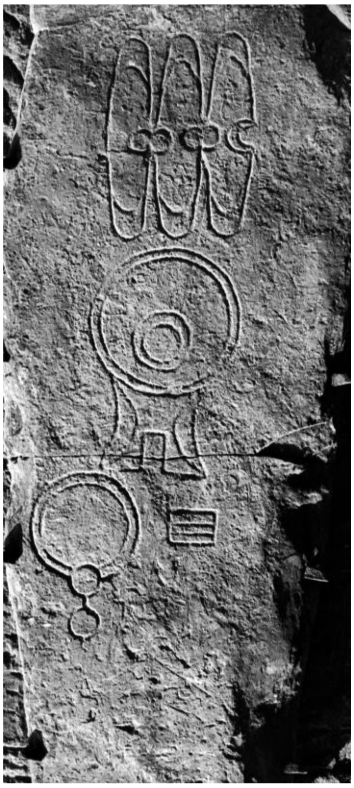
The main Pictish symbols were shown to be constellations possibly identified by the Picts as a pantheon of stellar deities. The brightest stars in those constellations were used as markers to identify festival days dedicated to the celebration of that deity when the alignment of the star due South at Civil Twilight occurred on its festival day. The stellar festival days formed a calendar of equally spaced festivals throughout the year. However, some Pictish symbols could not be identified as constellations but share their appearance with nebulae and galaxies which also happen to be perfectly aligned with cardinal positions at Civil Twilight on the same Pictish festival days indicated by the stellar alignments. The idea that deep space objects could be observed by our ancient ancestors millennia before the supposed invention of the telescope is controversial but is supported by the presence of a Pictish symbol that is dedicated to the measurement of the position of deep space objects, namely the Crescent and V-Rod which is proposed as representing a Pictish quadrant and also significantly, the constellation of Ursa Minor, where the Celestial Pole for angular reference is located. The angle of the "V", which has been carved on the symbol as a bent arrow indicates the declination of the deep space object as the angle between the Celestial Pole and the target galaxy or nebula. Often either within the crescent or immediately above the crescent, an image of the deep space object has also been carved to further confirm the identity of the deep space object. The fact that the appearance of many deep space objects and their declinations are both accurately carved on these stones makes the likelihood of this occurring by chance remote. Furthermore, the fact that the deep space objects portrayed are only those that are precisely aligned on the festival days indicated by the stellar alignments, supports the idea that deep space objects were visible to the Picts. Controversially, in order to have seen the nebulae and galaxies and carve their appearance and position indicates that a powerful telescope had already been developed by the time that the Class I Pictish Symbol stones were carved. The other consequence of the depiction of angles of deep space objects on the Crescent and V-Rod symbols is that, due to precession of the equinoxes, the declinations of nebulae and galaxies change as a function of time so that the date of carving the stone can be calculated by comparing the carved V-angle with the known declination of that deep space object as a function of time using an archaeo-astronomy program. Some crescent and V-Rods symbols have both a carved V-Rod and an image of the nebula that the angle of declination relates to but there are dozens more where the angles of declination for two of more deep space objects have been indicated by carving the V-Rod with distinct sections having different gradients giving the V-Rod the appearance of being slightly bent. By comparing the angles of the straight sections of the carved V-angles with deep space object declinations a date of carving around 1100-1200BC is consistently indicated coinciding with a calamitous natural disaster event that perhaps instigated the carving of the Class I Pictish stones as votive offerings.

Deep Space Objects Observed and Measured by the Ancestors

The Pictish symbols have been proposed as representing the constellations and it has been suggested that the constellations were identified by the Picts as stellar deities that formed the basis of their belief system and calendar with the alignment of the brightest stars in the constellations due South at Civil Twilight marking festival days dedicated to their pantheon of stellar deities.

There are however, some Pictish symbols that cannot be identified as constellations. The Triple Oval symbol was identified as possibly representing the constellation of Andromeda based on its similarity of appearance to a cluster of three galaxies comprising the Andromeda Galaxy (M31), M32 and M110 which appear as three ovals in close proximity in the constellation of Andromeda. Whilst the Andromeda galaxy is just visible to the naked eye, being the closest galaxy to Earth, the other two galaxies completing the proposed trio of galaxies are not visible without the aid of a telescope. As such, the suggested identification of a symbol carved on an ancient stone as a deep space object needs to be further examined and justified. The Sandside Stone has a good example of the Triple Oval symbol.

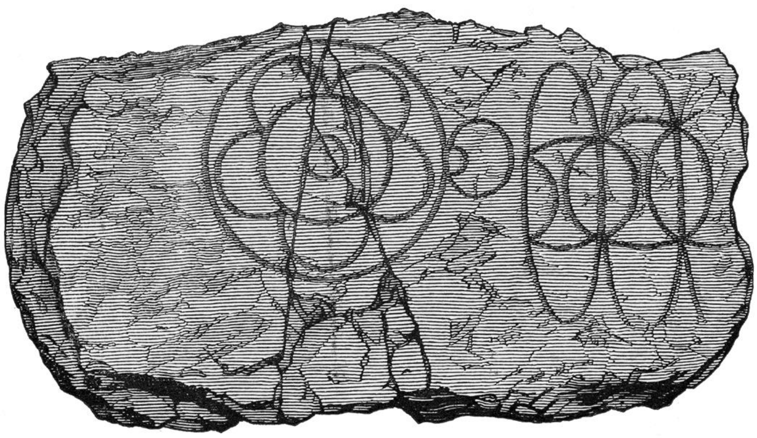


The Sandside Stone carved with the Triple Oval Symbol (top) proposed as

representing the triplet of galaxies seen in Andromeda

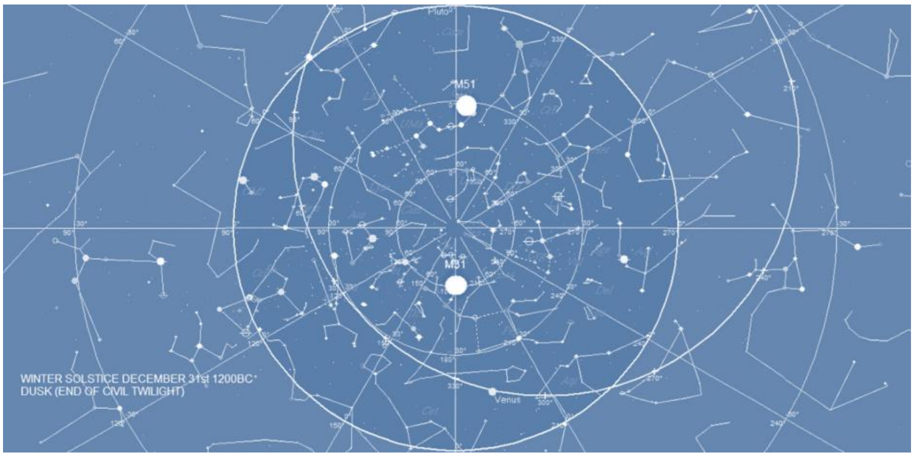
There are many examples of Pictish Class I carved symbols that share a generally similar form to the appearance of deep space objects as seen through a telescope. Examples of stones decorated with these symbols can be examined in terms of their similarity of the shapes carved to the known appearance of nebulae and galaxies and also their position in the night sky to see whether there is any relationship beyond any superficial shared appearance.

The Class I Pictish Stone from Keiss is decorated with a Triple Oval Symbol and another symbol consisting of a circle with a flower-like decoration inside it and a smaller circle attached to the side of the larger circle.



Keiss stone carved with the Triple Oval symbol believed to represent the Andromeda Galaxy besides a Flower-like pattern with a circular protuberance.

It is interesting to try and identify the other flower-like symbol by examining both its appearance and its possible association with the Andromeda Galaxy



Alignment of the deep space objects M31, the Andromeda Galaxy and M51, the Whirlpool Galaxy on the North South axis at dusk at the End of Civil Twilight on the day of the Winter Solstice (1200BC).

The appearance of M51, the Whirlpool Galaxy shares a strikingly similar appearance to the symbol carved on the Keiss Stone which resembles a large flower with a small circle carved to the right touching its outer circle.

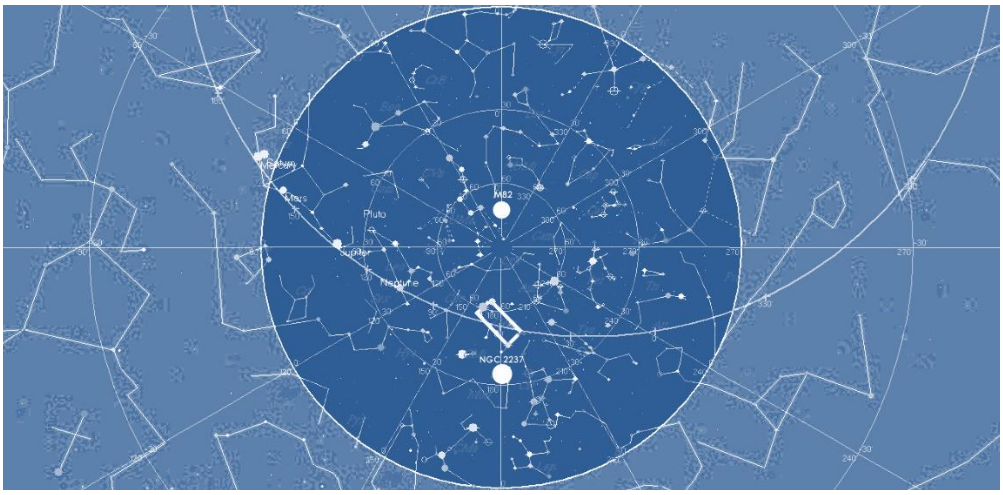
M51 The Whirlpool Galaxy

Whilst the symbols of the Triple Oval and the Flower with its attached small Circle seem to be very similar to the appearance of two galaxies that appear to be aligned due North and due South on the day of the Winter solstice at the End of Civil Twilight, we have now only confirmed the problem we had in that we are proposing that deep space objects were carved on stones millennia before what is currently accepted as the date of invention of the telescope.

There is another example of a stone carved with symbols that are not identifiable as constellations but which share a similarity of shape to prominent nebulae and galaxies. The Newton of Lewesk stone has two unusual symbols carved on it, one above and the other below the central rectangular symbol that represents the constellation of Gemini.

Newton of Lewesk Stone with the Rectangular symbol for Gemini sandwiched between two unknown carved symbols.

When the Pictish Autumn festival day celebrated on the 20th September is examined at dawn at the time of Start of Civil Twilight, the Constellation of Gemini lies due South in the sky, the constellation being bisected by the North-South line. On closer examination two deep space nebulae are also aligned due South and North at this exact time; M82 and NGC2237.

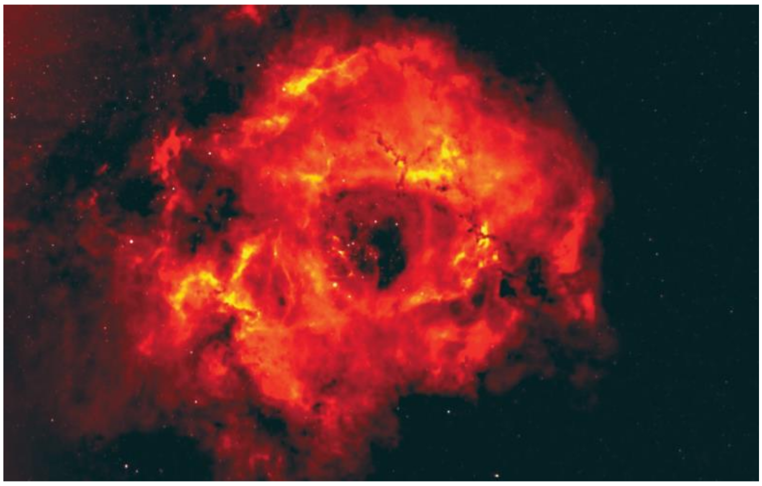


Skymap image of the night sky at Start of Civil Twilight on September 20th 1200BC. The white circles represent the deep space objects M82, the Cigar Galaxy in Ursa Major and below it, NGC2237, the Rosette Nebula in Monoceros, and show their alignment due North-South along with Gemini represented as a white rectangle.

The position of the symbols carved on the Newton of Lewesk stone seems to reflect the night sky at dawn on this important Pictish Autumn festival day.

M82 or Cigar Galaxy in Ursa Major

When the appearance of the deep space objects is examined, there is a remarkable similarity of form of the symbols carved in stone to the shape of M82 and NGC 2237 as observed through a modern powerful telescope.



NGC2237 the Rosette Nebula in Monoceros

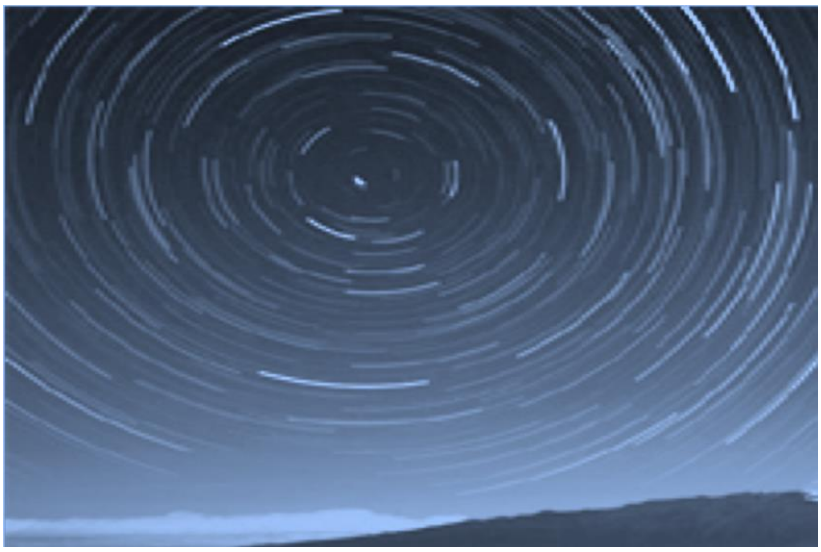
The above examples of stones with pairs of carved images that share a similarity of form with deep space objects is further supported by the fact that these same nebulae and galaxies appear together and are aligned due South at Civil Twilight on important Pictish festival days. The number of stones carved with what could be interpreted as deep space objects however is very limited and we need more and better evidence, given the controversial nature of the proposal that an advanced prehistoric telescope had existed over three thousand years ago.

Two of the Pictish symbols were identified as representing tools that were used by the Picts to measure time intervals and measure angles of separation, namely i) the compound pendulum represented as a Z-Rod and ii) the quadrant represented by the symbol known as the Crescent and V-Rod. The association of the Z-Rod symbol, as representing a compound pendulum, with the Double Disc, the Serpent and the Notched Rectangle Pictish symbols appeared to identify the constellations of Cetus, Draco and Vela as containing star pairs that could be used to calibrate pendulums due to the perfect separation of pairs of stars in these particular constellations by the Hour Angles required to give whole thousands of swings for each of the different pendulums. The other tool represented by the Pictish symbol known as the Crescent and V-Rod, is proposed to represent both the constellation of Ursa Minor, the location of the Celestial Pole and an astronomical tool we would call a quadrant, that uses the Celestial Pole as its reference point to determine the angular position of deep space objects.

Crescent and V-Rod Pictish Symbol with the constellation of Ursa Minor

Model Pictish Quadrant based on the Abdie stone Crescent and V-Rod symbol

It is suggested that the quadrant was used to measure the declination or angle of a deep space object with respect to the position of the Celestial Pole, the point in the sky about which the stars appear to rotate around.

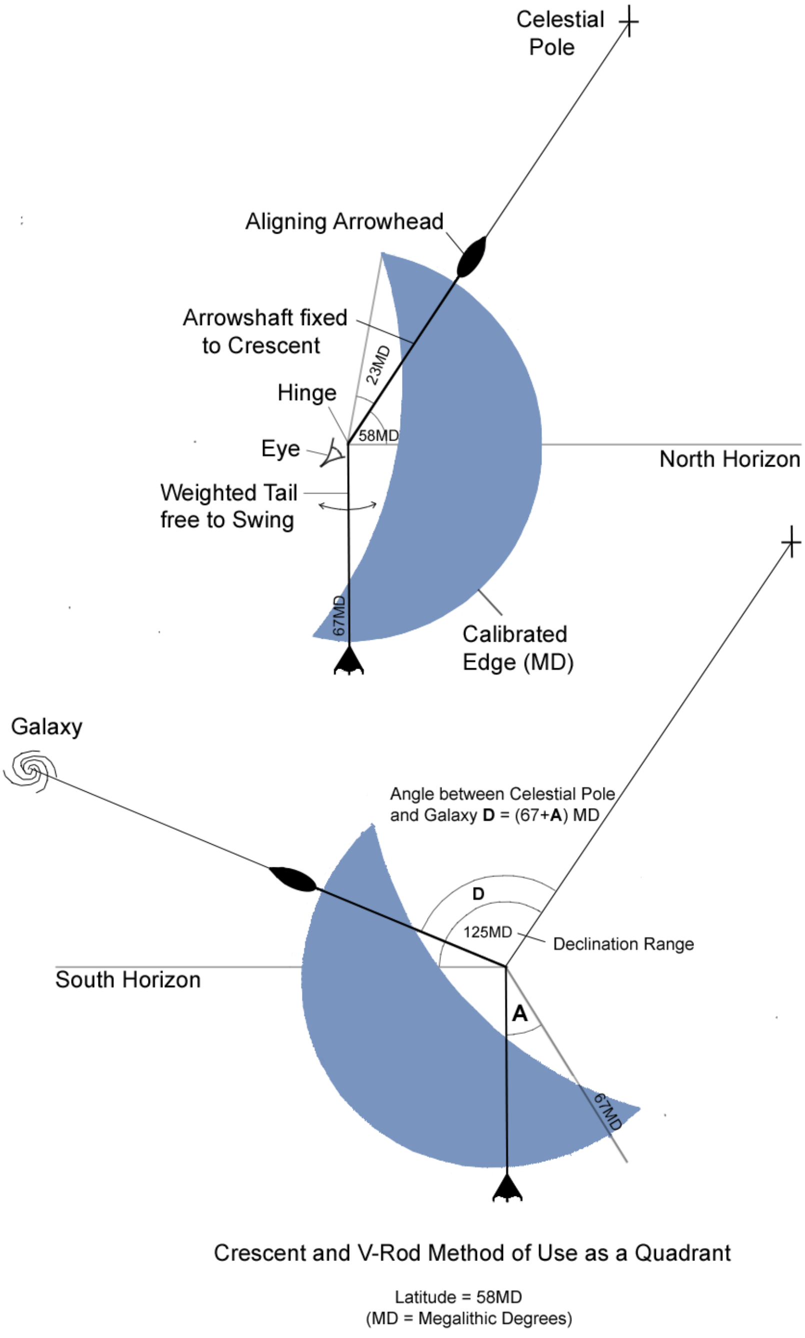


Time lapse image of stars moving around the Celestial Pole

Today the astronomical convention in measuring declination is to identify the celestial equator, lying 90 degrees from the celestial pole, and to identify the declination of a deep space object as the number of degrees above (positive value) or below (negative value) the celestial equator where that object can be found. There is no reason why the angle between the celestial pole and the deep space object cannot be used to identify its declination and this direct measure doesn't need to consider the added complication of specifying a positive or negative value.

The Pictish quadrant may have been constructed using a flat crescent-shaped board, calibrated with angles measured in Megalithic Degrees along its edge and a V-shaped arrow consisting of a hinged shaft with a weighted arrow tail and at the other end an arrowhead for alignment. The board oriented perpendicular to the crescent-shaped horizontal plane, could be tilted up and down until the arrowhead and upper half of the arrow shaft, fixed to the crescent, was aligned with a deep space object, whilst the tail section of the arrow shaft could move freely by means of a hinge or pin to allow it to adopt a vertical attitude. The position of a star or deep space object such as a nebula or galaxy could have been described in terms of its position, measured as an angle relative to the Celestial Pole.

A Pictish astronomer would place his eye at the vertex of the hinged arrow and align the arrow tip and fixed shaft with the celestial pole. The hinged weighted tail would swing to adopt a vertical position and that position marked on the edge of the crescent. This position would be permanently marked on the board as the reference origin as it would not change. The angles of declination from this point would then be marked on the edge of the crescent to provide a calibrated quadrant. The declination of a deep space object such as a galaxy could then be measured by aligning the galaxy with the arrow head and shaft and measuring the angle occupied by the weighted tail directly from the calibrated crescent edge.



Proposed method for using a Crescent and V-Rod Quadrant

A model Crescent and V-Rod was constructed to see how it could have been practically used as a quadrant. The first thing to remember is that the Celestial Pole is at a point high in the sky and due North at an angle equivalent to the latitude of the viewer relative to the northern horizon. In the case of Aberdeenshire, the latitude is 57 degrees North, corresponds to 58 Megalithic degrees. The arrow shaft used for alignment purposes is fixed on the quadrant 23 Megalithic Degrees from the tip of the quadrant. The outer edge of the quadrant describes a semi-circle and is marked at 2MD intervals to 183MD. If the quadrant is first aligned with the Celestial Pole to the North and then aligned with a deep space object beneath the Celestial Pole on the same North alignment the angle between the Celestial Pole and the deep space object is limited to an angle between the celestial pole and the horizon that is 58 Megalithic degrees. This is a very restrictive viewing range and it is more likely that the quadrant was firstly aligned to the Celestial Pole to the North and the vertical position of the tail marked on the crescent. This vertical position could then be marked as 67 Megalithic degrees representing twice the angle in Megalithic degrees between the Celestial Pole and the Vertical (2x(91.5 –(58+23) + 23) . The alignment of Deep Space objects could then be measured when the target nebula or galaxy was aligned due South as the deep space object, like the stars circle the celestial pole. In this way the range of declinations measurable is extended to the angle between the southern horizon and the North Celestial Pole which is approximately 125 Megalithic degrees. The angle marked on the quadrant corresponding to the alignment of the Celestial Pole could be marked as 67MD and the calibration along the edge of the quadrant marked upwards from this reference point. The minimum angle measurable to the South would be 56.5 Megalithic Degrees and any object closer could be measured when it was aligned due North beneath the Celestial pole by subtraction of 67 Megalithic degrees from the number corresponding to the deep space object.

Image of Crescent and V-Rod Model

The easiest way to determine the declination of the deep space object is to fix the arrow shaft at an angle corresponding to 23 MD from the top of the crescent, the crescent outer arc is a semi-circle of arc 183MD, the tail of the arrow shaft will hang down vertically and correspond to an angle of 10.5 Megalithic degrees from the very bottom tip of the crescent-shaped board when the arrow head is aligned with the North Celestial Pole.

The location of a deep space object might then be represented on a stone by carving a Crescent and V-Rod symbol with the angle of the “V” corresponding to the angle between the Celestial Pole and the deep space object. If this was the case then we would expect to find a range of angles depicted on the carved symbols but that certain angles would appear more often and that these more frequently occurring angles would correspond to the declination of particular deep space objects at the time the quadrant was used. The image of the deep space object might also be depicted by carving a likeness of the nebula or galaxy in the crescent symbol itself or immediately above it to confirm the identity of the target deep space object or perhaps the Pictish symbol representing the constellation where it could be found.

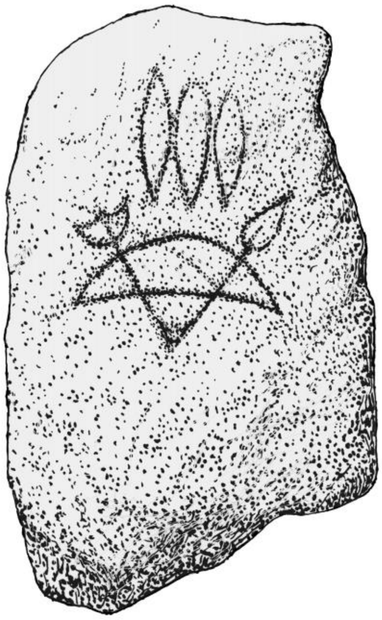
Crescent and V-Rod Quadrants and Deep Space Objects

If the Crescent and V-Rod symbol could be shown to represent a quadrant this would support the proposal that Pictish man was observing galaxies and nebulae, by some means and furthermore, the angle identified by the “V” for each deep space object should allow us to date when these stones were carved by matching the carved angles with the known declinations, converted to an angle with respect to the Celestial Pole, as a function of date due to the change in the declination of deep space objects caused by the precession of the equinoxes.

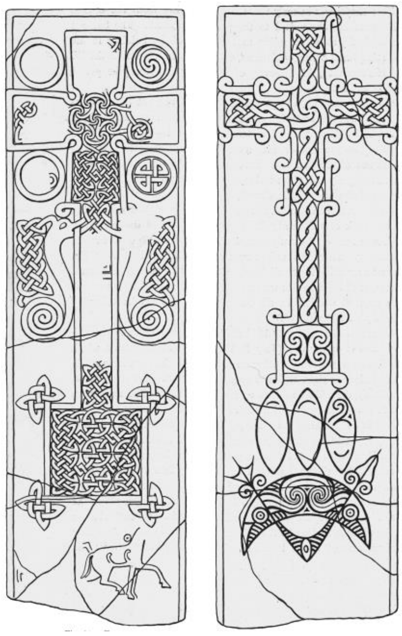
The Triple Oval Symbol

The Triple Oval symbol has already been proposed as representing the constellation of Andromeda from its similarity of appearance to the trio of galaxies lying together in close proximity in that constellation and its appearance on the Keiss stone along with a symbol that resembles the Whirlpool Galaxy M51 which share a North-South alignment at the End of Civil Twilight on the day of the Winter Solstice. The next stage in gathering support for the proposal is to find a Pictish Stone that has a Triple Oval symbol together with a Crescent and V-Rod symbol which has a V-Rod angle and to measure that angle to determine whether it coincides with the declination of the Andromeda galaxy.

Two megaliths carved with both the Crescent and V-Rod and the Triple Oval symbols were found, and an additional benefit of these two stones for the analysis is that the two stones were carved at widely different times; the Beauly stone carved as an “early” Class I Pictish Symbol Stone and the other, the Skinnet stone a much later carved Class II Pictish Symbol Stone complete with a symbol of a cross. The position of the Celestial Pole changes with time and therefore the angle of separation between the Andromeda Galaxy and the Celestial Pole carved on each stone should be different and each of those angles used to date the carving of each stone and compare these dates with the dates currently suggested for the carving of the Class I and II Pictish Symbol Stones.



Beauly Pictish Class I Stone



Skinnet Pictish Class II Stone

The angle of "V" carved on the Class II stone was measured at 55 degrees which gives a good agreement for the angle between the Andromeda Galaxy and the Celestial Pole around the year 900AD, the date when archaeologists believe the stone to have been carved. The angle of the "V" carved on the earlier Class I Pictish Symbol Stone however was measured at 66 degrees that corresponds to a carving date of around 1200BC, some 1800years earlier than the currently accepted date of carving these Pictish stones.

Year	Declination	Angle from Celestial Pole
1000 AD	+35 deg 43min	54.7 deg
800 AD	+34 deg 37 min	55.5 deg
600 AD	+33 deg 30 min	56.5 deg
500 AD	+32 deg 56 min	57.0 deg
01 AD	+30 deg 12 min	59.8 deg
500 BC	+27 deg 31 min	62.5 deg
1000 BC	+24 deg 56 min	65.1 deg
1200 BC	+23 deg 56 min	66.1 deg
1400 BC	+22 deg 57 min	67.0 deg
1500 BC	+22 deg 28 min	67.5 deg

Declination of Andromeda Galaxy as a function of Date. Class I stone details in blue and Class II stone details in green.

However the very early date indicated by the V-Angle of the Class I stone is consistent with other evidence presented by the author regarding the symmetry of the Pictish calendar presented as a “wheel of the year” and the date when certain star pairs used to calibrate pendulums, indicated by the association of a carved Z-Rod with certain symbols representing their constellations that could not have been used at the later currently accepted date because they had sunk below the horizon by that time and were therefore not visible at the known latitude. However, it is accepted that this date is very, very, much earlier than the conventionally accepted date of around 600-700AD that archaeologists have come to accept as being the date of carving the Class I Stones and as such the acceptance of the proposed date is naturally going to invite serious scepticism if not outright rejection. At first sight it doesn't seem reasonable to consider that archaeologists could be out in their estimation by over 1800 years for such relatively recently carved megaliths. The angle depicted on the Class II stone of 55 degrees however is in agreement for the believed date of carving this later class of Pictish stones so we are left with the dilemma that either the angle of the V-Rod does not represent the declination of the Andromeda galaxy or if it does, then our understanding of history/pre-history is wrong and the Class I Pictish stones may have been carved nearly two millennia before currently believed.

On closer examination, both the Beauly stone and the Skinnet stone V-Rods are seen to be slightly bent and might be considered as comprising of two discreet sections with different angles. The second angle measured on the Beauly stone was 71 degrees whilst the second angle measured on the Skinnet stone was 69.5-70 degrees. This second angle corresponds to the angle between the Celestial Pole and M27, the Dumbbell Nebula for the years around 1200BC for the Class I Beauly stone and between 800-1000AD for the Class II Skinnet stone. It is interesting to note the appearance of the symbol that appears directly above the Triple Oval Symbol on the Skinnet stone, at the base of the cross, which appears as a dumbbell shape mirroring the image of the M27 nebula.

Year	Declination	Angle from Celestial Pole
1000 AD	+20 deg 24min	69.5 deg
800 AD	+20 deg 3 min	70.0 deg
600 AD	+19 deg 45 min	70.25 deg
500 AD	+19 deg 36 min	70.5 deg
01 AD	+19 deg 4 min	71.0 deg
500 BC	+18 deg 48 min	71.25 deg
1000 BC	+18 deg 47 min	71.25 deg
1200 BC	+18 deg 51 min	71.2 deg

Declination of the Dumbbell Nebula M27 as a function of date (Blue=Class I, Green=Class II)

The declination of the Dumbbell nebula coincides with the angle carved in the V-Rod for the years between 800-1000AD which is consistent with the date proposed for the carving of the Class II stones and the date coinciding with the declination of the other Triple Oval symbol on the stone.

M27 The Dumbbell Nebula

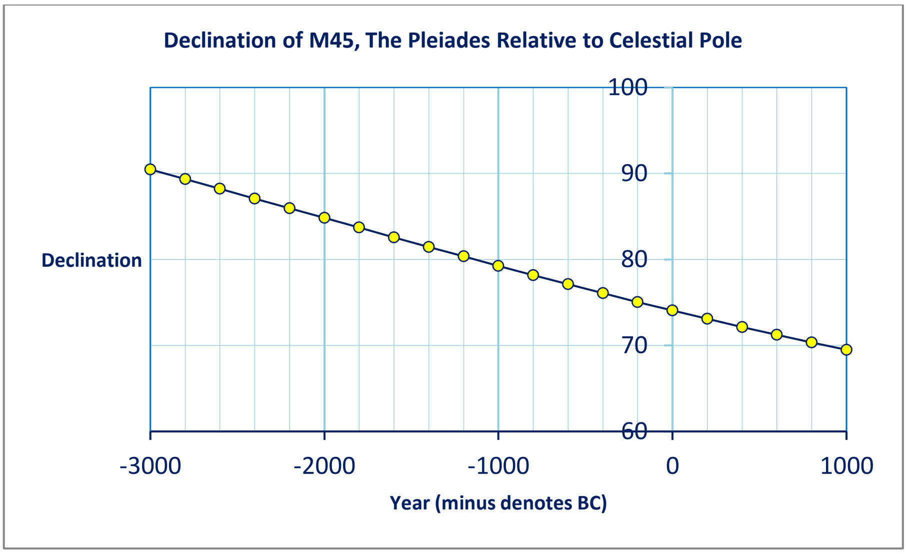
Once again, the angle carved on the Class I Beauly stone corresponds with the same nebula, M27 but the date of the match of declination is again much earlier than the currently accepted date of carving the Class I Pictish stones confirming the findings of the declination of the Triple Oval symbol proposed as representing the Andromeda triplet of galaxies. The rate of change of declination of M27 as a function of time for dates between 1AD and 1200BC is much less (71.0-71.2 degrees) than that seen for the Andromeda galaxy (59.8-66.1 degrees), however the measured angle of 71 degrees (+/- 0.5 degrees) is consistent with the finding that the stone could have been carved at a much earlier date than previously assumed as the declination of M27 in 1200BC was 71.2 degrees which is within the measured range of accuracy for the "V" carved on the stone.

There is a Class I stone in Abernethy in Fife that has a similar symbol to the symbol carved at the base of the stone cross, just above the "Triple Oval" symbol, on the Class II Skinnet stone that we interpreted as the Dumbbell nebula. The "Dumbbell-shaped" symbol on the Class I Abernethy stone is carved within the Crescent itself which implies a closer relationship between the symbol and the angle of the "V" and gives us a better measure of whether the symbol might correspond with the Dumbbell Nebula, M27.

The Abernethy Class I Pictish Stone

The Class I Pictish Symbol Stone at Abernethy has been reshaped in more recent centuries, truncating the V-Rod but by extrapolating the carved lines, an angle of around 71-71.5 degrees corresponds with the declination of M27 for the time around 1200BC. There is some evidence therefore that images of both the Andromeda Galaxy and the Dumbbell Nebula are carved on both Class I and Class II Pictish Stones together with Crescent and V-Rod symbols that give angles of "V" that are consistent with the declinations of these two deep space objects for the proposed dates of stone carving. When the Abernethy stone is examined in more detail it can be seen that each shaft of the “V” has two components as with the previous stones examined. The lines can be extrapolated and the other angles measured. The angles obtained are 71 degrees for M27 and a second angle of 80 degrees. The second angle appears to coincide with the declination of M45 or the Pleiades for the year 1200BC, which appear in the constellation of Taurus. This is interesting because a Tuning-Fork symbol, representing the constellation of Taurus is carved above the Crescent and V-Rod symbol reinforcing the likelihood that the Pleiades were being identified by the declination represented by one of the two angles carved on the V-Rod. The Pleiades unlike the Dumbbell nebula, comprising a cluster of stars is clearly visible to the naked eye and there is therefore not the same problem with arguing that it may have been represented by a carved quadrant angle but there still leaves the problem of the extremely early date that the stone would need to have been carved in order for the match of angle and declination to have occurred.

The declination of the Pleiades as a function of date shows again that the angle represented on the stone is consistent with a date of 1200BC.



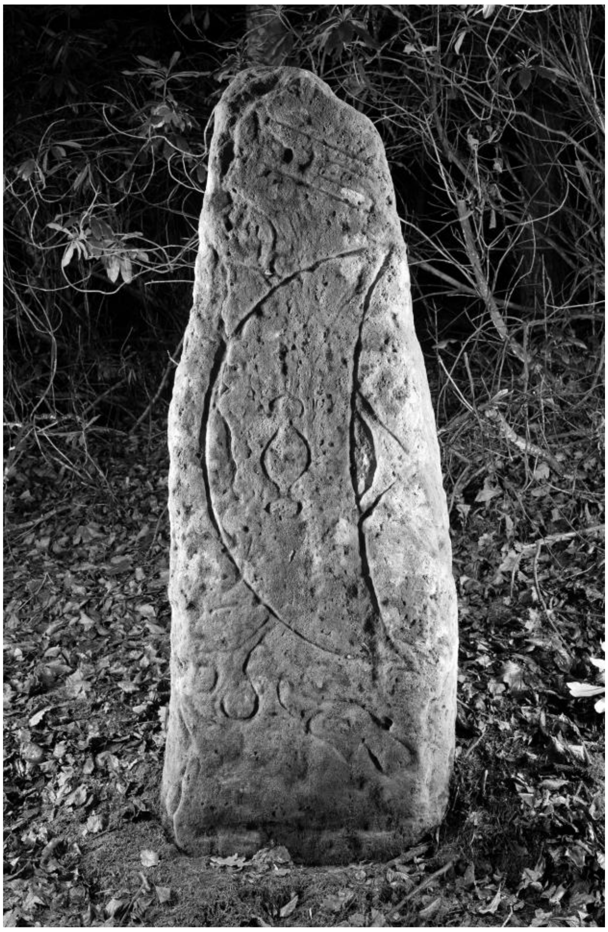
The V-Rod angle of 80 degrees on the Class I Pictish Stones coincides with a date of between 1200-1000BC.

The angles of the V-Rods carved on the Class I Crescent and V-Rod symbols together with the patterns of the carved symbols appearing on those stones appear to match the appearance of the deep space objects and their declinations for a consistent, albeit very early, date and merits further investigation of other Pictish stones.

There are many Class I Pictish Symbol Stones carved with the Crescent and V-Rod symbol. A series of stones carved with Crescent and V-Rod symbols together with a pattern of decoration which, like the Triple Oval symbol and the Dumbbell symbol, share a similarity of appearance with a deep space object were selected for further analysis to determine if there is further evidence that the people who carved these stones could have had the ability to view deep space objects and measure their declination at the early time suggested by the initial examination.

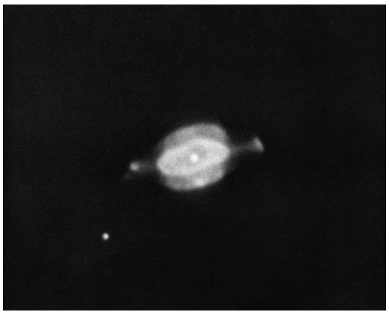
The Craigton Stone and the Saturn Nebula

The Craigton stone has a very large Crescent and V-Rod carved on its face, indeed it is unusual in being so large and being inclined vertically as it would be when used as a quadrant. There are two much smaller Pictish symbols carved on the face, the Notched Rectangle above the Crescent and V-Rod representing Vela and the “Flower” symbol representing Aquarius at the bottom of the stone. The only other carving is an unusual decoration within the crescent that appears as a large oval with two smaller protruding spherical ears either side of the oval.



The Craigton Stone

The angle of the V was measured as 108 degrees which corresponds to the angle separating the Saturn Nebula and the Celestial Pole around 1100-1200BC. The appearance of the Saturn Nebula, shown below, bears a remarkable similarity to the image carved within the Crescent and V-Rod symbol and, combined with the angle of the "V" gives further support for the proposal that the Class I stones were carved around 1200BC and that the people carving them knew of the appearance and position of deep space objects. The Saturn Nebula is positioned directly above Capricorn that was identified with the Cat-head god protector of the winter Sun who was a particularly important deity to the Picts.



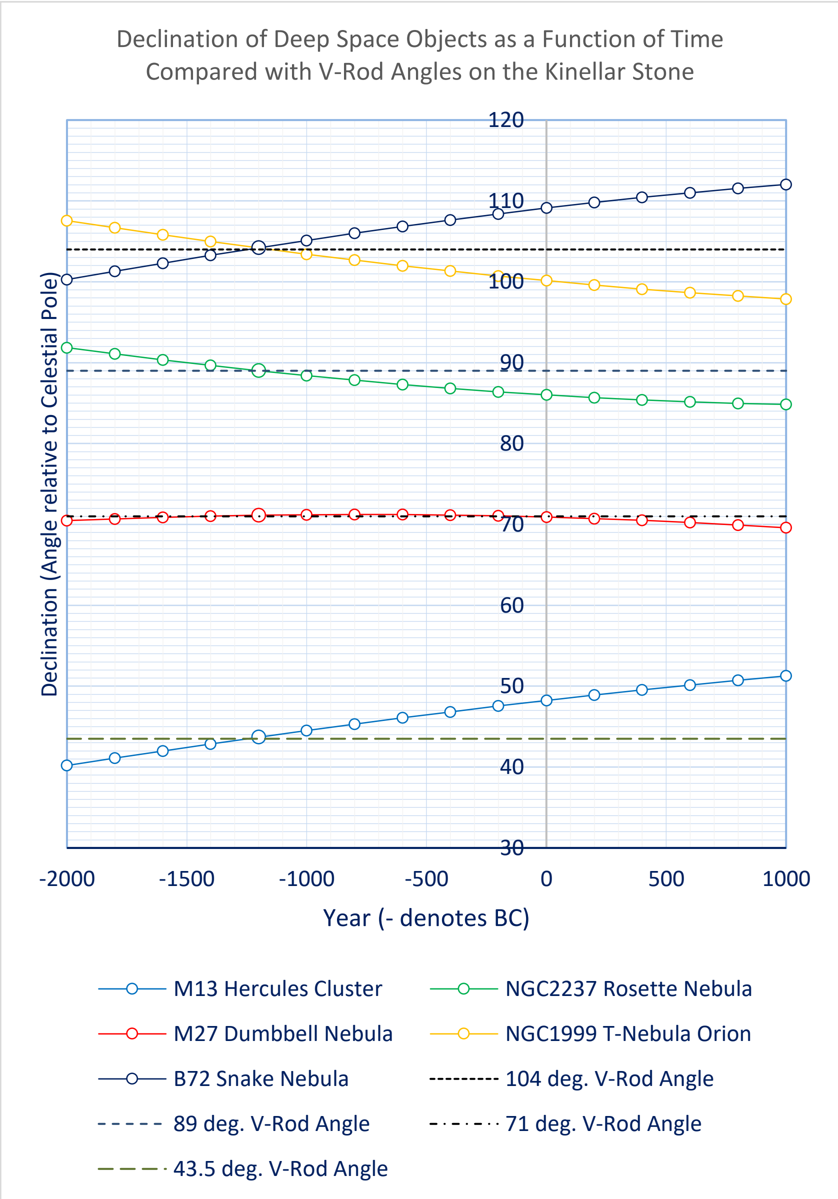
NGC7009 The Saturn Nebula in Capricorn

The Kinellar Stone and the Snake Nebula

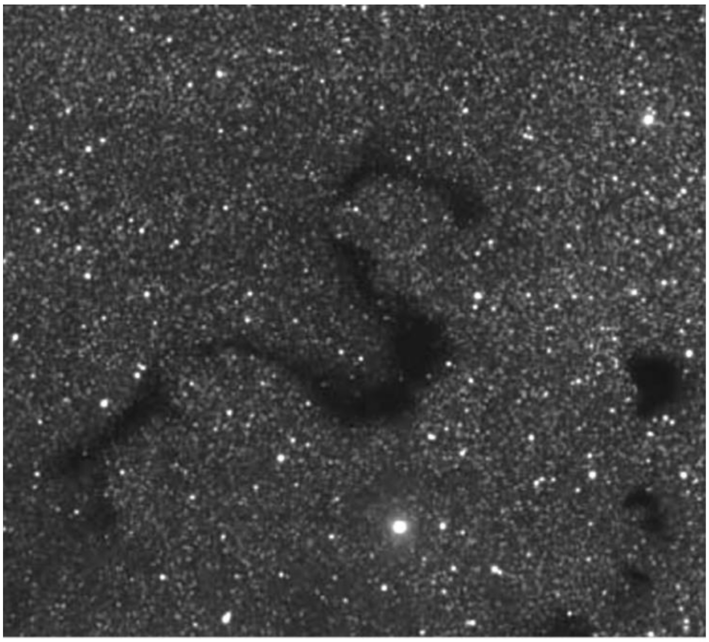
Perhaps the similarity of appearance of the Dumbbell Nebula, the Saturn Nebula and the triplet of galaxies in Andromeda to the carved images and the angles of the carved "V"s corresponding to the declination of these objects is coincidental but there is yet another Class I Pictish symbol stone, the Kinellar Stone, that reveals yet another example of a Crescent and V-Rod decorated with patterns that also bear a close similarity to deep space objects whose declinations marked by the angle of the carved V-Rod correspond to the declinations of those deep space objects.

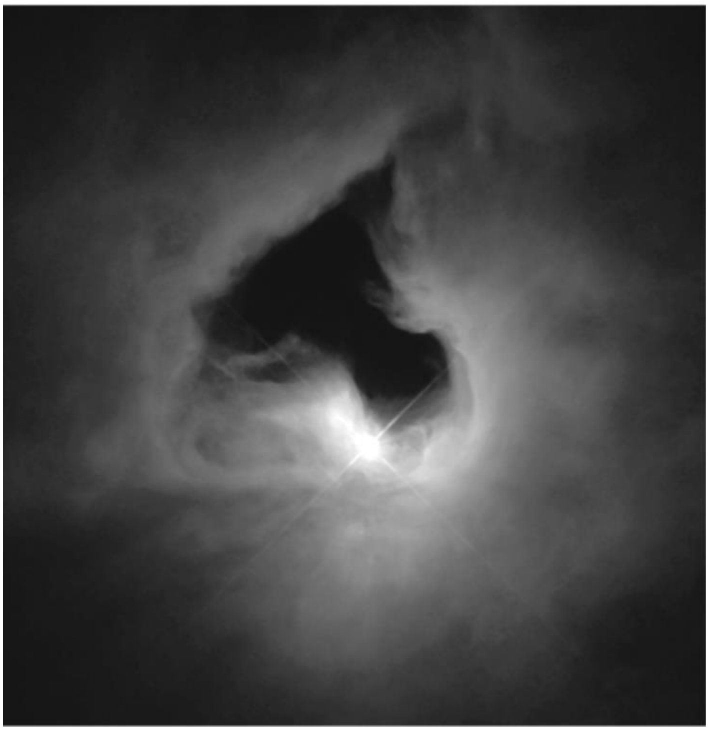
The Kinellar Stone

The angle of the "V" appears to mark three distinct angles within the crescent to the vertex and a fourth angle outside the crescent. The angles are 43.5 degrees, 71 degrees, 89 degrees and 104 degrees. The 71degree angle is familiar from the previous stones examined in coinciding with the declination of M27 around 1200BC. There are no significant Messier galaxies or nebulae within 44 degrees of the NCP there is however a major globular cluster in Hercules called the Great Globular Cluster of Hercules (M17) consisting of several hundred thousand stars. The table below reveals that the declination of the Rosette nebula NGC2237 coincides with the angle 89 degrees for 1200BC whilst the angle of 104 degrees coincides with two deep space objects for 1200BC, namely B72 the Snake Nebula and at the same declination, but different position in the sky NGC1999, the T-Shaped Nebula in Orion again for the year 1200BC.



It can be seen that the four angles carved in the various sections of the V-Rod coincide with the declinations of five deep space objects, namely M17, NGC 2237, M27, NGC 1999 and B72 for one date, namely 1200BC. The pattern of carvings in the crescent symbol, a snake-like decoration on the crescent and a T-Shape within the apex of the V-Rod, bear a remarkable similarity to the appearance of two of the deep space objects associated with the declination of 104 degrees; NGC1999 and B72 shown below. Even the apparently slightly asymmetrical carvings of both the snake and "T" on the stone reflect the appearance of the deep space objects when viewed through a powerful telescope.





The Snake Nebula B72 in Ophiuchus and the T-Shaped nebula NGC1999 in Orion

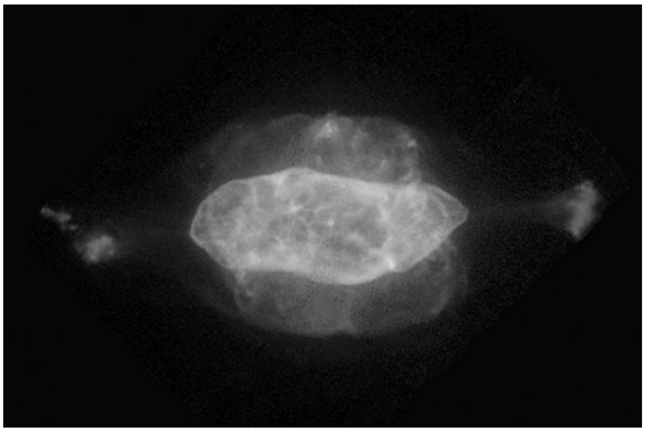
The Abdie Stone and the Horsehead Nebula

The Abdie Stone (76) in Fife is unusual in the amount of measurement data it contains especially as apart from being carved with the Class I Pictish symbols it also has subsequently been carved with a sundial and later still a benchmark, a means of determining the height above mean sea level for Ordnance Survey purposes. Benchmarks were carved during the last century on walls and various fixed objects to allow surveyors to determine whether the land was rising or falling with time.

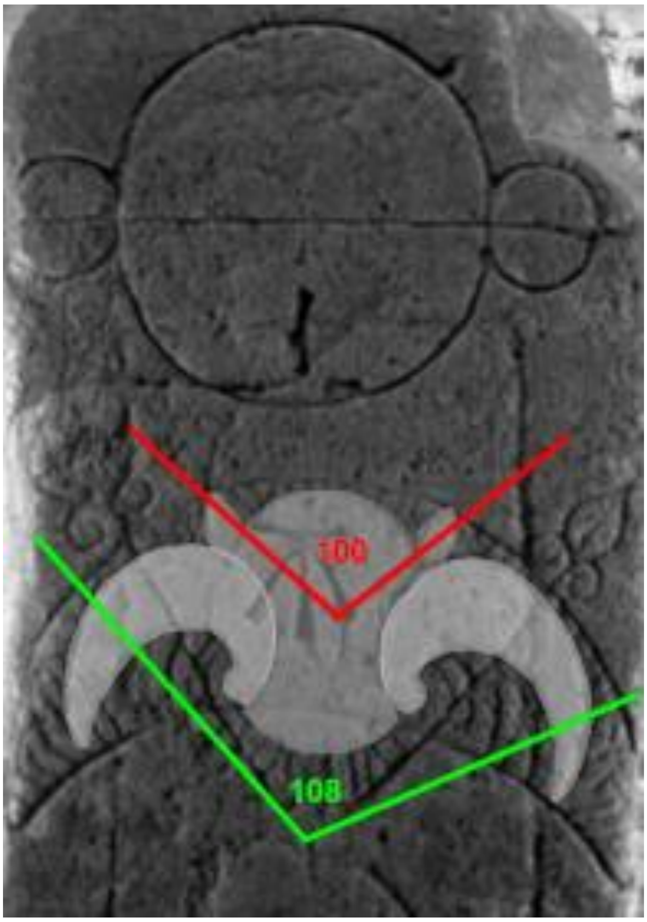
A Triple Disc symbolising Sagittarius sits above the Crescent and V-rod. The pattern within the crescent is complicated because of the amount of measurement information it contains with "recent" markings for a sundial and even the incredibly insensitive mark of a 20th Century Ordnance Survey benchmark gouged into its surface. There are also ancient marks along the edge of the crescent quadrant that appear to be calibrated to mark out angles of three Megalithic degrees from the vertex of the "V". Interestingly the radius of the circle that forms the crescent is 29.1cm or one half of the 58.25cm measure that we have described. This is a good choice of radius because the circumference of the circle is one half of 366cm in other words each megalithic degree is represented by 0.5cm of arc. The fact that the edge of the quadrant is marked every 1.5cm indicates that there are 3 megalithic degree calibrations along the edge of this quadrant. In practise perhaps these units were subdivided on the actual quadrant but in reality, these units could be easily estimated to the nearest half a megalithic degree by eye and perhaps again we see the importance of the triple unit in ancient times reflected in its calibration.

Abdie, Class II stone in Fife

An unusually large number of angles are indicated by the V-Rod which were measured on site at the old churchyard at Abdie, Fife in the Mort House as 71, 77, 81, 89, 100 and 108 Degrees respectively. The constellation of Sagittarius is due South at dusk at the Mid-Summer Festival on June 21st and due South at dawn on January 23rd.



Saturn Nebula NGC7009 similar in appearance to the Pictish Symbol of the Triple Circle



Horsehead Nebula Shaded in grey sandwiched by nubulous clouds (lighter grey). Declination of the Horsehead Nebula shown as a second shallow carved “V” (100^0) above the V-Rod where the declination of the Saturn Nebula is indicated at the apex of the V-Rod (108^0). The other angles are depicted by the different discreet angled sections of the V-Rod

When we look closely at the vertex of the "V" we can determine that an angle of around 108 degrees is indicated. The declination of the Saturn Nebula for 1200BC is -18 deg 21' or 108.3 degrees. The Saturn Nebula is due south around the Beltane Festival of May 6th at dawn as is the Dumbbell Nebula M27. If we look carefully within the crescent an attempt to define yet another angle appears to have been made as we can just make out a "V" angle whose vertex has been obscured by the carving of the benchmark. The angle measures 100 degrees and if we look closer at the pattern of carving within the crescent there is a shape that could be interpreted as a horse's head, suggested especially by the petal shaped "ears" along the top edge of the calibrated crescent. The declination of the Horsehead nebula in Orion is -9 deg 47' or 99.8 degrees. The horsehead and declination can best be observed by looking at the shaded image and then looking back at the earlier original image of the stone.

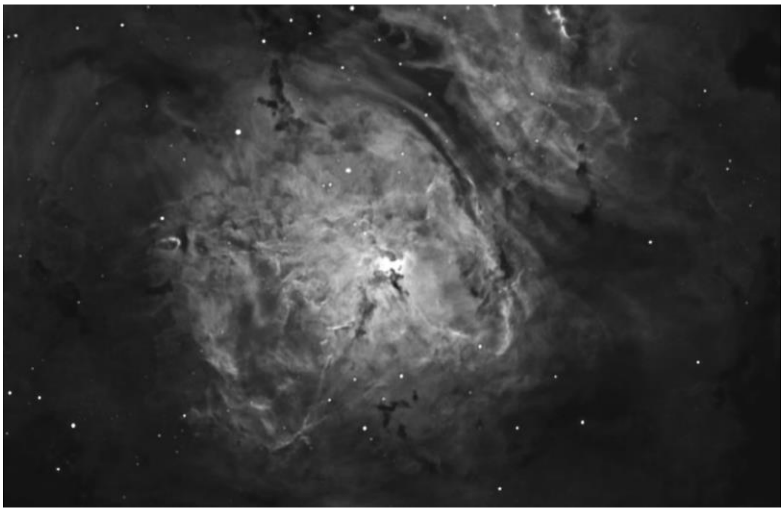
We have found that the rising and setting of both the Saturn nebula and Saturn itself (which of course share a similar appearance) were closely positioned on the horizon in the year preceding a natural disaster that was to change the lives of the Picts for decades and that event may have come to be associated as the harbinger of that disaster. In this stone therefore the two symbols can be used to identify nine of the main festivals consisting of, in a clockwise direction on the wheel of the year: December 21st the Midwinter festival, December 31st the Winter Solstice, January 23rd the Cetus festival, February 23rd the Orion festival, April 12th the Vela festival, May 6th the Start of Summer festival, June 21st the Mid-Summer festival, August 6th the End of Summer festival and September 20th the Autumn festival.

The Horsehead Nebula in Orion

Clynemilton Stone Number 1

Clynemilton stone number one shows a Mirror, a Crescent and V-rod and a Horseshoe above that represents Lyra. Unfortunately, the stone is broken through the Crescent but we can still measure the angles carved with a reasonable degree of accuracy.

The angle of V-rod is measured at 101 degrees but there appear to be three distinct angles as the V-Rod appears to be carved as three straight lines forming a bent curve. The other angles were measured as 105 degrees and 111 degrees. It might be reasonably argued that having described the Crescent and V-Rod as a quadrant, the idea of a bent sighting rod appears to be at odds with its function as a quadrant. However, it is believed that the symbol is satisfying the purpose of identifying more than one deep space object using this device. If the angles are identifiable as discreet angles and if each angle does relate to the declination of a deep space object that happens to be at a significant cardinal position on one of the festival days at the start and end of civil twilight then this is more supporting evidence that the staged bent V is a clever way of indicating more than one deep space object in a single symbol.



The horseshoe nebula or M17 has a declination of -11 degrees or 101 degrees from the pole position for the year 1200BC. It is interesting that perhaps the image of the horseshoe is being used to represent both the constellation Lyra and the Horseshoe Nebula. The declination indicated by the angle of the carved "V" matches the declination of the nebula for years around 1200BC +/- 100 years. The Horseshoe Nebula is due South at dusk at the Mid-Summer festival of June 21st and due South at dawn on the Cetus festival on January 23rd.

All declinations are to the nearest minute for midnight of December 21st of the respective year.

Date	Declination of Omega (M17)
1400BC	-10deg 19'
1200BC	-10deg 54'
1000BC	-11deg 36'
500BC	-13deg 9'
01AD	-14deg 25'
500AD	-15deg 22'
1000AD	-15deg 59'
2000AD	-16deg 11'

Searching for the other deep space objects represented by the other two angles we need to consider that given M17 appears to give a perfect match for 1200BC we would expect the other two objects to have a declination that matched the angles of 105 degrees and 111 degrees for the same date, that is declinations of -15 and -21 degrees.

Date	M93	HD44179
1400BC	-21deg 12'	-15deg 23'
1200BC	-21deg 2'	-14deg 47'
1000BC	-20deg 54'	-14deg 12'
500BC	-20deg 46'	-12deg 56'
01AD	-20deg 53'	-11deg 55'
500AD	-21deg 15'	-11deg 10'
1000AD	-21deg 52'	-10deg 43'
2000AD	-23deg 51'	-10deg 38'

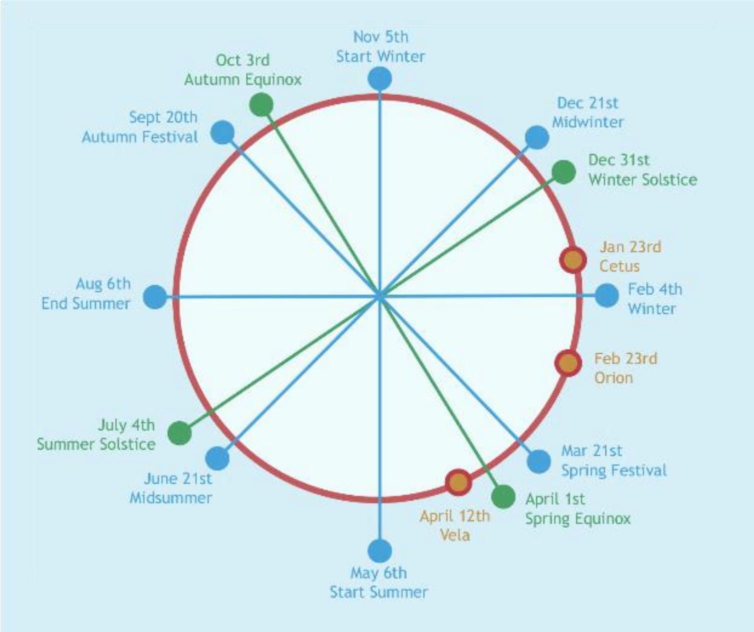
When we examine the declinations of other nebulae and galaxies, we find a match with M93 and HD44179 that have declinations of -21deg 2’ and -14deg 47’ respectively for the year 1200BC. The question we might ask is what significance, if any, do these three deep space objects have in terms of the proposed purpose of this stone as a calendrical marker? The answer is that the three deep space objects suggested by the angles depicted by the V-Rod all are aligned precisely due South in the sky at Civil Twilight on important festival days in the Pictish calendar.

Deep Space Object	Alignment	Time of Alignment	Date	Festival
M17	Due South	Start of Civil Twilight	23rd January	Cetus
	Due South	End of Civil Twilight	21st June	Mid-Summer
M93	Due South	End of Civil Twilight	21st March	Spring
HD44179	Due South	Start of Civil Twilight	20th September	Autumn

The three deep space objects are associated with four of the fifteen Pictish festivals. The other symbols carved on the Clynemilton stone are the Mirror, the Horseshoe and the Tuningfork. These “constellation” symbols represent the following festival days when they are aligned with cardinal points at Civil Twilight.

Symbol (Constellation)	Alignment	Time of Alignment	Date	Festival
Mirror (Virgo)	West	Start of Twilight	4th February	Winter
	East	End of Twilight	21st March	Spring
	South	End of Twilight	6th May	Start of Summer
	West	End of Twilight	21st June	Mid-Summer
	West	End of Twilight	4th July	Summer Equinox
	East	Start of Twilight	3rd October	Autumn Equinox
Horseshoe (Lyra)	East	Start of Twilight	21st December	Mid-Winter
	West	End of Twilight	21st December	Mid-Winter
	East	Start of Twilight	31st December	Winter Solstice
	South	Start of Twilight	21st March	Spring
	South	Start of Twilight	1st April	Spring Equinox
	West	Start of Twilight	3rd October	Autumn Equinox
	South	End of Twilight	6th August	End of Summer
Tuningfork (Taurus)	East	End of Twilight	5th November	Start of Winter
	East	Start of Twilight	4th July	Summer Solstice
	West	End of Twilight	12th April	Vela
	South	End of Twilight	4th February	Winter

The depiction of just four symbols does a good job in describing all twelve of the major stellar and solar Pictish festivals and the two festival days dedicated to calibrating pendulum lengths on the Cetus and Vela festival days.



Pictish Wheel of the Year Calendar of Stellar and Solar Festivals 1200BC

The Picts have not made it easy to simply measure the angles of the V-Rods they carved, because they have carved in many instances "Vs" that consist of two or three joined sections that each have discrete gradients. The only legitimate argument for the depiction of more than one angle on the V-Rod is that more than one deep space object is being represented in the one symbol to maximise the amount of information being conveyed by the Crescent and V-Rod. For this argument to have any veracity there would need to be some evidence that the objects indicated by the angles, either were themselves depicted in a carved pattern above or within the Crescent and V-Rod symbol, or the objects depicted had some relevance in terms of their position in the night sky on important solar and stellar festival days. The obstacles that need to be overcome in terms of convincing a rightly sceptical academia are enormous; the proposed date of carving 1900 years before the date currently accepted by archaeologists for their carving, the use of a quadrant to indicate the position of deep space objects, moreover a quadrant depicted with bent alignment shafts and above all, the requirement for a powerful telescope to observe galaxies and nebulae some 2800 years before Galileo. Perhaps this is stretching open-mindedness too far but what if history has got it wrong and we have led ourselves up a blind alley due to false assumptions that have never been properly challenged. The prize of open-minded consideration is the possibility of finally opening up three thousand years of lost history simply because our assumptions have been wrong from the start. The problem is that the assumptions have become so strongly entrenched by generations of academic acceptance, despite their flimsy nature, that any alternative idea is difficult for many to even consider objectively and scepticism has often become cynicism. However, there is clearly a responsibility to offer more evidence to be objectively considered.

Examination of Crescent and V-Rod Angles carved on Class I Pictish Stones

There are relatively few Pictish Class I stones that have carved patterns either within or above the crescent that can be identified as sharing a similar appearance to deep space objects, there are however very many stones carved with the crescent and V-Rod symbol and these stones can be examined to determine whether these symbols also portray angles that coincide with the declination of deep space objects.

The examination of the Crescent and V-Rod Class I Pictish Stones is best carried out by gathering a selection of good quality Class I Pictish Symbol Stones carved with a Crescent and V-Rod Symbol and measuring the angles clearly indicated by the carved V-Rod.

There are approximately fifty Class I Pictish symbol stones that have Crescent and V-Rod symbols carved on them. Of these, some are damaged and are missing parts of the symbol making it difficult to measure the angles carved in their V-Rods. Other stones are very weathered and this makes the measurement of the angles with a high degree of accuracy impossible. There is also the question of how to accurately measure the angles of the V-Rods from photographic images of the stones, as distortion will occur if the angle of view is not perpendicular to the stone face carved with the symbol. As a first stage, the examination of the photographic images taken by archaeologists and available to view on the Canmore site can be undertaken to obtain V-Rod angular data. Archaeologists take special care when taking photographic images of artefacts to try and ensure that the images are faithful representations of their subject matter. The images of Pictish stones are generally taken perpendicular to the flat surface of the stone, though sometimes the size of the stone and the available viewing position for the photographer can cause distortions of the image to be unavoidable. However, it is possible to determine whether a photograph has been taken approximately perpendicular to the stone's carved face in these particular images by examining the shape of the photographic image of carved circles, or circular arcs and comparing their curvature with perfect circles to see whether there is any significant distortion of the image caused by the image having been captured at an angle other than perpendicular to the stone's carved surface..

Optical Distortion

When an image of a carved surface is taken from an angle either above or below or to the left or right of the carving, the photographic image obtained will not be one that can be used to make an accurate direct measurement of the dimensions or angles carved on the original stone. The distortions can most easily be seen when a carved circle is examined; there are many Pictish symbols containing circular elements such as the Mirror, the Triple Disc, the Double Disc and Z-Rod and the Mirror-case, these circular patterns were most likely first drawn onto the stone using a string radius or pair of compasses before being carved. We can therefore measure how circular photographic images of these symbols appear to determine the likely angle of view of the camera when the image was taken. More importantly for this study, and for cases where no circular symbols are present on the stone, the Crescent and V-Rod symbol itself is carved as two arcs of different diameters, the larger outer crescent forming a circular arc and again the degree of obliquity can be measured of these two circular arcs to determine whether the photographic image was taken perpendicular to the stone's surface.

The Crescent and V-Rod as a quadrant requires that its outer arc is circular, at least within the range of angles measured by the arrow head shaft and hinged tail. The reason for this is that the quadrant was usually made with an outer circle diameter of 58.25cm which gave a circle of circumference 183cm so that each megalithic degree can be represented by 2cm of arc. The edge needed to be circular to allow it to be accurately calibrated with evenly spaced marks for the easy determination of angles during alignment. Sometimes the Crescent and V-Rod as carved on the stone departs from the circle towards the outer extremes of the crescent perhaps due to constrictions imposed by the size of the stone and the desire to maximise the size of the carved symbol on the available space. In these cases however, the edge of the crescent enclosed by the V-Rod appear to be circular and can be used to confirm that the image was taken from a viewing angle more or less perpendicular to the stone. The photographic images used for the analysis of Crescent and V-Rod carvings were taken from the Canmore site and in each case the image was examined to determine how circular the Crescent and V-Rod, and where present, other circular shaped symbols, such as the Mirror or Double disc were. It was also seen that some distortion occurs towards the periphery of the image even when the camera was perpendicular to the flat stone surface but showed no such distortion for the object directly in front of the camera.

The circle is described by the equation $\mathbf{x^2 + y^2 = r^2}$, where r is the radius of the circle.

Apollonius of Perga around 200BC in his treatise on conic sections proved that the intersection of an oblique circular cone with any plane intersecting all generatrices is always an ellipse. In other words, a carved circle will appear as an ellipse when a photograph is taken of it from any angle other than directly perpendicular to it.

The ellipse can be described by the equation $\mathbf{x^2/a^2 + y^2/b^2 = 1}$

The circle is simply a particular example of an ellipse where $\mathbf{a^2 = b^2}$ which are then described as $\mathbf{r^2}$, the radius of the circle squared.

The circle is converted to a flattened horizontal ellipse when viewed from above or below the perpendicular whilst it appears as an elongated vertical ellipse when viewed from left or right of the perpendicular. A combination of flattening and elongating effects occurs when the view angle is displaced both either up or down and left or right of the perpendicular. The angle of view is relevant to us in that apart from distorting the appearance of circular patterns, it will also distort the appearance of the V-Rod and the angle that can be measured. Again, the angle of the carved "V" will appear flattened in an image taken from a point either above or below the perpendicular angle of view, meaning that any angle measured from the image will be greater than the angle actually carved on the stone. Conversely the angle of the V-Rod will appear to be less if the image is taken from a point left or right of perpendicular. As it is the angle of the V-Rod that we wish to measure, this measurement will only be accurate if the image is taken perpendicular to the carved V-Rod but we can use the measurement of the degree of elliptical distortion of known circular curves to determine whether the angles of the V-Rods portrayed on the photos are reliable representations of the actual angles carved on the stones.

Whilst it is possible to mathematically determine the angle of view by measuring how circular or elliptical an image of a circle appears on a photograph and thereby make adjustments to the angle of V measured, and compensate for this obliquity, this level of manipulation has limitations and doesn't account for other optical distortional effects and it was decided therefore to select only carved stones that showed no measurable distortion to the carved circular lines and use measured data from these images and to minimise the effect of individual errors by analysing the data obtained from as many stones as possible to determine the overall pattern of distribution of angles portrayed on the group of stones.

Method of Measurement of Angles carved on the Stones

The photographic image of the Pictish stone (usually a Canmore Image) was imported into Photoshop Elements where the image could be magnified and enhanced if necessary to maximise the visibility of carved lines comprising the Crescent and V-Rod symbol. A new layer was created and thin lines of 1 pixel width were laid over the various straight sections of the V-Rod. The advantage of this method is that the image can be magnified to a level that allows a much thinner line to be drawn to bisect the carved "channels" comprising the carved V-Rod lines. The other advantage is that the bearing of the lines drawn to coincide with the different straight sections is displayed in Photoshop as the line is being drawn and gives a much more accurate and consistent measurement than could be achieved using a protractor.

Fifty Pictish Class I stones carved with the Crescent and V-Rod symbols of which thirty five stones, 36 faces (Dingwall stone 102a and 102b) were selected for examination are detailed in the table below.

Stones carved with Crescent and V-Rods

Stone Reference	Location	Symbols
4	Bourtie	Double Disc & Z-Rod, Mirror, Crescent & V-Rod
5	Brandsbutt	Crescent & V-Rod, Serpent
10	Daviot	Mirror, Crescent & V-Rod
11	Deer	Rectangle, Crescent & V-Rod
19(i)	Fyvie	Kelpie, Crescent & V-Rod, Mirror
22(i)	Inverurie	Double Disc, Crescent & V-Rod, Serpent
24	Kinellar	Circle, Crescent & V-Rod
27b	Kintore	Kelpie, Crescent & V-Rod
28(i)	Elphinstone	Double Disc & Z-Rod, Crescent & V-Rod
28(ii)	Elphinstone	Double Disc &Z-Rod, Crescent & V-Rod
28(iii)	Elphinstone	Kelpie, Crescent & V-Rod
36	Park House	Mirror, Crescent & V-Rod, Flower
39(iv)	Rhynie	Double Disc & Z-Rod, Crescent & V-Rod, Mirror
42	Tillypronie	Crescent & V-Rod, Notched Rectangle
43(ii)	Tillytarmont	Double Disc & Z-Rod, Crescent & V-Rod
43(iii)	Tillytarmont	Double Disc & Z-Rod, Crescent & V-Rod
58	Kinblethmont	Kelpie, Crescent & V-Rod, Mirror
64	Strathmartine	Kelpie, Crescent & V-Rod
75	Edinburgh	Double Disc and Z-Rod, Crescent & V-Rod
76	Abdie	Triple Disc, Crescent & V-Rod, Mirror
87	Advie	Crescent & V-Rod, Mirrorcase
91	Ballintomb	Crescent & V-Rod, Notched Rectangle
92	Beauly	Triple Oval, Crescent & V-Rod
94	Clach Ard	Double Disc & Z-Rod, Crescent & V-Rod, Mirror
95(i)	Clynekirkton	Rectangle, Crescent & V-Rod
95(ii)	Clynekirkton	Rectangle, Crescent & V-Rod, Mirror
96(i)	Clynemilton	Horseshoe, Crescent & V-Rod, Mirror
99	Craigton	Crescent & V-Rod, Flower, Notched Rectangle
100	Crosskirk	Crescent & V-Rod, Horseshoe
102a	Dingwall	Double Disc & Z-Rod, Crescent & V-Rod
102b	Dingwall	Circle, Crescent & V-Rod
111	Fiscavaig	Double Disc & Z-Rod, Crescent & V-Rod
116	Golspie	Kelpie, Crescent & V-Rod, Mirror

Stone Reference	Location	Symbols
119	Inverallan	Crescent & V-Rod, Notched Rectangle
120	Invereen	Double Disc & Z-Rod, Crescent & V-Rod
123(ii)	Kintradwell	Mirror, Crescent & V-Rod
136	Raasay	Tuningfork, Crescent & V-Rod
139	Roskeen	Tuningfork, Crescent & V-Rod
142	Skinnet	**Class II, Crescent & V-Rod, Triple Oval**
145	Tobar na Maor	Circle, Crescent & V-Rod
154	Covesea	Fish, Crescent & V-Rod
156a	Easterton of Roseisle	Mirror, Crescent & V-Rod
159(ii)	Inveravon	Triple Disc, Crescent & V-Rod, Mirror
159(iv)	Inveravon	Kelpie, Crescent & V-Rod
168	Knowe of Burrian	Mirror, Crescent & V-Rod, Eagle
169	Orphir	Rectangle, Crescent & V-Rod
172	Redland	Rectangle, Crescent & V-Rod
173a	South Ronaldsay	Crescent & V-Rod, Mirrorcase
176	Abernethy	Tuningfork, Crescent & V-Rod
203	Pabbay	Crescent & V-Rod, Flower
N/A	Greens, StAndrews, Orkney	Mirror case, Crescent & V-Rod, Mirror

Thirty-five stones, 36 stone faces (Dingwall stone both faces) (Stone reference numbers in bold) were selected for V-Rod angle measurement. Some stones that were damaged, badly weathered, photographed at non-perpendicular angles or whose images were only available as drawings were omitted from the analysis.

Analysing the V-Rods it can be seen that the range of angles expressed by the V, varies between about 65 degrees and 120 degrees. Significantly it is noticeable that the shafts of either one or usually both appear to be not perfectly straight along their entire lengths. It can be observed however that the bends of the shafts are formed from two distinct sections of straight sections rather than a curved shaft. In most examples of Crescent and V-Rods there are two discreet straight-line sections on each side of the V-Rod, two on the arrow shaft used to align with the deep space object and two on the weighted tail section that allows the angle of declination to be read from the quadrant 's edge. Perhaps this is a device to allow more than one deep space object to be identified on the quadrant, the general pattern of V-Rods is shown in the diagram below. The lines 1 and 2 describe the angles depicted by the tail branch of the "V" whilst lines 3 and 4 describe the angles of the arrow head branch of the "V". In this manner up to four declination angles can be depicted on each V-Rod, namely the angles between 1 and 3, 1 and 4, 2 and 3 and 2 and 4, allowing potentially four different deep space object declinations to be identified.

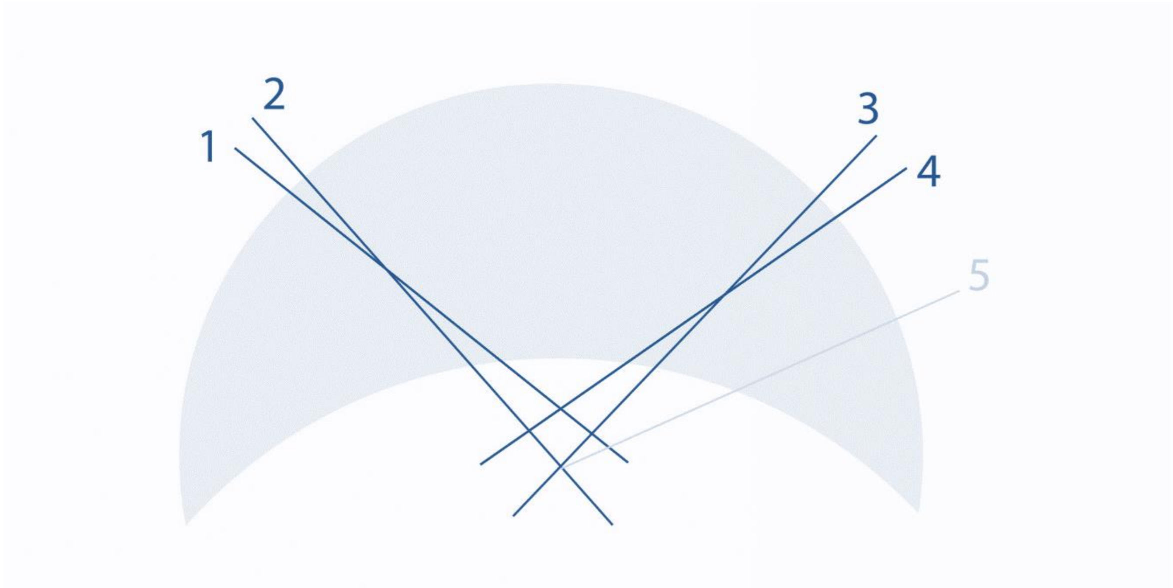


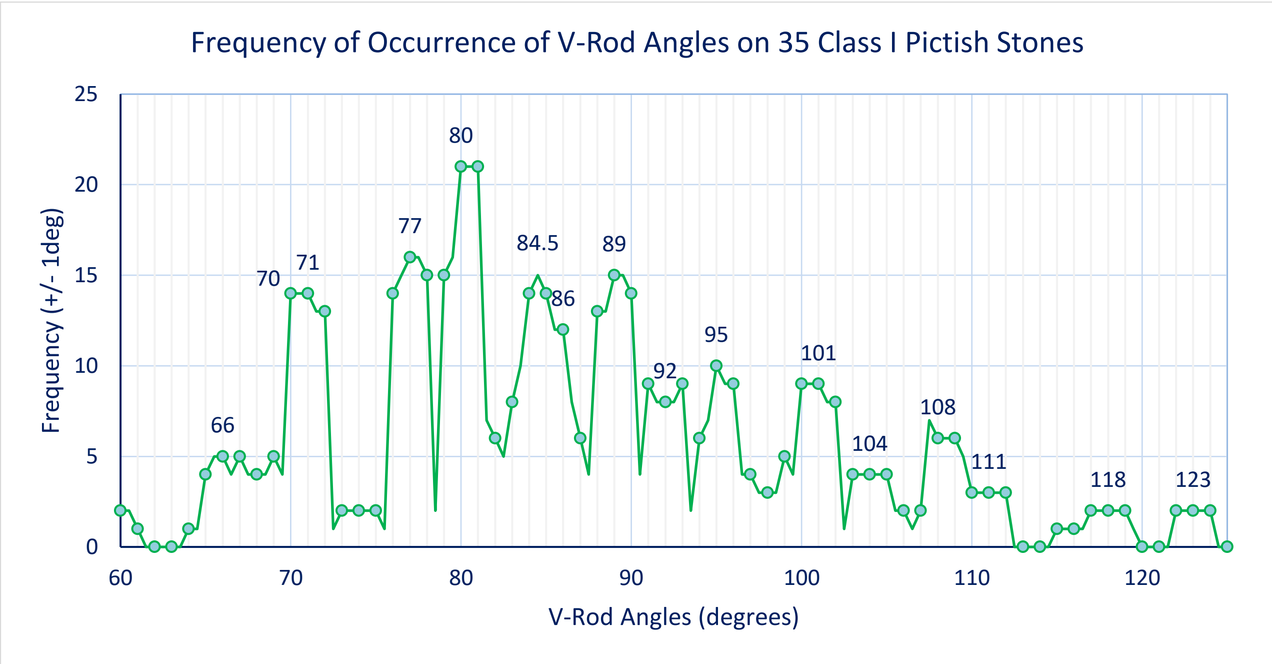
Diagram of Crescent and V-Rod with lines 1-4 representing a typical general arrangement of discreet alignments of the two arms of the V-Rod. Usually the V-Rod has more than one angle indicated in each arm but sometimes the arrowhead shaft arm is straight along its length so that there is no alignment 2 but there are maybe three sections of different angles in the tail section (lines 3-5).

Sometimes either the vertex of the V-Rod or the arrow head and tail are bent to express large angles and declinations of deep space objects widely separated from the Celestial Pole. These angles are more difficult to accurately measure than the straight sections of the shafts and have not always been included in the analysis due to the difficulty in objectively measuring these angles when the length of bend is short.

Each of the 36 stones measured is shown in the Appendix together with the best fit lines labelled 1-4 describing the various general pattern of alignments whilst lines 5 and 6 describe instances where additional bent sections of the tail shaft occur usually when the arrow shaft is carved as a single straight line rather than the more usual method of representing it as a twin angle shaft. It is difficult to measure the angles within an accuracy of 1 degree given the lines are best-fit lines for relatively short sections of carved lines taken from photographic images. The angles are stated as measured directly from Canmore images and although measured to the nearest half a degree should be considered at best as plus or minus 1 degree. The graph of frequency of occurrence of measured angles is plotted as a rolling average over plus or minus 1 degree to try and overcome the inherent difficulties in measurement.

All the measured angles are tabulated below. The frequency that these angles occur are expressed to determine whether the distribution of angles could be regarded as coincidental or whether there is a pattern of depicting particular angles more frequently than would occur by chance and therefore representing particular deep space objects if those frequently depicted angles coincide with their declinations.

Stone Reference	Location	V-Rod Measured Angles						Additional Angles
		1,3	1,4	1,5	2,3	2,4	2,5	
4	Bourtie	68	85	-	60	77	-	
10	Daviot	92	101	-	89	98	-	
19(i)	Fyvie	80	92	-	71.5	83.5	-	
22(i)	Inverurie	83.1	89.4	-	71	77	-	
24	Kinellar	68.4	88.9	104	-	71	86.1	64.9, 80, 123
27b	Kintore	76.5	83.5	86.1	-	-	-	
28(i)	Elphinstone	69	74	80	66	71	77	
28(ii)	Elphinstone	71.1	83.5	89	-	-	-	
28(iii)	Elphinstone	77	83.7	95	71	78.2	92.5	
36	Park House	80	86	-	71	77	-	
39(iv)	Rhynie	71	77	80	-	-	-	
42	Tillypronie	96	101	89	84.3	89.3	77.3	80, 71, 68.3, 59.3
58	Kinblethmont	77	86.4	-	71	80.4	-	
76	Abdie	90	100	108	77	87	95	70.8, 80.8, 88.8
91	Ballintomb	95.1	98.5	-	92	96	-	
92	Beauly	66	80.2	-	56.8	71	-	
94	Clach Ard	84.5	88.8	-	76.7	81.0	-	
95(i)	Clynekirkton	108.6	118	123.2	101	111	116	
95(ii)	Clynekirkton	92	98.4	-	89	95.4	-	
96(i)	Clynemilton	108	118.5	-	101	111	-	
99	Craigton	100.8	108.5	-	92	99.7	-	
102a	Dingwall	80	-	-	-	-	-	
102b	Dingwall	71	85.6	-	66	80.6	-	
111	Fiscavaig	106.5	111	-	104	108.5	-	
119	Inverallan	66.3	71	77.1	-	-	-	79.8
120	Invereen	92	102.5	-	84.7	95.2	-	
136	Raasay	70	81	-	66	81	-	
156a	Easterton of Roseisle	92	101	-	71	80	-	
159(ii)	Inveravon	84.2	88.9	-	80.7	85.4	-	
159(iv)	Inveravon	90	95	-	80	85	-	
168	Knowe of Burrian	80	88.3	-	77	83.4	-	
172	Redland	105	108.5	-	101	104	-	
173a	South Ronaldsay	77	80	-	-	-	-	
176	Abernethy	77	80	-	70.8	73.8	-	
203	Pabbay	94	96	-	87	89	-	
N/A	Greens St.Andrews, Orkney	84	89	-	80	85		



The measurements were made to the nearest 0.5 degrees and then the 139 measured angles were sorted and the frequency of each angle occurring determined. The frequency of occurrence was plotted as a moving total of five points each total represents that, plus or minus 1 degree, for each half degree angle measured. It is clear that there appear to be discreet peaks where certain angles are represented much more frequently than would be expected if the distribution was random. It is interesting to compare the measured angles with the declinations of deep space objects relative to the Celestial Pole for a date of around 1200BC.

The French astronomer Charles Messier catalogued 110 deep space objects including star clusters, galaxies and nebulae in around 1781. If we select only catalogued nebulae and galaxies and omit the star clusters and ignore any objects within 60 degrees of the North Celestial Pole, (as there are no V-Rod angles measured at less than 60 degrees), there are 33 galaxies and nebulae whose declination relative to the Celestial Pole can be examined. A further 15 galaxies and nebulae were selected from the New General Catalogue (NGC), and other astronomical catalogues.

The Table below lists the 48 selected galaxies and nebulae and their declinations calculated relative to the Celestial Pole.

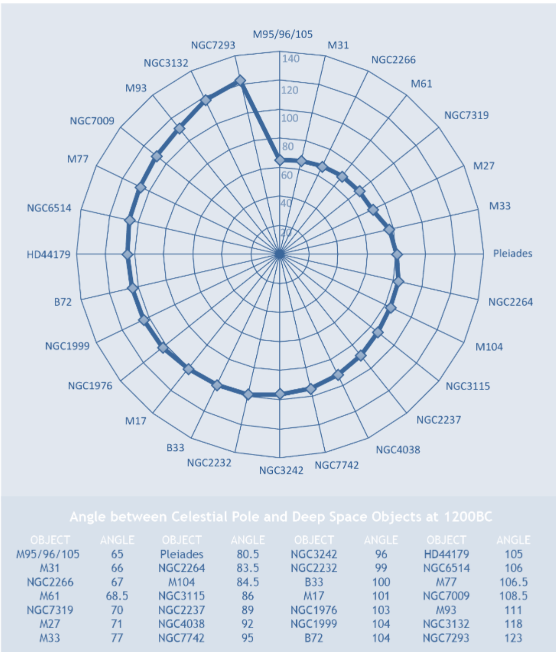
Messier Number	Constellation	Object	Declination (°,′,″) (1200BC)	Angle (°,′,″) from Celestial Pole
M8	Sagittarius	Lagoon Nebula	-17 32 20	107 32 20
M16	Serpens	Eagle Nebula	-8 28 8	98 28 8
M17	Sagittarius	Omega Nebula	-10 53 28	100 53 28
M20	Sagittarius	Trifid Nebula	-16 8 53	106 8 53
M27	Vulpecula	Dumbbell Nebula	+18 51 17	71 8 43
M28	Sagittarius	Globular Nebula	-19 26 7	109 26 7
M31	Andromeda	Andromeda Galaxy	+23 55 43	66 4 17
M32	Andromeda	Galaxy	+23 31 36	66 28 24
M33	Triangulum	Pinwheel Galaxy	+13 7 32	76 52 28
M42	Orion	Orion Nebula	-12 59 13	102 59 13
M43	Orion	Nebula	-12 51 10	102 51 10
M45	Taurus	Pleiades	+9 38 11	80 21 49
M49	Virgo	Galaxy	+25 3 23	64 56 37
M58	Virgo	Galaxy	+29 0 14	60 59 46
M59	Virgo	Galaxy	+28 54 0	61 6 0
M60	Virgo	Galaxy	+28 49 46	61 10 14
M61	Virgo	Galaxy	+21 23 4	68 36 56
M65	Leo	Galaxy	+27 54 49	62 5 11
M66	Leo	Galaxy	+27 52 14	62 7 46
M74	Pisces	Galaxy	-1 44 13	91 44 13
M77	Cetus	Galaxy	-16 28 1	106 28 1
M78	Orion	Nebula	-6 56 49	96 56 49
M83	Hydra	Galaxy	-12 20 41	102 20 41
M84	Virgo	Galaxy	+29 50 1	60 9 59
M86	Virgo	Galaxy	+29 54 58	60 5 2
M87	Virgo	Galaxy	+29 27 12	60 32 48
M88	Coma Berenices	Galaxy	+31 29 53	58 30 7
M89	Virgo	Galaxy	+29 42 20	60 17 40
M95	Leo	Galaxy	+24 53 50	65 6 10
M96	Leo	Galaxy	+25 9 20	64 50 40
M104	Virgo	Sombrero Galaxy	+5 38 28	84 21 32
M105	Leo	Galaxy	+25 57 14	64 2 46
M110	Andromeda	Galaxy	+24 22 13	65 37 47

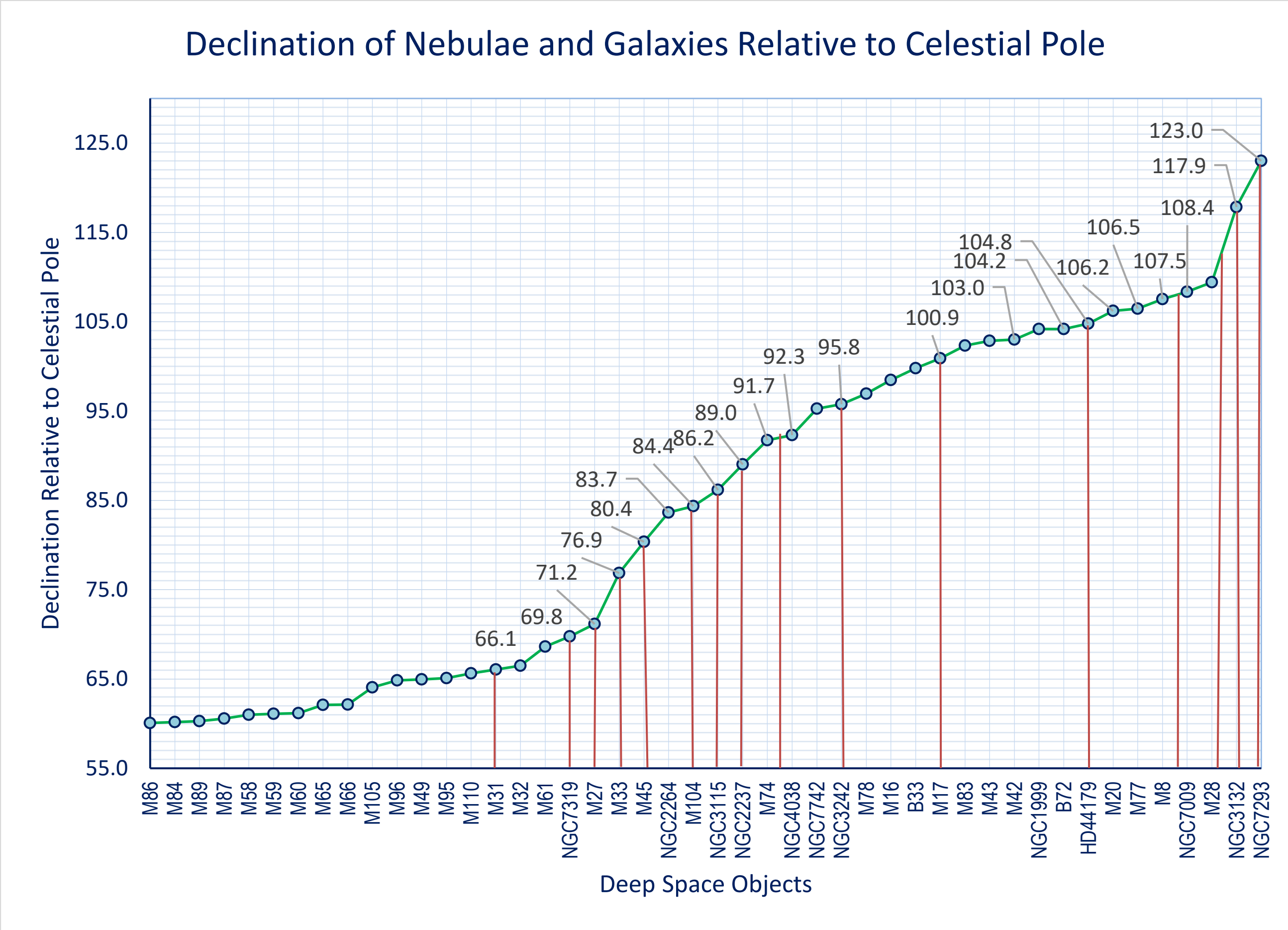
33 galaxies and nebulae catalogued by Messier

Additional bright Nebulae and Galaxies appearing in the New General Catalogue and other astronomical catalogues

NGC or Other Reference	Constellation	Object	Declination (⁰,′,″) (1200BC)	Angle (⁰,′,″ from) Celestial Pole
NGC 2264	Monoceros	Cone Nebula	+6 20 56	83 39 4
NGC2237	Monoceros	Rosette Nebula	+0 58 48	89 1 12
NGC4038	Corvus	Antennae Galaxies	-2 18 29	92 18 29
NGC7742	Pegasus	Egg Galaxy	-5 14 55	95 14 55
NGC7319	Pegasus	Stephan's Quintet	+20 13 28	69 46 32
NGC2266	Gemini	Open Cluster	+22 45 51	67 14 9
NGC3132	Vela	Eight Burst Nebula	-27 51 16	117 51 16
NGC1999	Orion	T shaped Nebula	-14 10 56	104 10 56
NGC3115	Hydra	Spindle Galaxy	+3 50 26	86 9 34
NGC3242	Hydra	Ghost of Jupiter	-5 46 10	95 46 10
NGC 7293	Aquarius	Helix Nebula	-33 0 28	123 0 28
NGC7009	Aquarius	Saturn Nebula	-18 21 43	108 21 43
B33	Orion	Horsehead Nebula	-9 47 24	99 47 24
B72	Ophichus	Snake Nebula	-14 12 2	104 12 2
HD 44179	Gemini	Red Rectangle Nebula	-14 47 8	104 47 8

It appears that there are deep space objects whose declinations match the angles carved as V-Rods on the Pictish Class I symbol stones. Moreover, the nebulae and galaxies that match the angles measured from the stones appear to be the brightest, most interesting deep space objects that can be observed and usually have individual names associated with them to describe their appearance.





The declinations relative to the Celestial Pole of deep space objects are plotted as degrees and the peak values from the graph of most frequently measured V-Rod angles are marked in red giving the possible identification of each of the most frequently angles carved on the Crescent and V-Rod symbols

The small peak V-Rod angle of 66 degrees coincides with the declination of the Andromeda galaxy M31 and this galaxy flanked by M110 and M32 that complete the triplet of galaxies as represented by the Triple Oval symbol on the Pictish stones seems like the only candidate for this angular representation on those Class I Crescent and V-Rods displaying an angle of 66 degrees.

The V-Rod angle peak of 70-71 degrees was one of the most frequently found angles on the 35 selected Crescent and V-Rod symbols. It appears to coincide with both NGC7319, Stephan's Quintet and the nebula M27 popularly known as the Dumbbell nebula due to its characteristic appearance.

Another commonly represented angle on the Crescent and V-Rod symbols is 77 degrees. This angle coincides with the declination of M33 popularly called the Whirlpool Galaxy. There appear to be no other galaxies or nebulae lying within a couple of degrees of this declination supporting this galaxy as the most likely deep space object identified by the carved angle of 77 degrees.

The angle of 80-81 degrees is the most frequently represented V-Rod angle and coincides with the declination of M45, The Pleiades or Seven Sisters in Taurus. It is perhaps to be expected that a deep space object that is easily visible to the naked eye is most commonly represented as a V-Rod angle. As was seen in the stone circle alignments, the seven sisters were used for alignment purposes some two thousand years before the Class I Pictish stones were carved though precession would mean that the days of alignment would change over two millennia. There are no other deep space objects that have a declination close enough to 80 degrees that could qualify them as possible candidates for the subject of the V-Rod representation.

The angle of 84-85 degrees represented on many of the Crescent and V-Rods coincides with two possible deep space objects, both of which have a characteristic appearance, namely the Cone Nebula in Monoceros NGC 2264 and the Sombrero Galaxy in Virgo M104. It is possible that both these objects are being represented by the 84 degree angle.

The angle of 86 degrees may represent the deep space object known as NGC3115, the Spindle Galaxy. There are no other major galaxies or nebulae within two degrees of this declination making it the prime candidate for the subject of this carved angle.

The Rosette Nebula NGC2237 in Monoceros has a declination that coincides with the next frequently carved V-Rod angle of 89 degrees.

The 92 degree V-Rod angle peak can be accounted for by either M74 or NGC4038 which lie within one degree of declination of each other. Given the appearance of NGC4038 as the Antennae galaxies and the carving sometimes of a horseshoe shape in association with the Crescent and V-Rod this may help identify this as the subject of this angular representation but M74 is a spectacular spiral galaxy in Pisces and it may have been represented by a V-Rod angle of 92 degrees carved on some of the stones. The days of alignment of these two deep space objects may determine which is the more likely object to have meant to be represented by the V-Rod angle.

The next peak angle of 95-96 degrees again corresponds with the declination of two deep space objects, namely NGC7742, the Fried Egg Nebula in Pegasus and NGC3242, the Ghost of Jupiter in Hydra. Again, the two nebulae lie within a degree of each other in their declinations and both are candidates for the V-Rod angular representation of 95-96 degrees.

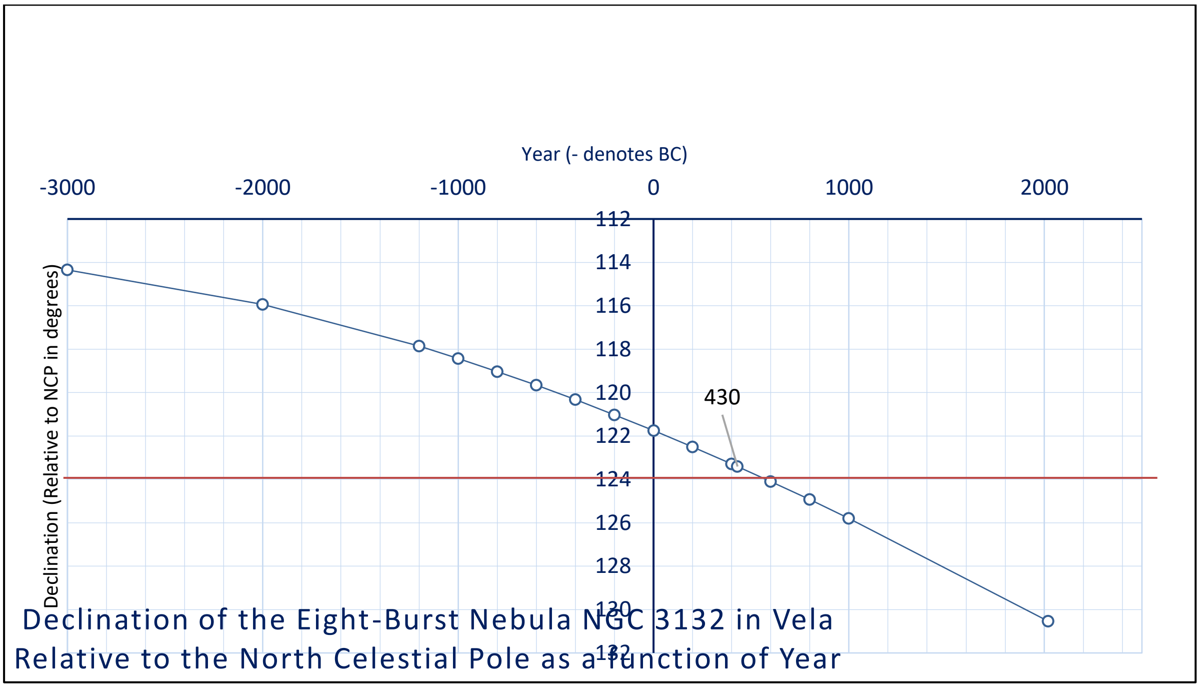
M17, the Omega or Horseshoe Nebula in Sagittarius has a declination that coincides with the next V-Rod angle peak of 101 degrees. Again, the characteristic shape of a horseshoe is sometimes carved alongside the Crescent and V-Rod to confirm the identity of the object represented by the V-Rod angle. However, the Horseshoe symbol is also representative of the constellation of Lyra and the alignment of its brightest star Vega on certain festival days.

The next V-Rod angular peak occurs around 104-105 degrees an angular range that matches the declinations of HD44179, The Red Rectangle Nebula in Gemini (105 degrees) and B72, the Snake Nebula in Ophiuchus and NGC1999, a T-Shaped Nebula in Orion (both 104 degrees from the North Celestial Pole).

The V-Rod angle peak at 108 degrees coincides with, within half a degree, the declinations of M8, the Lagoon Nebula in Sagittarius and NGC7009, the Saturn Nebula in Capricorn. The significance of the Saturn Nebula lies in its position directly above the head of the constellation of Capricorn, that was regarded as the Great God at this time and was identified as a Cathead god that protected the Sun god during the winter months.

The small peak around 111 degrees does not correspond with any of the deep space objects selected. However, the Open Cluster M93 in Puppis has an angular separation from the NCP of 111 degrees 1’ 57” and this possibility can be examined in more detail in the next section regarding the alignment of deep space objects on festival days.

The angle of around 118 degrees corresponds to the declination of NGC3132, the Eight Burst Nebula in Vela. This is an interesting deep space object from the point of view of dating the Class I stones since today it lies below the horizon at Scottish latitudes. The date when this deep space object was visible at a latitude equivalent to Aberdeenshire is shown in the graph below.



The red line shows the horizon and that after 430AD the Eight-Burst Nebula never rose above the horizon in Scotland and therefore was not visible. (NCP refers to the North Celestial Pole).

The final V-Rod angle represented as a small peak is around 122 degrees the deep space object with a declination closest to this value is the Helix Nebula NGC7293 in Aquarius.

Table to show possible identification of deep space objects associated with the most frequently occurring V-Rod angles as measured from 35 Crescent and V-Rod Class I Pictish symbols.

Peak	Angle	Possible Identity
1	66	M31
2	70	NGC7319
3	71	M27
4	77	M33
5	80	M45
6	84.5	NGC2264 M104
7	86	NGC3115
8	89	NGC2237
9	92	NGC4038 M74
10	95-96	NGC3242 NGC7742
11	101	M17
12	104-105	HD44179 B72 NGC1999
13	108	NGC7009
14	111	M93
15	118	NGC3132
16	123	NGC7293

Only the most frequently represented angles as measured from the Crescent and V-Rod symbols are considered for identification. The reason for this is the uncertainty in measuring multiple best-fit angles from photographic images and the inherent inaccuracies involved in carving the original lines. The measurement of 153 angles from 36 Crescent and V-Rod symbols optimises the chance of obtaining the main peaks and reducing the significance of any errors in the individual measurements.

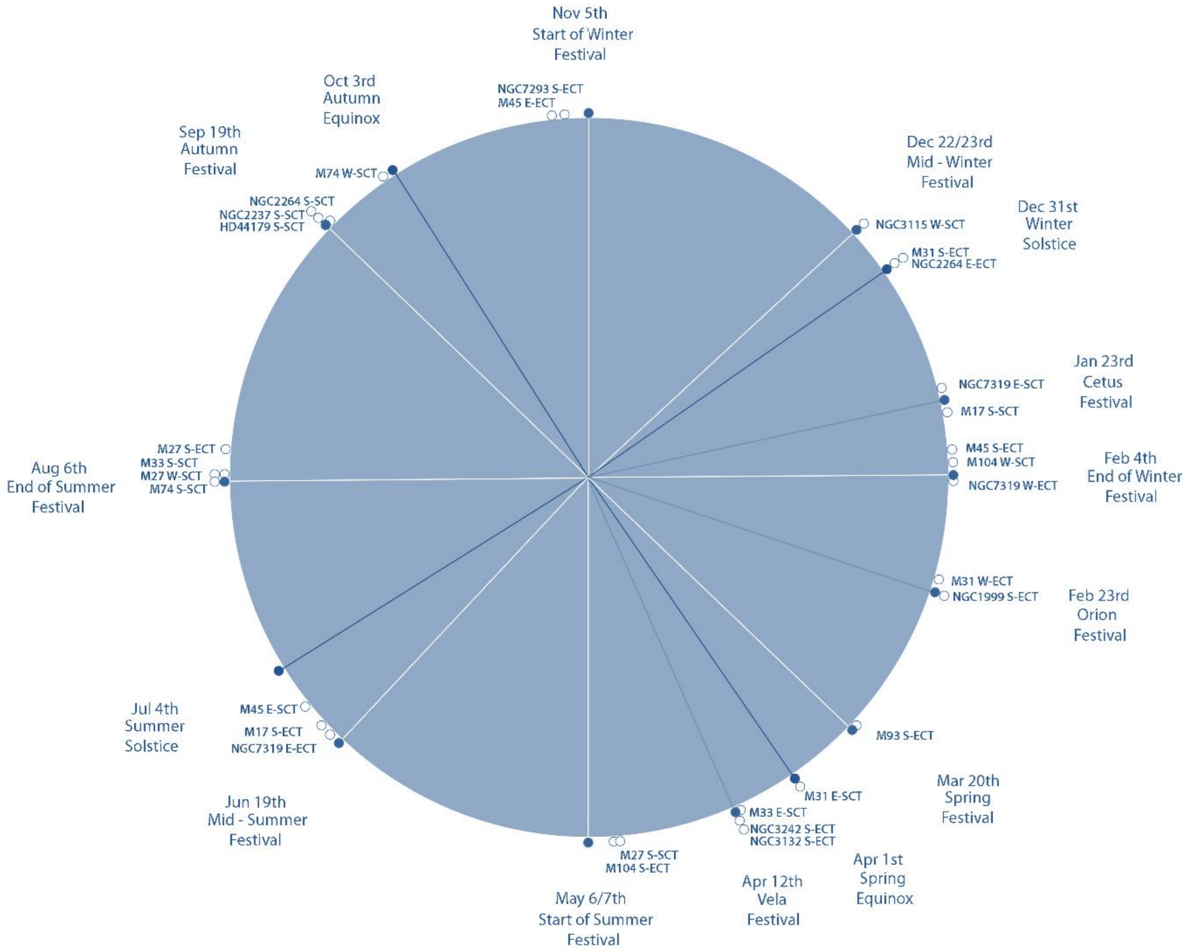
The candidate deep space objects can be examined further to see why these particular objects were represented by their declination (relative to the NCP). Analysing the Pictish symbols led to the identification of each symbol as a constellation. The brightest stars in the constellations depicted as Pictish symbols were found to describe an ancient calendar where the festival days dedicated to a particular constellation, perhaps associated with a stellar deity was marked by the alignment of the brightest star in that constellation at Civil Twilight on that day. Some festival days were indicated by the alignment of the star due South at dawn at the Start of Civil Twilight whilst others were indicated by the alignment of the star due South at dusk at the End of Civil Twilight (Civil Twilight being defined as the time when the Sun is 6 degrees below the horizon). When the Festival days are represented as a Wheel of the year, the festival days represented as spokes of the wheel form a regular near-symmetrical pattern of festivals.

Deep Space Object	Name	Constellation	Festival Day 1100-1200bc	Alignment at Start of C.T	Alignment at End of C.T
M31	Andromeda Galaxy	Andromeda	31st Dec 21-22nd Feb 1st Apr	 East	South West
NGC7319	Stephan’s Quintet	Pegasus	21st Jan 5th Feb 21st Jun	East	 West East
M27	Dumbbell Nebula	Vulpecula	6th Aug 8-10th Aug Apr 28th- 1st May	West South	 South
M33	Pinwheel Galaxy	Triangulum	5-6th Aug 9-14th Apr	South East	
M45	Pleiades	Taurus	31st Jan 26-28th Jun 28th Oct-1st Nov	 East	South East
NGC2264	Cone Nebula	Monoceros	30-31st Dec 20th Sep	 South	East
M104	Sombrero Galaxy	Virgo	1-3rd Feb 2nd May	West	 South
NGC3115	Spindle Galaxy	Hydra	23rd Dec	West	
NGC2237	Rosette Nebula	Monoceros	19th Sep	South	
NGC4038	Antennae Nebula	Corvus	-		
M74	Galaxy	Pisces	6th Aug 1st Oct	South West	
NGC3242	Galaxy	Hydra	12th Apr		South
NGC7742	Fried Egg Nebula	Pisces	-		
M17	Omega/Horseshoe Nebula	Sagittarius	24-25th Jan 23rd Jun	South	 South
HD44179	The Red Rectangle	Gemini	20th Sep	South	
B72	Snake Nebula	Ophiuchus	-		
NGC1999	T-Shaped Nebula	Orion	23rd Feb	South	
NGC7009	Saturn Nebula	Aquarius	-		
M93	Open Cluster	Puppis	19th Mar		South
NGC3132	Eight-Burst Nebula	Vela	12th Apr		South
NGC7293	Helix Nebula	Aquarius	31st Oct -3rd Nov		South

The stellar festival days comprise the following dates in 1200BC when represented by our calendrical labels of days and months. November 5th, December 23rd, February 4th, March 20th, May 6-7th, June 19th, August 6th and September 19th. Additional to these stellar festival days there were festival days dedicated to the constellations of Orion (February 23rd), Cetus (January 23rd) and Vela (April 12th), the last two festivals particularly important for the calibration of pendulums as these constellations contained star pairs separated by the required whole integer angles.

The solar festival days were the days of the solstices and equinoxes, the Winter solstice on 31st December, the Spring Equinox on April 1st, the summer solstice on July 4th and the autumn equinox on October 3rd. Whilst the solar festivals are fixed by the Sun there is still the possibility that coincidental alignment of deep space objects occur on some of these days and so the analysis of alignment of deep space objects has included these days along with the stellar festival days.

The days of alignment of the deep space objects with the cardinal positions of East, South and West at Civil Twilight can be plotted on the Wheel of the Year Pictish calendar proposed by the alignment of the brightest stars.



The days of precise alignment of the deep space objects indicated by the angles of declination carved on the Crescent and V-Rod symbols appears to coincide or cluster around the Pictish Festival days. The main alignments are due South either at the End of Civil Twilight (S-ECT) or at the Start of Civil Twilight (S-SCT). Some alignments are due East and due West at the Start and End of Civil Twilight (E-ECT, E-SCT, W-ECT and W-SCT). The four dark blue spokes mark the solar festival days of the winter solstice, spring equinox, summer solstice and autumn equinox. The eight white spokes mark the stellar festival days, eight evenly divided festivals whilst a further three additional festival days dedicated to Orion and two constellations involved in pendulum calibration are marked as pale blue spokes.

Conclusions

Some of the images carved on the Class I Pictish stones resemble the known appearance of nebulae and galaxies. The identification of carved images as deep space objects is supported by the angle of the "V" carved on the Crescent and V-Rod symbol, proposed as being a Pictish quadrant that accompanies the carved image which appears to coincide with the declination of the deep space object sharing its appearance.

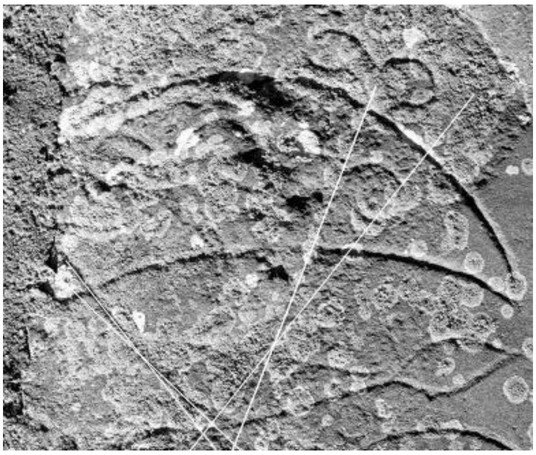
Whilst it is amazing that deep space objects appear to be identified by both their appearance and the V-Rod angles carved on the Crescent and V-Rod symbol, proposed to be a quadrant, it is even more surprising that those deep space objects represented, are those that are aligned with cardinal positions on the proposed Pictish festival days.

It seems unlikely that the similarity of appearance, the declination of the deep space objects, expressed as angles on the V-Rods, and the fact that only deep space objects that are aligned with cardinal points on the Pictish festival days are represented, occurs by chance.

The logical conclusion of this examination is that not only did the Crescent and V-Rod represent a quadrant that was used to determine the declination of deep space objects, relative to the North Celestial Pole, but in order to know where these deep space objects were and what they looked like, the people who carved these stones needed to have already invented a powerful telescope. The date of carving the Class I Pictish symbol stones is proposed to be around 1100-1200BC, maybe sometime after the believed date of the Hekla IV volcanic eruption in Iceland proposed, from bog oak growth ring analysis, to have occurred around 1156BC whose multiple eruptions lasted for around 28 years. The Pictish telescope would therefore have not only predated the supposed invention of the telescope by Galileo by some 2800 years, but the telescope they used was capable of allowing them to observe deep space objects that weren't visible to modern day astronomers until the 19^{th} Century when telescopes of a similar power to the Pictish telescope were assumed incorrectly to have been "first" developed.

Appendix

Pictish Class I Stones decorated with Crescent and V-Rods. Angles determined from the lines shown on the images.



Bourtie (4)

Daviot (10)

Fyvie (19(i))

Inverurie (22(i)

Kinellar (24)

Kintore (27b)

Elphinstone 28(i)

Elphinstone 28 (ii)

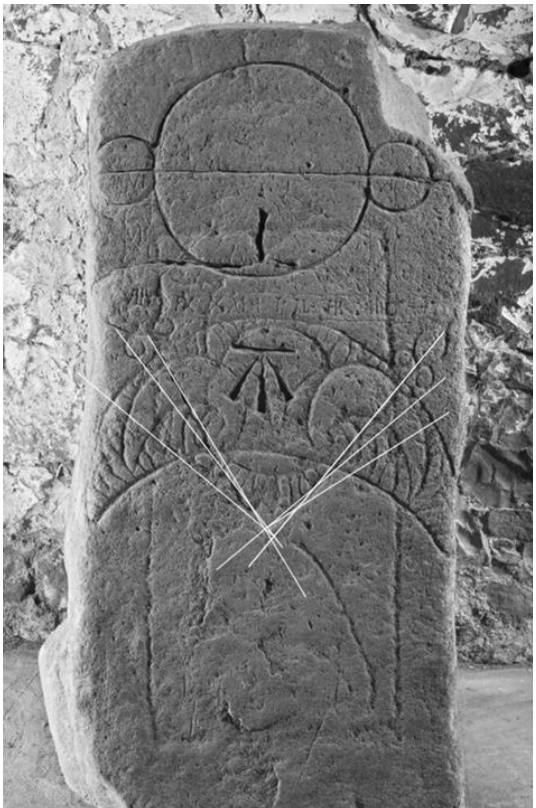
Elphinstone 28 (iii)

Park House (36)

Rhynie (39(vi))

Tillypronie (42)

Kinblethmont (58)



Abdie (76)

Ballintomb (91)

Beauly (92)

Clach Ard (94)

Clynekirkton 95 (i)

Clynekirkton (95(ii))

Clynemilton (96(i))

Craigton (99)

Dingwall (102a)

Dingwall (102b)

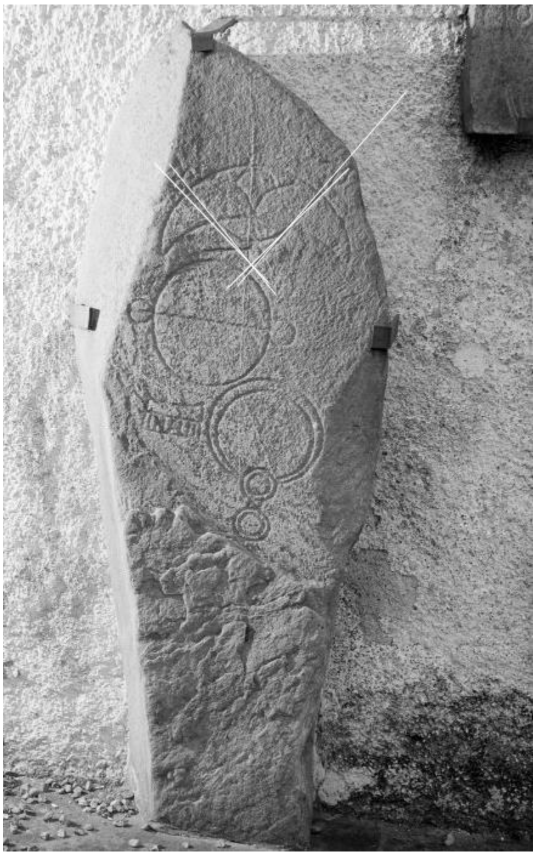
Fiscavaig (111)

Inverallan (119)

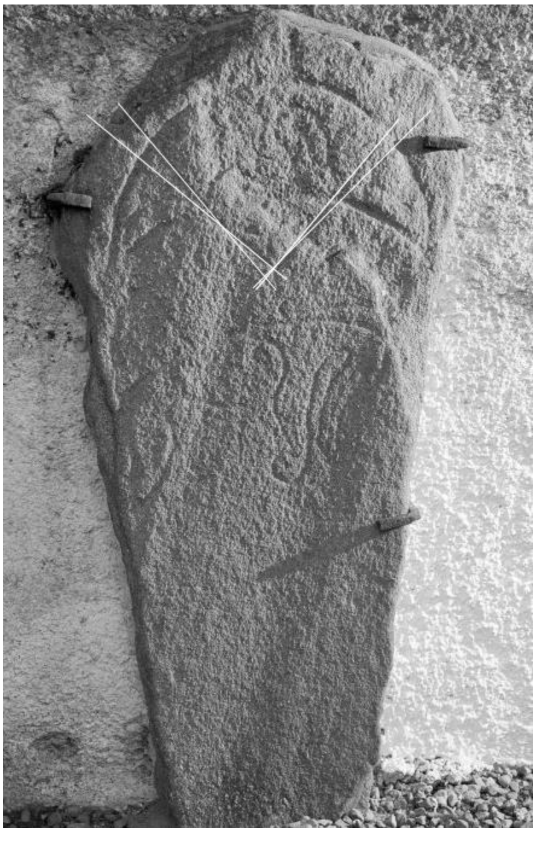
Invereen (120)

Raasay (136)

Easterton of Roseisle (156(a))



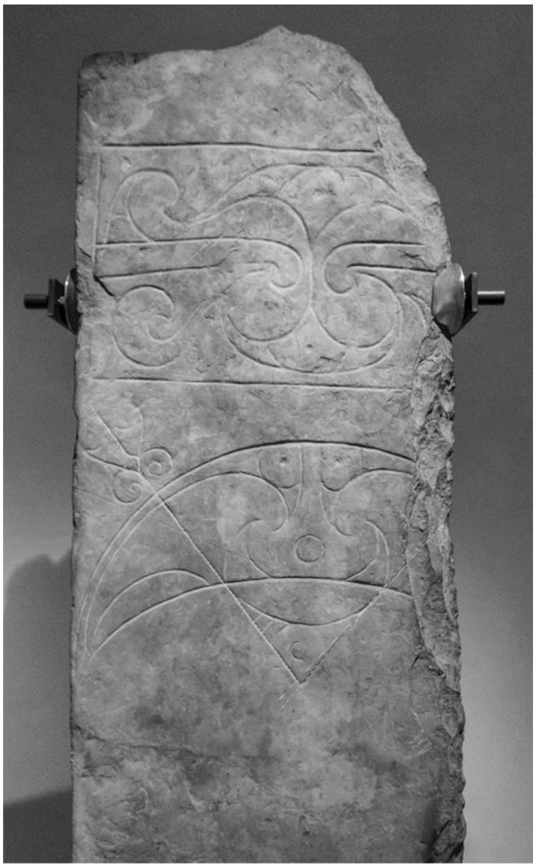
Inveravon (159(ii))



Inveravon (159(iv))

Knowe of Burrian (168)

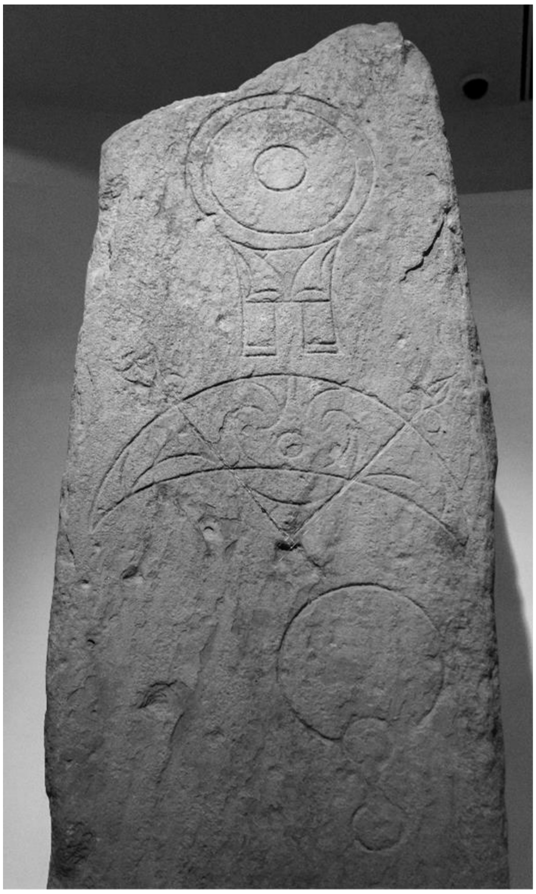
Redland (172)



South Ronaldsay (173a)

Abernethy (176)

Pabbay (203)



Greens St. Andrews, Orkney