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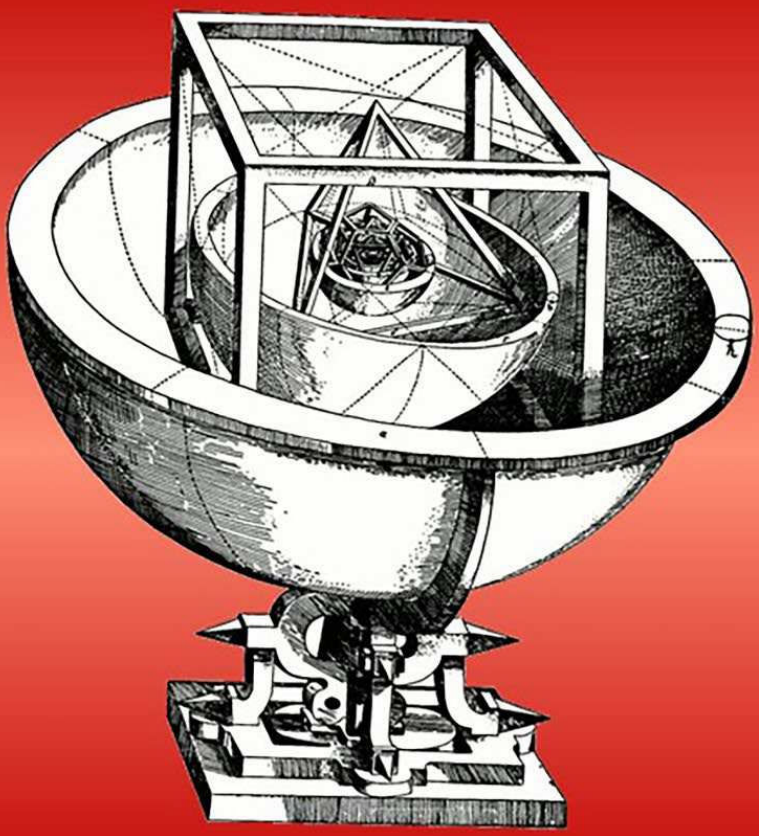
Harmony and Symmetry



Celestial regularities shaping human culture

Proceedings of the SEAC 2018 Conference in Graz

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Back Cover: Calendar Table with gods of the day and zodiac in Cistercian monastery Stift Rein, Andreas Pleninger, 1607 (Photo: Kurt Roth)

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Contents

The Hittite Rock Sanctuary of Yazılıkaya: A Time-Keeping Device from ca. 1230 B.C.

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Abstract: The Hittite rock sanctuary of Yazılıkaya in central Anatolia contains over ninety rock-cut reliefs of deities, humans, animals, and mythical figures dating to the second half of the 13^{th} century B.C. The site's function has thus far remained enigmatic. We suggest that the reliefs in Chamber A are arranged in groups for the purpose of keeping track of lunar months, the days of a lunar month, and years. By marking the days and synodic months, the Hittite priests were able to determine when additional months were required to keep lunar and solar years aligned. Keeping track of time was imperative for the Hittites priests to ensure that the many annual festivals fall into the appropriate seasons.

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

1.0.69 The Sanctuary

The Hittite Late Bronze Age sanctuary Yazılıkaya lies in the south of Çorum Province, 150 km east of Ankara near the modern village of Boğazkale and 1.7 km to the northeast of Ḫattuša's royal residence, Büyükkale. It consists of an irregular limestone rock massif extending over an area of about 50 × 80 m. Such isolated rock massifs crop out in many places, both within the walls of Ḫattuša and outside them. Its rock-carved reliefs depict more than 90 human, animal, and mythical figures. The reliefs were originally published by the French archaeologist Charles Texier in 1834. Excavations were conducted at Yazılıkaya from 1931 to 1939 and from 1966 to 1972 (Bittel et al. 1941; Bittel 1975). Resarch interest in the sanctuary continues unrestrictedly up to the present (Laroche 1952; Masson 1981; Seeher 2011; Schachner et al. 2016; Bolatti Guzzo et al. 2017).

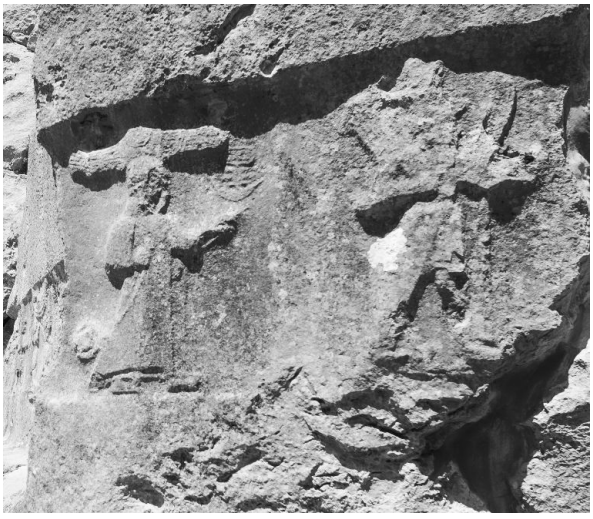

Figure 1.75:

Šimegi, The Sun God of the Heavens (Relief 34, left) and Kušuh, the winged Moon God (Relief 35, right)

The Hittite reliefs (Fig. 1.75) were cut into the inside-facing walls of two courts, designated as Chamber A and Chamber B. Chamber A, for the most part a natural internal enclosure, is about 30 m long. It contains reliefs of 64

deities (Fig. 1.76), all facing in a northern direction. With two exceptions, the deities on the left are all male; those on the right are female except for one. They appear to be marching in procession from both sides toward the climactic plateau at the northern end where the supreme deities meet: the Hurrian storm god Teššub on the left (Relief 42), standing on the mountain gods Namni and Hazzi, and his wife, the Hurrian goddess Ḫebat on the right (Relief 43), standing on a panther. Most reliefs contain an inscription in Luwian hieroglyphic in front of each figure's head.

A major effort was made at Yazılıkaya to shape the natural outcrop through quarrying and chiselling to produce level horizontal and vertical surfaces as well as sills. 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, consisting of a cleft that is 18 m long and only 2.15 m wide at its narrow south end and 4.5 m at its north end. Its vertical west and east walls rise up to 12 m above present ground level. The exceptionally perpendicular surface of the west wall runs north-south with a deviation of about 5°. Chamber B contains few reliefs, but these are better preserved, since they were buried and thus protected from weathering soon after the place went out of use. The western wall exhibits only one relief panel depicting 12 uniform male figures (Reliefs 69–80), interpreted as gods of the underworld (González-García & Belmonte 2011, 465). The panel matches an almost identical one in Chamber A (Reliefs 1–12).

A complex of buildings was raised in front of the southwest side of the massif. These formed an integral part of the rock sanctuary, screening off the rock chambers and thereby preventing access to them. People wishing to enter the courts of the rock sanctuary had to pass through these buildings. Archaeologists distinguish three phases of building (Seeher 2011, 125–137). Initially, possibly as early as 1500 B.C., the gatehouse (Building III) was erected together with the long wall of Building I, closing off 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 furnished with the present carvings.

The sanctuary was abandoned when the Hittite control over central Anatolia collapsed around 1190 B.C. Although over 33,000 fragments of tablets were found in Ḫattuša, not a single one contained an unequivocal direct reference to the rock sanctuary.

1.0.70 Indications for a Technical Function of Yazılıkaya

The renown archaeoastronomer Clive Ruggles lists three properties that are 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. The following observations indicate that the Yazılıkaya sanctuary had a practical purpose, probably in connection with astronomical display of time:

- The entire sanctuary was walled off from the outside, but not roofed over, even though this would have been easy to achieve (Bittel et al. 1941, 12; Güterbock 1953, 65; Haas & Wäfler 1974, 213). This means the reliefs were exposed to sunlight, rain, and weathering. This may imply that the movements of the Sun, shadows, and/or the Moon and stars were a component of the sanctuary's function.
- The northern wall of the gatehouse, the first structure erected at the sanctuary, is aligned with the sunset at the summer solstice. The sanctuary was built in a single phase of construction, suggesting a technical purpose (Belmonte 2000, 89; González-García and Belmonte 2011, 466, Fig. 4a). Later it was renovated and renewed in two distinct phases. The

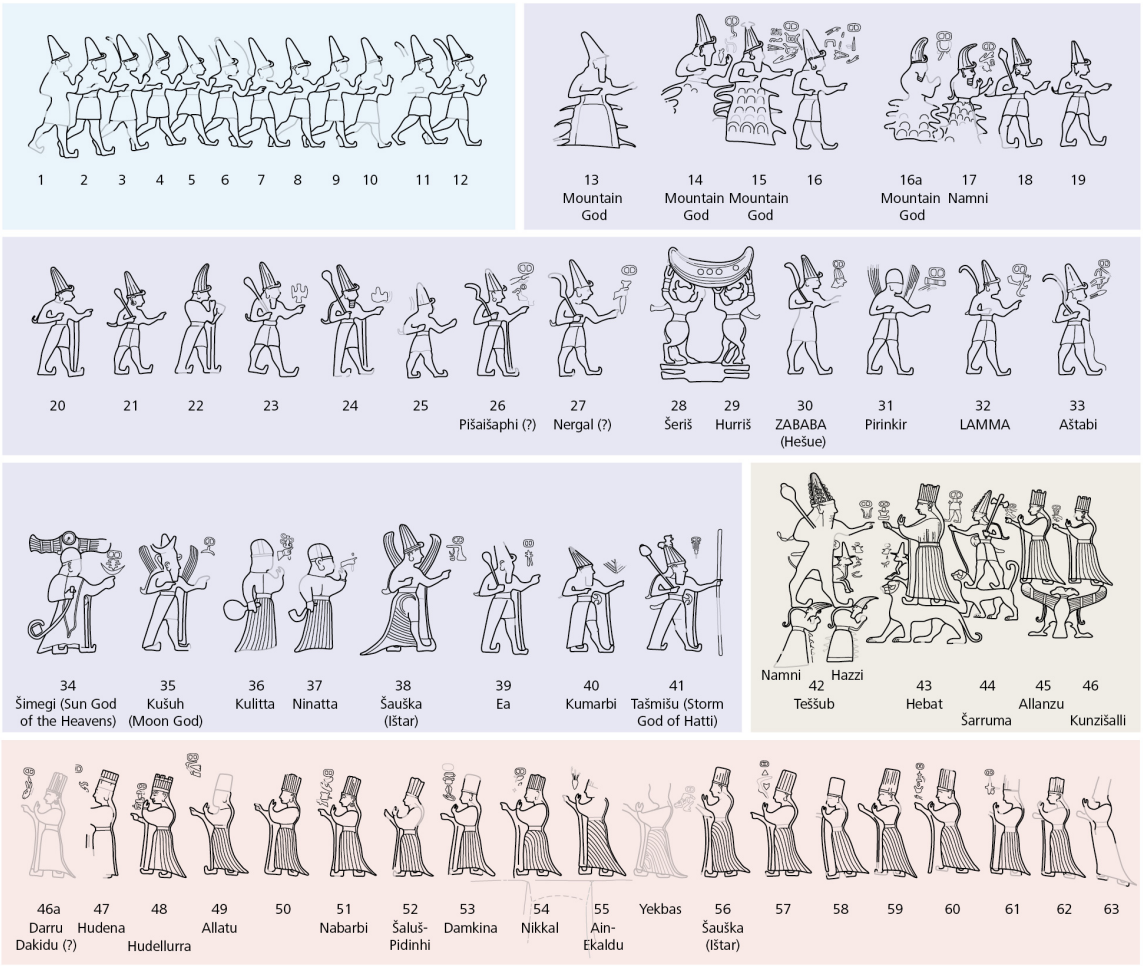

Figure 1.76:
The reliefs of deities in Chamber A can be arranged in groups that adhere to 19 annual cycles.

prominent western wall in Chamber B runs almost exactly north-south. Its flat bedrock face was even extended using ashlar building stones, indicating that the wall itself may have had a function that required a large surface.

- Sunlight falls on the relief (64) of Great King Tudḫaliya IV in Chamber A in the afternoon for a few days around the summer solstice in mid-June, which may imply that the most distinctive spot was reserved for the storm god's highest mortal representative.

- Chambers A and B exhibit reliefs with 12 uniform male gods, possibly indicating the 12 gods of the lunar year – and thus the months (Belmonte 2000, 89).

- The temples in front of the sanctuary may have been used for seasonal celebrations, including the New Year's festival (Seeher 2006, 125).

- A connection to celestial bodies is indicated by the presence of the Sun God, the Moon God and the goddess Šauška (Ištar) who is represented and named both in the male row of gods (as morning star and god of war) and in the female row (as evening star and goddess of fertility). This duality is also found in other goddesses of the ancient Middle East.

- For reasons that have so far remained unexplained, the Bronze Age stonemasons left a column of carefully shaped natural rock protruding from the wall between Reliefs 54 and 55; this column may imply a technical function.

These observations incited the working hypothesis that the entire sanctuary may have been used to record astronomical observations and to keep track of time in one way or another.

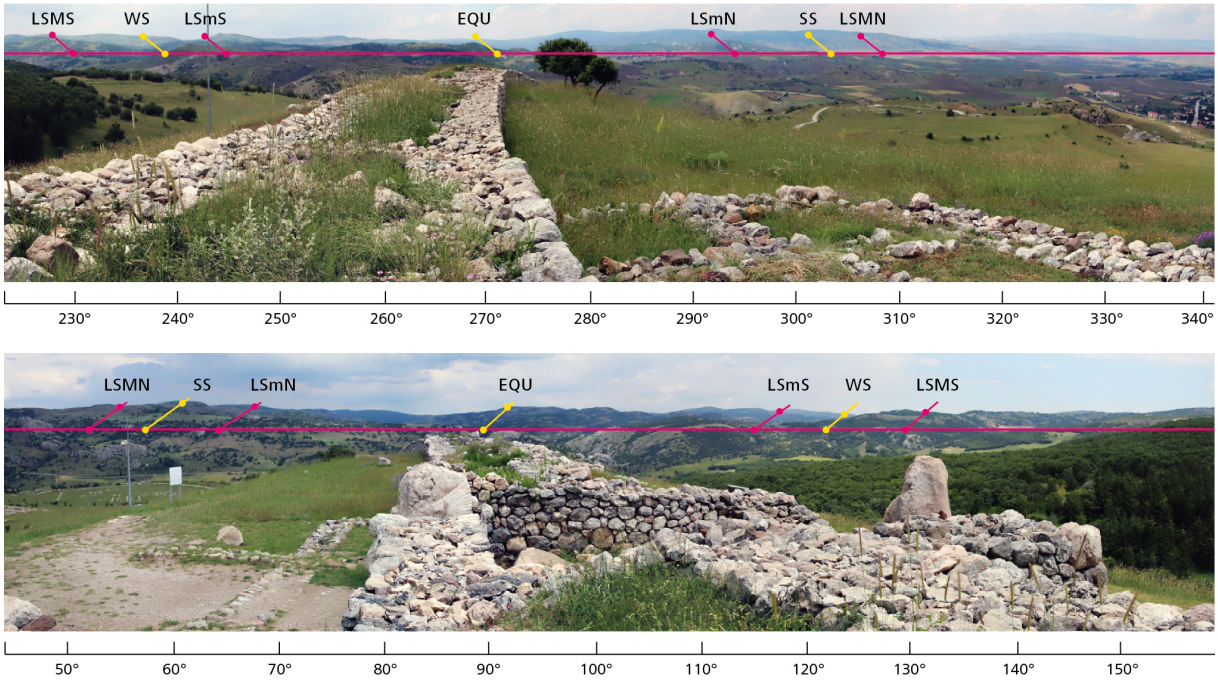

Figure 1.77:
Horizon profile as seen from Yerkapı in 1250 B.C. indicating the setting of the Sun at summer solstice (SS), winter solstice (WS), and equinox (EQU), and of the Moon during major southern (LSMS), minor southern (LSmS), minor northern (LSmN) and major northern lunar standstill (LSMN)

1.0.71 Astronomical Calculations to Determine Horizon Profiles

To determine Yazılıkaya's and Ḫattuša's potential for astronomical observations, we used horizon profiles based on topographic data generated from NASA's Shuttle Radar Topography Mission (SRTM; `https://www2.jpl.nasa.gov/srtm/`) with a resolution of about 90 m, backed by locally generated horizon panoramas. The artificial horizon profiles were created using Ulrich Deuschle's program (Deuschle 2013). The SRTM data were originally monitored with a resolution of 30 m, but only recently they have gradually become available with full resolution for regions outside the United States. Unfortunately, SRTM data for Greece, Turkey and the Middle East are still only available in lower resolution. In the lower resolution data, the mean of three measured data points is given. The data are thus smoothed, and prominent but confined features can get lost completely. This means that the panorama photos taken on site were essential to correct for features in the profile. For the calculation of the position of the Sun and the Moon we employed our own computer programs, which use the long-term DE 406 ephemerides of the Jet Propulsion Laboratory (Standish 1998). The position of

fixed stars such as Sirius and the Pleiades were calculated for 1250 BC starting from their coordinates in the year 2000 (Perryman et al. 1997, L49–52). As for the Pleiades, the brightest star in the cluster, Alcyone, has been used as the reference. Our computations take account of the effects of precession, nutation, changes in the obliquity of the ecliptic in the course of time, and the proper motion of the stars.

Although we considered the possibility that structures were oriented towards heliacal risings and settings of prominent stars and star groups, we did not find unambiguous evidence of this in Ḫattuša. The horizon in Yazılıkaya from the northeast to the south is dominated by a prominent hill a short distance away. This means that depending on the season, the rising Sun can be seen only one to two hours later and about 10° to 20° further to the south than calculated when assuming a flat horizon. Also, the heliacal rising of Sirius, the Pleiades, and other fixed stars can be observed only about two weeks later than at observation points on the same latitude with an almost flat horizon. For this reason, Yazılıkaya was not a suitable observation point for monitoring the heliacal risings of stars. On the other hand, the Upper City of Ḫattuša and Yazılıkaya were excellent points for observing the setting of the Sun and Moon and heliacal settings of fixed stars (Fig. 1.77). The site was also perfectly suitable for observing the first visibility of the lunar crescent after the New Moon on the western horizon, which was decisive for the start of a new month. However, the last visibility before the New Moon on the eastern horizon could not be monitored.

1.0.72 Chamber A: Keeping Track of Days, Months, and Years

We observed that the reliefs in Chamber A form certain groups. The climactic plateau (Reliefs 42–46) and the uniform male figures (1–12) stand out as such. This leaves Reliefs 13–41 as a third, in-between, group, and the female deities (Reliefs 46a–63) as a fourth. It is not completely certain what the exact number of female deities was. The reliefs of 17 goddesses are currently visible. One relief has completely disappeared except for its hieroglyphic sign (46a), and one relief that corresponds to the others has been found in 1945 in the nearby village of Yekbas and is now exhibited outside the museum of Boğazkale (Güterbock 1953, 67). Archaeologists have temporarily added a cast of this piece behind Relief 55 to demonstrate how it would fit there (Bittel 1975, Plate 36.2). The excavator argued that the Yekbas piece could also have belonged in the gap between Relief 46 and 46a (Bittel 1975, 145). In any case, the Yekbas relief brings the total number of female deities in this procession to 19 (Reliefs 46a–63). A column of carefully shaped natural rock protruding from the wall between Reliefs 54 and 55 splits this group, so that 8 female deities end up between the column and the climactic plateau. The number of elements in each group is therefore 12, 30, 5 and 19. These numbers – and thus the relief groups – can be correlated to basic astronomical periods (Fig. 1.78):

- Reliefs 1–12: Number of lunar months per solar year (12)
- Reliefs 13–41: Number of days per lunar month (29–30)
- Reliefs 42–46: Main group, no function as a calendrical tool
- Reliefs 46a–63: 19 solar years

Accordingly, Reliefs 1–12 would reflect lunar months each with a duration of 29 or 30 days. An intercalary month had to be added mainly every third year to keep lunar and solar years in line and to make sure that the months always coincided with the appropriate seasons (Belmonte & González-García 2014, 121).

The second group of deities in our reconstruction correlates to the days in a lunar month.

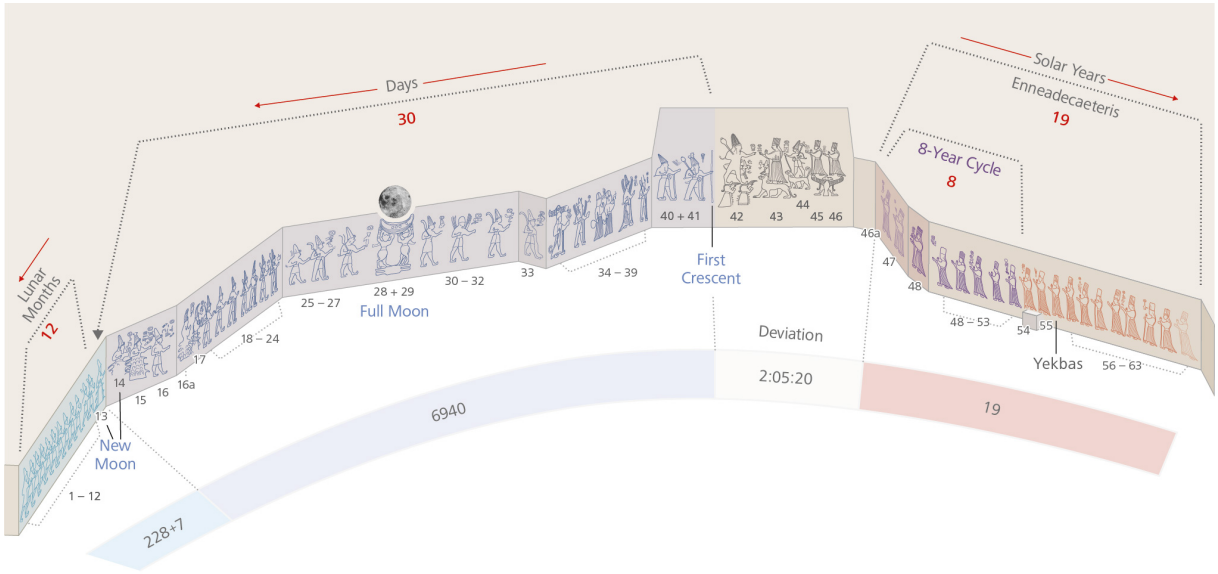

Figure 1.78:
Reliefs of deities in Chamber A can be arranged in groups in accordance with astronomic principles: 12 months; 30 days; climactic group; as well as a 19-year cycle (Enneadecaeteris), including an 8-year cycle (Octaeteris).

It extends from Relief 13 all the way to the beginning of the climactic group; that is, up to and including Relief 41. At the time the numbering was introduced, the deity between Relief 16 and 17 had not been fully recognized. It was only later added as Relief 16a (Bittel et al. 1941, 57). The bull-men (Reliefs 28 and 29), on the other hand, have always been considered to be two individuals, possibly the bulls of heaven, Hurris and Šeris. Reliefs 13–41 thus consist of 30 deities who differ strongly in character. They appear to be roughly organized into earth, water and air deities. Mountain gods appear mainly at the beginning of the procession; winged gods mainly towards the end. – We presume that the number of days of a synodic month was marked beginning with the first appearance of the lunar crescent after the New Moon. In our scheme, Relief 41 represents the first day of every month. The Full Moon always coincides with the bull-men (Reliefs 28 and 29) and symbolically fits into the CAELUM hieroglyphic sign for "sky" they carry. The latter has also been considered 'the boat of light' (Cohen 1993, 141–142; Rochberg 2016, 71). 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. If the number of 19 female deities on the east wall is correct, this group may have been a means of indicating solar years and synchronizing lunar and solar years in an advanced manner. A cycle of 19 solar years, the so-called *Enneadecaeteris* (later known as the *Metonic Cycle*) consists of nineteen times 12 lunar months plus 7 intercalary months, which equals 235 synodic months or 6,940 days. This cycle deviates by 2 hours 5 minutes and 20 seconds from nineteen tropical solar years. This means that if 7 extra lunar months were added to 19 lunar years with 12 lunar months each, a certain celestial constellation including the Sun, Moon and fixed stars repeats itself. The lunar phase of the first day of the 20^{th} year was therefore almost exactly the same as it had been 19 years previously.

A column of carefully shaped natural rock protruding from the wall between Reliefs 54 and 55 splits the 19-year cycle (*Enneadecaeteris*) into an 8-year cycle (*Octaëteris*) and secondary 11 years. The 8-year cycle could also have been used to synchronize lunar and solar years. The *Octaëteris* spans 99 lunations equalling eight times 12 lunar months plus 3 intercalary

months, amounting to 2,924 days in total and deviating by 1.5 days from eight tropical solar years. There is evidence that certain Hittite festivals were indeed celebrated only every eight or nine years (Bryce 2002, 188).

The system recorded in Yazılıkaya may therefore constitute a device to display a lunisolar calendar that could have yielded different degrees of precision. It only required that the number of days, synodic months and tropical years be kept track of, adding an intercalary month when needed. The people of Mesopotamia were accustomed to a lunisolar calendar from at least the late fourth millennium BC (Steele 2012, 374). Thus far, intercalary months at intervals of two and three years are documented in actual records from the 3rd millennium B.C. onwards, but instances of four successive intercalary years are attested during the First Dynasty of Babylon (reigns of Ḫammurapi and Ammiditana; Britton 2010, 119). The astronomical compendium MUL.APIN (compiled about 1000 B.C. 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 Steele 2019, 151–153). This may indicate that no general scheme for a regular intercalation practice existed. The 19-year cycle as well as its predecessor, the 8-year cycle is documented unambiguously so far only in the 5th and 8th century B.C., respectively. According to current knowledge, a regular intercalation pattern started to emerge during the Neo-Assyrian and Neo-Babylonian Period (750 to 539 B.C.), but evidence of a consistent 19-year intercalation scheme in Babylonia dates to 484 B.C. and onward. Recently, John Nolan proposed that a 19-year pattern of inserting intercalary lunar months was used in 3^{rd} millennium B.C. Egypt to synchronize the lunar calendar employed in Egyptian temples with a star-based event such as the heliacal rising of Sirius that played an important role in the Egyptian solar civil calendar (Nolan 2015, 340). He is able to explain most of the Egyptian data when applying the regular 19-year intercalation pattern later known as Metonic cycle. In Yazılıkaya different astronomical phenomena could have been used to determine when an intercalary month is necessary: either the heliacal rising or heliacal setting of a bright star such as Sirius, a leap rule using e.g. the Pleiades as known from the MUL.APIN compilation, or the illumination effect of Tudḫaliya's relief. It is quite conceivable that the ledges under reliefs 13–41 contained a movable pointer, perhaps in the form of a short wooden or stone column placed on the rock sill. This would have been used to indicate the day of the synodic month. Each day the pointer would have been moved manually one relief further from north to south (i.e. from right to left). Similar markers may have indicated the current month and year and were moved accordingly. Due to the large size of the sanctuary, no fixation was needed for the markers – their weight would have stabilized them. Thus, there is no need for holes as they occur in parapegmata. The carefully hewn column protruding from the bedrock between figures 54 and 55 would thus represent a permanent form of such a marker. For the years, two different markers may have been required. One of these movable markers would have travelled along all 19 deities, while the other only passed along the first 8.

Further to the right of the 19 female deities, there is a large relief (64) of Great King Tudḫaliya IV. The relief was placed at a spot that receives sunlight only around one of the most important moments of the year, the summer solstice. This moment of exposure to the Sun rays is beautifully choreographed: after the sunlight has ceased to illuminate the king's image there is a two-minute interval after which his cartouche is illuminated by another isolated ray of Sun penetrating a narrow gap in the natural western rock face. By utilizing and optimizing the natural outcrop to their needs, the stonemasons created an installation that could still be used as a calendar tool today without any need for adjustment.

1.0.73 Conclusions

Our study confirms what Juan Antonio Belmonte and A. César González-García have pro-

posed before, namely that "astral, notably solar divinities were certainly important in the Hittite pantheon" (Belmonte & González-García 2014, 114; see also Krupp 2005) and that *"Ḫattusa presents a striking and highly interesting astronomical and topographical landscape"* (González-García & Belmonte 2014, 326). The rock sanctuary of Yazılıkaya was indeed perfectly equipped for use as a calendrical tool – serving in a function that is comparable with parapegmata in later times. We suggest that Yazılıkaya has been a religious centre where the movements of stars, planets and the Moon were recorded and displayed to determine accurately when annual festivals ought to take place to adhere to the right seasons. Since astrology was an important aspect of everyday Hittite life – in particular for the royal family – the authority to make predictions about celestial movements as well as to identify and interpret celestial omina was a major task. Yazılıkaya was the place where the Hittite religious calendar was maintained, and annual, seasonal or even monthly festivals were celebrated. Our interpretation of Yazılıkaya supplements and reinforces earlier ideas about the proposed function of the sanctuary. What is more, it demonstrates that star gazing, celestial observations and a lunisolar calendar which were well-established in Mesopotamia and Egypt at the latest during the first half of the second millennium BC were also customary in Late Bronze Age Anatolia.

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