

Celestial Aspects of Hittite Religion: An Investigation of the Rock Sanctuary Yazılıkaya

Eberhard Zangger

President, Luwian Studies
e.zangger@luwianstudies.org

Rita Gautschy

Department of Ancient Civilizations, University of Basel, Switzerland
rita.gautschy@unibas.ch

Abstract: Regular celestial events assumed remarkable significance for the cultic rituals of the Hittite civilisation (c. 1600–1180 BC) in central Asia Minor. Numerous texts found at the capital Hattuša relate to solar deities and celestial divination reminiscent of Old Babylonian astronomical and astrological practices. Here we suggest that the rock sanctuary of Yazılıkaya, which was considered one of the holiest places in the Hittite kingdom, had a calendrical function. It contains more than 90 rock-cut reliefs, dating to the second half of the thirteenth century BC, of deities, humans, animals and mythical figures. The reliefs in Chamber A are arranged in groups to mark the days, synodic months and solar years. Using this system, the Hittite priests were able to determine when additional months were required to keep lunar and solar years aligned. The astronomical and astrological interpretation of Yazılıkaya serves as a point of departure for a brief re-examination of celestial aspects in Hittite religion.

Keywords: ancient calendars; archaeoastronomy; Bronze Age Anatolia; Hittite religion; lunisolar calendar; Yazılıkaya

1. Introduction: The Rock Sanctuary of Yazılıkaya

Not again shall I interchange [the festivals] of the spring and of [the autumn] and [the festivals of the spring] I shall perform punctually in the spring, [the festivals of the autumn] I shall perform punctually in the autumn.

—*The Prayer of Tudḫaliya IV to the Sun Goddess of Arinna*, KBo 12.58 + KBo 13.162 (CTH 385.9) vs. 8–9 (trans. in Hazenbos 2003, 12)



FIGURE 1. Wall on the western inside of Chamber A with 12 identical gods (Reliefs 1–12) on the far left and the Sun god of the heavens (Relief 34) on the right (© Luwian Studies).

The application of methods from the natural sciences to the study of archaeological problems has in recent years proven valuable in a number of fields, including landscape reconstruction, hydrology, metal provenance studies, tracing ethnic origins and analysing human organic remains. Here we propose to apply current knowledge and methods in astronomy to shed more light on certain aspects of Hittite religion. The starting point of our discussion is a new hypothesis about the use of the rock sanctuary at Yazılıkaya, arguably one of the holiest places in the Hittite kingdom (Figure 1 – Bryce 2002, 162). We show for the first time that the reliefs in Chamber A at Yazılıkaya are arranged in groups for the purpose of marking the days, synodic months and solar years, to determine when additional months were required to keep lunar and solar years aligned. We continue by examining supporting evidence for celestial aspects of Hittite religion already known from previous archaeological studies of Yazılıkaya. This is derived from the architectural remains of the Hittite capital *Hattuša*, from documents found in *Hattuša* and from investigations elsewhere in the Hittite kingdom (for example Müller-Karpe 2017, 111–112). By combining the contributions of archaeology and astronomy, along with linguistics and religious studies, we aim to gather the evidence for astronomical and astrological beliefs in Hittite society, as they have been recorded.

The Hittite Late Bronze Age rock sanctuary of Yazılıkaya, with its rock-carved reliefs, ranks as one of the world's most remarkable archaeological sites, and as such it was

added to the UNESCO World Heritage List in 1986, together with Hattuša. One of the most important manifestations of the Hittite religion available to us, the sanctuary has been called “the pinnacle of Hittite artistic achievement” and “the Sistine Chapel of Hittite religious art” (Bryce 2002, 161; Krupp 2005, 420). It is therefore an ideal point of departure for an attempt to assess the significance of astronomy and astrology in the Hittite religion. The sanctuary lies 1650 m to the northeast of Hattuša’s Great Temple (Temple 1), near the modern village of Boğazkale in the south of Çorum Province, 150 km east of Ankara (Figure 2). What is now called Yazılıkaya (“inscribed rock” in Turkish) consists of an irregular limestone massif extending over an area of about 50 × 80 m. Such isolated rock massifs crop up in many places in the region, both within the walls of Hattuša and outside of them.

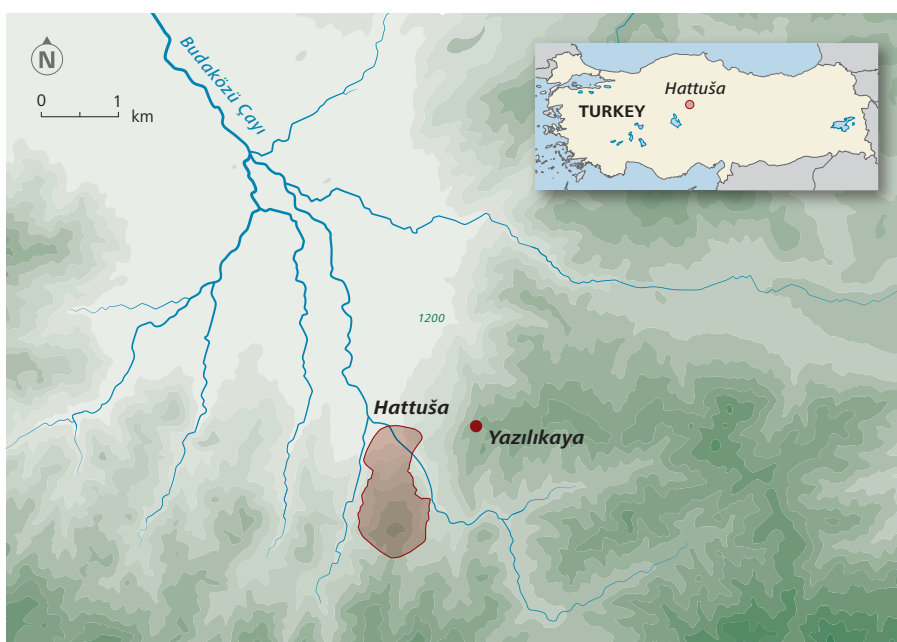


FIGURE 2. Topographic map showing the location of Hattuša and Yazılıkaya in central Asia Minor (© Luwian Studies).

The introductory quote reflects how the Great King of Hatti, Tudḫaliya IV, was particularly concerned about the correct timing of religious festivals. During his reign (c. 1236–1215 BC), the reliefs that are still visible today at Yazılıkaya were cut into the inside-facing walls of two, for the most part, natural courts designated as Chamber A (Figure 1) and Chamber B. One relief (no. 81) in Chamber B depicts Tudḫaliya IV with a round cap. Some scholars interpret this as being part of his usual priestly garb, while others think it indicates his apotheosis as a deceased king. The latter would indicate that this particular relief was constructed during the rule of his son and successor Šuppiluliuma II (Schachner 2011, 103).

The reliefs were originally published by the French archaeologist Charles Texier in 1834. Excavations were conducted at Yazılıkaya from 1931 to 1939 and again from 1966 to 1972 (Bittel *et al.* 1941; Bittel 1975), but the most recent compilation of knowledge on the sanctuary dates from 2011 (Seeher 2011). Additional monographs and other publications concentrate either on the reliefs in art history or on their short Luwian hieroglyphic inscriptions (Laroche 1952; Masson 1981; Alexander 1986; Schachner *et al.* 2016), providing the Hurrian names of the deities (Haas 1994, 633). The use of Luwian hieroglyphic script to write in a different language is something that is unique to this site.

Chamber A, for the most part a natural internal enclosure, is about 30 m long. It contains rock-cut reliefs of 64 deities, all facing in a northerly direction. With two exceptions, the deities on the left are all male, while those on the right are female. They appear to be marching in procession from both sides towards the climactic plateau at the northern end, where the supreme deities meet. The Hurrian storm god Teššub (Relief 42), “the preserver of order in the cosmos” (Bryce 2002, 143), is pictured on the left standing on the mountain gods Namni and Hazzi, while his wife, the Hurrian goddess Ḫebat, is pictured on the right (Relief 43) standing on a leopard (Haas 1994, 386; Seeher 2011, 65–67). Ḫebat can be equated with the Sun Goddess of Arinna, the chief female deity of the Hittite world (KUB 21.27, CTH 384; Bryce 2002, 137). Behind Ḫebat, on her right, are the couple’s son Šarruma (Relief 44) and Ḫebat’s daughters Allanzu (Relief 45) and Kunzišalli (Relief 46 – Haas 1994, 474). Most reliefs feature an inscription in Luwian hieroglyphics in front of each figure’s head. A few of these hieroglyphics cannot be read owing to weathering of the rock or because the signs have not yet been deciphered. Those figures that do bear a name are marked with the Luwian sign for “deity”. It is thus undisputed that Yazılıkaya represents a sequence of, for the most part, high-ranking Hittite/Luwian/Hurrian deities.

The natural court was walled off from the outside, but not roofed over, even though this would have been easy to achieve (Bittel *et al.* 1941, 19; Güterbock 1953, 65; Haas and Wäfler 1974, 213). Accordingly, the reliefs have been exposed to sunlight, rain and weathering. This in itself suggests that the movements of the Sun, shadows and/or the Moon and the stars may have been a component of the sanctuary’s function. A major effort was made to shape the natural outcrop by quarrying and chiselling to produce level horizontal and vertical surfaces as well as sills. These level surfaces and ledges (Figure 1) may have had a function that was as important as the depictions in the reliefs. The latter may not have been very well executed artistically (Bryce 2002, 161), but they are consistent with other depictions of deities in Hittite sculpture and glyphs. The reliefs were very probably painted, meaning that details could have been highlighted in colour.

In addition to the carvings, a complex of buildings was erected in front of the southwestern side of the rock massif (Figure 3). These formed an integral part of the sanctuary, screening off the rock chambers and thereby preventing access to them. Anyone wishing to enter the courts of the rock sanctuary had to pass through these buildings. Archaeologists have identified three phases of construction (Seeher 2011, 125–137). Initially, possibly as early as 1500 BC, the gatehouse (Building III) was erected, together with the long wall of Building I (Naumann 1975, 91; Seeher 2011, 134–136; 2016, 155), thereby closing off



FIGURE 3. Plan showing the location of Chambers A and B as well as the three phases of temple constructions. The gatehouse (Building III) is directed at the sunset during summer solstice. The northwestern wall of Building IV is aligned with the sunset during the winter solstice (© Luwian Studies).

access to the inner sanctuary. It is impossible to determine what the court looked like at that time, because all surfaces were later reworked when Chamber A was decorated with the present carvings. The temples were expanded during two later building phases in the thirteenth century BC. When the Hittite kingdom collapsed around 1190 BC, the sanctuary was abandoned.

Although many tablets were found in Hattuša, not a single one contained a clear reference to the rock sanctuary, and the original name of the site is therefore currently unknown. Various interpretations concerning its function have been proposed (Bittel *et al.* 1941, 146). Given the tantalising parallel between the sequence of gods in Chamber A in Yazılıkaya and the sequence of gods in a ceremony described on the tenth tablet of the so-called *itkalzi* ritual, Volkert Haas and Markus Wäfler suggested that Yazılıkaya was the place where the *itkalzi* ritual was performed (Haas and Wäfler 1974, 226). In the course of this ritual, *kupti* objects were driven into the ground for successive pairs of deities (Haas 1994, 638; Strauß 2006, 79–84). It is clear from the texts that such rituals were performed outside the town and under the open sky. Yazılıkaya fulfils both requirements. Later, Haas added that Chamber A was probably the setting for coronations while Chamber B was a *hekur*, an institution where the ancestors of the royal family were worshipped (Haas 1994, 639). Other authors take Yazılıkaya as the location of the *heštā* house mentioned

in religious texts from Büyükkale, or the mortuary shrine related to the Festival of the Crocus (AN.TAḪ.ŠUM), or as the site where the spirits of the dead kings of Ḫatti dwelt. A few specialists, indeed, interpret the site as having been the tomb of Tudḫaliya IV (Naumann 1975, 124; Masson 1989, 117; Hawkins 1998, 72; Seeher 2011, 164).

Emilia Masson (1989, 107) suggests that once a year, during the winter solstice, a divine assembly took place in Chamber A. It has also recently been suggested that the equinoxes determined the timing of the most important Hittite festivals – AN.TAḪ.ŠUM and *nuntarriyashas*, in spring and autumn (González-García and Belmonte 2011, 483). Jürgen Seeher, head of the excavations in Ḫattuša until 2006, describes Yazılıkaya as the location of the New Year's feast and the spring feast and also as the home of the weather god (Seeher 2002, 125). Since the Hittite cultic calendar included up to 165 festivals (Bryce 2002, 188), many of which were repeated each year, the ability to accurately determine dates and time was naturally of great importance.

Today, Yazılıkaya remains one of several enigmas in Mediterranean archaeology. Jürgen Seeher concludes: "It is still by no means clear today what function the rock sanctuary actually fulfilled" (Seeher 2011, 154). He adds that Yazılıkaya "continues to guard its secrets" (Seeher 2011, 5; Bilgin 2015).

2. Elements of a Lunisolar Calendar

2.1. Lunar Months are Reflected in 12 Uniform Male Gods

The deities in Chamber A of the rock sanctuary of Yazılıkaya are arranged in groups, which makes them ideally suited for calendrical purposes. In our view, the 12 uniform male gods (Reliefs 1–12) at the beginning of the sequence on the western wall of the chamber indicate synodic months, the time from one new Moon to the next new Moon. This association had already been proposed for the 12 uniform male gods in Chamber B (Reliefs 69–80) by the astrophysicist Juan Antonio Belmonte (2000, 89). Our scenario reinforces his ideas – and now additionally furnishes an explanation for the deities in Chamber A.

Throughout the second millennium BC, lunisolar calendars – a combination of solar years and lunar months – were frequently used (Hunger and Steele 2019, 7). To make a lunisolar calendar work, the days, lunar months and years had to be counted and kept track of. It takes the Moon 29 to 30 days to perform one complete orbit around Earth and to reach a similar alignment of Earth, the Sun and the Moon – that is, the same lunar phase as before. The length of such a synodic month varies because the Moon's orbit is elliptical. On average, a synodic month has 29.53 days, so that 12 lunar months add up to 354 days, thereby falling around 11.25 days short of a solar year. In order to keep a lunisolar calendar in step with the seasons, an intercalary month therefore has to be inserted mainly every third year.

In Yazılıkaya, the panel to mark the relevant lunar month occurs twice (Reliefs 1–12 in Chamber A and Reliefs 69–80 [Figure 4] in Chamber B). The deities in each panel are identical, because they were simply used for counting. These deities carry sickles, which they will need to separate the sky from the earth when night falls (Haas 1994, 150, 175).



FIGURE 4. Twelve identical male gods in Chamber B carrying sickle-shaped swords (© Luwian Studies).

2.2. Celestial Deities Represent Each Day of the Lunar Month

Proceeding in Chamber A from left to right, the next group of deities consists of 30 figures (Figure 5), equivalent to the maximum number of days per lunar month, starting at Relief 13 and ending at Relief 41 (although 29 deities were recognised as early as 1901 [Belck 1901, 477], one was not established until after the current numbering had been introduced and is now designated Relief 16a [Bittel *et al.* 1941, 57]). The depicted deities feature a wide range of characteristics and traits. At the beginning of the sequence (left) are mountain gods, but further to the right larger and often winged deities appear. References to the sky abound throughout the carved depictions in this group, and the celestial properties of some of the deities are therefore obvious. Šimegi, the Sun god of heavens (Relief 34), Kušuḫ, the Moon god (Relief 35) and Pirinkir (Relief 31), an Ištar-like star, are all identified by their names and prominently participate in this sequence. A connection to celestial bodies is also indicated by the presence of the goddess Šauška (Ištar), who is represented and named both in the male row of gods (Relief 38) as the morning star and in the female row on the eastern wall (Relief 56) as the evening star and goddess of fertility (Güterbock 1953, 69; Haas 1994, 143, 340, 351). This duality is also found in other goddesses of the ancient Middle East (Belmonte 2000, 89). The bull-men in Reliefs 28 and 29 that form one unit have always been considered to be two individuals, and are possibly the bulls of heaven, Hurriš and Šeriš (Laroche 1952, 118; Bittel 1975, 136; Güterbock 1975, 177; Seeher 2011, 53).

However, although we have proceeded clockwise, left to right, following Kurt Bittel's numbering (Bittel 1934, pl. 31), it is most likely that the sequence was originally envisioned anticlockwise. First, the Moon is known to have acquired prominence in Anatolian beliefs

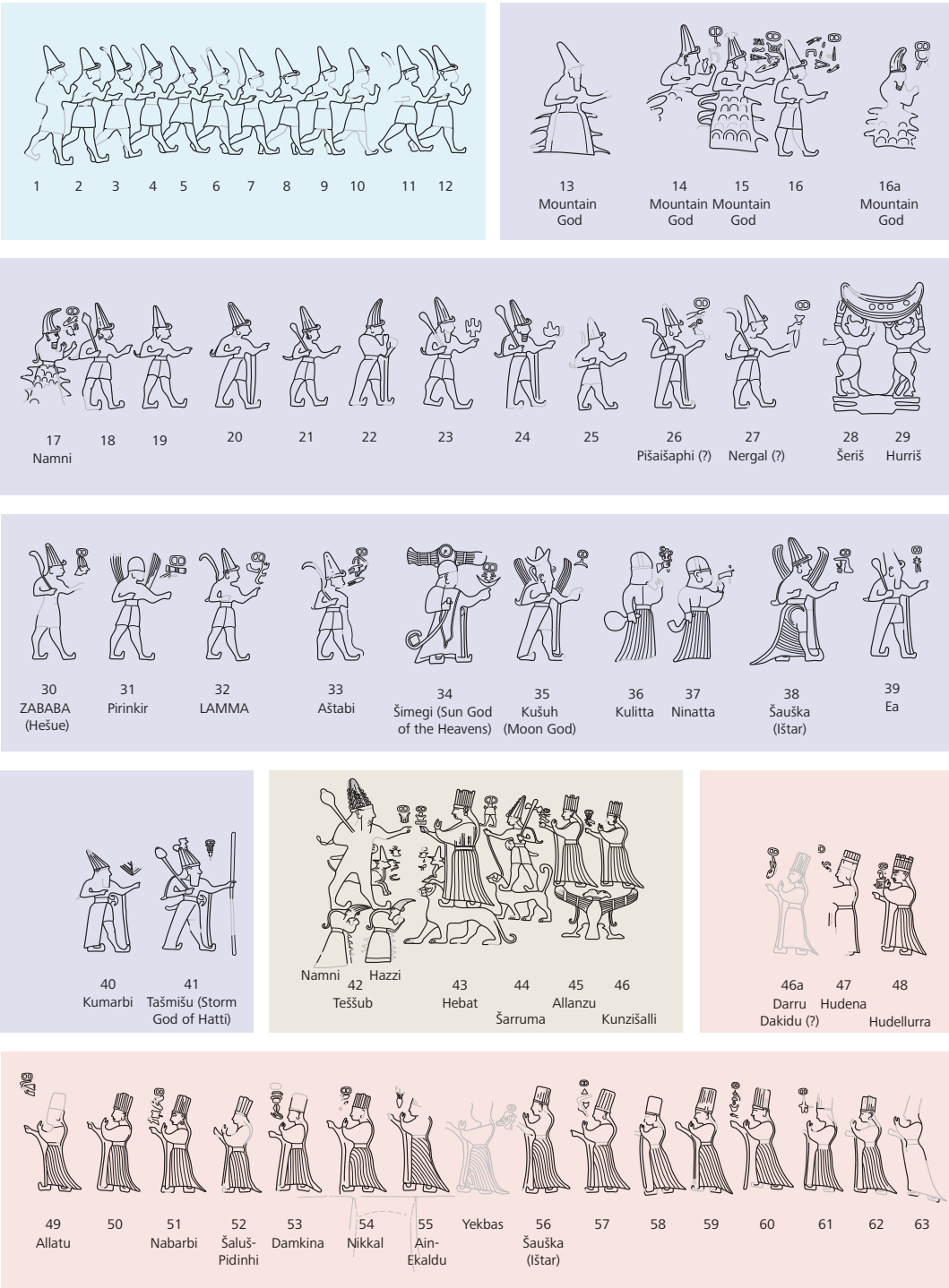


FIGURE 5. The reliefs of deities in Chamber A can be arranged in groups which adhere to astronomical principles: 12 lunar months, 30 days of a lunar month, a climactic group and 19 annual cycles (© Luwian Studies).

during the Hittite empire (Taracha 2009, 110; Belmonte and González-García 2014, 113). The phases of the Moon played an important part in omen astrology (Koch 2013, 133) and careful observations of the Moon were based on a long tradition (Maul 2013, 241). Ancient Near Eastern lore ascribed birth, life, growth and death to the waxing and waning of the Moon, so that the Moon thus occupied a firm place in the household and family cults (Haas 1994, 374). On certain occasions, Hittite people baked loaves of bread shaped like the crescent Moon, the Sun or the hieroglyph for “sky”, with stars placed in it, and devoted these to the gods (Haas 1994, 644). Second, in the Luwian hieroglyphic script, the direction of reading may change but it always runs counter to the signs with heads and pointing hands. Additionally, in Hittite and Hurrian prayer lists the Moon god Kušuh always precedes the Sun god Šimegi (e.g. KBo 20.119; Haas 1994, 141, 170). It is therefore most likely that the deities on the western wall were counted from right (Relief 41) to left (Relief 13) – just as the Moon travels across the sky. Bittel’s numbering replaced an older numbering system proposed by John Garstang in 1910, which began in the centre and proceeded anticlockwise on the western wall (Garstang 1910, 221). Garstang’s counting system was only one number away from the order in which we believe the deities were arranged.

In ancient Babylonia, the source of much of the specialist knowledge in Anatolian astronomy, the month began with the first appearance of the crescent new Moon. This first day of every month is represented by Tašmišu, the storm god of Ḫatti (Relief 41 – Seeher 2011, 65) on the far right of the group marking the days. A long vertical pole carried by this god forms the most conspicuous vertical divider among all the deities, thereby emphasising the beginning of the lunar month. We know that (at least in Egypt) the waxing days before the full Moon had a considerably higher standing than the waning days during the second half of the lunar month. In Yazılıkaya, this ranking becomes obvious, since the echelons within the Hittite pantheon decrease from right to left (Haas 1994, 633; Seeher 2016, 151). The deities for the first half of the month, beginning with Tašmišu, are much larger and have more individual features in comparison with the later ones (Reliefs 27–13). Every single deity before the full Moon bears a name. Still today, the names of some of our weekdays (for instance Sunday and Monday, or Moon-day) are indeed reminiscent of some of these deities. Lesser deities that are smaller in size and less characteristic, and which for the most part do not bear a name, make up the latter half of the month. Each month ended with the new Moon either at Relief 14 or 13, depending on whether the lunar month consisted of 29 or 30 days.

While Tašmišu marks the beginning of the lunar month, the full Moon always coincides with the two bull-men (Reliefs 28–29), located in a conspicuous central place on the panel facing the entrance. Bull-men occur already in Alaca Höyük in an Early Bronze Age context and appear on Syrian seals from the middle of the second millennium BC (Haas 1994, 138). As noted above, the bull-men here may be Hurriš and Šeriš, whose names are indeed Hurrian and stand for “night” and “day” (von Brandenstein 1943, 70), and who in Hurrian cosmogony carry the firmament (Haas 1994, 635). Their reliefs are further emphasised here, for they are placed on a podium that corresponds to the Luwian hieroglyphic sign Terra, or “earth”. Jointly, they hold up a large bowl symbolising the

Luwian hieroglyphic sign Caelum, or “sky”. This symbol, known in Babylon as *elip nūri*, has also been interpreted as “the boat” (Stol 1992, 247–249; Pizzimenti 2013, 267). The Assyriologist Mark E. Cohen mentions a “festival of the boat of light” or “festival of the boat of the Moon” from the Old Babylonian period, which he describes as a sub-festival of the *á-ki-ti* celebration that was based on the Moon (Cohen 1993, 141–142). So, even though the Caelum sign appears as a half Moon, it would represent the full Moon and as such is used to designate the sky as a whole (Stol 1992, 246). The full Moon was also, of course, the only night of the month when a lunar eclipse could occur.

The reliefs only make sense if the current day, month and year were marked with a movable pointer, perhaps in the form of a short wooden or stone column that was placed on the shelf-like ledges cut into the rock below the deities and projecting 0.4–0.6 m (Figure 1 above – Seeher 2011, 37). Where needed, these ledges were even added in ashlar form. Each day the marker for the days would have been moved manually one relief further from right to left. Masson (1989, 115) suggests that the sill was used to highlight the relevant god with its divine image, but since the image is already there in form of the relief a neutral marker would have sufficed. Due to the large size of the sanctuary, no fixing was needed for the markers – their weight would have sufficed to stabilise them. Neither was there any need for holes, as occur in the much smaller paraepemas of classical antiquity.

2.3. Female Deities Record Years in Eight- and 19-Year Cycles

Skipping the climactic group of Reliefs 42–45 for now, the final group in Chamber A consists of the sequence of uniform female deities on the eastern wall (Figure 5 above, Reliefs 46a–63). Their original number is uncertain, but currently the reliefs of 17 goddesses can be seen. One relief (Relief 46a) has completely disappeared, except for its hieroglyphic sign, and one that is consistent with the others was found in 1945 in the nearby village of Yekbas (today Evren) (Güterbock 1953, 67) and is now exhibited outside the museum of Boğazkale (Figure 6). The Yekbas relief brings the total number of known female deities in this procession to 19. Though there would have been space in the clefts for even more reliefs, there are no indications that any existed. If the number of 19 female deities on the east wall is correct, this group may have been a means of counting solar years and would thus have helped to synchronise them with lunar months.

The Hittites had adopted the concept of a female Sun deity from the indigenous Hattic culture (Bryce 2002, 142), which is why they displayed the years in the form of female deities. A cycle of 19 solar years, the so-called *Enneadecaeteris* or Metonic cycle, consists of 19 times 12 lunar months plus 7 intercalary months, which equals 235 synodic months or 6940 days. This cycle deviates by two hours, five minutes and 20 seconds over 19 solar years. The lunar phase of the first day of the twentieth year is therefore almost exactly the same as it was 19 years previously (Leverington 2013, 19). The system only required that the number of days, synodic months and solar years be monitored, adding an intercalary month when appropriate.

An intercalated lunar calendar was used as early as the Sumerian Archaic Period (3100–2500 BC) (Winckler 1906, 14; Maul 2013, 255). Administrative texts from this time provide evidence for the intercalation of a 13th lunar month approximately every third



FIGURE 6. The Yekbas piece in the court of the local museum in Boğazkale, bearing the inscription “Šauška” (Ištar) for the next deity to the right, perhaps Relief 56 (© Luwian Studies).

year (Haas 1994, 556 n. 113; Horowitz 2005, 174). During the period 2200–2000 BC, several Sumerian sites even correlated their years of intercalation (Sallaberger 1993, 9 and 11), but instances of four successive intercalary years are still attested for 1800–1600 BC (Britton 2010, 119). The Nebra sky disk, buried c. 1600 BC, has been interpreted as a tool used to determine the year for intercalation (Meller and Michel 2018, 116). The astronomical compendium MUL.APIN, most likely compiled between 1400 and 1200 BC in Babylonia, contains a discussion of intercalation practices and describes different rules for determining when the addition of an extra month is necessary (Hunger and Pingree 1989, 150–153; Hunger and Steele 2019, 151–153). This may indicate that no general scheme for a regular intercalation practice existed at that time. According to current evidence, a regular intercalation pattern started to emerge during the Neo-Assyrian and Neo-Babylonian periods (750–539 BC). A consistent 19-year intercalation scheme in Babylonia dates from 484 BC onwards. However, the fact that 19 solar years are equivalent to 235 lunar months became well established in Mesopotamia and China during the second millennium BC (Seidel 2014, 23; Shi 2015, 2034). Recently, John Nolan has suggested that a 19-year pattern of inserting intercalary lunar months was used in Egypt in the third millennium BC to synchronise the lunar calendar used in Egyptian temples with a star-based event, such as the heliacal rising of Sirius, which played an important role in the Egyptian solar civil calendar (Nolan 2015, 340), and he explains most of the Egyptian data in terms of the above-mentioned intercalation pattern later known as the Enneadecaeteris / Metonic Cycle. However, these ideas are currently the subject of debate (see contributions in Der Manuelian and Schneider 2015).

From the Hittites themselves, little information about their calendar and possible intercalations has been preserved. Texts describing 12 monthly feasts within a year show that a normal year consisted of 12 lunar months (Camarosano 2018, 107). A written record of a thirteenth-monthly feast for the weather god of Ḫalab (Aleppo) hints at an intercalary month (Haas 2001, 265). In Yazılıkaya, however, different astronomical phenomena could have been used to determine when an intercalary month was necessary. Either the heliacal rising or heliacal setting of a bright star such as Sirius, a leap rule – perhaps using the Pleiades, which is known from the MUL.APIN compilation, or the illumination effect of Tudḫaliya's relief – together with various different ways of determining the solstices (described below), could have been used for this. In short, the new findings in Yazılıkaya are no evidence for the application of regular intercalation. The lunisolar calendar would have worked just as well if the intercalary months were inserted haphazardly.

At this stage it is not yet possible to say which cycle was of primary concern (Figure 7). In addition to the *Enneadecaeteris*, the possibilities include the Saros cycle, a period of approximately 223 synodic months (18 years, 11 days, 8 hours) that can be used to predict eclipses of the Sun and Moon. Also, due to the precessional cycle of the lunar nodes, a major lunar standstill occurs every 18.6 years and these may have been of particular significance to prehistoric societies (González-García 2016). In theory, the arrangement could even have worked for the Callippic cycle, a period of 76 years that was proposed by Callippus in 330 BC as an improvement to the 19-year Metonic cycle. However, we favour a crude rather than a sophisticated system – one that is likely to have been common practice for centuries prior to the construction of Yazılıkaya. In any case, the system employed in the rock sanctuary works in perpetuity and could easily be reactivated today.

The stone masons – for reasons that remain inexplicable – left a column of carefully shaped natural rock protruding from the wall between Reliefs 54 and 55. It separates eight female deities from the climactic plateau and thus splits the 19-year cycle into an eight-year cycle and the remaining 11 years. The eight-year cycle (*Octaeteris*) could also have been used to synchronise lunar months and solar years – or it may have indicated the end of a second cycle of years, perhaps the eight-year cycle of Venus. As it turns out, certain Hittite festivals were indeed celebrated once every eight or nine years (Bryce 2002, 188). So, two different moveable markers may have been required. One of these would have travelled along all 19 deities, while the other only passed along the first eight. At the time, visitors were at eye level with most of the deities, since the floor consisted of a pavement of stone slabs at a level 0.5–0.6 m higher than it is today. The paving stones were evidently later removed and re-used as building materials (Seeher 2016, 149). Some damage also resulted from excavations conducted under the direction of Ernest Chantre in 1893–1894 (Bittel *et al.* 1941, 12; Bittel 1975, 17) and during the 3000 years since the sanctuary was abandoned all the movable items have, of course, also vanished. The carefully worked sill remained, as did the pillar-shaped column between Reliefs 54 and 55, hinting at the potential existence of more, possibly similar, but portable markers (Figure 8).

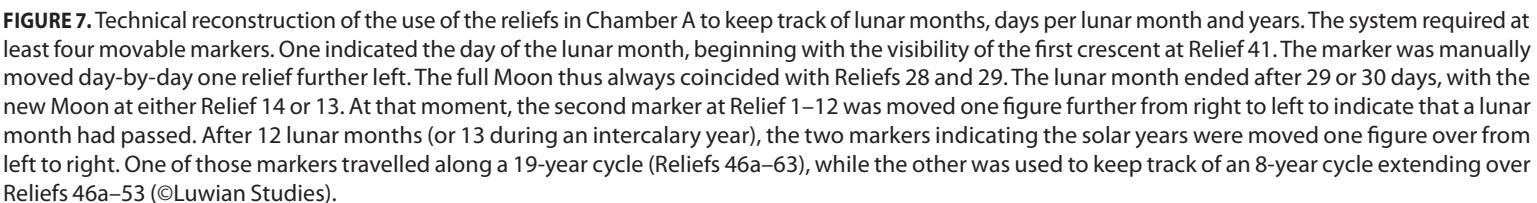




FIGURE 8. Artist's reconstruction of Chamber A around 1230 BC (© Rosemary Robertson).

The climactic group of the sanctuary (Figure 5 above, Reliefs 42–46) stands out prominently in terms of size and location. This group had no technical function, so there was no need for a ledge to accommodate a marker. The climactic group's position within the sanctuary – and the fact that the sequences of deities from the western and eastern walls of the sanctuary meet in the centre – highlights the pre-eminent importance of the central group. Its precise northern orientation is also found elsewhere in Hattuşa, for instance at Yerkapi, the prominent but still enigmatic architectural feature in the uppermost part of the city (Figure 9).

3. An Interest in the Sky at Yazılıkaya

3.1. The Summer Solstice Sun Illuminates the Relief of Tudḫaliya IV

One of the strongest indications that Yazılıkaya was used for astronomical purposes is the position of the relief of Great King Tudḫaliya IV (Relief 64) in Chamber A. The king is depicted in the iconography of the Sun god (Haas 1994, 633) and his relief was placed at a spot that receives sunlight only in the afternoon during a few days in mid-June (Figure 10 – Seeher 2011, 85), thus emphasising the summer solstice as the most important time of the year. It appears as if this distinctive spot – facing the climactic group – was reserved for the storm god's highest mortal representative. The moment of exposure to the rays of the Sun seems to have been beautifully choreographed: when the sunlight has ceased to illuminate the king's image, there is a two-minute interval of darkness, after which his

cartouche is illuminated by another isolated beam of sunlight penetrating through a narrow gap in the natural western rock face.

Portraying the king's superiority in a mythical transfiguration, and thereby legitimising his power, was one of the main social and political functions of religious ceremonies (Schachner 2011, 195). If the king, his family and the royal retinue participated in an annual festival to celebrate the summer solstice, and then processed into Chamber A, they would have witnessed the image of the king – taller than those of the leading deities – being illuminated before them by the Sun. In this apotheosis the divine power of the celestial gods was conferred upon their highest servant, thereby reinforcing his authority.



FIGURE 9. Star trails above Yerkapi emphasise the strict northern orientation of the architecture (© Bernd Pröschold).

3.2. Arrangements in Chamber B May Have Served as a Star Clock

While Chamber A is dominated by the open space of the court and the many reliefs at eye level around it, Chamber B is quite different. It consists of a cleft that is 18 m long and only 2.15 m wide at its narrow southern end and 4.5 m at its northern end. Its vertical western and eastern walls rise up to 12 m above present ground level and the exceptionally perpendicular surface of the western wall runs north–south, within a deviation of about 5°. Chamber B contains few reliefs, but they are better preserved because they were buried and thus protected from weathering soon after the site went out of use. The western wall has only one relief panel, depicting 12 uniform male figures (Figure 4 above, Reliefs 69–80), matching the almost identical panel in Chamber A (Reliefs 1–12).



FIGURE 10. The relief of Tudḫaliya IV (64) only catches sunlight during the afternoons around the summer solstice (© Luwian Studies).

In addition, there are two oblong niches in the western wall and one in the eastern wall of Chamber B, set at approximately the same height as the relief panel. The eastern wall contains a relief panel of the Great King, led by his protective god Šarruma (Relief 81). A Luwian hieroglyphic inscription denominates the figure as “My Sun, Great King, Labarna, Tudḫaliya, Labarna, Great King”. Next to it is the tallest relief of the sanctuary, measuring 3.4 m, consisting of a human head wearing a high-pointed hat and resting on four lions (Relief 82). According to the excavators, it probably represents the Sword God (Seeher 2011, 113). A natural recess, 3 m wide, in the eastern wall of Chamber B was artificially closed with ashlar up to a height of 2.5 m. Access to Chamber B from the north was sealed off with walls.

The orientation of the chamber means it is aligned with the celestial north pole, and thus with the axis of the rotation of astronomical objects. As a consequence, it is possible to assume a position in Chamber B in which the celestial north pole is indicated by the tip of a natural rock (Figure 11). The sharp edges of the rocks could have been used as references for a star clock, with the culmination of certain stars or asterisms indicating a specific hour in a particular month to a precision of about 10 minutes. Such a system of culminating hour stars is known from New Kingdom Egypt (Leitz and Thissen 1995, 142–146). The three oblong niches in the vertical wall faces may have contained tablets for taking notes and tools such as yardsticks or dials that were held at arm’s length to make measurements. If this was indeed the purpose it would explain why a separate set of reliefs (Reliefs 69–80) was used here to keep track of the months, because time calculations using a star clock have to take the current month into account.

Access to this area may have been restricted to a small number of initiates, perhaps because the niches in Chamber B contained valuable tools and notes. Rather than using guards, which may have been expensive or regarded as suspicious, the architects and priests appear to have resorted to an inexpensive way of preventing unauthorised people from entering. The passage to Chamber B was entirely man-made and only 80 cm wide at its narrowest point. Menacing-looking demons were carved in the rock face to the right and left of the entrance (Reliefs 67–68) to deter intruders.



FIGURE 11. Photo composition to show how Chamber B could have functioned as a star clock (© Bernd Pröschold).

3.3. The Alignments of Temple Buildings at Yazılıkaya

According to the German Archaeological Institute, which has been in charge of excavations at Yazılıkaya for almost 90 years, the gatehouse (Building III) and an enclosure wall (Building I) that blocked the entrance to Chamber A were originally erected on the premises. Initially, the chronological sequence of construction was interpreted differently (Naumann 1975, 123). The Roman numerals are therefore out of sequence, and it is still uncertain whether these buildings were erected during the fifteenth, fourteenth or early thirteenth century BC (Seeher 2011, 137). What is clear, however, is that the northern wall of the monumental gatehouse, the first structure built at the sanctuary, is aligned with sunset at the summer solstice (Figure 12), as recognised and documented by the astrophysicists A. César González-García and Juan Antonio Belmonte (Belmonte 2000, 89; González-García and Belmonte 2011, 466, fig. 4a).



FIGURE 12. Summer solstice sunset alignment of the northern wall of the monumental gatehouse (© Luwian Studies).

This implies that the entrance and the hallway of this earliest known building at Yazılıkaya were also aligned along this axis. At the rear of the gatehouse, opposite its entrance, two large monoliths produced a gap too narrow for a person to pass through (Figure 13 – Bittel 1975, Beilage 2). Beyond that was a court, about 9 m wide, followed by the enclosure wall of Building I. The orientation of the gatehouse and Building I is such that sunlight at the summer solstice sunset would have penetrated the whole building, passing through the narrow slit on its rear side and falling against the wall of Building I (Figure 14). If the priests recorded the shadows over a period of about two weeks before and after the solstice, they would have been able to determine the duration of a solar year quite precisely. This may have been an early and simple way by which people at Yazılıkaya kept track of the seasons and the years. The area around the natural limestone outcrop is indeed in an ideal position to catch the long horizontal beams of the sun as it sets across the valley. Between the gatehouse and Building II there is an outcrop of natural limestone bedrock that appears inconspicuous but that lies in the northern wall of the gatehouse. The illumination effect on this rock in itself may have sufficed to indicate the summer solstice.



FIGURE 13. The gap between the monoliths on the rear side of the gatehouse permitted a narrow beam of sunlight to hit the wall of Building 1 (© Luwian Studies).

During the reign of Ḫattušili III (c. 1266–1236 BC), the first genuine temple (Figure 3 above, Building II) was erected at Yazılıkaya. At about the same time, the reliefs in Chamber A were carved. Chisel marks in the court of the chamber indicate that some natural surfaces were then artificially pushed back and flattened to produce the vertical level surfaces required to carve the reliefs. Ledges in front of most of the panels were hewn from the rock or constructed using ashlar. Natural clefts in the rock formation were also walled up, using ashlar masonry. After this phase of expansion, the sunbeams at summer solstice may have passed through a window in an upper storey of the gatehouse. Then, passing into the courtyard of Building II, they would have hit a free-standing, eccentrically placed pedestal or altar (Bittel *et al.* 1941, 27, fig. 9; Seeher 2011, 131), perhaps supporting a divine rock, column or statue, at the moment when one solar year had passed (Figure 15). This means that people who had access to the sanctuary would have seen the statue as unilluminated for most of the year, but on one of four or five possible days around the summer solstice, when the sky was clear, the priests would have called for a religious service to be held in the court, during which the holy statue on the pedestal would have been illuminated by a beam of natural sunlight, thereby creating a very powerful effect. Through a door, the northeastern side of the altar directly faced the climactic group, symbolically linking the Sun with the Sun goddess of Arinna's Hurrian equivalent Ḫebat.

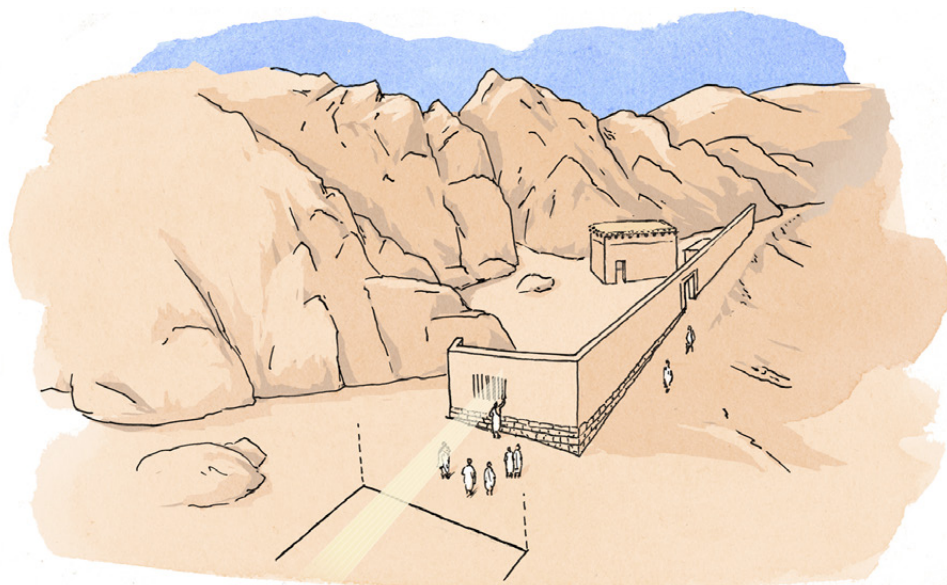


FIGURE 14. During the earlier construction phase (Building I), the slit between the monoliths at the rear of the gatehouse could have been used to record the movement of the Sun during the days around the summer solstice (© Oculus Illustrations).

The excavators have argued for a long time that Yazılıkaya was the place where the New Year festival was celebrated (Otten 1956, 101), which might explain the site's apparent netherworld associations (Bryce 2002, 197). In the Hittite year, autumn (*zena*) began with the eighth month. Liane Jakob-Rost (1963, 184) therefore thought that the Hittite New Year coincided with the winter solstice, as is customary in Indo-European traditions. The current excavator, however, sees the New Year festival within the framework of the AN.TAH.ŠUM in the second half of March (Schachner 2011, 195). Coinciding with the vernal equinox and the sprouting of seeds in March, the year apparently began with the division of heaven from earth (Haas 1994, 85).

During the reign of Tudḫaliya IV (c. 1236–1215 BC), the sanctuary went through another phase of reconstruction (Seeher 2016, 153). In connection with the renewal of the sanctuary, and work on access to Chamber B, the final temple (Building IV) was erected and the three panels of Tudḫaliya IV were added. Since that point the architectural plan of the temple buildings at Yazılıkaya has looked crooked (Figure 3 above), and the excavators have wondered for a long time why such unusual angles were used. With respect to the orientation of temple foundations in the upper city of Ḫattuša, the archaeologists in charge have commented: "It is of note that no special direction of the compass seems to have been preferred, either for the orientation of the temples or for that of the cult chambers themselves" (Seeher 2002, 68). González-García and Belmonte (2011, 61) argue that such a categorically negative attitude towards astronomical explanations may indeed have delayed progress in archaeological research. In any case, as is shown here for the first time, the northwest wall of Building IV is accurately aligned with



FIGURE 15. 3D-visualization of Building II and III (gatehouse) at Yazılıkaya showing how the object on the pedestal in the courtyard may have been illuminated during a religious service on the day of the summer solstice (© Oliver Bruderer / Luwian Studies).

the winter solstice sunset (Figure 3 above), and we were able to thoroughly document this photographically in 2018. The latest building thus completes the arrangement that was begun with the first construction work on the site.

What is more, the architecture would have created a similar illumination effect during the winter solstice as it did at the summer solstice. In the winter, the natural rock in the court next to Building IV may have been illuminated (Figure 3 above). This rock contains a circular artificial depression in the limestone, with a diameter of 28 cm that has been interpreted as a water stoup (Naumann 1975, 104, fig. 94). Initially, archaeologists thought this rock may have been a *ḫuwaši* (Bittel and Naumann 1939, 44). *Huwaši* sanctuaries consisted of a prominent stone stela erected in open terrain or (on a smaller scale) in temples. The stelae were considered to be images of certain deities and worshipped as such. They were carved with a relief and set up on an altar in a temple sanctuary (Bryce 2002, 156). One such stela in silver is said to have been embellished with the radiance of the sun goddess (Haas 1994, 508). Daniel Schwemer is following the argument of Hans Gustav Güterbock when he suggests that Yazılıkaya has to be identified with the *ḫuwaši* sanctuary of the weather god (Güterbock 1953, 76, n. 2; Schwemer 2006, 263–264). Our observations reinforce these interpretations.

3.4. *Astronomical Alignment of Foundations, Gates and Chambers in Ḫattuša*

The celestial concerns of ancient societies are often revealed in the astronomical orientation of their buildings. This is viewed as being highly significant elsewhere in the world (Ruggles 2015), but until recently it has not been considered important in the case of Hittite architecture. However, in the early summer of 2009 Juan Antonio Belmonte and A. César González-García came to Anatolia to determine the orientations of more than 60 religious structures (González-García and Belmonte 2011; 2014; 2015; Belmonte and González-García 2015, 19). Their analysis of this statistically significant sample of Hittite sacred enclosures showed that these monuments were not randomly orientated. In a histogram indicating the orientation of the temple walls in Ḫattuša, distinct peaks occur at declinations characteristic of the main points of the annual solar cycle, such as the solstices and the equinoxes. These researchers concluded that Hittite temple architecture reflects the importance of a solar cult and could yield insights into how this culture managed its sacred spaces and landscape.

During the 2015 summer solstice and the 2018 winter solstice, we visited Ḫattuša to take photographs of the alignments of various structures with the setting Sun. When the sky is clear, it becomes obvious that Chamber 1 in the upper city of Ḫattuša was erected at that particular location to catch the evening light during the winter solstice. Evidently this was done in order to illuminate the statue of a god or goddess, perhaps the Sun goddess of Arinna, which was either permanently or temporarily placed inside the chamber, quite possibly during a festival (Figure 16).



FIGURE 16. Chamber 1 in the Upper City of Ḫattuša was built to catch the light of the sun as it sets during winter solstice. Photo taken on 21 December 2018 (© Luwian Studies).

More fieldwork dedicated to studying the cultural astronomy of the Hittite civilisation was conducted under the direction of Andreas Müller-Karpe at Kuşaklı-Şarišša, a mid-sized Hittite provincial town. It was built during the sixteenth century BC and has a well-investigated Hittite temple. Archaeologists discovered that the city's gates had been systematically orientated, and that the walls of the main temple had been aligned to run parallel to sunrise during the summer and winter solstices (Müller-Karpe *et al.* 2009, 62; Müller-Karpe 2013, 343; 2015, 86; 2017, 112).

Moreover, the impressive Yerkapı structure, which includes the Sphinx Gate, is accurately aligned along the meridian (Figure 9 above), suggesting that the north–south axis of the city was determined with great precision and may have been related to certain aspects of culture. The southwest corner of Yerkapı also points in the direction of the setting Sun during the winter solstice (Figure 17). On a map, in a projection from the Sphinx Gate and the King's Gate Yerkapı defines the skyline and the direction of sunrise and sunset during the winter solstice (Belmonte and González-García 2015, 21).

4. Celestial Aspects of Hittite Culture

4.1. The Context Reflecting a Sun Cult in Hittite Anatolia

The broader framework for celestial orientations in Hittite religion was presented by Volkert Haas with his monograph *Geschichte der hethitischen Religion* (Haas 1994). Accordingly, the Babylonian didactic poem *Enūma Eliš*, named after its initial line “As above [in heaven]”, contains an evolutionary cosmogony claiming that the god Marduk (‘dAMAR.UTU, meaning “calf of the Sun god Utu”) formed the cosmos, before placing the stars and dividing the sky into 36 regions. He then defined the calendar (Haas 1994, 80), which is based on the phases of the Moon (Haas 1994, 140). The fundamental worldview underlying the Hittite religion rested on the marriage of heaven and earth. The great god of heaven, the provider of the rain, married the goddess of the earth and they produced the vegetation as their offspring, sometimes personified in form of the divine child (Haas 1994, 53). The pairing of the storm god Teššub and his wife Hebat had been known since ancient Babylonian times in the city of Mari (Haas 1994, 384). They head the divinities in Alalah, Ḫalab, Ḫattuša, Kummanni, Lawazantiya and Tarḫuntašša in the second half of the second millennium (Haas 1994, 385). The concept of a hierarchical, divinely ordered world in which the gods determine the destinies of men resulted from an urban social structure (Haas 1994, 36).

The sky is the natural realm of the weather god, who manifests his power in atmospheric phenomena such as thunder, lightning, rain and storms (Haas 1994, 324). The weather god dwells in the mountains, where he is close to the sky, and his sphere of influence extends over the entire Ḫatti land (Haas 1994, 329). The highest goddess of the land is the Sun goddess of Arinna, and this was already the case at the beginning of the Old Kingdom (Haas 1994, 378 and 425). Since standards found in the Hittite settlement of Alaca Höyük are interpreted as symbols of the Hattic Sun goddess (Haas 1994, 69), the Hittite adoration of the Sun most likely stemmed from an Early Bronze Age precursor. Sun goddess cults probably existed in almost all central Anatolian cities (Haas 1994, 422).

Testimonies of Sun worship on the part of the king include the Sun prayers made daily at sunrise to the Sun goddess of heaven or to the Sun goddess of Arinna (Haas 1994, 429). During the Middle Kingdom, the Hurrian Sun god Šimegi, one of the highest gods of the pantheon of Mitanni, was incorporated into the Hittite state pantheon (Haas 1994, 379). He was given the epithet “Sun God of Heaven” to better distinguish him from the Sun goddess of Arinna.

The king was regarded as the steward of the Ḫatti land. He described himself as a descendant of the divine couple and was thus seen as a manifestation of the Sun god, so that Sun god and king merge into one figure. This is essentially expressed in the Hittite king's title “Our Sun” and “My Sun”.

Celestial beliefs thus abound in Hittite religion, although unfortunately the archives reveal practically no information concerning timekeeping (Beckman 2000, 20). Of course, not all aspects of Hittite culture have been transmitted in imperishable documents. For instance, there is no information on hydraulic installations in Hittite archives, much as there are no reports of pottery-making techniques in Linear B documents from Mycenaean Greece, or of copper smelting in documents from Late Bronze Age Cyprus. And yet few scholars would question that within these cultures these techniques were practised with great ability. Technical skills may not have fitted the genre typically recorded in writing, or knowledge of them may have been limited to few initiated people. It would have defeated the purpose if the majority of participants in the festival had known how carefully fabricated their epiphanies were.

What is more, astronomical concerns might still be concealed in apparently inconspicuous information. For instance, a text referring to 12 deities – reminiscent of the lunar months – exists in the form of an incantation ritual in Hittite with many Luwian expressions and a mention of the deity Nergal (KUB 35.145; Güterbock 1975, 191). The Hittite rite called *ḫaššumaš* also attributes particular significance to the number 12 (IBoT I, 29; Ardzinba 1986, 96). It refers to 12 priests, 12 ploughmen, 12 prostitutes and 12 gods. Again, 12 gods are mentioned in an incantation (KUB 35.145, I, 10) and, of course, in the Hittite description of the festival of the month (KUB 2.13, I, 14, 28–39, 48; 3.16–27; IV, 1–3; CTH 591). And 12 deities also make up the pantheon of the town Ulamme (Haas 1994, 545). The 12 gods may represent the 12 months of the year, as in “when the twelfth month of the year commences” (KUB 17.35, 4.3) or “twelve half measures of ground *tarsan* (grain)” for the 12 monthly festivals (KUB 42.100, 3.20). A group of 12 deities indeed continues to exist in Anatolia in the form of the Lycian 12-god reliefs (Weinreich 1913; Freyer-Schauenburg and Petzel 1994; Schürr 2013; Rutherford 2016) or as the “twelve gods of the market” in Xanthos (Burkert 1977, 198, n. 1). It is thus quite possible that, once the astronomical concerns are realised, additional references to the sky might be found in Hittite sources.

4.2. The Pre-Eminent Role of Solar Deities

To date, more than 33,000 fragments of tablets have been retrieved from Ḫattuša. The celestial Sun god and “the gods of heaven” are ubiquitously present in these documents (for example KBo 15.2 rev. 18'–19'; see also Mouton and Rutherford 2010, 277) and of all surviving Hittite royal prayers, more than half are addressed to solar deities (Bryce

2002, 141). They also play an eminent role in Hittite mythology, magical rituals, treaties, instructions, festival descriptions and historical texts. Certain aspects of the documentary evidence on solar deities have been discussed since the late 1990s in the framework of two dissertations. Daisuke Yoshida (1996) presented a detailed study of Hittite festival texts, focusing on the sequence of deities initially based on Hattian traditions (Yoshida 1996, 280; Hutter 1998, 477). Yoshida starts out by referring to the wealth of material (“die Fülle des Materials”) that is available, but hesitates to regard the texts as a reliable source for the Hittite religion and thus provides no meaningful interpretation and evaluation of the roles and profiles of the solar deities.

Charles Steitler presented a voluminous treatment of the Hittite texts from the sixteenth to fourteenth century BC dealing with solar deities, thereby shedding more light on the formative stages of Hittite religious beliefs (Steitler 2017). Evidently, the deities belonged to broader religious traditions that had evolved among distinct ethno-linguistic population groups in Anatolia (Klinger 1996, 144; Steitler 2017, 25), before they were incorporated “on a grand scale” within the context of Hittite society and religion (Steitler 2017, 27). Deities taken from a whole range of cult centres in Palaic northern Anatolia, from the Luwian regions of western and southern Anatolia, from the Hurrian state and from Mesopotamia and Syria were all added to the Hittite pantheon (Bryce 2002, 136). Apart from the fact that his survey only covers a period up until two centuries before Yazılıkaya acquired its present appearance, Steitler (much like Yoshida) completely avoids taking celestial objects and stargazing into account.

4.3. *Astronomical Scholarly Texts in Hattuša*

The celestial and solar concerns of Hittite Anatolia were, however, recognised during the first season of excavations in Hattuša, which began on 21st July, 1906 (Winckler 1907, 53; Jeremias 1909, 32–34; Weidner 1923, 39). Four weeks of excavation on the northwestern slope of the acropolis Büyükkale produced 20 complete tablets and around 2500 fragments (Alaura 2006, 102). These documents were immediately interpreted in a nearby tent by Hugo Winckler, an orientalist with 20 years of experience in Late Bronze Age documents from Mesopotamia and Tell-el-Amarna. Among the first documents found in Hattuša in 1906 was the “Prayer to the Gods of Night” (KUB 4.47; CTH 432), which named the constellations and planets. This document is considered the earliest evidence of the paths of the gods Ea, Anu and Enlil and was also – as a drawing – one of the first documents from Hattuša to be published (Jeremias 1909, 32, 90; Weidner 1915, 60; van der Toorn 1985, 124–133; Beckman 2007, 69; Horowitz 2015, 1831). It contains a star list, partly in Hittite orthography, which names four of the planets and 13 constellations (Koch-Westenholz 1995, 46–47). Most of the enumerated celestial deities in this list seem to correspond to a list of Babylonian normal stars, according to which the sky was usually divided at the time. Even the first excavation thus produced proof that Babylonian astronomy and astrology had been assimilated in Hattuša.

Astronomy at the time was driven primarily by timekeeping and astrological concerns, and as such was particularly connected with the visibility of the Moon and the



FIGURE 17. The southwest corner of the pyramidal base of Yerkapı points towards the sunset at winter solstice. Photo taken on 21 December 2018 (© Luwian Studies).

planets. The relevant notations were invented as early as the Ur-III period (2000–1900 BC; Sallaberger 1993, 11) and are well documented in Old Babylonian astronomical and astrological texts dating from 1900–1600 BC (Meibert 2010, 29, 111; Ossendrijver 2015, 1865). As Ulla Koch-Westenholz (1995, 45) points out, a fact that has often been noted is the high proportion of astrological omens as opposed to other Mesopotamian divinatory genres at Hattuša: “[T]he number of astrological texts almost equals the total number of texts from the other divinatory genres combined.”

Among the documents found at Hattuša are several dozen scholarly texts originating in or copied from Babylonia which relate to lunar eclipses and signs of the Moon, Sun and stars (CTH; Rochberg-Halton 1988; Koch-Westenholz 1995, 45; Verderame 2015, 1837). At least two of the astrological texts are Old Babylonian originals (KUB 4.63; 4.64) or faithful copies of such (Rochberg-Halton 1988, 33), including an unusually well-preserved solar eclipse tablet (KUB 4.63). Most of the texts found, however, are apparently extant only in thirteenth-century BC copies (Kammenhuber 1976, 70). In this group are lunar-eclipse *omina* in Akkadian and Hittite (Koch-Westenholz 1993, 231; 1995, 45–46), *omina* concerning other lunar phenomena in Hittite and Hurrian (Kammenhuber 1976, 153) and one bilingual Akkadian-Hittite text (KUB 8.6; Güterbock 1988, 161). Further documents include Hittite translations of these texts, lunar *omina*, solar *omina* in Hittite and *omina* concerning comets or meteors.

A major concern was to correlate observed astronomical phenomena such as eclipses with political developments on earth in order to make predictions. That *omina* were consulted and used for political decisions is documented by a partly preserved prayer

of the Hittite king Muršili II (c. 1300 BC), who reports that his (Babylonian) stepmother had tried to plot against him when “the Sun god made an omen” (KUB 14.4; De Martino 1998, 19–48; Huber 2001, 641; Belmonte 2013, 427–429; Gautschy 2017, 23–29). This solar omen in the tenth year of his reign is usually interpreted as being a solar eclipse, since eclipses were the only omnia that could have severe consequences for the king. Careful observation of celestial movement was thus imperative to maintain the stability of the crown. Mathematical and scientific astronomy as we know it today, however, did not appear in Babylonia until the sixth century BC and afterwards advanced in ancient Greece and in the Hellenistic world.

4.4. SANGA Priests Slept “Under the Stars”

A Hittite priest who knew all of the cult’s activities, special festival celebrations and regular and special rituals was called a SANGA priest (Taggar-Cohen 2006, 173). The Sumero-gram SANGA appears in almost all of the text genres of the Hittite corpus: historical texts, letters, administrative texts, catalogues of texts, the Hittite laws, cult inventories, prayers and all the different kind of rituals written in Hittite, Hattic, Luwian and Hurrian (Taggar-Cohen 2006, 140). The SANGA priest of the Sun goddess of the Earth is said to have regularly slept “under the stars” (KUB 55.21; Ünal 1987, 481; Mouton 2003, 78) in the temple courtyard (Taggar-Cohen 2006, 181), and it has therefore been suggested that astronomical observations were among his duties (González-García and Belmonte 2015, 1786). The reason a SANGA priest was required when temples and cult centres were established or renewed (Taggar-Cohen 2006, 140) is probably that these buildings had to be oriented in accordance with astronomical principles. A review of the currently available information about Hittite SANGA priests concludes that each priest was dedicated to one of 28 deities (Taggar-Cohen 2006, 164). Nevertheless, each of them also functioned as a priest to all the gods worshipped in his temple.

It might be worth noting that the 30 temples recognised in the upper city of Hattuša matches the number of celestial deities marking the lunar measures in Yazılıkaya – and it is well known that temples were houses of individual gods (Bryce 2002, 154). As Masson (2001, 374, translated) remarks: “In this meticulous arrangement, where nothing seems to be left to chance, both the location and the size and nature of each temple should correspond to the personality of the god or goddess to whom it was dedicated.” Each celestial deity may thus even have had its own temple as well as its own SANGA priests in the upper city.

4.5. Parallels in Syria and Egypt

Regarding the appearance of the deities in the reliefs, in 1922, during the excavations in Carchemish, 29 small figurines of gods were found in a seventh-century BC grave. They are made of lapis lazuli, steatite and gold sheets, showing deities which are identical in type, attitude, attribute and dress with the images at Yazılıkaya (Figure 18 – Riemschneider 1954, pl. 106; Goetze 1957, 131). As described by the British archaeologist Sir Leonard Woolley: “These little figures are the jeweller’s reproduction in miniature of the

great rock-cut reliefs of Yazılıkaya” (in Woolley and Barnett 1952, 255; see also 256–257, pl. 64b). The deities are holding spears, birds, lightning, hammers, censers or sistra, with 14 of them facing right and 15 facing left. The purpose of these figurines, today part of the collection of the British Museum (BM/Big number 116232) has never been established. Woolley concluded: “They are not copied from the Yazılıkaya reliefs but, I would suggest, they and the reliefs alike are versions of a religious and artistic theme common to both countries and jealously preserved by that which survived the longer” (in Woolley and Barnett 1952, 257).

Of course, the question arises as to how motifs from the thirteenth century BC ended up in a tomb of the seventh. Woolley and Hans Gustav Güterbock (1954, 113) discussed the possibility that the figures were made before 1200 BC and handed down as “heirlooms” until they were deposited in the tomb, as well as the possibility that they were made in the late Hittite period but in a style that survived from the empire. The figurines, whose different orientations possibly reflect the waxing and waning days of the lunar month, may thus indicate that the concept of the calendar as transmitted in Yazılıkaya was indeed widely applied across space and time.



FIGURE 18. Gold figurines of celestial deities found in Carchemish in 1922 (© The Trustees of the British Museum).

The sequence of deities in Yazılıkaya is thus not as exceptional as is often thought – neither in terms of function nor in terms of appearance. A total of 15 lunar deities, perhaps representing specific days of the synodic lunar month, are depicted on the ceiling of the tomb of Senenmut in Deir el-Bahri in Egypt (c. 1460 BC) (Neugebauer and Parker 1969, 10–12, 194–199). A system virtually identical with the one described here for Yazılıkaya is also known to have existed in Hellenistic Egypt: the frieze on the northern wall of the Ptolemaic Temple of Edfu shows the tutelary gods for the 30 days of the month, either civil or synodic, in a procession (Parker 1950, 11–13; Altmann-Wendling 2019, 279–292) just like the one in Yazılıkaya (a drawing of the frieze at Edfu was first published in the second

edition of the *Description de l'Égypte* that resulted from Napoleon's expeditions into Egypt [Jomard 1820, pl. 58]; the frieze is also depicted by Parker [1950, pls. IV–V]). Behind them are – again in the form of deities – the 12 months of the Egyptian civil calendar. While in Yazılıkaya five deities form the climactic group, at the Temple of Edfu they are three in number. In any case, the relief shows that in Egypt, still during the Hellenistic period, the 30 days of a synodic month all had their individual names and were related to a deity – exactly as in Yazılıkaya.

5. Discussion

The rock sanctuary of Yazılıkaya is an expression of Hurrian religion, although in a Hittite context and presumably with Hittite interpretation. Hurrian religion is known to have been primarily preoccupied with astrology (Ünal 2013, 458). We suggest that the sanctuary and its temples were a place where the Sun, the Moon and planets were observed and probably also where records of celestial movements were kept and notes archived. The prominent British archaeoastronomer Professor Clive Ruggles lists three properties he considers relevant in evaluating the astronomical significance of archaeological sites: structural orientation, light-and-shadow effects and symbol counts (Ruggles 2015, 376–382). All three factors are exceedingly well preserved at Yazılıkaya. Chamber A could have served as a device where the calendar was kept, with Reliefs 13–41 reflecting the days of a lunar month, Reliefs 1–12 the lunar months and Reliefs 46a–63 the years. The primary reasons for such systematic efforts would have been practical, for example knowing the correct date for important festivals, for agricultural purposes or to satisfy the Hittite royal family's need for predictions about celestial movements and interpretations of celestial omens. Chamber B could have functioned as a star clock.

The image of the Great King in Yazılıkaya's Chamber A was carefully designed to be illuminated during the solstice and both Chamber A and Chamber B in Yazılıkaya were astronomically oriented. Temples in the upper city of Hattuša and elsewhere throughout the kingdom were aligned to celestial parameters; so were the city gates, the Yerkapi structure and the chambers in the upper city.

Our interpretation of Yazılıkaya as a facility where the religious calendar was kept does not exclude previous interpretations of the site. On the contrary, it supplements the suggestion that this was the location of the New Year's spring festival, or the place where the *itkalzi* ritual was performed.

And since he was a careful observer of the stars, he foretold many things which would take place throughout the world; and for the common people he introduced the year on the basis of the movement of the sun and the months on that of the moon and instructed them in the seasons which recur year after year. Consequently, the masses of the people, being ignorant of the eternal arrangement of the stars and marvelling at the events which were taking place as he had predicted, conceived that the man who taught such things partook of the nature of the gods. (Diodorus Siculus, *The Library of History* 3.56.3–5)

Acknowledgments

This paper would not have been possible without the pioneering research conducted by Juan Antonio Belmonte which began at Hattuša and Yazılıkaya as early as 1990, and by A. César González-García, who later joined him. We are extremely grateful for the support that these scholars generously gave us, as well as for their constructive criticism of the manuscript. We would like to thank Manfred Hutter, Alice Mouton, Lionel Sims, Fred Woudhuizen and a number of anonymous peers for reviewing the manuscript in various stages, and Bernd Pröschold for valuable discussions and hints in the field. Guido Köhler accompanied this investigation as head scientific illustrator from the fieldwork all the way to the typesetting. This project was partially funded by Luwian Studies.

Abbreviations

CTH = E. Laroche, 1971. *Catalogue des textes hittites*. Paris: Klincksieck.

IBoT = İstanbul Arkeoloji Müzelerinde bulunan Boğazköy Tabletleri.

KBo = Keilschrifttexte aus Boghazköi.

KUB = Keilschrifturkunden aus Boghazköi.

References

- Alaura, S., 2006. "Nach Boghazköi!": Zur Vorgeschichte der Ausgrabungen in Boğazköy-Hattuša und zu den archäologischen Forschungen bis zum Ersten Weltkrieg. *Sendschrift der Deutschen Orient-Gesellschaft* 13. Berlin: Deutsche Orient-Gesellschaft. <https://doi.org/10.2307/503586>
- Alexander, R. L., 1986. *The Sculpture and Sculptors of Yazılıkaya*. Newark: University of Delaware Press.
- Altmann-Wendling, V., 2019. *MondSymbolik – MondWissen. Lunare Konzepte in den ägyptischen Tempeln griechisch-römischer Zeit*. Studien zur Spätägyptischen Religion 22. Wiesbaden: Harrassowitz.
- Ardzinba, V. G., 1986. "The Birth of the Hittite King and the New Year (Notes on the Ḫaššumaš Festival)". *Oikumene: Studia ad Historiam Antiquam Classicam et Oriental Spectantia* 5: 91–101. <https://doi.org/10.1086/373338>
- Beckman, G., 2000. "Hittite Chronology". *Akkadica* 119–120: 19–32.
- Beckman, G., 2007. "A Hittite Ritual for Depression (CTH 432)". In *Tabularia Hethaeorum: Hethitologische Beiträge: Silvin Košak zum 65. Geburtstag*, edited by D. Groddek and M. Zorman, 69–81. Wiesbaden: Harrassowitz. <https://doi.org/10.29091/kratylos/2009/1/23>
- Belck, W., 1901. "Forschungsreise in Kleinasien". *Zeitschrift für Ethnologie* 33: 452–522.
- Belmonte, J. A., 2000. "From the Atlas to the Caucasus: The Other Side of the Mediterranean Before Islam". *Archaeoastronomy* 15: 78–94.
- Belmonte, J. A., 2013. "DNA, Wine & Eclipses: the Dakhamunzu Affaire". *Anthropological Notebooks* 19 (Suppl.): 419–443.
- Belmonte, J. A. and A. C. González-García, 2014. "Astral Symbolism and Time-Keeping in the Hittite Culture". In *Proceedings of the Eighth International Congress of Hittitology, Warsaw 5–9 September 2011*, edited by P. Taracha, 110–123. Warsaw: Agade.
- Belmonte, J. A. and A. C. González-García, 2015. "The Pillars of the Earth and the Sky: Capital Cities, Astronomy and Landscape". *Journal of Skyscape Archaeology* 1 (1): 9–38. <https://doi.org/10.1558/jsa.v1i1.26952>
- Bilgin, T., 2015. "Yazılıkaya". In *The Encyclopedia of Ancient History* (online edition), edited by R. S. Bagnall, K. Brodersen, C. B. Champion, A. Erskine and S. R. Huebner. Hoboken, NJ: Wiley Online Library. <https://doi.org/10.1002/9781444338386.wbeah26443>
- Bittel, K., 1934. *Die Felsbilder von Yazılıkaya*. Istanbul Forschungen 5. Bamberg: Deutsches Archäologisches Institut.

- Bittel, K., 1975. *Das hethitische Felsheiligtum Yazılıkaya*. Berlin: Mann.
- Bittel, K. and R. Naumann, 1939. "Vorläufiger Bericht über die Ausgrabungen in Boğazköy 1938". *Mitteilungen der Deutschen Orientgesellschaft* 77: 1–46.
- Bittel, K., R. Naumann and H. Otto, 1941. *Yazılıkaya: Architektur, Felsbilder, Inschriften und Kleinfunde*. Leipzig: Hinrichs.
- Britton, J. P., 2010. "Calendars, Intercalations and Year-Lengths in Mesopotamian Astronomy". In *Calendars and Years: Astronomy and Time in the Ancient Near East*, edited by J. M. Steele, 115–132. Oxford: Oxbow Books. <https://doi.org/10.1086/663034>
- Bryce, T. R., 2002. *Life and Society in the Hittite World*. Oxford: Oxford University Press.
- Burkert, W., 1977. *Griechische Religion der archaischen und klassischen Epoche*. Stuttgart: Kohlhammer. <https://doi.org/10.1524/hzhz.2012.0484>
- Cammarosano, M. 2018. *Hittite Local Cults*. Writings from the Ancient World 40. Atlanta, FL: SBL Press.
- Cohen, M. E., 1993. *The Cultic Calendars of the Ancient Near East*. Bethesda, MD: CDL Press.
- De Martino, S., 1998. "Le accuse di Muršili II alla regina Tawananna secondo il testo KUB XIV 4". In *Studi e Testi* vol. 1, edited by S. de Martino and F. Imparati, 19–48. Eothen 9. Florence: LoGisma.
- Der Manuelian, P. and T. Schneider, eds, 2015. *Towards a New History for the Egyptian Old Kingdom: Perspectives on the Pyramid Age*. Harvard Egyptological Studies 1. Leiden: Brill.
- Diodorus Siculus, *The Library of History*, vol. 2: *Books 2.35–4.58*, trans. C. H. Oldfather. Loeb Classical Library 303. Cambridge, MA: Harvard University Press. https://doi.org/10.4159/dcl.diodorus_siculus-library_history.1933
- Freyer-Schauenburg, B. and G. Petzl, 1994. *Die lykischen Zwölfgötter-Reliefs*. Bonn: Habelt.
- Garstang, J., 1910. *The Land of the Hittites*. London: Constable.
- Gautschy, R., 2017. "Remarks Concerning the Alleged Solar Eclipse of Muršili II". *Altorientalische Forschungen* 44 (1): 23–29. <https://doi.org/10.1515/aof-2017-0004>
- Goetze, A., 1957. *Kleinasien* (2nd edition). *Kulturgeschichte des alten Orients* 3.1. Munich: C. H. Beck.
- González-García, A. C., 2016. "Lunar Extremes, Lunar Cycles and the Minor Standstill". *Journal of Skyscape Archaeology* 2 (1): 77–84. <https://doi.org/10.1558/jsa.v2i1.30035>
- González-García, A. C. and J. A. Belmonte, 2011. "Thinking Hattusha: Astronomy and Landscape in the Hittite Lands". *Journal for the History of Astronomy* 42 (4): 461–494. <https://doi.org/10.1177/002182861104200404>
- González-García, A. C. and J. A. Belmonte, 2014. "Astronomy and Landscape in Late Bronze Age Central Anatolia". In *Proceedings of the Eighth International Congress of Hittitology, Warsaw 5–9 September 2011*, edited by P. Taracha, 317–330. Warsaw: Agade.
- González-García, A. C. and J. A. Belmonte, 2015. "Orientation of Hittite Monuments". In *Handbook of Archaeoastronomy and Ethnoastronomy*, edited by C. Ruggles, 1783–1792. New York: Springer. https://doi.org/10.1007/978-1-4614-6141-8_182
- Güterbock, H. G., 1953. "Yazılıkaya". *Mitteilungen der Deutschen Orient-Gesellschaft* 86: 65–76.
- Güterbock, H. G., 1954. "Carchemish". *Journal of Near Eastern Studies* 13 (2): 102–114.
- Güterbock, H. G., 1975. "Einschlägige Textstellen". In *Das hethitische Felsheiligtum Yazılıkaya*, edited by K. Bittel, 189–192. Berlin: Mann.
- Güterbock, H. G., 1988. "Bilingual Moon Omens from Boğazköy". In *A Scientific Humanist: Studies in Memory of Abraham Sachs*, edited by E. Leichty, M. de Ellis and P. Gerardi, 161–173. Philadelphia: The University Museum. <https://doi.org/10.1086/355485>
- Haas, V., 1994. *Geschichte der hethitischen Religion*. Leiden: Brill.
- Haas, V., 2001. "Hethiter", in *Religionen des Alten Orients*, Teil 1: *Hethiter und Iran*, edited by V. Haas and H. Koch. Göttingen: Vandenhoeck & Ruprecht. <https://doi.org/10.13109/9783666516955>
- Haas, V. and M. Wäfler, 1974. "Yazılıkaya und der Grosse Tempel". *Oriens antiquus* 13 (1): 211–226.
- Hawkins, J. D., 1998. "Hattusa: Home to the Thousand Gods of Hatti". In *Capital Cities: Urban Planning and Spiritual Dimensions*, edited by J. G. Westenholz, 65–82. Jerusalem: Bible Lands Museum.
- Hazenbos, J. 2003. *The Organization of the Anatolian Local Cults During the Thirteenth Century B.C.: An Appraisal of the Hittite Cult Inventories*. Leiden: Brill. <https://doi.org/10.1086/589255>

- Horowitz, W., 2005. "Some Thoughts on Sumerian Star-Names and Sumerian Astronomy". In *An Experienced Scribe Who Neglects Nothing: Ancient Near Eastern Studies in Honor of Jacob Klein*, edited by Y. Sefati, P. Artzi, C. Cohen, B. Eichler and V. Hurowitz, 163–178. Bethesda, MD: CDL Press.
- Horowitz, W., 2015. "Mesopotamian Star Lists". In *Handbook of Archaeoastronomy and Ethnoastronomy*, edited by C. Ruggles, 1829–1833. New York: Springer. https://doi.org/10.1007/978-1-4614-6141-8_187
- Huber, P. J., 2001. "The Solar Omen of Muršili II". *Journal of the American Oriental Society* 121: 640–644. <https://doi.org/10.2307/606505>
- Hunger, H. and D. Pingree, 1989. *MUL.APIN – An Astronomical Compendium in Cuneiform*. Horn, Austria: Berger.
- Hunger, H. and J. M. Steele, 2019. *The Babylonian Astronomical Compendium MUL.APIN*. London: Routledge.
- Hutter, M., 1998. Review of D. Yoshida, *Untersuchungen zu den Sonnengottheiten bei den Hethitern* (Heidelberg: Winter, 1996). *Bibliotheca Orientalis* 55: 475–478. <https://doi.org/10.1515/if-2001-0124>
- Jakob-Rost, L., 1963. "Zu den hethitischen Bildbeschreibungen (II. Teil)". *Mitteilungen des Instituts für Orientalforschung der Deutschen Akademie der Wissenschaften zu Berlin* 9 (1): 175–239. <https://doi.org/10.5962/bhl.title.82563>
- Jeremias, A., 1909. *Das Alter der babylonischen Astronomie*. Leipzig: Hinrichs.
- Jomard, E.F., ed., 1820. *Description de l’Égypte, ou Recueil des observations et recherches qui ont été faites en Égypte pendant l’expédition de l’armée française* vol. 1: *Antiquités* : [Planches] (2nd edition). Paris: C. L. F. Panckoucke. <https://doi.org/10.5962/bhl.title.62506>
- Kammenhuber, A., 1976. *Orakelpraxis, Träume und Vorzeichenschau bei den Hethitern*. Heidelberg: Winter. <https://doi.org/10.1017/s0041977x00124577>
- Klinger, J., 1996. *Untersuchungen zur Rekonstruktion der hattischen Kultschicht*. Wiesbaden: Harrassowitz.
- Koch, U. S., 2013. "Concepts and Perception of Time in Mesopotamian Divination". In *Time and History in the Ancient Near East – Proceedings of the 56th Rencontre assyriologique internationale at Barcelona 26-30 July 2010*, edited by L. Feliu, 127–142. Winona Lake, IL: Eisenbrauns.
- Koch-Westenholz, U., 1993. "Mesopotamian Astrology at Hattusas". In *Die Rolle der Astronomie in den Kulturen Mesopotamiens: Beiträge zum 3. Grazer Morgenländischen Symposium (23.–27. September 1991)*, edited by H. D. Galter, 231–246. Grazer Morgenländische Studien 3. Graz: GrazKult.
- Koch-Westenholz, U., 1995. *Mesopotamian Astrology – An Introduction to Babylonian and Assyrian Celestial Divination*. Copenhagen: Carsten Niebuhr Institute of Near Eastern Studies.
- Krupp, E. C., 2005. "Bedroom Politics and Celestial Sovereignty". In *Current Studies in Archaeoastronomy: Conversations Across Time and Space*, edited by J. W. Fountain and R. M. Sinclair. Durham, NC: Carolina Academic Press.
- Laroche, E., 1952. "Le Panthéon de Yazılıkaya". *Journal of Cuneiform Studies* 6 (3): 115–123.
- Leitz, C. and H.-J. Thissen, 1995. *Altägyptische Sternuhren*. Leuven: Peeters.
- Leverington, D., 2013. *Encyclopedia of the History of Astronomy and Astrophysics*. Cambridge: Cambridge University Press.
- Masson, E., 1981. *Le panthéon de Yazılıkaya nouvelles lectures*. Paris: Institut français d’études anatoliennes.
- Masson, E., 1989. *Les douze dieux de l’immortalité: croyances indo-européennes à Yazılıkaya*. Paris: Les Belles Lettres.
- Masson, E., 2001. "Le complexe culturel du 'Südburg' (Hattusa): quelques réflexions". In *Akten des IV. Internationalen Kongresses für Hethitologie, Würzburg, 4.-8. Oktober 1999*, edited by G. Wilhelm, 121–140. Wiesbaden: Harrassowitz. https://doi.org/10.1501/archv_0000000078
- Maul, S. M., 2013. *Die Wahrsagekunst im Alten Orient – Zeichen des Himmels und der Erde*. Munich: C. H. Beck. <https://doi.org/10.17104/9783406645150-9>
- Mebert, J., 2010. *Die Venustafeln des Ammī-šaduqa und ihre Bedeutung für die astronomische Datierung der altbabylonischen Zeit*. Vienna: Institut für Orientalistik der Universität Wien. <https://doi.org/10.1515/olzg-2017-0070>
- Meller, H. and K. Michel, 2018. *Die Himmelsscheibe von Nebra – Der Schlüssel zu einer untergegangenen Kultur im Herzen Europas*. Berlin: Propyläen.

- Mouton, A., 2003. "Usages privés et publics de l'incubation d'après les textes hittites". *Journal of Ancient Near Eastern Religion* 3 (1): 73–91. <https://doi.org/10.1163/1569212031960357>
- Mouton, A. and I. Rutherford (2010). "The Sun Deity of the *HILAMMAR*: An Unnoticed 'Pan-Luwian' Deity?". *Bibliotheca Orientalis* 67 (3–4): 276–281.
- Müller-Karpe, A., 2013. "Einige archäologische sowie archäoastronomische Aspekte hethitischer Sakralbauten". In *Tempel im Alten Orient*, edited by K. Kaniuth, A. Löhnert, J. L. Miller, A. Otto, M. Roaf and W. Sallaberger, 335–353. Colloquien der Deutschen Orient-Gesellschaft 7. Wiesbaden: Harassowitz. <https://doi.org/10.1515/olzg-2018-0068>
- Müller-Karpe, A., 2015. "Planning a Sacred Landscape. Examples from Sarissa and Hattusa". In *Sacred Landscapes of the Hittites and the Luwians*, edited by A. D'Agostino, V. Orsi and G. Torri, 83–92. Florence: Firenze University Press.
- Müller-Karpe, A., 2017. *Sarissa – Die Wiederentdeckung einer hethitischen Königsstadt*. Darmstadt: Philipp von Zabern.
- Müller-Karpe, A., V. Müller-Karpe and A. Schrimpf, 2009. "Geometrie und Astronomie im Stadtplan des hethitischen Sarissa". *Mitteilungen der Deutschen Orient-Gesellschaft zu Berlin* 141: 45–64.
- Naumann, R., 1975. "Die Bauanlagen". In *Das hethitische Felsheiligtum Yazılıkaya*, edited by K. Bittel, 91–119. Berlin: Mann.
- Neugebauer, O. and R. A. Parker, 1969. *Egyptian Astronomical Texts*, vol. 3: *Decans, Planets, Constellations and Zodiacs*. Providence, RI: Brown University Press. <https://doi.org/10.2307/40000046>
- Nolan, J. S., 2015. "Cattle, Kings and Priests: Phyle Rotations and Old Kingdom Civil Dates. Towards a New History for the Egyptian Old Kingdom". In *Perspectives on the Pyramid Age*, edited by P. Der Manuelian and T. Schneider, 337–365. Leiden: Brill.
- Ossendrijver, M., 2015. "Babylonian Mathematical Astronomy". In *Handbook of Archaeoastronomy and Ethnoastronomy*, edited by C. Ruggles, 1863–1870. New York: Springer. https://doi.org/10.1007/978-1-4614-6141-8_192
- Otten, H., 1956. "Ein Text zum Neujahrsfest aus Boğazköy". *Orientalistische Literaturzeitung* 51 (3–4): 102–106. <https://doi.org/10.1524/olzg.1956.51.16.51>
- Parker, R. A., 1950. *The Calendars of Ancient Egypt*. Chicago: University of Chicago Press.
- Pizzimenti, S., 2013. "The Other Face of the Moon: Some Hints on the Visual Representation of the Moon on Third-Millennium B.C.E. Mesopotamian Glyptic". In *Time and History in the Ancient Near East – Proceedings of the 56th Rencontre assyriologique internationale at Barcelona 26-30 July 2010*, edited by L. Feliu, 265–272. Winona Lake, IN: Eisenbrauns.
- Riemschneider, M., 1954. *Die Welt der Hethiter*. Zurich: Fretz & Wasmuth.
- Rochberg-Halton, F., 1988. *Aspects of Babylonian Celestial Divination the Lunar Eclipse Tablets of Enuma Anu Enlil*. Horn, Austria: Berger. <https://doi.org/10.1515/9781501504914-006>
- Ruggles, C. L. N., ed., 2015. *Handbook of Archaeoastronomy and Ethnoastronomy*, 3 vols. New York: Springer. https://doi.org/10.1007/978-1-4614-6141-8_25
- Ruggles, C. L. N., 2015. "Best Practice for Evaluating the Astronomical Significance of Archaeological Sites". In *Handbook of Archaeoastronomy and Ethnoastronomy*, edited by C. L. N. Ruggles, 373–388. New York: Springer.
- Rutherford, I., 2016. "Twelve Gods". In *The Encyclopedia of Ancient History* (online edition), edited by R. S. Bagnall, K. Brodersen, C. B. Champion, A. Erskine and S. R. Huebner. Hoboken, NJ: Wiley Online Library. <https://doi.org/10.1002/9781444338386.wbeah30125>
- Sallaberger, W., 1993. *Der kultische Kalender der Ur-III-Zeit*. Berlin: de Gruyter. <https://doi.org/10.1515/9783110889253>
- Schachner, A., 2011. *Hattuscha – Auf der Suche nach dem sagenhaften Großreich der Hethiter*. Munich: C. H. Beck. <https://doi.org/10.1524/hzhz.2013.0018>
- Schachner, A. with N. Bolatti Guzzo, S. Kühn, M. Marazzi and L. Repola, 2016. "Die Ausgrabungen in Boğazköy-Hattuša 2015". *Archäologischer Anzeiger* 2016 (1): 1–47.
- Schürr, D., 2013. "Beobachtungen zu den Zwölfgötter-Reliefs in Lykien". *Adalya* 16: 213–222.

- Schwemer, D., 2006. "Das hethitische Reichspantheon: Überlegungen zu Struktur und Genese". In *Götterbilder, Gottesbilder, Weltbilder – Polytheismus und Monotheismus in der Welt der Antike*, edited by K. R. Gregor and H. Spieckermann, 241–265. Tübingen: Mohr Siebeck.
- Seeher, J., 2002. *Hattusha Guide: A Day in the Hittite Capital*. Istanbul: Ege Yayınları.
- Seeher, J., 2011. *Gods Carved in Stone – The Hittite Rock Sanctuary of Yazılıkaya*. Istanbul: Ege Yayınları. <https://doi.org/10.1086/674804>
- Seeher, J., 2016. "Yazılıkaya". In *Reallexikon der Assyriologie und der Vorderasiatischen Archäologie*, edited by M. P. Streck, vol. 15, 149–155. Berlin: De Gruyter.
- Seidel, W., 2014. *Sternstunden – Die abenteuerliche Geschichte der Entdeckung und Vermessung der Welt*. Cologne: Eichborn.
- Shi, Y., 2015. *Ancient Chinese Astronomy – An Overview*. In *Handbook of Archaeoastronomy and Ethnoastronomy*, edited by C. Ruggles, 2031–2042. New York: Springer. https://doi.org/10.1007/978-1-4614-6141-8_210
- Steitler, C., 2017. *The Solar Deities of Bronze Age Anatolia*. Wiesbaden: Harrassowitz.
- Stol, M., 1992. "The Moon as Seen by the Babylonians". In *Natural Phenomena – Their Meaning, Depiction and Description in the Ancient Near East*, edited by D. J. W. Meijer, 245–277. Amsterdam: North-Holland.
- Strauß, R., 2006. *Reinigungsrituale aus Kizzuwatna. Ein Beitrag zur Erforschung hethitischer Ritualtradition und Kulturgeschichte*. Berlin: De Gruyter. <https://doi.org/10.1515/9783110903652>
- Taggar-Cohen, A., 2006. *Hittite Priesthood*. Heidelberg: Winter.
- Taracha, P., 2009. *Religions of Second Millennium Anatolia*. Wiesbaden: Harrassowitz.
- Ünal, A., 1987. Review of H. Freydank, *Hethitische Rituale und Festbeschreibungen* (Keilschrifturkunden aus Boghazköi 55 – Berlin: Akademie, 1981). *Bibliotheca Orientalis* 44: 474–486.
- Ünal, A., 2013. "Falcılık ve Kehanet / Divination and Prophecy". In *Hittites – An Anatolian Empire*, edited by M. Doğan-Alparslan and M. Alparslan, 452–475. Istanbul: Yapı Kredi Yayınları.
- van der Toorn, K., 1985. *Sin and Sanction in Israel and Mesopotamia: A Comparative Study*. Assen, Netherlands: Van Gorcum. <https://doi.org/10.1017/s0035869x00167000>
- von Brandenstein, C. G., 1943. *Hethitische Götter nach Bildbeschreibungen in Keilschrifttexten*. Leipzig: Hinrichs.
- Verderame, L., 2015. "Mesopotamian Celestial Divination". In *Handbook of Archaeoastronomy and Ethnoastronomy*, edited by C. Ruggles, 1835–1839. New York: Springer. https://doi.org/10.1007/978-1-4614-6141-8_188
- Weidner, E. F., 1915. *Handbuch der babylonischen Astronomie: Der babylonische Fixsternhimmel*. Leipzig: Hinrichs.
- Weidner, E. F., 1923. "Astrologische Texte aus Boghazköy". *Archiv für Keilschriftforschung* 1: 38–43.
- Weinreich, O., 1913. *Lykische Zwölfgötter-Reliefs: Untersuchungen zur Geschichte des dreizehnten Gottes*. Sitzungsberichte der Heidelberger Akademie der Wissenschaften, Philosophisch-Historische Klasse 5. Heidelberg: Carl Winter's Universitätsbuchhandlung. <https://doi.org/10.1017/s0009840x00112582>
- Winckler, H., 1906. "Die babylonische Weltschöpfung". *Der alte Orient* 8 (1): 1–34.
- Winckler, H., 1907. "Vorläufige Nachrichten über die Ausgrabungen in Boghazköi im Sommer 1907". *Mitteilungen der Deutschen Orient-Gesellschaft* 35: 1–71. <https://doi.org/10.1017/s0035869x00080795>
- Woolley, C. L. and R. D. Barnett, 1952. *Carchemish: Report on the Excavations at Jerablus on Behalf of the British Museum*, part III: *The Excavations in the Inner Town and the Hittite Inscriptions*. London: British Museum. <https://doi.org/10.1017/s0003598x00022018>
- Yoshida, D., 1996. *Untersuchungen zu den Sonnengottheiten bei den Hethitern: Schwurgötterliste, helfende Gottheit, Feste*. Heidelberg: Winter. <https://doi.org/10.1515/if-2001-0124>