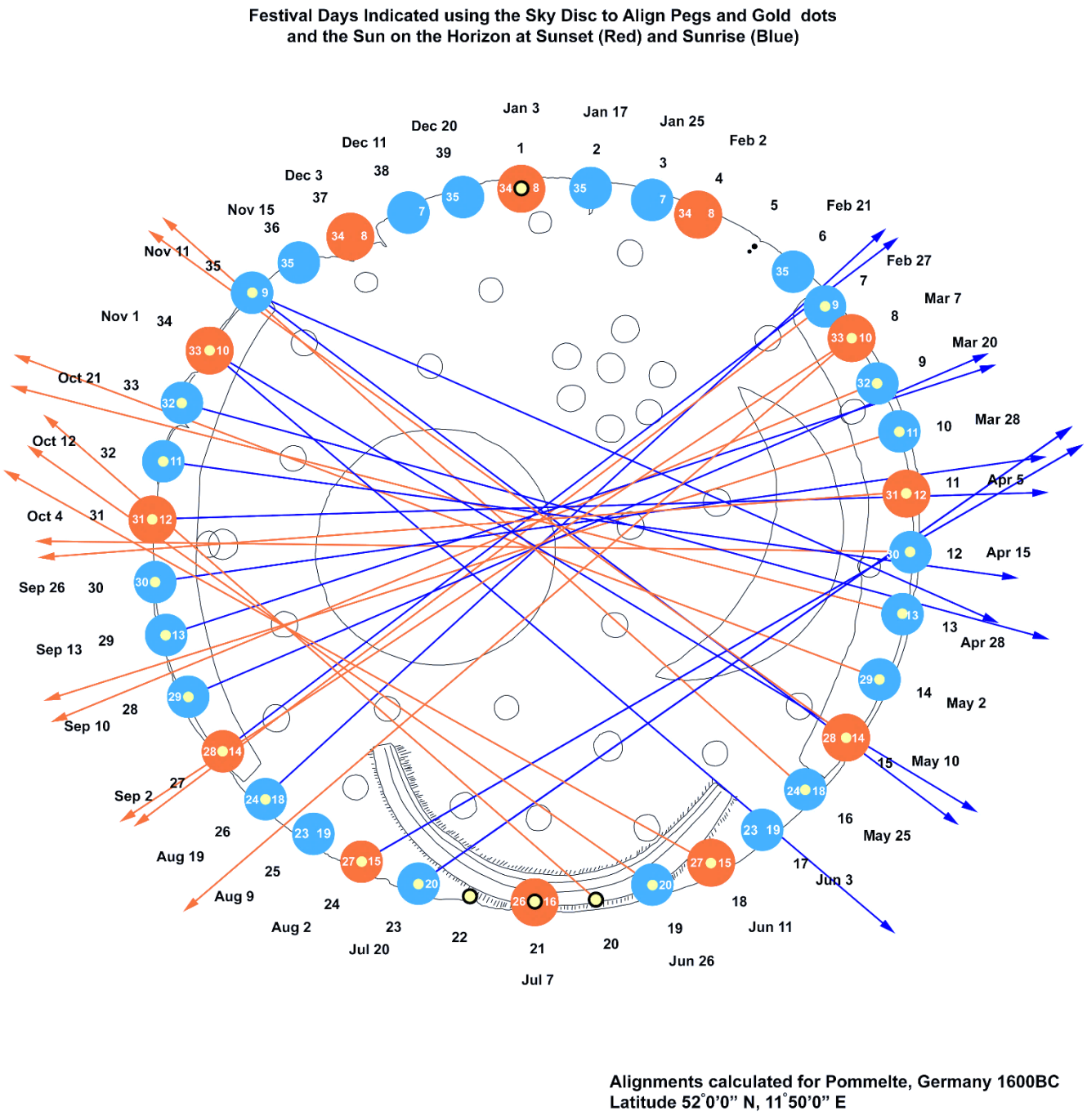


Diagram 61 Sunrise (blue arrows) and Sunset (orange arrows) Alignments for all 36 festival days indicated by alignments on the sky Disc between alignment pegs and gold dots and Festival Marker pins marked by blue and orange circles.

Tables indicating the Festival days, the holes representing these days, the Alignment Peg-holes and gold dots used to identify these festival Days.

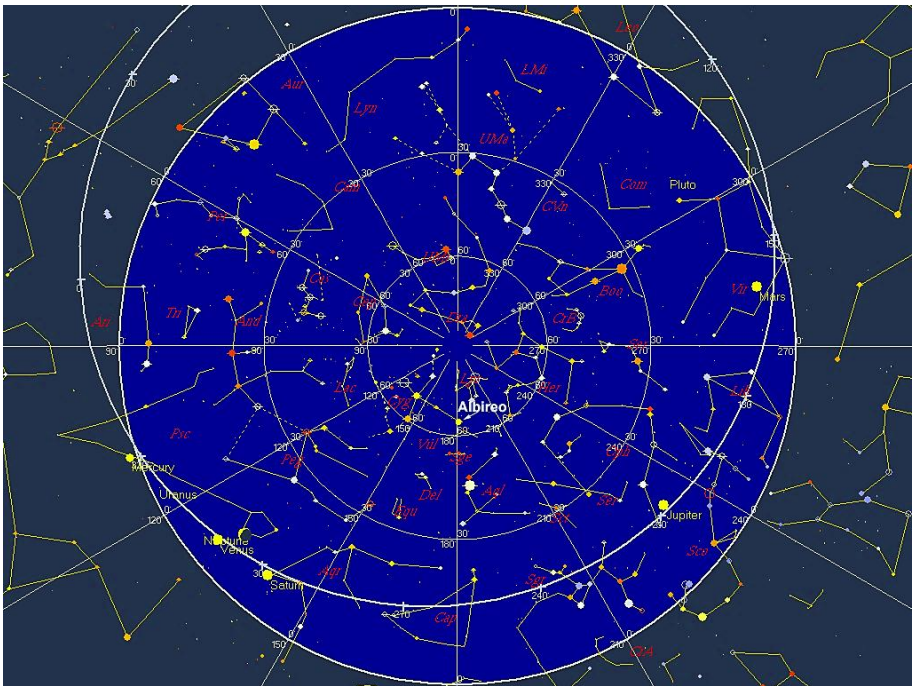
Festival Date	Festival Marker Hole	Sunrise Alignment Peg-hole	Sunrise Alignment Dot	Sunset Alignment Peg-hole	Sunset Alignment Dot	Alignment Peg Hole	Alignment Pegs sharing Festival Marker Hole
Jan 3	1	34	Solar barque (E)	8	Solar barque (W)		
Jan 17	2	35	A	-	-		
Jan 25	3	-	-	7	E		
Feb 2	4	34	J	8	E		
	5						
Feb 21	6	35	X,H,K	-	-		
Feb 27	7	-	-	9	D	7	Jan 25, Dec 11
Mar 7	8	33	I	10	D	8	Feb 2, Dec 3
Mar 20	9	32	I	-	-	9	Feb 27, Nov 11
Mar 28	10	-	-	11	C	10	Mar 7,
Apr 5/6	11	31	H	12	C	11	Mar 28, Oct 12
Apr 15	12	30	H	-	-	12	Apr 5/6, Oct 4/6
Apr 28	13	-	-	13	B	13	Apr 28, Sep 13
May 2	14	29	G	-	-	14	May 10, Sep 2
May 10	15	28	G	14	B	15	Jun 11/12, Aug 2
May 25	16	24	M,K	18	L,D	16	Jul 7
Jun 3	17	23	P,K	19	D		
Jun 11	18	27	F	15	A	18	May 25
Jun 26	19	-	-	20	D,N	19	Jun 3, Aug 9
	20					20	Jun 26, Jul 20

Festival Date	Festival Marker Hole	Sunrise Alignment Peg-hole	Sunrise Alignment Dot	Sunset Alignment Peg-hole	Sunset Alignment Dot	Alignment Peg Hole	Alignment Pegs sharing Festival Marker Hole
Jul 7	21	26	F	16	A		
	22						
Jul 20	23	20	D,N	-	-	23	Jun 3, Aug 9
Aug 2	24	27	F	15	A	24	May 25, Aug 19
Aug 9	25	19	D	23	P,K		
Aug 19	26	18	D,L	24	M,K	26	Jul 7
Sep 2	27	28	G	14	B	27	Jun 11, Aug 2
Sep 10	28	29	G	-	-	28	May 10, Sep 2
Sep 13	29	-	-	13	B	29	May 2, Sep 10
Sep 26	30	30	H	-	-	30	Apr 15, Sep 26
Oct 4/6	31	31	H	12	C	31	Apr 5/6, Oct 4/6
Oct 12	32	-	-	11	C	32	Mar 20, Oct 21
Oct 21	33	32	I	-	-	33	Mar 7, Nov 1
Nov 1	34	33	I	10	D	34	Feb 2, Dec 3
Nov 11	35	-	-	9	D	35	Jan 17, Dec 20 Feb21, Nov 15
Nov 15	36	35	X,H,K	-	-		
Dec 3	37	34	J	8	E		
Dec 11	38	-	-	7	E		
Dec 20	39	35	J	-	-		

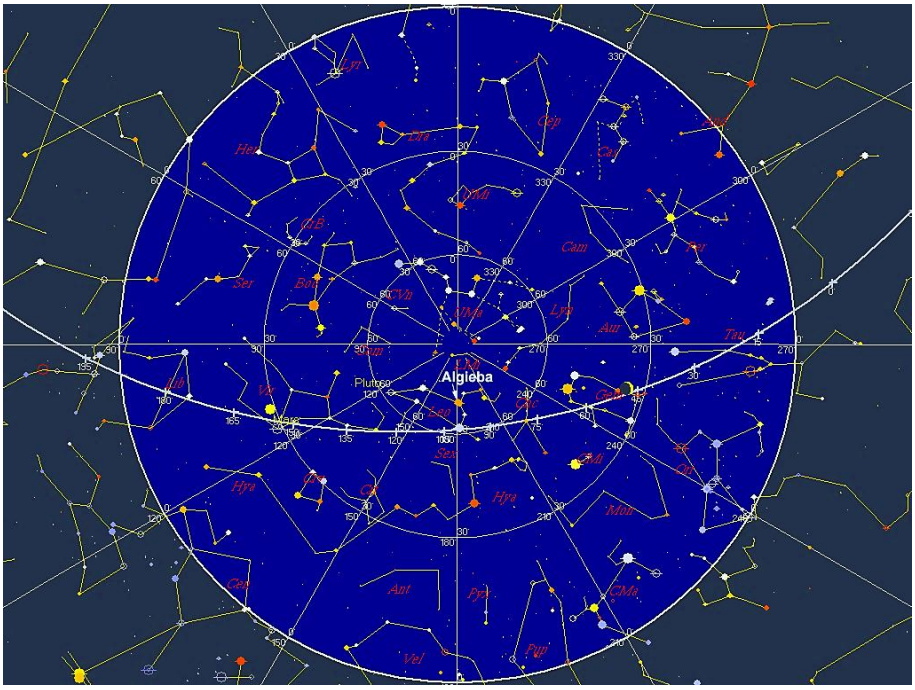
Table 9 The cells marked in light blue are those from holes in the vicinity of the eastern and western bows.The cells marked in green are those connected to the winter solstice alignments made at sunrise and sunset that use the solar barque. The yellow cells are those made from alignments at the bottom of the Sky Disc. The pink columns indicate holes that contain an alignment peg and the festival days that they identify (right hand side)

Mistake or Binary Star?

There is an intriguing possibility that arises from the Sky Disc alignments regarding the strange "Double Dot" which consists of two overlapping dots labelled as "C". This has been considered as a possible realignment of a possibly mis-positioned gold dot that was repositioned overlapping the original circular indentation and then inlaid with a gold dot just a few millimetres to West of its neighbour, but perhaps this overlapping double dot like so much on the Sky Disc was purposefully depicted in this way as yet another example of the ingenuity and knowledge of the disc's astronomer designer. The gold dot C aligns with alignment peg 12 and the setting Sun on March 28th (and October 12th) and with alignment peg 11 and the setting Sun on April 5th (and October 4th). Looking at the alignments on March 28th and a week later on the April 5th corresponding to the alignments of 11C and 12C, a remarkable observation occurs at the Start of Civil Twilight on March 28th when a bright star, Albireo in Cygnus is aligned due South whilst on April 5th at the End of Civil Twilight a bright star Algieba in Leo is aligned due South. The remarkable thing about the alignment of these two stars is that although they appear like normal stars to the naked eye, with a telescope these two stars are what have been described as "one of the finest double stars in the heavens" for Albireo and as "the most beautiful double star in the heavens" in the case of Algieba in Leo. We therefore have two double stars believed to be binary star systems aligned due South in the sky on two days where two alignment pegs align with a "Double Dot" on the Sky Disc. Could this also be just another remarkable coincidence or just further evidence of the skill of the astronomer who designed this endlessly amazing Sky Disc.



Star Map 12 Albireo due South on March 28th at the Start of Civil Twilight



Star Map 13 Algieba due South on April 5th at the End of Civil Twilight

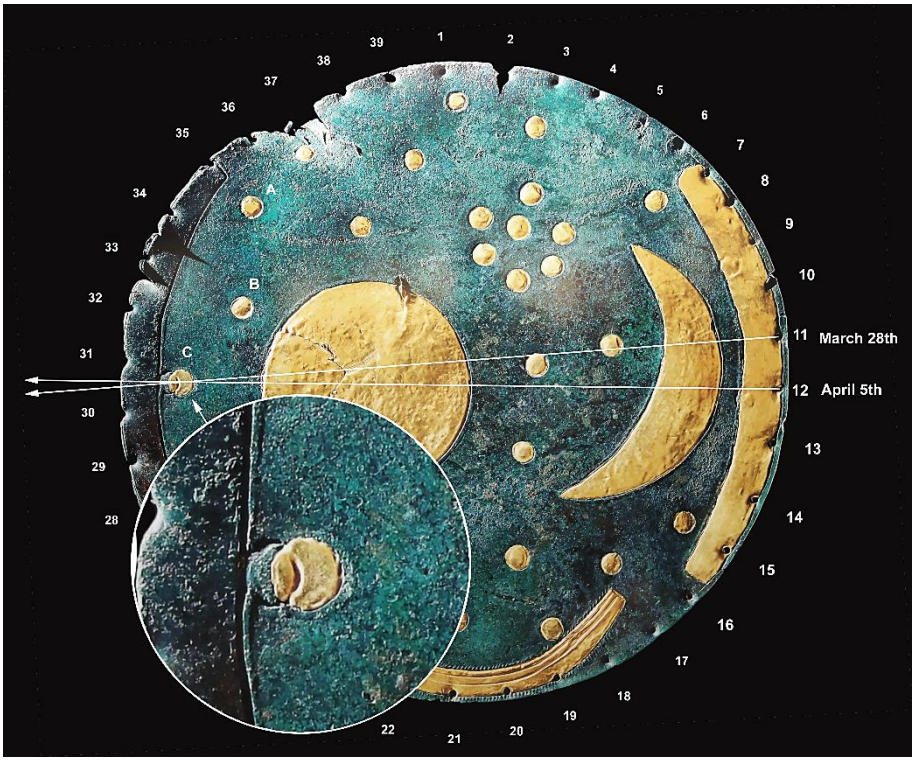


Diagram 62 Double Dot and its alignment with Peg-holes 11 and 12 on March 28th and April 5th at sunset, identifying the days when the Binary Stars Albireo and Algieba are aligned due South at the Start and End of Civil Twilight respectively

The fact that the gold inlay appears to have been pushed down into the overlapping circle of the other circle supports the idea that this double dot was intentionally formed. The two dots are also of different sizes just as the binary stars appear. Finally, the binary star

system Albireo has a bright yellow star accompanied by a smaller blue star so the appearance of the the overlapping gold and blue copper oxide dot replicates the appearance perfectly. There is even the possibility that the appearance of the binary star in 1600BC was different to the present day with the blue star partially masked by its larger yellow companion.

Image of the Binary star Albireo in Cygnus

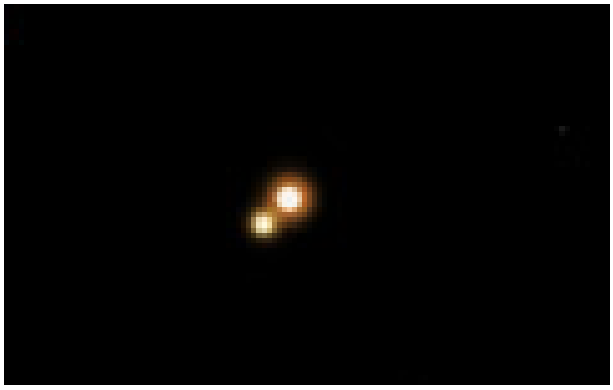


Image of Binary star Algieba in Leo

Even the appearance of Algieba is similar to the double gold dot if one considers the appearance of the gold dot as divided into two by the circular indentation from the second dot that divides the gold dot into two distinct parts.

The festival days when these two binary stars are aligned due South also have stellar and deep space alignments on those days. On March 28th at the Start of Civil twilight M33 the Pinwheel galaxy in Triangulum is due East whilst the Pleiades, M45 is due West at the End of Civil Twilight. On April 5th at the Start of Civil Twilight the Dumbbell nebula, M27 is due South whilst at the End of Civil Twilight Regulus (and Algieba) are due South. It is amazing to think that here portrayed on what might be considered a beautifully but simply decorated disc is the appearance of two binary star systems which shares a remarkable resemblance to both Albireo and Algieba some 3600years ago.

Part V The Sky Disc as a Celestial Map for Galaxies and Nebulae

There is a problem with the idea that the solar alignments using the Sky Disc result in a calendar punctuated by evenly space festival days coinciding with only the alignment of bright stars and the visible deep space objects Mel 111 and the Pleiades either due South, due East, due West or due North at Civil Twilight because the even distribution of festival days relies in part on seven festival days on which no bright stars or visible deep space objects were aligned with cardinal points.

Festival Day	Deep Space Object	Alignment
Feb 2	Stephan's Quintet (Pegasus) Stephan's Quintet M104, Sombrero Galaxy (Virgo)	Due West Dusk Due East Dawn Due West Dawn
Feb 27	NGC 2237, Rosette Nebula (Monoceros) NGC 2264, Cone Nebula (Monoceros)	Due South Dusk Due South Dusk
Apr 15	NGC 3132, Eight Burst Nebula (Vela) NGC7009, Saturn Nebula (Capricorn) M27, Dumbbell Nebula (Vulpecula)	Due South Dusk Due South Dawn Due South Dawn
Jun 12	M57, Ring Nebula (Lyra) M64, Black Eye Nebula (Coma Berenices)	Due East Dusk Due West Dusk
Jun 26	Stephan's Quintet NGC6888, the Crescent Nebula (Cygnus)	Due South Dawn Due East Dusk
Jul 20	NGC2264, the Cone Nebula (Monoeros) M31 Andromeda Galaxy (Andromeda)	Due East Dawn Due South Dawn
Sep 13	NGC 6888, Crescent Nebula (Cygnus)	Due South Dusk

Table 10 The seven festival days indicated by Sky Disc alignments that coincide with cardinal alignments of galaxies and nebulae at the Start of Civil Twilight at dawn and End of Civil Twilight at dusk.

Seven of the thirty-six proposed festival days, including two of the main twelve festivals indicated by the solar alignments on the Sky Disc are associated solely with alignments of galaxies and nebulae rather than visible bright stars as detailed in the following table.

It should also be considered that although there are stellar alignments occurring on the other festival days, there are also alignments of nebulae and galaxies that occur on these days as well and indeed there are more cardinal alignments of deep space objects than simple stellar alignments. Perhaps the alignments of galaxies and nebulae was as important as the stellar alignments. The question is if these deep space object alignments are not coincidental, then how would it be possible for people living at this time to know of the existence of galaxies and nebulae living some 3200 years before the currently accepted date of the invention of the telescope? The only answer, if galaxies and nebulae were seen by the ancients is simply that history is wrong in this respect and that a pre-historic telescope existed thousands of years before Galileo and that this technology was somehow lost before Galileo officially invented or rather re-discovered it. The other issue relates to the magnification power that such a pre-Galilean, prehistoric telescope would need to have in order to see these deep space objects, the telescope would have to have been much more advanced than Galileo's first simple refractor telescopes, something more akin to a 19th Century nine-inch reflector telescope. The problem is that as yet, archaeology has not found evidence of any physical remains of what might be recognised as part of a pre-historic telescope***.

"Oopart" or out-of-place artefact is used to describe an artefact of historical or archaeological interest found in an unusual context which challenges conventional historical chronology and appears too advanced for the technology believed to have existed at the time.

An example of such an oopart, is an ancient artefact, believed to have been constructed by our ancient ancestors somewhere around 87-200BC called the Antikythera Mechanism, an astronomical gear-based clock, discovered in a shipwreck off the coast of Greece, that was more much more technologically advanced than expected from the established historical record that assumed that such clocks were first made in the fourteenth century. Putting the proposal to one side for the moment the occurrence of the galaxy and nebulae alignments can be examined in some more detail to determine how strong a case can be made for these deep space alignments being anything other than chance occurrences.

It should be emphasised that the alignments of the deep space objects with South, East, West and North are quite precise alignments occurring at Civil Twilight on the days indicated by the Sky Disc solar alignments at sunrise and sunset. The total number of incidences of alignment of deep space objects seems very high if they occurred by mere coincidence, moreover particular deep space objects appear to be aligned at a cardinal

position on many different festival days with the possibility that the alignments of these deep space objects were specially selected and at least as important as some of the stellar alignments.

The following table outlines the number of times each of the eighteen deep space objects is aligned with a cardinal position on the days indicated by the solar alignments on the Sky Disc

*** the author has recently discovered strong evidence carved on stones for a telescope dating from 1200BC in Scotland.

Deep Space Object	Common Name	Constellation	Alignments
Mel 111	**Nine Maidens**	Coma Berenices	8
M45	**Pleiades**	Lyra	5
NGC2264	Cone Nebula	Cygnus	5
NGC6888	Crescent Nebula	Taurus	5
Stephan's Quintet	Stephan's Quintet	Pegasus	5
M31	Andromeda Galaxy	Andromeda	5
M57	Ring Nebula	Lyra	5
M64	Blackeye Galaxy	Coma Berenices	4
M27	Dumbbell Nebula	Vulpecula	4
M33	Pinwheel Galaxy	Triangulum	3
M104	Sombrero Galaxy	Virgo	3
NGC7742	Saturn Nebula	Capricorn	2
NGC3132	Eight Burst Nebula	Vela	2
NGC7293	Helix Nebula	Aquarius	2
M51	Whirlpool Galaxy	Canes Venatici	2
NGC7009	Saturn Nebula	Capricorn	2
NGC2237	Rosette Nebula	Monoceros	1
M77	Cetus A Galaxy	Cetus	1

Table 11 Deep Space objects aligned on the festival days indicated by Sky Disc Alignments

The star clusters Mel111 and M45 are visible to the naked eye and therefore the suggestion that they are markers of festival days is not so controversial as the idea that

galaxies and nebulae were also markers. Some argue that with perfect eyesight the Andromeda Galaxy M31 the closest galaxy to Earth is also visible but that still leaves 56 galaxies and nebulae of the 64 deep space object alignments that would only be known if there was some way in which these distant extremely faint deep space objects could be seen.

The deep space objects aligned on the proposed festival days have very distinctive appearances and are some of the brightest and most distinctive galaxies and nebulae in the heavens. The four most frequently aligned deep space objects share a resemblance with three of the gold symbols on the Sky Disc. The nine gold dots associated with Coma Berenices represent the star cluster Mel111 but are visible without the need for a telescope as are the Pleiades represented by the cluster of seven gold dots. The Crescent shape on the disc usually interpreted as being the Moon may instead or also represent the Crescent nebula, NGC 6888 in Cygnus whilst the arc at the bottom of the disc identified as the solar barque has a similar shape to the Sombrero galaxy M104 in Virgo. Moreover, the position of this striated golden arc lies below the gold dots that make up the pattern of Virgo on the Sky Disc reflecting its location in the night sky.

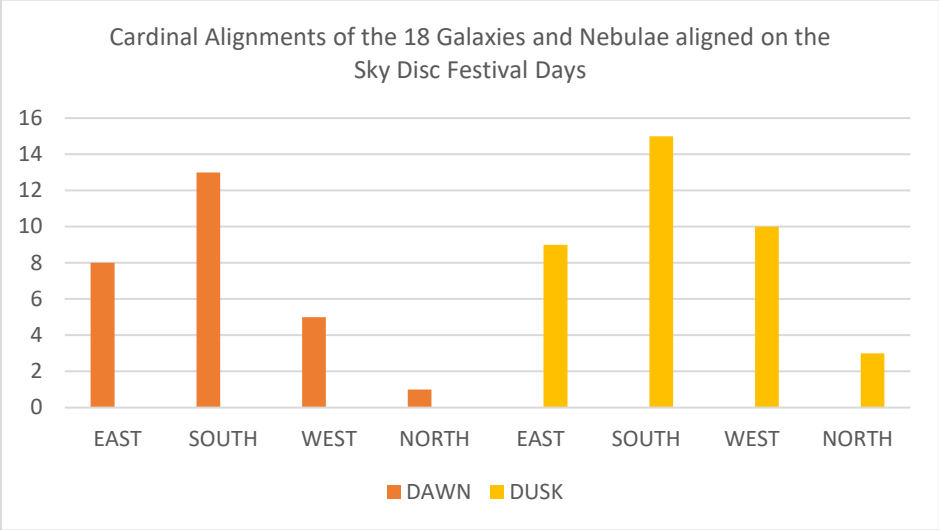
The four stars comprising the Square of Pegasus are unlike the Summer and Winter Triangles and the 7/9 dots of the Pleiades/Nine Maidens, depicted on the Sky Disc in being very rarely precisely aligned with a cardinal point on the festival days. The exception is Scheat in Pegasus which is aligned due East at dawn on one festival day Jan 25th. There are however, two prominent deep space objects in Pegasus, Stephan's Quintet, (comprising NGC 7317, NGC 7318a, NGC 7318b, NGC 7319 and NGC 7320) and the Fried Egg Nebula, NGC 7742 that are precisely aligned on seven occasions on festival days. Perhaps the simple bisection of the Square of Pegasus was used for alignment purposes using the two brightest stars at the top of the Square; Alpheratz to the East and Scheat to the West as marker stars but the Fried Egg Nebula NGC 7742 lying just below the Square of Pegasus bisects the constellation and is aligned on these days and we are left to wonder whether the alignment with NGC 7742 is by design or by chance. The alignment of NGC 7742 and Stephan's Quintet were precisely aligned with cardinal points at Civil Twilight on seven of the 36 festival days indicated by the solar alignments. The Andromeda galaxy M31 aligned five times, is also located right next to Pegasus and may have been considered as associated with the Square of Pegasus at the time the disc was made despite now being considered a part of the adjacent attached constellation of Andromeda especially as the nearby star Alpheratz as one of the four stars comprising the "Square of Pegasus" is itself known as Alpha Andromedae being in the constellation of Andromeda rather than Pegasus. Perhaps the deep space objects in Pegasus were more important than the stars in Pegasus being aligned twelve times (including M31) compared with the single alignment of Scheat due East on a single festival day and the other three stars comprising the Square of Pegasus never aligned on a festival day.

The frequency of alignment of deep space objects and the cardinal positions they occupy at Civil Twilight on the festival days can be analysed to see whether those patterns are likely to be coincidental. It might be expected that the frequency of alignments would be similar for each of the deep space objects and likewise that their alignments with the cardinal points would be randomly distributed if their alignment occurred by chance.

Deep Space Object	Start of Civil Twilight				End of Civil Twilight				Total
	E	S	W	N	E	S	W	N	
Mel 111		1	1			2	2	1	8
M45	1	1	1		1		1		5
NGC2264	1		1		1	1	1		5
NGC6888	1	2			1	1			5
Stephan's Quintet	1	1			1	1	1		5
M31	1	1			1	1	1		5
M57		1	1		1	1	1		5
M64	1				1		1	1	4
M27		2				1	1		4
M33	1				1	1			3
M104			1		1		1		3
NGC7742		1				1			2
NGC3132		1				1			2
NGC7293		1				1			2
M51				1				1	2
NGC7009		1				1			2
NGC2237						1			1
M77						1			1
Totals	8	13	5	1	9	15	10	3	64

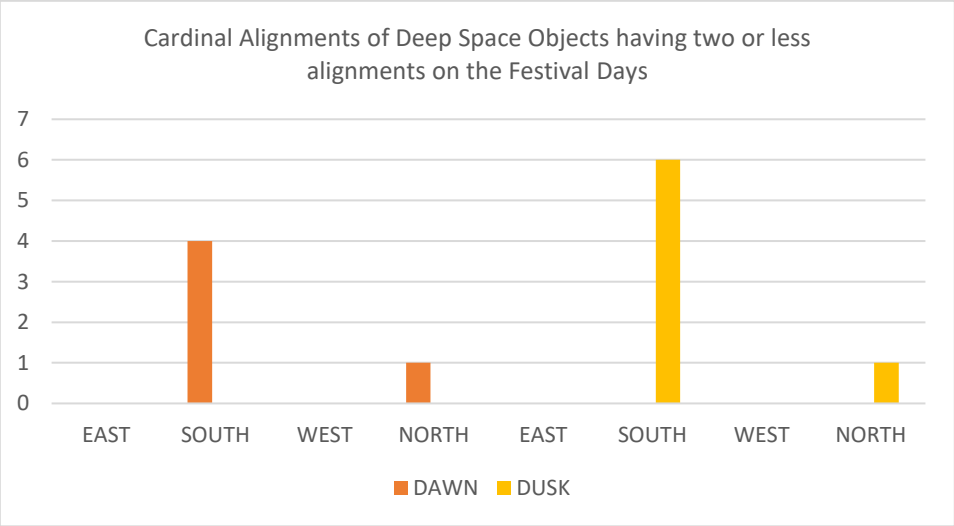
Table 12 Frequency of alignments of deep space objects and the cardinal alignment

There are many cardinal alignments of deep space objects on the festival days and the most frequent alignment at Civil Twilight is due South both for the dawn and dusk alignments.



Graph 2 Distribution of the cardinal alignments of all 18 deep space objects aligned on the 28 festival days indicated by the Sky Disc alignments with the Sun on the horizon.

The significance of the alignment of galaxies and nebulae particularly due South at Civil Twilight is emphasised when nine of the galaxies and nebulae with only one or two alignments (marked by the pale green shaded area on the table) are examined and, of the twelve cardinal alignments of the seven galaxies and nebulae, ten are due South, and two are due North whilst none are due East or due West. The likelihood of this distribution of all the alignments occurring on the North South axis by chance is very small.



Graph 3 Detail of the nine galaxies and nebulae aligned on the festival days indicated by the Sky Disc that have only 1 or 2 alignments on those days. The deep space objects are NGC7742, M33, NGC7009, M27, NGC3132, NGC2237, M77, NGC7293 and M51

The distribution of alignments of the eighteen deep space objects cardinally aligned on the festival days indicated by alignments on the Sky Disc shows that the alignments are predominantly due South. Furthermore, there are significantly more alignments at dusk at the End of Civil Twilight when they are more easily visible as skies darken than at the Start of Civil Twilight when it lightens. The distribution is consistent with the suggestion that days when deep space objects were cardinally aligned at Civil Twilight may have been specially selected.

The next challenge is to determine whether the particular deep space objects aligned with cardinal points on the 36 festival days indicated by alignments between the peg-holes and gold dots on the Sky Disc can be revealed on the Sky Disc perhaps in the same way that the shapes of the constellations were revealed. It has already been shown that given a cluster or cloud of dots it is possible to join them in all manner of ways to create any number of desired shapes and it would perhaps be of no surprise if ways could be found to form shapes that had the same general appearance of each of the galaxies and nebulae. However, bearing in mind that the patterns of constellations on the Sky Disc were designed to indicate the brightest star in each constellation using the same gold dot, as evidence that the constellation patterns were intentional, it may be possible that images of deep space objects were also portrayed in such a way as to include more evidence that they too appear by clever design. It would be ideal if for instance if apart from being able to join gold dots on the Sky Disc in a way that gave a good representation of the appearance of a galaxy or nebula, that it also provided some information that indicated the location of that deep space object in the heavens. It is understood that the idea of the Sky Disc made some 3600 years ago having images of galaxies and nebulae being revealed from the pattern of decoration on its surface seems so unlikely and incredible that it will most likely be instantly dismissed by many without any further thought. However, if a high level of supporting evidence can be obtained from the Sky Disc, then it deserves proper consideration.

The ideal evidence for the proposal that the appearance of galaxies and nebulae was known by the person who designed the disc would be that the Sky Disc could be used to reveal

1) the appearance of each of the eighteen galaxies and nebulae formed using the pattern of gold dots and other symbols on the Sky Disc and show a close resemblance to the deep space objects themselves and

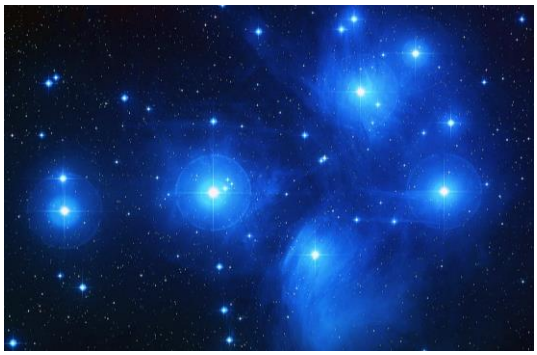
2) the neighbouring constellations of the galaxy or nebula or star cluster by joining dots remaining from 1) in such a way that they too form recognisable representations of those neighbouring constellations

   and finally

3) an indication of the location of the deep space object in relation to its neighbouring constellations is provide

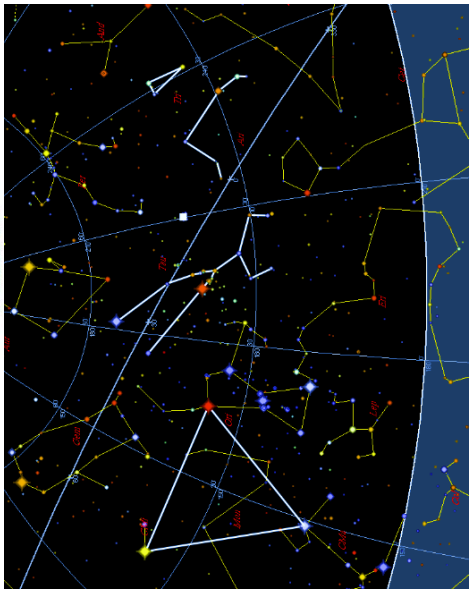
M45 The Pleiades in Taurus

It might be expected that the easiest of the deep space objects to find would be the star cluster known as the Pleiades given that it is visible to the naked eye and that we know how and where on the disc the cluster of seven gold dots representing it is depicted.



The method of analysis revealed by the portrayal of the Pleiades on the disc is to firstly satisfy the requirement of portraying the deep space object illustrated as a pattern of yellow dots, representing the cluster of seven stars in M45. The second requirement involves creating a star map where the constellations neighbouring the Pleiades are portrayed as patterns of stars depicted as white dots joined by lines. The final dot remaining, coloured red, should mark the location of the deep space object in relation to the surrounding constellations.

M45, Pleiades in Taurus



Star Map 14 Triangulum, Aries, M45, Taurus, Winter Triangle

Diagram 64 Aries (top right) represented by six white dots lie above M45 (yellow dots) and Triangulum (top left) with Taurus below all depicted in white. The other triangular shape beneath Taurus represents the Winter Triangle formed from the three bright stars Betelgeuse in Orion, Sirius in Canis Major and Procyon in Canis Minor. The red dot indicates the approximate location of M45.

In this way all the visible gold dots on the disc are utilised in portraying the appearance of the Deep Space Object, the neighbouring constellations and the position of the deep space object. The Star map on the right shows the position of the Pleiades, M45 (small white square), relative to Taurus and Aries with Triangulum shown above Aries. The winter triangle comprising Betelgeuse in Orion, Procyon in Canis Minor and Sirius in Canis Major lie below Taurus just as indicated on the disc interpretation as a triangular arrangement of white dots.

The pattern of constellations revealed by the joining of the gold dots is distorted especially in the case of Taurus but there is a general fit with the pattern of stars seen in the night sky. The red dot marks the approximate position of the Pleiades between Taurus and Aries.

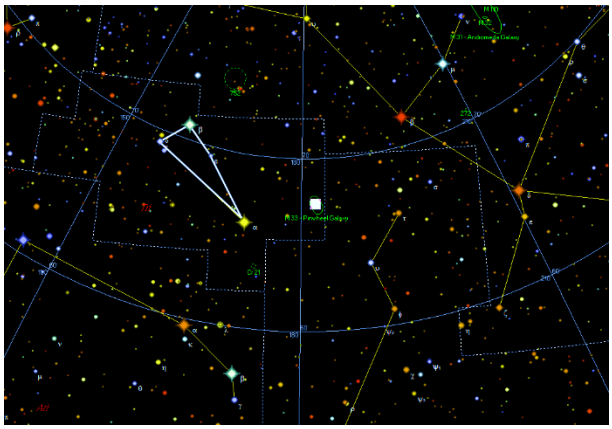
It can be seen how the positions of the stars are not a perfect match for the constellations and how a computer would miss the so-called match especially given the addition of the shorthand symbol of the Winter Triangle* but when the individual star groups are formed from the dots somehow the similarity with the night sky is very strong and it can be imagined how the disc could have been used to almost magically demonstrate the location of the Pleiades in a way that is both accurate and memorable. The Pleiades are visible to the naked eye but the next series of deep space objects are not visible without the use of a telescope.

* the same three gold dots used to represent the Winter Triangle were used to represent the Summer Triangle when the Sky Disc was broken down into eight segments.

During the exercise of forming star patterns of ten constellations by joining the gold dots on the disc it was found that three gold dots represented the brightest stars in the ten constellations. When these three gold dots are joined together, they form a triangle that is similar to the shape of the constellation of Triangulum. The Pinwheel galaxy M33 lies in close proximity to Triangulum and its position relative to the triangle can be marked by choosing the closest gold dot to that position which we have marked as a red dot. The remaining gold dots are coloured yellow and joined with yellow lines to see whether a close resemblance of the deep space Pinwheel galaxy can be represented.

Pinwheel Galaxy M33 in Triangulum

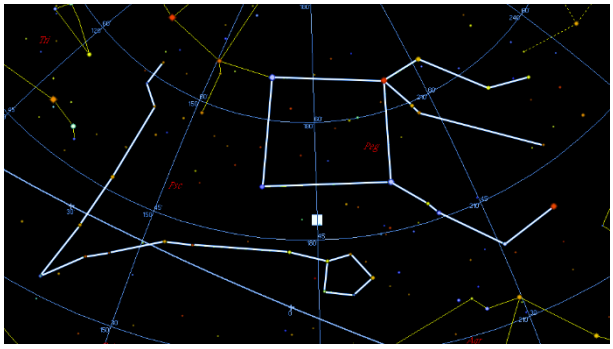
Diagram 65 The Pinwheel galaxy shown in yellow whilst the white dots are joined to form the constellation of Triangulum and the red dot is the position relative to Triangulum where the Pinwheel galaxy can be found.



Star Map 15 to show the the Pinwheel galaxy in relation to the constellation Triangulum.

NGC7742 in Pegasus

Diagram 66. The dots indicated in yellow have been joined to form the rings of NGC 7742 with the large gold circle or yolk at its centre. The remaining dots indicated in white can be joined to form the Square of Pegasus and the constellation of Pisces which sandwich NGC 7742. The red dot marks its location.



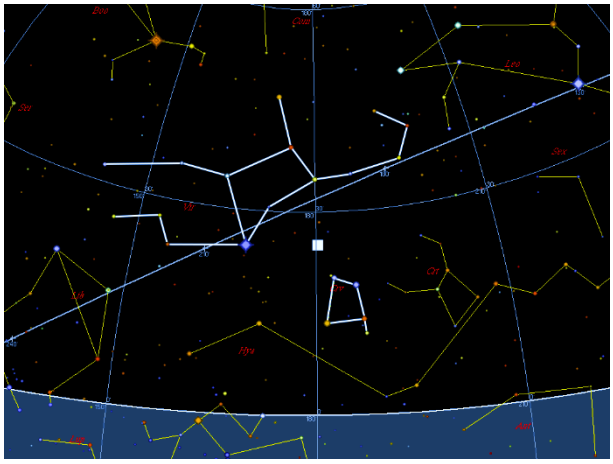
Star Map 16 NGC 7742 shown as the white square positioned between the Square of Pegasus and the head of Pisces

The Fried Egg galaxy, as its popular name suggests, has a distinctive appearance. The yellow centre has a similar appearance to the gold circle on the disc and this is the frame of reference to finding NGC 7742 on the disc. Two rings of dots are formed around the gold circle to replicate the appearance of the Fried Egg Nebula. The Square of Pegasus and Pisces are formed as the neighbouring constellations and the remaining gold dot is coloured red indicating the location of NGC 7742. This process allows the "invisible" deep space object to be depicted in yellow as one magnified layer and its position amongst the visible star groups depicted in white can be simultaneously seen with the "spare" gold dot depicted in red identifying reasonably accurately the location of the deep space object relative to the constellations of Pisces and Pegasus, so combining the two layers.

The interpretation of how you join the dots on the disc is obviously a subjective one, but the fact that it can be done at all let alone in such an apparently effective way, is remarkable and must go some way to persuading justifiable sceptics that despite our preconceived ideas telling us this must be impossible, the disc may indeed have been used as an advanced astronomical map and calendrical tool. However, it will still be argued by many that it must be coincidental and that dots can be joined in an almost endless number of ways to make anything you want appear, and it is hard to argue against this type of determined scepticism. Perhaps if every one of the many deep space objects, identified as being aligned on stellar festival days, can be portrayed in such a manner then though incredible, the logic of the improbability of this being achievable for each galaxy and nebulae from chance alone becomes astronomically small and we are left with no other alternative than to accept that the patterns of dots on the disc were ingeniously chosen to allow the appearance and location of deep space objects to be portrayed. The fact that these same deep space objects were the ones that were precisely cardinally aligned on the festival days identified by the alignment of pegs and gold dots on the Sky Disc is further evidence of the likelihood that this occurs by design.

The Sombrero Galaxy M104 in Virgo

Diagram 67 The Sombrero galaxy, M104 is indicated in yellow whilst the remaining white dots show the constellations of Virgo (top) and Corvus just below Virgo and the remaining red dot indicating the position of M104 relative to these constellations.



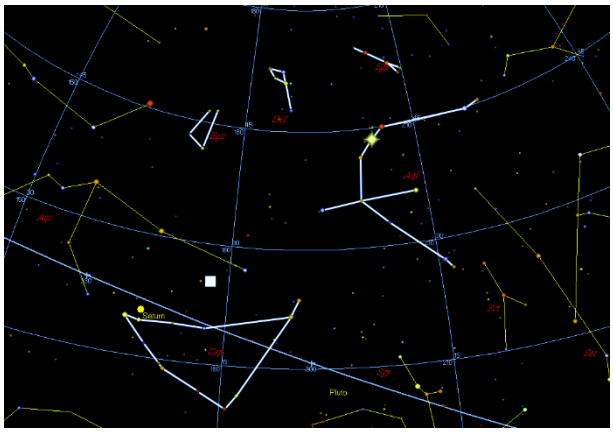
Star Map 17 image showing position of M104 as a white square between Virgo and Corvus

The Sombrero galaxy, M104 shares a similarity of appearance with the striated gold arc on the Sky Disc that was suggested as representing a solar barque.

Once again the slightly distorted image is none the less remarkably similar to the pattern of stars seen in the night sky. It isn't an exact mapping and it can be argued whether the pattern of yellow dots is a reasonable representation of the Sombrero galaxy, but given that these dots are representing so many different layered pictures of the night sky and that such a fit of a deep space object alongside its neighbouring constellations can be made must be regarded as very surprising.

The Saturn Nebula NGC 7009 in Capricorn.

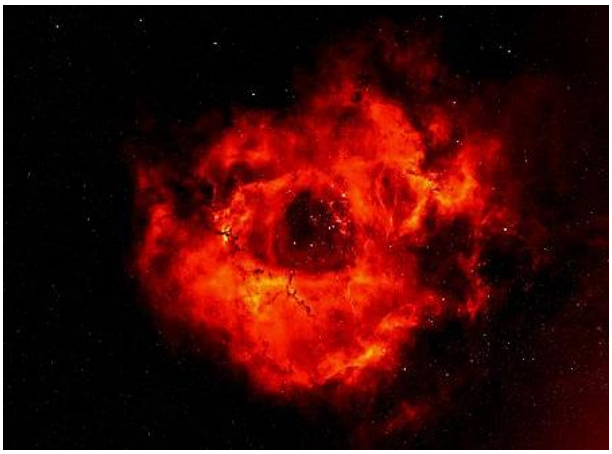
Diagram 68 The Saturn nebula is portrayed by the gold circle coloured yellow and two yellow dots located on either side of it whilst the white dots have been joined to form the constellations of Capricorn (bottom), Aquila (mid-right), Equuleus (top left), Sagitta (top) and Delphinus (below Sagitta). The red dot shows the position of the Saturn nebula above the ears of what was identified as the "Cat head God" or between the horns of Capricorn as the constellation later became associated with a fish-tailed goat.



Star Map 18 showing the position of the Saturn nebula NGC7009 as a small white square between Capricorn and Equuleus and Aquila with Delphinus and Sagitta above. The pattern of constellations and position of the Saturn Nebula above Capricorn appears to faithfully resemble the pattern of joined up dots on the Sky Disc.

Once again, the pattern that can be made to emerge from the disc bears a remarkable similarity to the night sky and each time a close resemblance of both a deep space object and its position surrounded by the correct neighbouring constellations can be achieved, the more likely it becomes that this was the intention of the Sky Disc's designer.

The Rosette nebula NGC 2237 and the adjacent Cone Nebula NGC 2264 in the constellation of Monoceros, the Unicorn.



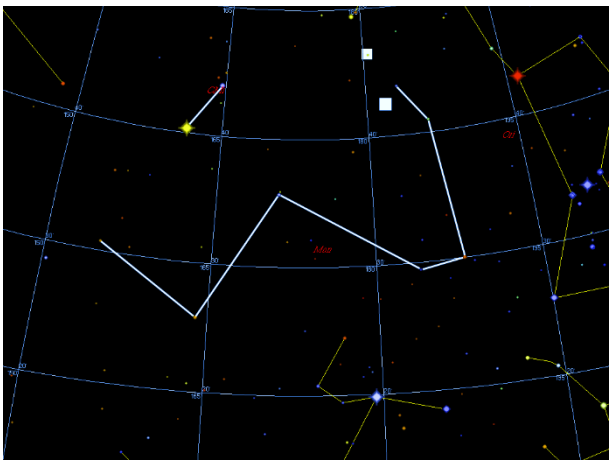
The Rosette nebula NGC 2237 in Monoceros

The Cone nebula NGC 2264 in Monoceros represented as a red triangle on the Sky Disc diagram.

The Rosette nebula is shown in yellow whilst the constellations of Monoceros (bottom) and Canis Minor (the two stars above Monoceros) are shown in white. The remaining gold dots are depicted in red and show the position of both the Rosette nebula as one red dot and the Cone nebula NGC 2264 which is depicted as three gold dots as a red triangular

cone. It is perhaps pertinent that a cone-shaped nebula is associated with a constellation that is called the Unicorn and it would be interesting to examine the date at which this constellation became identified with the unicorn to see whether the mythology pre-dated the supposed invention of the telescope and thereby help to start to break down the assumption that the telescope is a seventeenth century invention.

Diagram 69 The Rosette Nebula in yellow and the Cone Nebula (red triangle), adjacent nebulae in Monoceros, the Unicorn. The single red dot marks the position of the Rosette nebula relative to Monoceros



Star Map 19 showing the positions of the Rosette nebula NGC2237 shown as a white square with the Cone Nebula NGC2264 also depicted as a white square positioned just above it in the constellation of Monoceros. The constellation of Canis Minor with its brightest star Procyon is also indicated.

MEL 111 The Nine Maidens, Coma Berenices

As previously shown, the seven dots forming a cluster could also be interpreted as a cluster of nine stars by including two other adjacent gold dots, to form a star cluster known as Mel 111, the Nine Maidens. The Nine Maidens are located in the constellation of Coma Berenices, this association being revealed from evidence from Scotland in the form of Pictish carved symbols of Combs representing the constellation of Coma Berenices with their comb spines decorated with nine lozenges representing a cluster of nine stars (see Appendix). The Sky Disc may itself also be able to independently support this association if the pattern of golden dots on the disc can be joined to show Mel 111, and neighbouring constellations together with its position in Coma Berenices

Mel 111, Cluster in Coma Berenices

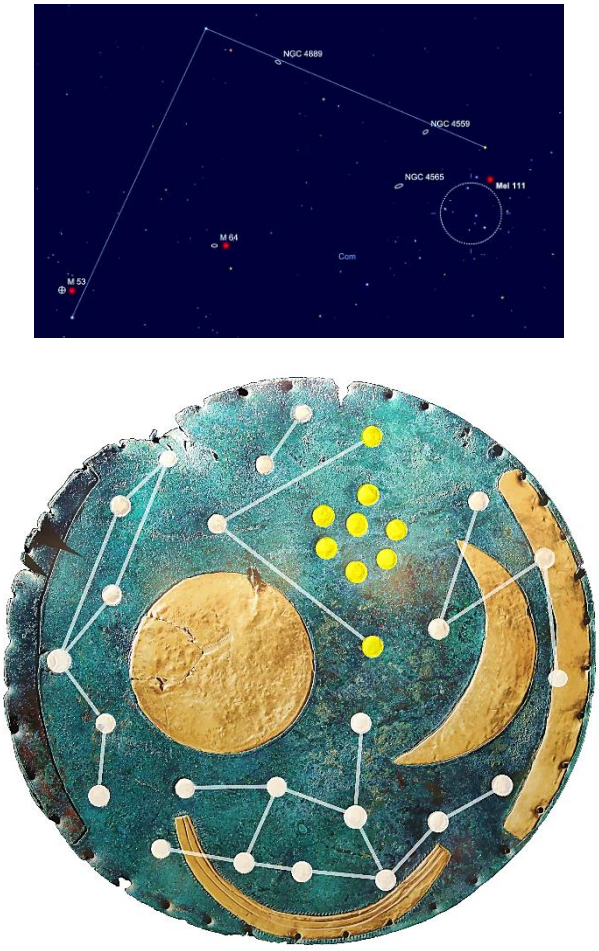
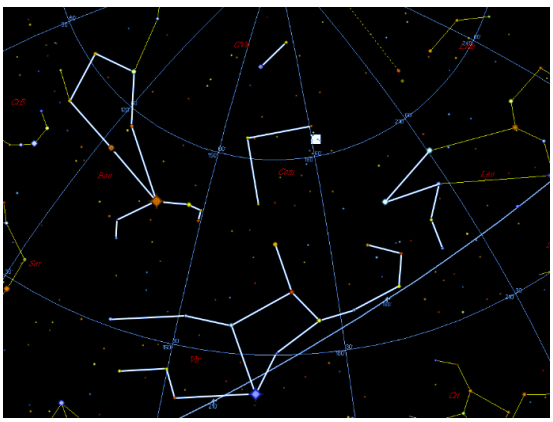


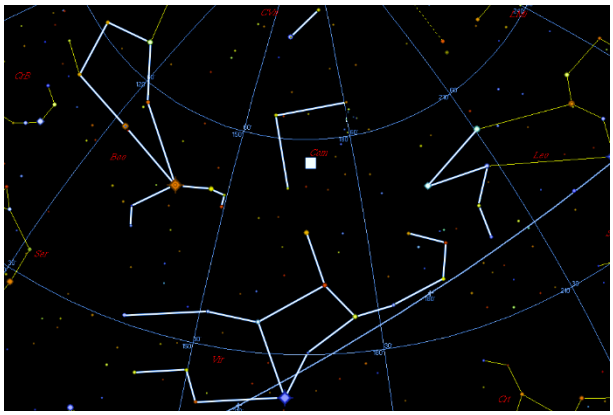
Diagram 70 The Nine Maidens represented as yellow dots as a star cluster within and forming part of the Constellation of Coma Berenices depicted as a white near-right angle. The other neighbouring constellations of Virgo(bottom), Bootes (left), Canes Venatici (top) and the rear of Leo (right)are portrayed.



Star Map 20 Coma Berenices, Virgo, Bootes, Canes Venatici and the rear of Leo appear to closely resemble the pattern of gold dots that can be formed to represent Mel 111 (white square) and the surrounding constellations.

M64 The Black Eye Galaxy, Coma Berenices

Diagram 71 The Black Eye galaxy is shown in yellow with the neighbouring constellations shown in white. The position of the Black Eye galaxy within Coma Berenices is shown by the red dot.



Star Map 21 The Blackeye galaxy M64 in Coma Berenices is indicated on the star map by a white square.

NGC6888, the Crescent Nebula in Cygnus

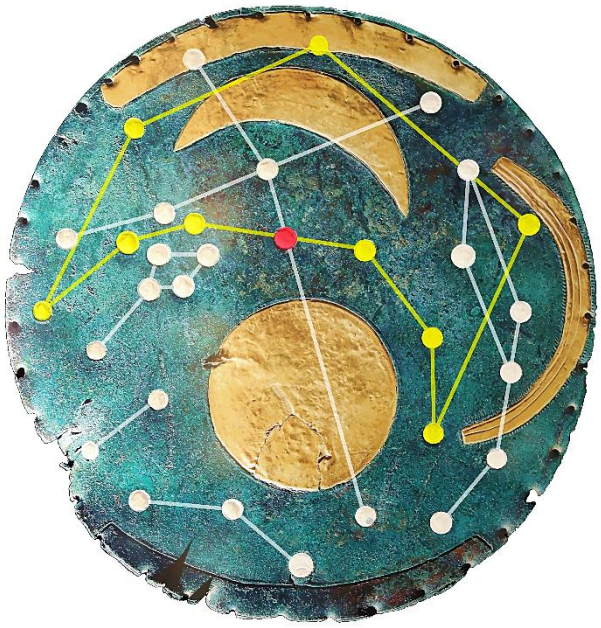
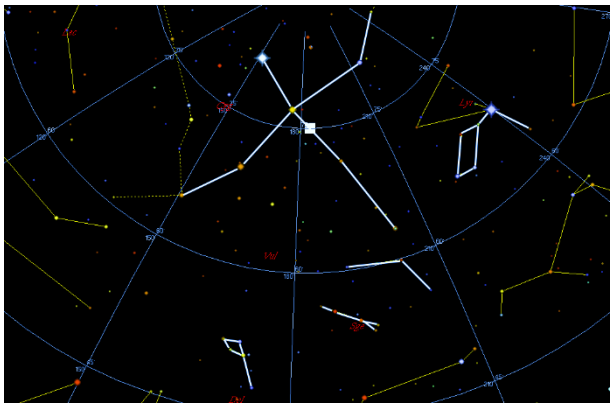


Diagram 72 NGC6888 is shown by the yellow crescent surrounding the gold crescent on the Sky Disc and neighbouring constellations of Cygnus, Delphinus (mid left), Sagitta (bottom left), Vulpecula (bottom) and Lyra (right) depicted in white. The position of the Crescent nebula amongst these constellations is indicated by the red dot.



Star Map 22 showing the Crescent nebula NGC6888 indicated by the white square within Cygnus and the neighbouring constellations Delphinus, Sagitta, Vulpecula and Lyra

NGC 7293, the Helix Nebula

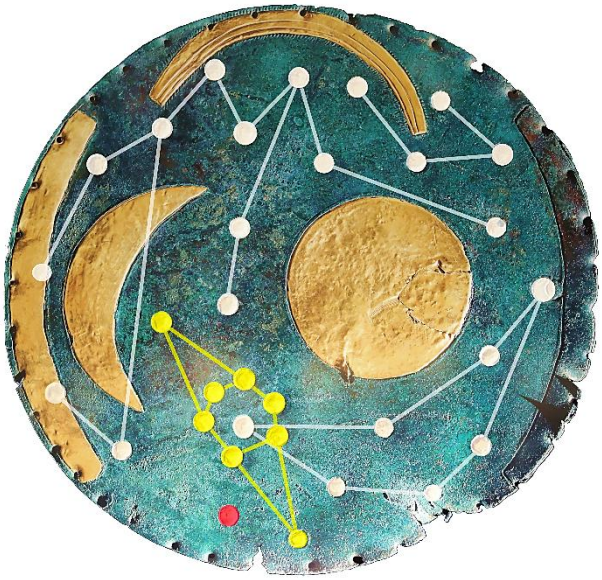
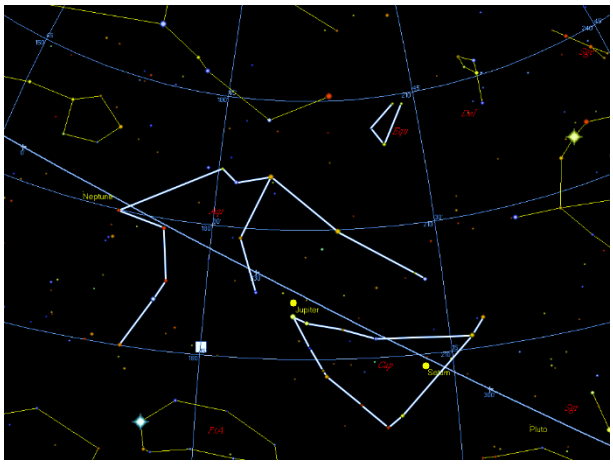


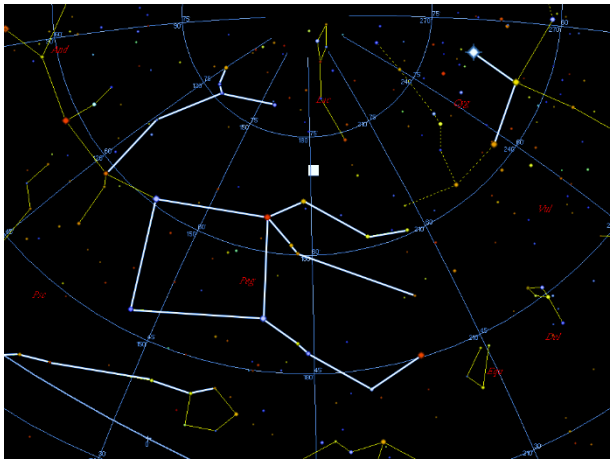
Diagram 73 The Helix nebula is shown in Yellow as an eye. The neighbouring constellations of Capricorn (bottom), Aquarius (top left) and Equus (top right) are shown in white and the position of the Helix nebula between Capricorn and Aquarius shown by the red dot.



Star Map 23 showing the position of the Helix nebula NGC7293 (white square) in relation to the neighbouring constellations of Aquarius, Capricorn and Equus above.

Stephan's Quintet in Pegasus (NGC 7317, 7318a, 7318b, 7319 and NGC7320)

Diagram 74 Stephan's Quintet depicted in yellow. Neighbouring constellations depicted in white are Pegasus (centre) with part of Andromeda (top left), Cygnus (top right) and Pisces (bottom)



Star Map 24 Stephan's Quintet shown with a white square with Pegasus below and part of Cygnus above to the West and part of Andromeda to the East and Pisces below.

M27 The Dumbbell nebula in Vulpecula

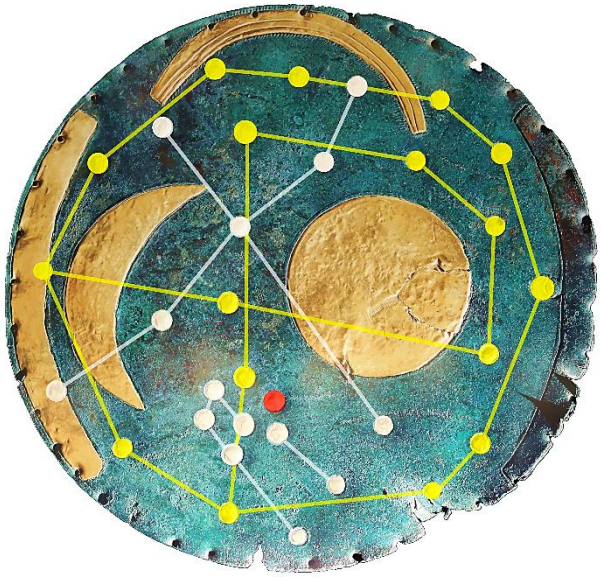
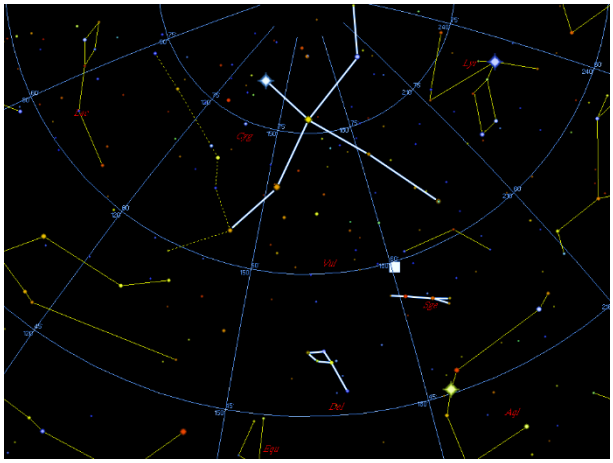


Diagram 75 The Dumbbell nebula is depicted in yellow. The neighbouring constellations Cygnus, Delphinus (bottom) and Sagitta (above Delphinus) are shown in white and the position of M27 depicted by a red dot.

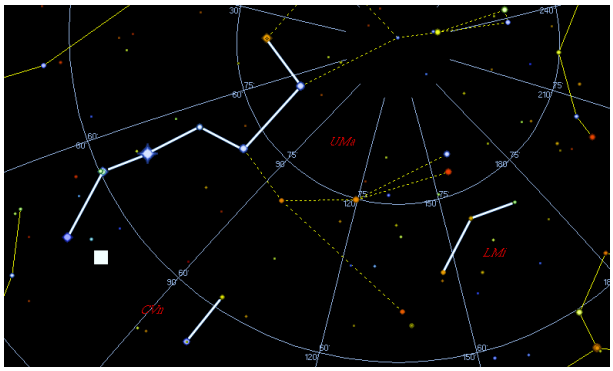


Star Map 25 Image of the Dumbbell nebula, M27 in Vulpecula shown as a white square between Cygnus and Sagitta just as it can be portrayed on the Sky Disc

M51, The Whirlpool Galaxy in Canes Venatici

The Whirlpool galaxy has an unusual, distinctive appearance in having a second smaller galaxy NGC5195 attached to one of its spiralling arms.

Diagram 76 The Whirlpool galaxy shown in yellow with its neighbouring constellations Canes Venatici (bottom), Ursa Major (top) and Leo Minor (right) shown in white. The Red dot shows the position of M51

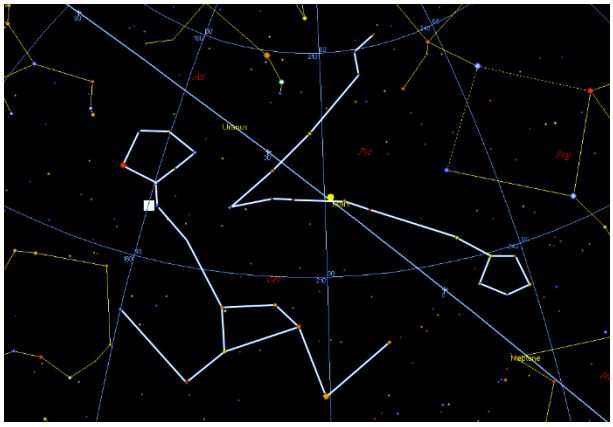


Star Map 26 showing the Whirlpool galaxy, M51 as a white square above the constellation of Canes Venatici and below Ursa Major with Leo Minor at the bottom.

M77 in Cetus

M77 is a spiral galaxy that varies from M33 and M51 in that it appears to have just two simple spiral arms.

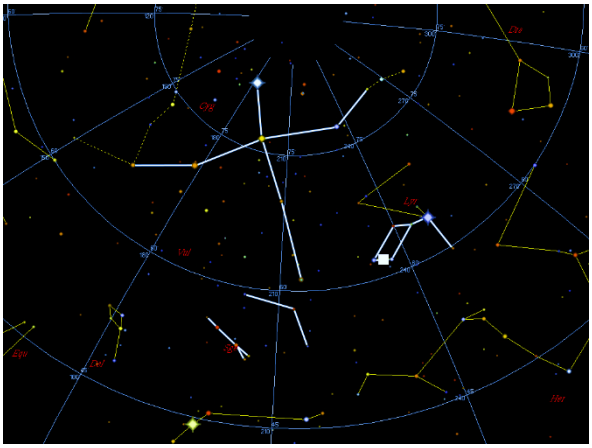
Diagram 77 M77 is shown in yellow with the neighbouring constellations Cetus (top left to bottom right) and Pisces (top right) shown in white with the location of M77 shown by the red coloured remaining gold dot.



Star Map 27 shows M77 as a white square beside the constellation of Cetus with Pisces to the West

M57, The Ring Nebula in Lyra

Diagram 78 The Ring nebula in Lyra is shown in yellow with neighbouring constellations Lyra (top right), Cygnus (top), Vulpecula (middle left) and Sagitta (left). The position of M57 in Lyra is shown by the red coloured gold dot.



Star Map 28 shows M57 as a white square in Lyra with nearby Cygnus, Vulpecula and Sagitta.

M31, Andromeda Galaxy

The galaxy forms a triplet of galaxies with the adjacent galaxies M32 and M110.

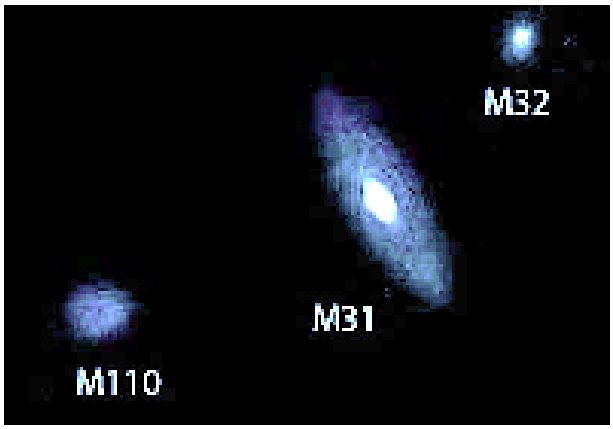
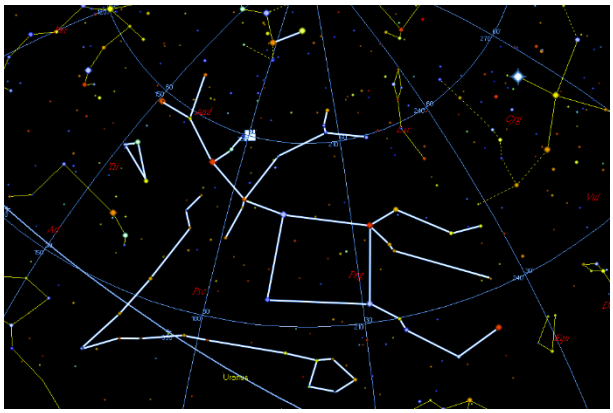


Diagram 79 The galaxies M31, M110 and M32 are represented by the three red dots. Andromeda and Pegasus (left to right) Triangulum (bottom left) ans part of Casseiopeia (top) are depicted in white whilst the pattern representing Pisces (bottom) is distorted.



Star Map 29 showing the Andromeda Galaxy (white square) in relation to the neighbouring constellations.

NGC3132, the Eight-Burst Nebula

The final deep space object aligned due South at the End of Civil Twilight on the festival day of April 15th is the Eight Burst Nebula (NGC3132) lying in the constellation of Vela.

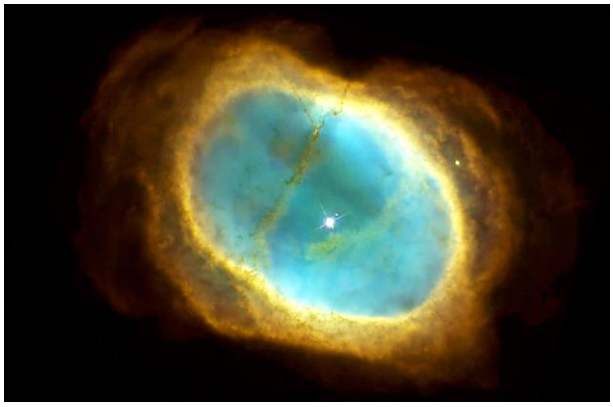
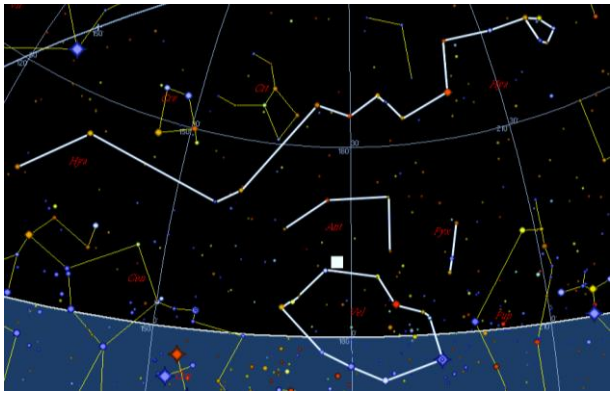


Diagram 80 The constellations of Vela (bottom) with Antlia (centre), Pyxis (right) and Hydra(top) are depicted in white. The Eight Burst Nebula NGC3132 is shown in yellow, its position above Vela shown by the red dot.



Star Map 30 showing the position of the Eight Burst Nebula (white square) above Vela with the constellations of Antlia and Hydra above with Pyxia to the West the pattern on the Sky Disc.

Conclusions

The Sky Disc is a truly amazing object and it is apparent that what seems on first appearance to be a beautiful but simply decorated gold and oxidised, copper-blue bronze disc actually conceals a multitude of fantastic complex astronomical and celestial information of an incredibly advanced level. The results of this study have demonstrated that however unbelievable, this artefact had the potential to have been used both as a Celestial Map and as a Calendrical Device. Three, star groups, two, star clusters, ten constellations, and even eighteen galaxies and nebulae can be revealed using the pattern of gold dots decorating the Sky Disc together with information about which are the brightest stars in the constellations and where deep space objects are located relative to their neighbouring constellations. The Sky Disc achieves this remarkable feat by overlaying a multitude of patterns of stars and deep space objects on top of each other and requires only that the patterns are disentangled from each other and that the gold dots are joined by imaginary lines in particular ways to produce patterns of stars that closely resemble the appearance of the constellations and deep space objects in the night sky. The Sky Disc has another purpose in that it could have been used as a Calendar and Calendrical sighting device where a peg placed in holes around the perimeter of the Sky Disc can be used to align with the Sun on the horizon and gold dots across the Sky Disc to identify particular days that were celebrated as festival days some 3600 years ago in Bronze Age Germany. The festival days indicated by the Sky Disc alignments appear to coincide with days when the brightest stars are aligned either due South, due East, due West or due North at the Start of Civil Twilight at dawn or at the End of Civil Twilight at dusk. The festival days indicated by the Sky Disc solar alignments are also days where deep space objects such as star clusters including the Pleiades in Taurus and Mel 111 in Coma Berenices, which are visible to the naked eye, and more surprisingly many galaxies and nebulae which are only visible using a telescope are cardinally aligned at Civil Twilight. The Sky Disc though has the ability to be used to show what the galaxies and nebulae look like together with their location in the sky relative to their neighbouring constellations. The fact that the gold dots and gold circle can be joined to represent each deep space object indicated by alignments using the Sky Disc together with their surrounding constellations and position relative to these constellations is almost impossible to imagine.

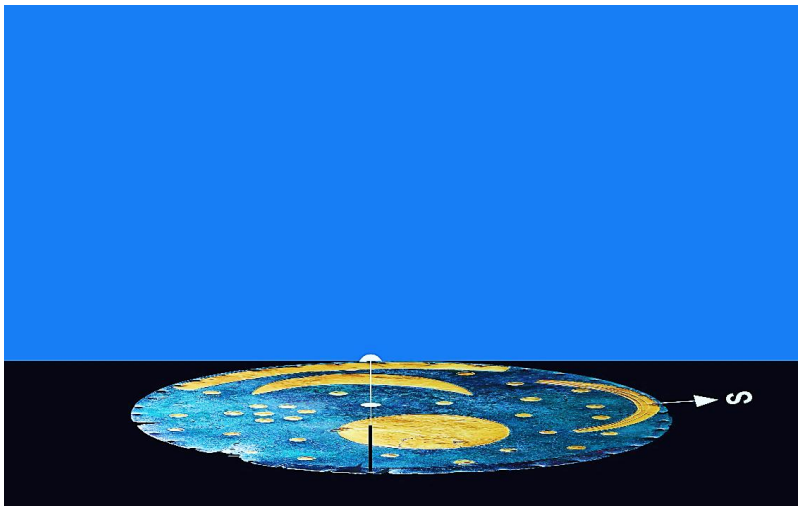
It is an exciting possibility that the Sky Disc is an example of an out-of place artefact displaying a level of technology that is according to the currently accepted historical time-line, over three thousand years before its time. The Sky Disc appears to be a sophisticated astronomical tool that was used as both a star and deep space map and as a calendrical sighting tool used to identify festival days. It is a tantalising possibility that apart from visible deep space objects, the Sky Disc was used to describe both the appearance and position of galaxies and nebulae that require a telescope to see them. If this was the case

then it would dramatically change our understanding of prehistory and the technological capabilities of our ancient ancestors and their understanding of astronomy.

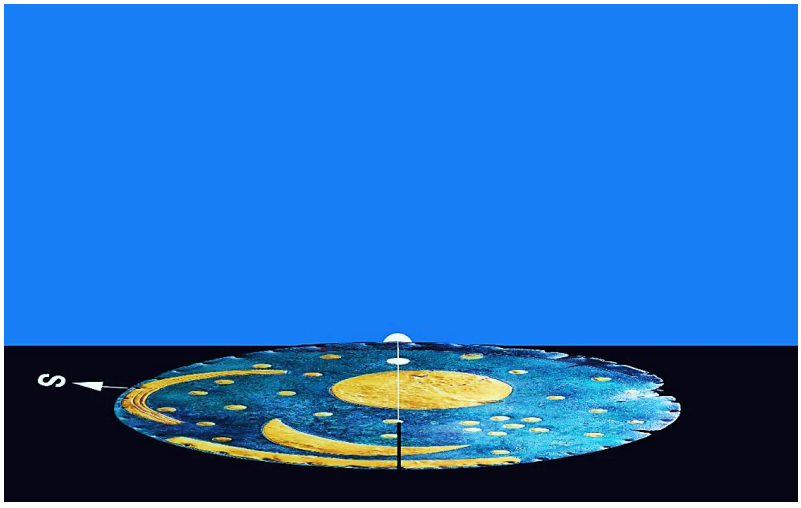
Appendix

The following diagrams show examples of how the Sky Disc when orientated North-South could be used to make alignments at sunrise and sunset by putting your eye at a peg located in a particular hole in the eastern or western arcs and aligning the peg with the Sun on the horizon. A festival day is indicated when the alignment of the Sun on the horizon and the peg coincides with a central gold dot positioned on the opposite side of Sky Disc to the peg. An alignment occurs on two different days of the year except on the days of the winter solstice and summer solstice. The festival days occur when important bright stars are aligned with cardinal points usually due South in the night sky at the start or end of Civil Twilight. The bright stars that are precisely aligned due South, East, North or West at the Start of Civil Twilight or the End of Civil Twilight can be viewed on these festival days by looking along the North-South axis or East-West axis of the Sky Disc.

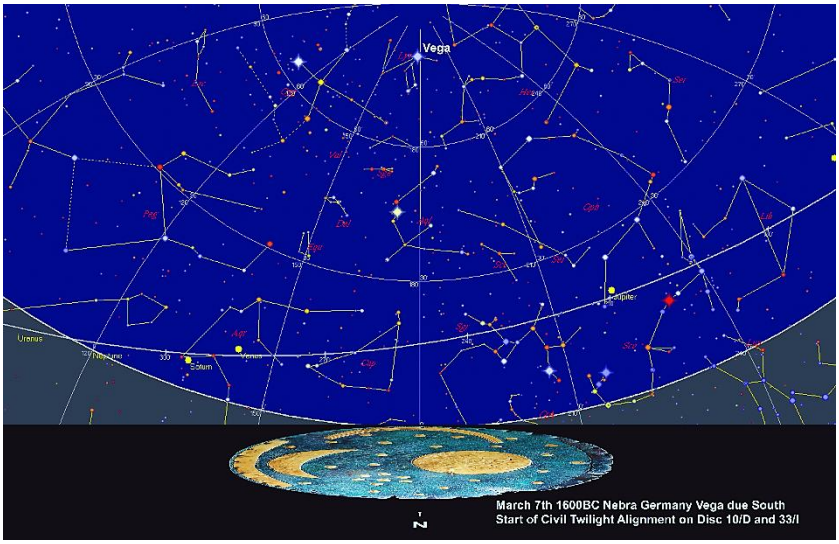
Example 1



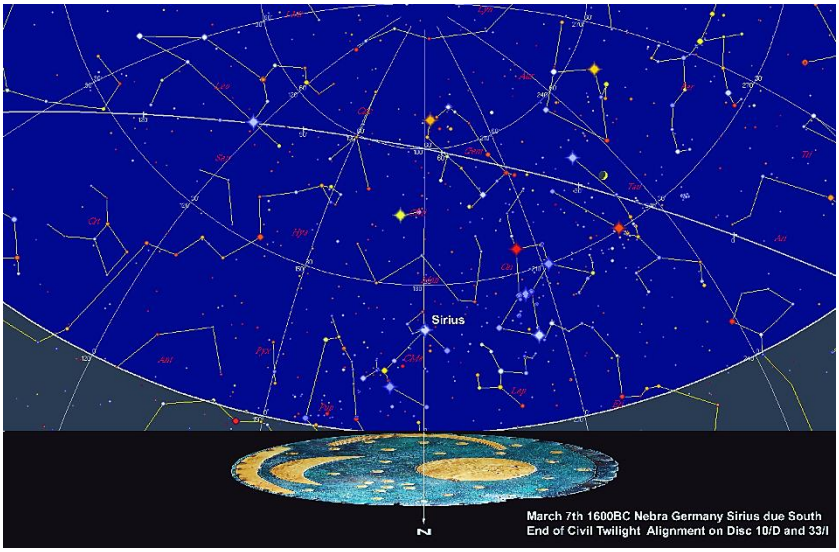
Alignment between peg-hole 33 and dot I and the Sun at sunrise on the 7th March and 1st November.



Alignment between Peg 10 and dot D and the Sun at sunset on the 7th March and 1st November



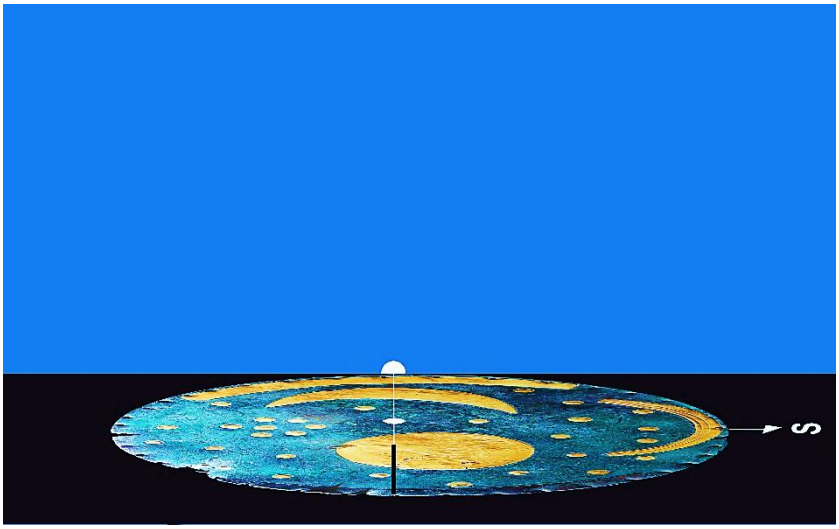
Looking due South using the North and South axis of the Sky Disc marked by two gold dots on the disc, at the Start of Civil Twilight on the 7th March Vega in Lyra is aligned due South in the sky



Looking due South at the End of Civil Twilight on the 7th March, Sirius is aligned due South in the sky

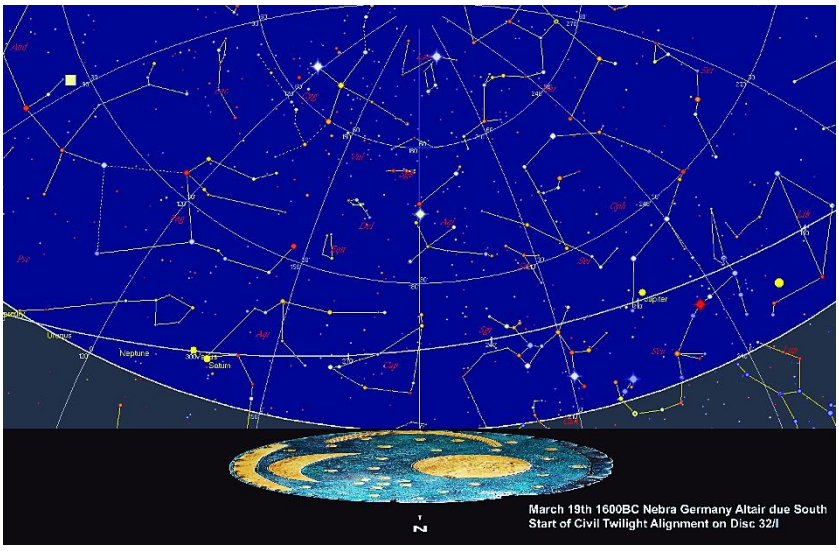
Perhaps the 7th March was a festival day celebrated in Germany in 1600BC when two stellar deities identified as the two very bright stars Vega and Sirius were venerated. The other day indicated by the solar alignment, the 1st November the Eight-Burst nebula NGC 3132 was aligned due South at the start of Civil Twilight.

Example 2



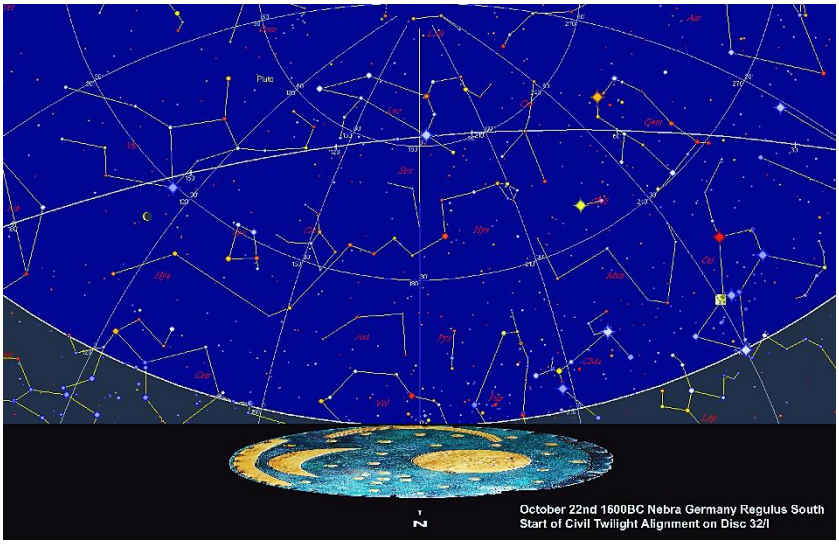
Sunrise alignment from peg-hole 32 with gold dot I and the Sun on the horizon. The alignment coincides with two dates namely the 19th March and the 22nd October

This alignment is unusual in that there is not a corresponding sunset alignment relating to the same dates. The stellar alignments that occur on the two dates are with Altair in Aquila and Regulus in Leo which are aligned due South at the Start of Civil Twilight on the 19th March and 22nd October respectively.



Alignment of Altair, the brightest star in Aquila due South at the start of Civil Twilight on 19th March.

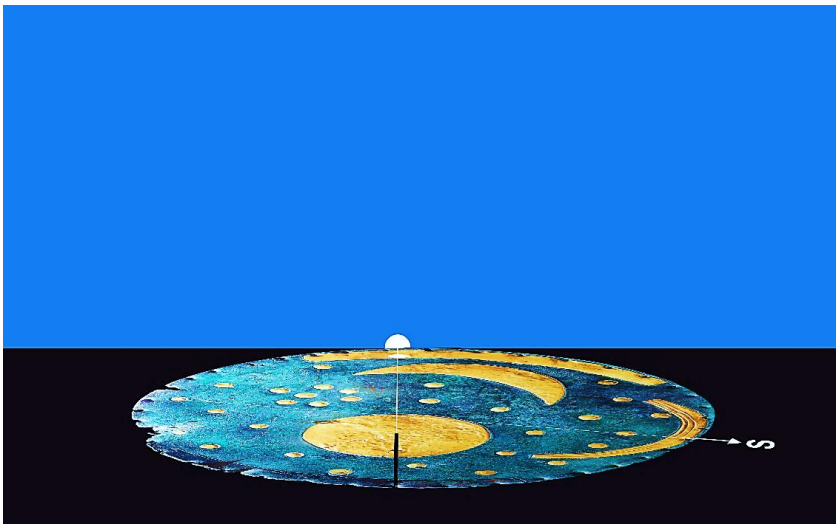
Perhaps this festival day was dedicated to a deity associated with a falcon or eagle.



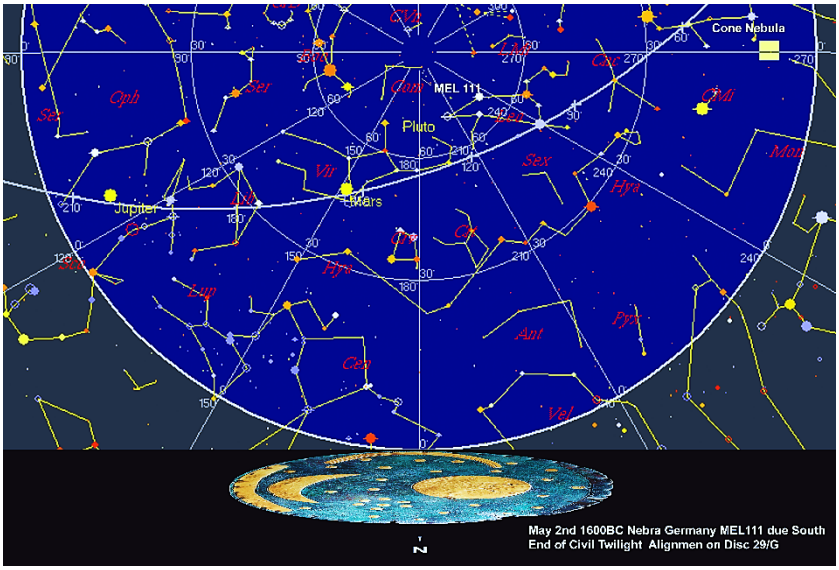
Alignment of Regulus the brightest star in Leo due South at the start of Civil Twilight on 22nd October.

This festival day may have celebrated a leonine deity or perhaps as in Scotland the constellation was identified with a wild boar rather than a lion.

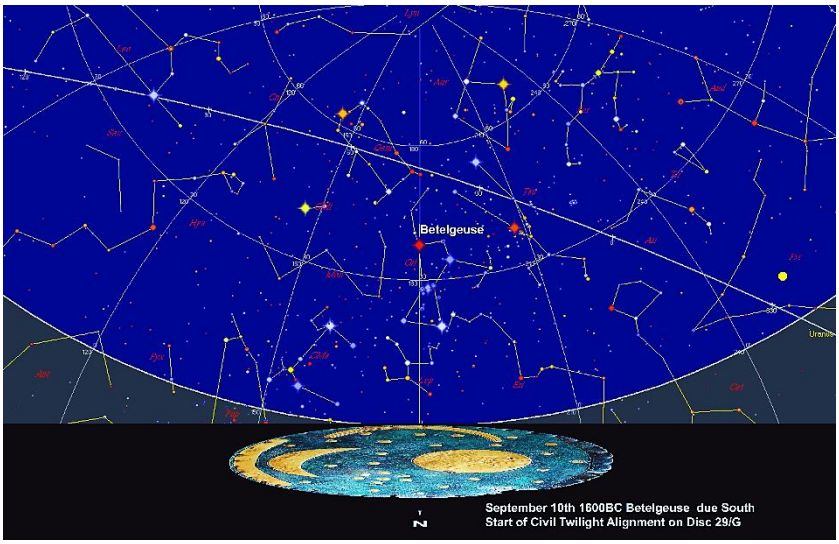
Example 3



Sunrise alignment of peghole 29 with dot G and the Sun on the horizon corresponding to May 2nd May and 10th September

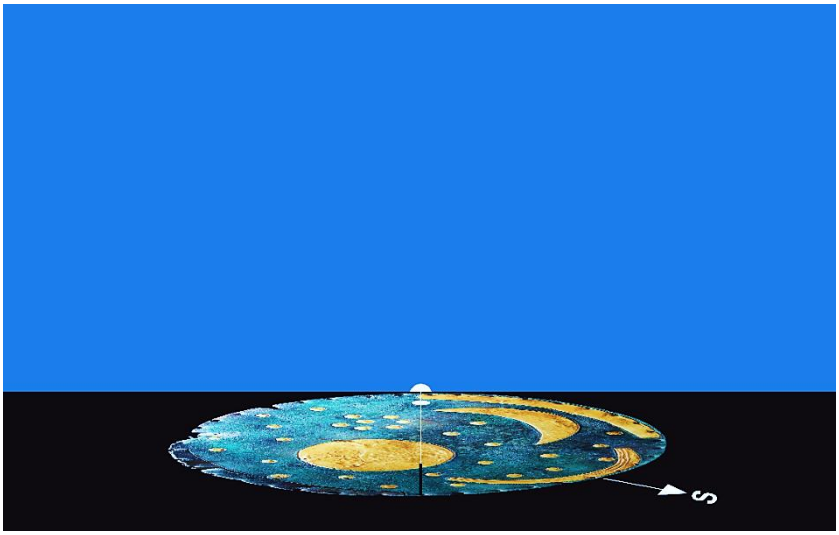


Alignment due South of MEL 111 or the Nine Maidens in Coma Berenices on 2nd May at the End of Civil Twilight whilst the Cone Nebula NGC2264 in Monoceros marked by the yellow square is aligned due West

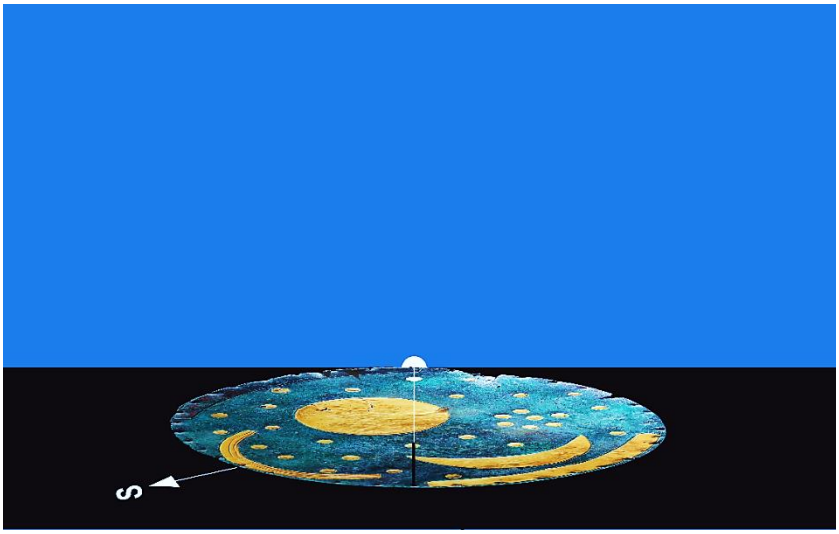


The alignment due South of Betelgeuse in Orion at the Start of Civil Twilight on 10th September. The alignments made at sunrise with the Sky Disc (29G)

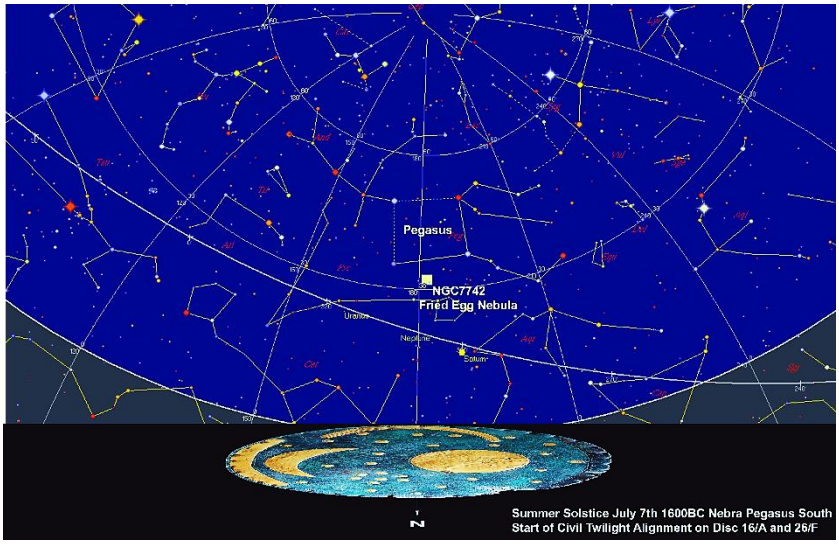
Example 4



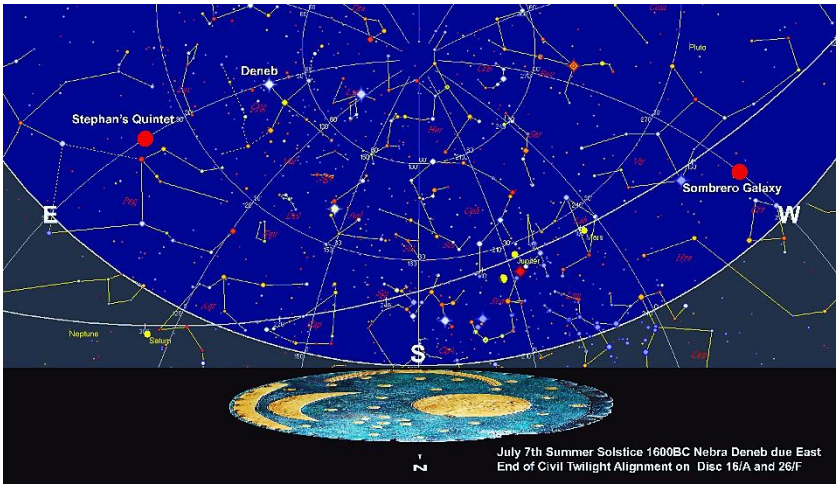
Summer Solstice July 7th 1600BC Pommelte Sunrise Alignment aligning peghole 26 with dot F and the Sun on the horizon



Summer solstice July 7th 1600BC sunset alignment with peghole 16 and dot A and the Sun on the horizon



The alignment due East of Betelgeuse in Orion at the Start of Civil Twilight on 7th July and Pegasus due South through an alignment of NGC7742 for the alignments made at sunrise and sunset alignments (26F and 16A)



The alignment due East of Stephan's Quintet in Pegasus and the Sombrero Galaxy M104 in Virgo due West at the End of Civil Twilight on 7th July for the alignments made at sunrise and sunset with the Sky Disc (26F and 16A)

Determining the North South Axis to allow the Sky Disc to be correctly orientated.

The North-South axis on the Sky Disc is indicated by two gold dots that bisect the disc between the two peripheral arcs which lie to the East and West. The alignment of the North-South axis on the disc with the actual North-South axis of Earth can be achieved by using the fact that the Sun reaches its Azimuth or highest point in the sky when it is due South. A vertical stick in the ground will have its shortest shadow when the Sun is due South in the sky.

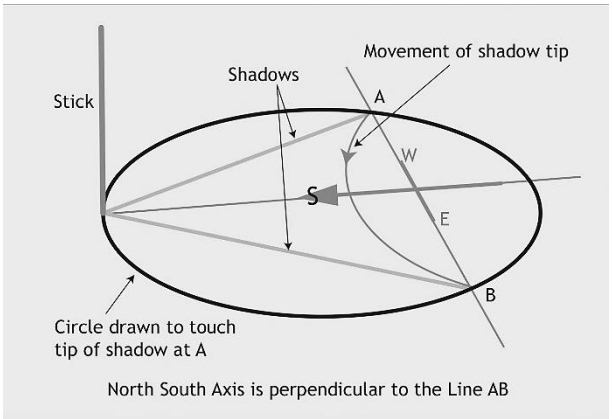


Diagram to show how South can be determined.

One simple method would be to use the Sky Disc itself and follow the apparent movement of the Sun across the sky. By laying the disc flat on the ground and inserting a suitable length thin straight straw vertically into or besides one of the holes around the edge of the disc, the disc can be rotated until the tip of the shadow of the vertical straw coincides with a hole on the western edged of the disc and a peg inserted into this hole to mark its starting position (A). The Disc is left in that position and if the first shadow is made some time before midday the straw's shadow will become progressively shorter as the azimuth of the Sun is approached when it is due South and then the length of shadow increases again until at position B the length of shadow is equivalent to that obtained at A. The line joining points A and B gives the West-East Axis and the North-South axis is perpendicular to this or can be calculated as the line that bisects the angle between the two points on the circle.

Possible Radial South Alignment Pegs

There is one hole (22) located at the bottom of the Sky Disc that does not appear to be occupied by either a festival day marker or alignment peg. There is also its companion hole 20 that has a peg but no festival marker. There are three other holes that were festival markers but had no alignment pegs (25, 21 and 17) and these five holes could have been fitted with pegs to form a radial pattern of alignment pegs either side of a due South peg placed in hole 21. Southern alignments could be made between a reference

peg placed in hole 1 marking North and a peg in hole 21 marking due South with pegs either side of 21 being used to determine how far bright stars were from being aligned due South at Civil Twilight and therefore how many days it might take before they were aligned due South and therefore how many days it would be before the festival day celebrating the event of their alignment due South at Civil Twilight.

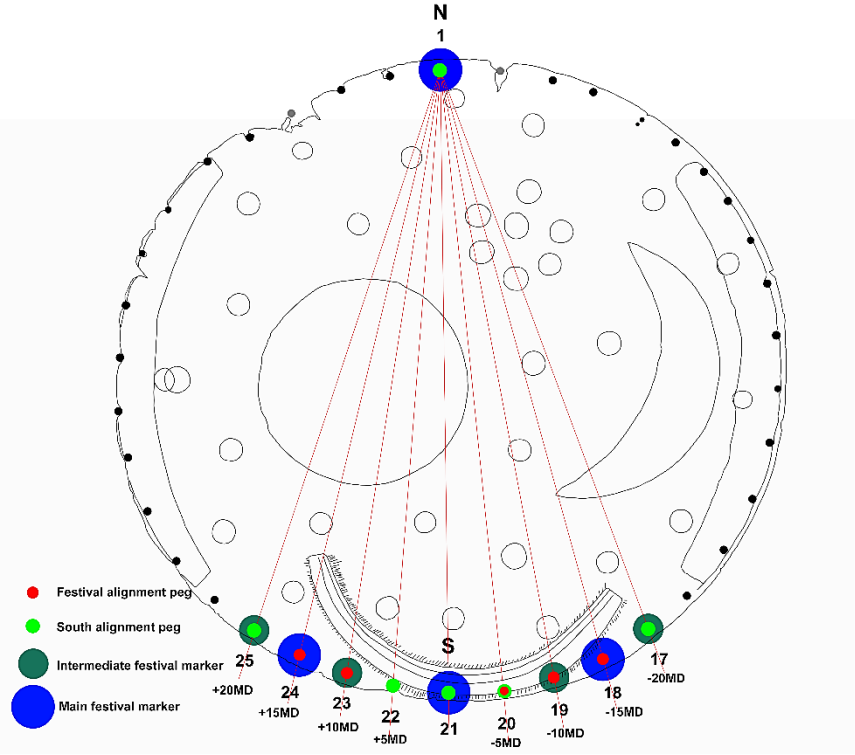


Diagram to show how pegholes 17-25 might have been used to determine the position of stars as they approach due South at 5 Megalithic Degree arc intervals. Red pegs are those already used for festival day alignments with gold dots on the Sky disc and the Sun on the horizon. The Green dots are the proposed South alignment pegs. The large blue circles are some of the main Festival Markers whilst the dark green circles are some of the intermediate festival day markers. (MD is a Megalithic Degree where 1 MD = $360/366^0$) Due South is marked by a peg in hole 21 viewed from the reference North peg in hole 1.

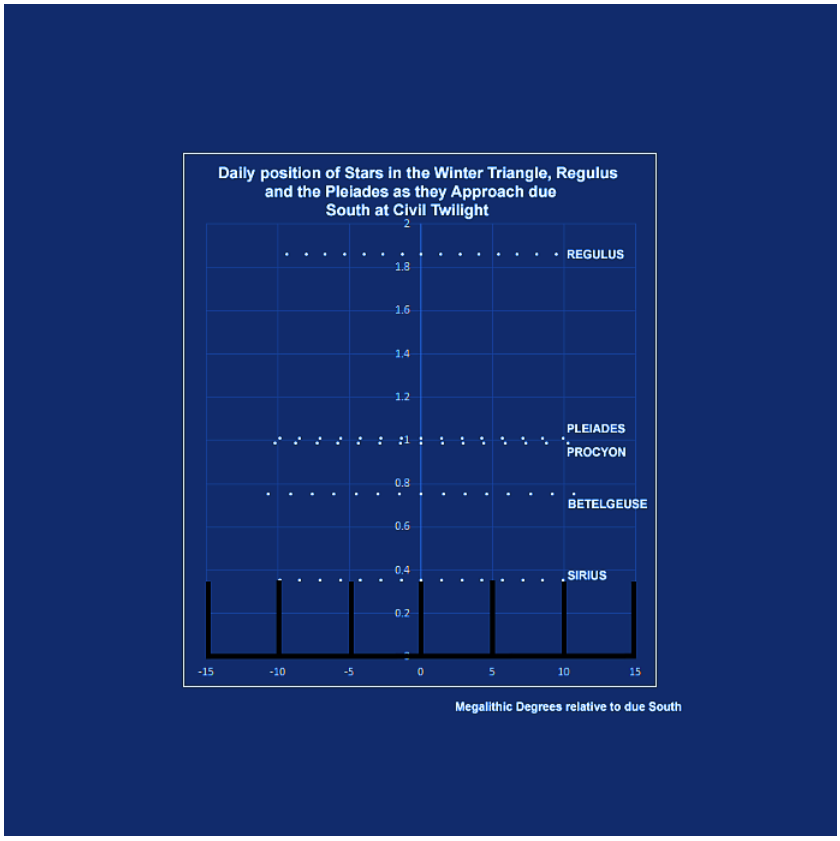
The lower nine holes on the Sky Disc including the three main Wheel of the Year festival days which include the summer solstice marker (21) form a very regular radial separation of alignments relative to the top winter solstice festival marker pin and North reference peg (1). The angles between consecutive holes relative to hole 1 was measured using Photoshop at a magnification of 800%.

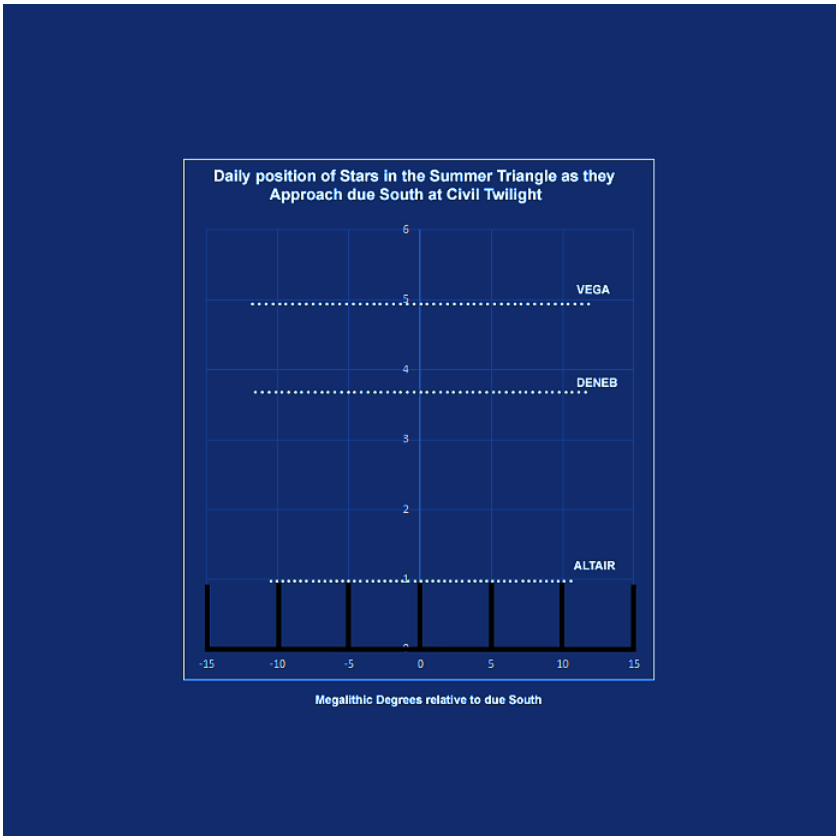
Angle between Holes	Angle Measured
17-18	5.0
18-19	4.8
19-20	4.8
20-21	5.0
21-22	5.1
22-23	(4.4)
23-24	4.8
24-25	4.8

The angle between holes 22 and 23 was considered an outlier and omitted from the calculation to measure the mean angle between the holes. The mean angle using the seven pairs of holes was 4.9 degrees. Although this value is very close to 5 degrees it should be considered that at this time angles were not measured using a circle of 360^0 but one that consisted of 366 Megalithic Degrees. When the mean angle separating the holes is calculated in Megalithic Degrees the angle obtained (4.9x(366/360)) is 4.982 Megalithic Degrees or very close to 5MD.

There is a possibility that vertical pegs or pins could have been located in these holes (17-25) to make alignments from a pin located at hole 1 with bright stars either side of due South. The angle separating the star from due South may have been used as an indication of the approximate number of days required until the star would align due South at Civil Twilight. Conversely if the star was observed to be West of the alignment due South, it might have given a good estimate of the number days after the festival day indicated by the due South alignment.

There are several bright stars that are aligned due South at Civil Twilight on their festival days such as Sirius on March 7th, Regulus on April 5th, Vega on August 2nd and Deneb on October 6th these alignments occur at the End of Civil Twilight. Other bright stars are aligned due South at the Start of Civil Twilight such as Betelgeuse on September 10th, Procyon on September 27th, Regulus on October 21st and Altair on March 20th.





The azimuth of each star was determined as a function of time to determine how their bearings change in the days approaching the due South alignment on the festival day so

that an idea of how the alignment with the pins either side of the South pin might be used to estimate the approximate number of days the actual due South alignment would take.

The stars of the Winter Triangle, Betelgeuse, Sirius and Procyon together with Regulus and the Pleiades approach due South at approximately the same rate. The daily movement measured at Civil Twilight is approximately 10 megalithic degrees every 7 days. The measurement of the position relative to sighting pins in peg-holes 17-25 allows the viewer to estimate the approximate number of days until the star is aligned due South at Civil Twilight

MEL 111 in Coma Berenices as the stellar identity of the Nine Maidens of popular mythology

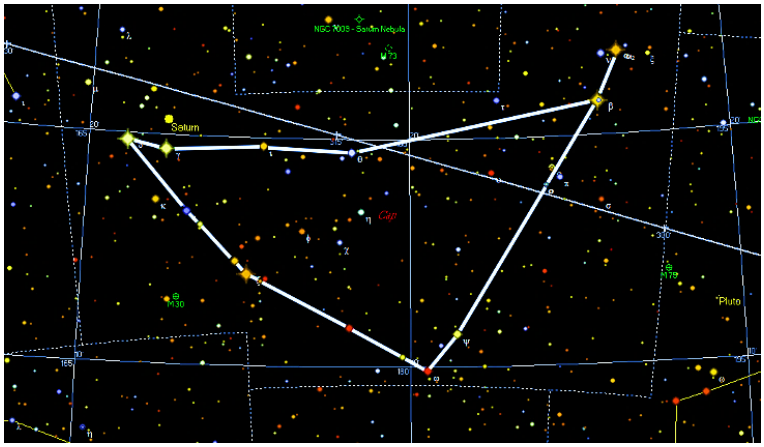
The Pictish symbol stones were carved by the people named "Picti" by the Romans meaning the painted ones on account of their habit of tattooing their bodies with the symbols of their stellar deities. One of the Pictish symbols is the Comb and often appears alongside a carved Mirror symbol associated with the constellation Virgo. The Comb symbol is believed to have represented the constellation of Coma Berenices and this was aligned due South in the sky at Civil Twilight on May 6th 1200BC in Scotland coinciding with the festival known as Beltane. Traditional mythology relates stories about the Nine Maidens as being associated with this festival and it is interesting that comb symbols carved by the Picts have a series of nine diamonds or lozenges carved along its spine. Lozenge shapes were often carved to represent stars indicating that a group of nine stars was associated with the constellation represented as a comb. The idea that the Nine maidens were identified as a cluster of nine stars, in the same way that the Pleiades a cluster of seven stars in Taurus was identified as the Seven Sisters, is supported by the fact that a cluster of nine stars identified as MEL 111 is located in the constellation of Coma Berenices

Image of Dunrobin Class I Pictish Stone with Nine Lozenges carved on the spine of the Comb. The Tuningfork symbol represents Taurus whilst the Salmon symbol is Pisces.

Parkhouse Pictish Stone with comb depicted as nine rectangular lozenge shapes.

The Crescent and V-Rod symbol represents a Pictish quadrant.

Capricorn – The Cathead Deity, Great God, and Guardian of the Winter Sun



Star map of the constellation of Capricorn as conventionally represented

Alternative Pattern of Capricorn when its brightest stars are joined by lines. The possibility is that the constellation was interpreted as a Cats Head (with one eye and the missing eye supplied by the Sun) The Saturn Nebula NGC7009 is shown as a small white square above.

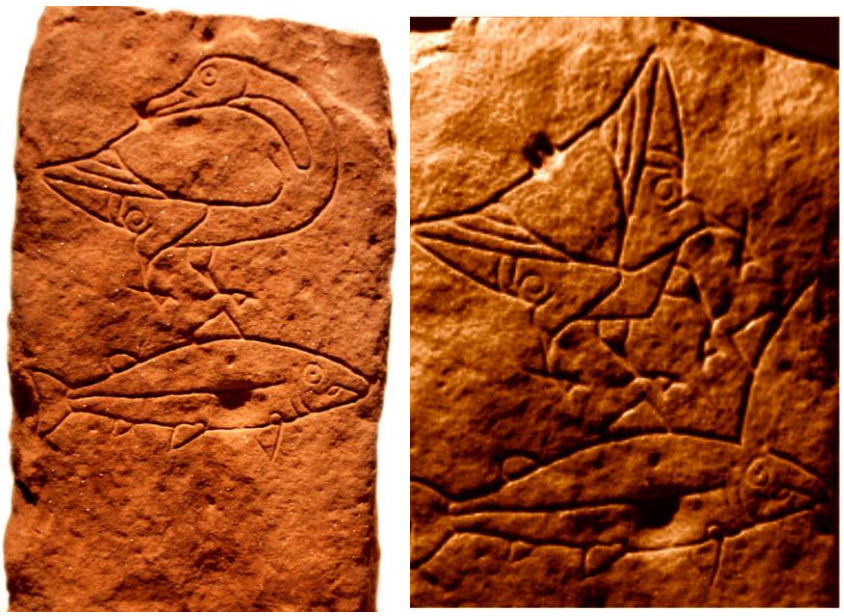
The constellation of Capricorn is of particular interest as from around 3000 BC this constellation was not visible in the night sky during the winter months as it travelled across the sky with the Sun, rising with the Sun and setting with the Sun until the end of winter, when it appeared again on the horizon after nightfall. For this reason, in pre-Christian times, Capricorn was regarded as the guardian god of the winter Sun and was venerated as the Great God throughout the Northern hemisphere. The constellation of Capricorn can be identified using an astronomy program as "the Head of the Great One" by the text on the Mul Apin tablet whilst the Lion described in the text is Leo.

Mul Apin Cuneiform Tablet (687BC) detailing astronomical observations
believed to date from around 1000-1400BC

'The Sun which rose towards the North with the head of the Lion turns and keeps moving down towards the South at a rate of 40 Ninda per day. The days become shorter, the nights longer....The Sun which rose towards the South with the head of the Great One then turns and keeps coming up towards the North at a rate of 40 Ninda per day. The days become longer, the nights become shorter.'

The prehistoric people of Northern Europe identified the constellation of Capricorn not as a fish-tailed goat but the head of a cat, with one eye, the other, missing eye, being provided by the Sun. This might sound a little strange but the worship of the Cat god Bastet in ancient Egypt reflects the special position held by the Cat deity until the

constellation ceased to rise and set with the Sun. This gradual separation of the constellation of Capricorn and the Sun due to the wobble of the Earth's spin called precession of the equinoxes, occurred much later at more northern latitudes such as in Northern Europe so that the pressure to change religious beliefs based on the movement of stars didn't finally happen there until around 500AD. There is hidden evidence carved in stone that still survives for the worship of the Cathead god in pre-Christian times in Northern Europe, part of the problem is that the Cathead god, the Great God, could not be portrayed in its entirety but only as a half image, an image concealed within another picture as a pattern so that the full image of the cat's head could only be revealed by using a mirror to complete the image of the great god as a Cat head half being a , carved representation completed by an ethereal half that is completed by mirror image.



Easterton of Roseisle Pictish Stone (1200BC) showing the Goose and Salmon symbols representing Cygnus and Pisces and the reflected image of a Cathead (Right) representing the constellation of Capricorn, the Guardian God of the Winter Sun

Precession of the equinoxes meant that after three thousand years the constellation of Capricorn no long rose and set with the winter Sun and the old stories and beliefs no longer fitted the pattern of stars in the night skies. A new religion or at least an amended version of the old beliefs with a new God almighty was required. The separation of Capricorn from the Sun was a function of latitude so that in Egypt the Cathead became visible in the winter night sky on the horizon around 30BC whilst in Scotland the separation wasn't apparent until some 500 years later going some way to explaining the acceptance of Christianity much later in Northern Europe than in countries at lower latitudes where the old religion had become redundant because the great stellar god could be seen to no longer fulfil its purpose. In Egypt whereas in ancient times the cat had been worshipped and killing a cat was a crime punishable by death even if it had been an accident, by 300BC, kittens were being killed in their hundreds of thousands and

mummified and presented as votive offerings to the Cat deity Bastet, in an attempt to appease the Cathead god, but by 30BC the separation of the Sun and Capricorn was irretrievable and it was realised that the old Great god no longer fulfilled his role showing how a religion based on what you can see in the heavens has a sell-by date.

Perhaps the Cathead constellation that would have been venerated by the people living in Germany at the time the Sky Disc was made can be similarly revealed using a mirror reflection of part of the Sky Disc. Once again, we must be aware that the necessity of using an object associated with trickery, namely the mirror, to reveal something is likely to raise an eyebrow or two. Herein lies part of the problem of understanding our ancient ancestors where mystery and reality were intimately woven to form their belief system and a time when perhaps a prehistoric telescope was an instrument that connected them to their stellar deities.

When reflected in the axis drawn through the two gold dots that had just one peripheral joining line, when the ten constellations were revealed in Part II, creates the head of a cat. The shape of the cat's nose reflects the shape of the constellation of Capricorn. The missing western bow gold inlay would have provided a golden mane

It is interesting that the cheeks of the cathead revealed on the disc are formed from the gold solar barque inlay that gave the sunrise and sunset alignments at the winter solstice. The solar barque may have been identified with the constellation of Capricorn in its role as the means of transporting the winter Sun through the heavens. On closer examination the edges of the solar barque appear to have either feathers or hairs along both edges

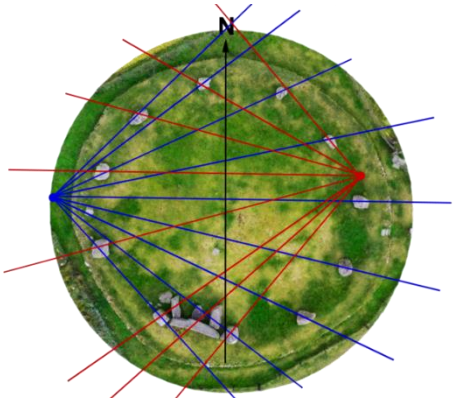
in-keeping with the association with a celestial solar boat and a feline deity. Perhaps Capricorn was identified with both the solar barque that transported the Sun and the Cathead god that protected the Sun as it travelled through the underworld after the Sun had set as it moved back to the eastern horizon to rise again the next morning.

The general idea behind the stellar deities is that the constellations may have represented a pantheon of deities in pre-historic, pagan times that had particular associations that were useful at different times. Festivals may have celebrated for example, a male god Orion when Betelgeuse was aligned due South at Civil Twilight, a female goddess of fertility Virgo, an avian deity Cygnus an equine deity Pegasus, a fish deity Pisces and other animal deities such as a bull, Taurus, an eagle, Aquila, a lion or wild boar, Leo, a pair of dogs, Canis Major and Minor and a serpent, Hydra formed a pantheon of deities and a belief system and calendar that helped to explain the pattern of stars in the night sky throughout the year and allowed our ancestors to organise their year for hunting and farming activities. The alignment sequence of stellar deities identified as birds and fish such as Cygnus and Pisces followed the cycle of seasons and the migration of geese and salmon for instance which arrived in Scotland just before winter to provide a vital source of fish, meat, oil for lamps and feathers for warmth from creatures that appeared from "out of the blue" as geese migrated from Iceland, 800 miles away to winter in Scotland and Salmon suddenly appeared in rivers having spent years feeding and growing in the Atlantic Ocean to spawn and continue the cycle that was reflected in the pattern of stars that our ancestors could see in the sky.

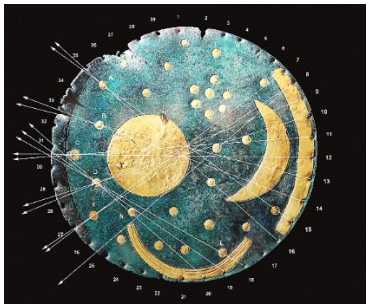
The Sky Disc in its Context as a Prehistoric Calendrical Device

When our ancestors turned from being nomadic hunter gatherers into farmers around 5000 years ago in Northern Europe, they became more organised as settlements of small communities and had time to consider the purpose of their lives and develop a religion based on the cycle of nature of fertility and birth and the appearance of migrating birds, fish and animals. They related these events to the gods they could see with their eyes, namely the movement of the Sun by day and the stars in the heavens at night. They associated events such as the changing seasons and the appearance of migrating creatures with the appearance of bright stars in the night sky and they looked for similarities between the pattern of stars around these bright stars with the shapes of animals with which they identified their appearance. The appearance of these constellations due South in the night sky at dusk coincided with the welcome appearance of migrating populations of hundreds of thousands of geese in the skies and salmon in the rivers before the onset of winter. The brightest stars in these constellations were identified as stellar deities and a calendar was constructed that celebrated these bright stars on the days that they were cardinally aligned at Civil Twilight. The Neolithic farming communities constructed stone circles as calendrical devices to identify these festival

days by placing the stones so that they aligned with the rising or setting Sun on the different festival days when the stellar deities were cardinally aligned at Civil Twilight. The alignments were made from the perimeter of the circle rather than from its centre, across the circle to the megaliths aligning with the position of the Sun on the horizon. This viewing position was more efficient and allowed a smaller stone circle with fewer megaliths to be constructed. The stellar alignments that were possible around 3000 BC however changed with the passing centuries because of the precession of the equinoxes and the position of stones would have needed to be adjusted every couple of centuries to take account of this phenomenon. There is no evidence that the positions of megaliths were ever changed and therefore the stone circles may have become redundant some time before 2000BC apart from their use to identify the solstices and equinoxes which remain relatively constant over the millennia. If the stone circles became redundant, what replaced them to allow these same festival days to be identified. There is the possibility that new timber circles were built that have since completely disappeared or that the beliefs changed or that a different calendar was made perhaps one based on dates as we use today. There is however no evidence as yet for these possibilities and instead there is the probability that stone circles were, as is the nature of humans, developed into more convenient portable calendrical devices that allowed people to determine the festival days from the comfort of their home perhaps in the same way that large sundials were developed into pocket dials. The author has found that in Scotland there are artefacts in museums described as annular and penannular brooches that are believed to have been decorative brooches whose pins were used to fasten clothing. However, these devices have been shown by the author to be calendrical devices using the same principles of the Neolithic stone circles, where the long pins were used to align with the Sun on the horizon and decorative raised features sometimes consisting of amber or glass beads on the “brooch’s” surface formed discreet alignment channels for the pin to sit in to mark the important stellar festival days. These brooches however are relatively recent (believed to be 700-800AD) and there is a gap where perhaps other portable sighting devices were used. The Sky Disc dating from 1600BC represents such a device, a unique artefact but one whose use is consistent with the alignment principles of the earlier stone Circles and later Penannular Pictish Brooches.



Stone Circle Easter Auquorthies, 3000BC Scotland



Sky Disc, 1600BC Nebra Germany

Tara Brooch, 800AD, made in Scotland