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**MATTERS ARISING**

**DECODING GÖBEKLI TEPE WITH ARCHAEOASTRONOMY: WHAT DOES THE FOX SAY?"**
by Sweatman, M.B. and D. Tsikritsis

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**CRITICAL EVALUATION OF THE PAPER BY SWEATMAN, M. B. AND D. TSIKRITSIS, "DECODING GÖBEKLI TEPE WITH ARCHAEOASTRONOMY: WHAT DOES THE FOX SAY?"** by Paul D. Burley

# MORE THAN A VULTURE: A RESPONSE TO SWEATMAN AND TSIKRITSIS

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## ABSTRACT

In a paper recently published in this journal, Martin B. Sweatman and Dimitrios Tsikritsis from the University of Edinburgh (School of Engineering) have suggested an interpretation for the early Neolithic monumental enclosures at Göbekli Tepe as space observatories and the site's complex iconography the commemoration of a catastrophic astronomical event ('Younger Dryas Comet Impact'). As the archaeologists excavating this site, we would like to comment on a few points that we feel require consideration in this discussion.

**KEYWORDS:** symbolism, Younger Dryas, comet, Taurid meteor, asterism, coherent catastrophism

Göbekli Tepe lies some 15 km east of Şanlıurfa (Southeast Turkey) in the Germuş Mountains (c. 770 metres above sea level) with commanding views over the Harran plain to the south and the modern city of Şanlıurfa to the west-south-west (Fig. 1).

***Figure 1: Aerial view of the mound of Göbekli Tepe with excavation areas. (Photo: E. Kücük, DAI)***

The mound, which is completely artificial, comprising prehistoric sediments and building remains, is 300 m in diameter, covers an area of 9 ha, and reaches 15 m at its highest point. Discovery and research at this unique site began in 1995 under the direction of Klaus Schmidt, with the support of the General Directorate of Cultural Assets and Museums, Ministry of Culture and Tourism of Turkey, and the Şanlıurfa Museum. Current research at Göbekli Tepe is funded by the German Research Foundation (DFG) within the frame of the long-term DFG project '*The Prehistoric Societies of Upper Mesopotamia and their Subsistence*', and the German Archaeological Institute. Meanwhile, more than 20 years of field research have culminated in the interdisciplinary study of several monumental buildings, which at the time of initial discovery were totally unexpected for the archaeological period in question, also illustrating the outstanding role of this site as a place of gathering, cult, and ritual (Schmidt 2012).

The prehistoric mound (tell) at Göbekli Tepe accumulated over a period of some 1200 years, from the so-called Pre-Pottery Neolithic A (PPNA; 9600-8700 BC), through the Early Pre-Pottery Neolithic B (EPPNB; 8700-8200 BC), and into the early Middle Pre-Pottery Neolithic B period (early MPPNB; late 9th millennium BC). Göbekli Tepe is best known for its large monumental round-oval buildings, formed by monolithic T-shaped limestone pillars (up to 4 metres in height) with interconnecting drystone walls. At the centre of these buildings (enclosures) stands an even larger pair of (central) T-pillars. The pillars have been identified as abstract anthropomorphic images, in some cases emphasised by depictions (in low relief) of arms, hands, and even items of clothing, such as belts and loincloths. The pillars are often adorned with further reliefs, mostly depictions of animals, but also abstract symbols and a small number of human images. In addition to the pillars, finds made at the site include numerous stone sculptures of humans and animals. In some cases, the monumental round-oval enclosures are (partially) superimposed by smaller rectangular-shaped buildings, commonly attributed to the PPNB. Remarkably, these buildings also feature T-shaped limestone pillars, albeit these are fewer and smaller than those in the round-oval monumental buildings (seldom higher than 1.5 m). The uppermost stratigraphic layer at Göbekli Tepe features sediments stemming from natural erosion and modern farming activities.

In a paper recently published in *Mediterranean Archaeology and Archaeometry* (Sweatman & Tsikritsis

2017) from the University of Edinburgh (School of Engineering) have suggested that the early Neolithic monumental enclosures at Göbekli Tepe were space observatories. Not only do they interpret the complex iconography found at the site as the commemoration of a catastrophic astronomical event (Younger Dryas Comet Impact), they also argue that some of the many (often complex) reliefs adorning the T-shaped pillars are representations of stellar constellations. In this context they refer to images on a small number of the pillars, for example the belt and buckle on Pillar 18 and combinations of animal representations on Pillar 2 and Pillar 38. (Sweatman and Tsikritsis 2017, 241-244). However, a particular focus of their contribution lies on the outstanding (but not exceptional) richly decorated Pillar 43 in Enclosure D (Fig. 2). According to the authors, it is this pillar that confirms ("date-stamp") the occurrence of the Younger Dryas cometary encounter and associated coherent catastrophism (Sweatman and Tsikritsis, 2017, 234).

***Figure 2: Pillar 43 from Enclosure D and its particularly rich relief-decoration – actually extending not only on the pillar's western broadside (left), but also the southern (middle) and northern (right) narrow sides. (Photos: K. Schmidt, N. Becker, DAI)***

At this point, we should note that similar observations have a long tradition in pseudo-archaeology circles (Colavito 2017), albeit this observation does not disqualify the argument per se. However, it is more than surprising that while authors of 'ancient alien' fame have found their way into the cited references of this paper, the large scientific body of work on the site of Göbekli Tepe and Pre-Pottery Neolithic iconography produced over the last two decades is mostly omitted.

The premise, however, that a comet impact triggered the Younger Dryas cooling, which was subsequently recorded in Göbekli Tepe's iconography, is highly debatable in its own right. The occurrence of such an extra-terrestrial impact event (cf. Firestone et al. 2007) has been contested by recent research, and conclusive evidence is still pending (cf. Pinter et al. 2011, Boslough 2012 – incl. further reading). While we do not exclude a possible astronomic link or orientation of the Göbekli Tepe monuments (and actually carefully consider this in our interpretations), convincing evidence is still lacking. Since Sweatman and Tsikritis present Göbekli Tepe as a 'smoking gun' in this ongoing debate, we as the archaeologists excavating this important site would like to raise a few points that we feel require urgent consideration in this discussion. As it is not exactly our field of expertise, we do not venture into comments on complex astronomical questions about the likelihood of proposed celestial observations, the visibility of certain asterisms etc., but confine ourselves to remarks on the archaeological part of the paper.

1. The original layout of Göbekli Tepe's monumental round-oval buildings (none of which has been entirely excavated) is still subject of ongoing research. One should be aware that many of the T-pillars incorporated into the enclosures at Göbekli Tepe are not standing in their original positions and the buildings underwent significant modification during their life-cycles. Building archaeology studies have revealed that in many cases pillars were 'recycled', i.e. pulled out and used elsewhere (Piesker 2014). The monuments as we see them today are the culmination of multi-phase building and rebuilding

events. Additionally, there is the significant possibility that we are dealing with roofed structures (Kurapkat 2014); this fact alone would pose limitations to a function as sky observatories. The arches depicted on the western broad side of Pillar 43 (also referred to as "handbags" (Sweatman and Tsikritis 2017, 236)) could even be images of the monumental buildings themselves, covered by a corbelled roof (Dietrich and Notroff 2017, 24-25) and flanked by an animal, perhaps an identification device comparable to an emblem/badge (see point 5.).

2. The chronological frame Sweatman and Tsikritsis (2017, 233, 246) suggest for Pillar 43 (10950 BC +/- 250 years) is still 700-1000 years older than the oldest radiocarbon date so far available for Enclosure D (which stems from organic material retrieved from a wall plaster matrix, cf. Dietrich and Schmidt 2010, Dietrich et al. 2013). While there is evidence for later re-use of pillars (see above), assuming such a long tradition of knowledge relating to an unconfirmed (ancient) cosmic event appears extremely far-fetched. So far, earliest radiocarbon dates from Göbekli Tepe coincide with the end of the Younger Dryas and not its onset.

3. The assumption that asterisms are stable across time and cultures seems not convincing. It is highly unlikely that early Neolithic hunters in Upper Mesopotamia recognized the exact same celestial constellations as described by ancient Egyptian, Arabian, and Greek scholars, which still populate our imagination today. This issue would certainly require further investigation (drawing analogies to historic and modern non-western astronomical concepts seems an encouraging approach, cf. Nakata et al. 2014).

4. Sweatman's and Tsikritsis' contribution appears incredibly arbitrary, considering images adorning just a few selected pillars. Their study certainly does not cover "much of the symbolism of Göbekli Tepe" as stated in the paper (Sweatman and Tsikritsis 2017, 233), but merely a very small part of a complex iconographic landscape. Meanwhile more than 60 monumental limestone T-pillars are known from Göbekli Tepe – among these many feature similar carved low reliefs of animals and abstract symbols, a few even as complex as Pillar 43 (e.g. Pillar 56 in Enclosure H; Fig. 3; Schmidt 2013, Dietrich et al. 2016). Furthermore, the iconographic programme is not restricted to the limestone pillars; it is known from other find groups (including stone vessels, shaft straighteners, and plaquettes) not only from Göbekli Tepe but also from numerous contemporary sites in the wider region (Schmidt 2005, Becker et al. 2012, Dietrich et al. 2012).

***Figure 3: Pillar 56 from Enclosure H is another example for the rich and often complex iconography of Göbekli Tepe. (Photos & drawing: N. Becker, DAI)***

5. Göbekli Tepe's iconography is actually even more complex than the paper suggests. The animals depicted on the pillars seem to follow an intentional pattern, whereby each building has a different emphasis, i.e. with one animal or more being especially prominent (e.g. Enclosure A – snakes; Enclosure B – foxes; Enclosure C – boars; Enclosure D – birds; cf. Fig. 4). If we interpret these differences as an expression of community and belonging, this could hint at different groups having been responsible for the construction of particular enclosures.

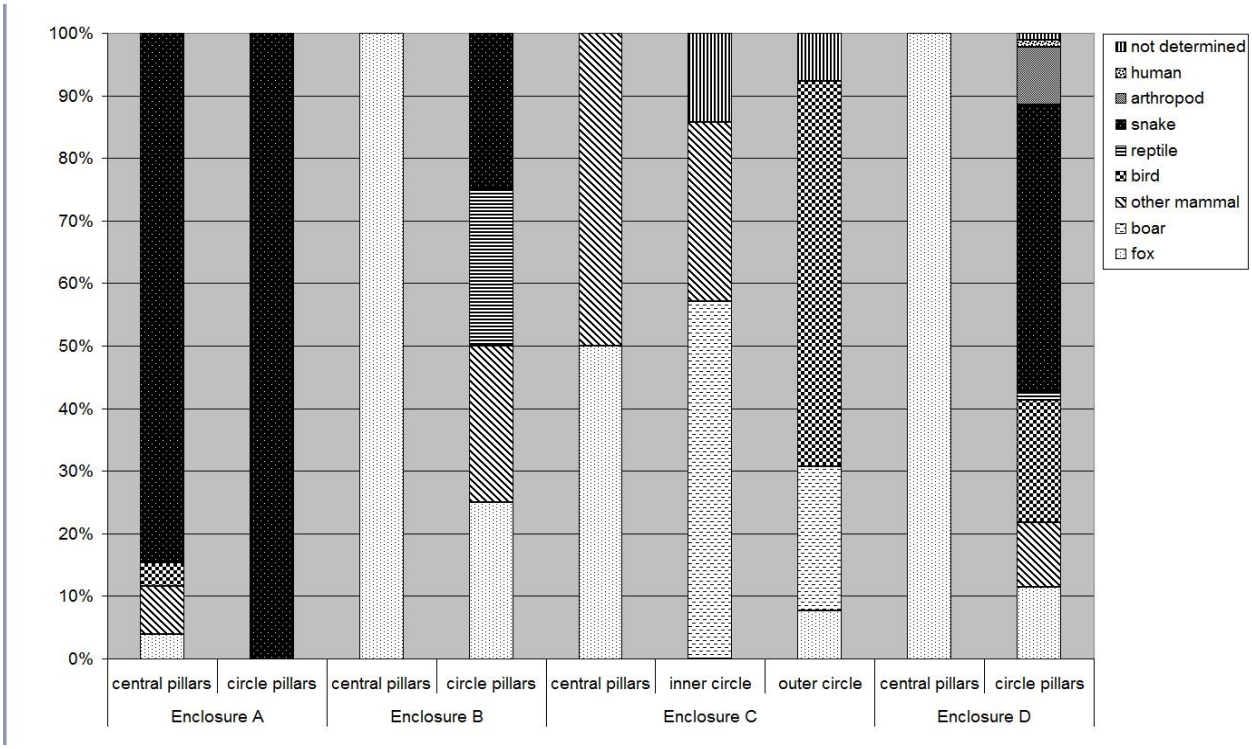


***Figure 4: Distribution of the appearance of figurative representations in the enclosures of Göbekli Tepe. Note: The different state of excavation as well as chronological depth of construction periods have to be considered; later added graffiti as well as symbolically reduced icons were not included. (Graphic: J. Notroff & N. Becker, DAI)***

In other words, specific enclosures may have served the needs of different social entities. Changing needs probably led to some of the modifications we can observe in the buildings; each having its own, very individual, 'biography' or buildings history. (Becker et al. 2012, Kinzel 2013, Notroff et al. 2014). For this reason, it is extremely problematic to pick out any one pillar and draw far-reaching but isolated interpretations while leaving out its context. A purely substitutional interpretation ignores these subtler but significant details. Details like the headless man on the shaft of Pillar 43, interpreted as a symbol of death, catastrophe and extinction by Sweatman and Tsikritsis (2017, 239), silently omits the clearly emphasised phallus which must contradict the lifeless notion; rather, this image implies a more versatile narrative behind these depictions. It should also be noted that there are even more reliefs on both narrow sides of Pillar 43 (Schmidt 2006) which apparently went unnoticed in the study at hand (cf. Fig 2). Pre-Pottery Neolithic iconography, by far exceeding the realms of Göbekli Tepe, is often especially concerned with articulation and disarticulation of the human body (Hodder and Meskell 2011). Particularly the depiction of severed human heads or headless bodies in combination with necrophagous animals (preferably but not exclusively vultures) is a well-known theme and may be rooted in a complex multiphase Pre-Pottery Neolithic mortuary ritual (Notroff et al. 2016) which includes post mortem removal of heads (Goring-Morris and Belfer-Cohen 2002; Kuijt and Goring-Morris 2002). Similar depictions of a bird grasping a human head are known from Göbekli Tepe (e.g. Fig. 5) as well as life-sized human sculpture heads which were deposited within the buildings (Becker et al. 2012).

***Figure 5: Fragmented sculpture from Göbekli Tepe showing a bird of prey crouched on a human head. (Photo: N. Becker, DAI)***

Therefore, with all due respect for the work and effort that the Edinburgh researchers put into their study, further serious discussion would, from the excavators' perspective of this important early Neolithic site, require proper consideration of the available archaeological sources.

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Sweatman, M. B. and Tsikritsis, D. (2017) Decoding Göbekli Tepe with archaeoastronomy: What does the fox say? *Mediterranean Archaeology and Archaeometry* 17(1), 233-250.

# COMMENT ON "MORE THAN A VULTURE: A RESPONSE TO SWEATMAN AND TSIKRITSIS"

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**ABSTRACT**

Here we respond to the comments of Notroff et.al. on our recent paper "Decoding Göbekli Tepe with archaeoastronomy: What does the fox say?", published in this journal.

**KEYWORDS:** symbolism, Younger Dryas, comet, Taurid meteor, asterism, coherent catastrophism.

## 1. INTRODUCTION

Here we respond to comments (Notroff et.al., 2017) concerning our earlier paper 'Decoding Göbekli Tepe with archaeoastronomy: What does the fox say'? (Sweatman and Tsikritsis, 2017). Please see these earlier works for the context of our response below.

As scientists and engineers we are obliged to present the results we find together with their context *and* estimates of confidence. Our earlier work (Sweatman and Tsikritsis, 2017) is accurately described in the context of the Younger Dryas (YD) impact hypothesis and is supported by a strong statistical case. Indeed, our work hinges crucially on the statistical case. As a reminder, consider Table 1 where we list the asterism – animal carving associations we find on two pillars (43 and 2) at Göbekli Tepe (GT). The probability that these matches can have occurred by pure chance is extremely remote – see our earlier paper for statistical estimates. In the field of particle physics such confidence levels would be sufficient to claim discovery of a new fundamental particle. To dispute our findings one must find sufficient flaws with our statistical case. However, Notroff et.al. do not, in any way, attempt to analyse this statistical case, focussing instead on the 'archaeological' aspects. As we describe below, this 'archaeological' viewpoint is mainly a collection of opinions without substantive supporting evidence. They, therefore, leave themselves in a difficult position.

Further regarding our statistical case, note that we are comparing given constellations with given animal symbols. This is *not* an arbitrary process, and is therefore statistically meaningful. On the other hand, it is common in popular media and across the internet to take a different approach, where given or arbitrary symbols are compared with *arbitrary* star patterns. This strategy is statistically meaningless, and therefore *not scientific*, because there are sufficient stars in the sky to match to any given pattern with probability close to 1.

Notroff et.al. also comment on the current debate concerning the YD impact hypothesis, saying that 'conclusive evidence is still pending'. We agree that the scientific community does not yet appear to have reached a consensus on this issue, and we provide a balanced view of the debate in our earlier paper. However, with the recent discovery of the platinum anomaly across North America and Greenland (Moore et.al., 2017), at the same horizon as much other claimed evidence for the event, it appears to us that the case in favour of the YD impact hypothesis is now very strong. Placed in this context, we consider our interpretation for GT is credible. Indeed, considering that Abu Hureyra, where potential YD event indicators (hollow glassy microspherules) have previously been found (Wittke et.al., 2013, Thy et.al. 2015), is only 160 km from GT, we suggest it would be worthwhile searching for YD event indicators near GT as well.

Finally, in this section we respond to remarks made in their introduction that appear to attempt to weaken the credibility of our work by association with 'ancient aliens' etc. As academic researchers we must give credit where it is due, even if the earlier work is somewhat speculative, and regardless of whatever else an individual might have said. We suggest Notroff et.al. should have confined their remarks to the evidence we provided in our earlier work.

## 2. COMMENTS

We now proceed to deal with each detailed comment in their rebuttal.

1. Notroff et.al. suggest GT might have been roofed, and this would limit its potential as an observatory. We defer to the on-site excavators who are best placed to determine the construction history of the site, and agree that a roof would limit its potential for observing the sky. However, as Notroff et.al. also suggest, it appears that GT was not built in one phase and that some pillars were likely moved. Accordingly, we suggest construction of the rough stone enclosure walls (which might, or might not, have supported a roof) might have followed an earlier phase of construction consisting of relatively free-standing pillars. We suggest this because the carvings on many of the pillars are covered by these walls. Given the undoubted extreme effort required and limited resources available to construct the pillars and their carvings, it makes little sense to us that the builders of GT would have immediately hidden many of the carvings within the rough stone enclosure wall. We also note that, whether GT was roofed at some point or not, this has little bearing on the statistics of our interpretation. It only affects interpretation of the usage of GT at some point in its history. To summarize, we agree that enclosures at GT might have been roofed at some point, but currently there is no firm evidence that they were, not even in the reference provided by Notroff et.al. (Kurupkat, 2014). We will follow developments in this aspect of the archaeological research with great interest.

2. Notroff et.al. are correct, there is a gap of around 1000 years or more between the proposed 'date stamp' on pillar 43 and the earliest radiocarbon dating of GT, derived from the organic content in the cement of a rough stone wall in which it is embedded. This is clearly described in our original work. Notroff et.al. suggest this is 'far-fetched'. This is just opinion – no firm evidence is provided to support this view. The date of construction of Pillar 43 itself is not known with much confidence, except that it is very likely within this period. Consistent with point 1 above, we suggest some pillars, especially Pillar 43, might have been constructed significantly before the addition of the rough stone walls. Considering this potential change of usage in GT (which appears to be coeval with the end of the YD period, and therefore might have been a response to quickly changing climate conditions), we do not find it surprising that the earliest calibrated radiocarbon date yet found for GT corresponds to building the rough stone walls. Moreover, given the undoubted major impact the YD event would have had on people at the time, we are not at all surprised that an event of this importance is remembered even several millennia later. There are plenty of examples of such long-term societal memories today, e.g. many major religions. Other than by making carvings on pillars, amply demonstrated at GT, we do not know how such astronomical data was stored and communicated across generations by other means. One can speculate about the possible mechanisms, e.g. oral tradition which is apparent even today in some parts of the world (e.g. India).
3. Notroff et.al. find the notion that asterisms are stable across time and cultures not convincing. According to our interpretation, in most cases the asterisms used at GT are very similar to those that appear in stellarium (Western Lore), although their interpretation as animals is often quite different. Notroff et.al. suggest that asterisms can only be expected to be stable over the timescale of several thousand years (going back to ancient Egyptian, Arabian and Greek scholars). This is just opinion, and no firm evidence is supplied to support this statement, or why a few thousand years is considered acceptable while eight or nine thousand years more is not. We agree with Notroff et.al. that the definition of specific constellations can be expected to 'drift' as one goes further back in time, and our statistical case suggests strongly that this has indeed happened, at least for some of the asterisms we have investigated so far. Like Notroff et.al., we find this extremely interesting, and suggest it opens-up a new line of historical investigation.
4. Notroff et.al. consider our selection of pillars extremely arbitrary, as more than 60 are known from GT. We have chosen pillars that enable us to decode GT. Like a crossword puzzle, we cannot decode all the symbolism at once, especially as not all the information on the 60+ pillars mentioned has been publicly released. We choose Pillar 43 initially because it has the scorpion symbol, an obvious match with Scorpius. Moreover, with its many symbols it allows us to develop a very strong statistical case. This then unlocks the meaning of the bending bird (or crane) as Pisces. To discover the meaning of the fox we turn to the only other pillar known to us with a fox in combination with one of the symbols we have already decoded, Pillar 2, which has a crane. This is not an arbitrary selection of pillars, but a necessary selection of pillars. This unlocks the meaning of both the fox and aurochs, although with less statistical certainty than for the other symbols. We suggest it might be possible to unlock the meaning of yet more symbols (e.g. the lion/leopard) if the excavators release more data. We note the pillar mentioned by Notroff et.al. (Pillar 56) is stylistically a little different to the ones we have already analysed, and one of the most complex Pillars at GT they could have asked us to interpret. To demonstrate the utility of our approach, we first provide a possible interpretation of aspects of Pillar 33 (Schmidt, 2003), which is stylistically similar to the other pillars we have analysed. One face shows an array of snakes emanating from the abdomen of a fox, while the other has an array of snakes emanating from the abdomen of a crane (see Figures 1a and 1b). All the snake heads converge on the inner narrow surface. This scene appears to defy straightforward interpretation in terms of normal animal behaviour. But with our astronomical interpretation the explanation is obvious – it is likely describing the Northern Taurid meteor stream once again. On one face we have meteors (snakes) emanating from the northern asterism of Aquarius (the fox), while on the other face they emanate from Pisces (the crane). In astronomical terms, the difference between these scenes amounts to just a few weeks as the Northern Taurid radiant moves across the winter night's sky. Returning now

to Pillar 56, it appears to us to be quite similar to Pillar 33 in some respects, in that it depicts snakes (meteors) and tall birds or cranes (Pisces), and therefore likely references the Taurids again. But it also depicts other symbols that we do not yet fully understand and are quite difficult to discern. A fuller interpretation of Pillar 56 deserves a separate report, and would probably benefit from closer inspection of the site. We are not surprised the iconography seen at GT occurs locally on other artefacts.

5. Notroff et.al. suggest they have an alternative interpretation for symbolism at GT. We respond that given the statistical basis or our interpretation, any interpretation inconsistent with ours is very likely to be incorrect. They mention that the different enclosures appear to emphasize specific animals, and therefore they likely represent different social groupings, perhaps evolving over time. This does *not* necessarily contradict our interpretation – it is potentially consistent. For example, the different enclosures might represent a focus on different meteor streams or the same meteor stream at different times. Indeed, the animals stated by Notroff et.al. (Enclosure A – snakes; Enclosure B – foxes; Enclosure C – boars; Enclosure D – birds) correspond to meteors (snakes) and the Northern and Southern Taurids (foxes, boars and birds) within our interpretation. Notroff et.al. suggest a purely substitutional interpretation, such as ours, is unlikely and limited in its complexity. Again, no clear evidence is provided to justify this statement, and it is therefore just opinion. We note that some of the earliest known forms of writing (e.g. Sumerian Cuniform and Egyptian Hieroglyphs) developed largely from early pictographic substitutional forms. Therefore, our interpretation does not rule out complexity, and is consistent with the known development of writing. Notroff et.al. speculate on the meaning of the phallus on the little headless man on Pillar 43, suggesting it refers to life. We do not speculate on this, but note that many of the animal symbols are similarly endowed. Notroff et.al. comment that PPN mortuary rituals included post mortem removal of heads in combination with necrophagous animals. We agree that this is interesting, and suggest it reinforces our interpretation that the little headless man refers to 'death'. Notroff et.al. suggest many of the symbols at GT went un-noticed by us. We respond that we do not claim a complete interpretation, and indeed since not all the data has been made publicly available, this would be impossible for us. Nevertheless, we think we have made a good start on some of the key pillars.

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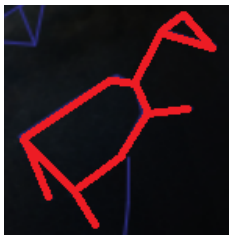
***Table 1: Animal symbol – asterism associations from Pillars 43 and 2 at Göbekli Tepe (GT) described in Sweatman and Tsikritsis. All asterisms are oriented as they go below the horizon as seen from Sanliurfa (near GT) at 9530 BC. Note the fox symbol from Pillar 2 has been reversed left-right, consistent with some other fox symbols at GT. Also notice the scorpion symbol is upside-down relative to its asterism.***

| Symbol | Asterism |
|---|---|
|  **Scorpion** |  **Scorpio** |
|  **Bending bird** |  **Pisces** |
|  **Duck/goose** |  **Libra** |
|  **Dog/wolf?** |  **Lupus** |

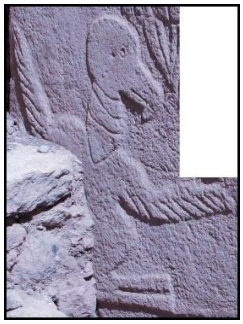
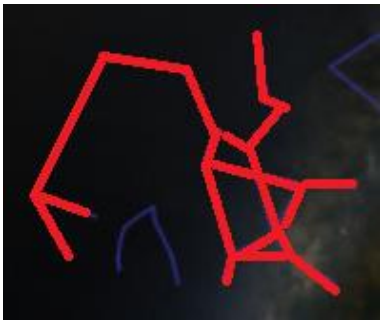
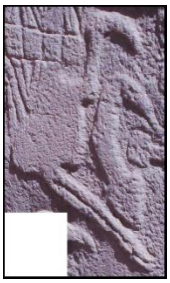
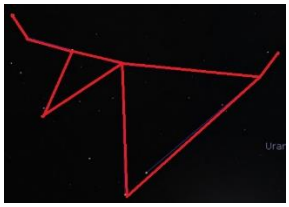
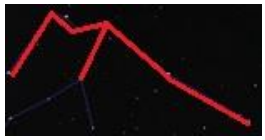
| | |
|---|---|
|  **Eagle/vulture** |  **Sagittarius** |
|  **Bending bird with fish** |  **Ophiuchus** |
|  **Down-crawling frog** |  **Virgo** |
|  **Charging ibex /crouching rat** |  **Gemini** |
|  **Aurochs** |  **Capricornus** |
|  **Fox** |  **Northern Aquarius** |

***Figure 1a. Left face of Pillar 33 showing snakes radiating from the belly of a fox (Schmidt, 2003). The snakes are hardly visible on this face, but their heads are more easily discerned on the forward face of this pillar.***

***Figure 1b. Right face of Pillar 33 showing snakes radiating from the belly of a bending bird (crane) (Schmidt, 2003). The snakes are clearly visible on this face, and their heads are easily discerned on the forward face of this pillar.***

# CRITICAL EVALUATION OF THE PAPER BY SWEATMAN, M. B. AND D. TSIKRITSIS, "DECODING GÖBEKLI TEPE WITH ARCHAEOASTRONOMY: WHAT DOES THE FOX SAY?"

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Sweatman and Tsikritsis's (2017) interpretation of symbolism carved on megalithic pillars at Göbekli Tepe as a "date stamp" marking a possible astronomical event is particularly intriguing. Of interest are several low-relief images of animals carved into the limestone of Pillar 43 in the northwest area of Enclosure D (Sweatman and Tsikritsis, 2017, fig. 1). The animals are arranged about a circle situated near the center of the broad southwest face of the pillar. The authors match the images with certain modern Western constellations or asterisms ("Western Lore in Stellarium 0.15"), concluding that Pillar 43 (the 'Vulture Stone') provides a date stamp for 10950 BC ± 250 years, and might be related to observations of meteor showers and/or cometary encounters, including an extraterrestrial impact (ET) such as the event proposed by Firestone et al. (2007). Sweatman and Tsikritsis (2017) do not provide a pillar-wide illustration comparing the carved symbols and respective astronomic correspondences based on their interpretation. The ET impact hypothesis for Younger Dryas cooling (Firestone et al., 2007) is controversial having been met with cautious support (Israde-Alcantara et al., 2012; Haynes, 2008; Kennett et al., 2009), arguments against (Paquay et al., 2009; Boslough et al., 2012; Buchanan et al., 2008; Wu et al., 2013; LeCompte et al., 2012), and general ridicule (Surovell et al., 2009; Pinter et al., 2011). However, such an event would certainly have provided incentive for recording the date, and Sweatman and Tsikritsis (2017) consider the potential for Göbekli Tepe to be *the* 'smoking gun' for the cometary encounter.

The purpose herein is to review specific correlations between symbols on Pillar 43 and constellations/asterisms referenced by Sweatman and Tsikritsis (2017), and to propose a revised set of correlations that more accurately reflects the spatial pattern of stars represented by symbols depicted on the pillar. Refer to Figure 1 (below) for illustrations related to the following discussion.

My comments are:

(1) Sweatman and Tsikritsis (2017) suggest the vulture/eagle with outstretched wings on the pillar represents the 'teapot' asterism associated with Sagittarius, with the carved circle above the bird's right wing representing the Sun. Those correspondences agree with findings described in Burley (2013), using Stellarium 0.10.61, in which a line drawn across the bird's shoulders/wings defines the ecliptic crossing Sagittarius and the carved circle symbolizes the Sun at the intersection of the ecliptic and galactic plane. Hancock (2015: 301-33) details findings provided in Burley (2013), inferring a date stamp on Pillar 43. The procedure is similar to the one leading to the interpretation proposed by Sweatman and Tsikritsis (2017). The date intended to be inferred from the symbolism, and therefore the meaning behind the artwork as a whole, remain in question. Nonetheless, in each the case the researchers conclude the symbolism is related to the ET impact hypothesis and Younger Dryas event. The emphasis herein concerns accurate interpretation of the symbols with respect to potential correlations with patterns of stars (constellations/asterism) rather than identifying the original purpose of creating the symbolism we see today on Pillar 43.

(2) The large crane or flamingo ("bent bird") with a curved snake between its body and legs, to the right of the circle (Sun), is interpreted by the authors as representing the constellation Ophiuchus. Burley (2013) suggests the body of the bent bird is represented by the south (lower) portion of Ophiuchus between the stars Yed Prior and

Sabik, and the bird's legs correspond to the line from Sabik toward the stars Pi Scorpii and Rhi Scorpii in the west portion of Scorpius; as such, the bird's legs are sub-parallel to the ecliptic west (right) of the Sun. The head of the curved snake, then, may represent the stars Dschubba, Graffias and Nu Scorpii in Scorpius, and Theta Librae in Libra farther west and near the ecliptic.

(3) The authors do not interpret the "squat bird" situated to the right of the scorpion, although they note it might represent the claws of Scorpius. Burley (2013) places the squat bird in just such location. However, a more accurate correlation may be indicated with the prominent eye and rump of the bird representing the stars Antares and Wei, respectively, in Scorpius, with feet extending toward Chi Lupi or Theta Lupi in the constellation Lupus. As with Burley (2013) this places the bird below and looking west along the ecliptic.

(4) The scorpion carved below the circle and left wing of the vulture/eagle is suggested by the authors to represent the east (left) portion of the modern constellation Scorpius. That interpretation conforms to Burley (2013), with the possibility that the right legs of the scorpion extend no farther west than MU1 Scorpii.

(5) Sweatman and Tsikritsis (2017) suggest the large goose/duck symbol at the bottom of the pillar represents the modern constellation Libra. However, Libra is located west of the west portion of Scorpius; in other words, based on the author's interpretation of the "bent bird" symbolizing Ophiuchus, the goose/duck is in the wrong location on the Pillar if it represents Libra, and should have been situated to the right of the curved snake to more accurately conform with the actual relative location of Ophiuchus and Libra. Burley (2013) interprets the head and neck of the goose/duck correlating with the constellation of Ara, with the star Alpha Arae representing the bird's prominent eye.

(6) The authors propose that a potential dog/wolf depicted to the left of the scorpion represents the constellation Lupus. However, Lupus is located west (right) and south (below) of Scorpius while the dog/wolf is situated left (east) of the scorpion carved on the Pillar. Little of the dog/wolf is apparent because much of the left portion of the Pillar has remained unexcavated. Burley (2013) does not interpret the apparent portion of the dog/wolf carving. However, assuming the head and neck of the goose/duck represent the constellation of Ara as suggested above, then exposed portions of the head, neck and forelegs of the dog/wolf may represent the constellation of Telescopium and star Theta Arae.

(7) Another curved snake appears left of the scorpion and above the head of the dog/wolf. Sweatman and Tsikritsis (2017) and Burley (2013) offer no potential stellar correlation of that feature. However, the arcuate constellation Corona Australis is located east (left) of Scorpius, and it is speculated that the as yet buried portion of the snake might represent Corona Australis with the head of the snake situated between that constellation and Scorpius. Further excavation of the pillar is necessary before further analysis can be made of the snake and dog/wolf in this area of the pillar.

(8) The authors note the apparent outline of a headless man at the bottom of the pillar, to the right of the goose/duck, but offer no suggestion of an astronomic correlation of the symbol. Burley (2013) makes no mention of the figure. However, the outline of the carving bears some resemblance with a dark region of the Milky Way immediately west (right) of the constellation Ara (represented by the goose/duck). If this interpretation is correct, then the carved headless man may be sized, shaped and oriented with respect to apparent features of the that portion of the sky and constellations represented by the animals noted above.

(9) Sweatman and Tsikritsis (2017) pose the possibility that "the artist(s) of Pillar 43 did not intend to depict an accurate star-map of the sky", while also stating that their interpretation of the symbols places the carvings "in approximately the correct spatial locations." However, as noted above, the overall pattern (locations and orientations) of carvings interpreted by Sweatman and Tsikritsis (2017) do not correlate well with the actual spatial pattern of stars.

(10) In summary, the interpretation by Burley (2013) with minor modifications and additions outlined herein provide a more accurate correlation between the carved symbols and constellations/asterisms. Significantly, the correlation proposed by Burley (2013) suggests that the Sun symbol is located at the crossing point of the ecliptic and galactic plane, with the ecliptic extending sub-horizontally across the Pillar from the left wing of the vulture/eagle to the feet of the "bent bird", while the Milky Way extends sub-vertically down the central portion of the pillar from the middle 'handbag' in the upper portion of the Pillar, through the Sun and scorpion, to the head and neck of the goose/duck at the bottom. Thus, the shape and orientation of the Pillar provides geometric context for orienting the ecliptic and Milky Way orthogonally across the face of the megalith with the Sun centered at the crossing point. The orientation of constella-

tions suggested by the carvings indicates the scene represents a view of the skyscape looking toward the south with the Sun situated at the meridian. In reality the constellations could not have been seen with the Sun situated in the southern sky. However, as a 'date stamp' with the Sun at the intersection of the ecliptic and galactic plane the symbolism is clear. The era inferred from that 'date' remains in question.

(11) Quantitative spatial analysis could be performed to further evaluate potential correlation between the carvings and respective constellations/asterisms. That would necessitate making assumptions about which characteristics of the carvings are important enough for inclusion within a point pattern that may then be compared to the point pattern of stars ca. 9,300 BC-10,950 BC using appropriate statistical analysis. The approach is beyond simple visual analysis of the artwork with respect to accurate modeling of astronomical events, but may prove valuable in substantiating proposed correlations between the carvings and patterns of stars.

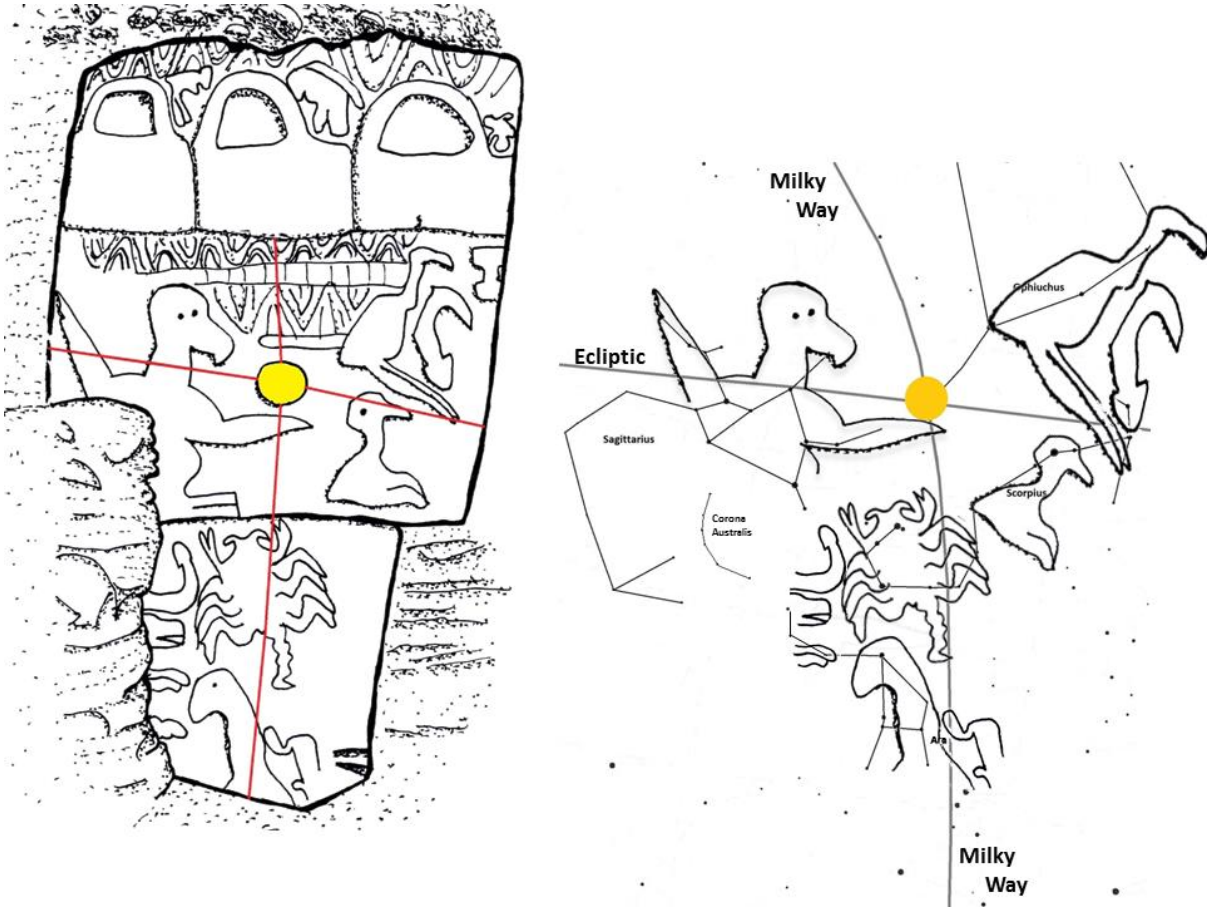


***Figure 1. Line drawing of Pillar 43 at Göbekli Tepe (left) with circular carving representing the Sun and red lines indicating locations and orientations of ecliptic and galactic plane per Burley (2013). Line drawing (right) illustrating correspondence of carvings and constellations interpreted in Burley (2013) modified as described herein.***

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