Göbekli Tepe and the Rebirth of Sirius

An examination of the night sky during the epoch of Göbekli Tepe's construction shows that the star Sirius was completely unsuitable for star alignments at this time.

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Summary: Göbekli Tepe is the site of a series of stone enclosures built during the tenth and ninth millennia BC on an isolated mountaintop in southeast Anatolia (Turkish Asia Minor). Speculation has mounted regarding their orientation towards stellar objects, with Orion and Cygnus having already been proposed. Sirius is the latest star to be put forward as the primary focus of key monuments at the site. Yet such a conclusion is thwart with problems, not only in connection with the faint appearance and feeble movement of the star during the epoch in question, c. 9500-9000 BC, but also with respect to the orientation and layout of the enclosures themselves. Instead of being orientated to the south, the direction of Sirius, the enclosures are more likely directed to the north, the direction of liminal activities since the Upper Paleolithic age. In this respect, a more suitable stellar candidate for the orientation of the enclosures is Deneb, the brightest star in Cygnus, which marks the opening of the Milky Way's Dark Rift, seen universally in the past as an entrance to the sky-world.

Key words: Archaeoastronomy, Giulio Magli, Göbekli Tepe, Pre-Pottery Neolithic, Sirius, Cygnus, Orion, Hallan Çemi, Upper Paleolithic, liminal activities, polar stellar tradition, Milky Way, Dark Rift.

Göbekli Tepe is perhaps the most enigmatic discovery in archaeology this century—a series of megalithic structures constructed during the tenth and ninth millennia BC by a hunter-gatherer society on an isolated mountain ridge at the western termination of the Ante-Taurus range in southeast Anatolia (37.2083° N, 38.9167° E).

Two types of structure are seen, one evolving from the other. The earliest enclosures, built most probably c. 9500-9000 BC, are composed of twin monoliths with T-shaped terminations, which have been set up parallel to each other. Around them are circles, or more correctly ellipses, of slightly smaller, radially positioned standing stones, which are also T-shaped in appearance. These are placed in stonewalls, often with stone benches between them.

A number of standing stones at Göbekli Tepe have clear anthropomorphic features, with many showing carved reliefs, some in 3D, of fearsome creatures, including lions, foxes, boars, snakes, cranes, vultures, aurochs, caprids, scorpions, insects and arachnids.

Later structures, built c. 8500-8000 BC and much smaller in size, also have T-shaped pillars. Yet here the twin central pillars are replaced by twin stones that stand parallel to each other, like doorways into a holy of holies.

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Astronomical Targets

Even though the sheer variety of enclosures present at Göbekli Tepe prevents a single solution to their overall purpose and function, the parallel alignment of the twin central monoliths has prompted speculation regarding their alignment to celestial objects, a possibility the site's lead archaeologist Professor Klaus Schmidt of the German Archaeological Institute (DAI) does not dismiss out of hand (personal communication with Andrew Collins, September 2013).

So far stars proposed as aligning with Göbekli Tepe's twin central pillars include the three stars of Orion's belt in the southern sky (Schoch, 2012), and Deneb, the brightest star in Cygnus, in the northern sky (Collins, 2006, 2013 & upcoming 2014). However, there is a new contender. Sirius, the fourth brightest object in the heavens (after the Sun, Moon and Venus) is the latest star to be put forward as the focus of the Göbekli builders.

Italian archaeoastronomer Giulio Magli proposes that the twin central pillars in three Gobekli enclosures–B, C, and D–targeted the rising of Sirius between the dates 9100-8250 BC (Magli, 2013). He points out that around 9300 BC Sirius began appearing low on the south horizon having been invisible from the latitude of Göbekli Tepe since c. 15,000 BC. The sight of this new "guest" star perhaps motivated the Proto-Neolithic peoples of southeast Turkey to create Göbekli Tepe.

Magli finds "unconvincing" other proposed stellar targets for the monuments at Göbekli Tepe. Possible alignments towards the rising of Orion's three belt stars are dismissed, since this would lead to "too low dating for the structures", while similar alignments to Deneb are also given short shrift. In Magli's opinion a northern orientation of the Göbekli monuments is "unnatural as the enclosures are rather open to the south-east."

Atmospheric Extinction

The biggest drawback with Sirius' use as a stellar target so soon after its reappearance on the southern horizon is that it would have been barely visible, its usual bright magnitude diminished greatly due to atmospheric extinction. A star's loss of brightness is affected by many factors, including water vapour, dust particles and height above sea level. Even in a clear sky with negligible pollution these effects can be severe. In addition to this, atmospheric extinction causes a star's colour to change. It becomes reddened and even less visible to the naked eye.

This loss of brightness is measured by the apparent change of the star's magnitude. Astronomical tables for average losses of brightness are given (Green, 1992). Based on observations made at a height above sea level of 500m, a star at an altitude of 5° loses 2.5 magnitudes. At an altitude of 1° it loses about 6 magnitudes, and actually on the horizon it loses over 9 magnitudes.

Sirius has a magnitude of -1.46°, so at 5° altitude it becomes magnitude 1, which is still bright. Yet at 1° altitude it becomes magnitude 4.5, which is extremely dim. At 0.5° altitude, the height at which Magli proposes the Göbekli builders targeted their monuments towards Sirius, the star possessed a magnitude of 6, which is at the very limits of naked eye visibility. This would have been the manner of its appearance for hundreds of years after its reemergence as early as 9500 BC. Under any normal circumstances such an insignificant sight cannot have moved an entire hunter-gathering culture to give up their old lifestyle and start building the first monumental architecture in human history.

These facts are expressed in the illustrations that accompany this article. Fig. 1 shows Sirius at an altitude of 0.5° for a date of 9100BC (courtesy of Stellarium software which incorporates atmospheric effects). Sirius is just a faint spot (magnitude 4.87) compared with, say, Orion's belt stars immediately above it. Clearly, Sirius rising appears totally insignificant during this period, for even at an altitude of 2° as seen in Fig. 2 it has a magnitude of just 2.3, which would have made it little different to any other star in the sky.

Fig.1. Sirius at half a degree altitude in 9100 BC showing its relative brightness to other stars (Credit: Stellarium).

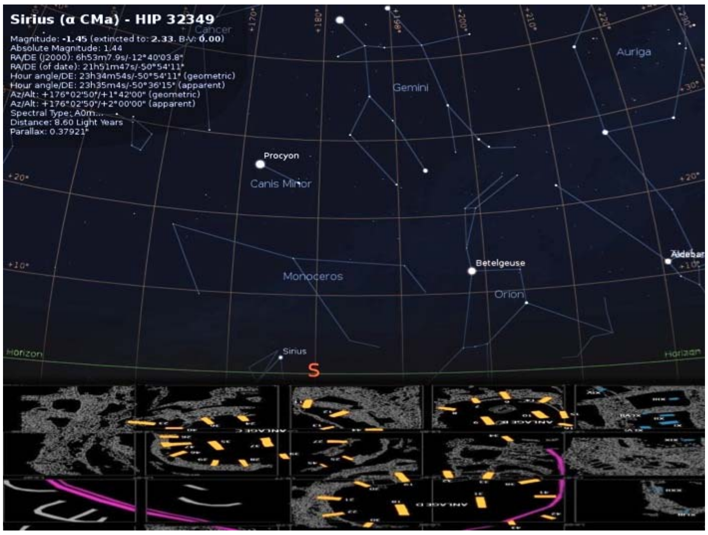

Fig. 2. Sirius at 2° altitude in 8950 BC showing its relative brightness to other stars (Credit: Stellarium).

Atmospheric Refraction

Another problem is atmospheric refraction, which Magli makes no reference to in his paper. He doesn't tell us whether it has or has not been taken into account, leaving some doubt over his Sirius azimuth figures. When altitudes as low as half a degree are employed for alignment purposes, refraction will raise the apparent altitude of a star by around half a degree, necessitating an adjustment to any proposed azimuth figures.

Until further details emerge this uncertainty must be borne in mind as we examine Magli's proposed mean azimuths for the twin central pillars of the enclosures involved, and the corresponding dates at which they target the rising of Sirius:

Enclosure D	172°	9100 BC
Enclosure C	165°	8750 BC
Enclosure B	159°	8300 BC

Not only do these dates reflect the monuments' approximate epoch of construction, but they also show very clearly that the twin pillars target a single star as it gradually shifts its rising or setting position on the local horizon due to the effects of precession (a point previously noted by both Schoch and the current authors). This is caused by the slow wobble of the earth against the stellar background across a cycle of nearly 26,000 years.

Frustratingly, Magli's mean azimuths for two of the enclosures differ from those suggested by the DAI's site plan. When all these factors are taken into account a slightly different correlation is revealed between the mean azimuths of the twin pillars and the rising of Sirius at a height of half a degree:

Enclosure D	173°	9400 BC
Enclosure C	165°	8950 BC
Enclosure B	157°	8275 BC

As can be seen from these revised figures (and from Fig. 3), in two instances the correlation date between Sirius rising and the alignment of the pillars has been shifted back hundreds of years, even though this adds little to Magli's theory. For instance, in 9400 BC when the twin pillars of Enclosure D would have aligned with the rising of Sirius at half a degree (with refraction taken into account), the star would still have been barely visible to the naked eye as it crawled along the horizon (see Fig. 4).

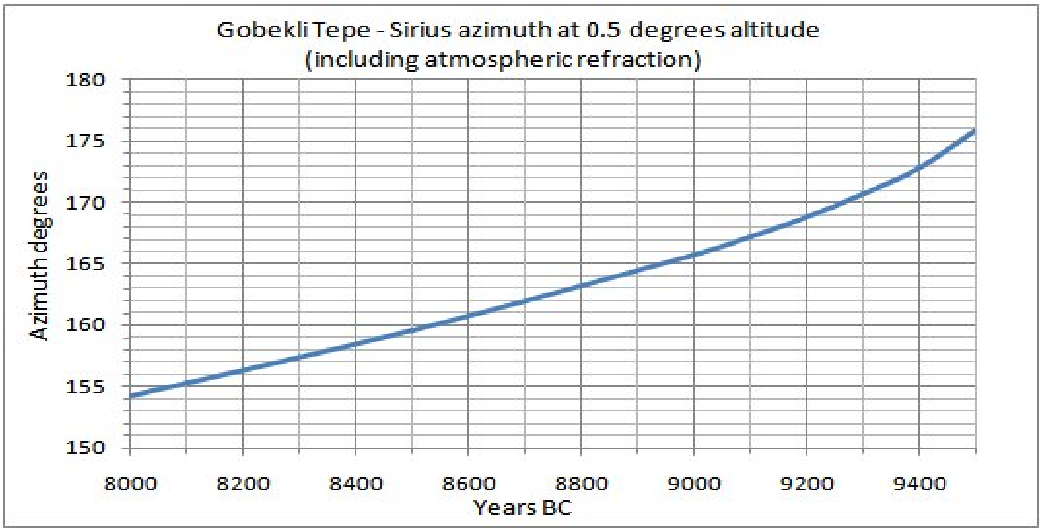

Fig. 3. The rising of Sirius based on an altitude of half a degree including atmospheric refraction from its first reappearance in around 9500 BC through till 8000 BC (Credit: Rodney Hale).

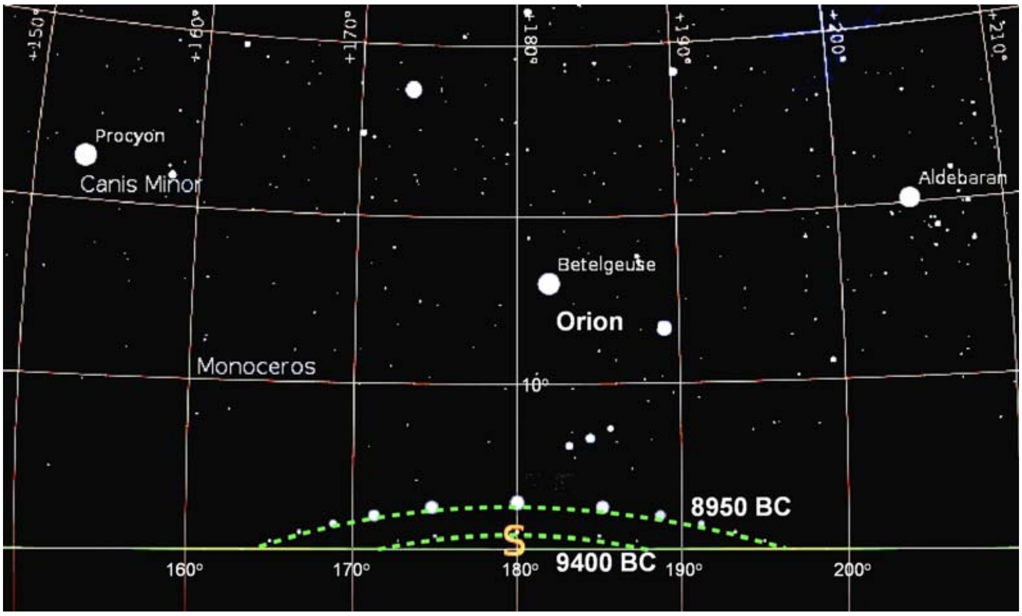

Fig. 4. The path across the southern horizon of Sirius on the dates 9400 BC and 8950 BC showing its brightness relative to other key stars of the southern sky (Credit: Rodney Hale/Stellarium).

By 8950 BC when Enclosure C's twin pillars targeted Sirius, the star would still have been faint as it moved across the horizon. Yet here, in Enclosure C, there is an added problem. The star would not have been seen from the position of the twin central pillars, as a rocky slope to the south partially obscures the view. Excavations in 2012 uncovered a staircase cut into the slope for use by entrants approaching from the south (Dietrich, 2013).

Around 8275 BC, when the central pillars of Enclosure B targeted the rising of Sirius, the star climbed to make a much more appreciable arc, reaching a maximum elevation of 6° as it crossed the meridian, due south. Despite this encouraging fact, we now come into massive dating issues.

Bone samples taken from Enclosure B have provided radiocarbon dates in the range of 8306-8236 BC (Schmidt and Dietrich, 2010), around the same time that its twin pillars targeted Sirius at an altitude of half a degree. Yet according to the excavators these human remains may well derive from an intrusive burial made long after the structure's construction. Indeed, since Enclosure B is built on the plateau's bedrock next to Enclosures C and D, the chances are all three are roughly contemporaneous, meaning that Enclosure B was most probably in existence by around 9000 BC. If so, then its twin central pillars cannot have been built to target the rising of Sirius in 8250 BC.

It might be proposed that instead of using an altitude of half a degree as the rising of Sirius, why not use either 1° or, preferably, 2°, when the star would have gained a slightly better magnitude. This could be done, although because the star will have moved sufficiently by the time it reaches these greater magnitudes it creates correlation dates much younger than those proposed here, perhaps by as much as a thousand years. Then the same problems that caused Magli to discount Orion as a stellar target at Göbekli Tepe would apply, for as he suggests, it would mean "too low dating for the structures".

North not South

Next we come to Giulio Magli's premise, necessary for his theory, that Göbekli Tepe's main enclosures are open to the south, enabling the light from Sirius to enter their interiors in a manner found in connection with later megalithic monuments worldwide.

Despite overwhelming evidence to show that many megalithic structures were indeed designed to allow the light of celestial objects to penetrate their interiors (Newgrange in Ireland's Boyne Valley being the prime example), there is no reason to assume the monuments of Göbekli Tepe, built several thousand years earlier, formed part of this same tradition. Its curvilinear structures seem to represent a supersizing of cult shrines that already existed throughout the Near East.

These early Neolithic structures seem to be the product of a much older tradition lingering from the Upper Palaeolithic age, where the entrances to caves and rock shelters used both for habitation and cultic purposes were, whenever possible, south-facing in perspective. In this manner they enjoyed maximum exposure to solar radiation, i.e. sunlight, and thus experienced warmer temperatures all the year round. It also permitted shelter from cold harsh winds coming from the north. This preferred utilisation of caves and rock shelters with south-facing entrances was employed by the Solutrean culture of France and Spain, c. 22,000-17,000 years ago (Straus, 1979), and later by the Magdalenian peoples, c. 17,000-11,000 years ago (Jochim, 2011, 103). Such ideas were prevalent even among the Neanderthal peoples of the Middle Paleolithic, c. 40,000-100,000 years ago (Mellars, 1996, 249).

Over the course of many thousands of years, the south (as the direction of the cave entrances) most likely became associated with life, light, human habitation and, by virtue of this, the mundane world. East, as the place of the rising sun, became the direction of new life, while the west became the direction of death, as it was here the sun died each day. This left the north which, since it did not provide sunlight, was viewed as the direction of darkness, liminal activities, as well as the turning point of the heavens, the origin perhaps of polar based sky-religions in the northern hemisphere.

Built on the Bedrock

Enclosures A, B, C, D and E were all built on the mountain bedrock with uninterrupted views of the local horizon (although, as we have seen, Enclosure's C view of the southern horizon is at least partially obscured by a rising slope–see Fig. 5). In time these primary enclosures were decommissioned and covered over by a gradually emerging occupational mound or tell, constructed from imported soil, stone chippings, and general refuse including faunal remains and some human remains.

Later structures were built either into the slopes of the gradually emerging tell, or directly on top of it. It was an organic process that continued through until the final abandonment of the site around 8000 BC, when any remaining structures were covered over, leaving behind a perfectly rounded, belly-like hill completely artificial in nature.

The fact that the main enclosures uncovered so far are grouped together in the southeast section of the occupational mound has given rise to the false assumption that they are, as Magli states, "open to the south-east". Yet as we can see, this is simply not so, and, if Enclosure C is anything to go by, the more likely scenario is that they were directed towards the north, the direction of liminal activities since the Paleolithic age.

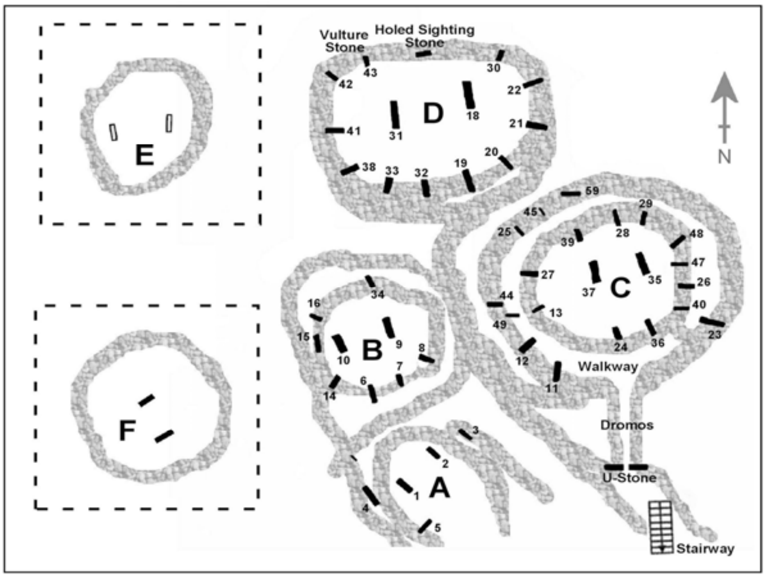

Fig. 5. Plan of Göbekli Tepe showing the stairway discovered in 2012 (Credit: Rodney Hale).

True Orientations

This directional preference appears to have been adopted from existing cult shrines of the Proto-Neolithic age. For instance, at Hallan Çemi, a site in the Eastern Taurus Mountains of eastern Turkey, two circular buildings were uncovered, dating to c. 10,250-9600 BC. Stone benches lined their interior walls, with hearths at their centres (Rosenberg, 1999; Peasnall & Dyson, 2002).

At the northern end of one of these cult shrines, a huge auroch's skull was found. It had hung on the wall, a central focus for all those who sat within its interior. The deliberate placement of this enormous bucranium within the cult shrine at Hallan Çemi prompted ethnoarchaeologist Brian Hayden to comment:

> It seems clear that this is a prototype of ritual structures that are to be found in more elaborate forms several hundred years later at Jerf el Ahmar (in northern Syria) and Mureybet (on the Middle Euphrates, also in Syria) in village contexts and perhaps even Çatal Höyük, where bucrania preferentially adorned the north walls (Hayden, 2003, 207).

As Hayden infers, the north was the primary direction of orientation of Proto-Neolithic and later Neolithic cult structures right down to the time of Çatal Höyük. Since Hallan Çemi was almost certainly a precursor to Göbekli Tepe, which lies some 225 km to the southwest, it very likely influenced the style and design of the monuments there, including their northerly orientations.

If this is the case, it is a highly significant realisation, for Hallan Çemi's cult shrines were constructed many hundreds of years *before* the reappearance of Sirius on the southern horizon, showing that this star is extremely unlikely to have played a role in the orientation of the monuments at Göbekli Tepe. Much more likely is that its enclosures were orientated towards the north in its capacity as the direction of liminal activities and supernatural agencies. In this manner, entrants wishing to commune with these supernatural agencies would approach the structure's twin central pillars from the south in order to access the otherworldly realms thought to exist beyond them to the north, the direction not only of the celestial pole, but also of the circumpolar stars, i.e. those that never set below the horizon.

Turning to Cygnus

If the twin central pillars in the main enclosures at Göbekli Tepe are aligned to a celestial object the chances are it was a near circumpolar star, i.e. one that rose on the north-northeast horizon, arced over the celestial pole on its upper transit, and then set on the north-northwestern horizon as it reached the climax of its lower transit.

An examination by the authors of the mean azimuths of the twin central pillars in three enclosures–C, D and E–shows a precise correlation with Deneb, the brightest star in the constellation of Cygnus in the epoch c. 9400-8900 BC. The star's setting (not its rising as Magli states) on the north-northwestern horizon would have been fully visible to the Pre-Pottery Neolithic peoples of Göbekli Tepe right down to an altitude of 2°, when it would have finally faded from view.

The reason perhaps for Deneb being chosen for this purpose lies in the fact that it marks the opening of the Milky Way's Dark Rift, known also as the Cygnus Rift. This is a darkened area running down the centre of the Milky Way caused by the presence of stellar debris. The Dark Rift stretches from Cygnus all the way to the stars of Sagittarius and Scorpius, precisely where the ecliptic, the sun's path, crosses the Milky Way. Globally, the Dark Rift has been seen as an entrance to the sky-world, as well as a place of the afterlife (Collins, 2006, and Collins, upcoming 2014).

Key Stones

Göbekli Tepe's Pillar 43 in Enclosure D shows a vulture with wings articulated in a manner that gives the bird the appearance of Cygnus (Vahradyane and Vahradyane, 2010 and see Fig. 6), while below it is a scorpion identified as a possible representation of Scorpius (Belmonte, 2010).

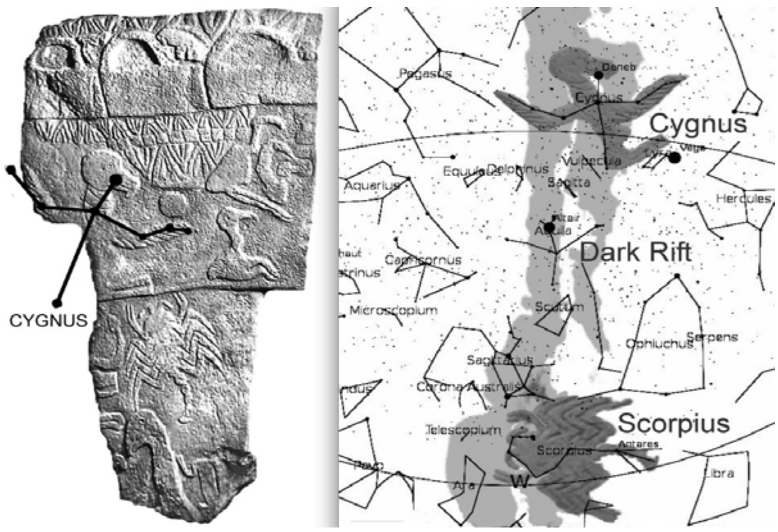

Fig. 6, left. Göbekli Tepe's Pillar 43 in Enclosure D with Cygnus overlaid on its vulture carving (Credit: Rodney Hale). Fig. 7, right. Pillar 43's vulture and scorpion overlaid on the Dark Rift as seen c. 9400 BC (Credit: Rodney Hale).

That these two constellations located at the top and bottom of the Milky Way's Dark Rift are shown together on one stone seems beyond chance, especially as in the second half of the tenth millennium BC when the stars of Scorpius were visible just above the western horizon the stars of Cygnus would be crossing the meridian, due north (see Fig. 7).

Further confirmation of Enclosure D's alignment to Cygnus was the recent discovery immediately to the east of Pillar 43 of a large holed stone that stands erect within the north-northwestern section of the perimeter wall. In contrast to the radially aligned pillars in the various enclosures, this holed stone has its widest face facing towards the twin central pillars. Anyone standing or crouching between these huge monoliths in c. 9400 BC, the approximate date of construction of the enclosure according to available radiocarbon evidence (Schmidt and Dietrich, 2010), could have peered through this hole to watch the setting of Deneb (see Fig. 8). The fact that carved imagery on the holed stone might well represent an abstract female form, the opening as her vulva, expresses a symbolic act in which Deneb and the entrance to the Dark Rift are recognised as the direction of new life entering the enclosure's interior from the starry realms to the north.

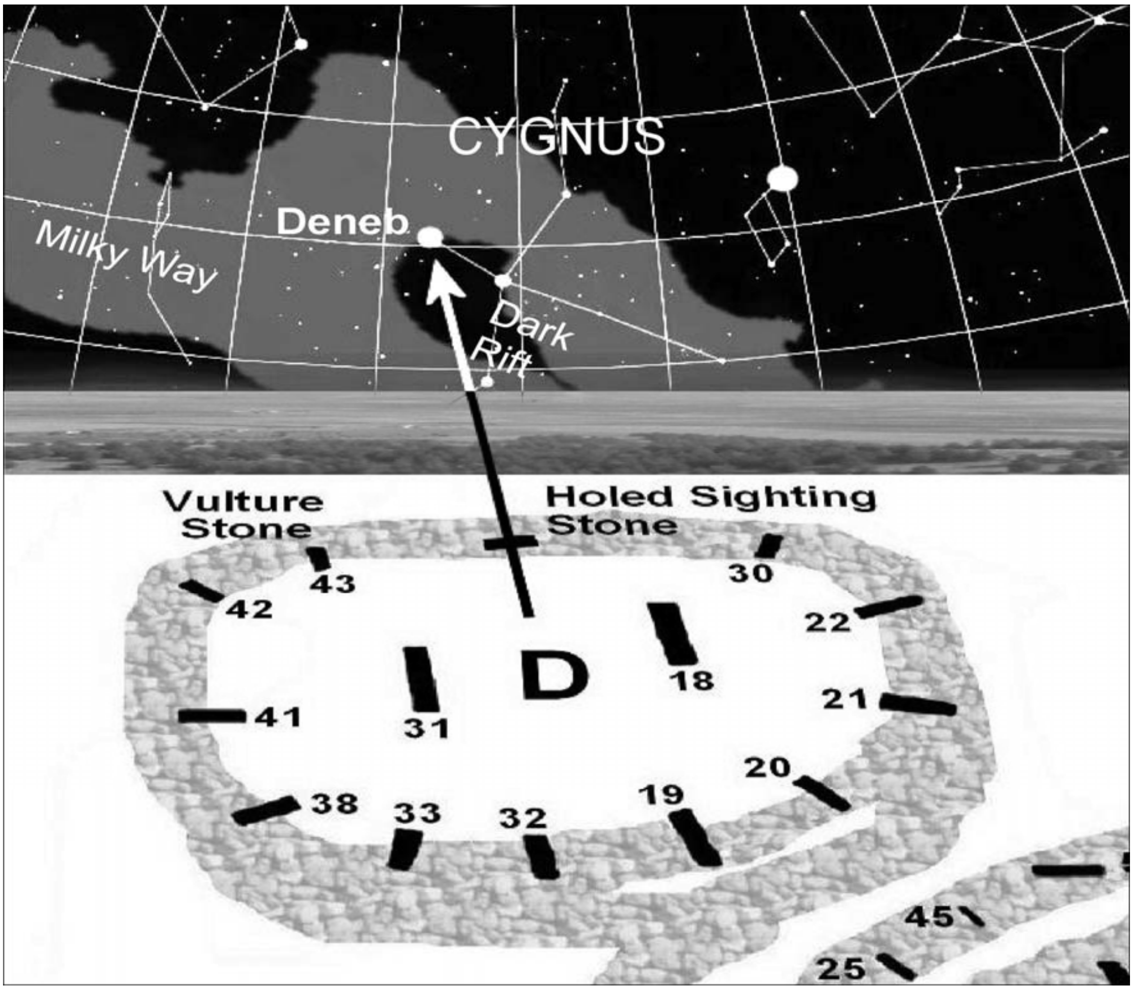

Fig. 8. Plan of Enclosure D showing the position of Pillar 43 and the holed stone in the NNW section of the perimeter wall. The arrow indicates the setting of Deneb in 9400 BC (Credit: Rodney Hale).

Here comes the sun

Only later did the switch towards other directions occur, most obviously the east, the direction of the rising sun. Enclosure F (not Enclosure E as Magli states) has an azimuth of 59°, directing it towards sunrise at the time of the summer solstice, while the Lion Pillar Building built on top of the tell, as much as 15m above the enclosures situated on the bedrock below, is orientated east-west. Its eastern end–where twin pillars bearing carved reliefs of rearing lions are to be seen–is almost certainly directed towards sunrise at the time of the equinoxes. Its twin lions, which face into the room, are very likely symbols both of the might of the sun, and arguably the presence of the constellation of Leo, the celestial lion. This would have risen into the sky immediately prior to the sun at the time of the spring equinox.

This change of orientation might well have had something to do with the fact that by this time, c. 8500-8000 BC, the hunter-gatherer society responsible for the original creation of Göbekli Tepe had now been replaced by representatives of settled farming communities following the introduction of subsistence agriculture across southeast Anatolia and the Levant. For the first time, the sun, in conjunction with the zodiacal constellations positioned along the line of the ecliptic, was emerging now as a primary influence in the sky-based beliefs of the Neolithic world.

Conclusions

It is clear that Sirius is unlikely to have been the primary focus of the earliest enclosures at Göbekli Tepe, due to its faint appearance and feeble movement during the epoch of their construction. Moreover, unless peoples from more southerly climes introduced the Göbekli builders to its greater significance, Sirius would have been seen as unimportant during the initial phase of construction at the site. This severely weakens any claims that Göbekli Tepe's twin central pillars were aligned to target the rising of this star.

On the other hand, Deneb and the entrance to the Milky Way's Dark Rift, being located in the north, the direction of liminal activities and otherworldly realms since the Upper Paleolithic, possessed an incredible symbolic value to the earliest Neolithic peoples of the Near East. In this manner, Deneb and the Dark Rift fare far better as primary candidates for the orientation of key monuments at Göbekli Tepe.

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